1. INTRODUCTION

Microbusiness actors in Indonesia have an essential role in national economic development because they can absorb quite a significant workforce (Putra, 2016). According to BPS Statistic Indonesia (2011), job opportunities in Indonesia are getting narrower, so it can drive people to open businesses independently. Based on OECD (2018) the number of micro-business actors in Indonesia is 64.2 million or 99.99%. The workforce absorbed is 117 million workers, or 97%. Meanwhile, according to Kementerian Koordinator Bidang Perekonomian Republik Indonesia (2022) stated that GDP data on micro-business actors contributed 61.1% to the economy in Indonesia. This proves that more and more Indonesian people are choosing to do business in the micro-business sector.

Prambontergayang Village, Tuban Regency, is one of the villages with a micro business centre in producing Rengginang cracker snacks. Rengginang crackers are a traditional snack made from rice or sticky rice (Abryandoko et al., 2023). Rengginang cracker snacks have a savory, crunchy, and sweet
In some parts of Indonesia, Rengginang cracker-type businesses are used in village-owned micro business units (BUMDES) because they have good market potential. The products vary; some are raw packaging, and some are ready-to-consume packaging. The quality of Rengginang crackers is determined by the water content reduced due to the drying process. Drying using the conventional method, apart from requiring a long time (6–7 days), allows uneven drying of the Rengginang to occur (Firmansyah & Musyahar, 2020). Another condition that occurs in partners is the rainy season. This condition will decrease product quality due to the change in rengginang color to blackish and less hygienic. If this condition is left without improvement, it will affect partner sales. The community service program that will be carried out is to improve the quality of the product so it doesn’t break easily during the frying process. The program will provide community service in one of the Rengginang producing micro business units with the Urnika brand owned by Mr. Suhadi. Based on primary information data from survey methods and direct field observation, Mr. Suhadi’s Rengginang cracker production has been established since 2015 and received PIRT (home industry food) legality in 2018 with number 2153523010443-23. Figure 1 shows the production process of Pak Suhadi’s Urnika Rengginang crackers.

The marketing area for Mr. Suhadi’s Urnika Rengginang crackers is spread around Soko District, Widang District, Tuban Regency and partly in the Bojonegoro Regency area. The average production produced in a day reaches 130 kg of raw rengengan, which is ready to be sold. According to Fahmi et al., (2022), Rengginang cracker-type businesses in some parts of Indonesia are often used as village-owned businesses (BUMDES) because they have good market potential.

Rengginang crackers can be purchased in various traditional markets and minimarkets. The products vary; some are raw packaging, and some are ready-to-consume packaging. The quality of Rengginang crackers can be seen from the bloom level after the frying process (Azzaroh, 2022). According to Karyantina et al. (2023), Rengginang with an appropriate drying process makes it possible to improve quality of the product so it doesn’t break easily during the frying process. Initial observation results were collected through primary information and direct observation. Potential problems that occur to partners are identified in the drying process, which is the longest stage in the production of Rengginang crackers. Partners still use conventional methods to carry out the drying process, namely by drying raw Rengginang in the sun using woven bamboo. Figure 2 Shows documentation of the drying process at partner.

According to Suryana et al. (2020a), the drying process is considered vital because it affects the quality of the Rengginang results. The crispness of Rengginang is determined by the water content reduced due to the drying process. Drying using the conventional method, apart from requiring a long time (6–7 days), allows uneven drying of the Rengginang to occur (Firmansyah & Musyahar, 2020). Another condition that occurs in partners is the rainy season. This condition will decrease product quality due to the change in rengginan color to blackish and less hygienic. If this condition is left without improvement, it will affect partner sales. The community service program that will be carried out is
the application of microcontroller-based Rengginang cracker food dehydrator technology innovation, which allows partner problems to be solved, including the quality and quantity of production results. The technology will also be ergonomically designed, mobile and portable, making it easier for partners to work safely and comfortably and not change the worker’s body posture.

![Figure 2. Rengginang drying process](image-url)

2. METHODS

The implementation method for PKM is carried out using two approaches, namely, through training and mentoring. The training approach was carried out to inform operational standards for the use of microcontroller-based cracker-producing food dehydrator technology. Meanwhile, the mentoring approach was carried out to evaluate the sustainability of activities carried out by Rengginang Crackers microbusiness actors in Prambontergayang village, Tuban district. The types of data and information used consist of primary and secondary information. Figure 3 is a schematic diagram of the PKM assistance techniques that will be carried out.

The stages of PKM activities are explained in Figure 4, where the program implementation evaluation plan will be implemented for each activity that has been programmed and planned. Meanwhile, for program sustainability, monitoring will be carried out once a month after the program is completed by recording all obstacles and problems that occur with partners so that this program can be sustainable and meet the main target, namely the effectiveness of drying and production of Rengginang.

Implementation of activities is determined based on planning in the PKM activity stages in Figure 4. Time allocation. Implementation of activities is carried out using a scheduled mechanism through activity guidelines prepared jointly between the implementers of PKM activities, namely the Bojonegoro University academic community, and partners, namely the owners of the Rengginang cracker snack business unit. Table 1 is a schedule of PKM activities agreed upon jointly between implementers from the Bojonegoro University academic community and partners.
Without improvement, it will affect partner sales. The community service program that will be carried out is the application of microcontroller-based Rengginang cracker food dehydrator technology innovation to the Rengginang producing micro business unit with the Urnika brand owned by Mr. Suhadi located in Prambontergayang Village, Tuban Regency, with the main objective being that the microbusiness unit managed by Mr. Suhadi, Prambontergayang Village, Tuban Regency. In this activity, partners will actively participate as participants in all activities that will be planned in the PKM.

For program sustainability, monitoring will be carried out once a month after the program evaluation plan will be implemented for each activity that has been programmed and planned. The technology will also be ergonomically designed, mobile and portable, making it easier for partners to work safely and comfortably and not change the worker’s body posture.

The stages of PKM activities are explained in Figure 4, where the program implementation method for PKM is carried out using two approaches, namely, through and mentoring. The training approach was carried out to inform operational standards for the use of dehydrator for Rengginang Crackers.

Figure 3. PKM mentoring techniques

Figure 4. Stages of PKM activities
Microcontroller based food dehydrator for Rengginang crackers micro businesses in Prambontergayang Village, Tuban District

Eko Wahyu Abryandoko, Faisal Ashari, Nungki Dio Febriansa, Ary Angga Fachreza

### Table 1. PKM activity schedule

<table>
<thead>
<tr>
<th>Activity Date</th>
<th>Type of Activity</th>
<th>Parties Involved</th>
</tr>
</thead>
<tbody>
<tr>
<td>7 up 8 Oktober 2023</td>
<td>Initial survey and identification of partner problems</td>
<td>PKM implementation team and Business Unit owners</td>
</tr>
<tr>
<td>15 up 22 Oktober 2023</td>
<td>Making a Microcontroller Based Food Dehydrator for Rengginang Crackers</td>
<td>PKM implementation team</td>
</tr>
<tr>
<td>16 up 29 Oktober 2023</td>
<td>Testing of a Microcontroller Based Food Dehydrator for Rengginang Crackers</td>
<td>PKM implementation team involving Business Unit owners</td>
</tr>
<tr>
<td>4 up 5 November 2023</td>
<td>The training process involves forming a forum with materials:</td>
<td>PKM implementation team and all Business Unit employees</td>
</tr>
<tr>
<td></td>
<td>1. Providing materials for using tools</td>
<td></td>
</tr>
<tr>
<td></td>
<td>2. Practice using tools</td>
<td></td>
</tr>
<tr>
<td></td>
<td>3. Evaluate the use of tools</td>
<td></td>
</tr>
</tbody>
</table>

### Strategy Used

The strategy used in assisting partners is explained in Figure 4, a diagram of the plan for achieving solutions to overcome the problems partners’ face, namely the Urnika business unit managed by Mr. Suhadi, Prambontergayang Village, Tuban Regency. In this activity, partners will actively participate as participants in all activities that will be planned in the PKM.

![Figure 4. Strategy diagram for achieving solutions to overcome partner problems](image)

The strategy used to assist partners begins with observations collected through primary information using a direct observation approach. After the primary data was obtained, the second stage involved the creation and testing of a microcontroller-based Rengginang cracker food dehydrator technology innovation based on the needs of microentrepreneurs. The third stage is training carried out through community learning activities by forming formal forums. The training activities carried out involved the owner and employees of Mr. Suhadi’s Urnika Rengginang cracker micro business. The involvement of Rengginang Cracker microentrepreneurs enables the sustainability of the program. The
training and mentoring carried out involved the PKM team from the Bojonegoro University academic community. The practice of the Rengginang drying process was carried out jointly with guidance from a team of presenters from Bojonegoro University using materials from wet Rengginang produced by partner business units.

3. RESULTS AND DISCUSSION

Implementation of the microcontroller-based food dehydrator for Rengginang crackers training activity is one of the community service programs that aims to optimize the drying process for Rengginang Crackers for partners, which initially took 6 to 7 days and was optimized to a few hours of drying. Training and mentoring at PKM allows the drying process to be carried out using innovative food dehydrator technology to optimally improve the drying quality of partners' products. The microcontroller-based food dehydrator for Rengginang crackers is considered capable of having a positive impact on microbusinesses because it is able to speed up the drying process (Lesmanah et al., 2021). The manufacture of the microcontroller-based food dehydrator for Rengginang crackers was adapted to the needs of partners, namely the Urnika business unit managed by Mr. Suhadi, Prambontergayang Village, Tuban Regency. The application of appropriate technology makes it possible to be an alternative and cost-effective solution compared to conventional drying (Firmansyah & Musyahar, 2020; Rizqiati et al., 2021).

Priority Issues

PKM activities began with a survey to identify problems among partners, namely Rengginang crackers micro business actors in Prambontergayang Village, Tuban District. The initial survey found priority partner issues that were priorities for finding solutions. Table 2 justifies the proposed activities based on several priority issues for partners.

<table>
<thead>
<tr>
<th>Aspect</th>
<th>Problems</th>
<th>Solutions Offered</th>
</tr>
</thead>
</table>
| Technology   | The Rengginang drying process relies on sunlight or conventional methods so that:  
1. The drying process takes 6-7 days.  
2. Production productivity is less than optimal due to long drying times.  
3. The quality and quantity of production could be better due to product defects (discolouration) during rainy weather. | Making a microcontroller-based food dehydrator for Rengginang crackers.  
Training on the use of microcontroller-based food dehydrator equipment for partners. |

The justification for the activities proposed in PKM is the technological aspect. PKM activities with technological aspects were chosen because solutions to problems faced by partners can be overcome with several technological approaches. Some of the problems faced by partners are in the drying process, which takes 6 to 7 days, so productivity in the production process is less than optimal. Apart from that, the quality and quantity produced are less than optimal due to product defects (discoloration) during rainy weather. Several discussions between partners and PKM implementers resulted in a solution for solving the problems faced, namely making a microcontroller-based Rengginang drying dehydrator and training partners on its use.
Implementation of PKM Tool-Making Activities

Tool-making activities in PKM activities are carried out in the product planning and design laboratory of the Industrial Engineering study program at Bojonegoro University by adapting to partner needs and testing by taking samples as Rengginang crackers from partners. The first stage is to design and plan the tool; the next step is to make the tool according to what was previously planned by paying attention to accuracy and using predetermined standards to produce the best tool. Figure 6 is the implementation of making a Microcontroller Based Food Dehydrator for Rengginang Crackers.

The results of making the Microcontroller-Based Food Dehydrator for Rengginang Crackers tool were then tested to ensure that the tool’s performance could function as expected. The parameters used to test the quality of Rengginang are water content as a response, thickness of Rengginang, drying temperature, and drying time (Handoko et al., 2022; Suryana et al., 2020b). Testing was carried out to determine the level of efficiency of the microcontroller-based food dehydrator for Rengginang crackers. Testing activities were carried out in the product planning and design laboratory at Bojonegoro University by taking samples in the form of processed Rengginang from partners. The use of a microcontroller-based food dehydrator tool is needed to handle problems that exist among PKM partners. Identification of tool use shows the performance of the Food Dehydrator Microcontroller tool design, which is described in Figure 7.

Testing analysis in using the tool was carried out using a black box system. The performance of the microcontroller-based food dehydrator tool works well; with an input capacity of 5000 pcs, it can produce good product drying.
The main objective of making a Microcontroller Based Food Dehydrator tool is that drying can be carried out optimally with better quality results for Rengginang crackers.

The training material was delivered by conveying the use of the microcontroller food dehydrator for Rengginang crackers as a tool that can make work easier, with the main function being too dry Rengginang with the help of measurable technology. Using a microcontroller food dehydrator for Rengginang crackers, the temperature and drying time can be adjusted according to predetermined criteria, namely using a temperature of 75 degrees, which can dry Rengginang for 120 minutes. We also explain using the Microcontroller Food Dehydrator tool to make the work process more efficient, which originally took seven days of drying to 120 minutes of drying perfectly.

After explaining the operation of the microcontroller food dehydrator tool, we then explain how the drying process is carried out properly according to the parameters that have been determined so that the drying can work more effectively. From the type of activity, we carry out direct practice for Rengginang cracker micro-entrepreneurs so that they can directly demonstrate the specified parameters. We also offer to try with other parameters by considering temperature and drying time. The main objective of making a Microcontroller Based Food Dehydrator tool is that drying can be carried out optimally with better quality results for Rengginang crackers.

**Figure 7.** Transparent box for microcontroller-based food dehydrator tool

**Figure 8.** Training on operating the microcontroller-based food dehydrator
The microcontroller-based food dehydrator tool shortens the drying process time. The microcontroller food dehydrator is made automatically using a heating lamp as a heat source for the machine, aluminium as a heat insulator, and a timer to set the drying time. Using a drying machine can shorten time and increase production capacity. Using a microcontroller-based Food dehydrator is important to optimize the drying process. Optimization resulting from the use of machines can reduce drying time from 2-3 days to 6-12 hours with production capacity from 300-600 per 3 days to 600-1200 per day. The influence of temperature and time is a benchmark for optimal drying results.

**Evaluation of Training on Operation of Microcontroller-Based Food Dehydrator Equipment**

The use of microcontroller-based food dehydrators has been put into practice. The use process has resulted in complaints from users about adding several components, such as Stavolt, to stabilize the electricity so that the device is safe when the electricity is unstable. Apart from that, several technical obstacles are insignificant but can be resolved directly in the field. As a follow-up to the results of the PKM that has been carried out to partners, it will be evaluated once a month until the Rengginang cracker micro-enterprise in Prambontergayang village, Tuban Regency, applies the technology provided consistently as a sustainable step in the use of Microcontroller Based Food Dehydrator Equipment, so that partners can easily dry Rengginang. Easily and quickly to increase partner productivity.

4. **CONCLUSION AND RECOMMENDATIONS**

This community service program aims to develop and train Rengginang crackers and Rengginang cracker micro-entrepreneurs in Prambontergayang village, Tuban district, using alternative technology for drying Rengginang crackers. The main target of this community service program is for participants to know and use alternative technology in the form of a microcontroller-based food dehydrator to dry Rengginang properly in a relatively faster time. PKM activities began with a survey to identify problems among partners, namely Rengginang crackers micro business actors in Prambontergayang village, Tuban district. The initial survey found priority issues for partners whose priority solutions were sought. Namely, the Rengginang drying process relies on sunlight or conventional methods so that the drying process takes 6-7 days, production productivity is less than optimal due to long drying times, and the quality and quantity of production are less optimally caused by product defects (discolouration) during rainy weather. The results achieved are the partner’s ability to apply alternative technology by using a Microcontroller Based Food Dehydrator to dry Rengginang to increase the productivity of the partner’s business.

Based on the community service that has been carried out, suggestions and input that must be considered for program sustainability are as follows: (1) In the future, partners will try to vary the temperature to determine a faster drying time so that we can record developments in the application of the technology that we have provided to partners; (2) The need for ongoing assistance to ensure the adoption of technological innovations presented during training can be developed; (3) Community service programs can be continued by providing the latest technology to support production to partners, such as dough molding equipment and digital financial management.

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