EMPOWERING THE SIDO MAJU FARMERS GROUP THROUGH THE DEVELOPMENT OF A SOLAR-POWERED CORN THRESHER

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ABSTRACT

This community service initiative seeks to enhance the design of a corn thresher to improve its functionality and expand its market potential. The activities include field inspections, discussions, training, and socialization with village officials, expert teams, and farmers' groups. Previous designs revealed several shortcomings, such as an intake hole positioned too high, causing user discomfort, and a small diameter that made it challenging to process larger corn cobs. Additionally, the separation mechanism between cobs and kernels was ineffective, leading to mixed results. Farmers also struggled with marketing their crops, often relying on traders visiting the village, which resulted in lower selling prices. The redesigned thresher addresses these issues by enabling upright operation, increasing intake capacity, and reducing costs through solar power. Complementing the redesign, online marketing training equips farmers with strategies to align their prices with market standards, reduce dependence on intermediaries, and enhance their income sustainably.

Keywords: A solar-powered corn thresher reduces threshing costs, increases capacity, and expands market reach

ABSTRAK

Program pengabdian masyarakat ini bertujuan untuk meningkatkan desain alat perontok jagung agar lebih fungsional dan memperluas potensi pasarnya. Kegiatan meliputi inspeksi lapangan, diskusi, pelatihan, dan sosialisasi bersama aparat desa, tim ahli, dan kelompok tani. Desain sebelumnya memiliki beberapa kelemahan, seperti lubang masuk yang terlalu tinggi sehingga menyulitkan pengguna, serta diameter yang kecil sehingga sulit memproses jagung berukuran besar. Selain itu, mekanisme pemisahan tongkol dan biji kurang efektif, sehingga hasil sering kali bercampur. Petani juga menghadapi kendala pemasaran, yang bergantung pada pedagang yang datang ke desa dan mengakibatkan harga jual lebih rendah. Desain baru mengatasi kendala ini dengan memungkinkan pengguna berdiri, meningkatkan kapasitas, dan menekan biaya melalui pemanfaatan tenaga surya. Pelatihan pemasaran daring turut mendukung petani dalam menyesuaikan harga dengan standar pasar, mengurangi ketergantungan pada perantara, dan meningkatkan pendapatan secara berkelanjutan.

Kata Kunci: A solar-powered corn thresher reduces threshing costs, meningkatkan kapasitas, dan expands market reach

1. INTRODUCTION

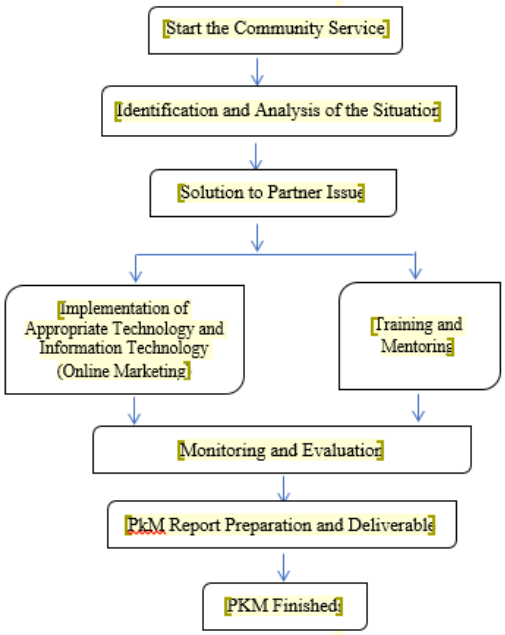
The agricultural land in Juwiring Village, Kendal Regency, relies on rainwater. In addition to growing rice, the village's fields are also planted with corn. After harvest, corn is separated from its cobs using a corn thresher. Once the corn is dried for threshing, it needs to be transported to a threshing location about 3 km away from the fields, which requires transportation and travel time. Post-harvest corn marketing is usually done by selling to traders who come to Juwiring Village, resulting in prices that do not align with current market rates. In the previous machine design, there were user feedback issues, such as the corn intake hole being too high, requiring farmers to squat, and the hole diameter being too small, making it difficult for larger corn to fit. The previous corn thresher had two discharge holes, one for corn cobs and one for corn kernels. However, during operation, the cobs did not exit through the designated discharge hole but mixed with the corn kernels.

Figure 1. The Service Team is Conducting a Testing of the Corn Shellen

Based on several studies that have been conducted, the developed solar power technology can effectively perform shelling operations at sunlight intensities exceeding 600W/m² without requiring power consumption from the battery because environmentally friendly energy that is available in tropical regions (Balveer Singh, 2022). he performance results of the corn shelling process show that the effectiveness of shelling is greatly influenced by the motor rotation speed (Haikal et al., 2023). Witching to the use of environmentally friendly corn shelling machines (without pollution) can reduce air pollution. Based on the results of the Nordic Body Map questionnaire, pain complaints exceed 50 percent. Therefore, it is necessary to design a corn shelling machine to alleviate this pain (Ekoanindiyo et al., 2020). The corn shelling machine will benefit agricultural workers by increasing efficiency and farmers' income (Das, 2023). he shelling capacity is influenced by the rotation speed of the shelling shaft, with the highest shelling capacity achieved at a shaft rotation speed of 700 rpm, which is 132.21 kg/hour (Ardianto et al., 2019). With the new beef scrubber tool, it does not injure workers' hands and reduces pain and soreness in the right wrist and hand, as well as speeds up and makes the cleaning of beef tripe more efficient (Ekoanindiyo et al., 2022). With the introduction of this semi-automatic machine, the cleaning time of intestines per kilogram, which initially required sixty minutes, can be reduced to thirty minutes per kilogram. The design of this machine also takes into account ergonomic aspects of labor and percentiles (Ekoanindiyo et al., 2020). he development of the corn shelling machine design refers to anthropometric data of farmers' body dimensions, specifically using elbow height measurements (Ekoanindiyo et al., 2022). Through this community service, it is hoped that a new design and development of the corn shelling machine can be achieved, which will improve upon the previous machine design, thereby increasing the machine's capacity and expanding its market reach. The connection with renewable energy in the context of SDG 7 is that solar energy is a renewable energy source, which is one of the main solutions to reduce dependence on polluting and expensive fossil fuels, while also supporting the goal of improving quality of life without harming the environment.

2. METHODOLOGY

This Community Service (PkM) activity is carried out through field surveys, discussions, socialization, training, and mentoring involving the PkM team, the village head, and village officials of Juwiring, expert teams, and the Sido Maju Farmers Group. The method applied is participatory action research, which generates new knowledge for problem-solving or practical improvements. This method follows structured steps: problem identification, action planning, action implementation, observation and data collection, reflection and evaluation, and revision of plans and actions. To achieve the established goals, this community service is carried out through the following steps:



Gambar 2. PkM Implementation Method

Stages of the PkM Activity Method can be described as follows:

1. Identification and Analysis of the Situation
   The first step is to formulate the elements to be used in the implementation of the community service. Identifying the partner's problems is done by conducting a field survey in Juwiring Village, Cepiring District, Kendal Regency, which is part of the Sido Maju Farmers Group. Subsequently, discussions and interviews are conducted with the farmers' group to identify the existing issues.
2. Solution to Problems
   After the field survey and discussions that result in a formulation of the partner's issues, the next step is to find solutions to these problems. Solutions are developed through communication with the partners and identification of the main needs that need to be addressed.
3. Addressing Needs
   In addressing the problems outlined in the background, the partner's needs that need to be fulfilled are divided into two categories: technology needs and training needs.
   a. Technology needs include a solar-powered corn sheller that is appropriate for improving productivity and reducing corn shelling costs. Additionally, other technology needs involve information technology for online marketing to expand market reach.
   b. Training will cover the use and operation of the solar-powered corn sheller as well as online marketing. Through this training and mentoring, it is expected that partners will gain additional knowledge and skills that can enhance corn shelling productivity and sales.
4. Implementation of the PkM Activity
   his PkM activity includes several stages: preparation by designing the corn shelling machine, development of the corn shelling machine, training on the use and operation of the solar-powered corn sheller, and training and creation of information technology designs for online marketing..
5. Monitoring and Evaluation
   The implementation of monitoring and evaluation activities aims to oversee the execution and sustainability of the program carried out by the PkM team. This activity is carried out by visiting the partners to conduct interviews to assess whether the machine is functioning properly. Is there a reduction in shelling time from 15 minutes per sack to 5 minutes per sack? Additionally, feedback

and input from the partners regarding the corn sheller machine are also gathered.

6. Report Preparation and Deliverables
   The final activity is the preparation of reports and results from the conducted PkM activities. The outcomes of the PkM activities include articles published in journals, mass media, posters, copyrights, activity videos, the design of the corn shelling machine, and the results of the corn shelling machine development.

3. RESULTS AND DISCUSSION

Problem identification of the partner is carried out through field surveys, discussions, and socialization in Juwiring Village, Cepiring District, Kendal Regency, which is part of the Sido Maju Farmers Group.

Figure 3. Focus Group Discussion with the Farmers Group

Figure 4. Socialization with the Farmers' Group and Village Officials

In the previous machine design, there were several user inputs, including: the hole for loading corn was not high enough, causing farmers to squat to insert the corn; the hole diameter was too small, so larger corn could not fit. Additionally, the previous corn sheller was equipped with two discharge holes, one for corn cobs and one for the kernels. However, during operation, the corn cobs did not exit through the designated cob hole but mixed with the corn kernels.

Figure 5. Previous Corn Sheller Machine Before Development

After the field survey and discussions that result in a formulation of the partner's problems, the next step is to find solutions to address these issues.

Figure 6. Coordination and Consultation on the Corn Sheller Machine Design

In the development of the corn sheller machine, anthropometric data or body dimensions are utilized, specifically the elbow height of farmers from the Sido Maju Farmers Group in Juwiring Village. This anthropometric data is obtained from measurement:

Table 1. Anthropometric Data

Name	Gender |	Age	Elbow Height
Mas	Male	62	85.2
Bu	Male	53	81
Abu	Male	56	79.1
Khas	Male	54	76.2
Urs	Male	50	78.1

Kar	Male	55	82.9
And	Male	49	79,1
Fir	Male	45	78.2

Source: Primary Data

Size selection uses percentiles, which essentially show the percentage of people in a population with body dimensions equal to or smaller than that value. The 5th percentile indicates a size that includes 5% of the population with smaller dimensions, while the 50th percentile reflects the average size of 50% of the population, and the 95th percentile includes 95% of the population with larger dimensions. In this measurement, the data used are the average data or the 50th percentile.

Table 2. Determination of Design Size

Design Size	Anthropometric Data	Percentile	Reason
Height of the Machine Opening	Elbow Height	50	For users of average to tall stature to be able to reach or use the machine effectively

Source: Processed Data

Table 3. Materials and Components

Component Name	Size
Tube	Ø 18 cm
Solar Panel	72 sel
AC Motor	220 V
Battery	150 Amp
Wheel	8 inch
DC to AC Inverter	1
Hollow Steel Frame	3 x 3

Each part of the machine has a function that is interconnected with one another. Below are the images and functions of each component of the solar-powered corn sheller machine:

Figure 7. Solar Panel

A solar cell is an electrical device that converts direct light energy into electricity through the photovoltaic effect. Its function is to capture energy from sunlight and convert it into electrical power.

Figure 8. Battery

A battery is an energy storage device that is charged by the DC flow from the solar panel. In addition to storing DC power, the battery also functions to convert chemical energy into electrical flow.

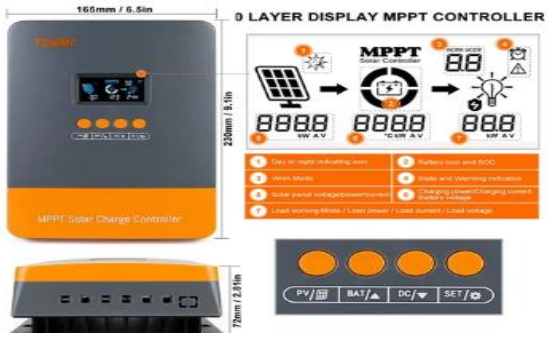


Figure 9. DC to AC Inverter

The DC to AC inverter in a solar panel system functions to convert the direct current (DC) produced by the solar panels into alternating current (AC) that can be used by household appliances or fed into the public electricity grid."

Figure 10. AC Motor

AC motors are often used to drive various corn sheller machines that utilize solar power.

Design of the Corn Sheller Machine

The design development images of the corn sheller machine are the result of field surveys, focus group discussions, coordination, and consultations with farmer groups:

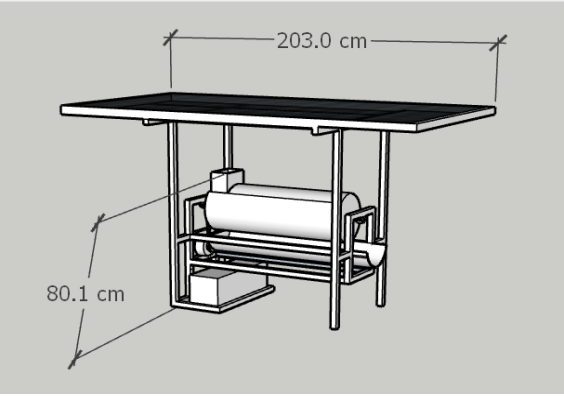


Figure 12. Design of the Corn Sheller Machine

Figure 13. Development of the Corn Sheller Machine

The results of coordination and consultation with the Village Head and the Sido Maju Farmer Group indicate that the placement of the corn sheller machine will be at TK Budi Luhur, as there are many corn fields in the surrounding area. With the development of the corn sheller machine compared to the previous machine, the processing time can be reduced from 15 minutes per sack to 5 minutes per sack. The shelling cost per quintal, which was originally Rp. 200,000, has been reduced to Rp. 0. The selling price of corn has increased from Rp. 8,000 per kilogram to Rp. 10,000 by using online sales through a marketplace. In the implementation of machine operation training, there were no issues because the farmers had previously used similar machines.

Figure 14. Inspection and Technical Measurement

4. CONCLUSION

The development of the corn sheller machine brings significant benefits to farmers by addressing key challenges in the shelling process. Designed with a focus on ergonomics,

the machine allows farmers to insert corn while standing, eliminating the discomfort of squatting during operation. This improvement reduces physical strain and enhances usability. The new design also increases efficiency, as larger openings enable the machine to process multiple cobs simultaneously, unlike the previous version that handled only one at a time. This innovation significantly reduces shelling time, making the process faster and more productive. Additionally, the integration of solar power in the corn sheller substantially lowers operational costs, providing farmers with a cost-effective and sustainable solution. The machine is strategically placed at TK Budi Luhur, an area surrounded by extensive cornfields, ensuring accessibility for local farmers. Complementing the machine's introduction, online marketing management training equips farmers with the tools to align their corn prices with market standards. This initiative reduces their reliance on intermediary traders, empowering them to achieve better profitability and market independence.

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