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Increasing productivity of meatball SMEs through the application of appropriate technology for meatball forming machines

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ABSTRACT

Meatballs are generally made from meat that is ground and built with flour. The results of this process are called *pentol*. Mr Jiman's meatball business which is located in Nganjuk Regency, still used conventional methods. This can affect the amount of *pentol* production because it still involves human labour. The method used also affects the shape and size, which is the unequal shape and needs a tool that improves this performance. Most of the equipment currently available in the market is a product with a large capacity, unreachable prices, expensive maintenance, and difficulty in obtaining spare parts. To solve partner problems, develop equipment in the form of a meatball forming machine with an electric motor. The method of making a machine is carried out in several stages: designing, measuring and cutting materials, manufacturing, assembling, and testing processes. This purpose is to increase meatball productivity. The results were obtained by using a meatball forming machine with a speed of 4 meatballs/second so that it has increased the efficiency of production time by 400% compared to the manual method, which produces one meatball/second. The productivity of business profits increased 43.7% compared to the previous one, which still used conventional processes.

KEYWORDS
Meatball forming machine,
Meatball business management,
Production capacity,
Time efficiency,
The first appropriate technologies

1. Introduction

Meatballs are one of the processed fish products that are quite popular and widely liked; besides that, the way of serving meatballs is also quite varied; it is not only boiled but also fried, baked or used as additional ingredients [1]. Meatballs are famous for their round shape which is processed using ground meat and several other combinations of ingredients [2]. Meatballs are processed products consisting of meat that has been ground with flour. Grinding is an activity to smooth meat before mixing it with other ingredients. This mixing process is an important process carried out in the manufacture of meatball *pentol* [3]. The meatballs are mixed into a dough using the principle of an oil-in-water emulsion. The emulsion is a dispersion or suspension of a liquid in another liquid, but the molecules do not form a single unit [4]. The Small and Medium Business Partner that is being fostered is a meatball business named Bakso Tunggal Rasa which is owned by Mr Jiman and located in the Begadung Village area, Nganjuk City—precisely located on the edge of a village road with a fairly wide road (9 meters), near public facilities such as schools and children's playgrounds, namely the Bungkarno Sports Center (GOR), the puskesmas hall and the Begadung sub-district office, Nganjuk District. This type of meatball business started from Mr Jiman's family's love of eating meatballs, and at one time, the family decided to open a meatball business, until now Mr. Jiman has been selling for about 16 years. The business can develop because of several supporting factors, including the business location, Figure 1, which is easy to find and strategic, it is still rare in partner neighbourhood locations, the price also not so expensive among the lower middle class, in that environment, many people are busy on working so they do not have time to cook, are near schools, playgrounds, health centres, and district offices.

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Fig. 1. Tunggal Rasa meatball partners' location in Begadung Nganjuk.

This business opportunity is quite good because the community around his home environment has not widely occupied this business, and he feels optimistic that he will achieve success. At first, this business did not utilize labour or employees. To overcome all the challenges faced in running this business requires stability and tenacity in running the business. Mr Jiman is also very serious in managing his stall business because it is a source of income for families with increasingly heavy burdens of life, such as the requirement to pay for their children's school. The Meatball Seller business actually provides opportunities for growth, including fulfilling domestic demand for meatballs, equal distribution and increasing employment opportunities and improving nutritional quality, as well as the activities that impact forward and backward linkages with supporting industries. The business problems of meatball sellers are relatively complex, where the productivity of meatball sellers are relatively low, sellers also generally have a relatively small business scale. The process of grinding meat and the process of mixing meatball dough is an obstacle faced by meatball traders because it requires a tool or machine to grind meat and stir meatball dough [5]. Based on the results of observations and interviews with partners conducted by the implementing team, data and information were obtained that the problem with partner SMEs is that the production of meatballs is still done manually. Hence, it takes 1-2 hours for 5 kg of meat. This business produced 25 kg of meat per day and had five employees in the past. The other factors of partners' problems are; (1) Limited funds owned in dividing spending funds; (2) The increase of raw materials price which is not stable; (3) Sometimes the meatballs do not sell well, which will make the business lose money; (4) Sometimes it is difficult to get fresh and good quality beef; (5) Lack of mastery the technological aspects in the meatball business. To overcome the problems of partner SMEs, the purpose of this service is to provide problem-solving steps, namely; (1) The application of appropriate technology is a meatball forming machine with a drive system using an electric motor to increase productivity and quality; (2) Providing training on the correct manufacture of meatballs and providing training on the use of *pentol* making machine technology and training on meatball business management.

2. Method

The implementation of this Community Service (PKM) program uses the appropriate technology application methods needed by partners to increase business productivity and ultimately improve people's living standards. Before implementing the technology, it begins with field studies and observations aimed at digging up information to determine the basic problems faced by SMEs [6]. Thus, it is hoped that the implementation of the service program will be well-targeted. Based on the surveys and interviews results with entrepreneurs and employees, it can be seen that the partner's problem is the inability to increase the amount of production due to limited workforce and still to use manual methods, also not implementing proper business management. To overcome these problems, the action taken by the PKM program implementation team was to develop Appropriate Technology (TTG) for the meatball making machine. This meatball forming machine was manufactured in the welding workshop of the Department of Mechanical Engineering, State University of Surabaya. The first step is to make a design, Figure 2. In designing, of course, paying attention to the basic principles of mechanical science and product design is

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a must. The steps that must be taken are observing the required machines, determining specifications and manufacturing processes [7]. The design of the meatballs forming machine is carried out by coordinating with the PKM program team and workshop technicians in order to get the perfect meatballs forming machine design. Furthermore, the results of the design are used as a benchmark in the manufacturing process of meatballs forming machines. The components of the meatballs forming machine, as shown in the figure below, consist of; (1) Motor Drive; (2) Funnel; (3) Gearbox; (4) Meatballs were forming. Machine width 50 cm, length 170 cm, height 130 cm,

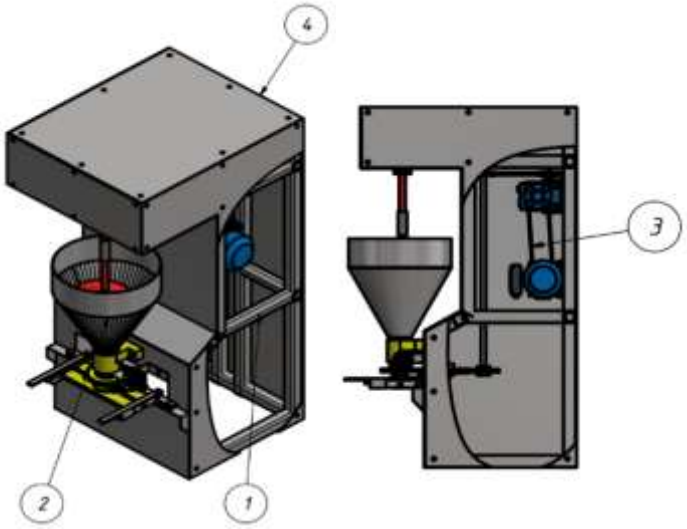

Fig. 2. Design of a meatball forming machine.

After the engine frame is completed, then the assembly of engine components is carried out. The components of a meatball forming machine consist of; (1) Drive Motor; (2) Funnel; (3) Meatball size adjuster; (4) Gearbox; (5) Pulleys and Belts; (6) Stamp; (7) Cutting knife; (8) Place of dispensing meatball. One of the assembly processes is done by welding. Welding techniques in the current era are mostly used to connect rods in machine construction [8]. After the machine assembly process is complete, Figure 3, the machine is ready to be tested. Testing the meatball forming machine is carried out for data collection, which will later be used as a result of data in the preparation of the final report.

Fig. 3. Meatball forming machine.

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In the implementation of the Community Service (PKM) program, an economical and efficient meatball forming was produced to assist business partners in Begadung village in handling the problems they faced. This meatball forming machine has a design that is not too complicated with the aim of making it easier for partners in the process of using it. This meatball forming machine is able to accommodate meatball dough with a capacity of 5 kg per process, with an electric motor of 0.5 hp. The speed in the meatball forming process can also produce four meatballs per second, which means that there is an increase in time efficiency of 400% compared to the manual process. The following is the calculation of production time efficiency r_1 Old machine produces one meatball/second; r_2 New machine produces four meatballs/second; Ef is production time efficiency. Therefore;

$$Ef = \frac{r2}{r1} \times 100\% \quad (1)$$

$$= \frac{4}{1} \times 100\%$$

$$= 400\%$$

So the increase of production time efficiency is 400% [9].

3.1. Delivery Items to the Partners

Figure 4 shows the delivery of Appropriate Technology (TTG) in the form of a meatball shaping machine to Bakso Tunggal Rasa's business partners in Begadung, Nganjuk Regency.

Fig. 4. Handing over of meatball forming machines to SMEs partner

The handover of this tool was carried out on Monday, September 30, 2019, by Dr I Made Arsana, M.T., as the head of the PKM implementation team. The Nganjuk regional government also witnessed the handover of the meatball forming machine to partners, Figure 5.

Fig. 5. Machines are handed over to the local government

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3.2. Training on The Use of Machine

In conducting the trial, it must be in accordance with the SOP (Standard Operating Procedure). This SOP is implemented to ensure that there are no unwanted obstacles in the process of using the machine; see Figure 6 (a) and Figure 6 (b). The following is the SOP for the use of a *pentol* forming machine; (1) The position of the meatball forming machine is not able to move or shift due to vibration; (2) Check the cutting blade; (3) Check the mould and dough mixer; (4) Check the condition of the driving motor, make sure the drive motor cable plug is connected to PLN electricity; (5) Turn on the engine for a while before giving the meatball dough; (6) Check the ability of the tool by inserting the meatball dough, if the funnelled dough is almost used up, immediately add the meatball dough again so that the level of roundness of the mould results remains stable; (7) After the meatball forming process is complete, turn off the driving machine and immediately clean the machine, especially the funnel and meatball dough mixer.

a b

Fig. 6. (a) Training on the use of machines, (b) conditions during tool use training

3.3. Business Management Training

At the business management training stage, the PKM team held discussions with partners on how to manage a good business, starting from sales, service and others, Figure 7. In addition, during this training, the PKM team also gave directions on how to produce sterile meatballs to keep the place clean and free from the borax content that we have encountered in meatballs.

Fig. 7. Conditions during the business management training.

The training also covers the management of funds/finances, where SMEs still implemented conventional management, which has no orderly financial administration. With this training, the PKM team provides guidance to manage business finances more professionally. So far, Mr Jiman's UKM is able to pay three employees, with a net profit of 3 million per month. In this training activity, the PKM team also provides direction on how to manage a good business so that it can provide greater profits.

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3.4. Impact

The impact on the activity of providing this tool is that the Baksi meatball UKM owned by Mr Jiman has increased the production process of the meatball with a total of 4 meatballs every second so that the human power used is not too large and workers do not complain of tiredness. The increase in productivity was also accompanied by an increase in operating profit of 43.7%. The improved management supports this as a result of the development of the PKM team in financial management.

4. Conclusion

A meatball forming machine was successfully developed with four meatballs/second capacity with a drive system using an electric motor. Based on the results of trials and training that have been carried out, it can be concluded that this machine can be categorized as very efficient in its use. Previously, when using the manual process, the speed of making a meatball was one meatball/second; using this meatball forming machine, the percentage of the meatball was four meatballs/second, which increased up to 400%. The increase in productivity and business profits also increased by 43.7% compared to the previous one, which was still using manual processes. Overall, the PKM program activities went well according to the planned schedule. Implementing this PKM program activity has resulted in a meatball forming machine that is effective, efficient, and hygienic. The addition of this Appropriate Technology makes the process of making meatballs more efficient.

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