

DUAL-FUNCTION COFFEE SKIN PEELING MACHINE TO IMPROVE THE WELFARE OF SUMBERCANDIK COFFEE FARMERS JELBUK JEMBER

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Abstract

Panduman Village, Jelbuk Jember District, is a fostered village by the University of Jember. Sumbercandik is one of the hamlets in Panduman Village with a geography of mountain slopes and hills and at an altitude that is very supportive for coffee farming/plantations. It is no wonder that the best coffee products are produced from this village. Ironically, the lives of many coffee farmers still fall into the pre-prosperous group. One of the reasons is that farmers sell coffee logs or wet-skinned coffee at relatively low prices. At the same time, factory-made chemical fertilizers have skyrocketed in price, and availability is strict. Various efforts have been made by the local government and other service teams related to these coffee farmers, but they have not touched those in Sumbercandik Hamlet. This community service seeks to uplift the economy of Panduman Village, especially the coffee farmers of Sumbercandik Hamlet, with the introduction of post-harvest coffee technology, utilization of coffee waste for fertilizer and briquettes, and management and cooperatives. This grant ceiling will carry out the proposal in three years. The first year was with the introduction of post-harvest technology in the form of wet and dry skin stripping (horn skin). In the second year, intensive drying techniques using technical and thermal methods. In addition, farmer group formation and simple production management. Year three, post-harvest waste processing technology. The first year's focus was on providing a coffee skin peeling machine. Each year will involve different lecturers with agricultural, management and cultural competencies. This activity is in line with the 2021-2025 RIPP of the University of Jember with the featured topic "Development of people's coffee towards an organic system to improve community welfare".

Keyword: Coffee Skin Peeling Machine, Community Service, Panduman Jember

INTRODUCTION

Panduman Village is one of the villages in Jelbuk Subdistrict, Jember Regency. The village has an area of 862.728 km² with a population of 6860 people or a density of 0.5 people/km² (Wikipedia, 2022). The village stretches from the Jember Bondowoso highway to the Argopuro Mountain area. Sumbercandik is one of the hamlets in Panduman Village. The

contours of this hamlet are ridges and mountains with altitudes above 1000 m. At the end of this hamlet is Panduman Waterfall. The cool temperature, fertile soil, and adequate altitude make this hamlet suitable for coffee farming. Most residents grow coffee. In addition to their land, they cooperate with Perhutani to plant in between plants belonging to this state-owned company. This hamlet is rich in bryophytes diversity (Purbasari & Akhmadi, 2019).

With such potential, the people of Sumbercandik should be economically well-off, but it is ironic that, in reality, most of them live in underprivileged families. Many residents received the Self-Help Housing Stimulant Assistance (BSPS) program from the district/central government (Mu'minin, 2018). Another sign of their low economic status is the number of stunting cases in Panduman village (Ariati, 2019), which 2018 amounted to 51.3% (Maulidah et al., 2019).

If we look closely, the problem of poverty and its series begins with the farmers' weakness in post-harvesting coffee (their mainstay crop). Generally, farmers sell wet coffee (they term it wet-raw coffee) at a relatively low selling price, around Rp 500,000 per quintal, which has stayed the same since two years ago. Meanwhile, if peeled dry, the price can reach four times. It is exacerbated by their need for fertilizer, which is increasingly difficult to obtain. Even if it is available, the price is very high, reducing their profit margin. The location of this hamlet, which is at a high altitude, made it a difficult access road to get there. Most roads have been paved or tarmacked, but many have been damaged. It has increased the cost of coffee production. Various efforts have been made by the district/central government, including through BSPS of 50 units (Agus & Bam, 2022). Campuses in Jember City also acted with various programs to improve nutrition by utilizing local food (Zahariah & Yassin, 2020) or coffee processing counselling (Widiarti et al., 2021). There are also efforts to form coffee farmer groups (Mawardi et al., 2022). However, the problem has not been resolved because it needs to be resolved continuously and supported by funds and many competent resources.

After discussing it with residents and community leaders there, the Manufacturing Technology Research Group conducted a preliminary survey and ventured to submit a service proposal to empower the Sumbercandik Panduman Hamlet community with integrated and sustainable post-harvest technology. With the limited funding ceiling provided through the internal service grant of this fostered village grant program, we propose the implementation of the service for three years. This is considering our duties as lecturers, where community service is only one of the three components of our primary duties. This effort also aims to realize the sustainable development of the fostered villages of Jember University. In addition, to support the implementation of UNEJ's excellent research in the "Development of people's coffee towards organic systems to improve community welfare".

IMPLEMENTATION METHOD

Facing the problem of (family) farmer poverty in Sumbercandik Panduman requires solutions from various disciplines and perspectives. Of course, everyone will propose according to their competence. After all, it is more solutive than not contributing at all or proposing something beyond one's reach to be actively involved in helping. Therefore, the Manufacturing Technology Research Group, which consists of lecturers with Mechanical Engineering knowledge, proposed post-harvest processing technology. The solution was offered in stages

over three years. The first year was introducing and socializing wet skin and horn skin peeling machines. For information, coffee processing starts with peeling the outer skin (wet skin), followed by drying. According to the partners during the survey, drying can be completed in five days during the harvest season (September). Then, proceed with stripping the horn skin into ready-to-process coffee beans (which the partners call dry-raw coffee). These two machines are readily available in the market.

Generally, wet skin peeling machines or pulper machines are available in various sizes, either a small capacity of 25 kg/hour (Ilmi & Widianoro, 2021), a medium capacity of 120 kg/hour (Nasution & Effendi, 2018) or a high capacity as used in industry. Even machines like this have been found in old literature (Fukunaga, 1957) and continue to undergo improvements and are usually the thesis of students (Fikri & Arifin, 2022; Fahmi et al., 2022; Hamni et al., 2013; Kelik et al., 2016; Primawati & Rahim, 2020). In essence, machines like this have been proven and can be directly used in community service schemes; no research is required. Not much different, the existence of dry skin or epidermis or horn skin peeling machines every day among farmers or coffee entrepreneurs and academics (Azhari & Laia, 2021; Budiyanto et al., 2019; Kelik et al., 2016; Palungan et al., 2013; Sahar et al., 2020).

This service activity begins with a preliminary survey to learn about the village, its problems and potential. This stage was carried out in early February 2023; the Research team rode a non-matic two-wheeled motorcycle to Sumbercandik Hamlet. This area is quite challenging. The natural scenery is stunning, and the road is enough for one car to pass, but the road conditions have been damaged a lot. The survey process was greatly facilitated by the presence of one Research Group member who was "oreng dibi" a person from their circle. So, it feels like something other than a survey. Instead, it feels more like a family gathering, as shown in Figure 1. Discussions and jokes, typical of the village community, made the survey successful in gathering the necessary data. In addition, from this meeting, they were pleased if there would indeed be coaching assistance for them in post-harvest coffee processing. We also asked for their help in getting this proposal funded.



Figure 1. The discussion was packaged as a gathering with farmers and community leaders of Sumbercandik

The next stage is carried out annually, as described in the previous paragraph. The details

of the activities that have been carried out in the first year are as follows:

- a. A follow-up visit. The visit discusses the criteria for the coffee peeling machine they needed according to the number of harvests in one farmer group.
- b. Design and manufacture of wet coffee skin peeling machine (pulper machine) and coffee horn skin peeler. This stage will involve students: two undergraduate students and one postgraduate student as supervisors. The design will be done in the Mechanical Design Lab. Machine manufacturing is done in the Manufacturing Process. These labs are in the Faculty of Engineering, University of Jember.
- c. While waiting for the two machines to be finished and for the harvest period in September, the service team will often go to the village to discuss and exchange ideas, go to the coffee farm, etc. It is also to establish familiarity between the partners and the service team to smooth the course of the project. It is also to establish familiarity between partners and the service team to smooth the course of the project. More importantly, everything will be more accessible if the service team has been accepted as family. This period can also initiate the formation of farmer groups, such as those created by other service groups in lower Panduman (Mawardi et al., 2022; Widiarti et al., 2021). A comparative study between the Sumbercandik community above and the farmer groups formed in Panduman Village (below) is also being attempted.
- d. As the two coffee skin peeling machines are completed, we test and make sure the machines will work as expected. Fix the machine if performance is not up to standard.
- e. We are delivering the machines to the location. Given that the location and the road to get there are not easy, we will rent a particular 4WD transport vehicle, although the tariff is expensive.
- f. Introduce the machines and train partners to use them. Assist and give tips and tricks on simple maintenance.
- g. Provide counselling and practice of coffee post-harvest processing techniques. Collaborators outside of research group members with expertise in the field have been prepared here.
- h. Continuous coaching with regular communication and visits. Regular or incidental visits can be made every two weeks. It is also possible to take the family for recreation to Panduman waterfall, located at the end of Sumbercandik hamlet, considering that this is a multi-year project, not a hit-and-run project.

Evaluation of activities can be done in the weekly Research Group meeting agenda, which has become a routine agenda. The schedule will adjust to the teaching schedule and other agendas. For information, the Research Group of Manufacturing Technology has a meeting agenda every Tuesday at 12:30-13:30 WIB while having lunch together. This activity is quite good as a venue for discussion and evaluation of activities. So that all the grants we receive (three research grants and one service grant in 2022) can be done according to the time available and other outcomes and reports can be completed. We will continue to improve this good culture.

RESULTS AND DISCUSSION

This service involves students. They were recruited and actively joined the Research Group of Manufacturing Technology Team. Their main task was to design and build a coffee skin peeling machine (outer skin and horn skin). They are Mechanical Engineering undergraduate students in the final stage. Their activities in the research group team will also be the topic of their thesis, which will be completed in the 2023/2024 odd semester. Therefore, they are expected to graduate with a study period of seven semesters. Of the many stages planned, several activities have been carried out:

a. Design of Coffee Pulping Machine

The coffee peeling machine, which usually consists of two stages: wet skin peeler (pulper machine) and huller, is redesigned into one. Therefore, this machine can have dual functions. The various considerations for combining the two machines into one include efficiency (considering that the approved funds were only about 60% of what was proposed). In addition, it is for practicality. The design was carried out by four students in the Mechanical Design laboratory under the direct supervision of the head of service, who was the head of the lab. The design of this dual-function machine is presented in Figure 2.

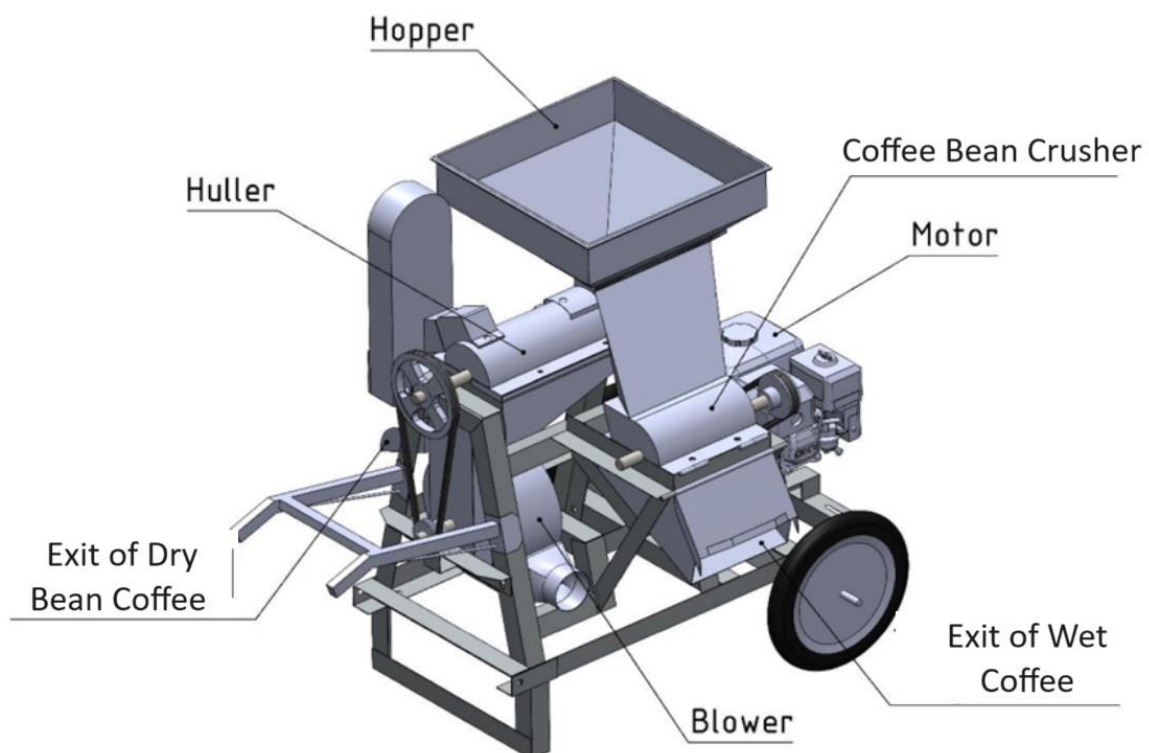


Figure 2. Design of dual-function coffee peeler machine

b. Manufacture of the dual-function machine

Manufacturing is carried out in the Applied Technology Laboratory and Metal Workshop. At this stage, students were guided directly by service members Dr. Koekoeh and Mr. Dwi Djumhariyanto, who headed the lab and workshop. The machine was completed and ready to operate in the first week of June 2023—the final check of the engine assembly (Figure 3a). A group photo of the dedication team with the fabrication results can be seen in Figure

3b.



Figure 3. Dual function coffee skin peeling machine; (a) final assembly check, (b) service team

c. Engine Testing

Machine testing was conducted to ensure the machine was functioning correctly before handing it over to the partners in Panduman. The testing was delayed due to the availability of coffee that had yet to be harvested, including in Panduman Village. The first coffee bean harvest we got from a farmer in Sidomulyo Village, Silo Sub-district, towards Banyuwangi, weighed 69 kg of mixed quality wet coffee. There are several stages of husking: soaking for a day and sorting. Sorting is taking the floating coffee from the soaking tub. The next day, the coffee is ready to be pulped. It is followed by drying in the sun. Drying takes four days. The result of drying is then peeled again (huller). It is necessary to adjust the distance or gap of the input and output holes to get optimal results. If the second hulling is repeated twice, the result will be cleaner in the form of coffee without any skin (cleaned-dry coffee). Schematically, the process of stripping coffee logs into ground coffee with this dual-function machine is presented in Figure 4.

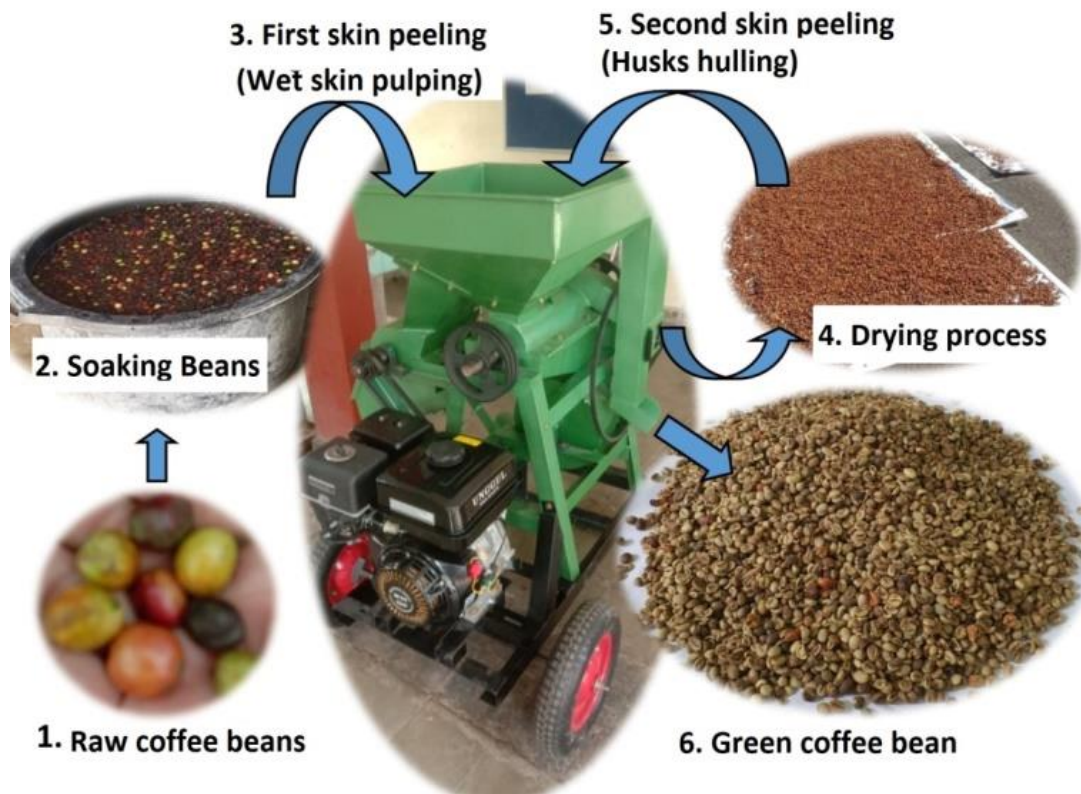


Figure 4. Schematic of the two-stage coffee pulping process with a dual-function pulping machine.

d. The next step was to share the good news with our coffee farmer partners in Sumbercandik Hamlet, Panduman.

In our previous communication, we had asked them not to sell coffee in the form of logs. That is right! They had already harvested and dried their coffee and stored it in their homes, awaiting our arrival. Our last visit was on July 19, 2023, coinciding with the 1st Muharram 1445H holiday. The moment of our visit is captured in Figure 5.



Figure 5. Memories of the service team's visit to partners on July 19, 2023

- e. With the machine completed and the coffee harvested, the team headed to the service location in Sumbercandik Hamlet, Panduman.

The machine was delivered to the location on July 27, 2023, with a rented pick-up vehicle. While the Service Team and the students involved rode their respective motorcycles, considering the conditions at the location were quite tricky for family passenger vehicles. The farmers were eagerly awaiting the arrival of the machine. They helped unload the machine from the pick-up car. Training on the use of coffee skin peeling machines was directly guided by Mr. Dwi Djumhariyanto in the local language (Madura). The training was conducted in two stages. First, the service team gave examples of machine operation, and then the villagers (partners) were guided to run the machine. It was easy for them to follow the guidance and practice. Basically, this machine is simple and easy to operate. A series of photos of this activity are presented in Figure 6.



Figure 6. Photo of a series of community service activities in Sumbercandik Hamlet: (a) The team and partners work together to unload the machine from the pick-up, (b) Briefing the operation of the machine, (c) Trying the coffee skin peeling machine, (d) Group photo, (e) Handover of machine

CONCLUSION

The service of the Assisted Village scheme has been successfully carried out with the cooperation of the Manufacturing Technology KeRis Service Team, coffee farmer partners in Sumbercandik Hamlet, Panduman village, Jember, Panduman village officials, and students who are actively involved. The dual-function machine, peeling the outer skin and peeling the coffee horn skin, has been successfully redesigned, made, tested, and handed over to coffee farmer partners. They are delighted with the performance of the machine and very grateful for the assistance of this machine. Communication is still maintained between the Devotion Team and partners through occasional visits and telephone media.

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