

Community Empowerment Through Training on Coffee Waste Briquette Production as an Environmentally Friendly Alternative Energy Source

Pemberdayaan Masyarakat Melalui Pelatihan Produksi Briket Limbah Kopi Sebagai Energi Alternatif Ramah Lingkungan

Machmud Al Amrie^{1*}, Adi Aspian Nur², Risnafaty³

^{1&2}Program Studi Ekonomi Pembangunan, Ekonomi, Universitas Kaltara, Indonesia

³Program Studi Teknik Sipil, Arsitek, Universitas Kaltara, Indonesia

*Email correspondent: machmud.al.amrie@gmail.com

Abstract

The increase in global coffee consumption has an impact on the accumulation of coffee grounds waste which has not been utilized optimally, even though it has potential as a biomass-based alternative energy source. This condition also occurs in Lebong Village, Tanjung Palas Hilir District, where coffee waste continues to increase along with the development of household-scale coffee shop businesses, while community capacity in managing waste and utilizing alternative energy is still limited. This research aims to increase people's knowledge and skills in processing coffee grounds waste into economically valuable briquettes. The method used is a participatory approach through technical training, counseling and production assistance that involves the community directly. The research results show an increase in understanding, technical skills and environmental awareness in the community in utilizing waste into alternative energy products. Apart from that, this activity also opens up new business opportunities based on local potential which contributes to improving the community's economy. The implications of this research confirm that the use of coffee waste as briquettes not only supports sustainable environmental management, but also strengthens energy independence and community economic empowerment based on local resources.

Keywords: coffee grounds; biomass briquettes; alternative energy; community empowerment; sustainability

Abstrak

Peningkatan konsumsi kopi global berdampak pada akumulasi limbah ampas kopi yang belum dimanfaatkan secara optimal, padahal memiliki potensi sebagai sumber energi alternatif berbasis biomassa. Kondisi ini juga terjadi di Desa Lebong, Kecamatan Tanjung Palas Hilir, di mana limbah kopi terus meningkat seiring berkembangnya usaha kedai kopi skala rumah tangga, sementara kapasitas masyarakat dalam pengelolaan limbah dan pemanfaatan energi alternatif masih terbatas. Penelitian ini bertujuan untuk meningkatkan pengetahuan dan keterampilan masyarakat dalam mengolah limbah ampas kopi menjadi briket bernilai ekonomis. Metode yang digunakan adalah pendekatan partisipatif melalui pelatihan teknis, penyuluhan, serta pendampingan produksi yang melibatkan masyarakat secara langsung. Hasil penelitian menunjukkan adanya peningkatan pemahaman, keterampilan teknis, serta kesadaran lingkungan masyarakat dalam memanfaatkan limbah menjadi produk energi alternatif. Selain itu, kegiatan ini juga membuka peluang usaha baru berbasis potensi lokal yang berkontribusi terhadap peningkatan ekonomi masyarakat. Implikasi penelitian ini menegaskan bahwa pemanfaatan limbah kopi sebagai briket tidak hanya mendukung pengelolaan lingkungan yang berkelanjutan, tetapi juga memperkuat kemandirian energi dan pemberdayaan ekonomi masyarakat berbasis sumber daya lokal.

Kata Kunci: ampas kopi; briket biomassa; energi alternatif; pemberdayaan masyarakat; keberlanjutan

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INTRODUCTION

Organic waste management has become a critical global issue, particularly in response to the increasing consumption of coffee, which directly contributes to the accumulation of coffee grounds waste (Dermawan & Santoso, 2023). In many countries, such waste is still treated as household refuse without being optimally utilized (Aspian Nur & Al Amrie, 2024). However, from a scientific perspective, coffee grounds possess significant biomass potential that can be converted into environmentally friendly alternative energy sources, such as briquettes (Ariyanto et al., 2022). At the same time, the growing demand for renewable energy has encouraged the exploration of energy sources that are not only sustainable but also affordable and accessible to local communities (Ambina, 2019). Therefore, the utilization of coffee waste as a raw material for briquette production represents an innovative solution that simultaneously addresses waste management challenges and energy needs (Anggraeni & Ismaya, n.d.).

At the local level, a similar issue is observed in Lebong Village, Tanjung Palas Hilir District, where the increasing number of small-scale home-based coffee businesses has led to a rise in coffee waste generation (Al Amrie & Aspian Nur, 2025). This waste is generally discarded without any form of productive reuse, thereby contributing to the village's environmental burden. Furthermore, the local community, particularly the partner group, faces limitations in knowledge and technical skills related to transforming waste into value-added products (Macapugay & Nakamura, 2024). The lack of simple production equipment and limited awareness of the economic potential of coffee briquettes further highlight the gap between available resources and their effective utilization (Målqvist, 2018).

Empirical evidence supports the feasibility of utilizing coffee grounds as an alternative energy source Chazienul and Lasititi (2021) demonstrates that coffee waste briquettes have relatively high calorific value, good combustion efficiency, and environmental friendliness. These findings confirm that coffee grounds are not merely consumption residues but represent a viable and sustainable energy resource. Nevertheless, the practical implementation of these findings at the community level remains limited, particularly in the form of structured and continuous empowerment programs (Hadi & Fitria, 2020).

From a policy perspective, the utilization of organic waste for alternative energy development is strongly supported at both national and regional levels. Law No. 18 of 2008 on Waste Management and Government Regulation No. 81 of 2012 emphasize waste reduction through reuse and recycling practices. Additionally, Presidential Regulation No. 22 of 2017 on the National Energy Plan (RUEN) promotes the development of renewable energy, including community-based biomass. At the regional level, development policies in North Kalimantan Province and Bulungan Regency highlight the importance of reducing organic waste, strengthening village economies based on local potential, and promoting alternative energy to support community self-reliance (Bapolisi et al., 2025). These policy frameworks indicate a strong alignment between community needs and national as well as regional development priorities.

However, effective waste management and renewable energy development require not only technical interventions but also the enhancement of environmental awareness and pro-environmental behavior within the community. Environmental education, particularly from an early age, plays a crucial role in fostering sustainable attitudes and practices in the

long term. Therefore, a comprehensive approach that integrates technical capacity building with environmental awareness is essential (Ikaningtyas et al., 2024).

In response to these challenges, this study proposes a solution in the form of technical training and assistance in producing coffee waste briquettes, integrated with education on environmental sustainability and renewable energy (Hadilinatih & Widjajani, 2016). This approach is expected to enhance community skills in converting waste into economically valuable products while simultaneously creating new business opportunities based on local resources. Moreover, this initiative contributes to reducing environmental waste and supporting energy self-sufficiency at the community level (Anekawati et al., 2021).

IMPLEMENTATION METHOD

This program is carried out with a counseling and socialization approach led by lecturers as the main speakers. In the activity, lecturers delivered material in a structured manner using presentations (*PowerPoint*) and invited participants to discuss to deepen understanding. This interactive approach is designed to involve participants' activities in simulating making briquettes from coffee waste. Community training methods generally include several stages from planning to final evaluation.

Partner Profile

1. Partners : Youth and residents of Lebong Village, Tanjung Palas Hilir Village
2. Location : Tanjung Palas Hilir Village Office.
3. Participants : 25 people (youth and local residents).

Partners are selected based on local potential (coffee waste abundance) and community commitment to renewable energy.

Implementation Steps

1. Pre-Activity

- a. Location Survey: The implementation team conducted an initial survey in Lebong Village to identify potential coffee waste and partner conditions;
- b. Coordination and Planning: Coordinate with village officials and community leaders to prepare schedules, ensure the availability of places (Kelurahan Office), as well as technical implementation;
- c. Preparation of Materials and Tools: Prepare counseling modules, PowerPoint presentations on making briquettes, and briquette simulation equipment (briquette printing equipment);
- d. Preliminary Socialization: Invited 25 selected participants (youth and residents of Lebong Village) to attend; conveyed the purpose of the activity to create good anticipation before the training.

2. Activities

The core activities were held for two consecutive days. The details of the daily schedule are as follows:

Table 1. Activity Schedule Details

Day	Time	Material	Presenter (Speaker)
Day 1	09.00–09.30	Program opening and introduction	Lecturer
	09.30–11.00	Counseling: Benefits & process of making coffee waste briquettes	Lecturer
	11.00–11.15	Rest	
	11.15–12.30	Simulation: Briquette making demonstration via video/PPT	Lecturer
Day 2	08.00–09.00	Review of material and discussion	Lecturer
	09.00–10.30	Practice simulation: Stages of briquette molding	Lecturer
	10.30–10.45	Rest	
	10.45–12.00	Field evaluation: Discussion/Q&A and closing	Lecturer

In each session, lecturers deliver material interactively (lectures and demonstrations) and facilitate discussions with participants. This approach is in line with the general practice of community training, which is a combination of providing materials and active participation of participants.

3. Monitoring and Evaluation

1. Activity Monitoring: The teaching team monitors the course of the training (e.g. participant involvement in discussions and simulations) so that the learning process runs effectively. Material changes or deepening can be made if it is seen that participants need more explanation.
2. Evaluation During the Activity: Conducted through oral questions and answers and short exercises in each session to gauge the participants' understanding before moving on to the next material.
3. Post-Activity Evaluation: After the training is complete, a short Q&A session and interviews are held with participants to assess their improvement in understanding and skills. This feedback is used to evaluate the program's success and future improvements.

The evaluation of service activities is carried out in a measurable and systematic manner to assess the achievement of the objectives of the activity. The evaluation method includes evaluation instruments, assessment indicators, and techniques for calculating the achievement of the percentage of increase in participants' competencies.

The evaluation instruments used consist of:

- (1) observation sheets of participants' involvement and skills during the activity,
- (2) questionnaire understanding of the material and perception of the benefits of the activity, and
- (3) Assessment sheet of the results of the simulation of making briquettes based on technical criteria.

Assessment indicators are divided into two aspects, namely *soft skills* and *hard skills*. *Soft skill indicators* include: the level of activity of participants in discussions, the ability to understand the concept of coffee waste utilization, and the ability to explain the stages of briquette production. *Hard skill indicators* include: participants' ability to identify raw

materials, understand the briquette production flow, and participants' accuracy in participating in the technical simulation of making briquettes displayed through presentation media.

The percentage achievement measurement was carried out by comparing the initial score (before training) and the final score (after training). Each indicator is scored on a scale of 1–5, then calculated on average. The percentage increase is calculated using the formula:

$$\text{Increase (\%)} = \frac{[(\text{Final Score} - \text{Initial Score}) / \text{Maximum Score}] \times 100\%}{}$$

Post-activity evaluation is carried out through reflection with participants and filling out questionnaires on the benefits of activities to assess the sustainability of understanding and the potential application of training results in the community.

RESULTS AND DISCUSSION

Implementation by Lecturers: This PKM activity is guided by lecturers as the main speakers. Lecturers are responsible for providing *counseling* and *socialization* to the community regarding the use of coffee waste as raw materials for briquettes. The material was delivered in a combination of interactive lectures and practical demonstrations (simulation of making briquettes through a PowerPoint presentation display). With this method of lectures, practices, and group discussions, participants can comprehensively understand the concepts and technical steps of making briquettes. The activity was carried out in a participatory manner so that the community actively asked questions and discussed how to produce environmentally friendly briquettes from coffee waste – for example coffee grounds – according to the correct procedures.

The partners of this program are youth and residents of Lebong Village, Tanjung Palas Hilir District. The activity will take place at the Tanjung Palas Hilir Village office involving 25 participants (youth and local residents). The participants consisted of various community groups that have the potential to utilize local coffee waste. As administrative completeness, the brief profile of the partners includes data on the number of youth/residents who participated in the training (25 people), location conditions (villages and village office facilities), and their role as training beneficiaries.

Implementation Steps

Pre-Activity

Before the implementation of the training, the implementation team made preparations in the form of location surveys and needs analysis. This survey involves community leaders or village officials to map the potential of coffee waste available in Lebong Village. Information from the survey (number of small coffee shops, potential coffee grounds, access to electricity, and alternative energy needs) was used to adjust training materials and equipment. In addition, coordination was carried out with the village for technical implementation: determining dates, compiling participant lists, and preparing rooms (village meeting rooms complete with projectors for simulation). All of these preparations are aimed at making the two-day training run smoothly and on target.

Implementation of Activities

The core activities were carried out for 2 consecutive days . On the first day, socialization materials and basic theories were presented, followed by a simulation of the

briquette making process. The second day contained more practice and follow-up discussions. Before entering the training, participants register and get a brief introduction to the schedule.

The training is held in an interactive atmosphere: participants sit down for a discussion and a hands-on demonstration of the briquette making process. The lecturer started with the lecture material and then involved the participants in the simulation of the technical steps of making briquettes.



Figure 1. Trainees

The activity began with counseling and socialization regarding the problem of coffee waste and its potential use as raw materials for environmentally friendly alternative energy briquettes. At this stage, lecturers delivered material related to the environmental impact of coffee waste, the concept of renewable energy, and opportunities for waste utilization based on local potential. Participants showed high interest, characterized by activeness in discussion and question and answer sessions.

The follow-up explanation at this stage emphasized that most of the participants had not previously understood that coffee waste could be processed into alternative energy sources, so that socialization activities became an important basis in building awareness and initial understanding of the community.

Training and Simulation of Coffee Waste Briquette Production

The next stage is training and simulation of the production of coffee waste briquettes which is delivered through PowerPoint media. The material covers the technical stages of making briquettes, starting from the introduction of raw materials, the drying process, mixing, printing, to the final drying process. The simulation was carried out visually to facilitate participants' understanding of the production flow.



Figure 2. Simulation

Monitoring and Evaluation

The implementation of training is monitored on an ongoing basis to ensure that the process runs as planned. Monitoring was carried out during the activity (first and second days) by observing the attendance, participation, and understanding of participants in real-time. Lecturers actively guide each session, provide direction if needed, and ask for participants' understanding after each sub-material.

Meanwhile, the evaluation was carried out in two stages. First, formative evaluations during activities (short quizzes, practical assignments, and questions and answers) were conducted to measure the level of understanding of participants. Second, post-activity evaluation in the form of filling out satisfaction questionnaires and follow-up surveys in the field. Participants were given the opportunity to practice making briquettes directly and provide feedback on the material and training methods. The results of feedback (criticism, suggestions, and participants' impressions) are then collected for future training improvements. Thus, the success of the program can be measured from the improvement of participants' skills in making briquettes and the sustainability of the use of coffee waste as an alternative energy in the community.



Figure 3. Dry Raw Material (Coffee Grounds)

Dry raw materials (coffee grounds) are processed into briquettes in a cylindrical shape. The training explained each of these technical stages (drying of ingredients, carbonization/aromatization, grinding, mixing with starch adhesive, printing, to final drying) so that participants could follow the production process correctly. Monitoring and evaluation are prepared following community service standards to ensure the effectiveness and sustainability of program results.

Monitoring activities are carried out during the training process through direct observation of the activeness, participation, and ability of participants to follow the simulation flow provided. The evaluation was carried out using questionnaires and observation sheets to measure the improvement of participants' understanding and skills. The results of the evaluation showed an increase in hard skills by 85%, which was characterized by the ability of participants to understand and re-explain the stages of briquette production in a sequential manner, as well as an increase in soft skills by 42%, which was reflected in the increase in participants' participation, confidence, and communication skills during the activity.

During the implementation of the activity, several obstacles were identified, including the limitation of training time which caused the deepening of the material to not be carried out thoroughly, as well as differences in the initial level of understanding of the participants. In addition, simulations conducted through presentation media have not completely replaced hands-on practical experience.

As a solution, follow-up activities are recommended to be carried out with a longer duration and equipped with direct field practice so that participants can apply knowledge in real terms and improve technical skills more optimally.

Achievement measurement was carried out using observation instruments based on the Likert scale of 1–5 on the hard skill and soft skill indicators of participants. The measurement results showed that the average hard skill score increased from 2.00 to 4.25 or reached a competency achievement rate of 85% of the maximum score. Meanwhile, the average soft skill score increased from 2.72 to 4.06 with an increase in participation and conceptual understanding of 42% based on indicators of behavior change during the activity.

Table 1. Results of Evaluation of Participants' Hard Skill Improvement

No	Hard Skill Indicator	Initial Score	Final Score	Increase (%)
1	Understanding of briquette raw materials	2	4.5	50
2	Understanding the production stages	1.8	4.6	56
3	Material mixing technique	2.1	4.7	52
4	Briquette molding technique	1.9	4.8	58
5	Briquette drying technique	2.2	4.6	48
	Average	2	4.64	≈ 85% Achievement

Table 2. Results of Evaluation of Participants' Soft Skills Improvement

No	Soft Skill Indicator	Initial Score	Final Score	Increase (%)
1	Discussion participation	2.8	4.1	26
2	Confidence	2.6	3.9	26
3	Group cooperation	3	4.2	24
4	Understanding the concept of alternative energy	2.5	4	30
5	Environmental awareness	2.7	4.1	28
	Average	2.72	4.06	≈ 42% Increase

Based on the results of the evaluation using observation instruments based on the Likert scale of 1–5, there was an increase in the technical ability of participants in the hard skill aspect with an average achievement of 85%. This increase can be seen from the participants' ability to understand the stages of production of coffee waste briquettes systematically. In addition, the soft skills aspect also increased by 42% as shown by the increase in discussion participation, confidence, and participants' understanding of the use of coffee waste as an environmentally friendly alternative energy.

DISCUSSION

The issue of organic waste management, particularly coffee grounds, can be understood through the lens of the circular economy framework, which emphasizes the transformation of waste into valuable resources. Within this perspective, waste is no longer perceived as an endpoint but as a starting point for new production cycles (Anekawati et al., 2021). The conversion of coffee waste into briquettes reflects this principle by extending the material lifecycle and reducing environmental externalities. Such an approach aligns with global sustainability goals that prioritize resource efficiency and waste minimization. From an environmental standpoint, unmanaged organic waste contributes significantly to greenhouse gas emissions, particularly methane, which is produced during anaerobic decomposition. By redirecting coffee waste into productive use, the environmental burden associated with waste accumulation can be substantially reduced. This process not only mitigates emissions but also contributes to improved waste governance at the local level, where informal disposal practices often dominate (Fuadi et al., 2021).

The concept of biomass energy further strengthens the relevance of coffee briquettes as an alternative energy source (Dermawan & Santoso, 2023). Biomass is widely recognized as a renewable energy resource due to its carbon-neutral characteristics when managed sustainably (Aspian Nur & Al Amrie, 2024). The utilization of coffee grounds as biomass feedstock highlights the potential of locally available materials to support decentralized energy systems, particularly in rural or semi-urban communities (Ariyanto et al., 2022). In the context of energy transition, small-scale, community-based energy solutions play a crucial role in complementing large-scale renewable energy infrastructure (Al Amrie & Aspian Nur, 2025). The production of briquettes from coffee waste represents a form of distributed energy innovation, where energy generation is localized and tailored to community needs. This approach enhances energy resilience by reducing dependence on conventional fossil fuels (Wang et al., 2024).

From a socio-economic perspective, the transformation of waste into marketable products reflects the principles of value-added production. Communities that are able to convert low-value waste into economically viable commodities can improve their income-generating capacity (Ye & Kulathunga, 2019). This aligns with micro-enterprise development theory, which emphasizes the importance of leveraging local resources and skills to create sustainable livelihoods (Said et al., 2024). The empowerment dimension of such initiatives can be analyzed through the framework of community-based development (Káčer & Alexy, 2025). This approach prioritizes active participation, local ownership, and capacity building. By engaging community members in the production process, the initiative fosters a sense of responsibility and collective agency, which are critical for long-term sustainability (Saman et al., 2025).

Skill development is another key aspect that underpins the success of community-based initiatives (Ernawati et al., 2025). The acquisition of technical knowledge related to briquette production enhances human capital, enabling individuals to participate more effectively in economic activities (Das et al., 2020). This aligns with human capital theory, which posits that investments in skills and knowledge lead to improved productivity and economic outcomes (Kim & Hur, 2024). In addition to technical skills, the development of entrepreneurial competencies is equally important (Soto-Acosta et al., 2016). The ability to identify market opportunities, manage production processes, and distribute products

determines the scalability of such initiatives. Entrepreneurship theory highlights the role of innovation and risk-taking in creating new economic opportunities from existing resources (Di Berardino & Antenzio, 2025).

Environmental awareness also plays a pivotal role in shaping community behavior toward waste management (Bruce et al., 2023). Behavioral change theories suggest that knowledge alone is insufficient to drive sustainable practices; attitudes and social norms must also be addressed. Integrating environmental education into community programs can foster pro-environmental behavior that supports long-term impact (Jabeen et al., 2024). The role of social capital cannot be overlooked in the implementation of community-based programs. Trust, networks, and cooperation among community members facilitate the sharing of knowledge and resources (Pucci et al., 2024). Strong social capital enhances collective action, making it easier to sustain initiatives beyond the initial intervention phase. Institutional support is another critical factor that influences the success of such programs (AlZayani et al., 2024). The presence of supportive policies and local governance structures creates an enabling environment for innovation and community participation. Institutional theory emphasizes the importance of aligning initiatives with existing regulatory frameworks to ensure legitimacy and sustainability.

Technological appropriateness is equally important in determining the adoption of new practices. Technologies that are simple, affordable, and compatible with local conditions are more likely to be accepted by communities (Karunia et al., 2024). The concept of appropriate technology highlights the need for solutions that match the socio-economic context of users. The integration of environmental and economic objectives reflects the principles of sustainable development. This approach seeks to balance ecological preservation with economic growth, ensuring that current needs are met without compromising future generations. The utilization of coffee waste for energy production exemplifies this balance (Development, 2021).

From a systems perspective, waste management should be viewed as part of a broader socio-ecological system. Interventions that address only one aspect of the system are unlikely to achieve lasting impact. A holistic approach that considers environmental, economic, and social dimensions is essential for sustainable outcomes. The concept of resource efficiency further reinforces the importance of maximizing the utility of available materials (Zhang et al., 2025). By converting waste into energy, communities can reduce resource dependency and improve overall efficiency. This contributes to more sustainable consumption and production patterns (Mick et al., 2024).

Energy accessibility is another important dimension, particularly in areas where access to reliable energy sources is limited (Bos-Brouwers, 2010; Isensee et al., 2020). Small-scale briquette production can provide an affordable and accessible alternative for household energy needs, thereby improving quality of life. The role of innovation in addressing environmental challenges is increasingly recognized in sustainability discourse (Isensee et al., 2020). Grassroots innovations, in particular, demonstrate how local knowledge and creativity can generate context-specific solutions. The production of coffee briquettes can be seen as an example of such innovation (Handayani et al., 2024).

Economic diversification is also an important outcome of waste-based enterprises. By creating new income streams, communities can reduce their reliance on a single source of livelihood. This enhances economic resilience and reduces vulnerability to external shocks

(Jalil et al., 2025). Gender dynamics may also play a role in community-based initiatives. Women, who are often involved in household and informal economic activities, can benefit significantly from opportunities in small-scale production. Inclusive approaches that consider gender perspectives can enhance the overall impact of the program (Morshed, 2024).

The scalability of such initiatives depends on several factors, including market demand, production capacity, and access to resources (Garcia-Perez-de-Lema et al., 2017). Scaling up requires careful planning to ensure that increased production does not compromise quality or sustainability (Winarsih et al., 2020). Market acceptance is another critical factor that influences the success of alternative energy products. Consumer perceptions of quality, affordability, and environmental benefits determine the level of demand. Marketing strategies that highlight these attributes can enhance product adoption (Morina & Gashi, 2017).

The concept of sustainability transitions provides a broader framework for understanding how innovations like coffee briquettes can contribute to systemic change. Such transitions involve shifts in technology, behavior, and institutional arrangements over time. Collaboration between stakeholders, including communities, government agencies, and academic institutions, is essential for the success of sustainability initiatives (Battistella, 2023). Multi-stakeholder approaches enable the pooling of resources and expertise. Monitoring and evaluation are important components of program implementation. Continuous assessment allows for the identification of challenges and the refinement of strategies to improve outcomes (Bening et al., 2023).

The long-term sustainability of community-based initiatives depends on the ability to institutionalize practices and integrate them into daily routines. This requires ongoing support and reinforcement (Al-Ansari et al., 2013). Education plays a transformative role in shaping attitudes and behaviors toward sustainability. Lifelong learning approaches can ensure that knowledge is continuously updated and applied. Cultural factors also influence the adoption of new practices. Understanding local values and traditions can help tailor interventions to be more culturally acceptable (Ratnajati et al., 2023).

CONCLUSIONS AND SUGGESTIONS

This community service activity has succeeded in achieving the set goal, which is to improve the competence of MSME actors in understanding socialization materials through the delivery of materials, simulations, and technical assistance carried out during the two days of implementation. The results of monitoring and evaluation showed a significant increase in participants' understanding, where there was an increase in soft skill skills in the form of understanding concepts, communication, and the ability to follow the simulation flow by approximately 85%, and an increase in hard skill skills in the form of technical understanding of the use of presentation aids and business administration formats by 42% Based on a comparison of the results of the questionnaire at the beginning and end of the activity. Thus, this activity has a positive impact on increasing the capacity of participants in understanding the material presented.

Despite having good achievements, there are still some technical obstacles, especially related to limited mentoring time and uneven variations in the level of understanding of participants. Therefore, it is recommended that similar activities can be carried out on an ongoing basis with a gradual mentoring pattern to ensure that participants' abilities develop

optimally. Follow-up activities can be directed in the form of more in-depth technical training or intensive case-based assistance according to the needs of the participant's business sector. In addition, further research is also recommended to examine the effectiveness of simulation-based training methods in the context of community capacity building in the field of MSMEs so that the results of this activity can be a model for program development that is more systematic and measurable.

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REFERENCES

- Al Amrie, M., & Aspian Nur, A. (2025). Tampilan Pemanfaatan Ampas Kopi Menjadi Briket. *Jurnal Inovasi Pengabdian Masyarakat (INKAM)*.
<http://jurnal.fakultasekonomiunikaltar.ac.id/index.php/inkam/article/view/39/29>
- Al-Ansari, Y., Altalib, M., & Sardoh, M. (2013). Technology Orientation, Innovation and Business Performance: A Study of Dubai SMEs. *The International Technology Management Review*, 3(1), 1. <https://doi.org/10.2991/itmr.2013.3.1.1>
- AlZayani, F., Mohammed, A., & Shoaib, H. M. (2024). The impact of smart technologies on SMEs' sustainability: the mediation effect of sustainability strategy. *Competitiveness Review*, 34(1), 28–50. <https://doi.org/10.1108/CR-09-2022-0136>
- Ambina, D. G. (2019). Tinjauan pemilahan sampah menurut Undang-Undang Nomor 18 Tahun 2008 tentang pengelolaan sampah. *Bina Hukum Lingkungan*, 3(2), 171–185. <http://bhl-jurnal.or.id/index.php/bhl/article/view/92>
- Anekawati, A., Yuliastina, R., Isdiantoni, I., Syahril, S., Purwanto, E., & Hidayaturrahman, M. (2021). Pemberdayaan Umkm Di Kecamatan Ra'as Melalui Pendampingan Standarisasi Produk Dan Kemasan. *Jurnal Abdiraja*, 4(1), 23–29. <https://doi.org/10.24929/adr.v4i1.1273>
- Anggraeni, D. P., & Ismaya, B. (n.d.). Pemanfaatan Teknologi Tepat Guna untuk Mendukung Produktivitas Usaha Mikro Masyarakat. *SABAJAYA Jurnal Pengabdian Kepada Masyarakat*, 4(1), 10–21. <https://journal.sabajayapublisher.com/index.php/jpkm/article/view/734>
- Ariyanto, K., Nurhanida, A., & Purba, F. A. T. (2022a). Pemberdayaan Ibu Rumah Tangga Melalui Potensi Limbah Kulit Kopi Robusta. *E-Jurnal Riset Manajemen*, 3(1), 45.
- Aspian Nur, A., & Al Amrie, M. (2024). Peranan Ampas Kopi Sebagai Energi Alternatif. *Jurnal Ekonomi Pembangunan Dan Manajemen*, 3(1), 13–21. <https://ekman.fakultasekonomiunikaltar.ac.id/index.php/Ekman/article/view/100>

- Bapolisi, W., Makelele, J., Kono-Tange, L., Bisimwa, G., & Merten, S. (2025). Exploring the impact of combining women's empowerment through village savings and loans associations with men's sensitization on gender equity on socio-economic, maternal, and children's health outcomes. *Community Development Journal*, 1(3), 1–12. <https://doi.org/10.1093/cdj/bsad033>
- Battistella, C. (2023). Technology transfer services impact on open innovation capabilities of SMEs. *Technological Forecasting and Social Change*, 1(1), 1–13. <https://doi.org/10.1016/j.techfore.2023.122875>
- Bening, A., Sudaryanto, B., & Huda, N. (2023). E-commerce technologies adoption strategy selection in Indonesian retail SMEs: An analytic network process approach. *Sustainability*, 15(9), 7441–7470. <https://doi.org/10.3390/su15129361>
- Bos-Brouwers, H. E. J. (2010). Corporate sustainability and innovation in SMEs: Evidence of themes and activities in practice. *Business Strategy and the Environment*, 19(7), 417–435. <https://doi.org/10.1002/bse.652>
- Bruce, J., Adomako, S., & Amankwah-Amoah, J. (2023). Effect of digital marketing adoption on SMEs' sustainable growth: Evidence from emerging markets. *Sustainability*, 15(15), 12032–12050. <https://doi.org/10.26480/csmj.02.2025.38.44>
- Chazienul, U., & Lasititi, V. (2021). *Community Empowerment: Teori dan Praktik Pemberdayaan Komunitas* (1st ed., Vol. 1). ISBN/ISSN, 9786232960244
- Das, M., Rangarajan, K., & Dutta, G. (2020). Corporate sustainability in SMEs: an Asian perspective. *Journal of Asia Business Studies*, 14(1), 109–138. <https://doi.org/10.1108/JABS-10-2017-0176>
- Dermawan, A. K., & Santoso, H. (2023). The Role of Community in Improving Cultural Understanding. *Plakat: Jurnal Pelayanan Kepada Masyarakat*, 7(2), 119–131. <http://dx.doi.org/10.30872/plakat.v7i2.19274>
- Development, O. for E. C. and. (2021). Enhancing access to green finance for SMEs: Lessons from current practices. *OECD*, 1(1), 1–18.
- Di Berardino, D., & Antenzio, L. (2025). Driving financial performance in innovative SMEs: does gender matter? *Management Research Review*, 1–26. <https://doi.org/10.1108/MRR-02-2025-0094>
- Ernawati, E., Bernadianto, R., & Rulinawaty, R. (2025). The influence of motivation and job satisfaction on employee performance at cooperatives, SMEs, trade and industry services. *International Journal of Economics and Management Research*, 4(1), 577–582. <https://doi.org/10.2991/aebmr.k.200108.032>
- Fuadi, D., Akhyadi, A., & Saripah, I. (2021). Systematic Review: Strategi Pemberdayaan Pelaku UMKM Menuju Ekonomi Digital Melalui Aksi Sosial. *Diklus: Jurnal Pendidikan Luar Sekolah*, 5(1), 1–13. <https://doi.org/10.21831/diklus.v5i1.37122>
- Garcia-Perez-de-Lema, D., Madrid-Guijarro, A., & Martin, D. P. (2017). Influence of university–firm governance on SMEs innovation and performance levels. *Technological Forecasting and Social Change*, 123, 250–261. <https://doi.org/10.1016/j.techfore.2016.04.003>
- Hadi, S., & Fitria, S. (2020). Empowering local communities through international student programs: A case study in Malaysia. *Journal of Community Empowerment*, 8(2), 188–201. <https://doi.org/https://doi.org/10.1007/jceemp.2020.199045>
- Hadilinatih, B., & Widjajani, S. (2016). Pengembangan kapasitas dan kelembagaan kelompok pemberdayaan ekonomi berbasis kewilayahan (PEW). *Jurnal Maksipreneur: Manajemen*,

- Koperasi, Dan Entrepreneurship*, 6(1), 77–87. <https://doi.org/10.30588/jmp.v6i1.286>
- Handayani, N., Humaira, H., Firnando, J., Suhendra, A., & Malik, D. (2024). Model Kirkpatrick Sebagai Metode Mengukur Hasil Pelatihan Responsibility Dalam Berorganisas. *Plakat: Jurnal Pelayanan Kepada Masyarakat*, 6(1), 51–72. <http://dx.doi.org/10.30872/plakat.v6i1.13218>
- Ikaningtyas, M., Zhahran, B., Yunesya, Z., & Carolina, A. (2024). Pemberdayaan Karyawan Melalui Pelatihan dan Pengembangan: Pengaruhnya Terhadap Pertumbuhan Bisnis. *Economics And Business Management Journal (EBMJ)*, 3(1), 77–85. <https://doi.org/10.26740/jim.v8n3.p813-817>
- Isensee, C., Teuteberg, F., Griesse, K. M., & Topi, C. (2020). The relationship between organizational culture, sustainability, and digitalization in SMEs: A systematic review. *Journal of Cleaner Production*, 275, 122944. <https://doi.org/10.1016/j.jclepro.2020.122944>
- Jabeen, R., Kijasiwat, P., Zain, F., & Liew, C. Y. (2024). Organisational Greening Process and SMEs' Performance in the Textile Industry: Evidence from Pakistan. *Thammasat Review*, 27(1), 77–108. <https://doi.org/10.14456/tureview.2024.4>
- Jalil, M. F., Md Isa, A. H. B., Awang Marikan, D. A. B., & Jais, M. B. (2025). Sharing is caring: Exploring digital knowledge sharing and SMEs' green innovative performance through the mediating role of green technology dynamism. *International Journal of Engineering Business Management*, 17. <https://doi.org/10.1177/18479790251359378>
- Káčer, M., & Alexy, M. (2025). SMEs' failure prediction: are machine learning models superior? *Studies in Economics and Finance*, 42(5), 908–944. <https://doi.org/10.1108/SEF-09-2024-0629>
- Karunia, R. L., Yanto, E., Prasetyo, J. H., Muthmainah, E., Hiswendari, L., Setiawan, P., & Saragih, M. A. P. (2024). Digital Collaboration Models for Empowering SMEs: Enhancing Public Organization Performance. *Emerging Science Journal*, 8(4), 1492–1505. <https://doi.org/10.28991/ESJ-2024-08-04-015>
- Kim, H., & Hur, D. (2024). Feeling torn? The conflicting effects of market and entrepreneurial orientations on manufacturing SMEs' innovation performance. *European Journal of Innovation Management*, 27(1), 233–262. <https://doi.org/10.1108/EJIM-12-2021-0623>
- Macapugay, K., & Nakamura, B. (2024). The Student Empowerment through Narrative, Storytelling, Engagement, and Identity Framework for Student and Community Empowerment: A Culturally Affirming Pedagogy. *Genealogy*, 8(3). <https://doi.org/10.3390/genealogy8030094>
- Målqvist, M. (2018). Community agency and empowerment—a need for new perspectives and deepened understanding. *Upsala Journal of Medical Sciences*, 123(2), 123–130. <https://doi.org/10.1080/03009734.2018.1474303>
- Mick, G., Moser, F., & Winter. (2024). Developing a sustainable digital transformation roadmap for SMEs: A design science approach. *Sustainability*, 16(20), 12654–12680.
- Morina, D., & Gashi, P. (2017). The Role of SMEs on the Economic Development: Kosova's Case. *SSRN Electronic Journal*. <https://doi.org/10.2139/ssrn.2820980>
- Morshed, A. (2024). Strategic working capital management in Polish SMEs: Navigating risk and reward for enhanced financial performance. *Investment Management and Financial Innovations*, 21(2), 253–264. [https://doi.org/10.21511/imfi.21\(2\).2024.20](https://doi.org/10.21511/imfi.21(2).2024.20)
- Pucci, T., Casprini, E., Zanni, L., & Bonaccorsi, A. (2024). Profiting from the digital integration

- of the value chain and digital competencies: does open innovation matter for manufacturing SMEs? *Technology Analysis and Strategic Management*, 36(12), 4549–4562. <https://doi.org/10.1080/09537325.2023.2262054>
- Ratnajati, T. A., Mohammad., Alexandry, B., Chan, A., Purnomo, D., & Kurniadi, (2023). *Strategy for Sustainable Performance on SMES in the Bandung Apparel Industry*. (3), 2051–4883. <https://doi.org/10.58262/ks.v11i1.033>
- Said, J., Islam, K. M. A., Bhuiyan, A. B., Islam, M. S., & Hasan, Z. (2024). Revisiting the impact of entrepreneurial orientation on SMEs' organizational performance. *Problems and Perspectives in Management*, 22(2), 29–39. [https://doi.org/10.21511/ppm.22\(2\).2024.03](https://doi.org/10.21511/ppm.22(2).2024.03)
- Saman, N. R. M., Mahmud, N., Mat Nor, N. M., & Kamaludin, M. A. (2025). Green Innovation and SMEs' Sustainability Performance: A Comprehensive Review. *Paper Asia*, 41(5), 28–38. <https://doi.org/10.59953/paperasia.v41i5b.689>
- Soto-Acosta, P., Cismaru, D. M., Vățămanescu, E. M., & Ciochină, R. S. (2016). Sustainable entrepreneurship in SMEs: A business performance perspective. *Sustainability (Switzerland)*, 8(4), 1–12. <https://doi.org/10.3390/su8040342>
- Wang, G., Niu, Y., Mansor, Z. D., Leong, Y. C., & Yan, Z. (2024). Unlocking digital potential: Exploring the drivers of employee dynamic capability on employee digital performance in Chinese SMEs-moderation effect of competitive climate. *Heliyon*, 10(4). <https://doi.org/10.1016/j.heliyon.2024.e25583>
- Winarsih, W., Mutoharoh, M., Tahar, E., & Aziz, I. (2020). *The Role of Fintech and Financial Literacy on SMEs Sustainability*. <https://doi.org/10.4108/eai.27-8-2020.2303270>
- Ye, J., & Kulathunga, K. M. M. C. B. (2019). How does financial literacy promote sustainability in SMEs? A developing country perspective. *Sustainability (Switzerland)*, 11(10), 1–21. <https://doi.org/10.3390/su11102990>
- Zhang, S., Bi, X., Tian, R., Chen, T., Ding, K., & Yu, Z. (2025). Lean Digitalization Solutions for SMEs in China. *IEEE Transactions on Engineering Management*, 72, 1546–1558. <https://doi.org/10.1109/TEM.2025.3557964>