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Improving Household Income and Changing Waste Perception through Community-Based Coconut Shell Charcoal Processing Training

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ABSTRACT

Background: Coconut shell waste in rural agricultural communities represents a largely underutilised resource due to limited processing knowledge, lack of organised entrepreneurship, and absent institutional support. Adabai Village, East Seram Regency, Maluku Province, produces significant quantities of coconut shells that are routinely discarded or burned, despite their high economic potential as raw material for charcoal production.

Purpose of the Study: This community service activity aimed to increase farmers' knowledge of the economic value of coconut shell waste, build the capacity of business groups in entrepreneurship and financial management, and collect qualitative data as a foundation for a sustainable coconut shell charcoal enterprise.

Methods: A qualitative case study approach was employed, integrating Participatory Rural Appraisal (PRA), Experiential Learning, and Project-Based Learning. A total of 16 respondents participated, selected through purposive sampling. Data were collected via structured interview guides and field observations, and analysed using thematic analysis.

Results: The programme produced a three-fold increase in economic value per sack of coconut shells (from Rp 15,000–22,500 to Rp 65,400–65,574), and 87.5% of participants expressed readiness to join a collective business group. Five key qualitative findings were identified: a shift in waste perception, collective entrepreneurial readiness, identification of technology and capital needs, strong village government support (including potential BUMDes integration), and significant export and domestic market potential for charcoal products.

Keywords

Coconut shell charcoal;
Community empowerment;
Circular economy;
Entrepreneurship training;
Rural entrepreneurship

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Introduction

Rural areas in Indonesia possess abundant natural resources that are often underutilized due to limited knowledge, market access, and institutional capacity. One prominent example is agricultural waste, which is frequently treated as having little or no economic value. Coconut-producing regions, in particular, generate significant amounts of by-products such as coconut shells, which are commonly discarded or burned without further process. This practice illustrates a broader challenge in matching local resource potential with community capability and market integration, in addition to being an interruption economic opportunity (Dewi & Achadiyani, 2013; Hanafi et al., 2015).

A typical example of this condition is Adabai Village. The village has a lot of potential for natural resources, especially coconuts, but before this initiative was put into place, coconut shells were mostly disposed of as garbage rather than as a useful input. Majority of locals either disposed of or used coconut shells in low-value ways, according to preliminary field observations and community involvement. At the same time, there was limited knowledge regarding value-added processing, such as converting coconut shells into charcoal, and limited experience in organizing collective business efforts. These results align with Indonesia's overall rural development issues, where local economic development is frequently constrained by the gap between resource availability and community capabilities (Mardela et al., 2017; Muhid et al., 2018).

This situation is evident in Adabai Village, where the cultivation of coconuts produces a substantial amount of shell trash that has not been used to its full potential. Before this scheme was put into place, coconut shells were typically considered low-value by-products rather than potential sources of income. This scenario is a reflection of larger structural issues, such as restricted access to stable markets, a lack of technical expertise in value-added processing, and prior experiences with communal economic efforts that did not expand sustainably. Simultaneously, the community demonstrates an underlying economic drive to enhance home livelihoods, indicating a firm foundation for development of community-based economic activity.

In response to these conditions, this community service program was designed to introduce and develop a community-based coconut shell charcoal enterprise through a participatory approach. Three primary factors were taken into account when choosing Adabai Village for the community service project: (1) the availability of available yet underutilized coconut shell resources; (2) the presence of community members who are willing to participate in group economic activities; and (3) the support of local stakeholders, including village authorities and facilitators. The program's objectives were to improve local capacity, change how the community views waste materials, and promote the development of a sustainable, community-driven business model that aligns to the circular economy's principles (Scarinci et al., 2010; Sulistiowati & Sirait, 2014).

This idea of community empowerment and participatory development, which emphasize active community involvement in problem identification, planning, and execution, is the theoretical foundation of this project (Schiffman et al., 2007; Wantini, 2018). Additionally, it is in line with project-based learning, which combines organizational, technical, and financial aspects into a single process, and hands-on learning approaches, which build knowledge via direct experience and reflection. Previous studies have shown that such approaches can enhance community participation, improve knowledge transfer, and increase the likelihood of sustainable outcomes, particularly in rural economic development contexts (Yunitasari et al., 2016).

However, there are ongoing debates regarding the effectiveness of community-based enterprises in rural settings. Long-term sustainability may be limited by concerns including low institutional frameworks, restricted market access, and low participant trust (Mardela et al., 2017). Others believe that community-based approaches can produce major socioeconomic improvements and increase community resilience when they are supported by suitable facilitation,

training, and outside support (Muhid et al., 2018). These differing perspectives highlight the importance of context-specific, in-depth analysis, such as a case study approach, to better understand the dynamics of community-based initiatives.

Under such circumstances, the primary goal of this study is to examine the procedures and results of a community service initiative that aims to increase the production of coconut shell charcoal in Adabai Village using participatory techniques. The study specifically aims to investigate how community views of coconut shell waste shift over a long period, identify important variables affecting involvement and group dynamics, and evaluate the contribution of outside assistance to the growth of a community-based organization.

In line with the study's findings, the program greatly altered the community's perception of coconut shells, which made them appear not as a waste and more like a useful economic resource. In addition, the program stimulated community participation and highlighted the importance of small-group collaboration, economic motivation, and external facilitation in supporting early-stage enterprise development. These results suggest that integrating participatory approaches with practical, context-based training can play a critical role in bridging the gap between resource potential and community capacity.

Overall, by offering a comprehensive illustration of how local resources can be converted into economic opportunities through participatory and experiential methodologies, this study adds to the increasing body of knowledge on community-based rural development and circular economy practices. The results of this study should be able to guide the development and execution of corresponding initiatives for community service in other rural settings with comparable characteristics.

Method

This study was conducted through six systematic stages, as illustrated in Figure 1, encompassing preliminary assessment, programme design, implementation, practical demonstration, data analysis, and evaluation. Each stage was designed to ensure a structured and rigorous research process aligned with the programme's objectives.

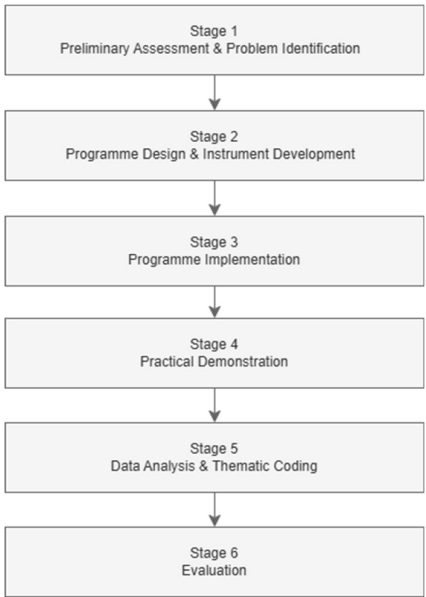


Figure 1. Stages of the Community Service Program

This study uses a qualitative case study methodology to investigate community-based use of coconut shell trash, with a particular focus on Adabai Village. This approach enables an in-depth understanding of local socio-economic conditions, community behavior, and institutional dynamics related to the development of coconut shell charcoal as a community-based enterprise.

The subjects of this study consisted of 16 village residents who participated in a structured questionnaire, complemented by in-depth inductive interviews with key stakeholders. The village chief, community members (especially male participants in village hall talks), facilitators, and local partners were among these stakeholders. Purposive sampling was used to select participants based on their participation in village decision-making processes, community organizations, and coconut-related activities. All respondents provided their informed approval before to the interviews, guaranteeing their voluntary involvement and consent to the use of the data for research.

Community service activities were conducted over an extended period from October 2025 to July 2026. The process followed a participatory approach, integrating Participatory Rural Appraisal (PRA), experiential learning, and project-based learning methods. This activities emphasized joint community action planning (community organizing), where the assisted community was actively involved in identifying problems, exploring local potential, and designing collective solutions related to coconut shell waste utilization.

The program was implemented in several stages. A preliminary evaluation was carried out to gather a fundamental understanding of village conditions, including potential natural resources, current knowledge, and socioeconomic factors. Second, community people were interviewed and involved in conversations to identify important challenges and possibilities. These early stages of analysis and problem identification are the main focus of this study.

Instruments used in this study included a structured questionnaire and a semi-structured interview guide. The interview instrument was designed to explore participants' perspectives on resource utilization, economic motivation, group dynamics, institutional support, and business processes. It allowed for deeper probing into participants' experiences while maintaining consistency across key topics. The instrument was reviewed internally before implementation to ensure clarity and contextual relevance. All interviews conducted with prior consent, and participants were informed that their responses would remain anonymous.

Data collection was conducted through questionnaires, direct observation, and in-depth interviews. Interview data were collected through discussions at village hall and with key informants, including village head and community members. Observations were conducted during training sessions and community interactions to capture behavioral and participatory aspects of the program.

Data were analyzed using a thematic analysis approach. An initial open coding process was conducted based on interview transcripts, resulting in a structured codebook. The analysis was conducted iteratively to ensure consistency between empirical findings and thematic interpretation.

To enhance data validity, triangulation was used by comparing findings across multiple data sources, including questionnaire responses, and in-depth interviews with key stakeholders. This approach ensured the reliability and consistency of the findings across different perspectives.

This study is limited by its case-study focus on a single village, which allows for in-depth contextual understanding but limits the generalizability of its findings to other regions with different socio-economic and cultural characteristics. In addition, the duration of observation does not fully capture long-term business sustainability outcomes.

Data Collection Instruments

The data collection instrument employed was a structured interview guide developed to capture the perspectives of multiple stakeholder groups. Respondent categories covered by the guidance include (A) coconut farmers and (B) village officials. Knowledge of coconut shell processing technology, entrepreneurship motivation and readiness, organization management, and the sustainability and economic viability of charcoal products were the main topics of interview questions.

Before each interview, respondents provided verbal consent to participate and to be recorded. Data collected reported in aggregate form and did not disclose individual identities.

Data Analysis

Qualitative data obtained from interviews and field observations were analyzed using a thematic analysis approach. Major themes were categorized along four dimensions: (1) changes in perceptions towards coconut shell waste; (2) group entrepreneurial readiness and motivation; (3) technical and managerial capacity; and (4) business sustainability potential. The results of this analysis was subsequently used to identify enabling and inhibiting factors in the development of a coconut shell charcoal enterprise in Adabai Village.

Result

This section presents the findings from both the structured questionnaire administered to 16 community participants and the in-depth qualitative interview with from key stakeholders at Adabai Village, including the village head, farmers, and facilitators. The results are organized according to the five thematic categories identified in the coding analysis: (1) village potential versus capacity; (2) transformation of waste perception; (3) motivation and participation; (4) social and institutional dynamics; and (5) external support.

Village Potential Versus Capacity

Interview data confirmed that Adabai Village possesses significant natural resource potential, centred on coconut production. The village head explicitly acknowledged, *“There are resources, but the community does not yet understand how to manage them”*. This statement reflects code C1 (Natural resource potential) and C2 (Limitations of Knowledge), underscoring the central paradox that characterises many rural coconut-producing communities: abundant physical resources coexist with limited processing knowledge and institutional capacity.

Market access barriers were further identified as a structurally limiting factor. The village head noted, *“The buying and selling system is not yet suitable... outside buyers are still somewhat inconsistent”*. This narrative aligns with code C3 (Market Access), indicating that the absence of reliable and stable buyer networks constitutes a major constraint on economic diversification, even when production potential is available.

Table 1: Summary of Questionnaire Responses: Resource Potential and Capacity Dimensions

Statement / Indicator	Agree / Strongly Agree	Neutral	Disagree
Village has abundant coconut shell resources	15 (93.75%)	1 (6.25%)	0 (0%)
Community lacks knowledge of shell processing	14 (87.5%)	2 (12.5%)	0 (0%)
Shell selling price is currently very low	13 (81.25%)	2 (12.5%)	1 (6.25%)
Buyers are inconsistent or absence	12 (75%)	3 (18.75%)	1 (6.25%)

Transformation of Waste Perception

Prior to the program intervention, coconut shells were consistently treated as waste materials with no perceived economic value. As one farmer participant stated, *“Shells have always just been thrown away... the community discards them because no one came to buy them”*. This statement, coded as C6 (Waste Utilization), reflects a deeply embedded pattern of waste disposal rooted in the absence of market awareness and technical knowledge.

Following exposure to the training and carbonisation demonstration, a visible shift in perception emerged. Participants began to recognise shells as collectible, processable resources, *“Now people have started collecting them... they gather from coconut trees everywhere and peel them”*. This behavioural shift represents a critical early indicator of the perceptual transformation that the program sought to facilitate.

Economic Motivation and Community Participation

Economic motivation emerged as the predominant driver of community interest in the program. Participants consistently linked engagement to immediate household financial needs. One participant stated, *“The benefit is for the family, like money for children's school fees”*. This aligns with code C4 (Economic Motivation), confirming that short-term livelihood needs constitute the primary motivational anchor for early-stage enterprise participation in low-income rural communities.

Program perception (C5) was uniformly positive across respondents. The collective sentiment is captured in the farmer's statement, *“This activity is positive... we agree because processing shells in the village brings income”*. This positive reception is reinforced by quantitative questionnaire data showing that 87.5% of respondents expressed willingness to participate in a collective business group.

A potential explanation for the small proportion of respondents who disagreed with joining the coconut shell charcoal business group is the lack of awareness or understanding of the program and its potential benefits. Individuals who are not fully informed about the economic value, processing methods, or market opportunities of coconut shell utilization may perceive the initiative as uncertain or irrelevant to their livelihoods. This is consistent with previous studies, which indicate that limited awareness and insufficient knowledge are significant barriers to community participation, as individuals are less likely to engage in activities, they do not fully understand or trust (Mulvale et al., 2023). Therefore, improving knowledge dissemination, training, and communication strategies is essential to enhance participation and reduce hesitation among community members.

Table 2: Questionnaire Results: Economic Motivation and Participation Readiness (n =16)

Indicator	Yes / Strongly Agree	No / Disagree
Would join the coconut shell charcoal business group	14 (87.5%)	2 (12.5%)
Believes the activity will increase household income	16 (100%)	0 (0%)
Activity is perceived as beneficial and relevant	15 (93.75%)	1 (6.25%)
Economic motivation: need for additional income	16 (100%)	0 (0%)
Willing to invite other community members to join	13 (81.25%)	3 (18.75%)

Social and Institutional Dynamics

Interview data revealed a nuanced understanding of group dynamics and institutional history. When asked about conflict resolution, one participant responded, *“If there are problems, go quickly to the leader... the leader, there is already a leader, the secretary can settle it within the group”*. This reflects code C8 (Association Dynamics) and suggests that participants possess an intuitive understanding of organisational hierarchy, which may facilitate the formation of formal business governance structures.

However, institutional memory presented a cautionary dimension. A farmer participant noted, *“A cooperative once existed but failed... there was no cooperation among members”*. This aligns with code C9 (Inability of Institutions), underscoring that past institutional failures remain present in community consciousness and may generate scepticism or reluctance. Acknowledging this history and building explicit trust mechanisms will be critical in the formation of the new enterprise group.

Regarding the composition of the group, participants also expressed informed views on intergenerational collaboration, *“In my opinion, the most positive composition includes married people, older men, and young people too”*. This observation reflects the social capital embedded in cross-generational collective action as a stabilising mechanism for newly formed enterprise groups.

External Support and Programme Sustainability

Participants consistently identified the need for sustained external facilitation as a precondition for programme success. One participant observed, *“Training is not regular... if quick results are available, the community is interested”*. This reflects code C10 (External Support) and highlights a critical tension in community development programming, community motivation is frequently contingent on the visibility of short-term outcomes, while institutional sustainability requires long-term capacity building.

Stakeholder support from the village head was notably strong. The village head expressed, *“There must be involvement from village residents to truly support the programme that has been brought here”*. This institutional endorsement is a significant enabling factor, as village head support has been shown to substantially strengthen community programme legitimacy and participant mobilisation (Akbar et al., 2020).

Table 3: Full Qualitative Coding Summary — NVivo-Based Thematic Analysis

Code	Label	Key Evidence from Data
C1	Natural resource potential	Adabai has coconut, village head & farmers confirm high natural endowment
C2	Limitations of Knowledge	Knowledge gap in value-added processing
C3	Market Access	Inconsistent buyers, unstable market
C4	Economic Motivation	Household financial necessity drives participation
C5	Persepsi Program	93.75% respondents perceive program positively
C6	Waste Utilization	Previously discarded coconut shells are now being collected, indicating a clear shift in community perception
C7	Partisipasi Masyarakat	87.5% willing to join group; multi-generational interest
C8	Association Dynamics	Small groups are preferred, while structured group work is perceived to higher output
C9	Inability of Institutions	Cooperative existed before but failed due to lack of member collaboration” — reflecting institutional memory of past failure

Code	Label	Key Evidence from Data
C10	External Support	Training was not conducted regularly” — indicating the need for sustained facilitation; the village head supports integration with BUMDes

Economic Potential Analysis of Coconut Shell Utilisation

An empirical foundation for assessing the economic potential of coconut shell processing was supplied by field observations and quantitative data gathered during the community service project in Adabai Village. Under smallholder cultivation circumstances, coconut trees (*Cocos nucifera* L.) produce about 25 kg of coconut fruit per tree annually, according to accepted agricultural standards (Badan Pusat Statistik, 2022; Asian and Pacific Coconut Community [APCC], 2021). The shell, or tempurung kelapa, makes up around 12% of the weight of each coconut fruit (Siregar et al., 2018; Yacob et al., 2011), producing about 3 kilogram of shell material per tree every year. These benchmarks align with the production statistics provided by farmers in Adabai Village during field interviews; each tree was estimated to yield about eight fruits every harvest cycle, with harvests taking place every three months.

In alignment with local handling and collection practices observed during field observations, each participant contributed one sack (*karung*) of raw coconut shells, each of which contained roughly 15 kg of shell material. This method was used to quantify community contributions for the purposes of this economic analysis. A subsequent comparative economic analysis is based on this unit of contribution, which is one sack per participant.

Under the conventional practice of selling raw coconut shells directly to collectors or small traders, predominant current practice in Adabai Village, prevailing market price in East Seram Regency was recorded at approximately Rp 1,000–1,500 per kilogram of raw shell. Accordingly, one sack (15 kg) of raw coconut shells generates revenue of only Rp 15,000–22,500 per participant. This price level reflects the minimal value-added treatment that has historically characterised the local coconut shell commodity chain, in which shells function as an undifferentiated bulk material with limited market recognition.

In contrast, when coconut shells are processed into charcoal (arang tempurung kelapa) through the carbonisation method demonstrated during the activity, the economic value increases substantially. Data collected from the resource persons and supporting partners during the activity indicated a carbonisation yield rate of approximately 21.82% that is, every 15 kg of raw coconut shell produces approximately 3.27 kg of charcoal product. A single bag of raw shell thus makes about Rp 65,400–65,574 in charcoal revenue at the current selling price of Rp 20,000 per kilogram of coconut shell charcoal, as confirmed by market data obtained from partner networks operating in East Seram Regency. This calculation is presented in Table 4.

Table 4: Economic Comparison of Raw Coconut Shell Sales versus Charcoal Processing per Participant Contribution

Parameter	Raw Shell (Sold Directly)	Processed Charcoal
Input per participant	1 sack = 15 kg raw shell	1 sack = 15 kg shell → 3.27 kg charcoal
Selling price	Rp 1,000–1,500 / kg	Rp 20,000 / kg charcoal
Revenue per sack	Rp 15,000–22,500	Rp 65,400–65,574
Value-addition ratio	2.9–4.4x (estimate: 3x)	

When shells are converted into charcoal, the value-addition ratio is roughly 2.9–4.4 times, as Table 4 illustrates. A conservative estimate of this improvement in economic return is roughly three times (3x). Additionally, revenue per sack rises from Rp 15,000–22,500 for raw shell to about Rp 65,400–65,574 for processed charcoal. This is an absolute added value of Rp 43,074–50,574 per participant per collecting cycle. Comparing maximum raw shell income (Rp 22,500) to charcoal revenue (Rp 65,574) yields the most cautious multiplier (2.9x), while comparing minimum raw shell revenue (Rp 15,000) to the same charcoal revenue number yields the greatest multiplier (4.4x).

These findings carry significant implications for household welfare in Adabai Village. The systematic carrying out carbonization procedures has the potential to result in significant and long-lasting increases in household income because coconut farming is the population's main source of income and produces large amounts of shell waste. Assuming each farming household contributes one sack of processed shells per collection cycle, incremental income gain of Rp 43,074–50,574 per cycle is achievable without additional land, seed, or primary production costs, since the raw material is a by-product that would otherwise be discarded. The total community-level gain each cycle for a participating community with, say, 27 active contributors would be between Rp 1,162,998 and Rp 1,365,498. This is a real and ongoing economic benefit that comes exclusively from previously unused waste.

In terms of revenue, this program gives individuals an additional and comparatively secure source of income, enhancing economic resilience, especially in rural areas where income diversification is crucial (Gautam, Y., & Andersen, P., 2020). By decreasing untreated coconut shell waste, it also supports environmental sustainability from a non-financial standpoint. This aligns with the ideas of the circular economy, which prioritize resource efficiency, waste valorization, and less environmental impact (Leong et al., 2021; Hsiao & Hu, 2024; Adeleke et al., 2025).

The economic feasibility shown here offers a data-driven justification for the creation of a formal communal enterprise in Adabai Village, going beyond the immediate income benefit. Even with modest price assumptions, the economic rationale for producing charcoal from coconut shells is robust, as confirmed by the three-fold value multiplication. The per-unit economics would remain favorable and the overall welfare impact would be proportionately increased if the business were to grow through collective management, combining contributions from all participating households, systematizing production, and creating stable market channels of distribution.

Assistance Process Data

An outline of the community assistance program's implementation procedure in Adabai Village is given in this subsection. The programme involved about forty individuals in all. Five training sessions and meetings were used to carry out the assistance activities. The purpose of each one-hour session was to present and illustrate the process of turning coconut shells into charcoal products. A modest level of participation throughout the programme was indicated by the average attendance percentage of almost 75% every session. Nevertheless, a number of implementation issues were found. The main obstacle was the participants' limited availability, which had an impact on some sessions' overall involvement and schedule regularity. Although participation patterns show the need for more flexible scheduling techniques in future programmes, the support process was generally carried out in an organised manner.

Discussion

The results of this community service program show that the participatory training approach, which integrated Project-Based Learning, Experiential Learning, and Participatory Rural Appraisal (PRA), effectively started fundamental changes in community awareness, perception,

and entrepreneurial readiness with regard to coconut shell charcoal production in Adabai Village. These findings warrant discussion in relation to four intersecting dimensions: perceptual transformation, participatory motivation, social and institutional dynamics, and programme sustainability.

Perceptual Transformation and Circular Economy Principles

The observed shift in community perceptions, from treating coconut shells as worthless waste to recognising them as collectible economic resources is a foundational precondition for enterprise development. This transformation aligns directly with circular economy principles, which emphasise the productive reintegration of by-products and waste into local value chains (Mallapiang et al., 2020). Asfar et al. (2024) show that community-based waste valorization programs in Indonesian settings are successful when participants acquire a financial interest in previously discarded items. The current results support this pattern, indicating that perceptual change is supported by tangible economic evidence, such as the 3x value-multiplication ratio seen in the comparison of raw shell and charcoal.

Furthermore, Rahayu et al. (2025) note that coconut-producing communities exhibit strong potential for waste-to-value transitions when supported by cross-sectoral facilitation, a condition that the multi-stakeholder composition of the present programme (university, NGO, village government, community) was specifically designed to provide. The economic case was visibly and tangibly confirmed by the effective carbonization demonstration, which produced about 3.27 kg of charcoal from 15 kg of raw shell. This is in line with the theory of experiential learning, which holds that community knowledge is best developed through direct, observable practice rather than theoretical learning (Yunitasari et al., 2016).

Participatory Motivation and Economic Drivers

Chambers's (2017) claim that closeness to livelihood outcomes greatly mediates rural community program involvement is supported by the prevalence of short-term economic incentive, as seen by references to school fees, daily income, and supplemental household income. In the current situation, 87.5% of questionnaire respondents said that they would be willing to join a collective business group, and 100% respondents confirmed that they thought the program would raise household income. Compared to similar rural Indonesian case studies, this level of engagement exceeds participation benchmarks.

The research does, however, also show an issue between long-term sustainability and short-term incentive. In line with Nalhadi et al. (2020), who warn that early-stage rural firms sometimes experience participant turnover when initial economic returns are delayed, one participant noted that community interest is dependant on immediate outcomes. Due to the economic instability of smallholder households and the lack of financial safeguards to maintain involvement during the firm development stage, this problem is structural rather than personal. In order to retain motivation at the crucial formative stage of the firm, external facilitation must not only offer technical training but also design systems for early, concrete income production.

Group Dynamics, Social Capital, and Institutional Memory

Strong social capital (gotong royong, multigenerational solidarity, village head support) and institutional memory of collective failure (the previously dissolved cooperative) coexist in this dualistic institutional landscape, according to the qualitative findings. According to Burhanuddin (2024), a distinguishing characteristic of Indonesian village-based economic initiatives is the

coexistence of institutional skepticism and enabling social norms. Then he proposes that program design must explicitly identify and address past failures in order to prevent them from undermining new institutional formations.

Results of Akbar et al. (2020), who show that participatory planning in rural Indonesia is more successful when carried through bounded, socially integrated groups, where interpersonal trust is already established, are consistent with participants' preference for limited-group organization. The choice for an intergenerational, which includes farmers, further demonstrates an understanding that business viability necessitates both youthful enthusiasm and seasoned leadership, a combination that multiple studies link to more robust rural cooperatives (Omondi, 2020). The governance structure of an organization group should be directly influenced by these insights.

External Support, BUMDes Integration, and Programme Sustainability

The community empowerment literature emphasizes that one-time interventions are insufficient for lasting behavior change and enterprise formation, which is consistent with the identification of irregular training as a limiting factor (C10) (Utami et al., 2024). According to research by Anwar and Meilizar (2025), processed coconut shells enterprises embedded within village-level institutional frameworks exhibit significantly higher rates of post-training sustainability than those operating informally, indicating that the village head's support of BUMDes integration represents a strategically significant institutional pathway.

Furthermore, Yirijor and Bere (2024) report that three enabling conditions, reliable raw material collecting mechanisms, stable market connections, and easily accessible start-up financing, help coconut shell charcoal businesses make a smooth transition from informal to formal production. Carbonization demonstration and collaborative harvesting model were used in the current initiative to address the first of them, but market networks and funding are still significant unresolved obstacles. The formalization of the business group and the creation of market connections with local consumers, particularly distributors focused on exports and cuisine that have already been identified via partner networks, should be given top priority in subsequent program phases. Additionally, this program is an attempt to strengthen the community's potential to grow economically in their village. Additionally, this program is a capacity-building activity that aims to improve the Adabai Village community's ability to develop their local economy, especially through institutional strengthening, skill development, and knowledge transfer. It is commonly acknowledged that capacity-building programs are crucial for enabling rural areas to maintain economic activity and enhance long-term development results (UNDP, 2020; OECD, 2019).

When considered collectively, these results indicate that the program has effectively created the requirements for enterprise formation, perceptual shift, motivational engagement, and institutional preparedness. However, in order to convert these prerequisites into long-lasting socioeconomic results, ongoing facilitation, financial scaffolding, and market development support are required. This conclusion is consistent with the multi-level empowerment framework that this model proposes.

Conclusion

This community service programme, encompassing entrepreneurship training, business organisation, and hands-on carbonisation demonstration for a community-based coconut shell charcoal enterprise, was successfully implemented in Adabai Village, Siwalalat District, East Seram Regency. Drawing on data from structured questionnaires (n = 16) and in-depth qualitative interviews with key stakeholders, including the village head and community farmers, the study

identifies outcomes that collectively advance the programme's development objectives.

1. Program contributed to a measurable and significant shift in community perceptions of coconut shell waste, from a discarded by-product to a recognised and economically productive resource, as evidenced by spontaneous collection behaviour observed among participants following the training.
2. Quantitative analysis confirmed that coconut shell charcoal processing generates a three-fold increase in economic return per unit of raw material compared to conventional shell disposal, providing a robust economic rationale for enterprise development.
3. Community participation readiness was high, with 87.5% of respondents willing to join a collective business group and 100% affirming the income-generating potential of the program.
4. Qualitative interview data surfaced a nuanced institutional landscape in which enabling social capital (*gotong royong*, multi-generational cooperation, village head endorsement) coexists with institutional memory of past collective failures, indicating that group formation must be accompanied by explicit trust-building and governance design.
5. The study confirmed that external support quality, particularly the regularity and practical orientation of facilitation, is perceived as a critical enabling condition for programme effectiveness and participant retention.

The principal limitations of this study include its single-village case study focus and the temporal constraints of the intervention, which precluded the completion of a full production-to-market cycle. Recommended follow-up activities include: (1) advanced technical training in charcoal quality standardisation and packaging; (2) facilitation of the formal establishment and legal registration of the business group; (3) development of a market linkage strategy targeting regional, culinary, and export buyers; (4) exploration of BUMDes integration to access village government institutional support and financing mechanisms; and (5) the establishment of a monitoring and evaluation framework to track enterprise performance across subsequent production cycles.

These steps are essential to translate the awareness, motivation, and initial capacity generated during this programme into tangible, sustained, and community-owned economic outcomes. The findings of this study contribute to the growing evidence base on circular economy-based rural empowerment and offer replicable insights for similar coconut-producing communities in Eastern Indonesia and the broader archipelago.

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Conflicts of Interest

The authors declare no conflict of interest.

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