

Introduction of a Coffee Drying House to Ndalisodo Coffee MSME to Improve Product Quality and Quantity

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ABSTRACT

This community service initiative was carried out to assist the Lawu Tengah Nature Lovers' Group in overcoming challenges in the coffee drying process by introducing an environmentally friendly drying house. Prior to this initiative, the coffee-drying process relied solely on direct sunlight, making it heavily influenced by weather conditions. In addition to taking a relatively long time, sun-drying can reduce the quality of the resulting coffee. This initiative employed a participatory approach, involving the partner group at every stage, from needs assessment and planning, through the construction of the drying house and operational training, to monitoring and evaluation. Through this initiative, the partner group gained access to a drying house with a capacity of 500 kg per cycle, whilst also enhancing their knowledge and skills in operating and managing the facility. These drying houses can reduce the drying time from around 21 days to 14 days, thereby increasing drying capacity, reducing the risk of disruption from rain and contamination during the drying process, and improved the consistency of the drying process and reduced factors that may adversely affect coffee quality. Therefore, this initiative has improved the effectiveness of post-harvest handling and supports the enhancement of both the quality and quantity of Ndalisodo coffee. Besides, the local government can emphasize on the facility program of the quality standard and market access.

Keywords : coffee quality, postharvest, production process

INTRODUCTION

Coffee is a high-value trade commodity. According to a survey by GoodStats.id entitled "Coffee Consumption Patterns Among Indonesians", published in October 2024, 40% of the respondents consume two cups of coffee a day, 29% consume one cup a day, and the remaining 23% consume three cups a day. Specifically, this increase in coffee consumption is influenced by a shift in the lifestyle of young

people, particularly university students and the younger generation (Yonatan, 2024). According to Alfareza et al. (2024), the sustained and long-term increase in coffee consumption reflects a shift in consumption patterns among the population, which stimulates the production of goods and services, drives growth in Gross Domestic Product, and ultimately fosters economic growth. Findings on the phenomenon of increased consumption are supported by Paramita dan Fitrianto (2024), who state that

Indonesia's coffee production in 2022/2023 reached 11.85 million bags, making it the world's third-largest coffee producer after Brazil and Vietnam, and the second-largest in ASEAN after Vietnam.

One of Indonesia's provinces that serves as a centre for coffee plantations is East Java. East Java Province is the fourth-largest contributor to national coffee production on the island of Java, with a total land area of 92,185 hectares and a total production of 47,109 tonnes. East Java Province has several regencies that are key coffee-producing areas, including Malang, Pasuruan, Banyuwangi, Bondowoso, Jember, Lumajang, and Magetan ([Dinas Perkebunan Jawa Timur, 2022](#)). The coffee varieties cultivated in these regencies are mainly Robusta and Arabica. In addition to these two varieties, Magetan Regency is also developing the Liberica coffee variety (*Coffea liberica*). This significant potential for coffee cultivation prompted Sutoyo, leader of the Lawu Tengah Nature Lovers group from Sukowidi Village, Panekan District, Magetan Regency, to provide guidance on all stages of the coffee production process, from cultivation to processing the coffee harvest into ready-to-drink ground coffee under the Ndalisodo brand.

Ndalisodo coffee products currently rely on raw materials sourced from the local farmers' crops, comprising Robusta, Arabica and Liberica coffee. The Liberica variety grown in Indonesia is *Liberica excelsa* ([Praswoto et al., 2010](#)). The farmers' coffee is processed very simply, namely by drying it on bamboo racks or plastic sheeting. The drying takes place in backyards exposed to direct sunlight because there is a lack of open land.

The drying process significantly impacts coffee quality because it determines more than 50% of the final flavour profile, particularly in the natural and honey processes. Drying process is also crucial for preventing physical defects in the product. Proper drying aims to achieve a stable moisture content of 10–12% ([Ghosh, 2014](#)). Sun-drying produces a different flavour profile compared to mechanical drying. The drying process, particularly the natural method, allows sugars and mucilage from coffee cherries to be absorbed into the beans, thereby enhancing sweetness and complex acidity ([Aung et al., 2025](#)). The natural sun-drying process takes around 21 days at the partner's site. This relatively long drying period was primarily associated with the use of open sun-drying,

which was highly dependent on the availability and intensity of sunlight and was frequently interrupted by cloudy or rainy weather. High ambient humidity also contributed to slower moisture removal from the coffee.

The weather in Sukowidi Village, Panekan District, Magetan Regency, often changes rapidly from sunny to rainy. Rainfall in this area tends to be high as it is situated at an altitude of over 800 metres above sea level. This can prolong the drying time and also affect the quality of the coffee product. Under these conditions, coffee beans may remain at a relatively high moisture content for longer, increasing the risk of undesirable microbial growth and uncontrolled fermentation. In addition, intermittent rainfall and high humidity may cause moisture reabsorption, resulting in uneven drying and increasing the potential for physical defects, off-flavours, and reduced storage stability. Coffee quality can be assessed by its aroma, flavour, colour and body ([Alam et al., 2022](#)). Further, coffee quality also influences the selling price of coffee products. Coffee that is not of premium quality cannot command the highest selling price on the market.

Previous community service initiatives in the coffee sector have generally focused on improving cultivation capacity ([Wibawa et al., 2023](#)), developing product packaging ([Lubis et al., 2026](#)), digital marketing ([Astuti et al., 2022](#)), or strengthening farmers' group institutions ([Anggarini et al., 2021](#)). However, initiatives specifically introducing environmentally friendly drying houses as the primary solution to address post-harvest coffee issues at the group level remain relatively limited. It primarily utilizes renewable solar energy and natural air circulation to facilitate the drying process without relying on fossil-fuel-based heating. This community service program aims to introduce environmentally drying houses for the Ndalisodo Coffee Group to improve consistency of the coffee-drying process by shortening drying time and increase product quantity. The novelty of this initiative lies in the implementation of a drying house with a capacity of 500 kg per cycle, designed to suit the geographical conditions of Sukowidi Village, as well as the use of a participatory approach involving partners from the planning and construction stages right through to the operational use of the technology.

The growing demand for coffee from the farmers' group in Sukowidi Village has spurred

them to manage their coffee farming operations more diligently to achieve optimal yields. This will further drive the economy in the Central Lawu region, a major producer of various coffee varieties. This proposed community service programme aims to support the achievement of Sustainable Development Goals No. 1 (No Poverty), No. 4 (Quality Education), No. 8 (Decent Work and Economic Growth), and No. 17 (Partnerships to Achieve Goals).

METHOD

Community service programme to address coffee production issues in Ndaliso, carried out in collaboration with the Lawu Tengah Nature Lovers' Group, utilised a participatory approach. This approach was chosen because it aligns with the objective of empowerment, namely, self-reliance. Any empowerment initiative should actively involve the communities being empowered, enabling them to recognise their own capabilities and ultimately motivating them to take responsibility for all decisions. The ultimate aim is to enable these partners to become self-reliant as soon as possible and to benefit their surrounding environment ([Qonita et al., 2021](#); [Widjajanti, 2011](#)). This initiative also involved an international partner, Dr Nur Fakhzan Binti Marwan, who made a positive contribution to this participatory approach. Dr Nur Fakhzan's experience in empowering productive groups in Malaysia was replicated and adapted for this partner group. Collaboration with the international partner took place both online and in person during each planned activity.

The drying house for coffee production has been built on 2nd June 2026. It means that this activity for introducing drying house has been conducted at the same time. The activity used a location in the Ndaliso coffee of Sukowidi Village, Magetan Regency, East Java Province.

The implementation process for this activity was as follows:

- a. The community service team, the international partner, and the partner group discussed the location, land area, and materials to be used in constructing the environmentally friendly drying house.
- b. The community service team, together with the partner group, designed the drying house, selected and determined the building materials and other equipment, and then collaborated with a supplier to construct it.

- c. The community service team, partner groups and suppliers test the drying house to ensure it functions optimally.
- d. The community service team provides training on the use of the drying house to ensure it is utilised to its full potential, including training on maintenance management, operational management and time management.
- e. The community service team, together with the international partner, carries out monitoring and evaluation of the activities.

RESULTS AND DISCUSSION

Introduction to the Environmentally Friendly Drying House

The community service activity began with a participatory discussion among the community service team, the Lawu Tengah Nature Lovers Group, and Dr Nur Fakhzan Binti Marwan from Malaysia. The discussion was conducted in a hybrid format, comprising an in-person meeting at the partner's location and online communication with Dr Nur Fakhzan Binti Marwan. The aim of this activity was to reach an agreement on the technological requirements, the construction site, the drying house's capacity, the building specifications, and the operational mechanisms suited to the environmental conditions in Sukowidi Village. This participatory approach provided all group members with an opportunity to share their experiences and the challenges they faced ([Utami et al., 2022](#)), ensuring that the resulting technological design truly met the needs on the ground.

[Figure 1](#) illustrates a survey to identify a drying house site. Besides, the survey collects the information regarding drying house issues and benefits. It was conducted in the Ndaliso coffee of Sukowidi Village.



Figure 1. Survey of drying sites and identification of drying-related issues

Based on the field assessment findings, it was established that the current drying site was unable to support the drying process optimally. Part of the drying area was situated in a garden surrounded by coffee plants and fruit trees, so it did not receive full sunlight throughout the day. Furthermore, the drying process relied solely on drying racks and plastic sheeting, making it highly dependent on weather conditions. These conditions made the drying process frequently

interrupted by rain, resulting in longer drying times. Following a joint consultation, it was agreed that the site for the drying house would be relocated to an area with better sunlight exposure, as shown in [Figure 2](#). This optimal location is expected to accelerate the drying process, thereby improving efficiency ([Meja et al., 2025](#)).



Figure 2. The process of clearing the construction site and the surrounding area to ensure optimal sunlight

The next step was to determine the capacity of the drying house to be built. The community service team, together with the partner group, conducted calculations based on the average coffee harvest volume per season, the available land area, and the target increase in production capacity. Based on the results of these discussions, it was agreed that the drying house to be built would have a capacity of 500 kg of coffee cherries per drying cycle. This capacity was deemed sufficient to accommodate the group's harvest whilst allowing scope for increased production in the following harvest season. Subsequently, the team, together with the partners, drew up an effective building design. The design took into account ease of operation, air circulation, natural lighting and efficient use of space to enhance the drying process ([Meja et al., 2025](#)).

Once the building design had been agreed upon, the community service team, together with the partner group, entered into negotiations with the contractor who would build the drying house. The negotiations were held to agree on the building's technical specifications, the types of materials to be used, the capacity of the drying racks, the construction schedule, the work procedures, and the costs, all in line with the programme's budget. Negotiation is a process in which two or more parties interact to reach an agreement that serves as a guideline for future actions ([Martin-raugh et al., 2020](#)). The

involvement of partners in this process aims to ensure they understand every component used, thereby facilitating maintenance and repairs should damage occur in the future. These negotiations with various parties resulted in an agreement to construct the drying house in accordance with the jointly designed plans to meet the coffee drying needs of the Ndaliso Coffee Group. The construction process is illustrated in [Figure 3](#). The drying house measures 5 x 5 m. Construction began with levelling the ground, as the site was sloped. This was followed by the laying of the foundations. The foundations were built from bricks, and the floor of the drying house was plastered with cement mortar. This ensures the drying house is more durable and meets hygiene standards.





Figure 3. The building process for a coffee drying house

[Figure 4](#) shows the results of the construction, with the community service team, partner group and vendor carrying out initial testing of the drying house to ensure that all components functioned correctly. The testing involved evaluating the structural condition of the building, the stability of the drying racks, the ease of loading and unloading raw materials, and the convenience of use for group members. The test results showed that the drying house met the planned specifications and was ready for use in the coffee drying process. The success of this introduction phase demonstrates that a participatory approach not only produces technology that meets the partners' needs but also fosters a sense of belonging, as the group was actively involved from the planning stage right through to the testing of the building ([Soste et al., 2015](#)).



Figure 4. The completed coffee drying house

Operational Training for the Drying House

Once the drying house was ready for use, activities continued with operational training for members of the Lawu Tengah Nature Lovers' Group. This training aimed to enhance the partners' capabilities ([Irianto et al., 2024](#)). One of the skills developed was the ability to operate the drying house correctly, so that the technology built could be utilised to the full. This activity was carried out through a hands-on demonstration led by the community service team, with all group members actively participating.

The training began with an explanation of the working principles of the environmentally friendly drying house, covering the flow of solar heat into the building, the role of ventilation in regulating air circulation, and techniques for arranging coffee cherries on the drying racks to ensure even heat distribution. The community service team also explained the importance of maintaining the drying room's cleanliness to prevent contamination by dust, dirt, or microorganisms that could reduce coffee quality during the post-harvest process. Through hands-on operational training, the partners were not only able to operate the facility but also gained knowledge regarding its components, basic maintenance techniques and how to independently resolve basic technical issues ([Astuti et al., 2025](#)).

Participants practised the steps involved in using the drying house first-hand, starting with the preparation of raw materials, arranging coffee cherries on the drying racks, adjusting capacity to the building's holding capacity, and monitoring the condition of the coffee whilst drying was in progress. The outreach team provided guidance to each participant to ensure that all stages were carried out in accordance with operational procedures. In addition, participants were given an explanation of simple

indicators to monitor the drying process, thereby ensuring the coffee's quality is maintained until the desired moisture content is achieved. This training combined theoretical instruction with hands-on practice to enhance the partners' understanding and technical skills ([Harisudin et al., 2025](#)).

[Figure 5](#) figures out the practical activity for drying coffee in the drying house. This activity is conducted to exercise the beneficial impact of drying house on drying coffee process.



Figure 5. Practical demonstration of how to use the drying house

The training also covered the operational management of the drying house. Group members were trained in drawing up schedules for the use of the drying house during the harvest season, allocating tasks during the operational process, recording drying results, and implementing building maintenance procedures to extend the service life of the drying house. The implementation of operational management carried out in a participatory and organised manner is expected to improve coordination amongst group members, strengthen commitment to the management of shared facilities, and optimise the use of the drying house technology that has been introduced ([Kusnandar et al., 2024](#)). The training results showed that all participants understood the stages of using the drying house and could operate the facility independently.

Monitoring, Evaluation and Discussion

Monitoring and evaluation were carried out after the drying house began to be used by the Lawu Tengah Nature Lovers' Group for post-harvest coffee activities. The monitoring was conducted periodically through field visits and online communication to ensure that the drying house was being used in accordance with the operational procedures provided during the training. Furthermore, this monitoring aims to identify technical and non-technical challenges that arise during utilisation so that solutions can be provided promptly ([Ramdhani et al., 2024](#)). Evaluation was also conducted in collaboration with partners to gather feedback on ease of use, operational effectiveness, and the technology's benefits for post-harvest coffee activities.

[Figure 6](#) expresses the drying coffee process in the drying house. This process was executed to improve the quality of coffee and reduce drying process time. The short time of drying process delivers beneficial impact for farmers to provide a coffee product quickly in the local and national markets.



Figure 6. Coffee drying using the drying house to ensure a more controlled and uniform drying process.

The monitoring results show that the drying house has been actively used to dry the coffee cherries harvested by the group's members. The drying house's capacity of 500 kg per cycle also enables the group to process larger harvest quantities without splitting the drying across multiple locations. The changes experienced by the group after using the drying house are shown in [Table 1](#).

Table 1. Comparison of before and after the introduction activity

Aspect	Before	After
Drying time	21 days	14 days
Drying capacity	Capacity is limited to the area used, which is the surrounding area of the local residents' houses.	Capacity has increased to 500 kg, making it more space-efficient
Risk of exposure to rain	High	Very low
Risk of contamination from dust and dirt	Exposure to dust and environmental contaminants. Directly exposed to the surrounding environment during open sun-drying	Coffee was protected inside the drying house, reducing direct exposure to dust, dirt, rainfall, and other external contaminants
Frequency of handling needs	High when it rains	Low due to being protected
Labour	Higher, as workers must be on standby in case it rains at any time	Lower
Quality	Inconsistent; the seeds are dry and their moisture content varies more widely.	Consistent; coffee was dried under more protected conditions, reducing direct exposure to rainfall, dust, dirt, and other environmental contaminants.

[Table 1](#) shows that the use of drying houses has led to improvements in various aspects of the post-harvest coffee processing. The drying time has been reduced from around 21 days to 14 days, indicating an increase in drying process efficiency of around 33 per cent compared with the open-air drying method. Furthermore, drying capacity has increased to 500 kg per cycle, enabling the group to process larger harvest volumes during each drying period. Drying houses also mitigate the risk of adverse weather conditions, particularly rain, and reduce the potential for contamination by dust and dirt, as the drying process takes place within a more sheltered structure ([Duque-dussán et al., 2026](#)). These improvements in drying conditions have led to more uniform product quality, meaning that the coffee beans produced are of a more consistent quality than before the drying house was introduced ([Duque-dussán et al., 2026](#)).

The joint evaluation with the partners showed that the drying house has brought about changes in the management of post-harvest activities at the group level. Use of the facility is organised through a jointly agreed schedule, ensuring that every member has an equal opportunity to utilise the drying house during the harvest season. The division of tasks for operations, cleaning, and maintenance has also

been implemented, ensuring that management responsibilities do not rest solely on a few individuals. This management approach, combined with open communication, has helped to improve coordination amongst members, whilst simultaneously strengthening the group's institutional capacity to manage the shared facility ([Rijal et al., 2024](#)). The results of this activity are in line with various previous community engagement programmes, which have shown that the introduction of post-harvest technology, accompanied by training and mentoring, can enhance the group's capacity to manage agricultural produce ([Sugiarto et al., 2025](#)).

CONCLUSION

The community service programme successfully introduced a solar-based drying house with a capacity of 500 kg per cycle and strengthened the Lawu Tengah Nature Lovers' Group's capacity to operate and manage the facility. Its use reduced the coffee-drying time from approximately 21 to 14 days and provided greater protection from rainfall, dust, dirt, and other environmental contaminants compared with the previous open sun-drying practice. These outcomes demonstrate improvements in the efficiency and reliability of post-harvest

coffee drying at the partner's site. To ensure sustainable use, the group should consistently implement operational procedures and conduct regular maintenance of the drying house. Future community service programmes should incorporate quantitative measurements of coffee quality, particularly final moisture content and moisture uniformity, as well as physical and sensory quality assessments, to objectively evaluate the effects of the drying house on coffee quality. Further support for quality certification and market development is also recommended to strengthen the competitiveness of Ndalisodo coffee, thereby enhancing the competitiveness of coffee-producing SMEs whilst supporting the achievement of the Sustainable Development Goals (SDGs), particularly Goal 8 on decent work and economic growth.

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