

Dissemination of environmentally friendly appropriate technology to increase corn added value in South Bontolangkasa Village, Gowa Regency

Rahmansah^{1*}, Bakhrani A. Rauf¹, Syafiuddin Parenrengi¹, Herman¹

¹ Universitas Negeri Makassar, South Sulawesi, Indonesia

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ABSTRACT

This community service program aimed to increase the value of maize by disseminating environmentally friendly, appropriate technology in Bontolangkasa Selatan Village, Bontonompo District, Gowa Regency. Although maize production in the area is relatively high, farmers predominantly sell their harvest in the form of dried kernels, resulting in low economic returns. The main problems identified included limited access to post-harvest technology, low diversification of maize-based products, weak business management, and insufficient human resource capacity. The program was implemented using a Participatory Rural Appraisal (PRA) approach to ensure active community involvement at all stages, including problem identification, planning, implementation, and evaluation: the intervention combined technology transfer, technical training, mentoring, and business management assistance. Environmentally friendly technologies introduced included maize shelling, grinding, and milling machines, accompanied by hands-on training in processing value-added products such as corn chips, popcorn, corn brownies, and roasted maize snacks. The results demonstrated a significant improvement in post-harvest efficiency, with processing time reduced from approximately 16 hours to 2 hours per quintal and production capacity increasing from ± 30 kg/hour to ± 100 kg/hour. Post-harvest losses decreased by up to 70%, while partner household income increased by approximately 25–30%. In addition, partners developed locally branded and packaged maize-based products and began applying simple financial record-keeping and digital marketing practices. Overall, the program strengthened local economic resilience by integrating appropriate technology with capacity-building and participatory empowerment. This initiative demonstrates a sustainable model for community-based agro-processing development and can be replicated in other maize-producing rural areas.

Keywords: Appropriate technology; Maize; Post-Harvest; Community empowerment; Value addition.



*Corresponding Author:

Rahmansah, Universitas Negeri Makassar, South Sulawesi, Indonesia

Email: rahmansah@unm.ac.id



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INTRODUCTION

Maize is one of the most strategic agricultural commodities in Indonesia, playing a crucial role in national food security and serving as a primary source of income for rural farming communities (Anwar & Yuniar, 2018). Beyond its role as a staple food and animal feed, maize has significant potential for downstream processing into a range of value-added products (Bashir et al., 2020). However, at the smallholder level, maize utilization remains predominantly limited to the sale of dried kernels, resulting in low economic returns and high vulnerability to price fluctuations. This condition indicates a structural gap between production potential and value creation within the maize value chain, particularly in rural areas (Lestari & Wulandari, 2021).

In many maize-producing villages, including Bontolangkasa Selatan Village in Bontonompo District, Gowa Regency, agricultural productivity has not been accompanied by adequate post-harvest handling and processing capacity (Salim & Sutrisno, 2021). Despite relatively high maize yields, farmers face persistent challenges, including limited access to appropriate post-harvest technologies, low diversification of maize-based products, weak business management practices, and insufficient human resource capacity (Wijanarko et al., 2021). As a consequence, most harvested maize is sold as raw material without further processing, leading to low added value and limited opportunities for income enhancement (Syafurudin & Asmara, 2018).

Post-harvest losses and inefficiencies further exacerbate this problem. Manual shelling and traditional processing methods are time-consuming, labor-intensive, and prone to product loss and quality degradation (Mutungi et al., 2023). In addition, a lack of knowledge and skills in food processing, packaging, branding, and marketing limits farmers' ability to reach broader markets. These constraints not only suppress household income but also hinder the development of sustainable rural enterprises based on local agricultural resources (Shaikh et al., 2025).

One of the key strategies to address these challenges is the dissemination of environmentally friendly appropriate technology combined with community capacity building (Rita Uchenna Attah et al., 2024). Appropriate technology refers to simple, affordable, and locally adaptable innovations that match the socio-economic conditions of rural communities. When effectively introduced and supported through training and mentoring, such technologies can improve post-harvest efficiency, reduce losses, enhance product quality, and stimulate the development of diversified maize-based products. Moreover, integrating technology transfer with participatory approaches ensures that community members are actively involved in the process, thereby increasing adoption rates and long-term sustainability (Williamson et al., 2020).

Based on these considerations, this community service program focuses on addressing the core problems faced by maize-producing communities in Bontolangkasa Selatan Village through a comprehensive intervention. The main problems identified include limited post-harvest technology, minimal product diversification, weak business management, and low human resource capacity. To overcome these issues, the program offers solutions in the form of environmentally friendly appropriate technology dissemination, technical training in maize processing, assistance in developing value-added products, and strengthening of basic business management and marketing skills.

By combining technology transfer with participatory training and continuous mentoring, this program aims to enhance the added value of maize, improve production efficiency, increase household income, and empower local farmer groups and women's groups. Ultimately, the initiative is expected to contribute to sustainable local economic development and serve as a replicable model for community empowerment based on appropriate technology and agricultural value chain strengthening.

METHOD of IMPLEMENTATION

The community service program was implemented using a Participatory Rural Appraisal (PRA) approach, which emphasizes active community involvement at every stage. This approach positions community members not merely as beneficiaries but as key actors in identifying problems, planning activities, implementing solutions, and evaluating outcomes. The use of PRA was intended to ensure that the program interventions were relevant to local needs and could be sustainably adopted after the program's completion.

The program was carried out in Bontolangkasa Selatan Village, Bontonompo District, Gowa Regency, with the Jiwa Baru Borong Kanang Farmer Group and the Tuma' Kampung Women's Group (PKK) as primary partners. The implementation process consisted of five interrelated stages, as described below.

Problem Identification and Needs Assessment

The initial stage involved identifying key problems and assessing community needs through field observations, in-depth interviews, and focused group discussions with partner groups. This stage aimed to map existing maize production practices, post-harvest handling methods, available resources, and constraints faced by the community. The assessment revealed major issues, including limited access to post-harvest technology, limited product diversification, weak business management practices, and inadequate skills in food processing and marketing.

Socialization and Capacity Building

Following the needs assessment, socialization and educational sessions were conducted to enhance community awareness of the importance of post-harvest processing, value addition, and business-oriented agricultural development. These sessions provided theoretical knowledge on maize value chains, opportunities for product diversification, food safety, and basic entrepreneurship. The objective of this stage was to build a shared understanding and to motivate community members to participate in subsequent training and technology adoption.

Technology Transfer and Technical Training

The third stage focused on the dissemination and application of environmentally friendly appropriate technology. This included the introduction and hands-on training in the use of maize shelling, grinding, and milling machines. Participants were trained on operational procedures, maintenance, and safety aspects of the equipment. In parallel, practical training sessions were conducted on the production of various maize-based processed products, such as maize chips, popcorn, maize brownies, and roasted maize snacks. The training emphasized standardized processing techniques to ensure consistent product quality.

Production Assistance and Marketing Support

After the training phase, continuous mentoring was provided during the production process to support partners in applying the acquired skills. Assistance covered production standardization, simple financial record-keeping, calculation of production costs, and pricing strategies. In addition, partners were introduced to basic digital marketing practices, including using social media platforms and WhatsApp Business, to expand market reach and improve product visibility.

Monitoring and Evaluation

The final stage involved monitoring and evaluation to assess the effectiveness of the implemented activities. Evaluation indicators included improvements in post-harvest efficiency, production capacity, product diversification, income levels, and partner independence in operating the technology. Feedback from partners was also collected to identify challenges and opportunities for further improvement. The results of this stage were used to measure program impact and to formulate recommendations for sustainability and replication in other rural communities.

This section describes the approach and procedures used to implement the community service program aimed at enhancing the added value of maize through the dissemination of environmentally friendly appropriate technology. The implementation method was designed to address local community needs, ensure active partner participation, and support the sustainable adoption of technology. A participatory approach was applied to integrate technology transfer, capacity building, and business strengthening to improve post-harvest efficiency, product diversification, and community economic empowerment.

Stage	Activity	Description	Expected Output
1	Problem Identification and Needs Assessment	Field observations, interviews, and focus group discussions were conducted to identify constraints in maize post-harvest handling, product diversification, business management, and human resource capacity.	Precise mapping of community problems and priority needs
2	Socialization and Capacity Building	Educational sessions were provided to increase awareness of the importance of value addition, post-harvest processing, and entrepreneurship in maize-based agribusiness.	Improved knowledge and motivation of community members
3	Technology Transfer and Technical Training	Hands-on training on the use of environmentally friendly maize shelling, grinding, and milling machines, along with training in processing maize-based products.	Increased technical skills and adoption of appropriate technology
4	Production Assistance and Marketing Support	Continuous mentoring in production standardization, cost calculation, simple financial records, packaging, branding, and digital marketing.	Improved product quality, business management, and market access
5	Monitoring and Evaluation	Evaluation of technology application, production efficiency, product diversification, and income changes through observation and partner feedback.	Measurable program impact and sustainability indicators

RESULT

The community service program implemented in Bontolangkasa Selatan Village produced measurable outcomes in technical performance, economic improvement, and community capacity building. The results were primarily achieved through the application of appropriate post-harvest technology, product diversification training, and business management assistance.

Application of Post-Harvest Technology

The application of corn milling, grinding, and flouring machines can significantly increase post-harvest efficiency. Shelling time is reduced from an average of 16 hours to about 2 hours per quintal of corn. Production capacity increased from ± 30 kg/h to ± 100 kg/h with a yield loss rate of up to 70%. The technology used is environmentally friendly, easy to operate, and in line with the partner's conditions.



Figure 1. Application of environmentally friendly corn shelling machine technology

Hilirisasi dan Diversifikasi Produk

Through practice-based training, partners have successfully developed several corn-based processed products, such as corn flakes, popcorn, corn brownies, and corn meringue. The products are packaged with packaging designs and local brands that increase market appeal. This product diversification provides significant added value compared to selling pipilan corn.



Figure 2. Diversification training in the manufacture of corn flake products



Figure 3. Tuma' Crunc popcorn and Tuma'rasa marning corn products

The economic and social impacts of the program were evident in the increase in household income of partner members by approximately 25–30%. Women's participation also increased significantly through the active involvement of the PKK group in processing, packaging, and marketing activities. Collaboration between farmer groups and women's groups helped establish a productive village-based business unit, strengthening the local economy and community resilience.

Strengthening Management and Human Resources

Business management assistance results in the implementation of simple financial recording and an understanding of production costs. In addition, partners are increasingly using social media and WhatsApp Business for marketing. Increasing human resource capacity is reflected in the partner's ability to operate tools, manage production, and market products independently.

Economic and Social Impact

The impact of activities can be seen in increasing partner household income by 25–30%. This activity also increases women's participation through the active role of PKK groups in product

processing and packaging. Collaboration between farmer groups and PKK forms village productive business units that strengthen the local economy.

DISCUSSION

The dissemination of environmentally friendly, appropriate technology in Bontolangkasa Selatan Village demonstrates a tangible contribution to enhancing the value-added of maize-based agricultural products and strengthening local economic resilience. The discussion of this community service program highlights four main aspects: post-harvest efficiency improvement, product diversification through downstream processing, capacity building in human resources and business management, and broader socio-economic impacts.

The introduction of post-harvest processing technologies, including corn shelling, grinding, and milling machines, significantly improved production efficiency (Becerra - Sanchez & Taylor, 2021). Before the intervention, maize processing relied heavily on manual labor, which was time-consuming and resulted in high post-harvest losses (Bello & Onyeonula, 2021). The reduction in processing time and increase in production capacity observed in this program align with previous studies, indicating that appropriate technology adoption can substantially reduce post-harvest losses and improve productivity in smallholder farming systems (Kumar et al., 2023). The observed decrease in yield losses of up to 70 percent reflects the technology's suitability to local conditions, particularly its ease of operation, low energy consumption, and adaptability to community-based production systems (Layuk et al., 2021).

Beyond efficiency gains, the downstream processing and diversification of maize products played a critical role in increasing economic value (Liao et al., 2024). The development of derivative products such as corn chips, popcorn, maize brownies, and roasted corn snacks demonstrates the effectiveness of value addition strategies in rural agribusiness development (Luckyardi et al., 2022). These products have greater market appeal and longer shelf life than raw maize, enabling farmers and community groups to reach broader markets (Mujbaile et al., 2023). This finding supports the existing literature, which emphasizes agro-processing and product diversification as key mechanisms for improving farmer income and reducing dependence on fluctuating commodity prices (Nath et al., 2024).

The incorporation of packaging, branding, and basic quality control further strengthened the competitiveness of locally produced maize-based products (Nsubuga et al., 2022). The use of local brand identities not only enhanced product recognition but also fostered a sense of ownership and pride among community members. Such social capital is an essential but often overlooked factor in sustaining rural economic initiatives. By positioning local products as distinctive and marketable goods, the program helped bridge the gap between traditional agricultural practices and market-oriented production (Palani et al., 2022).

Capacity building emerged as another crucial outcome of the program. Training and mentoring activities enabled community members to acquire technical skills in operating machinery, processing food products, and maintaining production standards (Arvind et al., 2021). In addition, the introduction of simple financial record-keeping and cost calculation improved the participants' understanding of production economics (Sharma et al., 2023). This shift from informal practices to basic business management represents an essential step toward enterprise sustainability. The adoption of digital marketing tools, such as social media platforms and messaging applications, further expanded market reach and reflects increasing digital literacy in rural communities.

The participatory approach applied in this program played a significant role in ensuring its effectiveness. By employing Participatory Rural Appraisal (PRA), community members were actively involved in problem identification, decision-making, and implementation. This approach enhanced program relevance and encouraged collective responsibility, increasing the likelihood of long-term adoption of the introduced technologies. Community-driven implementation has been widely

recognized as a determinant of sustainability in rural development initiatives, as it aligns interventions with local needs and capacities.

From a socio-economic perspective, the program generated positive impacts on household income and social inclusion. The reported 25–30 percent increase in partner income indicates that integrating technology and value-added processing can directly improve rural livelihoods. Moreover, the active involvement of women through the PKK group strengthened gender inclusion and expanded income-generating opportunities at the household level. Women's participation in processing, packaging, and marketing activities contributes not only to economic empowerment but also to more balanced community development.

Despite these positive outcomes, several challenges remain. Market expansion beyond the local level requires compliance with food safety standards, product certification, and more advanced marketing strategies. Additionally, continuous technical assistance is necessary to ensure proper machine maintenance and consistent product quality. Addressing these challenges will require collaboration between community groups, local government, and academic institutions to provide ongoing support and policy alignment.

CONCLUSION

The dissemination of environmentally friendly, appropriate technology for maize post-harvest processing in Bontolangkasa Selatan Village has proven effective in increasing production efficiency, diversifying products, and enhancing community capacity. The application of shelling, grinding, and milling technologies significantly reduced post-harvest losses and increased processing capacity, while downstream processing into value-added maize products enhanced market competitiveness. Strengthening human resources through technical training, business management support, and the adoption of digital marketing increased household income and improved the community's economic independence. Overall, this program demonstrates that integrating appropriate technology with participatory community empowerment can serve as a sustainable model for rural economic development.

It is recommended that similar programs be expanded to other maize-producing villages to strengthen local value chains. Continuous mentoring is needed to ensure technology sustainability, product quality consistency, and equipment maintenance. Future initiatives should also focus on product certification, food safety standards, and broader market access to enhance competitiveness at the regional and national levels. Collaboration among universities, local governments, and community groups is essential to support the long-term sustainability of community-based agro-processing enterprises.

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