

# Increasing the productivity of MSMEs processing herbal medicine with appropriate technology for choppers and grinders

Riswan Eko Wahyu Susanto<sup>1</sup>, Ahmad Dony Mutiara Bahtiar<sup>1</sup>, Yohan Bakhtiar<sup>2</sup>, Miftakhul Huda<sup>3</sup>, Setiyo Rojikin<sup>4</sup>

<sup>1</sup>Department of Mechanical Engineering, <sup>2</sup>Department of Accounting, <sup>3</sup>Department of Electronics Engineering, <sup>4</sup>Department of Production Mechanical Engineering, State Polytechnic of Malang  
Jl. Lingkar Maskumambang No. 1 Kediri, 64121, Indonesia

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## ABSTRACT

Indonesian society has traditional healing methods that involve a variety of uses of plants, animal products and minerals. Medicinal plants have been used and mixed well by various ethnic groups of Indonesian society as herbal medicine. Wahyu Alam Foundation MSMEs located in the city of Kediri, which are farmers and herbal plant entrepreneurs who have problems. The Wahyu Alam Foundation MSME as a community service partner has problems related to processing herbal plants with the process still being manual, so they need help to make the production process easier. The results of this service activity include the visible increase in productivity, previously manual production in two stages after direct chopping, grinding, took 20 minutes per kg and 20 kg of product was obtained in a day, resulting in a faster time of 10 minutes per kg, while the product yield increased to 40 kg per day. The predicted increase in profits based on data obtained by UMKM Herbal Medicine was at the average of 18%, while the average increase in rupiah was 3.222 million. This increase was due to the optimal use of machines, along with increased marketing due to the increasing demand for herbal medicine on the market.

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## 1. INTRODUCTION

Indonesian society has traditional healing methods that involve a variety of uses of plants, animal products, and minerals. In practice, most traditional medicine is based on the use of plants rather than the use of animal products and minerals. More than 2500 plant species in Indonesia are recognized as medicinal plants (Suhandono & Chahyadi, 2014) through extensive ethnobotanical studies (de Padua et al., 1999; Grosvenor et al., 1995). Medicinal plants have been utilized and mixed well by various ethnic groups of Indonesian society as herbal medicine (Silalahi et al., 2015). Herbal medicine contains certain active compounds, such as antimicrobial or antiviral, anti-inflammatory, and immunostimulant activity, which are found in medicinal plants or spices such as turmeric (Rahman et al., 2018), ginger (Agustina et al., 2022), Sambiloto leaf (Masluha, 2020), honey (Mulyono et al., 2015), and Mahkota Dewa (Sulistiowati,

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*Riswan Eko Wahyu Susanto, Ahmad Dony Mutiara Bahtiar, Yohan Bakhtiar, Miftakhul Huda, Setiyo Rojikin*

2020). These compounds are assumed to have the capacity to modulate immune responses, so they are believed to have beneficial effects for preventing or salving COVID-19 (Kocaadam & Anlier, 2017; Sharma et al., 2009).

Several sectors in Kediri as a small city in East Java perceive direct impact of the pandemic, including a Micro, Small, and, Medium Enterprise (MSME) Wahyu Alam Foundation which runs the business in the sector of health plant producer. Indonesian Government implemented a strict rule to reduce the spread of pandemic by reducing the number of workers in almost all aspect of human life, including in the sector of business. Due to this rule, Wahyu Alam Foundation as the partners of this community service has difficulty to maintain the production rate in a limited number of workers who can work at the same time since they still rely on manual production (Baskoro, 2014). To solve this issue, the community service team tries to offer the solutions, such as: (1) Implementing the use of herbal plant processing technology (chopper machines and herbal plant grinders after harvesting the herbal plants); (2) Providing assistance in simple machine operation and machine maintenance.

To make the aforesaid solutions possible, it is necessary to conduct land development of the herbal plants to elevate the production rate which can directly contribute to the rapid grow of MSE business in Banaran Village which can also contribute to the enhancement of the economy level of the surrounding people. Before the herbal plants are offered to the market, they are processed in several stages (Murtidjo, 1991; Saepudin et al., 2016). First, the herbs and spices are chopped and grinded to obtain the extract of the finely pressed spices. After that, the extract is crystallized by cooking it in a traditional fire oven and frying pan while at the same time retaining the original taste and properties of these spices. This crystallization process takes quite a long time, around 1 hour with a ratio of 1 liter of water and 1 kg of sugar. Figure 1 shows the production process for crystallizing spice juice into powder.



**Figure 1.** Manual processing documentation, results from crystallized spices and powder

The result of this crystallization is in the form of a coarse powder that can be brewed directly with hot water as needed without any dregs from the processed herbal medicine. Using this crystallization process has its own advantages for the Wahyu Alam Foundation, namely that the resulting product does not make consumers feel hoarse when drinking the herbal medicine. However, this product is not recommended for diabetes sufferers since it can trigger an increase in sugar for sufferers. The following are examples of the results of pressing spices before the crystallization process and the results of the crystallization itself.

Apart from producing products in the form of crystallized powder, Wahyu Alam Foundation also makes medicinal plants into herbal medicines which are packaged in capsule form to make it easier for consumers to consume and to meet the demand of people who do not like the crystallized powder form. In this case, the ingredients used to make the capsules are herbal plant leaves such as bitter leaf, cat's whisker leaves and others which have been dried and ground. After achieving the desired refinement, the process is continued to make the herbal medicines package in capsules so that they are efficient and remain hygienic. This product has the advantage that it can be consumed by some diabetes sufferers because it contains basic ingredients that have properties for curing diabetes and there is no additional sugar in the capsule.

The problem faced by Wahyu Alam Foundation in Banaran sub-district is the process of chopping herbal ingredients (plants) which still uses the traditional method manually with a simple tool in the form of a chopping knife which is done by two workers which takes 4 hours per kilogram and the grinding process is still using a regular blender which takes 1 hour per kilogram. Besides requiring long production time, the results of those processes are less smooth and not homogeneous. As a consequence, in terms of time and costs for grinding and chopping becomes inefficient. Apart from that, the packaging design for processed products is still simple and they do not have a business product permit, which makes the marketing of these products a bit hampered. This problem was exacerbated by the COVID 19 pandemic which affected the financial balance sheet so that financial management became unstable due to having to repeat initial activities.

Wahyu Alam Foundation hopes for the development of technology that can be used during the process of chopping and grinding herbal ingredients. With the existence of medicinal plant and herbal medicine processing machines, it is hoped that this can provide a solution to this problem. Apart from that, the use of packaging design machines is also expected to increase productivity and consumer buying interest in herbal preparations. In general, the problems faced by the Wahyu Alam Foundation are: (1) Medicinal Plant and Herbal Processing Technology (Chopping and Grinding Machines) requires the creation of a Medicinal Plant and Herbal Chopper and Grinding Machine which is faster than the manual process so that the raw materials for Medicinal Plants and herbal medicines that have been dried are ready to be marketed. This machine is expected to be able to replace the role of a blender as a grinding tool that produces non-homogeneous powder results; (2) Technology for Grinding Medicinal Plants and Herbal Herbs (Chopping and Grinding Machines) It is necessary to provide training on the operation of Medicinal Plant and Herbal Processing Machines so that our partner can operate the machine themselves in an applicative manner. In addition to that, the training on processing machine maintenance, it is hoped that our partner can handle problems that arise on the machine so as to reduce maintenance costs.

## **2. METHODS**

The service method carried out at Community Service (PPM) used the method of implementation and application of appropriate technology (Susanto et al., 2020), in the form of "A Herbal Processing

## Increasing the productivity of MSMEs processing herbal medicine with appropriate technology for choppers and grinders

Riswan Eko Wahyu Susanto, Ahmad Dony Mutiara Bahtiar, Yohan Bakhtiar, Miftakhul Huda, Setiyo Rojikin

Machine” accompanied by partner assistance related to problems in the field of production. The levels of development were measured by distributing questionnaires to all MSME employees. The Community Service (PPM) steps implemented in this project presented in Figure 2.

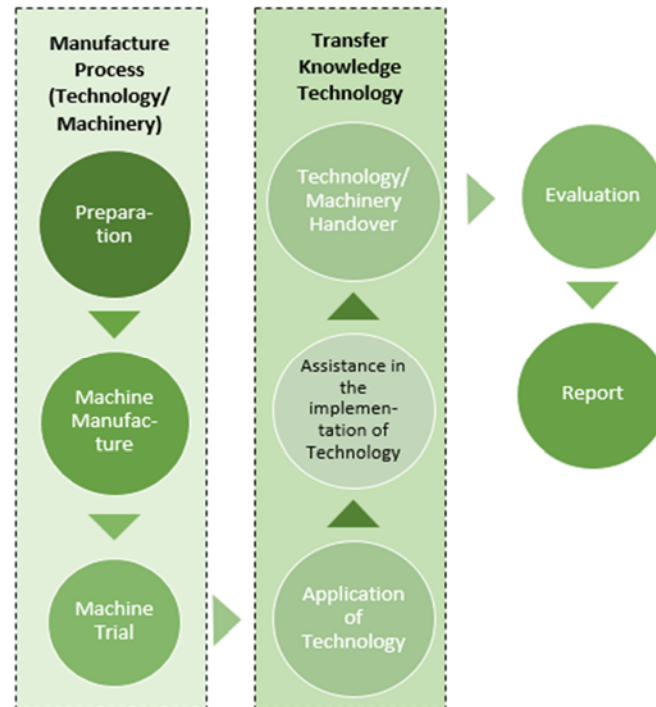


Figure 2. Implementation stages of community service program

### Implementation Stages

Community Service to increase the productivity of herbal medicine at Wahyu Alam Foundation MSME Partners located at Jl. Toga Kleco, Banaran Village, District. Kediri City was divided into 7 stages as depicted in the following Figure 2. The first stage was preparation which includes formulation of an implementing team consisting of a machine building team and training team (consisting of proposing lecturers, PLP), partners, and technical implementers (students); and coordinating with partners and doing observation. The second stage was the manufacture of herbal herbal chopper machines which includes procurement of materials to make the machine and cleaning of materials and assembly of the machine. Followed by the third stage, namely operational testing in the form of machine trials that were given to target partners. The fourth stage was training and mentoring, includes machine use, assistance with simple machine maintenance (machine maintenance training), as well as financial management training. Apart from that, machine operational assistance was also provided by the proposing team to the partners when using machines as well as machine maintenance management and financial management. Handover of technology (machines) to partners includes signing the machine handover letter and it was closed with the final stage, namely evaluation. After the assistance was carried out, the proposing team looked at the results of the machine and assisted in the operation and fixed the obstacles faced by partners and then followed by observation and measurement for the achievements of technology implementation activities.

## Mentoring Stages

The mentoring stages to increase the productivity of herbal plants at the Wahyu Alam Foundation MSMEs were divided into 3, including; initial mentoring stage (assistance in the operation and use of technology tools/machines, continued to the second mentoring stage with simple maintenance on machines/technology, and continued to the final mentoring stage which aims to ensure that MSME partners can use and operate machines correctly, as well as measuring the level of understanding of assistance to MSME partners.

## Parties Involved

This program involves the role of the proposing team, students and partners (MSMEs Wahyu Alam Foundation). The role of each team involved in the proposed PPM Regular Competition activities can be seen in Table 1.

**Table 1.** Roles of involved parties

Involved parties	Roles
Proposing team from lecturers	a. Elaborating problems faced by the partners b. Finding and implementing solutions for the problems faced by the partners by using technology developed by the proposing team c. Undertaking coordination for the program with regional governments regarding partners' problems and approved solutions d. Making a proposal and activity program planning e. Providing the necessary materials to make a herbal medicine chopper machine. f. Providing training on machine use, machine maintenance management, preparation of financial reports and proposals for working capital credit. g. Evaluating the activity results h. Making the final report based on the activity results
Students	a. Helping to provide the necessary materials to make machines and implementation activities
Wahyu Alam Foundation (partner)	a. Communicating the problems faced to the proposing team b. Providing the data needed to make a herbal medicine chopper machine. c. Providing data related to environmental conditions. d. Providing a place for implementing coordination and training. e. Assisting the proposing team to evaluate the results of the activities. f. Assisting to provide materials for machine testing.

## Place and Time for Implementation

This Community Service was carried out at Malang State Polytechnic PSDKU Kediri while our partner was Mitra Wahyu Alam Foundation, located at Jl. Toga Kleco, Banaran District, Pesantren, Kediri. The program implementation time was 8 months starting from the approval of the proposal.

## 3. RESULTS AND DISCUSSION

### Results

#### Stages of making an herbal chopper machine

There were several stages implemented to create the machine including; cutting the angle bar before connecting the frame components which act as the main support for the transmission. The

**Increasing the productivity of MSMEs processing herbal medicine with appropriate technology for choppers and grinders**

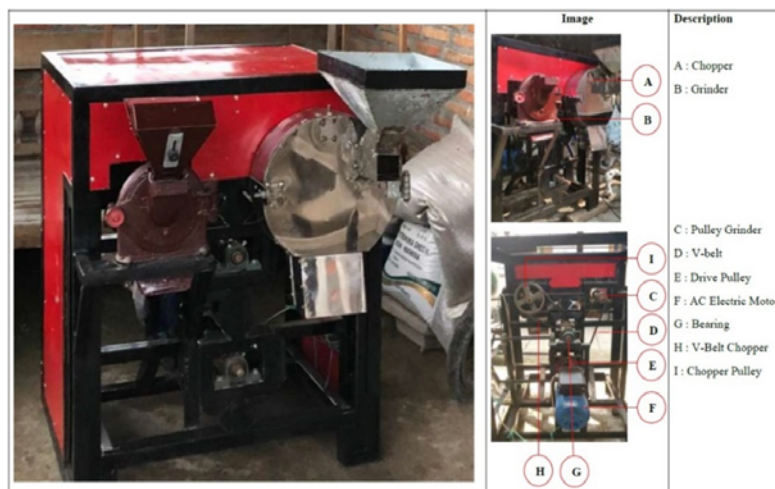
*Riswan Eko Wahyu Susanto, Ahmad Dony Mutiara Bahtiar, Yohan Bakhtiar, Miftakhul Huda, Setiyo Rojikin*

process of cutting the grinder stand using a 3 x 3 angle bar, then cutting the chopper knife cover to the adjusted size and the chopper knife after being attached to the chopper disk.



**Figure 3.** Designing product phase, assmabled knives, and cover for chopper

Followed by the process of turning the clutch shaft to a size of 20 mm and adjusting the bearing size according to the size available on the market. The turning was done by drilling the claw clutch shaft hole. The welding process on angle bar that has been cut according to the desired requirements. The process of welding or assembling the grinder stand, the welding process using SMAW welding was followed by the process of smoothing the scale after welding on the inner frame. The bearing assembly on the clutch shaft adapts to the flexible clutch so that the clutch can enter perfectly and function properly. The process of painting the engine cover used a 1 PK compressor and an Isagola with the size of 1.5. Installation of the chopper disk on the shaft had determined the diameter of the shaft. Installation of disc mill type grinding components with distribution via shaft and bearing. The flour house consists of four rotating knives with the size of 3 x 2 x 2 cm, eight cylindrical knives with a diameter of 1.5 cm, and 24 static knives with the size of 2 x 2 x 1.5 cm, one flour dispensing channel made of iron plate with the size of 15 x 6 cm. Below are some photos of activities from the process above (figure 3) and result machine/technology can see at figure 4.



**Figure 4.** Ready use machine for processing herbal medicine

### Operation assessment process

At this stage, machine testing was carried out to determine the magnitude of the cutting force that occurs on ginger, turmeric and Mahkota dewa using empirical testing. The test was carried out with a weight placed on a knife, then those ingredients were cut with the size of the load. The testing was carried out three times that is presented in the Table 2.

**Table 2.** The results of chopping in various forces

Weight	Types of Ingredients	Notes
1.3 Kg	Mahkota Dewa, Turmeric, and Ginger	Chopped easily
1.6 Kg	Mahkota Dewa, Turmeric, and Ginger	Chopped with minimal problems
1.9 Kg	Mahkota Dewa, Turmeric, and Ginger	Chopped with problems (too heavy)

Data collection was carried out to obtain information regarding the effectiveness of partners' use of appropriate technology to measure production increases and identify machine damage when operated by partners so that data on repairs and maintenance scheduling can be obtained. Community service program to increase the productivity of processing herbal plants at Wahyu Alam Foundation MSME was divided into 3 stages, the implementation of mentoring was carried out in 3 stages, initial mentoring, mentoring a month after mentoring 1 and continued final mentoring which aims to ensure that MSME partners can use and operate machine.

This community service activity is also an important means of ongoing promotion and showing the existence of higher education with various activities. Higher education levels should be committed to dedicating themselves to society. This activity is also strongly supported by the study program which has facilities and infrastructure that accommodate the community partnership (PPM) activities.



**Figure 5.** Mentoring MSME partners

**Figure 6.** The people from Wahyu Alam Foundation MSME with the proposing team

### Discussion

Based on the results of testing, production, and maintenance on appropriate technology machines (Table 3).

### Economic and social benefits obtained

After a series of activities in this community service program was completed, there was an increase in productivity for partners from an economic and social perspective with the following conditions:

## Increasing the productivity of MSMEs processing herbal medicine with appropriate technology for choppers and grinders

*Riswan Eko Wahyu Susanto, Ahmad Dony Mutiara Bahtiar, Yohan Bakhtiar, Miftakhul Huda, Setiyo Rojikin*

**Table 3.** The results of community service activity

Research Results	Partner's Problems	Solution	Achievement Indicators	Achievement	Notes
Technology development	The process of processing herbal plants into herbal medicine is done manually, which takes a long time, including chopping and grinding processes.	Herbal chopping and grinding machines were made to help speed up the efficient and hygienic production process.	a. Duration for manual production in two stages for chopping and grinding was 20 minutes per kg.  b. Manual production capacity was 20 kg / day	After community service program, duration decrease to 10 minutes  Production capacity increase to 40 kg / day	Exceed the target. The duration is reduced 100% as the new machine is more effective and faster  Production capacity is two times bigger because the new machine time is more effective and faster
		Provide training and mentoring in operating and maintaining machines so that the partner can increase production rate independently.	a. Almost 70% of MSME workers joined the training  b. 50% of those workers can operate the machine independently	Among 10 workers, 6 have the sufficient knowledge to operation the machine  (100%) where 7 employees can operate the machine and one can carry out independent maintenance on the machine	Only 50% of those wokers taking part in the training (target not achieved) because the rest of workers are located in another area  Increasing employee abilities and skills
		Production costs before and after the use of herbal plant chopping and grinding machines	a. Production cost was Rp. 2000 / kg	The cost reduce to Rp. 200 / kg that can reduce electricity costs per hour	Lower production costs due to using appropriate technology

### Worker's knowledge improvement

In this community service activity, an assessment was carried out on the Herbal Medicine MSME group before and after carrying out training and mentoring activities in the use of appropriate technology machines. This assessment was carried out using a questionnaire given to the Herbal Medicine MSME group. Among 10 employees who are working there, 7 people attended the training and mentoring activities for the operation of appropriate technology machines. The assessment questionnaire was filled in before and after the activity, then the increase in understanding or knowledge value was calculated so that the average results of increasing knowledge of MSME employees were obtained, shown in Figure 7.



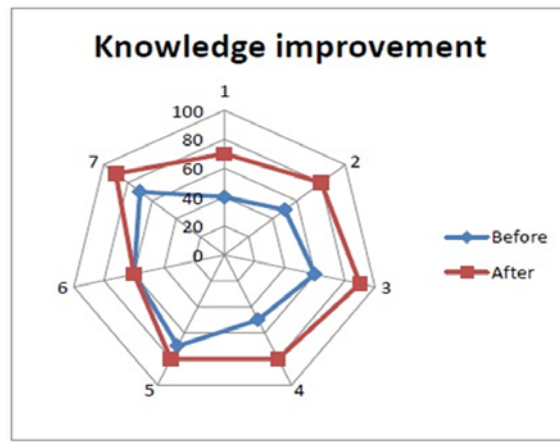


Figure 7. Knowledge improvement obtained by workers at Herbal Medicine MSME

Increased knowledge of Herbal Medicine MSME employees at Banaran Village – District, Pesantren, Kediri experienced an increase of 21.4%. From 7 employees, there was only 1 person who did not experience an increase in knowledge and had the same knowledge after joining several mentoring phases in using appropriate technology machines.

### Worker's skills improvement

To obtain the data of improved skills on the workers at Herbal Medicine MSME, an assessment was carried out before and after mentoring activities and before and after they implement the appropriate technology machines. The assessment was carried out through a questionnaire, where of the 10 employees working there, 7 people attended training and mentoring activities in operating appropriate technology machines. The assessment questionnaire was filled in before and after the activity, then the increase in skills was calculated so that the average results before training and after training were obtained. The increase in the skills of UMKM Herbal Medicine employees in operating the label printing machine can be seen in the graph shown in Figure 8.

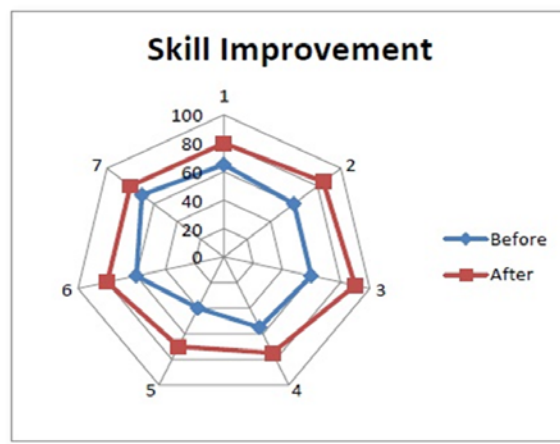


Figure 8. Skills improvement obtained by workers at Herbal Medicine MSME

**Increasing the productivity of MSMEs processing herbal medicine with appropriate technology for choppers and grinders**

*Riswan Eko Wahyu Susanto, Ahmad Dony Mutiara Bahtiar, Yohan Bakhtiar, Miftakhul Huda, Setiyo Rojikin*

The Figure 8 shows that there is an improvement of workers' skills in operating appropriate technology machines for chopping and grinding for herbal medicine MSME at Banaran Village– Pesantren - Kediri for 85% for 7 employees who took part in the mentoring activities and implementation of the herbal medicine processing machine.

**The increase of MSME business production**

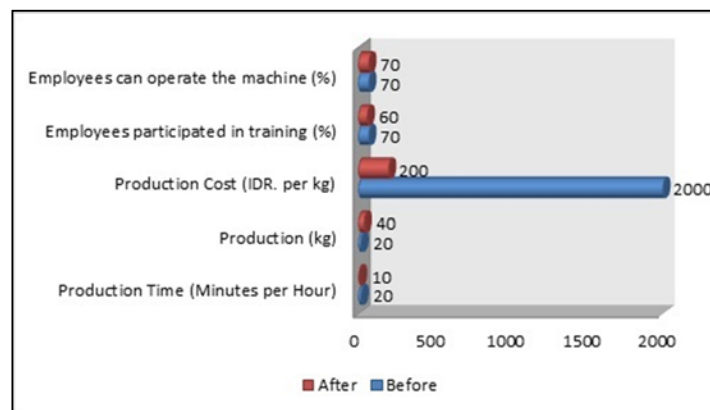
The increase in the number of products can be seen from the increase in the number of herbal plants owned after the workers followed mentoring and implementation activities. Products that have packaging and labels can be seen in Figure 9. Figure 9 are pictures of herbal medicine products before the activity and after the mentoring activity.



**Figure 9.** Herbal medicine products before and after the implementation of community service activity

**Tabel 4.** Production capacity before and after the implementation of community service

Capacity	Before	After
Production duration (minutes per kg)	20	10
Production capacity (kg)	20	40
Production cost (Rp. Per kg)	2000	200
Workers joined training (%)	70	60
Workers can operate the machine (%)	70	70



**Figure 10.** Production capacity after the implementation of community service activity

### The Increase of MSME Production Capacity

In this community service activity, the increase in production capacity can be seen from the increase in the number of herbal medicine products produced and the supply of labeled herbal medicine for sale to customers directly. The increase in production capacity can be seen in Figure 10.

### The Increase of Profit Obtained by MSME

The increase in profits obtained by Herbal Medicine MSME before and after community service is shown in the data in Figure 11. The increase in profits can be seen from sales results from April to August 2022 and from April to August 2023.

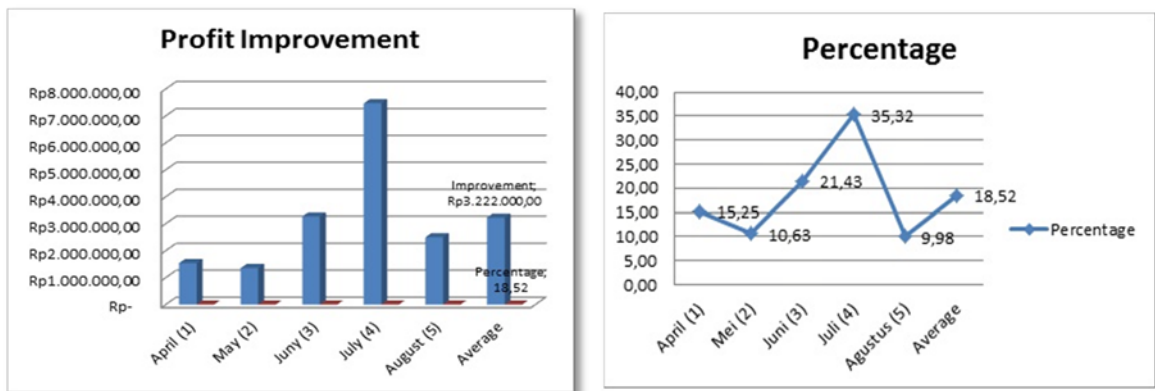


Figure 11. Profit improvement and presentage improvement of Herbal Medicine MSME at Banaran Village – Pesantren – Kediri

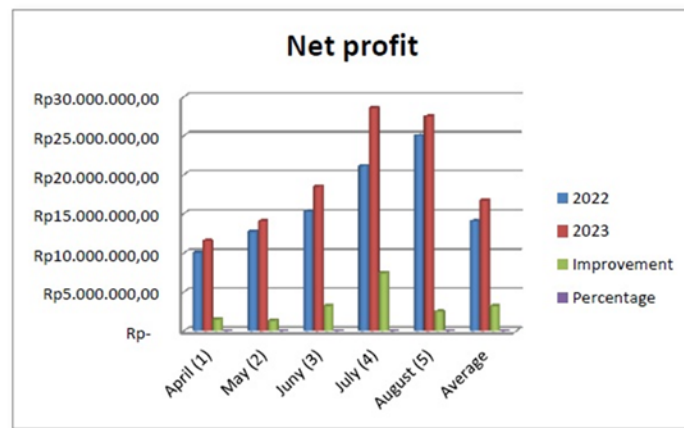


Figure 12. Profit improvement from April 2022 until August 2023

Figure 11 shows the increase in monthly profits obtained from MSME partners. The increase in income can be seen from the graph. Prediction of an increase in average profits based on data held by Herbal Medicine MSME was 18%. Meanwhile, the average increase in rupiah was 3,222 million. Data in July experienced a significant increase reaching 35.32%. This increase was due to the optimal use of machines and the new packaging that was more attractive for the consumers. However, the 18%

increase has not been offset by training or product marketing assistance, as in the existing reference, a significant increase was obtained from the results of the implementation of appropriate technology as long as product marketing assistance. So, in Figure 12, the profit graph is summarized starting from April 2022 to August 2023.

#### **4. CONCLUSION AND RECOMMENDATIONS**

Based on the discussion, the following conclusions were drawn from this community service program: appropriate technology for this herbal medicine processing machine is one of the solutions provided to the community, in this case the solution is felt by MSME Wahyu Alam Foundation located at Toga-Kleco street, Banaran Village, Kediri City. This is the result of the work of the community service team which has been implemented from March 2023 to October 2023. In general, the problems faced by MSME Partners are related to the processing of herbal medicinal plants (chopper and grinder processes) which are still manual so the production process requires labors, time, and expensive production costs. With the appropriate technology for this herbal processing machine, it is hoped that it can speed up the production process and increase production results. Appropriate technology created by a team consisting of lecturers and students from Mechanical Engineering department at State Polytechnic of Malang in Kediri City has an advantage because it can be used for two processes at the same time, namely the chopping process and the grinding process. Previously, those processes were carried out in shifts due to limited workforce. Apart from handing over appropriate technology, the head of service has also implemented assistance in the use of appropriate technology so that MSME partners can operate and carry out machine maintenance with simple techniques. The real results of this service activity include an increase in productivity which was previously produced manually in two stages after the chopper was directly grinded, it took 20 minutes per kg and in a day 20 kg of product was obtained so that the time was 10 minutes faster per kg, while the product yield increased to 40 kg per day. The predicted increase in profits based on the increase in assets owned by MSME herbal medicine is an average of 18%, while the average increase in Rupiah is 3,222 million. Based on data in July, the results increase significantly that is 35.32%. This increase is due to the optimal use of machines and supported by the significant increase in the demand of herbal medicine during the pandemic.

The suggestions for this community service that need to be implemented in the future include: precision level in making the machines needs to be done carefully so that the optimum machine quality can be obtained. The improvement in the aspect of transmission assembly is also needed to be administered. Apart from this, efforts need to be made to prioritize cleanliness in selecting materials that do not rust easily and are more hygienic to fulfill the standard for food grade for example by using stainless steel or semi-automatic. MSME partner Wahyu Alam Foundation also provided suggestions for continuing service activities to other community groups so that the impact felt could be wider.

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