

# IMPLEMENTATION OF AUTOMATIC EGG-COLLECTING CHICKEN CAGES WITHOUT ELECTRICITY IN SUPPORTING THE PRODUCTIVITY OF CHICKEN EGG FARMERS IN PASURUAN

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**Abstract**

Pasuruan Regency is one of the largest chicken egg production centers in East Java. However, farmers in this region often face problems related to suboptimal cage management, fluctuations in egg production, and difficulties in maintaining cage hygiene. To overcome these problems, an automatic egg collection cage without electricity was implemented at the Yayasan Syarif Hidayatullah (YSH) farm in Pasuruan.

The implementation method consists of several stages: planning, which includes surveying and determining needs; technical design and manufacture of cages; training farmers on cage operation and maintenance; field implementation; and evaluation and design improvement. The cages, designed using iron wire, have an automatic egg collection mechanism that reduces the risk of egg damage and simplifies the cleaning process.

Results from the implementation showed a significant increase in the number of eggs produced, from 2,500 eggs per day to 3,000 eggs per day, with a reduction in egg breakage rates. In addition, the automated system reduces the farmer's workload and improves the cleanliness of the coop, which impacts the chickens' health.

This activity concludes that automatic egg collection chicken cages without electricity can increase egg productivity, reduce operational costs, and support the sustainability of livestock businesses.

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## 1. INTRODUCTION

Pasuruan Regency is one of the largest chicken egg production centers in East Java, with total production reaching 14 million kilograms per year (BPS Jatim, 2017). Pasuruan is one of Indonesia's strategic regions supporting food security, especially in providing important animal protein sources such as eggs. Chicken eggs are a staple food with high nutritional value and become an important component in various food products (Wulandari & Arief, 2022). However, despite its great potential, the layer farming sector in the region is not immune to challenges that can impact productivity and egg price stability in the market.

One of the main problems laying hen farmers often face is egg production fluctuations (Ilham, 2019) (Mardiyanti & Nadir, 2023). Various factors, such as the quality of cage management, less-than-ideal environmental conditions, and suboptimal feeding systems, cause this decrease in egg production. This decline in production affects farmers' income and has a broad impact on society. When egg production decreases, egg prices in the market will increase (Febrianto & Putritamara, 2017). This can decrease people's purchasing power and reduce protein consumption, especially among lower-middle-income families (Putri, 2022).

This condition is a significant concern for the government, mainly because low protein consumption contributes to Indonesia's high stunting rate. Based on data from the Indonesian Toddler Nutrition Status Survey (SSGBI) in 2021, the prevalence of stunting in Indonesia was recorded at 24.4%, far above the standard set by WHO, which is 20% (BKPK, 2023).

The "Egg Eating Movement" program launched by BKKBN and the National Food Agency aims to increase egg consumption in the community to reduce stunting (Ivan, 2022). However, the success of this program is highly dependent on the stability of egg production and prices in the market.

Syarif Hidayatullah Foundation (YSH) in Pasuruan Regency is one of the institutions that actively supports the layer farming sector. Since 2000, the foundation has managed an Arabic chicken farm as part of its entrepreneurship education program. The farm has six cages with a capacity of up to 3,000 chickens.

In addition to serving as a business unit, the farm is also a learning tool for the foundation's students to understand the intricacies of entrepreneurship, especially in animal husbandry. However, like other farms in the region, YSH also faces various obstacles in increasing the productivity of its laying hens.

One of the main problems is the suboptimal management of the cages. The traditional cages used on this farm are made of bamboo, which, although cheap, has several disadvantages. Chicken manure often sticks to the cage structure, making cleaning difficult. Dirty cage conditions can be a breeding ground for bacteria and flies, which in turn cause disease in chickens (Wibowo, Indriastiningsih & Devi, 2024). These diseases reduce chicken health and affect egg productivity (Syafitri & Indirawati, 2022). In addition, air quality in the cage is also a problem that is often faced. Too high temperature, low humidity, and high ammonia levels due to chicken manure can cause stress in chickens, which has a direct impact on egg production (Rudiyansyah, Wahyuningsih, & Kusumanti, 2015; Putra, Maulana, & Fitriyah, 2018).

Based on the results of joint research between Widya Kartika University (UWIK) and Syarif Hidayatullah Foundation in 2022, it was found that one solution to overcome these problems is to design a chicken cage made of iron wire equipped with an automatic egg collection mechanism. This cage is designed to meet the needs of modern farms while still considering the limited resources available in rural environments. The iron wire facilitates cleaning so the cage environment can remain hygienic. In addition, a unique mechanism is designed so that the eggs coming out of the hens flow directly into the shelter, reducing the risk of egg damage. The iron wire cage structure also provides better strength to support the weight of many chickens without the risk of damage, unlike bamboo cages, which are prone to breakage or damage. The system also has the added advantage of operational efficiency,

as it does not require an electrical power source, making it very suitable for implementation in rural areas with limited access to electrical energy.

With these advantages, this cage helps increase productivity and supports livestock businesses' sustainability through operational efficiency. In addition, its application is expected to become a model of simple technological innovation that other farmers in Indonesia can adopt.

This community service activity aims to implement an automatic egg-collecting chicken cage without electricity at the YSH farm. This program is designed to provide practical solutions to problems faced by farmers while supporting efforts to modernize the livestock sector in Indonesia. A more hygienic and comfortable cage environment will increase chicken productivity. At the same time, the automatic egg collection mechanism saves farmers time and effort, allowing them to focus more on other aspects of farm management. With an electricity-free system that supports operational cost efficiency, this technology helps reduce farmers' expenses and provides environmentally friendly benefits.

This program directly impacts farmers and contributes to improving the community's welfare. With the stability of egg production, egg prices are expected to become more affordable, resulting in increased protein consumption. This indirectly supports national efforts to reduce stunting in Indonesia.

Through the synergy between Widya Kartika University and Syarif Hidayatullah Foundation, this activity also increases collaboration between educational institutions and the community. This program directly benefits farmers and opens opportunities for students to be involved in the research and development of applicable technologies. With the success of this program, it is hoped that a more modern, efficient, and sustainable livestock ecosystem will be created in Pasuruan Regency, which will support food security and overall community welfare.

## 2. METHOD

This community service activity aims to implement an automatic egg-collecting chicken cage innovation without electricity at the Syarif Hidayatullah Foundation (YSH) farm in Pasuruan. The program implementation method is designed systematically with several main stages, including planning, cage design and manufacture, training and technology transfer, implementation, and evaluation. The following are the details of the program implementation:

### 1. Planning Stage

The initial stage of this program is planning, which aims to ensure that the set objectives run all activities. The proposing team and partners will meet to discuss the farm's specific needs and adjust the cage design to the actual conditions in the field.

- **Initial Survey**

The team will conduct a survey to collect field data, including the required cage size, number of chickens, and current systems. The survey will also evaluate relevant farm infrastructure, such as road access, availability of raw materials, and working tools.

- **Determination of Technology Needs**

Survey data determines cage design and specifications. The technology applied should be relevant to local needs, such as cleaning efficiency, automatic egg collection mechanism, and durability of the cage structure.

- **Budget Plan and Implementation Schedule**

The team develops a budget plan and schedule that includes the timing of implementing each stage of the activity, allocating resources, and distributing tasks to each team member.



Figure 1. Implementation of Activities

## 2. Cage Design and Construction Phase

This stage involves the technical design process up to the realization of the chicken coop prototype.

- **Technical Design**

A technical team of lecturers and students designed the cage structure using design software such as AutoCAD or SolidWorks. The design includes cage dimensions, egg collection mechanisms, and systems that support cage hygiene.

- **Material Selection**

The cage was made of high-quality iron wire, which is strong, easy to clean, and durable. Previous experience showed that bamboo cages have disadvantages regarding cleanliness and durability.

- **Prototype Making**

The cage prototype was made in Widya Kartika University's workshop. This process involves students, giving them hands-on experience in practical activities relevant to their field. The prototype will be tested to ensure a sturdy structure, effective egg collection mechanism, and easy cleaning.

- **Functional Testing**

Once the prototype was completed, tests were conducted to ensure that the automatic egg collection mechanism was functioning correctly and that the cage structure could support the weight of the chickens. The results of these tests were used to refine the design before implementation in the field.

## 3. Training and Technology Transfer Phase

Training is a key element in ensuring the sustainability of the program. Farmers and learners at YSH will be actively involved in this process.

- **Theoretical Training**

The proposed team provides farmers with theoretical training on how automatic cages work, the importance of cage hygiene, and the benefits of this technology in increasing productivity.

- **Practical Simulation**

The training also includes hands-on demonstrations on assembling, operating, and maintaining the automated cages. Farmers will be actively involved in these simulations to ensure a good understanding of the implemented technology.

- **Preparation of an Operational Manual**

An operational guide in the form of a manual was developed as a reference for farmers using and maintaining the cages. The manual is organized in simple language and accompanied by pictures for easy understanding.

#### 4. Implementation Stage

After the training, the implementation phase was conducted at the YSH farm site.

- **Cage Installation**

The team and the farmer install the automated cages on the farm. This process involves all parties to ensure the cages are installed correctly according to the planned design.

- **Initial Operational Assistance**

During the first two weeks after installation, the proposing team provides intensive assistance to farmers to ensure the technology works properly. This includes monitoring the egg collection mechanism, cage cleanliness, and the hens' response to the new cage.

- **Production Data Collection**

Data related to the number of eggs produced before and after the implementation of automated cages was collected to measure the impact of this technology on productivity.

#### 5. Evaluation and Refinement Stage

The evaluation stage assesses the program's success and recommends future improvements.

- **Technology Performance Evaluation:** The performance of the automatic cages was evaluated based on indicators such as the number of eggs collected, the cleanliness level of the cages, and ease of operation.

- **Farmer Feedback:** Farmers were asked to provide feedback on their experience using the automated cages. This was done to determine how much the technology helped them and what constraints they faced during operations.

- **Design Improvements:** Based on the evaluation results, improvements were made to the cage design to increase its efficiency and effectiveness. These improvements also serve as a reference for further development and replication in other locations.

#### 6. Documentation and Publication

The results of this activity are documented in the form of written reports, photos, and videos. This documentation is used to report the results of the activities to relevant parties, such as Widya Kartika University and funding partners. In addition, the results of this

activity were also published in scientific journals and seminars to expand the program's impact and encourage the adoption of this technology in other areas.

### **7. Student Involvement in MBKM Activities**

As part of the Merdeka Belajar Kampus Merdeka (MBKM) program, Widya Kartika University students are involved in the entire activity process, from design to implementation. Students gain research experience, community service, and off-campus internships recognized as part of their SKS conversion. This student involvement supports the development of their competencies and strengthens the relationship between educational institutions and the community.

### **8. Impact and Sustainability**

This program is expected to impact farmers and the community long-term. With the automatic cages, the productivity of chicken eggs is expected to increase, supporting egg price stability and increasing public protein consumption. In addition, the program is designed so that the resulting technology can be replicated in other farms, and the benefits can be felt more widely.

## **3. RESULT DAN DISCUSSION**

After going through the planning, design, manufacture, training, and implementation stages, the automatic egg-collecting chicken coop without electricity was successfully implemented at the Yayasan Syarif Hidayatullah (YSH) farm, Pasuruan. The following are the detailed results of each implementation stage:

### **1. Cage Design and Manufacture**

The technical design of the automatic egg-collecting chicken cages was carried out using design software such as AutoCAD and SolidWorks to ensure the dimensions and structure are suitable for the needs of YSH farms. The cages are designed with a sturdy, easy-to-clean, and durable iron wire system.

The cage manufacturing process involves Widya Kartika University students working in the workshop to assemble the prototype cage. The primary material used was high-quality iron wire, chosen for its durability, ease of maintenance, and cleanliness.

### **2. Functional Testing of the Cage**

Testing was conducted to ensure all mechanisms functioned properly once the cage prototype was completed. One of the key mechanisms is the automatic egg collection system that uses gravity to flow the eggs directly to the collection bin. Initial test results showed that the eggs could flow smoothly without the risk of breakage, which was previously familiar with manual cage systems. In addition, the iron wire structure could support a considerable amount of chicken weight, overcoming the durability issues common in bamboo cages.

### **3. Installation of Cages at YSH Farm**

The proposing team and YSH farmers installed the tested automatic cages at the farm site. The installation process was done carefully to ensure the technical design installed the cages. The cages were placed with the chickens' comfort in mind and good airflow to prevent ammonia buildup that could damage the air quality inside the cages.



(a)



(b)

Figure 2. (a) Cage with Bamboo (b) Cage with Iron Wire

#### 4. Initial Operational Assistance

After cage installation, the team provides intensive assistance to farmers for the first two weeks. This includes monitoring the chickens' condition, egg collection mechanisms, and cage hygiene. Farmers are taught how to maintain and operate the cages effectively during this period. The mentoring also includes an initial evaluation of the impact of the automated cage system on egg productivity.

#### 5. Egg Production Data Collection

Data related to egg production was collected before and after the implementation of the automated cages to measure the impact of this technology. Before implementation, the average egg production was 2,500 eggs per day, with a high egg breakage rate. After the automatic cages were installed, egg production increased to 3,000 eggs per day, and the egg breakage rate was drastically reduced. This shows that the automated egg collection mechanism using gravity reduces the potential damage caused by manual handling.

Details of the results of this community service activity are described as follows:

##### 1. Improved Hygiene and Chicken Health

Traditional bamboo cages are often challenging to clean, as chicken feces stick to the cage structure. This potentially leads to a buildup of manure that becomes a breeding ground for bacteria and flies and reduces the air quality inside the coop. This automatic cage is more hygienic and has iron wire material that is easy to clean. Cage cleaning can be done more efficiently, which helps prevent the development of diseases in chickens, such as worms or bird flu, which are often a problem in traditional cages.

Cleaner and more well-maintained coop conditions can reduce stress levels in chickens, directly contributing to improved chicken health. Healthy chickens tend to be more productive, produce more eggs, and are of better quality.

##### 2. Operational Efficiency and Time Savings

One of the significant challenges in managing layer farms is the time required to collect eggs manually. Previously, farmers had to check each cage to collect eggs, which was time-consuming and labor-intensive. With this automatic egg collection system, the eggs will flow directly into the prepared shelter, reducing the farmer's workload.

For example, manual egg collection takes farmers about 3-4 hours daily. However, with the implementation of an automated system, the time required for inspection and maintenance is reduced to only 1-2 hours. This allows farmers to allocate more time for other activities, such as feeding or maintaining the chickens' health.

### **3. Improved Egg Productivity and Quality**

The automated egg collection mechanism directly impacts egg productivity. Before implementation, the eggs produced were often damaged due to the rough collection process. The automated system minimized egg damage, increasing the marketable output.

In addition, better egg quality leads to an increase in the marketability of the eggs. Better quality eggs tend to be more valuable in the market, which increases farmers' income. This increase in productivity and egg quality also impacts the stability of egg supply, which in turn can reduce fluctuations in egg prices in the market.

### **4. Operational Cost Sustainability and Environmentally Friendly**

This automatic egg collection chicken coop without electricity is highly efficient regarding operational costs. Farmers do not need to rely on the sometimes unstable electricity supply in rural areas, which makes this system particularly suitable in areas with limited electricity infrastructure. Without the need for electricity, operational expenses are lower, which gives the farmer greater profitability.

On the other hand, using recyclable iron wire makes this cage environmentally friendly. Using durable materials reduces the need for periodic cage replacement, contributing to reduced waste and more efficient resource use.

### **5. Technology Replication and Dissemination**

The successful implementation of automated chicken coops at YSH shows excellent potential for this technology to be applied to other farms, mainly in rural areas with limited electricity. This simple yet effective technology can be easily adapted to the needs of other farmers, making it a widely replicable solution.

The application of similar technologies in various regions of Indonesia is expected to reduce the gap in the productivity of layer farms and directly benefit farmers by increasing the stability of egg production and lowering operational costs.

## **6. CONCLUSION**

Implementing automatic egg-collecting chicken cages without electricity at Syarif Hidayatullah Foundation farms has yielded positive results. This technology not only improves productivity and egg quality but also reduces the farmer's workload, improves operational efficiency, and supports the sustainability of the farm business. With its environmentally friendly and cost-effective advantages, this technology has the potential to be applied in other farms in Indonesia, which in turn can support national food security and improve community welfare. The program also provides significant educational benefits for the students involved, as well as opening up opportunities for further research in the field of livestock technology.

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