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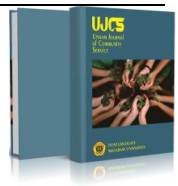

# Application of Appropriate Technology for Automatic Hatching Machines in the Kelompok Ternak Bebek Mukti in Rajamandala Village

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**Abstract:** Automatic incubator is an incubator device designed to hatch eggs artificially with automatically controlled temperature, humidity, and egg turning settings, in the hope of increasing the success rate of hatching, saving time and energy, and enabling hatching on a larger scale. The purpose of this community service is to apply appropriate technology for automatic egg hatching to improve the knowledge, skills, accessibility, and income of farmers in Rajamandala Village. This program is a Kosabangsa scheme through a collaboration between Universitas Perjuangan Tasikmalaya and Universitas Siliwangi. This activity starts in September 2024 to December 2024 in Rajamandala Village, Rajapolah District, Tasikmalaya Regency. Kosabangsa activities consist of various activities, namely socialization / counseling regarding automatic incubators, training on their application which can be controlled using Android, and assistance in the application of automatic incubator technology to partners until their marketing activities. The target partner for this activity is Kelompok Ternak Bebek Mukti with a total of 20 group members as participants in the activity. The results of this community service activity show that the application of automatic incubator technology in Kelompok Ternak Bebek Mukti is able to increase the percentage of hatching power and reduce the hatching time compared to the application of manual incubator technology that is commonly used. The output of this activity is able to increase the knowledge, skills, accessibility, and income of Kelompok Ternak Bebek Mukti partners in the egg hatching process.

**Keywords:** Automatic incubators; Cihateup ducks; Community empowerment; duck eggs; Kosabangsa.

## Introduction

The poultry sector in Indonesia has currently experienced rapid development, both on a smallholder farm scale and on a large-scale livestock industry. In addition to chicken commodities, ducks are one of the poultry commodities that are widely developed by utilizing hatching technology. The incubator used for hatching can function to replace the mother duck in the process of incubating its eggs (Fitroh et al., 2024). Naturally, egg incubation can only be done on a few eggs, requiring an incubation period of between 28-30 days. The temperature in the incubator required for duck eggs when they are 1-24 days old is 38°C, while when they enter the age of 25-30 the temperature required is around 34°C (colder than the previous day). In addition to setting the right temperature, another thing that must be considered in hatching duck eggs with a machine is the humidity level. The humidity level required by the machine to hatch duck eggs on days 1-

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24 is around 55-65% while on days 25-28 the humidity is increased to 76% with this incubator hatching can be done in large quantities and simultaneously (Sugara et al., 2023).

Natural hatching by mother ducks is less effective in hatching eggs because one mother duck can only incubate about 10 eggs, while artificial hatching can hatch hundreds or even thousands of eggs, depending on the capacity of the incubator (Isma et al., 2021). During the artificial hatching process, the temperature and humidity in the incubator must remain stable and appropriate to maintain the condition of the eggs so that they remain good. Optimal temperature and humidity will affect the success rate of hatching. This is because temperature and humidity greatly determine the growth rate of the embryo, the success of the development of body organs and the hatchability of the eggs. Humidity can also function to control the fluid in the egg and help soften the egg shell to make it easier for DOD to break the egg shell. However, if the humidity is high, it can also cause too much water to enter through the pores of the egg shell, causing fluid to accumulate in the egg (Nirwana et al., 2022).

Indicators of the success of the hatching process can be measured based on the percentage of fertility, embryo mortality, or dead in shell (Fitroh et al., 2024). According to Azhar et al. (2023) there are 5 factors that must be considered during the hatching process using an incubator, namely temperature, humidity, ventilation, egg turner, and cleanliness. Thus, technological development is needed to be able to make an egg incubator by paying attention to these five aspects. An automatic incubator is designing the conditions of the poultry egg parent automatically with several advantages and conveniences. In this automatic system, farmers no longer need to turn the eggs by hand as is usually done in manual hatching, and the temperature and humidity settings can also be adjusted automatically. The incubation period of various types of poultry differs from each other, depending on the size of the egg, where the larger the egg, the longer the incubation period (Wirajaya et al., 2020).

An automatic incubator based on the Internet of things (IoT) is a concept where the incubator has the ability to transfer data over a network without requiring human interaction to a computer device. IoT can include several other sensor technologies such as wireless technology or QR codes. This IoT application refers to a machine or tool that can be identified as a virtual representation in its internet-based structure. Actually, IoT works by utilizing a programming argument, where each argument command can produce an interaction between machines that have been connected automatically without human intervention and without being limited by any distance. So, the internet here is the link between the two machine interactions. Humans in IoT only act as an introduction and supervisor of the incubator that works directly (Jusman et al., 2021).

The internet of things-based automatic incubator is very potential to be applied to the Kelompok Ternak Bebek Mukti as a medium for hatching Cihateup duck eggs as local livestock in Tasikmalaya Regency. The application of this automatic incubator technology is expected to help partners in cultivating Cihateup ducks so that they are more effective and efficient.

## Method

This community service activity is a Kosabangsa scheme that will be implemented from September to December 2024 in Rajamandala Village, Rajapolah District, Tasikmalaya Regency. This Kosabangsa activity is carried out by Universitas Perjuangan Tasikmalaya as the implementing team and Universitas Siliwangi as the accompanying team. This activity aims to empower the community as target partners. The target partner group consists of 2 partners, namely the Kelompok Ternak Bebek Mukti and Satria Mandala Village-Owned Enterprise (Bumdes Satria Mandala). The number of participants in the Kosabangsa activity was 40 people, consisting of 20 people from the Kelompok Ternak Bebek Mukti and 20 people from the Bumdes Satria Mandala. This Kosabangsa activity is carried out with various activity methods, namely counseling, training, and mentoring regarding local food diversification, namely the processing of herbal salted eggs and discarded duck meat sausages. Counseling, training, and mentoring activities are carried out periodically until the end of the program.

The Kosabangsa activity begins with a permit to carry out the activity to the relevant institutions. After obtaining the permit and assignment letter, a focus group discussion and socialization of the implementation of the Kosabangsa activity were carried out. The next activity was counseling or socialization of the urgency of implementing automatic incubator technology, designing automatic incubator technology, and training and assistance in implementing automatic incubator technology. The process of hatching duck eggs in an automatic incubator takes about 30 days to hatch. During the hatching process, continuous assistance is provided so that the hatching techniques and procedures run according to standards. After the eggs hatch and the Cihateup duck DOD is produced, the DOD is tested for quality and quantity. After being declared qualified in terms of quality and quantity, the next step is product marketing carried out by members of the livestock group. Marketing is carried out offline and online to reach a wider marketing area and the income generated is more optimal.

## Result and Discussion

Hatching is the process of embryo development in the egg until the egg hatches with the aim of producing a new individual. Hatching methods are divided into two methods, namely natural hatching using a mother hen and artificial hatching using an egg incubator. Artificial hatching has the advantage of being more practical and more efficient than natural hatching, the capacity of eggs hatched is greater so that it helps farmers in maintaining the sustainability of their business. However, natural egg hatching has advantages in terms of hatching techniques, namely it is practical, economical, and produces a high hatchability index. Natural hatching is done using ducks that are brooding. However, natural hatching has the disadvantage that the number of eggs can be very limited and must be done simultaneously. The process of hatching duck eggs with the help of a mother hen is only up to a capacity of around 10 eggs per head. If using Muscovy ducks, it can reach a maximum of 15 eggs per head. With this natural incubation period, it takes about 30 days from when the duck eggs are first incubated by the mother (Sugara et al., 2023). The duck egg incubation process in the Kelompok Ternak Bebek Mukti is still carried out traditionally so that it has a low success rate due to the lack of technology application, where the egg turning process is still done manually, there are no measuring and temperature and humidity regulators, resulting in low egg hatch rates (Saputera et al., 2020).

In this Kosabangsa program, an incubator system has been designed and created that can monitor the temperature and humidity of the room temperature in the egg incubator automatically. Where all activities during the hatching process of the system can be controlled automatically using Android. The temperature and humidity control process can be monitored and regulated as desired so that duck eggs can hatch into superior quality duck seeds. During the hatching process, there are several factors that influence the success of egg hatching, including temperature, humidity, type of egg, and egg turning.

The eggs used for the hatching process in this program are fertile eggs or eggs that have been fertilized by sperm produced from a breeder duck farm. The hatching eggs are produced from the Cihateup duck farm owned by members of the Kelompok Ternak Bebek Mukti. Eggs that will be hatched must go through a good selection process because not all hatching eggs can be used in the hatching machine. The main factor that needs to be considered in selecting hatching eggs is the quality of the eggs, where if the quality of the eggs to be hatched is poor, the percentage of the number of eggs that can hatch will be low. In addition to egg quality, the weight of the hatching eggs must also be uniform and should not be too large or too small. Eggs that are too large can cause the air sac to be too small for embryo development so that the eggs will be delayed in hatching. Several factors that can affect egg weight are environmental factors, genetics, egg composition, laying period, age of the poultry and body weight of the parent. The egg hatching process in this automatic incubator begins with the hatching egg selection process so that the selected eggs meet the specified criteria. The criteria for eggs that are suitable for hatching are normal egg shape, meaning not too round or too oval, uniform egg size and color, and even egg shell thickness with a smooth egg surface texture. Members of the Kelompok Ternak Bebek Mukti have been able to select hatching eggs well through counseling activities carried out in the Rajamandala Village hall (Figure 1).

**Figure 1**. Urgency Counseling Activities for Automatic Hatching Machines

There are many things that need to be considered in the process of selecting eggs. The selection process for hatching eggs is carried out to produce good quality hatching eggs, so it is necessary to pay attention to the cleanliness of the shell, the integrity of the shell, the shape of the egg, and the weight of the egg. The shape of the egg is one of the reference indicators during the selection process, because the shape of the egg can determine the hatching weight. The body weight of the ducklings obtained at the end of the hatching period is influenced by the shape of the hatching egg, where the size of the hatching egg will affect the ducklings that hatch. One way to overcome bacterial contamination in hatching eggs and maintain the quality of hatching eggs is to carry out the egg sanitation process using the fumigation method. The fumigation method on hatching eggs can be done using formaldehyde gas which can be produced from a mixture of formalin and potassium permanganate.

Fumigation of hatching eggs is a prevention so that hatching eggs are protected from contamination by pests, fungi or bacteria that can later interfere with the development of the embryo in the egg during the hatching process. Selected hatching eggs should be fumigated to prevent and avoid contamination by pests, fungi and bacteria using formalin and $KMnO_4$ for 20 minutes. One of the preparations made before starting the hatching process is fumigation of the incubator. The incubator room must be cleaned first before use by disinfecting it using a disinfectant which aims to prevent bacterial contamination through the incubator. Furthermore, after disinfection is carried out on the incubator, the next step is the fumigation process of the incubator. The temperature in the incubator greatly affects the success of the hatching process, therefore when hatching using an incubator, the condition of the incubator must still refer to the natural temperature when the mother duck incubates her hatching eggs. Temperature control that is not properly considered can thwart the egg hatching process. This is due to the principle of the operation of the incubator, the temperature must be stable and can be controlled regularly. The temperature will continue to increase and decrease when the eggs are about to hatch. The temperature and humidity control mechanism in the automatic incubator has been trained and mentored as presented in Figure 2.


**Figure 2.** Training and Mentoring Activities for the Implementation of Automatic Hatching Machines

Ventilation in the incubator also plays an important role because it plays a role in regulating the entry and exit of air in the incubator. When carbon dioxide increases, the ventilation of the incubator will take oxygen into the incubator and remove the carbon dioxide from the incubator. Ventilation in the incubator must be adjusted according to needs so that air circulation in the incubator can run well so that the development of the embryo in the incubator can grow well. This ventilation plays a role in balancing temperature and humidity. Poor ventilation will cause a buildup of carbon dioxide which can interfere with the growth process of the embryo in the hatching egg. When the hatching egg is put into the incubator, the ventilation must be closed. Towards the sixth day and beyond, ventilation begins to be activated so that a good gas exchange process occurs so that it has a good impact on embryo development. This is because the greater the development of the embryo in the egg, the more oxygen is needed.

The process of turning the eggs in the incubator is important so that each part of the egg can receive heat evenly. Turning the eggs has the opposite direction to the original position of the egg. This egg turning functions to standardize the surface temperature of the egg and prevent the embryo from sticking to the egg shell that will be hatched. A good egg turning process will help optimize the embryo growth process, so that the eggs that hatch produce ducklings in normal conditions. The position of the egg turning plays an important role in the hatching process using an incubator. Turning the eggs with a good frequency will give good results in the final results of hatching the hatching eggs. Egg turning should be done once every hour so that during one day it can rotate up to 24 times. This egg turning can be done at an angle of 450 so that it gives good results in the hatching process. The egg turning process in this incubator has been set automatically through the settings on the incubator button that has been conveyed to the members of the Kelompok Ternak Bebek Mukti.

Candling on an incubator is done by candling the eggs to check and observe the embryos in the eggs to be hatched using light. Candling begins by turning on the electric light on the automatic incubator. This candling is done with the aim of determining the presence of embryo development in the hatching eggs. Fertile eggs exposed to light will appear reddish during the candling process. In addition to determining the presence of embryos, candling can also function to determine fertile and infertile eggs, as well as to determine whether there are embryos that die before hatching. How to carry out the candling process on this automatic incubator has been trained in a simple way, namely by turning on the light button on this automatic incubator. After the light is on, the eggs to be hatched are then candled to detect the embryo and its fertility so that they are suitable for hatching (Garno et al., 2022).

The hatching power of hatching eggs indicates the number of fertile eggs that hatch at the end of the hatching period expressed as a percentage. There are many factors that can affect the hatching power of eggs, one of which is the storage period. Hatching eggs if stored for a long period of time will reduce the percentage of egg hatching power. The hatching power of eggs will decrease along with the increase in storage time and the length of time the eggs are stored before being hatched. This storage period determines the hatching power and death of embryos in the hatching eggs. The results of the hatching activities carried out by the Kelompok Ternak Bebek Mukti have produced egg hatching power with a percentage of 50%. This shows a higher hatching power percentage compared to the hatching power in the manual hatching machine owned by the Kelompok Ternak Bebek Mukti. Documentation of the application of this automatic hatching machine technology is presented in Figure 3.

**Figure 3.** Participants in the Automatic Hatching Machine Implementation Activity

## Conclusion

The implementation of automatic incubator technology in the Kelompok Ternak Bebek Mukti in Rajamandala Village went well where the participants were very enthusiastic in several activities carried out starting from counseling, training, to mentoring the implementation of appropriate technology. This activity was able to increase the knowledge, skills, accessibility, and income of the Kelompok Ternak Bebek Mukti partners before and after the activity through pretest and posttest.

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