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Implementation of Rice Threshing Machine Technology for Improving Production Capacity and Operational Efficiency in the Dalanta Farmers Group of Boangmanalu Village

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A B S T R A C T

The Dalanta Merpulung Farmers' Group in Boangmanalu Village, Salak Subdistrict, Pakpak Bharat Regency, has considerable rice production potential but faces constraints during the post-harvest stage. This community service program introduced a rice threshing machine to improve production capacity and operational efficiency. The program consisted of preparation, implementation, training, and evaluation involving 20 farmers. The results showed that threshing capacity increased from 20–30 kg/hour to 100–150 kg/hour after machine adoption. The technology also reduced labor requirements, shortened processing time, lowered harvesting costs, and minimized grain losses. The final evaluation confirmed that participants were able to operate and maintain the machine independently. Overall, the program successfully promoted agricultural mechanization while improving productivity, operational efficiency, and the sustainability of the Dalanta Merpulung Farmers' Group.

INTRODUCTION

Indonesia is one of the world's leading agricultural countries, where agriculture plays a crucial role in supporting food security, rural livelihoods, and economic development. Favorable agroecological conditions enable the cultivation of a wide range of crops, particularly food crops. Among these, rice is the most important staple crop and serves as a strategic commodity in Indonesia's agricultural sector (Laila et al., 2025; Saputri et al., 2026). Rice is the most important food crop in Indonesia, serving as the primary staple food for the majority of the population. Beyond its role as the main source of daily caloric intake, rice is also a strategic agricultural commodity that contributes significantly to national food security and rural economic development. Data from the (Statistik, 2025) Indonesia's rice production reached 53.14 million tons in 2024. However, Indonesia also imported 4.52 million tons of rice during the same year (Rachman, 2025). This situation is a matter of concern considering Indonesia's status as an agrarian country with substantial agricultural resources, particularly in the rice sector. Therefore, optimizing rice production and improving production efficiency are essential to strengthening national food self-sufficiency and food security.

Pakpak Bharat Regency, located in North Sumatra Province, is an area in which agriculture plays an important role in the local economy. Agricultural commodities actively cultivated in the region include maize, coffee, sugar palm, pineapple, rice, and other food crops (Purba et al., 2023). As an agricultural region, Pakpak Bharat Regency relies heavily on farming as the primary source of livelihood. Farmers commonly adopt collaborative farming practices through organized farmer groups to strengthen cooperation, facilitate knowledge and technology exchange, and improve agricultural productivity and operational efficiency. The partner in this community service program was the Dalanta Merpulung Farmers' Group, located in Boangmanalu Village, Salak Subdistrict, Pakpak Bharat Regency. Established on February 1, 2021, the group is a legally registered farmer organization recognized by the Ministry of Law and Human Rights of the Republic of Indonesia. It comprises 20 active members and is chaired by Mr. Torus Boangmanalu.

Figure 1. Rice Field of the Dalanta Merpulung Farmers' Group Leader

The partner conducts rice harvesting activities approximately one to two times per year, with the amount of production determined by the cultivated land area and weather conditions. Based on an interview with the group leader, a cultivated area of 0.5 hectares generally produces approximately 150 cans of paddy, equivalent to approximately 2,250 kg of paddy, assuming that one can of paddy is equivalent to approximately 15 kg. Although the partner has considerable rice production potential, challenges remain in the production process, particularly during the threshing stage.

Rice threshing is still conducted using conventional methods involving a makeshift bamboo table and manual foot threshing. This method results in low production capacity, with manual threshing capable of processing only approximately 20–30 kg of paddy per hour. With a harvest of approximately 2,250 kg, the threshing process requires approximately 75–112.5 working hours, equivalent to approximately 9–14 working days. To overcome this problem, the partner increases the number of workers during the harvesting process. However, this approach has not effectively resolved the problem and instead increases labor costs. (Asriadi & Husain, 2025) stated that labor wages are one of the factors that significantly contribute to high rice farming costs.

Figure 2. The Process of Rice Harvesting and Threshing Using Conventional Methods at Partner Farms

In addition, the traditional threshing method results in post-harvest losses of approximately 5–10% because many rice grains are not completely separated from the stalks. This condition is consistent with (Sugandi et al., 2024), who reported that manual rice threshing can result in losses of up to 10% because the grains are not collected in a single location and are not completely separated from the straw. To address these problems, the application of rice threshing machine technology is proposed as an appropriate technological solution. The use of a rice threshing machine is expected to significantly increase production capacity. Whereas manual threshing is capable of processing only approximately 20–30 kg of paddy per hour, the rice threshing machine is expected to increase capacity to approximately 100–150 kg per hour.

Figure 3. Design of the Rice Thresher to Be Implemented

The use of this machine can also reduce the need for additional labor. Furthermore, threshing losses can be minimized because the machine is capable of separating the rice grains from the stalks more effectively. The threshing process can also continue under less favorable weather conditions because the machine can be operated in a more protected location. According to (Alfidyah, 2025), agricultural mechanization is a key factor in improving production efficiency, reducing labor costs, and accelerating production processes in small- and medium-scale farming enterprises. (Setiawan et al., 2025) reported that the use of rice threshing machines can reduce post-harvest losses to below 2% and significantly improve farmer productivity. This approach is also consistent with the results of a previous community service program conducted by the proposing team involving the application of a coffee pulping machine among the Usahanta Women Farmers' Group in Salak II Village. The program increased the partner's production capacity from 12 kg/hour to 60 kg/hour (Siahaan et al., 2025). This experience served as the basis for the team to once again apply mechanical technology as a solution to address production capacity constraints among the Dalanta Farmers' Group in Boangmanalu Village.

The application of rice threshing machine technology is therefore expected to increase the production capacity and work efficiency of the Dalanta Merpulung Farmers' Group. Accordingly, this community service program aims to implement rice threshing machine technology to improve the efficiency of the rice post-harvest process and strengthen the productivity and independence of the partner farmers' group.

IMPLEMENTATION AND METHODS

The implementation method used in this community service program consisted of socialization, training, technology implementation, mentoring, and evaluation. The activities were carried out systematically through the following stages:

Preparation Stage

The preparation stage was the initial stage of the community service program and aimed to ensure the readiness of both the community service team and the partner group. This stage included internal team coordination, work-plan development, scheduling, task allocation, and the preparation of supporting facilities and infrastructure, including the rice threshing machine, training materials, and mentoring materials.

Implementation Stage

1. Socialization
   The implementation stage began with a socialization session. The socialization was conducted through a direct meeting at the partner's location to explain the objectives, benefits, and scope of the community service program. The technical aspects of the activities were also discussed, including the implementation schedule, required equipment and materials, and the roles and responsibilities of the partner during the program. The socialization aimed to establish a shared understanding and encourage the active involvement of the partner throughout all stages of the program. This stage also served as an initial step in building the partner's commitment to the implementation and sustainable utilization of the rice threshing machine technology.
2. Training
   Training activities were conducted to enhance the partners' knowledge and technical competencies in supporting the successful implementation of the program. The training materials focused on the application of rice threshing machine technology, including an introduction to the rice threshing machine, operational procedures, and hands-on practice in machine operation. The training was delivered during the second and third field visits, with implementation adjusted as necessary to accommodate field conditions. A **learning-by-doing** approach was employed to enable participants to gain practical experience, thereby facilitating a better understanding and effective application of the technology introduced.
3. Technology Implementation
   The technology implementation stage constituted the core component of the community service program. During this stage, the rice threshing machine was directly integrated into the partners' post-harvest operations to replace the conventional manual threshing method. The implementation was carried out through practical field application, allowing participants to operate the machine under direct supervision. This stage was conducted concurrently with the training activities during the second and third field visits to ensure that participants acquired both theoretical understanding and practical skills in utilizing the technology.
4. Mentoring
   Mentoring was conducted continuously through direct field visits to the partners' location. This activity aimed to ensure that the partners were able to operate the rice threshing machine correctly and perform routine maintenance to maintain its optimal performance. In addition, the mentoring process served as a platform for discussion between the implementation team and the partners regarding any technical or operational challenges encountered after the completion of the training. Appropriate solutions and recommendations were subsequently provided to address these challenges and to support the sustainable utilization of the technology.

Evaluation

Evaluation constituted the final stage of the community service program. It was conducted through direct observation and semi-structured interviews with the partner farmers by comparing conditions before and after program implementation, with particular emphasis on improvements in paddy production capacity. Observations were undertaken to assess the partners' ability to operate the rice threshing machine effectively in the field, while interviews were conducted to explore their experiences, perceptions, and challenges encountered during the adoption of the technology. The evaluation findings were used as the basis for assessing program effectiveness, identifying areas for improvement, and formulating recommendations for future follow-up activities. Both the mentoring and evaluation processes were scheduled to be carried out during the third field visit.

Table 1. Activity Evaluation Indicators

No	Solutions	Outcomes	Evaluation Indicators
1	Implementation of Rice Threshing Machine Technology.	✓ Rice threshing machine. ✓ Training on the use of rice threshing machines. ✓ Increased production capacity.	✓ Are rice threshing machines already available? ✓ Are the partners already able to use rice threshing machines? ✓ Has production capacity (threshing) increased from approximately 20–30 kg/hour to 100–150 kg/hour?

RESULTS AND DISCUSSION

The implementation of this community service program consisted of several stages, including preparation, implementation, training, and evaluation. Each stage was conducted systematically and continuously to ensure that the application of rice threshing machine technology could be implemented optimally and provide tangible benefits to the Dalanta Farmers' Group in Boangmanalu Village. The results of each stage are described as follows.

Preparation Stage

During the preparation stage, the community service team conducted internal coordination to develop the work plan, allocate responsibilities, establish the activity schedule, and identify the resources required for program implementation. The team also coordinated with the Chairperson of the Dalanta Merpulung Farmers' Group to agree on the activity schedule, location, number of participants, and form of assistance to be provided during the program.

Based on the initial observations and discussions with the partner, it was agreed that the community service program would focus on the application of rice threshing machine technology to improve post-harvest efficiency. During this stage, the team also prepared the rice threshing machine to be implemented by the partner. After the assembly and functional testing of the machine had been completed, the rice threshing machine was transported from Universitas Negeri Medan to the partner's location in Boangmanalu Village, Salak Subdistrict,

Pakpak Bharat Regency, on June 1, 2026. The machine was delivered in advance to ensure that it was available at the partner's location prior to the commencement of the field activities.

Implementation Phase

The implementation stage was conducted through two field visits, with each visit focusing on different activities. The first visit consisted of program socialization, the handover of the rice threshing machine, and training on the application of the technology. The second visit focused on providing assistance and monitoring the use of the machine by the partner group.

Program Socialization and Machine Handover

The socialization activity was conducted to introduce the overall community service program to the partner, establish a shared commitment, and hand over the rice threshing machine to the farmers' group. The first field visit was conducted on Saturday, June 20, 2025, in Boangmanalu Village, Salak Subdistrict, Pakpak Bharat Regency. The activity was attended by 20 participants, including members of the partner group, the community service team, and a facilitator from the Institute for Research and Community Service (LPPM) of Universitas Negeri Medan. Upon arriving at the partner's location, the community service team immediately prepared the venue, including installing the banner and setting up the rice threshing machine.

Figure 4. Banner Installation and Machine Preparation

While preparing the machine, the community service team, assisted by students, also conducted participant registration by asking participants to complete the attendance list.

Figure 5. Participant Registration

Once preparations for the event were complete—including banner After all preparations had been completed, including banner installation, venue arrangement, and coordination with the management of the farmers' group, the community service activity officially began at 9:00 a.m. Western Indonesia Time (WIB). The activity was guided by a Master of Ceremonies (MC) to ensure that the event proceeded in an orderly manner according to the predetermined agenda. The activity began with a welcoming speech delivered by the Head of the Community Service Team, who explained the purpose and objectives of the Community Partnership Program. In the speech, the Head of the Team explained that the program represented the university's commitment to supporting the improvement of agricultural productivity through the application of appropriate technology.

Based on the initial observations, the partner was found to face challenges in the post-harvest process, particularly in rice threshing, which was still conducted manually. This condition resulted in a relatively lengthy threshing process, required a greater number of workers, and led to low work efficiency and production capacity. To address these challenges, the community service team provided a rice threshing machine intended to accelerate the threshing process, improve work efficiency, reduce post-harvest losses, and support increased productivity of the farmers' group. On this occasion, the Head of the Community Service Team also emphasized that the handover of the machine was not merely the provision of equipment but was accompanied by training, assistance, and evaluation to ensure that the technology could be utilized optimally and sustainably. At the conclusion of the speech, the Head of the Team encouraged all members of the farmers' group to properly maintain, care for, and utilize the rice threshing machine so that its benefits could be sustained over the long term and contribute to improving farmers' welfare.

Figure 6. Welcoming Speech by of the Head of The Community Service Team

Following the opening ceremony, the activity continued with the formal handover of the rice threshing machine to the partner as a realization of the community service program. The handover was formalized through the signing of a handover document by the Head of the Community Service Team and the Chairperson of the Dalanta Merpulung Farmers' Group. After the signing process was completed, the rice threshing machine was symbolically handed over to the Chairperson of the partner group in the presence of the participating members of the farmers' group.

Based on the specifications of the machine implemented in this program, its threshing capacity reached approximately 100–150 kg of paddy per hour, whereas the previous manual threshing method was capable of processing only approximately 20–30 kg of paddy per hour. This increase in capacity indicates that the use of a rice threshing machine can significantly accelerate the post-harvest process, reduce labor requirements, minimize post-harvest losses, and improve the work efficiency of the farmers' group.

Figure 7. Rice Threshing Machine

The figure above shows the rice threshing machine that was provided and formally handed over to the partner. Through this activity, the machine officially became available for use by the partner farmers' group.

Figure 8. Delivery of the Rice Threshing Machine to the Partner Farmers' Group

Training and Technology Implementation

Following the formal handover of the machine, the activity continued with training and technology implementation. Prior to the practical training session, an explanation of the rice threshing machine was delivered by Siti Ulgari, S.Pd., M.Pd. The session covered the function of the machine, its main components, operating principles, production capacity, the benefits of using the machine compared with manual threshing methods, and occupational safety procedures. This theoretical explanation was provided as a foundation before the partner proceeded to the practical session.

Following the theoretical presentation, the activity continued with the implementation of the technology through hands-on practice. Before operating the machine, the community service team first introduced the operating procedures, explained the function of each machine component, described the initial inspection procedures, demonstrated how to start the machine, and explained the occupational safety measures that needed to be observed. Members of the farmers' group were then given the opportunity to start the machine in turns under the supervision of the community service team. This approach was intended to provide each participant with direct practical experience while increasing their confidence in operating the machine independently during subsequent harvest seasons.

Figure 9. Machine Operation Practice

The practical session then continued with the rice threshing process. The community service team provided guidance regarding safe working positions, the proper technique for feeding rice into the machine, and the importance of maintaining stable engine rotation to ensure optimal threshing performance. During the practical session, the threshing process was considerably faster than the conventional method previously used by the partner. The paddy grains were separated from the panicles more cleanly and evenly, thereby minimizing post-harvest losses, reducing labor requirements, and accelerating the completion of the post-harvest process. The members of the farmers' group demonstrated a high level of enthusiasm throughout the practical session. They directly experienced the benefits of using the machine, particularly in terms of time savings, reduced workload, and improved production efficiency. Through this training, all members of the group were expected to acquire the ability to operate and maintain the machine independently, thereby ensuring the sustainability of the technology's utilization.

Figure 10. Rice Threshing Practice and Threshed Rice Grains

After all training sessions had been completed, the first field visit concluded with a discussion and question-and-answer session between the community service team and the members of the Dalanta Merpulung Farmers' Group. The community service team explained that the program would continue with subsequent visits to provide assistance, conduct monitoring, and evaluate the implementation of the rice threshing machine technology. At the end of the activity, the Chairperson of the Dalanta Merpulung Farmers' Group, representing all members, expressed appreciation and gratitude to the Directorate of Research and Community Service (DPPM) of the Ministry of Higher Education, Science, and Technology; the Institute for Research and Community Service (LPPM) of Universitas Negeri Medan; and the entire community service team for the support provided. The partner stated that the rice threshing machine and the accompanying training were highly beneficial in improving the efficiency of the post-harvest process.

Figure 11. Group Photograph at the End of the Activity

Assistance and Monitoring

Following the socialization, machine handover, and training conducted during the first visit, the community service team returned to the Dalanta Merpulung Farmers' Group on July 16, 2026, to conduct assistance and monitoring activities. This activity aimed to ensure that all solutions provided during the previous visit had been properly implemented by the partner. The assistance was conducted directly at the partner's location and involved the members of the farmers' group. The process was intended to ensure that the members of the group were able to operate the rice threshing machine independently in accordance with the procedures provided during the training. During this activity, the community service team did not provide another demonstration. Instead, the members of the group were given the opportunity to operate the machine independently, beginning with machine preparation, followed by the threshing process, and concluding with machine cleaning after use.

The monitoring results showed that the members of the farmers' group were able to operate the machine properly. The threshing process was completed more quickly than when using the conventional method previously employed by the partner. The partner also reported that the use of the machine reduced labor requirements, thereby improving the efficiency of harvesting costs.

Figure 12. Assistance in the Use of the Rice Threshing Machine

Evaluation Stage

The evaluation stage was conducted to determine the extent to which the program had addressed the problems faced by the partner, measure the achievement of the indicators established in the community service proposal, and identify the benefits experienced by the partner after participating in the entire series of activities. The evaluation was conducted through observation and interviews with representatives of the partner group.

As part of the final evaluation, a third field visit was conducted on July 23, 2026. During this activity, the community service team assessed all program outputs by comparing the partner's conditions before and after the implementation of the community service program. Based on the observations, the members of the Dalanta Merpulung Farmers' Group were able to operate the machine independently without direct assistance from the community service team. The use of the machine accelerated the rice threshing process, thereby reducing working time compared with the conventional method, which previously relied on manual foot threshing and simple bamboo equipment. In addition, the threshing results were cleaner, thereby minimizing grain losses. The partner also reported that the use of the machine reduced labor requirements, resulting in more efficient harvesting costs.

Therefore, the evaluation results indicate that all solutions provided through the community service program generated tangible benefits for the partner.

Table 2. Achievement of Community Service Program Indicators

No	Issues	Indicator Target	Achievements
1	Rice threshing is still done manually.	Rice threshing machines are used by farmer groups	**Achieved**. The machine has been used independently by members of the farmers' group.
2	Production capacity is low	Improved efficiency of the threshing process	**Achieved.** The threshing process is faster than the manual method.
3	Threshing takes approximately 9–14 days	Reduced threshing time	**Achieved.** Work time has been reduced, allowing the harvest to be completed more quickly.

4	Labor costs are high	Reduced labor requirements	**Achieved.** The number of workers needed during the threshing process has decreased.
5	Harvest losses are around 5–10%	Reduced grain loss	**Achieved.** The threshed grain is cleaner, minimizing grain loss.

The implementation of this community service program demonstrated that all proposed interventions effectively addressed the primary challenges encountered by the Dalanta Merpulung Farmers' Group. The introduction of a rice threshing machine significantly enhanced the efficiency of post-harvest operations by reducing processing time, minimizing labor requirements, and decreasing post-harvest grain losses. These findings are consistent with the study conducted by (Setiawan et al., 2025), which reported that the application of rice threshing machines increased threshing capacity by more than threefold compared to conventional manual methods while simultaneously reducing operational time, physical workload, and labor costs. Similarly, (Ikada et al., 2023; Suhendra et al., 2024) found that the utilization of rice threshers substantially improved both the efficiency and operational capacity of the threshing process. Furthermore, mechanized threshing contributes to higher grain cleanliness and minimizes quantitative post-harvest losses, thereby enhancing overall agricultural productivity.

The adoption of appropriate technology represents an important component of agricultural mechanization that supports improvements in farming productivity while accelerating the modernization of rural agricultural systems. The application of rice threshing machines specifically designed to meet the needs of smallholder farmers enhances post-harvest efficiency by providing demand-driven technological solutions that are adaptable to local farming conditions (Putra et al., 2025). Overall, this community service program successfully achieved the objectives outlined in the initial proposal, particularly in improving the efficiency of post-harvest rice production within the Dalanta Farmers' Group in Boangmanalu Village. From the perspective of sustainable development, the program also contributes to the achievement of several Sustainable Development Goals (SDGs). Increased agricultural productivity and farmers' income support *SDG 1 (No Poverty) and SDG 8 (Decent Work and Economic Growth)*. Meanwhile, improved efficiency in rice production contributes to *SDG 2 (Zero Hunger)* by strengthening local food security and promoting sustainable agricultural production. Beyond its contribution to the SDGs, this program is also aligned with Indonesia's national development agenda under the *Asta Cita*, particularly the commitment to strengthening national food security and promoting village-based economic development. Furthermore, the implementation of this community service initiative supports the National Research Master Plan (RIRN) in the priority sectors of food and agriculture through the application of appropriate technologies that can be directly adopted and utilized by farming communities.

CONCLUSIONS AND RECOMMENDATIONS

The Community Partnership Program, through the implementation of rice threshing machine technology, successfully improved both the production capacity and operational efficiency of the Dalanta Merpulung Farmers' Group in Boangmanalu Village. The program was implemented through four sequential stages, namely preparation, implementation, training, and evaluation, which were conducted over three field visits. These included the socialization and machine handover on 20 June 2025, technical guidance and monitoring on 16 July 2026, and the final evaluation on 23 July 2026, involving twenty members of the farmers' group. The evaluation results demonstrated a substantial improvement in threshing performance. Paddy threshing capacity increased from approximately 20–30 kg/hour using conventional manual methods to 100–150 kg/hour following the adoption of the rice threshing machine. This significant increase reduced labor requirements, harvesting costs, and production losses, which had previously represented the major constraints faced by the partner group. In addition to improving production performance, the program successfully enhanced the technical capacity of farmers to independently operate and maintain the rice threshing machine, as evidenced by the final evaluation. Therefore, this community service initiative not only increased production capacity and work efficiency but also strengthened the self-reliance of the farmers' group in utilizing appropriate agricultural technology for sustainable farming practices.

To ensure the long-term sustainability of the program, the partner group is encouraged to continue utilizing and maintaining the rice threshing machine on a regular basis. Routine inspection and maintenance of machine components, particularly those susceptible to wear during intensive harvesting periods, are essential to maintaining optimal machine performance. Furthermore, continuous capacity-building activities should be conducted to improve farmers' technical competencies in machine operation, maintenance, and organizational management. Future support from government institutions, universities, and private-sector stakeholders is expected to strengthen the sustainability and scalability of this program while creating broader opportunities for collaborative development. Consequently, the successful implementation of this technology can be replicated by other farmer groups to improve agricultural productivity in surrounding areas. Ultimately, this community service program is expected to empower local farming communities, enhance their independence, and optimize the utilization of local agricultural resources as sustainable drivers of rural economic development.

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