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Application of Semi-Mechanical Cocoa Pod Splitter to Reduce Mold Risk and Bean Damage

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Abstract

Cocoa is a leading plantation commodity with high economic value. Yet its quality and productivity are often constrained by post-harvest handling, particularly by manual pod splitting, which risks damaging beans and causing fungal contamination. This community service method is a participatory approach that combines the transfer of appropriate technology and continuous mentoring, encompassing activities such as socialization, training, field implementation, evaluation, and strengthening digital marketing capacity. This community service aims to improve efficiency, maintain hygiene, and produce export-quality beans. The program was implemented in collaboration with the Kabuttu Farmer Group in Gattareng Village through participatory approaches, including socialization, training, field application, and monitoring and evaluation. Beyond technical aspects, the program also provides digital marketing assistance to expand distribution networks. The expected outcomes of the community service include scientific and mass media publications, intellectual property registration, and digital documentation. The anticipated impacts are increased farmer income, reduced bean damage, and the development of local cadres to ensure sustainability. This initiative is expected to serve as a replicable post-harvest technology model, contributing to farmer welfare, rural economic empowerment, and the achievement of sustainable development goals.

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INTRODUCTION

This community service project aims to enhance cocoa pod processing efficiency and improve bean quality by applying semi-mechanical tools and providing digital marketing training to the Kabuttu farmer group. Cocoa is a key plantation commodity and a major source of livelihood for farmers in Soppeng Regency. However, the quality of cocoa beans remains constrained by post-harvest practices, as manual pod splitting using machetes often causes up to ±20% bean damage, reducing fermentation quality, raising fungal risks, and limiting export access (Pitri et al., 2024). Consequently, beans are sold

only in local markets at lower prices, weakening farmers' income and competitiveness. The sample of cocoa production of Kabuttu farmer groups is given in Figure 1.

Figure 1 Cocoa production of Kabuttu farmer groups

The community service program introduced a semi-mechanical stainless-steel tool that reduces bean damage to ±5% and increases efficiency by 25–30% in order to overcome this. Combined with IoT-based drying methods, technical training, and digital marketing strategies, the program enhances both product quality and market opportunities (Rahmah & Minarti, 2024). Farmers are empowered through training on quality standards, safe tool operation, consistent drying practices, and e-commerce platforms such as Shopee and Tokopedia. This participatory approach strengthens group organization, improves market access, and enables premium-quality cocoa production, potentially raising farmers' income by 25–35%.

METHODS

This community service program was implemented using a participatory approach, combining the transfer of appropriate technology with continuous mentoring. The activities encompassed socialization, training, field implementation, evaluation, and the enhancement of digital marketing capacity. The program lasted approximately two hours and involved 35 farmers, including the head and members of the farmer group, as well as members of the surrounding community. The activities were structured into five main stages, which are as follows:

1. **Preparation and Coordination**. Initial coordination was conducted with the village government of Gattareng and the Kabuttu Farmers Group to determine the schedule, technical arrangements, and field activities.
2. **Socialization.** A socialization session was held with local stakeholders to introduce the program's objectives and emphasize the importance of maintaining cocoa bean quality through appropriate technology (Sabahannur et al., 2023). Farmers actively participated by sharing their experiences and constraints in post-harvest practices, particularly bean damage and fungal contamination.
3. **Training and Demonstration**. Training activities were conducted in an educational, demonstrative, and participatory manner. The sessions included the introduction of a stainless-steel semi-mechanical splitter, guidance on tool operation and maintenance, sanitation and hygiene practices, field demonstrations, and training on digital marketing using e-commerce platforms. The results indicated that farmers could operate the tool independently, and demonstrations confirmed higher efficiency and hygiene than traditional machete-based methods.
4. **Application of Semi-Mechanical Tools and IoT-Based Drying**. Direct application in the field showed significant improvements:

- **Efficiency:** pod splitting was completed more quickly compared to manual methods (Hartuti et al., 2020).
- **Reduced bean damage:** the incidence of physical damage decreased considerably.
- **Lower fungal risk:** stainless-steel materials ensured more hygienic handling.
- **Improved productivity:** reductions in labor requirements and operational costs were achieved.

5. **Evaluation and Indicators of Success**. Evaluation was conducted through observation, questionnaires, and interviews. The findings demonstrated substantial improvements:
   - **Bean quality:** fewer beans were damaged or contaminated.
   - **Labor efficiency:** reduced manpower and shorter harvesting times.
   - **Economic outcomes:** farm-gate prices increased from an average of IDR 115,000/kg toward the national standard of IDR 170,000/kg (Fauji, 2020).

RESULTS AND DISCUSSION

Partner Profile and Program Context

This community service program was implemented in collaboration with the Kabuttu Farmers Group, located in Gattareng Village, Marioriwawo District, Soppeng Regency. The group is a key cocoa production center with significant potential to strengthen the local economy. However, farmers face persistent challenges in post-harvest quality, particularly related to pod splitting and bean drying. The selection of this partner was based on the consideration that improving cocoa bean quality would directly increase farmers' income, enhance community welfare, and generate a multiplier effect on local economic growth and food security.

The partner's location is approximately 33.6 km from the implementing university, with an average travel time of 52 minutes. The relatively short distance facilitated regular field visits, which were crucial for effective monitoring, evaluation, and continuous mentoring. The village itself possesses extensive cocoa plantation areas; however, post-harvest processing is highly dependent on weather conditions. During the rainy season, drying failures frequently reduce product quality, while in the dry season, manual practices often result in inconsistent and unhygienic handling. The continued use of traditional, unmodified tools exacerbates these challenges, underscoring the need for appropriate technology interventions.

The Kabuttu Farmers Group has a structured organization consisting of a chairman, secretary, treasurer, and several technical units responsible for operations. This structure enabled efficient coordination and became the backbone of program activities. Clear division of tasks ensured that responsibilities—ranging from administration and finance to equipment operation and bean drying—were distributed evenly. The active participation of all members in training, field practice, and evaluation demonstrated a strong collective awareness of the importance of cocoa quality (Minarti, 2024). This social capital is a key factor for sustainability, as technological success depends not only on the tools provided but also on the commitment of farmer groups.

One of the core activities was the dissemination of cocoa bean quality standards. The community service team explained the differences between local, national, and international quality benchmarks and their direct impact on selling prices. This activity increased farmers' understanding of the strong link between post-harvest quality and product value, motivating them to adopt improved practices from pod splitting to drying.

Training and Demonstration of Semi-Mechanical Pod Splitter

The semi-mechanical tool training was the core practical activity. Initially, farmers received theoretical sessions on the tool's components, stainless-steel material, and working principle (Adawiah et al., 2024). The design was based on a lever-and-guided cutting system, ensuring precise splitting and minimizing pulp loss. This foundation was critical to ensure proper technical understanding and occupational safety (Hermawati, Jalaluddin, 2020).

Subsequently, live demonstrations were conducted. Farmers observed correct pod placement, lever operation, and bean extraction. A direct comparison with traditional machete use highlighted that the semi-mechanical tool produced beans that were more intact, clean, and less damaged (see Figure 2).

Figure 2 Comparison of cocoa pods split using a machete and the semi-mechanical tool
The following presents the field test results of the cocoa pod splitter."

Table 2 The results of the field test of the cocoa fruit splitter are shown in Table 2.

Table 2 Field test results of the cocoa pod splitting tool

No	Tool	Word Speed (%)	Seed Integrity (%)	Fungal Sanitation (%)
1	Machete (Baseline)	0	0	0
2	Manual Tool	20	31	82
3	Semi-Mechanical Tool	15	63	41

The manual-type tool equipped with a seed comb feature demonstrated significant improvements in several aspects, namely a 20% reduction in processing time, a 31% decrease in mechanical damage, and an 82% reduction in mold infection. Its main advantage compared to the traditional machete is its ability to prevent mold contamination, as the stainless-steel blade is rust-resistant and the seed-sorting process does not rely on direct hand contact, which could introduce contaminants.

Meanwhile, the semi-mechanical tool provided a 15% reduction in processing time, a 63% decrease in mechanical damage, and a 41% reduction in mold infection. Its key strength lies in minimizing mechanical damage by using a consistent, well-aligned cutting axis. However, its effectiveness in preventing mold is lower than that of the manual-type tool, since the sorting process still requires manual handling.

Farmers then engaged in hands-on practice under intensive supervision. Each participant used fresh pods to practice correct handling techniques. Interactive discussions addressed tool efficiency, maintenance costs, and durability. Farmers were reassured that the tool was faster, more hygienic, and long-lasting with proper care. Evaluations showed

that most farmers could operate the tool independently after short training sessions, with several preferring it over manual methods (Haris et al., 2020).

Maintenance training was also provided, emphasizing sanitation to prevent fungal contamination. Procedures included cleaning, dry storage, and inspection of moving parts. A time-efficiency simulation showed clear advantages: splitting 100 pods required 45 minutes with a machete but only 25 minutes with the semi-mechanical tool. This innovation reduced bean damage by 65–75%, improved speed, and enhanced operator safety.

Digital Marketing (E-Commerce) Training

In addition to technology adoption, training in digital marketing was provided to address farmers' dependence on traditional markets and middlemen, which suppressed farm-gate prices (±IDR 115,000/kg versus the national average of IDR 170,000/kg). The training aimed to equip farmers with e-commerce skills to achieve marketing independence and fairer prices (Hasbi & Christi, 2022).

Practical sessions introduced popular marketplaces such as Shopee and Tokopedia, as well as the use of social media for promotion. Farmers were guided in account creation, stock management, product photography, description writing, price setting, and transaction simulation (Rahmah et al., 2024). During field practice, dried cocoa beans processed with the semi-mechanical tool were uploaded to marketplaces with proper descriptions and photos. Simple promotional techniques—such as hashtags, short content, and testimonials—were introduced to enhance visibility (Ilmi et al., 2025).

The training received positive responses: several farmers successfully created online shop accounts and began recognizing the opportunities of digital markets. This awareness motivated them to consistently maintain bean quality, as they experienced the direct link between higher-quality beans, the use of appropriate technology, and improved selling prices.

IoT-Based Cocoa Bean Dryer

An IoT-based dryer was introduced to accelerate cocoa bean drying and ensure export-quality standards. The dryer was designed as a cabinet with horizontal racks, insulated with aluminum foil, and equipped with temperature and humidity sensors connected to an IoT module. Real-time monitoring was conducted via a smartphone application. The system applied forced convection drying, maintaining a temperature range of 40–55°C and achieving a final moisture content of 6–7%, producing stable, hygienic, and storable beans (Nusri et al., 2025).

The drying process involved preparation, IoT system setup, real-time monitoring, periodic moisture checks, cooling, and storage. Drying data were recorded for evaluation and documentation. Advantages included time efficiency, consistency, food safety, easy monitoring, and improved product value. This technology minimized dependence on weather and ensured that local cocoa products could compete in higher-value markets. IoT-based cocoa bean dryer is shown in Figure 3

Figure 3 IoT-based cocoa bean dryer

Outcomes and Implications

The program demonstrated that the combination of appropriate technology (semi-mechanical splitter and IoT-based dryer), capacity building (training and demonstration), and digital innovation (e-commerce) produced significant impacts:

- Technical outcomes: reduced bean damage by 65–75%, improved hygiene, faster processing, and consistent drying.
- Economic outcomes: farm-gate prices improved toward national standards, with stronger access to premium markets.
- Organizational outcomes: enhanced group coordination, clear task distribution, and strengthened collective awareness.
- Social outcomes: increased farmer confidence in adopting innovations and motivation to sustain quality improvement.

These results confirm that integrating technological and digital solutions with participatory approaches can substantially strengthen farmers' competitiveness, sustainability, and resilience in global cocoa value chains.

CONCLUSION

This community service program was designed to improve the quality and economic value of cocoa beans through the application of appropriate technology, capacity building, and digital innovation. The activities carried out with the Kabuttu Farmers Group in Gattareng Village demonstrated that the introduction of a semi-mechanical cocoa pod splitter, IoT-based drying technology, and e-commerce training effectively addressed key post-harvest challenges. The results confirmed a significant reduction in bean damage, increased efficiency in pod splitting and drying, and improved hygiene standards.

In line with the initial objectives, the program successfully enhanced farmers' technical skills, organizational capacity, and market access (Zulfayani et al., 2023). The empowerment of farmers through participatory training and mentoring has increased their confidence in adopting new technology and digital platforms. Furthermore, economic benefits were observed, with farm-gate prices moving closer to national standards, thereby strengthening farmers' income and local economic resilience.

Overall, the outcomes indicate that integrating appropriate technology with participatory extension and digital marketing strategies can serve as a replicable model for sustainable cocoa post-harvest management. The program not only supports farmer welfare and rural economic empowerment but also contributes to the achievement of broader sustainable development goals.

Based on the outcomes of this community service program, several recommendations can be proposed:

1. **Sustained Mentoring and Monitoring**. Continuous assistance and periodic monitoring are recommended to ensure that farmers consistently apply the semi-mechanical splitter and IoT-based dryer while maintaining proper sanitation and safety standards.
2. **Expansion of Technology Adoption**. The semi-mechanical splitter and IoT-based dryer should be introduced to other farmer groups in Soppeng Regency and surrounding areas, enabling wider replication and greater regional economic impact.
3. **Integration with Value-Added Processing**. Future programs may focus on diversifying cocoa-based products (e.g., cocoa powder, chocolate derivatives) to further increase product value and market competitiveness.

4. **Strengthening Digital Marketing Capacity**. Continued training in e-commerce and social media marketing is essential, including advanced topics such as branding, packaging, and online customer engagement, to expand access to premium domestic and export markets.
5. **Policy and Institutional Support**. Collaboration with local government, cooperatives, and related institutions is necessary to provide enabling policies, financial support, and infrastructure that sustain the use of appropriate technology and digital platforms.

By following these recommendations, the sustainability and scalability of this program can be ensured, creating long-term benefits for farmers, communities, and the broader cocoa value chain.

CONFLICTS OF INTEREST

The authors declare that there is no conflict of interest.

AUTHOR CONTRIBUTIONS STATEMENT

Conceptualization, AM and I; methodology, I and HA; formal analysis, AM; investigation and field implementation, HA and I; resources and data curation, I; writing—original draft preparation, AM; writing—review and editing, HA; supervision and project administration, AM. All authors have read and approved the final version of the manuscript.

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REFERENCES

Adawiah, A., Asmini, Minarti, A., & Amriana, N. (2024). Penyuluhan umkm kepada kelompok usaha masyarakat di desa pising kabupaten soppeng. *Jurnal Pengabdian Masyarakat UNIPOL (Abdimas Unipol)*, *2*, 41–45.

Fauji, A. (2020). Penerapan sni biji kakao dalam rangka meningkatkan mutu biji kakao rakyat. *Warta: Pusat Penelitian Kopi Dan Kakao Indonesia*, *32*(3), 22–26.

Haris, M. N. H., Sariyusda, S., Hamdani, H., & Zaini, Z. (2020). Rancang bangun mesin pemecah buah coklat dengan daya 5.5 hp. *Jurnal Mesin Sains Terapan*, *4*(2), 71. https://doi.org/10.30811/jmst.v4i2.2010

Hartuti, S., Juanda, J., & Khatir, R. (2020). Upaya peningkatan kualitas biji kakao (Theobroma Cacao L.) melalui tahap penanganan pascapanen (ULASAN). *Jurnal Industri Hasil Perkebunan*, *15*(2), 38. https://doi.org/10.33104/jihp.v15i2.6318

Hasbi., & Christi, S. R. N. (2022). Pelatihan pemanfaatan teknologi di era digital. *Abdimas Unipol: Jurnal Pengabdian Kepada Masyarakat*, *1*(1), 32–38. https://doi.org/28305302

Hermawati, Jalaluddin, L. (2020). Rancang bangun alat pembelah buah kakao (Theobroma cacao) semi mekanis. *Pendidikan Teknologi Pertanian*, *6*, 101–114.

Ilmi, U. A., Adawiah, R., & Fajrina, A. N. (2025). *Peningkatan strategi pemasaran umkm*. *Jurnal Pengabdian Masyarakat Universitas Lamappapoleonro*, *4*(1), 7–12.

Minarti, A. (2024). Marketing information system for maize commodities in soppeng

regency to increase agricultural productivity and national food security. *Maneggion*, *1*(August), 57–67.

Nusri, A. Z., Arismanza, A., & Annisa, N. (2025). Rancang bangun sistem pengering biji kakao berbasis internet of things di desa citta. *Jurnal RISTER: Riset Sistem Cerdas*, *2*(1), 13-17.

Pitri, I. W. R., Baros, F. D., Setiawati, F. I., Sudarti, S., & Anggraeni, F. K. A. (2024). Kajian faktor yang berpengaruh terhadap mutu produk unggulan biji kakao nusantara. *Jurnal Ilmiah Wahana Pendidikan*, *10*(24.2), 568-577.

Rahmah, P., & Minart, A. (2024). Inovasi teknologi dalam upaya peningkatan nilai jual melalui diversifikasi produk olahan jagung pada kelompok tani di kabupaten soppeng. *Prima Abdika: Jurnal Pengabdian Masyarakat*, *4*(3), 627-636.*5636*(3), 627–636.

Rahmah, P., Patappari, A., & Lamappapoleonro, U. (2024). Pengembangan teknologi tepat guna pembuatan tepung pisang dan dodol pisang pada kelompok usaha desa watu kabupaten soppeng. *Jurnal Pengabdian Masyarakat Universitas Lamappapoleonro*, *2*(2), 26-29.*2*.

Sabahannur, S., Syam, N., & Ervina, E. (2023). Mutu fisik dan kimia biji kakao (Theobroma cacao L.) pada beberapa jenis klon. *AGROTEK: Jurnal Ilmiah Ilmu Pertanian*, *7*(2), 99–107. https://doi.org/10.33096/agrotek.v7i2.347

Zulfayani, A., Rahma, P., & Lamappapoleonro, U. (2023). Penyuluhan manajemen keuangan keluarga pada warga kelurahan galung kecamatan liliriaja kabupaten soppeng. *Jurnal Pengabdian Masyarakat Universitas Lamappapoleonro*, *2*(1), 13-16.

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