Jurnal DIALEKTIKA: Jurnal Ilmu Sosial,
Vol 24 No. 2 2026

ARTICLE

UTILIZATION OF WATER HYACINTH AS LAYER CHICKEN FEED THROUGH AN APPROPRIATE CHOPPING MACHINE IN SITU TUNGGILIS

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Article History
Received: 16 September
Accepted: 16 October 2026
Published: 30 October 2026

Abstract

Situ Tunggilis, a lake in Situsari Village, Cileungsi District, Bogor Regency, experienced a severe outbreak of water hyacinth (*Eichhornia crassipes*) that covered more than 10 hectares of its surface by late 2025, paralyzing boat tourism and disrupting the lake's water catchment function. At the same time, this biomass has potential as an alternative feed ingredient for household-scale layer chicken farmers around the lake, who supply the Free Nutritious Meal (MBG) Program yet remain dependent on costly commercial feed. This community service activity aimed to optimize the use of water hyacinth as a feed supplement through appropriate chopping and fermentation technology while strengthening the capacity of the Situ Tunggilis Community Monitoring Group (Pokmaswas). The methods applied included problem identification, outreach, training, machine fabrication and trials, and continuous mentoring and evaluation. The activity produced a conveyor-fed, petrol-engine water hyacinth chopping machine with a capacity of one quintal per hour, capable of six hours of continuous operation. Evaluation showed that partner competency across all measured aspects rose from a 20-40% range to 85-95%. The activity demonstrates that appropriate technology can transform an aquatic weed into a feed resource that supports local food security and the ecological quality of the lake. This study recommends follow-up measurement of feed cost savings and egg production to confirm the economic impact of the technology.

Keywords: Water Hyacinth, Chopping Machine, Layer Chicken Feed, Community Service, Situ Tunggilis

A. INTRODUCTION

Situ Tunggilis, a freshwater body of approximately 35 hectares in Situsari Village, Cileungsi District, Bogor Regency, faced a serious escalation of environmental problems towards the end of 2025. In less than two weeks, the population of water hyacinth (*Eichhornia crassipes*) exploded

and covered more than 10 hectares of the lake surface, triggered by heavy rainfall and strong winds that drifted the plants across the entire lake (Jaenudin, 2025). As a result, boat tourism came to a complete halt, and of the 24 vendor stalls that previously operated in the tourist area, only one remained open (Jayanti, 2025).

Water hyacinth outbreaks are a problem in many other countries as well (Abba & Sankarannair, 2024; Nashrullah et al., 2025; Zeleke et al., 2025). On the other hand, abundant water hyacinth biomass can be turned from an environmental burden into a valuable resource, including as a feed ingredient (Nandiyanto et al., 2023). Previous studies have shown that fermented water hyacinth meal can be used as poultry feed without significantly reducing production performance (Hidayaturrahman & Irawati, 2021; Nhara et al., 2025, 2026). This potential is highly relevant for household-scale layer chicken farmers around Situ Tunggilis, who supply eggs to the kitchens of the Free Nutritious Meal (MBG) Program but depend heavily on commercial feed, which can account for 60-70% of total production costs (Emrani et al., 2023). This dependence leaves small-scale farms vulnerable to feed price fluctuations and limits their capacity to produce eggs as an affordable source of animal protein.

Before this community service activity, the Situ Tunggilis Community Monitoring Group (Pokmaswas), whose members include farmers, layer chicken farmers, freshwater fish farmers, and local environmental managers, only removed water hyacinth manually without further processing, while the partners' livestock businesses remained fully dependent on costly commercial feed. Field observations by the community service (PKM) team and Pokmaswas showed that water hyacinth covered 50-70% of the lake surface in certain seasons, and a projection using a logistic growth model estimated that coverage could increase from 10 hectares (28.6%) to more than 27 hectares (77.6%) within four weeks if left uncontrolled (Figure 1).

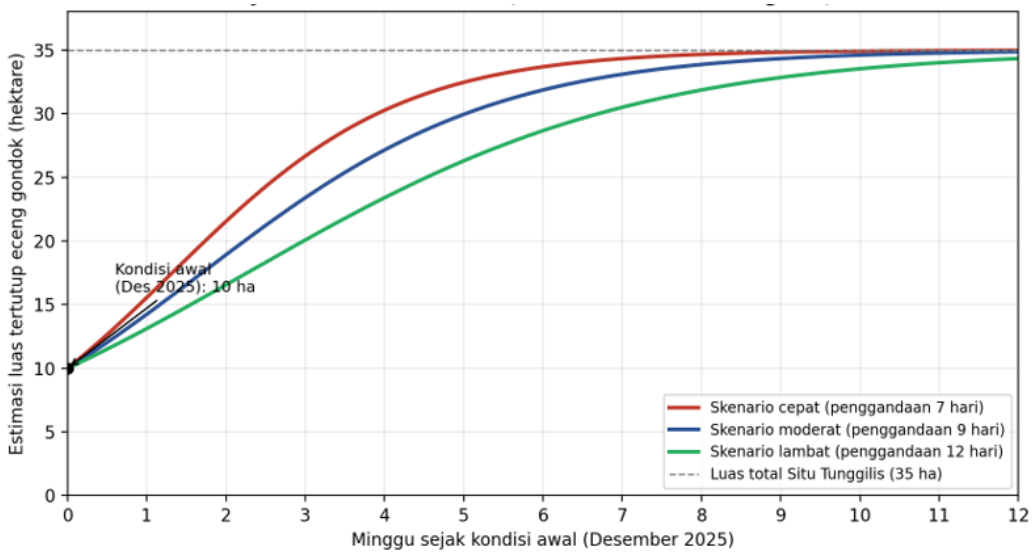


Figure 1. Projected water hyacinth coverage without control in Situ Tunggilis
Source: Processed by the Researcher, 2026

Excess nutrients from agricultural runoff and domestic waste accelerate the uncontrolled growth of water hyacinth. The impacts include siltation and lower fish catches due to blocked sunlight penetration, the death of aquatic biota due to reduced dissolved oxygen, obstructed water flow, and disruption of fisheries and tourism. The manual clearing carried out by Pokmaswas has required considerable labor, time, and cost, yet it has not solved the problem permanently because water hyacinth grows and reproduces rapidly. A more sustainable approach is needed that integrates growth control, biomass management, and utilization into value-added products.

The novelty of this activity lies in two aspects. First, the water hyacinth chopping machine was designed to suit field conditions: it uses a horizontal conveyor with a safety guard and is driven by a petrol engine because the site lacks adequate electricity, which distinguishes it from similar machines on the market. Second, the activity combines aquatic weed control, feed processing, and the institutional strengthening of Pokmaswas in a single series connected to the egg supply of the MBG Program. The urgency of the activity is shown by the projection that water hyacinth could cover 77.6% of the lake surface within four weeks without control.

Based on these conditions, the PKM team of Universitas Budi Luhur, together with Pokmaswas Situ Tunggilis, carried out this community service activity with the following objectives: (1) to optimize the use of water hyacinth biomass as a layer chicken feed supplement through appropriate chopping and fermentation technology; (2) to reduce feed costs and support the productivity of the partners' layer chicken businesses; (3) to strengthen local food security by supplying eggs to support the MBG Program; and (4) to improve the institutional capacity and economic self-reliance of Pokmaswas Situ Tunggilis while improving the quality of the lake environment. In practical terms, the activity provides partners with the technology and skills to manage water hyacinth independently, while academically it adds evidence on the application of appropriate technology in community-based aquatic weed management.

B. LITERATURE REVIEW

Water hyacinth as an aquatic weed and a biomass resource

Water hyacinth is known as an invasive aquatic weed with wide-ranging impacts on rural communities in many countries, and various mitigation strategies continue to be studied (Abba & Sankarannair, 2024). Water hyacinth invasion also affects water quality and the trophic state of water bodies, as shown in the case of Lake Tana (Zeleke et al., 2025). Besides being controlled, water hyacinth can be used as biomass, for example as compost and organic soil amendment (Nashrullah et al., 2025), as well as for other value-added products (Nandiyanto et al., 2023). This view treats water hyacinth not merely as an environmental problem but also as a local resource.

Water hyacinth as a poultry feed ingredient

Water hyacinth contains approximately 10-20% crude protein, crude fiber, and minerals that can be used as livestock feed after certain processing, such as fermentation using rumen microbes

with the addition of molasses (Susanti & Rahmi, 2023). In broilers, diets containing water hyacinth meal fermented with *Aspergillus niger* and water hyacinth leaves with improved nutritional value can be used without significantly reducing performance (Al-Aboudi & Hamodi, 2023; Hidayaturrahman & Irawati, 2021). In laying hens, supplementation with fermented water hyacinth meal improved protein utilization efficiency and reduced ammonia excretion (Nhara et al., 2025), without impairing internal egg quality or shelf life (Nhara et al., 2026). A common finding of these studies is the need for pre-processing, such as chopping and fermentation, before water hyacinth is given to livestock.

Conceptual framework of the activity

Based on this review, the activity follows a sequence: the problem of water hyacinth outbreaks and high feed costs; the application of appropriate technology in the form of a chopping machine and fermentation techniques; the capacity building of partners through training and mentoring; and the evaluation of partners' knowledge and skills. A participatory approach was used so that the partners act as the main actors in water hyacinth management.

C. RESEARCH METHODOLOGY

The activity was carried out at Situ Tunggilis, Situsari Village, Cileungsi District, Bogor Regency, from April to August 2026. The target group was the members of Pokmaswas Situ Tunggilis, consisting of farmers, household-scale layer chicken farmers, and freshwater fish farmers around the lake. They were selected because they are directly affected by the water hyacinth problem and are potential main users of its utilization as livestock feed. The activity was designed in stages and in a participatory manner by combining the following ten approaches.

Outreach was conducted to provide knowledge about the hazards of water hyacinth, its nutritional content, and its potential as a raw material for derivative products. Training was given through hands-on practice in operating the water hyacinth chopping machine, followed by a demonstration of the chopping process by the PKM team, which the partners then practiced. Mentoring was provided during the application of the technology until the partners were able to carry it out independently, while technology transfer was realized through the fabrication of the chopping machine, a dryer, and water hyacinth fermentation techniques.

Equipment assistance in the form of a water hyacinth chopping machine was handed over so that the partners could apply the technology sustainably, following the principle of community empowerment, which places the partners as the main actors in water hyacinth management rather than mere program beneficiaries. A Participatory Rural Appraisal (PRA) approach involved Pokmaswas from problem identification and needs assessment to solution planning, reinforced by a field school method (*learning by doing*) in which partners produced water hyacinth feed over several production cycles. All stages were followed by monitoring and evaluation of indicators covering water hyacinth coverage, feed cost, feed consumption, egg production and quality, and partners' income.

The main tools and materials included angle-iron frames, steel plates, a chopping cylinder and blades, a drive engine, a pulley-belt system, and fresh water hyacinth biomass harvested from Situ Tunggilis. The chopping machine was designed with a target capacity of 1 quintal of chopped material per hour under continuous operation.

The outcomes of the activity were evaluated by comparing the partners' level of knowledge and skills before and after the activity in five aspects, namely water hyacinth utilization, harvesting water hyacinth from the water, cutting technique, chopping, and maintenance of the chopping machine. The evaluation results were expressed as percentages and analyzed descriptively.

D. RESULT AND DISCUSSION

The implementation of the PKM activity with the partners consisted of five systematic stages: problem identification, outreach, training and preparation, implementation, and evaluation and mentoring.

Problem identification was carried out on 30 April 2026 through observation of the existing conditions of Situ Tunggilis to obtain a direct picture of the extent of water hyacinth coverage, its impact on ecological functions and community activities, and the control efforts already made by Pokmaswas. The results became the basis for determining the technology needs, the form of training, and a water hyacinth utilization strategy suited to the community.

Outreach was held on 19 June 2026 for the community and Pokmaswas members to improve their understanding of the impact of uncontrolled water hyacinth growth on water quality, aquatic life, fisheries, and the use of the lake, while building the understanding that water hyacinth can be used as value-added biomass for layer chicken farming.

Training and preparation were held on 10 July 2026 to improve the community's skills in collecting, chopping, processing, and using water hyacinth as an alternative feed ingredient, together with the preparation of tools and materials so that the introduced technology could be applied according to field conditions.

Implementation began with clearing and collecting water hyacinth from the lake from 15 July 2026, followed by trials of the chopping machine on 10-12 August 2026, and the use of the chopped biomass in fermentation as layer chicken feed starting on 13 August 2026 for 14 days. Evaluation and mentoring were carried out continuously from problem identification until the end of the activity, covering the achievement of each stage, the effectiveness of the technology, the partners' ability to operate the equipment, and the potential of water hyacinth as feed (Figure 2).



Figure 2. Implementation of the PKM activity with Pokmaswas Situ Tunggilis
Source: Processed by the Researcher, 2026

To control the water hyacinth population at Situ Tunggilis while producing feed raw material, this PKM activity produced a water hyacinth chopping machine. The machine was designed in three-dimensional technical drawings before fabrication, covering the overall shape of the machine, the construction of the chopping cylinder, and the shape of the blades (Figure 3). The machine has an angle-iron *A-frame* that supports the chopping unit at the top and the engine mount at the bottom. It is equipped with a feed *hopper*, and power is transmitted through a pulley-belt system to the shaft of the chopping cylinder.

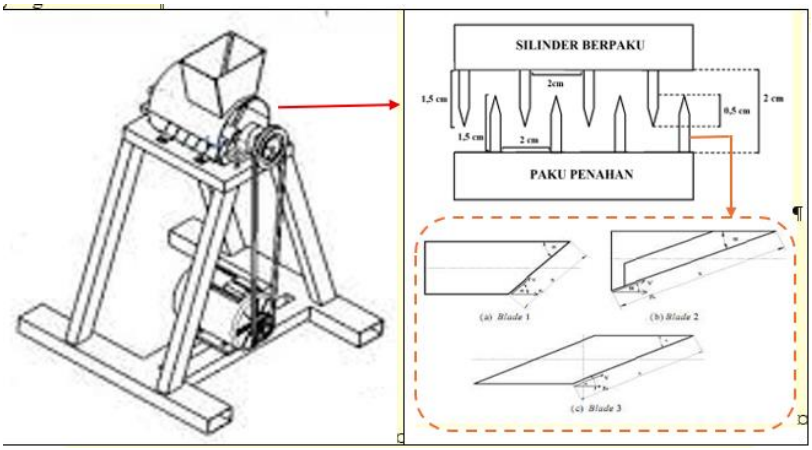


Figure 3. Initial design of the water hyacinth chopping machine
Source: Processed by the Researcher, 2026

Fabrication was carried out in five stages: preparing and cutting the angle iron and steel plates according to the design dimensions; building the main frame by welding the *A-frame*; making and installing the chopping unit together with the feed hopper and outlet chute; installing the drive system (engine, pulley, and belt) with an *alignment* check so that the belt does not slip; and

finishing, which included painting, installing wheels, labeling, and a functional test showing that the machine produced uniformly chopped material (Figure 4).



Figure 4. Fabrication process of the water hyacinth chopping machine
Source: Processed by the Researcher, 2026

The resulting machine underwent several adjustments from the initial proposal design based on technical and practical considerations in the field, covering three main aspects. First, the chopping blades: the initial design planned a spiked cylinder or sharp-angled blades working on a friction-tearing or cut-slicing principle, whereas the final machine uses *flat bars* bolted across the rotor shaft and paired with a fixed *counter bar*, working on an impact-friction principle similar to a *hammer mill* (Figure 5). This change was based on ease of fabrication by small welding workshops, durability against hard objects, and ease of maintenance.

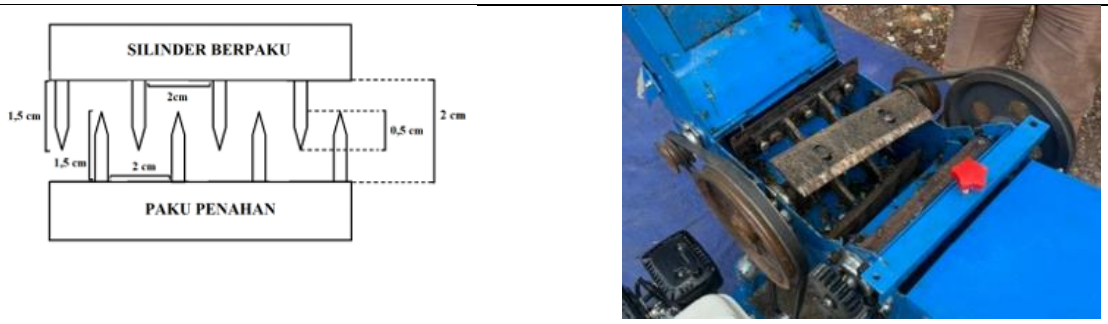


Figure 5. Comparison of the chopping blades in the design and the fabricated machine
Source: Processed by the Researcher, 2026

Second, the drive engine: the initial design used an electric motor because of its simple maintenance, low vibration, and zero emissions. The final machine uses a petrol engine because Situ Tunggilis lacks adequate access to electricity (Figure 6). A petrol engine is self-contained, so the machine can easily be moved between locations; its spare parts are easy to obtain and repair by local residents; its torque is more stable when chopping thick stems; and its initial investment cost is lower. The trade-offs are the need for regular fuel as well as noise and exhaust emissions.

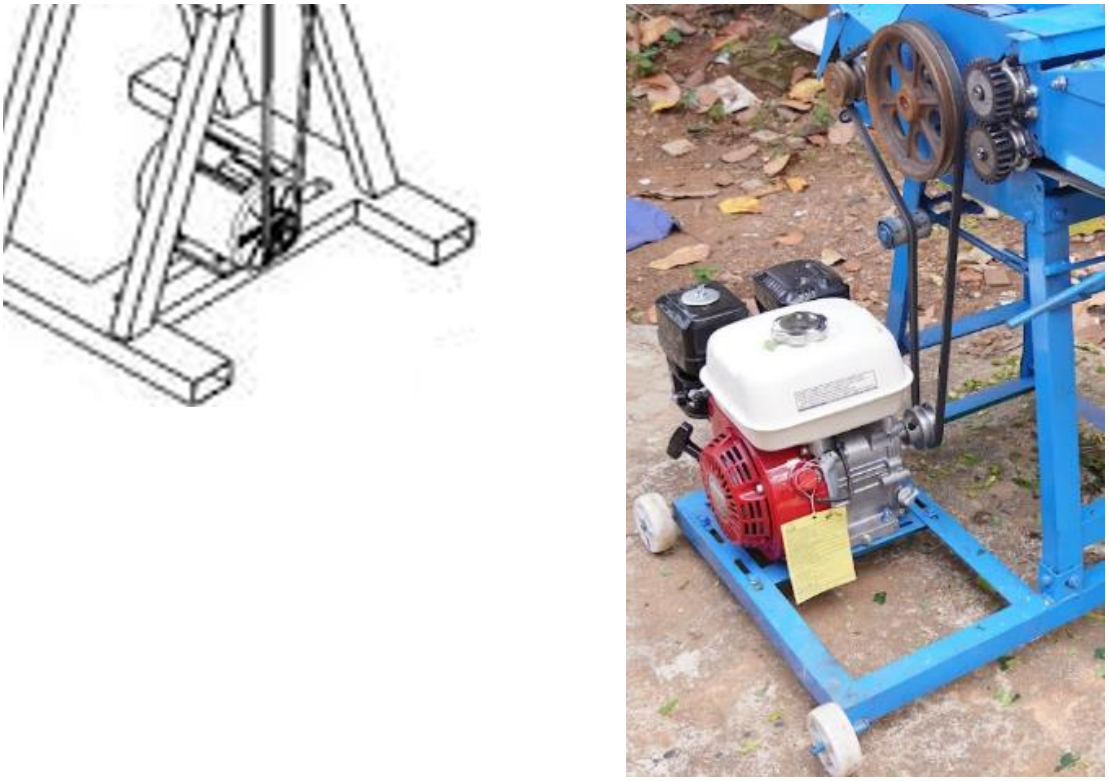


Figure 6. Comparison of the drive engine in the design (electric) and the fabricated machine (petrol)
Source: Processed by the Researcher, 2026

Third, the water hyacinth input system: in the initial design, water hyacinth was fed vertically from the top through a hopper without a guide or barrier, so the operator's hands could reach the blade area. The final machine changes the feeding direction to horizontal through a chute or *conveyor* on the side of the machine, equipped with a *safety guard* around the inlet and along the *conveyor*. This increases the safe distance between the operator's hands and the rotating blades and makes feeding more controlled and even (Figure 7).

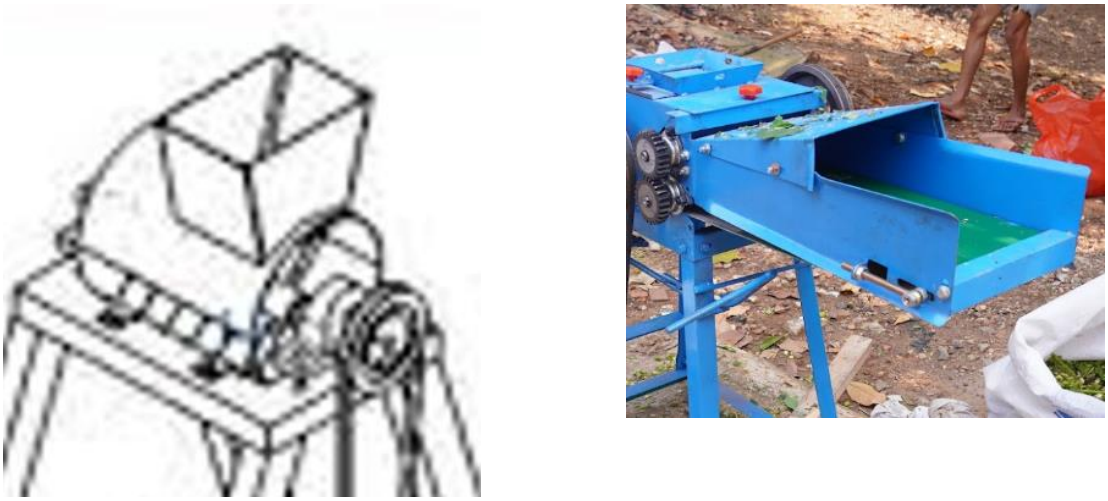


Figure 7. Comparison of the water hyacinth input system in the design and the fabricated machine
Source: Processed by the Researcher, 2026

The water hyacinth chopping machine produced by this PKM activity has a production capacity of 1 quintal of chopped material per hour and can operate continuously for 6 hours without a decline in chopping quality. It therefore meets the needs of Pokmaswas Situ Tunggilis and differs from similar machines on the market because it is equipped with a *conveyor* system and driven by a petrol engine. This result is consistent with the finding that water hyacinth needs to be processed before being used as feed (Susanti & Rahmi, 2023), making the chopping machine a prerequisite for the feed fermentation process.

The evaluation assessed changes in the partners' knowledge and skills related to water hyacinth utilization, harvesting water hyacinth from the water, cutting technique, chopping, and maintenance of the chopping machine before and after the PKM activity (Table 1). Before the activity, the participants' understanding and skills in all five aspects were low, ranging from 20-40%, indicating that the partners lacked adequate knowledge and technical skills to manage water hyacinth and operate chopping equipment.

Table 1. Evaluation of partners' knowledge and skills before and after the PKM activity

Aspect	*Before (%)*	*After (%)*

Water hyacinth utilization	30	85-95
Harvesting water hyacinth from the water	40	85-95
Water hyacinth cutting technique	20	90
Water hyacinth chopping	30	95
Chopping machine maintenance	20	90

Source: PKM activity evaluation results, 2026

After the training and mentoring, all aspects increased sharply to a range of 85-95%. The most notable increases occurred in cutting technique and machine maintenance, each rising from 20% to 90%, or by 70 percentage points, while water hyacinth chopping reached the highest score after the activity at 95% (Figure 8). Overall, these data show that the hands-on training and mentoring methods were effective in improving the participants' technical competence in managing water hyacinth, particularly the practical skills of operating and maintaining the chopping machine.

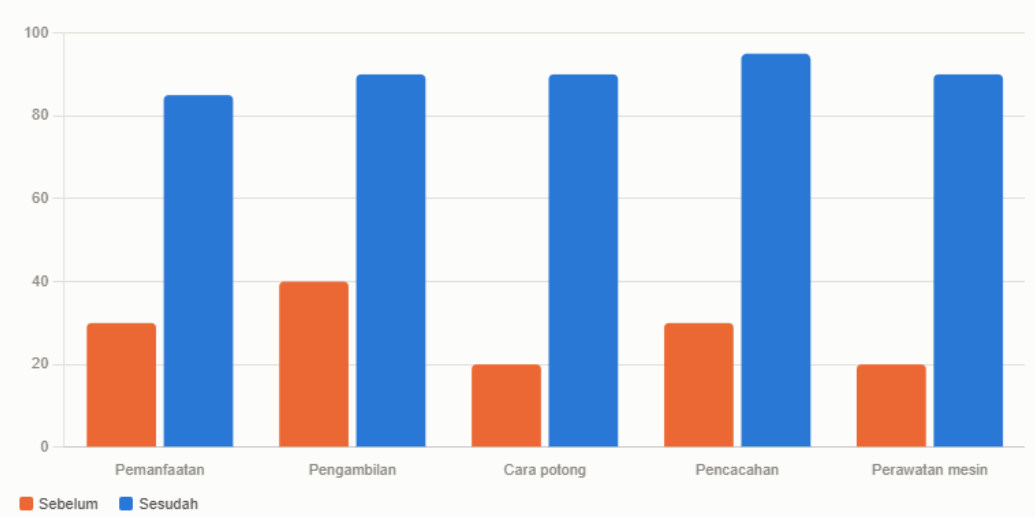


Figure 8. Evaluation results before and after the training and fabrication of the water hyacinth chopping machine

Source: Processed by the Researcher, 2026

E. CONCLUSION

This PKM activity successfully produced a water hyacinth chopping machine as a solution for aquatic weed control and a source of layer chicken feed raw material at Situ Tunggilis, through five systematic stages: problem identification, outreach, training and preparation, implementation, and continuous evaluation and mentoring together with Pokmaswas Situ Tunggilis. The machine is equipped with a *conveyor* system and driven by a petrol engine, has a production capacity of 1 quintal per hour, and can operate continuously for 6 hours without a decline in chopping quality, so it differs from similar machines on the market and meets the partners' needs.

The machine design was adjusted from the initial design based on field trials, including changing the blades from a spiked cylinder or angled blades to bolted flat impact bars, changing

the drive from a planned electric motor to a petrol engine due to limited electricity access at the site, and changing the input system from a vertical hopper to a guarded horizontal *conveyor* for operator safety. These changes reflect the adaptation of appropriate technology to real field conditions.

The evaluation showed a significant increase in partner competency in all measured aspects, from 20-40% before the activity to 85-95% afterwards, with the sharpest increases in cutting technique and machine maintenance. This finding shows that hands-on training and mentoring effectively improved the technical capacity of Pokmaswas Situ Tunggilis to manage water hyacinth independently and sustainably, while supporting local food security through the MBG Program.

This activity has a limitation: the evaluation covered only the partners' knowledge and skills, while the impacts on feed cost, egg production and quality, and water hyacinth coverage have not yet been reported quantitatively. Follow-up activities are recommended to measure these indicators in order to confirm the economic and ecological benefits of the technology.

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