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Utilization of a Paddy Thresher Machine to Increase Production Capacity of the Makmur Mandiri Farmers' Group in Boangmanalu Village, Pakpak Bharat Regency

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Abstract: Manual rice threshing remains a major bottleneck in rural post-harvest operations, contributing to low operational efficiency, high labor demands, and potential grain losses. This community service program aims to improve post-harvest efficiency and operational capacity among members of the Makmur Mandiri Farmers' Group in Boangmanalu Village, Pakpak Bharat Regency, by introducing and implementing mechanical rice threshing technology. The program involved 20 farmers and was conducted through five structured stages: socialization, hands-on training, technology implementation, mentoring, and evaluation. The results showed that the use of a mechanical rice thresher increased threshing capacity to approximately 100 kg per hour, achieving a processing rate approximately five times higher than that of traditional manual methods while reducing farmers' physical workload. Furthermore, collective ownership of the machine reduced the group's dependence on costly external equipment rental services, which typically cost IDR 850,000–1,250,000 per hectare. The formal handover of the equipment, combined with practical training in operation and maintenance, enabled group members to acquire the skills necessary to operate and maintain the technology independently. Overall, the adoption of appropriate post-harvest technology provides tangible benefits in improving agricultural operational efficiency and strengthening the institutional capacity of farmer groups.

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Introduction

Boangmanalu Village, located in Pakpak Bharat Regency, possesses substantial agricultural potential, supported by favorable agroclimatic conditions that strongly support rice cultivation as a primary agricultural commodity. Based on village-level land-use data in Salak District, Boangmanalu Village has a total agricultural land area of approximately 2.00 hectares, consisting of 0.68 hectares of wetland paddy fields and 1.32 hectares of non-wetland agricultural land (Statistik, 2025). The vast majority of the village community depends directly on the agricultural sector for their economic livelihood; consequently, the long-term sustainability and operational efficiency of farming endeavors serve as crucial, determinant factors in sustaining and elevating community welfare. The intrinsic potential of

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this region actually presents a remarkable opportunity to increase agricultural productivity and farmers' income generation, provided that it is adequately supported by the implementation and integration of appropriate agricultural technology, particularly concerning the critical aspects of post-harvest handling and local resource management (Paman et al., 2014) ; (Purwantini & Susilowati, 2018).

Nevertheless, the overall utilization of this regional potential has not been executed optimally, particularly with respect to rice post-harvest activities. The *Makmur Mandiri* Farmers Group, which is chaired by Mr. Hotma Boangmanalu and geographically located on Jl. Lae Ordi, Boangmanalu Village, Salak District, Pakpak Bharat Regency comprising a total active membership of 20 farmers is still persistently employing manual rice threshing methods utilizing rudimentary tools. This current operational practice is largely incompatible with the scale of the agricultural land area and the overall volume of production that is actually generated. This disadvantageous condition causes the post-harvest processing workflow to operate highly inefficiently, requiring a substantial amount of manual human labor, consuming an excessive length of time, and carrying a severe risk of causing high post-harvest yield losses (Andriani & Kusrini, 2025), (Idin, 2024). Such pervasive inefficiency directly hampers the optimization of rice production capacity that should theoretically and practically be achieved in a region endowed with adequate land resources like Boangmanalu Village.

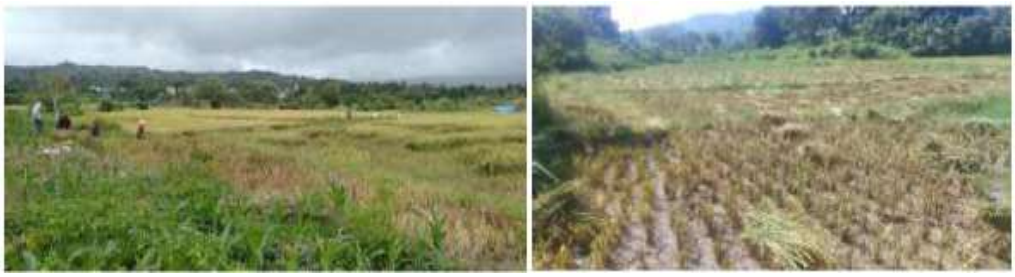


Figure 1. Agricultural Land in Boangmanalu Village Owned by Mr. Hotma Boangmanalu, Chairperson of the Partner Farmers' Group

Throughout this time, the partner farmers group has continuously relied on conventional methods within the rice threshing process, namely by means of manual treading. This traditional technique does not merely demand a large force of human labor, but it is also exceptionally time-consuming, which ultimately leads to low overall production efficiency. In addition to these operational drawbacks, the prolonged use of this manual method carries a high risk of incurring financial losses, given that a considerable volume of rice grains becomes damaged, broken, or scattered and lost during the threshing operation itself. These persistent conditions strongly underscore the urgent necessity for the adoption and application of modern technologies or mechanized machinery to significantly bolster productivity while simultaneously minimizing post-harvest loss rates (Hasbullah, 2009); (Jagat et al., 2024).



Figure 2. Post-Harvest Process of Separating Rice Grains from Stalks by Partner Groups

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One of the primary constraints faced by farmers in adopting agricultural technology is their severely limited access to modern farm equipment, particularly mechanized rice threshing machines. Within the partner farmers group, such essential machinery is not adequately available, thereby compelling the farmers to rely on renting equipment from third-party providers. However, the relatively exorbitant rental fees ranging from approximately IDR 850,000 to IDR 1,250,000 per hectare, heavily depending on the difficulty of the terrain to be traversed impose a heavy additional economic burden on the farmers, especially those who possess limited landholdings or suffer from unpredictable seasonal crop yield amounts. This economic constraint effectively hinders the optimal utilization of technology, preventing the potential gains in rice harvesting efficiency and overall productivity from being fully realized. As a direct consequence, the ultimate harvest yields obtained by the farmers frequently remain sub-optimal in terms of both cumulative quantity and overall crop quality.

The proposed community service program is grounded in the team's previous research and community engagement activities in agricultural machinery engineering and postharvest technology. The team's relevant experience is demonstrated through a previous community service program entitled "Improving Postharvest Production Efficiency through Rice Thresher Machine Innovation for the Dame Ukur Women Farmers Group in Pakpak Bharat Regency" (Ulgari, S, Silaban, S, 2025). This previous activity focused on introducing agricultural mechanization to improve postharvest processing efficiency and reduce the physical workload of farmers. The experience gained from this program provides a relevant technical and practical foundation for implementing similar appropriate technology in the Makmur Mandiri Farmers' Group. Building on this experience, the current program extends the application of rice threshing technology through equipment implementation, operational training, technical mentoring, and maintenance assistance to strengthen farmers' capacity for independent and sustainable postharvest operations.

This community service program aims to improve postharvest efficiency and strengthen the operational capacity of the Makmur Mandiri Farmers' Group through the implementation of mechanical rice threshing technology. Specifically, the program seeks to increase threshing capacity, reduce processing time and farmers' physical workload, and minimize dependence on external equipment rental services. Its contributions include providing access to appropriate agricultural machinery, improving farmers' technical skills through operational and maintenance training, and strengthening the group's capacity for independent and sustainable machine management.

Method

This Community Service Program activity is designed to address the challenges faced by partner farmers regarding rice production, post-harvest time efficiency, and production cost reduction through a structured series of stages: socialization, training, technology application, mentoring, and evaluation. The activity was implemented through five stages: socialization, training, mentoring, and evaluation.

1) Socialization
   The partner group was provided with theoretical and practical knowledge of rice thresher machine operation, as well as strategies for reducing production costs through optimized postharvest handling. The socialization was conducted through group meetings, interactive discussions, and initial demonstrations to ensure that the benefits, technical procedures, and objectives of the program were well understood by the participants.

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2) Training
The training phase focuses intensively on the operational techniques, routine maintenance, and technical servicing of the rice thresher machines, as well as operational cost management strategies to enhance post-harvest efficiency. This training is executed through direct hands-on practice at the partner's location, ensuring that every member of the farmers group acquires the practical skills needed to operate the technology correctly and safely.

3) Application of Technology (Rice Thresher Machinery Deployment)
The rice thresher machinery was deployed and operated directly on the partner farmers' farmland during the postharvest process. The machinery was implemented in accordance with established standard operating procedures (SOPs) to improve threshing efficiency, reduce grain losses, shorten processing time, and minimize farmers' operational costs. The application of this technology also enabled the partner group to gain direct experience in operating mechanical rice threshing equipment under actual field conditions.

4. Mentoring
Direct and intensive mentoring was provided during rice threshing operations, including assistance in scheduling machinery utilization among group members, supervision of machine operations, and strengthening of internal group coordination. This mentoring was conducted to ensure program sustainability and enhance the partner group's capacity to manage and operate the technology independently and consistently.

5. Evaluation
Program evaluation was conducted to assess its effectiveness based on key performance indicators, including threshing capacity, processing time, grain loss, operational costs, and farmers' technical competencies. Quantitative data were analyzed descriptively by comparing pre- and post-implementation conditions and calculating percentage changes in relevant indicators. Qualitative data obtained from observations, interviews, and discussions were analyzed descriptively to assess improvements in farmers' knowledge, operational skills, and group management capacity. The evaluation results were used to identify program achievements and provide recommendations for sustaining the independent operation and maintenance of the machinery.

Result and Discussion

The preparatory phase began with an internal coordination meeting involving all participating lecturers and student team members to draft the activity concept, assign roles and responsibilities, establish an implementation schedule, and identify technical and administrative requirements. To finalize field plans, the team subsequently coordinated directly with Mr. Hotma Boangmanalu, the head of the "Makmur Mandiri" Farmer Group; this ensured alignment with the partner's needs and confirmed site readiness, resulting in an agreement to hold the community service activity on Wednesday, June 17, 2026, in Boangmanalu Village, Salak District, Pakpak Bharat Regency. In addition to administrative preparations and partner coordination, the team focused on preparing the technology-specifically a paddy thresher machine through a process encompassing design, assembly, and component performance testing at the workshop, alongside the development of training modules and relevant informational materials. Once all technical testing was concluded and the necessary materials were ready, the paddy thresher machine and its supporting equipment

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were transported to Pakpak Bharat Regency for use in the technology introduction and training session with the partner farmer group.



Figure 3. Shipment of Paddy Thresher Machine to Pakpak Bharat Regency

- **Opening of the Activity and Presentation of the Program Plan**

The activity began at 10:30 AM with opening remarks from the head of the community service team, Dr. Saronom Silaban, M.Pd., who introduced himself and all participating team members to the attendees. He explained the purpose and objective of the community service program conducted for the Makmur Mandiri Farmers Group, emphasizing that this initiative represents Universitas Negeri Medan's contribution to solving partners' operational challenges, particularly in post-harvest handling. He noted that based on prior observations and discussions, the farmers group still faced several obstacles, such as manually separating grain from stalks, which requires substantial time and physical effort.



Figure 4. Opening Remarks

Therefore, through this program, the team provided a solution by implementing thresher machine technology for the partner group. On that occasion, the head of the team also announced that the prepared thresher machine would be officially handed over to the Makmur Mandiri Farmers Group as a form of appropriate technology implementation to enhance post-harvest efficiency. In closing his remarks, he expressed hope that the provided machinery would be utilized optimally and sustainably to boost productivity, work efficiency, and the overall welfare of the farmers group members.

- **Handover of rice threshing machines**

Following the welcome address, the event proceeded with the official handover of the machinery. This session served as formal confirmation that the machine was handed over to the partner. The handover process was accompanied by the signing of the Handover Minutes (BAST) by the community service team and the partner, witnessed directly by the LPPM Universitas Negeri Medan representative.

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Figure 5. Signing of the Handover Minutes for the Paddy Thresher Machine

Through this session, the team officially transferred one unit of the paddy thresher machine to the partner, the Makmur Mandiri Farmers Group.



Figure 6. Handover of Paddy Thresher Machine

- **Implementation of Paddy Thresher Machine**

Following the official handover of the machinery, the event continued with a training session and the practical application of the paddy thresher machine. The training covered the introduction of machine components, safe operating procedures, maintenance techniques, and direct hands-on threshing practice. This session was led by the head of the service team from the Chemistry Department, Dr. Saronom Silaban, M.Pd. The training methods included live demonstrations, field practice, and interactive discussions. Each participant was given the opportunity to operate the machine to gain firsthand experience with the introduced technology. Once the participants understood the operating procedure, the service team together with the partners conducted a trial run of the paddy thresher machine. The operating steps are as follows:

- Start the engine



Figure 7. Paddy Thresher Machine

- Insert the rice that you want to thresh into the machine slowly

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Figure 8. Insert The Rice That You Want To Thresh Into The Machine Slowly

Once the rice is fed in, the machine threshes it rapidly; in no time at all, the threshed grain emerges, immediately separated from the straw. Consequently, through this training activity, the community service team successfully trained the partners in the use of a rice thresher, resulting in faster rice threshing. The machine utilized has a processing capacity of approximately 300–400 kg per hour.



Figure 9. Threshed Rice Yield

The entire series of community service activities concluded following the successful implementation of all planned socialization, training, technology deployment, and mentoring sessions. The program closed with a discussion session, allowing partners to share their feedback and impressions regarding the executed activities. On that occasion, the leader of the Makmur Mandiri Farmers Group, representing all members, expressed appreciation and gratitude to the Institute for Research and Community Service (LPPM) of Universitas Negeri Medan and the service team for their support and dedication. He noted that the provision of the paddy thresher machine alongside the mentoring sessions was highly beneficial in addressing post-harvest challenges previously managed through manual labor.

Furthermore, the partner group expressed hope for continued collaboration through future community empowerment initiatives. They anticipated follow-up mentoring and further agricultural technology transfers to support sustainable productivity enhancement and business development. The program officially concluded with a joint photo session involving the service team, LPPM Universitas Negeri Medan supervisors, students, and members of the Makmur Mandiri Farmers Group. This documentation symbolizes a strong partnership between higher education institutions and local communities in enhancing agricultural capacity and community welfare through the application of science and technology.

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Figure 10. Group Photo at the End of The Activity

- **Activity Evaluation and Changes in Partner Capacity**

An evaluation was conducted to determine the success rate of the program implementation and to measure the benefits gained by the partner following the entire series of activities, including socialization, the handover of the paddy thresher machine, and machine operation training. The evaluation was carried out through field observations, interviews with members of the Makmur Mandiri Farmers Group, group discussions, and monitoring of the paddy thresher usage.

The evaluated aspects included the partner's capability to operate and maintain the paddy thresher machine, changes in time and labor efficiency during the threshing process, the partner's understanding and skills, as well as its impact on production costs and the fertility of the partner's agricultural land. The evaluation results demonstrated that the members of the farmers group were capable of operating the paddy thresher machine independently and understood basic machine maintenance procedures.

Table 1. Comparison of Partner Conditions Before and After the Community Service Program

No.	Indicator	Condition Before the Program	Condition After the Program
1)	Rice threshing method	Threshing was performed manually (beating/stomping) using human labor	Threshing is performed using a mechanical rice thresher (power theresher) provided to the partners
2)	Threshing capacity	Manual threshing capacity	Threshing capacity increased to approximately 100 kg/hour.
3)	Defoliation Time Efficiency	The manual threshing process takes a relatively long time due to low work capacity.	The threshing process becomes faster, with a work capacity approximately five times greater than that of manual methods.
4)	Access and Machine Usage Fees	The partner does not yet own the machinery and must rent it from another party at a cost of approximately IDR 850,000 -IDR 1,250,000 per hectare.	Partners have access to shared machinery, thereby minimizing reliance on external rental services.
5)	Paddy Yield Losses	Yield loss during manual threshing ranges from approximately 7% to 10%.	Post-harvest losses were lower following the use of the machine, according to field measurement results.

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6)	Labor Force Requirements	The manual threshing process requires a relatively large amount of human labor.	Labor requirements are more efficient, and the physical burden on farmers during the threshing process is reduced.

Discussion

The observed changes indicate that the intervention addressed the central postharvest constraint of the partner group: limited access to suitable threshing technology. The result is consistent with previous community-service studies showing that introducing rice threshing machinery can improve farmers' ability to handle harvested rice and can reduce dependence on conventional manual threshing (Hanun & Riandadari, 2021); (Idin, 2024) ; (Narullova, 2023). The intervention also aligns with research demonstrating that power-thresher performance is related to machine configuration and operating parameters, particularly cylinder speed and threshing components (Ikada et al., 2023); (Pristiansyah et al., 2022); (Susilawati et al., 2024).

An important aspect of this activity is that technology delivery was combined with practical training. A machine that is provided without adequate user competence may not generate sustained benefits because improper operation can reduce performance and increase the risk of mechanical problems. In this activity, farmers were introduced to machine components, operating procedures, and basic maintenance and then directly practiced the process. The change from passive observation to hands-on use strengthens the likelihood that the technology can be integrated into the group's routine postharvest activities (Amrullah et al., 2025).

From an economic perspective, collective ownership or collective access can reduce the need to rent equipment from external providers. The partner group previously faced rental costs of approximately IDR 850,000 –1,250,000 per hectare. However, the present activity did not conduct a full before–after accounting analysis of fuel, maintenance, labor, rental-equivalent cost, or depreciation. Therefore, the economic benefit should be described as a reduction in dependence on external rental services rather than as a quantified net cost saving (Hanggana et al., 2023).

The same caution applies to grain losses. The PKM document reports manual losses in the range of approximately 7–10% and sets lower losses as an expected outcome after mechanization, but the field report does not provide a complete measured post-intervention loss dataset. Consequently, this article does not claim a specific percentage reduction in grain losses. A follow-up study should measure input grain mass, recovered grain mass, unthreshed grain, spilled grain, processing time, labor requirements, fuel consumption, and operating cost under standardized field conditions. Such measurements would provide stronger quantitative evidence of the technology's effectiveness.

Conclusion

The implementation of a rice threshing machine in the Makmur Mandiri Farmers' Group provided an appropriate technological response to the group's limited access to postharvest equipment and dependence on manual threshing. The activity involved 20 farmers and combined technology delivery with socialization, formal handover, hands-on training, field demonstration, mentoring, and evaluation. The evaluation recorded an operating capacity of approximately 100 kg h−1 and indicated that threshing was about five times faster than the previous manual method. Farmers also acquired practical competence in

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machine operation and basic maintenance, while access to a collectively managed machine reduced dependence on external rental services. Nevertheless, quantitative measurements of grain losses, labor requirements, fuel use, and net operating costs are still needed to establish the magnitude of the intervention's benefits.

Recommendation

The Makmur Mandiri Farmers' Group is encouraged to operate and maintain the paddy thresher machine regularly in accordance with standard operating procedures and maintain records of threshing capacity, processing time, labor requirements, grain losses, fuel consumption, and maintenance costs during each harvest cycle. Local governments and the Department of Agriculture are encouraged to support the adoption of appropriate agricultural machinery through equipment assistance, technical training, continuous mentoring, and institutional support to improve farmers' productivity and reduce dependence on external equipment rental services. Furthermore, future community service teams are encouraged to conduct standardized measurements and comprehensive evaluations of machine performance, operational costs, rental savings, and economic feasibility over several harvest cycles to strengthen the evidence base for technological improvement and program replication in other farmer groups.

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