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GUIDEBOOK
CAGE-FREE LAYER HEN PRODUCTION SYSTEM

Directorate General of Livestock and Animal Health
Ministry of Agriculture of the Republic of Indonesia

FOREWORD

We express our gratitude to God Almighty, for by His abundant grace, blessings, and guidance, this Guide to Cage-Free layerHen Production System has been compiled and completed. The preparation of this guideline is part of the Government's efforts, specifically the Directorate General of livestock and Animal Health, to strengthen the governance of sustainable, responsible, and highly competitive national poultry production.

In line with global commitments and national development policy directions, the implementation of a cage-free laying hen production system is a strategic step in supporting the achievement of the 2030 Sustainable Development Goals (SDGs), especially those related to food security (SDG 2), health and well-being (SDG 3), sustainable consumption and production (SDG 12), action on climate change (SDG 13), and partnerships to achieve the goals (SDG 17). Improved animal welfare, efficient use of resources, and the implementation of environmentally friendly poultry farming practices are essential elements of a modern, sustainable food system.

The Indonesian poultry industry has shown significant growth over the past few decades, both in terms of scale, technology, productivity, and its contribution to the national supply of animal protein. With increasing public awareness and global market dynamics, the poultry industry is being challenged to adapt to new standards that emphasize food safety, sustainability, and animal welfare. Internationally, various global companies in the food, retail, and catering sectors have committed to using 100% cage-free eggs in their supply chains. This commitment has direct implications for the domestic market and opens up opportunities for national businesses to develop production models capable of meeting these expectations and requirements.

Given these developments, an official guideline is needed that can provide technical references, operational standards, and best practice recommendations for farmers, companies, local governments, academics, and all stakeholders. This guideline is expected to serve as a reference in implementing a cage-free laying hen production system that takes into account biological, technical, socio-economic, and environmental sustainability aspects. Furthermore, this guideline is a crucial instrument in driving the transformation of the national poultry industry toward a more modern, adaptive, and market-oriented production system.

The development of these guidelines is inseparable from the collaboration and contributions of various parties. We would like to take this opportunity to express our appreciation to CATALYST, our partner in the Directorate General of Livestock and Animal Health Services, for their technical support, substantive input, and close collaboration throughout the development of these guidelines. Synergy between the government, development partners, the business sector, and the community is a crucial foundation for strengthening the resilience of the national food system.

Finally, we hope that these Guidelines for Cage-Free Laying Hen Production Systems will be utilized optimally by all stakeholders as a reference for implementing efficient, safe, and sustainable production systems that align with scientific developments and global market demands. We hope these guidelines will make a tangible contribution to increasing the competitiveness of the Indonesian poultry industry and supporting the realization of a sustainable livestock system towards an Advanced Indonesia.

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GUIDEBOOK

CAGE-FREE LAYING HEN PRODUCTION SYSTEM

Why is Cage-Free Keeping Necessary for Laying Hens?

Safe, environmentally responsible, and ethical food production is the new direction for modern egg farming. With a "cage -free " system , farmers provide an environment that allows laying hens to live a more natural life—not only free from harmful factors, but also with the opportunity to express their natural behaviors, feel comfortable, and have choices.

The main question is why is cage-free maintenance necessary for raising laying hens?

In accordance with minimum welfare standards, livestock must be able to express their natural behaviors. Natural behaviors of laying hens include:

1. Wing Flapping
2. Dust Bathing
3. Food exploration (Foraging)
4. Preening
5. Nesting
6. Perching
7. Interaction with other chickens and the environment (Interaction)

Figure 1. Wing Flapping

Figure 2. Dust Bathing

Figure 3. Foraging

Figure 4. Preening

Source: https://stock.adobe.com/

Figure 5. Nesting

Figure 6. Perching

Figure 7. Interaction

Sumber: shutterstock

This guide is designed to help farmers in four main aspects:

1. Setting up and setting up a cage-free system.
2. Monitoring the health and welfare of chickens.
3. Providing practical, farmer-friendly tips.
4. Opening new market access for cage-free egg products.

Today's consumers are increasingly concerned about ethical aspects, egg quality, and health, especially in the modern consumer and premium market. They expect products from well-treated livestock, high-quality eggs from healthy hens, and a healthy rearing environment. They also expect low environmental impact through eco-friendly and sustainable systems, as well as product choices with higher animal welfare values.

The increasng number of global companies committed to using cage-free eggs in the retail, restaurant and hotel sectors is also expected to encourage the development of cage-free egg-laying chicken farms.

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CHAPTER I INTRODUCTION

Background and Urgency of Cage-Free Systems

The poultry industry in Indonesia continues to grow in line with the growing public demand for safe, nutritious, and affordable sources of animal protein. Laying hens are a leading commodity, playing a crucial role in the national egg supply. In recent years, animal welfare issues have become a global concern, influencing the direction of policies and practices for raising laying hens, including in Indonesia.

The cage-free layer system has emerged as an alternative to conventional battery cages. In this system, hens have the freedom to express their natural behaviors, such as moving, roosting, dust bathing, and other activities. This approach is considered more favorable to animal welfare and part of sustainable food production that is socially, environmentally, and ethically responsible.

In addition to international market demand and global food corporations' commitment to cage-free eggs , this trend is also gaining ground domestically, in line with increasing consumer awareness of the origins and production methods of the food they consume. However, implementing cage-free systems at the farmer level still faces various challenges, such as limited technical knowledge, the need for larger initial investments, and health and productivity risks that require careful management.

Therefore, the development of a Guidebook for Cage-Free Laying Hen Production Systems is crucial to provide technical, practical, and standardized references for breeders, extension workers, and other stakeholders to support the effective and sustainable implementation of this system. The Directorate General of livestock and Animal Health Services has also published the 2023 Animal Welfare Guidelines for Laying Hen Farms, which can serve as a complementary reference.

1.2 Goals and Objectives of Developing the Guide

Goal

This guide is designed to

1. Provide a comprehensive understanding of the principles and practices of cage-free laying hen farming.
2. Provide technical references in the planning, construction and management of cage-free housing systems that are efficient and comply with animal welfare standards.
3. Encourage the implementation of sustainable, safe and highly competitive egg production systems.
4. Supporting government policies in improving animal welfare, food security, and the sustainability of national poultry farming businesses.

Source
instagram.com/telurayambahagia/

Target

The objective of this guide are:

1. Egg-laying chicken breeders and entrepreneurs who will develop a cage-free system.
2. Extension workers and livestock technical staff in the field.
3. Government agencies, academics, and supporting institutions involved in the development and supervision of egg-laying chicken farming businesses.

1.3 Scope of the Guide

This guide covers all stages and technical aspects of raising cage-free laying hens, including:

1. Basic principles of cage-free systems.
2. Housing.
3. Infrastructure and Facilities.
4. Maintenance Management.
5. Chicken Welfare and Health.
6. Egg Production and Quality.
7. Business Analysis and Sustainability.

This guide focuses on the implementation of indoor cage-free systems (barn and aviary systems), but also provides a general overview of the implementation of semi-free -range systems for any farm scale that allows.

1.4 Benefits for Farmers and Stakeholders

The implementation of this guide is expected to provide the following benefits:

1. For Breeders:
   a. Increase understanding of how to raise healthy, productive and prosperous chickens.
   b. Serve as a guideline in designing efficient cages and management systems.
   c. Expanding market access through value-added and highly competitive egg products.
2. For the Government and Supervising Institutions:
   a. To be a reference in the preparation of policies, training, and sustainable poultry farming development programs.
   b. Support the implementation of regulations related to animal welfare.
3. For Academics
   a. To be a reference for research development.
   b. To be a means of education for the community.
4. For Consumers and the Food Industry:
   a. Ensuring the availability of safe, quality, ethically produced eggs for consumption.
   b. Increase public trust and awareness of domestic livestock products.
   c. Improve the image and competitiveness of ethical national products and increase public trust in the global market.

1.5 Origin, Natural Behavior of Chickens, and Breeding

A. Origin and Natural Behavior of Chickens

Chicken Domesticated jungle fowl originate from jungle fowl that live freely in nature. The four main species that are their ancestors are the red jungle fowl (Gallus gallus), the gray jungle fowl (G. sonneratii), the Ceylon jungle fowl (G. lafayettii), and the green jungle fowl (G. varius). Two of these, the red jungle fowl and the green jungle fowl, live naturally in Indonesia.

Chicken domestication began when humans tamed and selected jungle fowl for food. This process resulted in the modern, highly productive laying hen, capable of producing around 350 eggs per year, significantly more than the jungle fowl, which only lay 6–10 eggs twice a year. Despite this, the jungle fowl retains its natural endurance and stable behavior.

In their natural habitat, jungle fowl live in small groups consisting of one male and several females. They actively forage in the morning and afternoon, then roost on high branches at night to avoid predators. Several basic chicken behaviors, such as roosting, nesting, exploring, and dust bathing, need to be facilitated in a cage-free system . A high and stable perch allows the chicken to rest safely.

A quiet, partially covered, and clean nest provides comfort for the chicken while laying eggs. A spacious cage area lined with rice husks or other materials is essential for foraging and dust bathing. Dust bathing is a natural behavior essential for maintaining feather hygiene and controlling parasites.

Chickens are also social animals that form hierarchical structures within groups. They recognize each other and form specific relationships within the flock. Chickens are also able to learn from each other, including identifying feeding and drinking areas, and other behaviors. In small groups, aggressive and dominant behaviors sometimes emerge. High-crowding can cause stress and trigger aggressive behavior. Therefore, it's important to regulate the number of chickens per unit area to ensure natural social interactions and prevent stress.

Understanding the origins and natural behavior of chickens is a crucial foundation for cage-free chicken management. An approach that balances productivity with welfare will produce healthy, resilient, and productive chickens. A husbandry system that facilitates natural behavior not only improves chicken welfare but also positively impacts production performance.

Understanding the evolution of jungle fowl behavior can help us understand the environments and behaviors that are important to domestic laying hens.

B. Breeding

Good breeding is the foundation for long-term welfare and productivity. By selecting hens for endurance, bone strength, feather thickness, and calm demeanor—not just egg production—farmers can reduce common health problems and support hens to live healthier, more natural lives. Valuing welfare traits equally with production traits will ensure a stronger and more sustainable flock in the future.

Figure 8. Commercial Breeding of Broiler Chickens with a Cage-Free Systemr

Sumber: stock.adobe.com

Examples of Commercial Breeds Commonly Used in Cage-Free Systems

Hy-Line Brown

Figure 9. Hy-Line Brown

Source: hyline.co.uk

A globally popular laying hen breed, especially in commercial egg production, thanks to its high egg-laying efficiency, easy management, and good adaptability to different environments.

1. Lays around 479 eggs equivalent to 29.5 kg per cycle/ Hen Housed .
2. The egg-laying period is 18–100 weeks of age
3. Average egg weight is 61.6 grams
4. 92% life span
5. Peak production 96.6%
6. Feed conference ratio (FCR) 2.19
7. Strong immunity, good disease resistance
8. Suitable for open/cage-free or free-range systems

Lohmann Brown

The brown egg-laying hen is widely used and known for its high and persistent production, calm temperament, and ease of management in a variety of climates and housing systems.

1. Lays approximately 461 eggs equivalent to 29.9 kg per cycle/ Hen Housed (with good management; higher in long cycles)
2. The egg-laying period is 18–100 weeks of age
3. Average egg weight is 64.9 grams
4. 94% life span
5. Peak production 96%
6. Feed conference ratio (FCR) 2.2
7. Good feed efficiency and strong shell quality
8. Docile, easy to handle; well trained for perching and nesting
9. Suitable for open/cage-free systems, chicken coops, or free-roaming systems.

Figure 10. Lohmann Brown

Source: Lohmann Breeder

Isa Brown

ISA The Brown is currently a popular and reliable brown egg-laying breed, known for its high production and high feed conversion efficiency. It adapts well to a variety of climates and housing systems, boasting excellent egg production consistency and strong shells.

Figure 11. Isa Brown
Source: Isa Poultry

1. Production life 18-100 weeks
2. Lays around 470 eggs (29.6 kg) per parent in 1 period
3. The average egg weight is 63 grams
4. 93% life span
5. Peak production 96.5%
6. Feed conference ratio (FCR) 2.15
7. Able to adapt well to various climates, especially hot and tropical climates.
8. Tame and likes to interact with humans.
9. Suitable for cage-free or free-range systems

Hisex Brown

HThe Hisex Brown produces high-quality eggs with strong, dark brown shells. Current Hisex chicken characteristics focus on a balance between high productivity, good egg quality, and production efficiency, which is continuously improved through an ongoing genetic breeding program.

1. Production life 18-100 weeks
2. Lays around 480 eggs (29.7 kg) per parent in 1 period
3. The average egg weight is 63 grams
4. 93% life span
5. Peak production 97%
6. Feed conference ratio (FCR) 2.13
7. Having a relatively light body weight, which has an impact on better feed efficiency because its feed requirements are lower.

Figure 12. Chicken Hisex Brown

source: Hisex

Novogen Brown

Figure 13. Chicken Novogen Brown
Source: Novogen Layers

Novogen brown has the main characteristics of a calm nature, easy to maintain from the brooding period to production, very adaptable to various environmental conditions, microclimates, and maintenance systems, ranging from modern to simple systems.

1. Production life 18-100 weeks
2. Lays about 454 eggs (29.1 kg) per parent in 1 period
3. The average egg weight is 64 grams
4. 93% life span
5. Peak production 95%
6. Feed conference ratio (FCR) 2.2

Examples of local chickens that are widely used for cage-free systems:

Sembawa Chickens

The Sembawa chicken is a very uniform breed with silver shimmering, black and white striped feathers, and the hen appears to wear a veil. This breed is characterized by a lively disposition, almost no broody behavior, and high egg production.

1. The average egg production/ Henday of Sembawa Chicken is 61.44%
2. The annual egg production of Sembawa chicken is 200-250 eggs.
3. The feed consumption for Sembawa chickens in the layer phase is 90 g/head/day.
4. The brooding nature of Sembawa Chicken is 1% of the total population
5. Peak production 75-85%
6. The first egg laying age is 20-23 weeks
7. Egg weight 35-45 grams
8. Feed conference ratio (FCR) 3.14
9. Mortality up to 8 weeks < 3%
10. Mortality of production age > 10%
11. The first parent weight is 1200-1400 grams
12. The first egg weighs 27-31 grams
13. Fertility 90-95%
14. Hatchability 85%
15. DOC weight 28-34 grams
16. The weight of a 20-week-old male Sembawa chicken is 1.4 kg ± 0.18 kg, and the female 1.1 kg ± 0.16 kg.

Figure 14 Chicken Sembawa

Source republika

KUB-1 Chicken

KUB (Kampung Unggul Balitbangtan) chickens are native chickens genetically selected for their superior productivity, feed efficiency, and disease resistance. They are suitable for both meat and egg farming.

Figure 15. Chicken KUB-1

Source: BPTP Yogyakarta

1. The average egg/ henday production of KUB chickens is 44-70%
2. The peak production of KUB Chicken is 65-70%
3. KUB Chicken egg production per year is 160-180 eggs
4. KUB Chicken feed consumption is 85-90 grams/head/day
5. Brooding trait 10% of the population
6. The first egg laying age is 22-24 weeks
7. Egg weight 36-45 grams
8. Feed conversion 3.8 kg/kg egg
9. Yellow shank color variant
10. Body weight at 10 weeks male 0.9 kg, female 0.7 kg.

Chicken KUB-2 (Janaka and Narayana)

KUB (Kampung Unggul Balitbangtan) chickens are native chickens genetically selected for their superior productivity, feed efficiency, and disease resistance. They are suitable for both meat and egg farming.

1. Average egg production/ Henday is 45-80%
2. Peak production is 70-75%
3. Egg production per year 187-212 eggs
4. Feed consumption is 90-100 grams/head/day
5. Brooding trait 5% of the population
6. The first egg laying age is 20-22 weeks
7. Egg weight 36-46 grams
8. Feed conversion 3.5 kg/kg egg
9. Yellow shank color variant
10. The body weight of KUB-2 Janaka 10 weeks male is 1.2 kg, female 0.9 kg. and the body weight of KUB-2 Narayan 10 weeks male is 1 kg, female is 0.8 kg

Figure 16. Chicken KUB-2 (Janaka)

Source: TRUBUS

Figure 17. Chicken KUB-2 (Narayana)
Source: (Trubus/Mohammad Iqbal Shukri)

CHAPTER II. BASIC PRINCIPLES OF CAGE-FREE SYSTEMS

2.1 Definition and Types of Cage-Free Systems

A cage -free layer system is a farming system in which chickens are raised without the use of battery cages or individual enclosures. In this system, chickens are kept indoors or outdoors with sufficient space to express their natural behaviors such as perching , dust bathing , nesting , and walking freely around the cage.

Figure 18. Dust bathing, perching, nesting behavior @personal collection image

Cage-free systems allow chickens to freely express their natural behaviors—roosting, nesting, dust bathing, foraging, exploring, and socializing. Scientific studies have shown that even captive-bred chickens are highly motivated to engage in these behaviors, working hard for the opportunity to do so. Good farm design ensures these behaviors are safely realized. Therefore, housing design and daily management are crucial.

Cage-free systems can be divided into several types based on the chickens' movement space and access to the outside environment, namely:

Barn System (Indoor Cage-Free)

Definition: A single-level housing system where chickens have unlimited access to the entire floor area.

1. Chickens are kept in closed buildings (barn houses) without cages.
2. The floor is generally covered with litter (wood shavings, rice husks, sawdust, or an organic mixture) with special areas for eating, drinking, laying eggs, and perching.
3. Suitable for tropical climate conditions and easily adapted by breeders with conventional cage facilities.

Figure 19. Barn system with full litter bedding

Source: Personal collection

Figure 20. Barn system with slat bedding and litter

Source: Personal collection

Key Features:

1. Single-level cage floor with complete freedom of movement within the room
2. Perch
3. Laying place
4. Food and drink place
5. Litter area
6. Slat area (perforated floor) on the slat-litter floor combination type .
7. No outdoor access (as opposed to free range)

Advantages

1. Initial investment is lower compared to chicken coops
2. Chicken management and observation is easier compared to aviary systems.
3. Good biosecurity control compared to free-range farming
4. Suitable for renovation of existing buildings
5. Reduced

Disadvantages

1. Utilization of limited vertical space
2. Higher floor space requirements per chicken
3. Potential for increased competition for chickens in cages

Aviary System *(Multi-Level Cage-Free)*

Definition: An aviary cage or aviary system is a type of cage-free, multi-level cage system designed primarily for laying hens in large-scale chicken farms.

1. Chickens are kept in multi-story buildings with several levels of perches, nests, and feeding/drinking areas.
2. This system maximizes the use of vertical space and increases the chicken population per unit floor area.
3. Better ventilation and lighting management is needed to maintain the comfort of chickens at each level.

Key Components:

1. Wide space for movement
2. Perch
3. Egg-laying place, using autonest system on industrial scale
4. Integrated feeding and drinking places at various levels
5. Litter area
6. Slat area (perforated floor) several levels/ tiers (usually 2-4 levels)
7. Ramp system for movement between levels

Figure 21. Free cage closed house

Sourcer: Isa Poultry

Advantages

1. Maximum utilization of vertical space
2. Supports natural perches at height and offers more options to chickens
3. Better air quality at upper levels
4. Higher chicken density per floor area

Disadvantages

1. Higher initial investment
2. More complex management
3. Higher risk of injury due to collision

Free-Range System (Outdoor Access)

Definition: A cage-free enclosure system that has two access areas for movement, namely indoor and outdoor .

1. Chickens are kept in cage-free pens with access to the outside to an open area (range area).
2. The outdoor area should be equipped with vegetation, shade, and a protective fence from predators.
3. This system is the highest in terms of chicken welfare, but requires large areas of land and strict biosecurity controls.

Key Features

1. Free access to the yard during the day
2. Area inside the cage
3. Perch
4. Laying place
5. Food and drink place
6. Litter area
7. Better chicken home range in areas of trees, bushes, shrubs and outdoor foraging opportunities

Advantages

1. Expressing natural behavior of exploration, foraging, and frequent dust bathing
2. Expressing environmental choices
3. Provides more space per chicken overall

Disadvantages

1. Protection from predation is necessary
2. Good biosecurity can be more difficult
3. The number of chickens that can be kept on the same land is less
4. Maintaining good quality with vegetation requires more effort

Each system has its own advantages and challenges, so the selection needs to be adjusted to climate conditions, land capacity, resources, and the livestock farmer's business goals.

2.2 Comparison with Conventional Battery Systems

The fundamental differences between cage-free and conventional battery systems can be seen in animal welfare, productivity, management, and costs. The following table provides a general comparison:

Table 1. Comparison with Conventional Battery Systems

Aspect	Conventional Battery System	Cage Free System
Cage Structure	Chickens are kept in individual cages or small, multi-story groups.	Chickens are released on the floor or a tiered area without cages.
Freedom of Movement	Limited, chickens cannot walk or flap their wings, litter bath , preening , nesting , perching.	More freedom to move, perch, bathe in litter , nest , preen , and socialize.
Animal Welfare	Low, due to natural behavioral restrictions.	High, allowing for the expression of natural behavior.
Feed Requirements	Feed requirements are lower due to the low activity in the battery.	Feed requirements are higher because the energy required is 7-12% higher for indoor and outdoor activities .
Egg Hygiene	Easier to maintain because it is not in contact with litter .	Good litter management is needed to prevent contamination.
Initial Investment	Lower for large scale.	Higher because it requires additional space and facilities.
Health Management	Easier to control individually.	More complex, the risk of disease between chickens is higher.
Consumer Perception	Neutral or less ethical from a welfare perspective.	More positive and added value in marketing.

From this comparison, cage-free systems offer improved animal welfare and ethical production values, but require better environmental management and control to maintain optimal productivity and efficiency.

2.3 Relevant Regulations and Standards

The implementation of a cage-free maintenance system needs to refer to applicable provisions and standards, both at the national and international levels.

National Regulations:

1. Law Number 18 of 2009 concerning livestock and Animal Health as amended by Law Number 41 of 2014, which mandates the protection of animal welfare in all animal livestock activities.
2. Government Regulation Number 95 of 2012 concerning Veterinary Public Health and Animal Welfare.

Technical Standards and Guidelines:

1. Indonesian National Standard (SNI) ISO 34700:2016 on animal welfare management – general requirements and guidelines for organizations in the food supply chain.

International Standards:

1. European Union Council Directive 1999/74/EC on minimum standards for the welfare of laying hens.
2. Global Animal Partnership (GAP) and Certified Humane as references for cage-free product certification .
3. ISO 34700:2016 Animal Welfare Management.

The implementation of these regulations and standards is expected to encourage laying hen farming in Indonesia towards a more ethical, productive, and sustainable system, as well as meet the demands of both domestic and global markets.

CHAPTER III. HOUSING INFRASTRUCTURE AND FACILITIES

3.1 Location Selection and Cage Layout

Site selection is the initial stage that is crucial to business success. The location must meet technical, environmental, and biosecurity requirements, including:

1. Location criteria:
   a. Far from residential areas (minimum 500 meters) to reduce odor pollution and the risk of spreading disease.
   b. Not located in a flood area, has good drainage, and is easily accessible by vehicles.
   c. Have sufficient and good quality clean water sources.
   d. There is sufficient land available for the development of pens, supporting facilities, and buffer vegetation areas.
   e. Pay attention to the dominant wind direction so that natural ventilation works well and minimizes the spread of dust or ammonia to the surrounding environment.
2. land Layout:
   a. The cages are arranged parallel or facing each other with a distance between buildings of at least 10–15 meters (as wide as the cage).
   b. The area around the cage is given a fence and vegetative barrier as a biosecurity zone.
   c. The main facilities (pens, feed barn, egg storage area, and waste area) are placed with efficient and hygienic traffic flow.

Site selection is a crucial initial factor in determining the success of a cage-free laying hen system. The right location will support chicken health, management efficiency, and biosecurity.

Suggested location criteria:

1. Far from dense settlements and sources of pollution, at least 500–1000 meters away to prevent disturbances from odors, noise, and the risk of spreading disease.
2. Easily accessible, close to sources of feed, water, and transportation for egg distribution.
3. Have a good drainage system, so that it does not become waterlogged and minimizes excess moisture.
4. Wind direction and sun exposure need to be considered; the ideal position for the cage is east-west to minimize direct sunlight exposure.
5. The land topography is flat or slightly sloping (2–5%) to facilitate the flow of liquid waste.

The layout of the cage and supporting facilities includes:

1. The main cage area for laying hens.
2. Feed warehouse, rice husk warehouse, equipment warehouse, vaccine and disinfectant medicine warehouse, and egg storage room.
3. Quarantine area and chicken health room.
4. Sanitation and biosecurity facilities (foot bath , disinfectant spray, guard post).
5. Power house and water tank .
6. Separate traffic lanes for feed, product and waste.

Good organization will facilitate workflow, maintain cleanliness, and reduce the risk of cross-contamination between areas.

3.2 Desain Kandang dan Ventilasi

Cage-free housing designs should support chicken comfort, work efficiency, and the implementation of animal welfare principles.

Cage Type

a. Closed House
1. Using a mechanical ventilation system with cooling pads and exhaust fans .
2. Suitable for hot and humid areas, as well as high chicken populations.

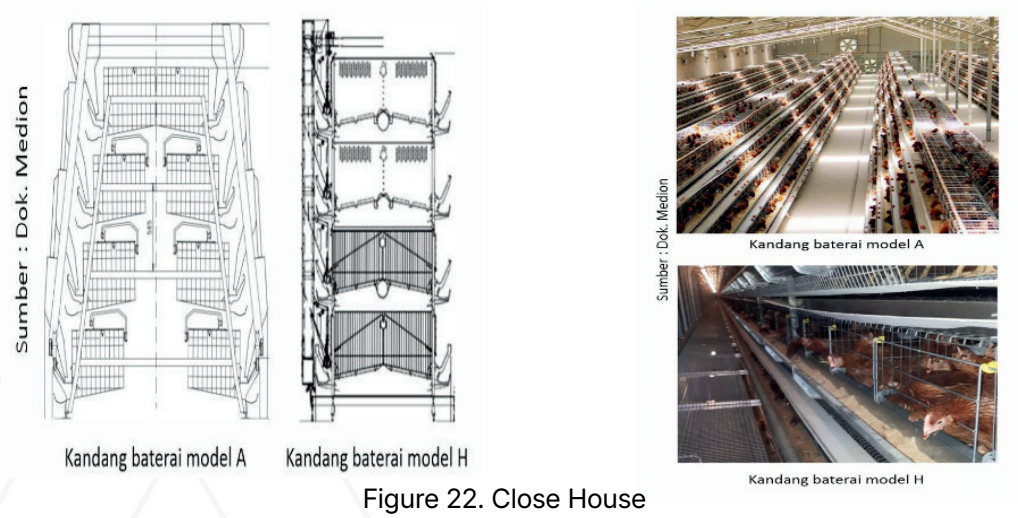


Figure 22. Close House

Source: Medion

b. Open House
1. Rely on natural ventilation or open air blowing through the side walls of wire, wiremesh, bamboo or curtains.
2. More economical and suitable for small-medium breeders.

Figure 23. Free range outdoor access

Source: wikifarmer

c. Size and Density

1. Space per bird should be at least sufficient for standing, walking, perching, and socializing.
2. The chicken density for a barn system using a full litter floor is a maximum of 7.14 chickens/m^2, barn systems that use a combination of slat-litter floors have a maximum density of 9.1 chickens/m^2 , while for aviary systems the maximum is 10–12 chickens/m^2 depending on the height and number of levels.

d. Ventilation Design

closed and open house cages must take into account cage ventilation.

1. In a closed house, the best ventilation is achieved by manipulating the climate inside the cage using exhaust fans , cooling pads , and heaters . The number of exhaust fan and cooling pad size are determined by the chicken coop's capacity. Air circulation is regulated according to the chickens' needs using a climate controller equipped with temperature and humidity sensors, ensuring the coop's temperature and humidity are maintained at all times based on predetermined set points .
2. For open house cages , the best ventilation is obtained by selecting the right location, cage dimensions, chicken density, cage direction, cage walls, and auxiliary fans if needed.
3. Ensure good air circulation to maintain a temperature of 18–27°C and humidity of 60–70%.

3.3 Cage Equipment

Housing equipment is a crucial component in supporting natural chicken behavior and ensuring efficient rearing. Housing facilities in a cage-free system should support natural chicken behavior, facilitate easy maintenance, and ensure animal welfare. Key components include:

a. Feeder

1. Designed to be easily accessible to all chickens without fighting.
2. The height is adjusted to the age of the chicken for optimal consumption.
3. An automatic system (chain feeder or nipple drinker) is recommended to maintain cleanliness and efficiency of feed and water.
4. Feeding places based on their shape are linear feeders (trough feeders /gutters, chain feeders) or round feeders (hanging feeders , pan feeders, baby chick feeders).
5. Feeder space depends on the type of equipment. Linear feeders provide 10 cm per chicken, while round feeders provide 4 cm per chicken .
6. The number of feeding equipment should be adjusted to the chicken population. Feed should be distributed evenly and according to need so that the animals can eat without competition.

Figure 24. Feeder

Source: IFA COOP

Example of Feeder Requirements :

Cage size 120 m x 12 m, population 13,000 chickens

If using a chain feeder :

Population	: 13.000 chickens
Feeder space	: 13.000 x 10 cm/chicken : 130.000 cm
Chain Feeder Requirements	: 130.000 cm / 100 / 2 sides : 650 m chain feeder dalam 1 cage

If using a Pan Feeder :

Population	: 13.000 Chickens
Feeder Space	: 4 cm/chicken
Pan Diameter	: 88/4 : 22 chicken/pan
Number of Pan/Cage	: 13.000/22 : 590 pan inside 1 cage

Figure 25. *Round feeder dan linear feeder*

b. *Drinker*

1. Chickens needs to have continuous (ad libitum) access to a clean, fresh, and adequate supply of drinking water. It's important to calculate the need for drinkers to ensure adequate water access.
2. The need for chicken drinking equipment is adjusted to the type of drinker used.
3. Drinker space several types of tools as follows:
   - Bell drinker 1 unit for every 100 chickens
   - Nipple drinker 1 unit for every 12 chickens
   - Water gutter 1.3 cm per 1 chicken
4. Make sure the height of the drinker is adjusted to the age of the chicken.
5. Drinking water quality should be checked regularly, contaminated drinking water can cause health problems.

Figure 26. Several types of drinking equipment (bell drinker, gallon drinker, nipple drinker, trough drinker)

c. Nest Box

1. A good nesting box encourages hens to lay eggs in it and not on the floor.
2. Substrates that can be moved by chickens are preferred, for example straw, wood shavings.
3. Synthetic grass or rubber mats can be used.
4. The nest boxes should be separated.
5. Make sure there are enough nest boxes, for example 1 per 5 hens to reduce egg-laying competition.
6. Turn on the light above the nest box path and turn off the light in the litter area for training purposes until 30 weeks of age to encourage the hens to climb into the area where the nest boxes are located.
7. If necessary, train the hen by taking it from the litter area every night and placing it in the roosting area.
8. Provided with a ratio of 1 nest for 4–5 hens.
9. It is designed to be comfortable, dark, and have a soft floor so that the chickens will lay eggs in the nest, not on the floor.
10. Nest boxes are important for handling eggs in the coop, securing eggs to keep them clean, hygienic, avoiding cracks /breaks, and floor eggs .
11. The base of the nest box must have a clean and soft surface, the material can be materials such as rice husks, straw, wood shavings, or plastic grass.
12. The nest box should be easy to reach and not directly exposed to bright light.
13. Individual nest box 1 hole for 4-5 chickens, while for communal nest box such as automatic nest is calculated 1 m2 ^{for} 100 chickens.
14. The number of nest boxes in the cage is provided based on the capacity of the chickens.

Example of nest box calculation :

Cage capacity 13,000 chickens
Using a manual nest type , each unit contains 24 holes .
So the requirement is: 13,000 / 24 holes / 5 birds = 108 nest box units

Nest 1 hole
for 5 Chickens

Nest 4 hole
For 20 chickens

Nest 24 hole
For 120 chickens

Automatic Nest
1 m2 for 100 chickens

d. *Perch*

1. Facilities for perching at night, according to the natural behavior of chickens.
2. Arranged at a height of ±40–60 cm from the floor and a distance between the rods of 30–40 cm.
3. Made of strong but non-slip material (e.g. wood or rough round pipe).
4. Perches are provided for chickens to rest and engage in natural behavior. Chickens naturally roost on branches at night for safety. Perches can improve muscle and bone health, reduce fear and aggression, improve litter conditions , and reduce feather pecking.
5. Perches should be non-slip and have no sharp surfaces, allow the chickens to stand comfortably, have sufficient spacing throughout the coop and be easily accessible, have a width of about 3-4 cm.
6. Can be made from round wood, bamboo, or plastic-coated iron with a diameter of ±4–5 cm.
7. Placed about 40–60 cm from the floor with a minimum length of 15–20 cm per chicken.

Figure27. Perch

Sumber: *certified humane*

Good cage design and placement will reduce stress, increase comfort, and improve egg production performance.

3.4 Lighting System

Lighting is a crucial factor in regulating the activity, growth, and egg production of chickens. Light stimulates the production of Follicle-Stimulating Hormone (FSH) and Luteinizing Hormone (LH), which are responsible for maturing and releasing eggs from the ovaries, respectively. Light can also stimulate the production of the hormone thyroxine, which plays a role in metabolism and growth in chickens. Light stimulation is useful for regulating sexual maturity , the onset of egg laying (on-set lay), and the production cycle .

a. Light intensity and Duration

1. Light intensity: 10–20 lux during production.
2. The lighting duration during the production phase is 14–16 hours per day to maintain the laying rhythm. Don't reduce the lighting duration while the hens are producing.
3. A combination of natural and artificial light can be used, with automatic control (timer).
4. Lighting in the cage can be done naturally (sunlight) or artificially (lamps).
5. Avoid sudden light fluctuations that can cause stress.
6. The artificial lighting system is set for 14–16 hours per day to ensure stable egg production.
7. Examples of lighting programs for closed houses and open houses .

Contoh program pencahayaan pada close house dan open house.

Table 2. Close House Lighting Program

Age (weeks)	Duration of Lightning (standard)	Intensity of lighting (lux)
Day 1 -2*	24	20 – 40
Day 3 – 6*	18	20 – 30
2	16	10 – 20
3	14	10 – 20
4	12	4 – 6
5	11	4 – 6
6	10	4 – 6
7	9	4 – 6
8	9	4 – 6
9	9	4 – 6
10	9	4 – 6
11	9	4 – 6
12	9	4 – 6
13	9	4 – 6
14	9	4 – 6
15	9	4 – 6
16	9	4 – 6
17	10	5 – 7
18	11	5 – 7
19	12	5 – 7
20	13	10 – 15
21	14	10 – 15
22	14	10 – 15
23	14	10 – 15
24	14	10 – 15

Table 3. Open House Lighting Program

Age (weeks)	Duration of Lightning (standard)	Intensity of lighting (lux)
Day 1 -2*	24	20 – 40
Day 3 – 6*	16	20 – 30
2	16	10 – 20
3	14	10 – 20
4	12	4 – 6
5	12	4 – 6
6	12	4 – 6
7	12	4 – 6
8	12	4 – 6
9	12	4 – 6
10	12	4 – 6
11	12	4 – 6
12	12	4 – 6
13	12	4 – 6
14	12	4 – 6
15	12	4 – 6
16	12	4 – 6
17	14	5 – 7
18	14	5 – 7
19	15	5 – 7
20	15	10 – 15
21	16	10 – 15
22	16	10 – 15
23	17	10 – 15
24	17	10 – 15

b. Colour and types of

1. Warm white LED lights (2700–3000K) are most recommended because they are efficient and close to natural light. They reduce excessive chicken activity, can reduce unwanted behavior, increase sexual arousal and production performance, and can be used for production chickens, PS Farms , and broiler chickens >2 kg.
2. Cool white type lights can increase growth during the grower /pullet period, can increase undesirable behavior, can be applied to the maintenance of pullets and broiler chickens <2kg.
3. Color Lighting

Red: Mix with white to reduce feather pecking.
Blue: Makes chickens calmer , use during vaccination or when culling.

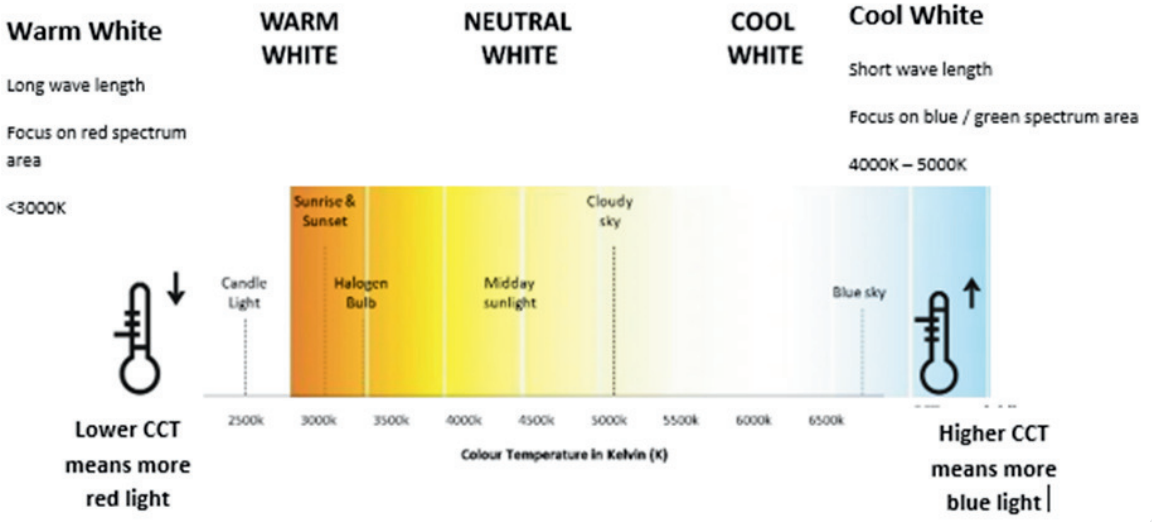


Figure 28. Lighting Program

c. Light Distribution

1. Good light distribution will improve behavior, well-being, and performance .
2. Good light distribution: The right amount of light in the right areas in the cage.
3. Overall this : Stimulates uniform feed intake and thus uniformity of chickens, Reduces pecking and mortality.
4. Prevent floor eggs .
5. Prevent chicken buildup.

Good lighting management will maintain stable egg production and reduce chicken stress.

3.5 Litter Management and Environmental Cleanliness

Litter Management

In a cage-free system, litter serves as both floor covering and a place for chickens to dust bathe. Litter quality significantly impacts egg hygiene, chicken foot health, and indoor air quality.

a. Litter Material and Thickness

1. Commonly used materials include rice husks, wood shavings, sawdust, chopped straw, sand, chopped corn stalks, or other local agricultural by-products.
2. The initial thickness is 8–10 cm, during production the thickness is 10–20 cm, additions are made periodically and the clumped or wet husks must be removed from the cage.
3. Use absorbent materials such as rice husks or wood shavings 8–10 cm thick.
4. Litter should be kept dry, mold-free, and stirred regularly to prevent excess ammonia.

b. Litter Management

1. Stir and turn the litter every few days to maintain dryness and air circulation. Add new litter material at the same time as the litter turning .
2. Keep it dry, loose, and free from clumps, with a moisture content of less than 30% to prevent mold and bacteria growth. Litter that is saturated with water and clumps due to poor management should be removed.
3. litter due to accidental flooding of the drinking bowl must be removed and replaced immediately.

4. Use dry disinfectant or bio-enzymatic powder if necessary.
5. Good litter management reduces the risk of diseases such as coccidiosis , pododermatitis , and respiratory infections, and supports the overall well-being of the chickens.
6. Litter storage must be in a clean and pest-free warehouse/room.

Environmental Hygiene

1. Clean cage equipment regularly with a safe disinfectant.
2. Make sure the area around the cage is free from puddles, accumulated feces, and leftover feed.
3. Dispose of trash in its place, use a special place for broken eggs.
4. Implement an all in–all out system to facilitate total cleaning before adding new chickens.

3.6 High Welfare Design Elements in Barn and Aviary Housing Systems

1. Perches: Perches should provide at least 15 cm of space per chicken, with the lowest perch at least 35 cm above the floor, and be approximately 3-4 cm wide. The perches should be non-slip, have a non-sharp surface, be evenly distributed throughout the coop, and allow the chickens to stand comfortably. Provide a choice of two or more types of perches, for example, different diameters, shapes, and materials.
2. Ramps (Stair Ramps): Provided to facilitate access between levels in a multi-story system, and thereby reduce the risk of collisions that could result in injuries/fractures.
3. Nesting: Hens prefer nesting substrates that they can move and manipulate with their beaks, such as long fibers like straw, or softwood shavings. Number of nest boxes box) which is sufficient to reduce competition at peak production times and the possibility of laying eggs on the floor (floor egg).
4. Floor: The floor is the primary area for chickens to move. All chickens must have sufficient freedom of movement to stand normally, turn around, and stretch their legs and wings without difficulty. The number of chickens in the coop is determined by the floor space . Different floor densities per square meter vary according to the type of coop.
5. Litter : The function of litter is to reduce the humidity of the cage, absorb the water content of feces , control harmful gases in the cage, provide an area for chickens to play, bathe in dust, provide interaction between chickens and prevent bumble foot .
6. Ventilation: Ventilation aims to regulate air circulation in the cage at all times and maintain the temperature and humidity at ideal conditions.

    a. Air circulation serves to continuously supply fresh air and remove stale air. Poor air circulation can lead to decreased oxygen levels and the accumulation of harmful gases.

b. Suboptimal ventilation can lead to the accumulation of harmful gases, which can cause respiratory problems, increased mortality, and decreased productivity. Ideally, ammonia (NH3) levels in the coop should be less than 10 ppm and should not exceed 25 ppm, oxygen (O2) above 19.6%, carbon monoxide (CO) less than 10 ppm, and carbon dioxide less than 0.3%, as measured from the height of the chicken's head.
c. High temperatures and humidity due to poor ventilation make it difficult for animals to release heat from their bodies, leading to heat stress and even death . In mild conditions, this can lead to decreased feed intake , resulting in poor body weight gain and decreased productivity. The ideal temperature for adult chickens is 18–28°C and humidity is 60–75%.

3.7 High Welfare Design Elements in Free Range Systems

Indoor Components:

1. The components are similar to the barn system
2. Has a door that provides outdoor access (pop hole)
3. Outdoor Components (grassland or land):
4. Typical area ranges: 1 m² per chicken (EU standards) to 2 m² per chicken (some organic standards)
5. Protective structures (shrubs and trees, artificial shelters)
6. Have access to water and food outdoors
7. Trees and natural shade within a 20 m radius of the indoor enclosure
8. Attractive features (dust baths, varied terrain, foraging opportunities) e.g., wind blocks, fodder/alfalfa blocks, chopped carrots, nets for chopped hay/straw or vegetables such as papaya, guava, bananas evenly distributed and rearranged/moved weekly to encourage manipulation e.g., hanging objects, CDs, stationary bale presses, ropes/string ties, round objects.

Pop Hole Specification:

1. Minimum 2 m x 45 cm, total linear length = 600 tails/m
2. Must be open at least 8 hours/day, no later than 09.00 until dusk

Tabel 4. Comparison of Cage Systems

Feature	Barn	*Aviary*	*Free Range*
Density / Stocking density (indoors)	Full litter ≤7,14 chickens/m² combination of litter and slats ≤9,1 chickens/m²	≤11,11 chickens/m²	≤9,1 chickens/m² indoors
Outdoor access	NO	NO	Yes Minimum of about 1 m² (10 square feet) per chicken
Natural behavior	Good	Very good	Very good
Perching space	Minimum 15 cm per chicken and minimum 35 cm above any floor or platform		
Nesting space	nest box 1 m² per 100-120 chickens nest box 1 hole for 5 chickens		

3.8 Management Support Facilities and Infrastructure

Cage free laying hen farming requires specially designed infrastructure and facilities to support chicken welfare, production efficiency, and ease of management. Proper planning and provision of these facilities are key to creating a safe, comfortable, and productive housing environment for the chickens.

In addition to the main enclosure, a cage-free system requires supporting facilities to ensure smooth, hygienic, and efficient maintenance. These facilities include:

a. Feed warehouse and equipment
1. Separate from the cage, well-ventilated, and protected from pests and moisture.
2. Equipped with shelves and closed containers to prevent feed contamination.

b. Egg handling and storage areas:
1. Clean, cooled (temperature ±18°C), and dry room to maintain egg quality.
2. Equipped with sorting tables, storage shelves, and a production recording system.

c. sanitation and biosecurity facilities:
1. There are footbaths, work clothes changing rooms, and separate entry and exit routes for workers and vehicles.
2. Hand washing facilities and regular disinfection are available.

d. Waste storage area:
1. Facilities for collecting and managing chicken manure and waste water.
2. Designed not to pollute the environment, for example through composting or biogas.

e. Other supporting facilities:
1. Administration office or production control post.
2. Vaccine and drug storage room with refrigerator.
3. Digital or manual recording equipment for production, health, and feed.

CHAPTER IV. MAINTENANCE MANAGEMENT

livestock management is the most important aspect of a cage-free laying hen system, as it directly impacts the welfare, productivity, and health of the hens. Cage-free systems require close attention to environmental conditions, hen behavior, and cage maintenance to maintain optimal production performance.

4.1 DOC Management to Production Period

The initial period of raising Day-Old Chicks (DOC) determines their production performance during the egg-laying period. Steps to consider include:

Brooding
DOC Handling:

1. Make sure the DOC is healthy, active, and has a uniform weight (±35–38 grams).
2. Before placing the DOC in the brooder , make sure the heater is working properly. Do pre-heating 2-4 hours before the DOC arrives at the farm to heat the room temperature to 33-34 ^{0} C (target temperature for the first day).
3. The brooder temperature is set from the first day until the heating is removed (1-21 days) at 32–34°C in the first week, then lowered by 2–3°C per week until it reaches the normal ambient temperature (26–28°C). The optimal DOC body temperature is 40–41 ^{0} C, if it is not reached, immediately evaluate the brooding heating system .
4. brooding expansion stages according to the target DOC weight starting from day 3 until full use of the cage. At the age of 0-3 days the density is 40 birds/m2 , at the age of 4-6 days the density is 30 birds/ ^{m2} , at the age of 7-9 days the density is 20 birds/ ^{m2} , at the age of 10-12 days the density is 16 birds/m2 , and at the age of 13-15 days the density is 14 birds/m2 . After the final expansion, the brooder partition is removed then adjust the population according to the size of the existing cage partition. The cage must be divided into several partitions (pen partitions) to facilitate monitoring, implementation of weight grading, implementation of vaccines, and prevent accidental chicken accumulation.

Providing food and drink :

1. Provide high-quality starter feed ad libitum .
2. Before the DOC is spread in each brooder , make sure the feeders and drinkers are filled and distributed.
3. DOC must immediately get food and drink, check the cropfill to ensure this in the first 4 hours, check the next cropfill at the 8th hour, then at the 12th hour. Make sure the DOC has received all food and drink at the third cropfill .
4. Use paperchick for the first 3 days on top of the litter , sprinkle some of the feed on top of the paperchick .
5. Drinking water must be clean, available at all times, and supplemented with vitamins or electrolytes to reduce adaptation stress.
6. The height of the drinker is adjusted to the height of the chicken to make it easier for the chicken to drink.

Rearing

1. Sensitive periods for learning about food, foraging activities , dust bathing materials, and perch use occur during the first 10 days of life.
2. Chicks exposed to a variety of stimuli in the first few days of life tend to be less afraid of foreign objects.
3. Maintaining litter quality during the rearing period is just as important as during the laying period. Studies show that insufficient litter availability in the first four weeks of life and brief interruptions in litter access during rearing can be associated with increased incidence of feather pecking in older hens.
4. Things that must be considered in this phase are density settings (brooder expansion), lighting (lighting intensity and duration), temperature (temperature set point per age), humidity, ventilation, vaccination, and litter care .

Grower Phase Maintenance

1. Perform grading to maintain uniform body weight.
2. Chickens are fed grower feed until they are 14–16 weeks old, then switched to layer feed when egg production begins.
3. Lighting is regulated gradually to stimulate egg production at 18–20 weeks of age.
4. The environment during rearing is vital for the physical, physiological and behavioral development of young chicks/ pullets .
5. Providing enrichment during the rearing period can reduce fear in both pullets and adult laying hens

Transition to adolescence (grower) and production (layer):

1. Adapt the rearing system to a similar structure to the laying cage to eliminate unnecessary stressors. Another benefit of adapting both systems is familiarity with equipment, such as water and feed systems. This means the hens can access food and water sources more quickly when placed in the laying cage.
2. Compliance with enrichment, light patterns, feeding, and schedules during the rearing and early laying periods can also reduce undesirable behaviors associated with cannibalism (injurious pecking).
3. Changes should be made gradually once the hens are completely calm and accustomed to the laying cage.

4.2 Stocking Density and Rotation System

Density and rotation systems affect chicken welfare as well as environmental cleanliness.

a. Ideal Density:
1. For a barn or floor cage-free system , provide a minimum of 7–9 chickens/m^2.
2. aviary systems , capacity can be higher because the chickens can utilize vertical space.

b. Rotation System in Free Range Chicken:
1. Implement area rotation to prevent dirt buildup and maintain litter quality .
2. If using a free-range system , ensure the outdoor area is given a rest period for vegetation recovery.

4.3 Providing Feed and Drinking Water

Feed and drinking water requirements must be adjusted to the growth phase and production level.

a. Feed:
1. Nutritional composition: protein 16–18%, calcium 3.5–4.5%, phosphorus 0.35–0.45%.
2. Provide sufficient feed with even distribution throughout the cage area.
3. Use a chain feeder or manual system according to capacity.

b. Drinking Water:
1. Use a nipple drinker or bell drinker system .
2. Water should be clear, germ-free, and at a temperature of 15–25°C.
3. Clean drains regularly to prevent biofilm and contamination.

Feed Nutrition
Chickens adjust their feed intake based on its energy content
1. Balanced diet components according to energy needs.
2. Dilute with insoluble non-starch polysaccharides (fiber) such as rice bran to increase the delivery time and improve digestive tract function (gizzard)
3. Feed supplements – use safe local by-products, but no more than 5–10% of the feed, such as rice hulls, corn husks, water ferns, oil palm fruit bunches, palm kernel meal, palm kernel, and coconut husks.
4. Provide insoluble grit separately
5. Spread whole grains in the litter area or outdoors.
6. Provide pesticide-free supplementary feed (e.g. grass, vegetables, fruits, nuts)

Providing variety in feed and feeding methods helps chickens express natural behaviors and stay satisfied.

1. Make sure food and drink containers are available at the appropriate height for each age.
2. Add foraging devices (e.g., pecking blocks)
3. Use appropriate commercial feed formulated for laying hens at every stage of production.
4. Protein: Ensure adequate protein intake to support growth and egg production. Hens raised in loose-fill systems may require more energy and protein due to their higher activity levels. Generally, 15-18 g of protein per day is recommended (highest during peak egg-laying periods, decreasing as the hen ages).
5. Calcium: Essential for strong bones and high-quality eggshells. Provide continuous access to a source of calcium (e.g., oyster shells). Ensure a proper balance of calcium and phosphorus, supported by Vitamin D for absorption. Phosphorus (~13:1 for laying hens)
6. Monitor intake: Feed intake should be monitored daily, including the amount, timing, and finish of the feed . Chickens raised in a free-range system require more feed than those raised in a barn system .

4.4 Vaccination and Biosecurity Program

Kesehatan ayam harus dijaga dengan penerapan biosekuriti yang ketat dan vaksinasi rutin.

a. Vaccination Program
1. ND (Newcastle Disease): 1st and 3rd week, repeated every 3 months
2. Coccidiosis : week 1
3. IB (Infectious Bronchitis): weeks 1 and 4
4. Gumboro: weeks 2 and 4.
5. AI (Avian Influenza): weeks 2, 6 and 16
6. Fowlpox : week 10
7. Coryza : 7th and 18th weeks
8. AE, EDS: week 17

b. Biosecurityi:
Elemen biosekuriti:
1. Isolation
2. Cleaning and Disinfection
3. Movement Restrictions

Biosecurity on farms is important to implement. Diseases can spread easily if proper biosecurity is not implemented.

Risks of Disease Spread include:

1. Staff worker traffic in the farm area.
2. Sharing equipment, vehicles, machinery, feed and husks.
3. Chicken traffic within the farm area and between one farm and another.
4. Pests can be a source of spreading disease, rats, mice, carcasses.
5. Contact with neighboring chickens approaching the farm area.
6. Contamination of river and water sources.

Steps for Implementing Biosecurity

1. Isolation
    a. separate newly arrived poultry at the farm in isolation/quarantine cages;
    b. Segregate chickens based on age (all in–all out system)
    c. separate poultry contaminated/infected with disease agents from healthy poultry

2. Footware and Clothing
    a. Gunakan pakaian kerja khusus dan footbath di setiap pintu masuk
    b. Gunakan alas kaki dan pakaian khusus untuk zona yang berbeda
    c. Celupkan kaki dengan disinfektan
    d. Ganti sepatu/pakaian saat berpindah antar zona.

3. Zone design and marking
    a. Use special work clothes and footbaths at every entrance.
    b. Use specific footwear and clothing for different zones.
    c. Dip your feet in disinfectant
    d. change shoes/clothes when moving between zones.

4. Cleaning and disinfection
    a. Ensure all vehicles are clean and disinfected upon entry.
    b. Perform regular cleaning and disinfection of the cage
    c. Keep roads, concrete runways, and play areas dry and free from mud/puddles.
    d. Regular pest/rat control; excluding chickens/wild mammals.

5. Movement restrictions
    a. have a prohibition sign in the livestock area
    b. have a fence and gate
    c. create a risk list to limit which people, objects and animals may enter the transition area or the clean area.
    d. have special clothing according to the work area
    e. have special signs/equipment labels according to the work area
    f. have special transportation equipment according to the work area
    g. Limit unnecessary visitors and vehicle movement.
    h. Limit human/visitor traffic
    i. Restrict vehicles; lock gates/put up signs/prohibition signs.

6. Vehicle entry and exit control
    a. Spraying vehicles at the entrance to the farm area and disinfectant spraying is carried out on vehicles entering and leaving the farm.

7. Employee/Guest control on the farm
    a. Poultry visits/checks are carried out starting from DOC first.
    b. Visits from healthy poultry flocks to sick poultry flocks
    c. Must use PPE & understand biosecurity protocols
    d. Guests are required to use PPE & understand biosecurity protocols
    e. There needs to be monitoring of guest activities on the farm.

8. Control of wild animals on farms
    a. Repair and close all holes that will allow mice to pass through.
    b. Set traps and rat poison
    c. Monitor for signs of wild animals (rats, snakes, birds, dogs, flies, monitor lizards, etc.)
    d. Waste disposal sites must be far away and clean.
    e. Maintain cleanliness around the cage (e.g. cleaning up spilled feed)
    f. Minimize the accumulation of unnecessary items in the area around the cage so that it does not become a nest for rats and snakes.

9. Feed & Drinking Water Quality Control

Feed Quality:

a. Feed must be checked first before entering the silo which has been cleaned and disinfected.
b. Feed transport vehicles must be disinfected when entering and leaving the farm.

Water Quality:

a. Filter installation
b. Regular water treatment: chlorination and acidification
c. pH examination (5.5-6.5), chlorine levels (< 250 mg/L), lab tests (microbiology)

4.5 Sanitation, Decontamination, and Disinfection Activities

Sanitation Activities

1. Wash your hands before and after handling sick animals using disinfectant.
2. Wear special shoes/boots when entering the cage and dip the shoes in disinfectant.
3. Use of disinfectants.
4. Wear special clothing (cattle pack) when entering the pen.
5. Use sterile equipment during quarantine measures.
6. The cage is always cleaned with disinfectant.
7. Feeding areas are always cleaned with disinfectant.
8. Drinking places are always cleaned with disinfectant.
9. Cage equipment is always cleaned with disinfectant.
10. Feed storage areas that are always cleaned regularly.
11. Cleaning from floor to roof to achieve better disinfectant efficacy.
12. Detergent to loosen organic matter on surfaces and crevices, and break down organic matter, preventing deposits from forming.
13. High pressure cleaning.
14. Eradication of rodents & other vectors.
15. Disinfection (destruction of microbes)

Decontamination

Throw away all visible material (dust, dirt) with soap/detergent, water and friction.

Disinfection

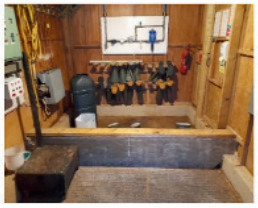
1. Destroy/kill pathogenic microbes that cause disease
2. Using chemical/physical substances in the environment, cages and equipment

STEP 1

STEP 2

STEP 3

STEP 4



STEP 5

STEP 6

STEP 7

STEP 8

4.6 Pest Control

Pest control is crucial to an effective overall biosecurity program. The most common pests found in poultry farming are rodents (mice and rats), insects, and wild birds. Eradication and control of rodent and insect pests are crucial to preventing the introduction and spread of chicken health problems.

1. Monitor for signs of wild animals (rats, snakes, birds, dogs, flies, monitor lizards, etc.)
2. Eradication of rodents and other vectors
3. Control of wild animals on farms
4. Repair and close all holes that will allow mice to pass through.
5. Set traps and rat poison

4.7 Waste Management (Manure and Litter)

Poultry waste (manure and litter) is a significant source of pathogens for both birds and humans. Litter needs to be kept dry to control ammonia levels. Litter quality significantly impacts chicken foot health, egg hygiene, and indoor air quality. The following strategic steps should be implemented:

1. Sprinkle new litter material to help keep the litter dry.
2. Make sure the cage ventilation is functioning optimally so that ammonia levels are low and the litter is not damp.
3. Discard any wet or hardened litter and refill with new litter .
4. Keeps litter from clumping and odor-free.
5. Spray with water mist if the litter is too dry or dusty to maintain humidity, but keep the litter humidity at no more than 30%.

4.8 Enrichments

One of the principles of animal welfare is providing opportunities for chickens to express their natural behaviors. Environmental enrichment helps create a positive emotional environment for chickens. Farmers should provide at least one type of object or complex structure that encourages chickens to explore and investigate. To maintain interest and prevent habituation, enrichment should be varied and changed periodically.

a. Enrichments Objectives:
1. Reduces stress and abnormal behavior such as cannibalism or feather pecking.
2. Improves exploration activity and physical health of chickens.

b. Recommended Types of Enrichments:
1. Exploratory objects such as old wheels, straw, plastic bottles, beak smoothers, or piles of wood.
2. Materials must be safe, not sharp, easy to clean, and replaced periodically.

c. Managing Enrichments:
1. Vary the shape and position of the enrichment periodically so that the chickens do not get bored (habituation).
2. Make regular observations of the chickens' responses to assess the effectiveness of enrichment.

Tabel 5. Enrichment provided vs. Cost and Labor input

Item	***Bird enjoyment***	***Cost (implementation)***	***Labor input***
Straw / lucerne / hay	*High*	*High*	*High*
*Veranda / Winter Garden **	*High*	*High*	*Low*
Artificial shelters (on range)	*High*	*Medium*	*Low*
Friable litter substrate	*High*	*Medium*	*Low / Medium*
Scattering of grit	*High*	*Medium*	*Low*
String / rope	*Medium*	*Low*	*Low*
Pecking stones / blocks / rings	*Medium*	*Medium*	*Low / Medium*
Grit in containers	*Medium*	*Low / Medium*	*Medium*
Cardboard boxes	*Medium*	*Low*	*Low*
Good litter management	*Medium*	*Low*	*Medium / High*
Hard, plastic objects	*Low*	*Low*	*Low*
Cones	*Low*	*Low*	*Low*
Plastic discs	*Low*	*Low*	*Low*

4.9 Production and Health Recording

Record keeping systems are an important tool for performance evaluation and management decision making.

a. Data that needs to be recorded:
1. Number of live chickens, daily egg production, egg weight, and feed consumption.
2. Vaccination schedule, mortality, and disease cases.
3. Environmental conditions (temperature, humidity, litter quality).

b. Purpose of recording:
1. Early detection of production or health problems.
2. Evaluate feed efficiency and management.
3. As a basis for technical and economic planning of livestock farming.

Cage-free laying hen management requires an integrated approach that encompasses technical, health, and animal welfare aspects. Implementing litter management strategies, environmental enrichment, and proper record-keeping will result in healthy, productive hens and a conducive and sustainable housing environment. Daily and weekly production and health recording forms can be found in Appendix 3.

CHAPTER V. CHICKEN WELFARE AND HEALTH

5.1 Chicken Welfare Parameters

Animal welfare is all matters related to the physical and mental condition of animals according to the standards of natural animal behavior that need to be implemented and enforced to protect animals from any person's improper treatment of animals that are used by humans. While animal health is all matters related to animal care, animal treatment, animal health services, control and prevention of animal diseases, disease prevention, reproductive medicine, conservation medicine, animal medicine and animal health equipment, and feed safety.

The implementation of animal welfare aspects in raising laying hens includes the five freedoms : freedom from thirst and hunger; freedom from discomfort; freedom from pain, injury, illness, and disease; freedom from fear and stress; and freedom to express natural behavior. Applying these principles requires a basic understanding of chicken behavior. Chickens can experience pleasure, pain, fear (stress), discomfort, hunger, thirst, illness, fear, curiosity, social emotions, and so on. Chickens also have the ability to recognize and adapt to their environment in the process of forming positive or negative mental states.

In practice, some indicators of chicken welfare in cage-free systems include:

a. Natural Behaviour:
1. Chickens actively forage, perch, dust bathe , and nest quietly.
2. Do not exhibit abnormal behavior such as feather pecking, attacking each other, or excessive restlessness.

b. Physical Condition:
1. The condition of the feathers is intact, not falling out or damaged due to pecking .
2. Feet and claws are free of wounds, swelling, or lesions due to rough floors.
3. The skin of the chest and abdomen does not have pressure sores (breast blisters).

c. Productivity:
1. Egg production is stable and according to genetic potential.
2. The feed conversion ratio to production results is within optimal limits.

Pemantauan parameter ini dilakukan secara berkala sebagai dasar evaluasi kesejahteraan ayam.

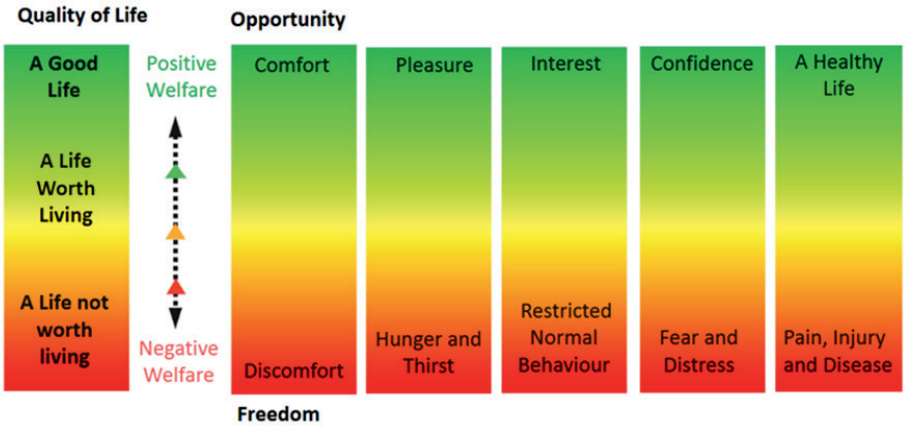


Figure 29. Quality of Life Parameter

References : Edgar JL, Mullan SM, Pritchard JC, McFarlane UJC, and Main DCJ 2013. Towards a 'good life' for farm animals: developing a resource-level framework for achieving positive welfare for laying hens. Animal 3, 1-10 http://www.mdpi.com/2076-2615/3/3/584

The main principle is to provide resources that allow the chickens to freely choose for themselves. The simple idea is that the more choices we give animals, the more opportunities they have to express their behavioral needs, which will result in a more positive experience.

1. Welfare level +
2. Welfare level ++
3. Welfare level +++

To achieve the highest "Good Life" score (+++), a farm must also meet the lower level criteria (+ and ++) to achieve the goal of having a "Good Life".

The Good Life framework checklist for self-assessment and continuous improvement can be found in the following appendix:

Appendix 1 – Feather Record Sheet
Appendix 2 – Good Life Hen Framework Checklist

Offering meaningful choices to chickens allows for increased positive behavior and welfare because:

1. Chickens will enjoy their favorite food
2. Chickens get additional pleasure through the choice itself
3. Chickens have different characteristics and do not always choose the same things to enjoy at the same time.

Tabel 6. Opportunities for welfare development

Opportunities for the development of positive well-being	Resources allocated
Comfort	• Environmental choices • Thermal options • Physical options
Pleasure	• Food choices • Cognitive enrichment • Breeding and parenting experience
Confidence	• Positive social experiences • Nesting options • Positive handling experience
Interest	• Dust bath options • Enriched outdoor environment • Enriched indoor environment
Healthy living	• Positive genetic selection • Managing everyday health and well-being • Promoting natural body types

The parameters for fulfilling complete animal welfare actually involve fulfilling the physical and mental needs required for chickens to achieve a positive or negative welfare status . To achieve a positive welfare status in cage-free laying hens, at least five aspects of animal freedom must be met, as follows:

a. Free from thirst and hunger

1. Availability of quality water and feed: availability of clean water that is suitable for drinking and free from contamination. The feed provided contains nutrients according to the nutritional needs of the chickens' growth phase and is free from contaminants (aflatoxins, fungi, and heavy metals). The feed has a ration composition/formulation that allows each chicken to achieve good health, meets the physiological needs of the chickens, and prevents disorders/malnutrition with sufficient quantity and quality.
2. Access to feed and clean water: Chickens must have easy access to feed and clean water continuously (ad libitum) . Feed and water troughs must be easily accessible and sufficient in number for the chicken population.

b. Free from pain, injury, illness and disease

Physical appearance: A healthy chicken appears to have an ideal body condition, not thin, with intact feathers, no feather loss or damage due to feather pecking . There are no wounds (breast blisters) on the chest and abdomen .

1. Foot and claw health: Cage-free chickens are at risk for conditions such as bumblefoot (inflammation of the soles of the feet) and joint injuries. Their feet should be checked regularly to ensure they can walk, stand, and move comfortably. Any foot abnormalities, such as wounds, swelling, or lesions, should be investigated immediately, as these could be due to rough flooring or dirty, damp, or watery litter .
2. Feather condition: Inspecting the condition of the feathers can reveal aggressive behavior in the chickens (pecking). Damaged or lost feathers can indicate problems within the flock or other causes.

Routine monitoring: To ensure chicken health, all chickens should be observed at least twice daily. Any chicken showing signs of illness or abnormal behavior should be addressed immediately. Chickens often experience bullying within their flock, which requires prompt action. Farms have a biosecurity program designed and implemented according to the health conditions and disease risks of each flock . Personnel responsible for health management should at least be able to recognize symptoms of illness or stress.

c. Free from discomfort and stress

1. Cage density: Chicken population density should be maintained at an appropriate level so that chickens have enough space to move freely, roost, and perform other natural activities.
2. Perches: Perches should be provided with adequate length, i.e. at least 15 cm per adult chicken, to allow the chickens to rest and perch.
3. Natural activities: The environment should allow chickens to engage in natural behaviors, such as dust -bathing , scratching, and exploring the environment.
4. Stress indicators: Stress levels can be measured physiologically, such as by measuring the heterophil/lymphocyte (H/L) ratio in a blood sample. A low H/L ratio indicates lower stress levels. Behaviors such as panting and drooping wings can also indicate heat stress.

d. Free from fear

1. Environmental enrichment : Cage -free enclosures should provide facilities that support natural behavior and reduce fear. Examples include providing hiding places, such as artificial hiding structures or cubicles. This is done to protect the chickens from predators and provide a sense of security.
2. Access to the outside environment: chickens should have access to a sheltered outside area for at least 6 hours each day, with protection from extreme weather.

e. Free to express natural behavior

1. Natural behavior: Healthy chickens actively forage, roost, dust bathe , and nest quietly. Good-behaving chickens do not exhibit abnormal behavior such as feather pecking, attacking each other, or excessive restlessness.
2. Availability of nest boxes: Farms must provide sufficient nest boxes for laying eggs, with a minimum ratio of one box for every five hens.
3. Social interaction: Chickens can interact with other chickens, rest, and eat and drink whenever they want, which supports healthy social behavior.
4. Exploratory behavior (exploring the environment): The presence of a scavenging area and sufficient space allows chickens to move and explore their environment which is important for supporting their well-being.

5.2 Animal Welfare Principles in Cage-Free Systems

Animal welfare is the primary foundation of cage-free systems. Based on the Five Freedoms principles of the World Organization for Animal Health (WOAH), laying hens must be raised in a manner that ensures:

1. Freedom from hunger and thirst – through the provision of sufficient and easily accessible food and clean water.
2. Freedom from physical discomfort – by providing a safe, dry, well-ventilated and comfortable environment.
3. Freedom from pain, injury, and disease – through proper health programs, vaccinations, and care.
4. Freedom to express natural behavior – by providing space, nests, perches, and dust bathing areas.
5. Freedom from stress and fear – with calm handling, standard population densities, and protection from predators.

In the context of a cage-free system, the application of these principles needs to be realized through:

1. Coop design that supports the natural behavior of chickens;
2. Maximum density setting (e.g. 7–9 birds/m^2 for barn systems);

3. Providing sufficient nests and perches (1 nest per 4–5 chickens, 15–20 cm perch per chicken);
4. Lighting and ventilation that maintains thermal comfort;
5. Regular monitoring of chicken behavior as an indicator of welfare.

The welfare and health of chickens are the foundation of cage -free farming systems . In this system, chickens have more freedom to behave naturally, but they are also at higher risk of social stress, physical injury, and exposure to environmental pathogens. Therefore, the implementation of planned, measured, and consistent health and welfare management is crucial to ensure chicken productivity and quality of life.

In fact, implementing animal welfare does not have to be expensive, but understanding the concept of implementing animal welfare aspects is the main key in implementing animal welfare. Animal welfare aspects are considered important today because they support the achievement of the Sustainable Development Goals (SDGs), especially points 2 (Zero Hunger), 3 (Good Health and Well-being), and 12 (Responsible Consumption and Production). This aligns with the One Health and One Welfare principles in raising laying hens that are safe, highly competitive, and sustainable.

Productivity and animal welfare may be positively correlated in production systems. However, pushing productivity too high can be detrimental to animal welfare, as McInerney (2004) explains, as shown in the following figure.

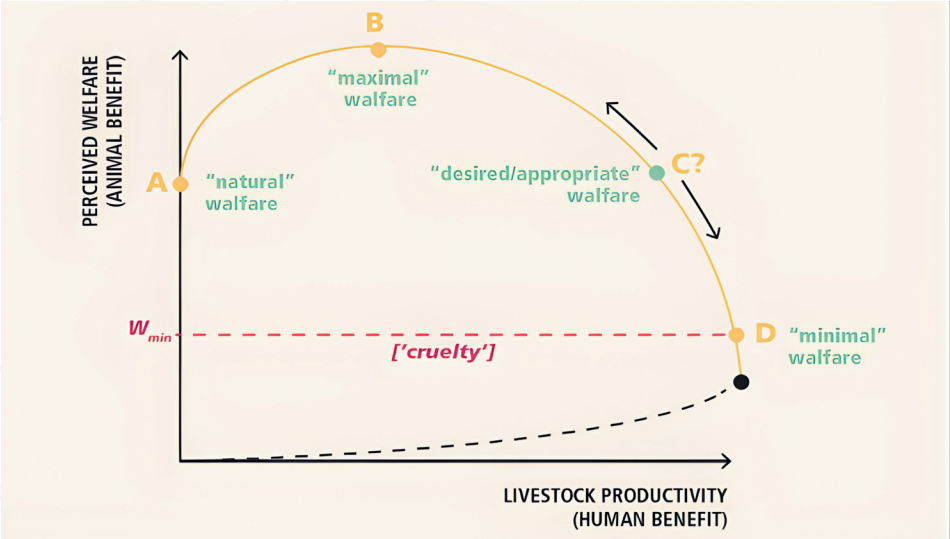


Figure 30. Graphic illustration of the relationship between animal welfare implementation and productivity. Source: ' 'Animal Welfare for Production and Working Animals : Evidence and Need for Action , FAO 2025''

Description:
A) Livestock are left to their natural state without regard for animal welfare.
B) By implementing animal welfare to the maximum, livestock productivity will be high and efficient
C) Implementing welfare that is not optimal does not have a real impact on livestock productivity.
D) Implementing animal welfare is poor.

5. 3 Welfare Fulfillment Indicators

Indicators for fulfilling welfare in cage-free chicken farming as described in the previous chapter include:

1. Aspec of fulfilling drinking water and nutritional needs

    a. Availability of feed and clean water for drinking
    b. Access to food and drink
    c. Treatment of poultry that cannot access food and drink
    d. Maintenance and cleaning of drinking water and food containers
    e. Checking the feeding system or method either manually or automatically.

2. Environmental aspects of maintenance

    a. Have an adequate location area according to the population capacity
    b. Have adequate cage facilities such as food/drink places, including: perches, egg-laying areas, and scratching areas.
    c. The facilities used are well maintained
    d. The maintenance area/pen has good air circulation, sufficient lighting, and good litter management.
    e. Protected from extreme weather disturbances
    f. Have access or openings to the environment outside the cage

3. Animal health aspects

    a. Have a disease prevention, treatment and control program
    b. Have and/or implement welfare beak trimming SOPs
    c. Have and implement strict biosecurity SOPs
    d. Have daily observation/inspection reports (flock daily recording)

4. Expression of natural behavior

    a. Birds are free to express natural behavior
    b. Immediately take corrective action on findings of poultry that cannot express natural behavior.

Indicators of success in implementing animal welfare from another perspective are:

    a. Productivity: Egg production in cage-free farming is more stable (in line with genetic potential) and can reach its maximum production age. The feed conversion ratio to production yield is within optimal limits.
    b. Product quality: The eggs produced are healthier and of better quality, with a taste that is considered different and better by some consumers.
    c. Food safety: Eggs have been tested in a laboratory to ensure quality and freedom from harmful bacteria such as Salmonella and E. coli.

5.4 Daily Observation and Monitoring

Daily monitoring is a key preventative measure in maintaining chicken health and well-being. Farm staff must understand normal chicken behavior to detect changes early.

Daily monitoring activities include:

1. Observe eating, drinking, perching, and egg-laying behavior.
2. Randomly check the physical condition of the chicken, including feathers, beak, feet, and eyes.
3. Check the temperature and humidity of the cage environment.
4. Observe the quality of the litter (dry, loose, free from high ammonia).
5. Count and record the number of chickens that are sick, dead, or showing abnormal symptoms.

The results of these daily observations form the basis for taking immediate corrective action if deviations are found.

5.5 Stress Identification and Management

Stress is the body's response to stimuli (stressors) from within the body or the environment. Prolonged stress is called distress. Causes of stress include psychological, physiological, and environmental factors. Psychological factors include separation, anxiety, boredom, loneliness, and fear. Physiological factors include injury, pain, illness, hunger, and dehydration. Environmental factors include crowded/noisy environments, chemicals, climate, food, other species, and human presence.

Stress can affect the immune system, egg production, and behavior of chickens. In cage-free systems, stress is commonly caused by overcrowding, extreme temperatures, noise, unbalanced feed, or poor social interaction.

Signs that chickens are stressed include:

1. Decreased appetite, abnormal activity.
2. Feathers stand up, chickens are restless or huddled in a corner of the cage.
3. Decreased egg production or increased eggs with thin shells.
4. Aggressive behavior, feather pecking, or cannibalism.

Stress Management Steps:

1. Ensure stable ventilation and cage temperature (18–27°C).
2. Reduce noise and traffic in the kennel area.
3. Ensure that feed and water are evenly available.
4. Provide environmental enrichment (such as rope, straw, stacked wood) to distract the chickens.
5. Isolate injured or weak chickens so they don't become targets of aggression.

5.6 Prevention of Common Diseases in Cage-Free Systems

Cage-free egg-laying systems offer a higher level of exposure to the surrounding environment. This can increase the risk of disease exposure caused by contact with dust, droppings, or wild birds. Therefore , disease prevention is the most effective approach compared to treatment, through the implementation of biosecurity, vaccination, and strict sanitation.

Common diseases to watch out for include:

- Coccidiosis (Eimeria spp.) – Can be prevented by keeping the litter dry and implementing a regular anticoccidial program.
- Avian Influenza (AI) – Monitoring of poultry movement and implementation of vaccinations according to recommendations of animal health authorities.
- Newcastle Disease (ND) – Can be prevented through routine vaccination and strict biosecurity controls.
- Infectious Bronchitis (IB) – Prevention is done by maintaining good ventilation in the cage and regular vaccination.
- Fowlpox and other skin diseases – Controlled through insect vector control and optimal equipment sanitation.
- Gumboro (Infectious Bursal Disease/IBD) – Prevention is done by vaccinating the chicken according to its age and maintaining the cleanliness of the cage and equipment to reduce the spread of the virus.
- Coryza (Infectious Coryza) – Can be prevented by maintaining cage ventilation, avoiding high density, as well as good vaccination and biosecurity to prevent transmission between chickens.
- Avian Encephalomyelitis (AE) – Prevention through vaccination of mother hens before the production period so that the chicks have passive immunity, as well as maintaining environmental cleanliness and sanitation.
- Egg Drop Syndrome (EDS) – Prevention is carried out by vaccination before the egg-laying period and maintaining the cleanliness of the cage, equipment, and water sources to ensure they are free from virus contamination.

Principles of disease control :

- Implement an all-in all-out system to break the cycle of disease transmission.
- Use separate equipment for each cage to prevent cross-contamination.
- Perform regular disinfection on the walls, floors, and all cage equipment.
- Keep drinking water clean and avoid puddles around the cage.
- Isolate sick chickens immediately to prevent the spread of the disease to the rest of the population.

Negative behavior that arises due to the failure to fulfill animal welfare aspects in poultry farming using a cage-free system includes feather loss and the emergence of pecking behavior among the flock (cannibalism).

a. Hair loss

Kondisi bulu merupakan indikator kesejahteraan utama bagi ayam betina. Kualitas bulu yang buruk dapat menandakan adanya masalah seperti:

1. Pecks painfully in flocks
2. Emphasize
3. Nutritional deficiencies
4. Inadequate environment (e.g., lack of foraging opportunities)
5. Disease
6. Injury
7. As chickens age, their feathers will also become damaged.

Memberikan ayam kesempatan untuk berperilaku alami mendukung kesehatan bulu yang lebih baik, Kesejahteraan fisik dan mental jangka panjang, dan kualitas hidup secara keseluruhan baik.

b. Pecking that injures

1. Pecking or plucking the feathers of other members of the flock
2. Abnormal behavior, usually caused by lack of opportunity to forage

Various forms of pecking behavior that cause injury include:

1. Gentle feather pecking is generally directed at the tip of the tail, causes only minor damage and rarely poses a welfare problem, but can be a sign that the flock is not having enough foraging opportunities.
2. Severe feather pecking is the use of a hard beak to peck and pull out another chicken's feathers, resulting in injury or severe feather loss. This causes the chicken to feel pain, fear, and stress.
3. Vent Pecking only targets the cloaca and usually begins when the hen comes to lay eggs.
4. Cannibalism is pecking the skin and underlying tissue of another chicken.

Risk factors for the emergence of feather pecking behavior:

1. Materials or enrichment that do not meet the chicken's needs for natural foraging behavior.

2. Even when chickens are given enough food they still have a need to scratch and peck, and will do this to other chickens if the environment does not provide enough foraging opportunities.
3. Improper feeding (inadequate nutrition, too little protein) or diet, sudden changes in diet.
4. Poor lighting. Chickens evolved to see well in dense forest conditions, and forage at dawn and dusk when the light is not too bright. Hens prefer enough light to see, but it shouldn't be too bright. Uneven lighting, with very dark and very bright areas, can cause stress.
5. Some factors that trigger stress include unexpected events such as loud noises, or certain chronic illnesses.
6. Genetics (some breeds are known to be more at risk of unhealthy pecking)

Maintaining the integrity of feathers is crucial. Feathers are crucial for regulating and maintaining proper body temperature and protecting chickens from sunburn and dust. Feather loss in chickens requires up to 40 percent additional feed to grow new feathers.

Fur care: Observing, assessing and understanding the causes of hair loss can help us develop strategies to address this problem.

1. Effective daily health and well-being management

Managing chicken welfare is not just a one-time activity, but an ongoing process that requires commitment, regular supervision, and the involvement of experts.

The principles of effective management include:

a. The stock keeper or barn attendant is directly responsible for monitoring the health and welfare of the chickens on a daily basis.
b. Chicken health and welfare plans are developed and reviewed periodically every 6 months or more frequently if necessary.
c. Incidents of injury, wound, fracture, or tissue damage must be recorded, measured, and followed up with corrective measures.
d. Conduct regular 3-monthly dialogues between the farmer, veterinarian, and/or animal welfare advisor to evaluate health conditions, management effectiveness, and welfare protocol updates.
e. Evaluation results records are kept as documentation and a basis for improving maintenance quality.

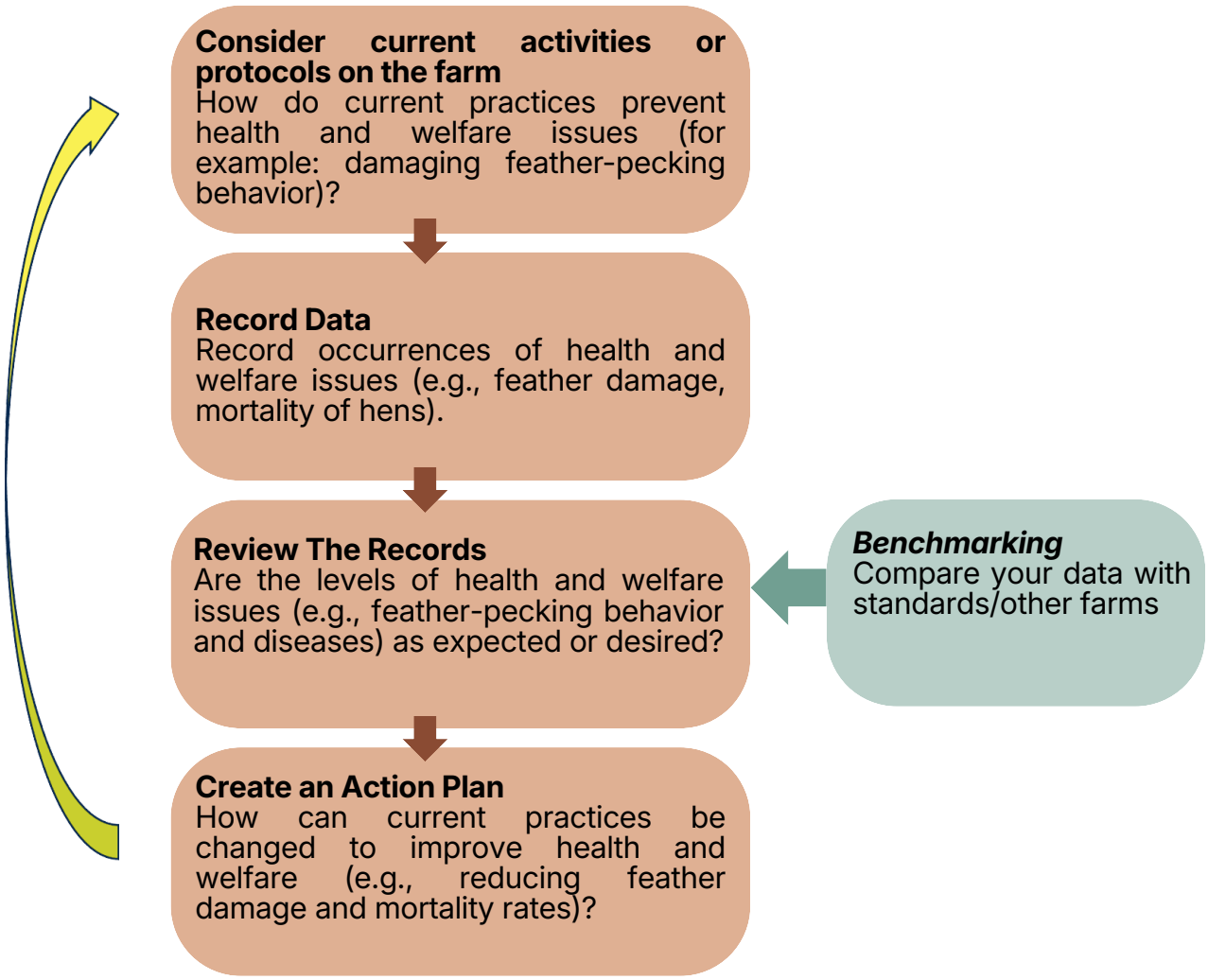
This management approach ensures that chicken welfare is the primary priority in production activities, not merely an operational complement. The well-being and health of cage-free laying hens are the result of a consistent, observation-based management system supported by robust biosecurity practices. Daily monitoring, disease prevention, and collaboration between farmers and professionals are key to achieving ethical, safe, and sustainable egg production.

2. Culling method, considering animal welfare

a. Culled chickens must still be fed and watered, do not fast them.

b. The farm manager informs customers that the trucks and chicken boxes that will be used for culling chickens must be washed first outside the farm area to prevent contamination.
c. Prepare a location that will be used for loading and weighing chickens, preferably outside the cage with a stage and canopy to protect it from heat and rain.
d. The culling is done sequentially starting from the front to the back of the cage.
e. Use a net to slowly herd the chickens so they are calmer when caught, don't make it too dense so the chickens can still access the drinking place.
f. Weigh the chickens using a sitting scale, do not use a hanging scale by hanging the chicken's legs in large numbers, this can cause leg injuries and stress.
g. Put the chicken into the box slowly, make sure the number is not too dense, then weigh the chicken and the box . Record the net weight of the chicken by means of the total weight minus the weight of the empty box .
h. Make sure the culling process takes place carefully, do not prioritize speed without paying attention to the condition of the chicken.

5.7 Informing Health and Wellbeing Planning on the Farm



Example of animal health and welfare planning

Table 7. Animal health and welfare planning

Topics	Current situation (including review of previous plans)	Plan (tasks to be done)	Date to finalize plan/review situation
Biosecurity Plan	The entrance does not yet have a vehicle disinfectant; the area around the enclosure is still open.	Install disinfectant *spray* at the entrance, add a barrier fence, and create clean/dirty zones.	
Disease management	Mild cases of ARI were found in 3 chickens; no recent vaccination records were available.	Perform ND, AI, IB vaccinations; update vaccine records; improve cage ventilation.	
Hair loss	Some chickens show feather loss due to stress or protein deficiency.	Evaluate feed and nutritional balance; add environmental enrichments to reduce stress.	
Enrichment program	Enrichment is still limited to perches and sand baths.	Add scratching areas, hanging toys, and better natural lighting.	
Other	There is no animal welfare recording system yet.	Create a monthly welfare audit format (check behavior, injuries, feed consumption, mortality).	

CHAPTER VI. EGG PRODUCTION AND QUALITY

Egg production and egg quality are the primary indicators of success in a cage-free layer management system. While the primary goal of this system is to improve chicken welfare, egg production and quality remain crucial for the farm's economic sustainability. In a cage-free system, productivity is highly dependent on livestock management, environmental conditions, chicken health, and hygienic and efficient post-harvest handling.

6.1 Factors Affecting Productivity

The productivity of cage-free laying hens is influenced by various interrelated factors including the condition of the hens, the environment, and farm management.

Internal (biological) factors:

1. Chicken genetics – Selecting a chicken strain or lines that perform well in a cage-free system is crucial, as some strains are more adaptable to high mobility and open environments.
2. Chicken age – Optimal production is usually achieved at 28–50 weeks of age, then decreases gradually.
3. Health and body condition – Healthy chickens with ideal weight have better feed conversion efficiency and egg production

External factors (environment and management)

1. Feed and water quality – Nutrient content should be appropriate for the production phase and easily digestible; deficiencies in protein, calcium, or phosphorus will reduce production and shell quality.
2. Lighting – Optimal light duration of 14–16 hours per day is required to maintain the rhythm of egg production.
3. Ventilation and cage temperature – An ideal temperature of 18–27°C and humidity of 60–70% helps chickens produce optimally and avoid heat stress.
4. Litter quality and cage cleanliness – Dry litter reduces the risk of foot disease and egg contamination.
5. Chicken density – Too high a density increases social stress and decreases productivity.

Managerial factors:

1. Consistency of feeding and lighting times.
2. Proper vaccination and health programs.
3. Implementation of good biosecurity and daily monitoring.

6.2 Post-Harvest Egg Handling

Post-harvest egg handling aims to maintain the physical and microbiological quality of the eggs until they reach the consumer. In cage-free systems, the risk of contamination is higher because hens lay eggs in open areas, making hygiene crucial.

Recommended egg handling steps:

a. Egg Collection

Laying hen eggs must be collected carefully and regularly to ensure good quality. Improper collection can result in financial losses and reduced quality. Things to consider when collecting eggs:

1. Eggs are collected at least 3–4 times a day to prevent them from breaking or getting dirty.
2. Use a clean, dry, and non-sharp container.
3. Separate dirty, cracked, or abnormal eggs.

b. Egg Cleaning:

Egg cleaning is the process of removing dirt, dust, or other foreign matter from the surface of eggs to maintain their cleanliness and quality before they are sold or used. The purpose of cleaning is to remove any contamination that may be present on the eggshell, reduce the risk of disease transmission, and ensure optimal hygiene before consumption. Cleaning can use a wire scrubber for dry cleaning methods. Cleaning with water is highly discouraged because it causes eggs to spoil quickly and also contains microorganisms that can enter the egg. Things to consider when cleaning eggs:

1. Avoid washing directly with water because it causes the eggs to become damp, which can lead to mold and bacterial contamination.
2. Eggs can simply be cleaned dry using fine sandpaper or a soft cloth.
3. If washing is necessary, use warm water (10°C warmer than the temperature of the egg) and dry immediately.

6.3 Egg Quality Standards in Cage-Free Systems

The quality of cage-free eggs is measured not only by physical aspects, but also by ethical standards and food safety. Consumers expect eggs that are clean, healthy, and come from hens raised in a fair manner.

The egg quality standards refer to the Indonesian National Standard (SNI) for consumable eggs. This standard was developed by the Veterinary Public Health Technical Committee and involved relevant stakeholders, including representatives from the government, industry, consumers, and experts.

Physical quality standards for eggs:

The quality standard for chicken eggs for consumption refers to the Indonesian National Standard (SNI) with the number SNI 3926:2023, Chicken eggs for consumption, which in English is entitled Chicken eggs for consumption , is a revision of SNI 3926:2008 Chicken eggs for consumption. This standard was prepared using its own development method and was stipulated by BSN in 2023. This standard was prepared to provide assurance of the safety and quality of chicken eggs for consumption by following the development of science, innovation and technology. The physical quality of eggs includes the condition of the shell, the condition of the air sac, the condition of the egg white, the condition of the egg yolk and the smell. The physical quality requirements for eggs as the following table :

Tabel 8. Physical quality requirements for consumption chicken eggsi

No.	Quality Factors	Quality Level		
		Quality I	Quality II	Quality III
1	Shell condition			
	a. *Shape Index* (SI)	Normal (SI 72-76)	Normal (SI 72-76)	Abnormal (SI 76)
	b. Fineness	Fine	Fine	May be a little rough
	c. Thickness	Thick	Currently	Thin
	d. Integrity	Intact	Intact	Intact
	e. Cleanliness	Clean	May have a little *stain*	May have a little *stain*
2	Air sac condition			
	a. Depth air sac	< 0.5 cm	0.5 cm – 0.9 cm	>0.9 cm
	b. Freedom move	Stay in place	May be free move	May move freely and can be formed air bubbles
3	Condition of egg white			
	a. Cleanliness	Free of foreign objects	Free of foreign objects	there may be a small amount of foreign matter
	b. Viscosity	Thick	It may be a little runny	It can be runny, the egg yolk has not been mixed with the egg white
	c. Index	0.134 – 0.175	0.092 – 0.133	0.050 – 0.091
4	Condition of egg yolk			
	a. Form	round	round	May be oval
	b. Position	in the middle	may be slightly shifted from the middle	may be a bit to the side
	c. Appearance of boundaries	unclear	quite clear	clear
	d. Cleanliness	clean	clean	clean
	e. Index	0.458 – 0.521	0.394 – 0.457	0.330 – 0.393
5	Smell	Typical	Typical	Typical

Sorting and Grading

1. Sorting

Egg sorting is the process of separating eggs based on their quality, size, and weight. The purpose of sorting is to group eggs to facilitate stock management, processing, and meet different market requirements. The sorting process allows for certain criteria and ensures that only high-quality eggs are distributed to the market. Egg sorting is divided into two types: abnormal and normal. Abnormal eggs are broken, cracked, thin-shelled, missing shells, too small, too large, wrinkled or uneven, or with many white spots. Normal eggs are physically flawless, clean, and neither too large nor too small. The standard egg weight used is 54-58 grams per egg (Ustomo, 2016). Egg sorting methods have their own criteria in livestock farming, but in this case, the standardization of egg sorting treatment is explained as follows:

- Preparation: Ensure the work area and equipment are clean and sterile before beginning the sorting process. Necessary equipment includes a work table, adequate lighting, a container or tray for collecting eggs, and sorting tools such as a sieve or weighing scale.
- Criteria Selection: Determine the sorting criteria to be used, such as size, weight, turbidity, or other visual parameters. Align these criteria with market requirements and applicable quality standards.
- Sorting Process : Carefully sort the eggs one by one. Inspect the shells for damage or cracks. Group the eggs based on predetermined criteria, such as size or weight. Eggs that do not meet the criteria can be discarded.
- Handling After Sorting : After sorting is complete, ensure that the grouped eggs are placed in appropriate containers with appropriate labels or identification marks. Ensure the eggs remain in proper condition, protected from shocks or impacts that could damage them.

2. Grading

grading is the process of grouping eggs based on quality and size. This grading is important to ensure that eggs consumed or sold meet good quality standards. Egg selection from grading based on quality is divided into two, namely internal and external. Determining the grade based on external factors includes factors such as shell cleanliness and cleanliness , shell soundness , egg size , shape , size, texture, and color . Meanwhile, determining the grade based on internal quality includes the condition of the egg white (the condition of the white), the yolk (the condition of the yolk), and the air cavity (air cell) (Widyantara and Ardani, 2017).

Egg quality can be classified into four types of quality, including AA (Very Good), A (Good), B (Quite Good), and C (Poor), where this classification is categorized based on the thickness of the egg white (Sholihin and Rohman, 2018). Based on Stewart and Abbot (1972) explaining the quality standards can be explained as follows:

Tabel 9. Quality (Grade)

No.	Quality (Grade)	Information
1.	AA Quality	The shell is clean and not broken, the shape is normal, the egg white is clear and thick, the yolk is well centered, the appearance is bright and free from damage and stains, the air space is 3 mm smaller and is arranged regularly.
2.	Quality A	The shell is clean and not broken, the shape is normal, the egg white is clear and thick, the yolk is well centered, the appearance is bright and free from damage but sometimes there are stains, the air space is 6 mm smaller and is arranged regularly.
3.	Quality B	Shell is bright, has a few stains, is not broken, the shape is sometimes abnormal, the air space is 9.5 mm or smaller, the egg white is thin and clear, the yolk is located out of the center, the appearance is less bright and there are a few stains.
4.	Quality C	There are stains on the shell of more than 25%, the shape is abnormal, the surface is cracked, the egg white is slightly cloudy, there are blood stains, the egg yolk is located outside the center, the appearance is not bright, there are no blood stains but there is germination or other stains.

Based on Indonesian National Standard (SNI) No. 3926:2008, chicken eggs for consumption are classified based on shell color and egg weight. Egg weight is divided into three groups: small (less than 50 grams), medium (50 grams to 60 grams), and large (more than 60 grams).

Indonesian farmers generally grade eggs based solely on external factors, not only because it's easier to quickly identify eggs that qualify for the market. Brown eggs generally have thicker shells than white eggs, and white eggs are smaller than brown eggs. Smaller eggs are generally from young or newly breeding mothers; these should be separated to facilitate packaging and prevent breakage and cracking.

Grading eggs based on weight can affect their market value. For example, 1 kg containing 20 or more eggs is typically sought after for business purposes or resale by collectors, compared to 1 kg containing 14-17 eggs, which is typically more sought after by individuals for personal use. The benefits of grading include:

a. Maintaining Quality: Grading helps ensure that only high-quality eggs are sold or consumed. This is essential to meeting consumer expectations for safe, high-quality products.
b. Uniformity: Grading ensures that eggs sold are of uniform size and quality. This makes it easier for consumers to use the eggs in recipes or other foods.
c. Food Safety: Grading helps reduce the risk of contamination by harmful bacteria or microorganisms that can be present in defective eggs. This contributes to better food safety.
d. Simplify packing and increase security in marketing distribution.

3. Abnormal eggs and their treatment

An abnormal egg is an egg that has abnormalities or damage to the shell or contents. This can include changes in the shape, size, structure, or composition of the egg. Abnormal eggs can have damaged shells, abnormal yolks, unusual shapes or sizes, double eggs, or unusual shells. Abnormal eggs generally do not meet the quality requirements set for sale as eggs for direct consumption. Farmers can sell abnormal eggs to the public or consume them themselves if they are still considered suitable for consumption. They must be handled separately from normal eggs, and they can be classified to determine the selling price on the market. The following is an example of the classification of abnormal eggs for sale:

Table 10. Classification of abnormal egg shapes

Classification	Types of Abnormal Forms	Price
I	Blood-stained eggs, feces, *double yolk*	Price is the same as normal eggs
II	Eggs with small damaged shells	85% of the price of normal eggs
III	Rough cracked egg	80% of the price of normal eggs
IV	Thin shell eggs	50% of the normal selling price
V	Without shell and very small	Not for sale or personal consumption

Floor egg

Floor eggs are defined as all eggs laid outside the nest. To help prevent floor eggs, special attention should be paid when pullets (young chickens) are first placed in the laying shed, and floor eggs should be collected once or twice daily. The presence of floor eggs can be anticipated early in the laying period, but by the time the hens reach peak production (peak lay), with active management strategies, the percentage of floor eggs should be less than 1%.

Storage

Egg storage requires specific methods to maintain quality until it reaches the consumer. Eggs from healthy chickens are generally sterile upon release. Egg contamination typically occurs through cracks or breaks in the eggshells of infected chickens (Muchtadi et al., 2010). Egg quality is significantly affected by storage time. The longer they are stored, the more their quality and freshness decline (Haryoto, 2010). During storage, CO2 release from the egg causes an increase in acidity, and evaporation occurs, resulting in a decrease in egg weight and egg white viscosity. During storage, the air pockets within the egg undergo changes, making the albumin thinner. Several things to consider when storing eggs:

1. Egg storage is carried out in the warehouse using an arrangement method using egg trays .
2. The ground base is given a layer of a kind of floor pallet to support the egg container, this avoids direct contact with the floor base which tends to be damp.
3. Egg storage must be sterile from the mobilization of ABK (Cage Crew), footwear must be removed and cleaned at all times.
4. The room temperature for storing eggs is 18–21°C with humidity 70–80%.
5. Avoid temperature fluctuations to prevent condensation which triggers microbial growth.
6. Eggs stored at room temperature should be sold within a maximum of 7 days.
7. Eggs stored in a cool room (15–18°C) can last up to 3 weeks.
8. In addition to cleanliness, indoor ventilation must be controlled as an exchange of air entering and leaving the room.

Recording of Harvest Results

Recording chicken egg harvest results serves as a control, evaluation, and decision-making tool in farm management, so that production remains optimal, efficient, and profitable.

1. Knowing Chicken Productivity. By recording the number of eggs each day, farmers can determine:
    - Average egg production per head per day.
    - Trend of increasing or decreasing production.
    - This data helps assess the performance of laying hens and determine whether productivity is still in accordance with age and breed standards.
2. Detect Production Problems Faster.
    - If production drops suddenly, record keeping can help identify the cause, such as disease or stress in the chickens and changes in feed, weather, or lighting.
    - Farmers can immediately take corrective action before losses become greater.
3. As a Basis for Feed Management Evaluation
    - Harvest yield records can be compared with daily feed consumption.
    - This helps calculate the Feed Conversion Ratio (FCR), which is the efficiency of feed use to produce eggs.
    - This way, farmers know whether the feed is being used optimally or needs adjustment.

4. Calculating Business Profit and Efficiency

   - Egg production data is combined with selling prices and production costs to determine net profit.
   - Can be used to prepare simple financial reports and determine sales strategies.

5. Production and Marketing Planning
   - With historical data, farmers can estimate the number of eggs that will be produced in a certain period, the best time to sell eggs (e.g. when market prices are high).
   - Helps maintain continuity of supply and relationships with buyers.

6. Supporting Managerial Decisions. Good record keeping facilitates:
   - Determining the time to cull chickens (when productivity decreases).
   - Determine the need for new seeds.
   - Set up a feeding and vaccination schedule.

7. As Evidence and Business Archives. Harvest records can serve as evidence of business performance, useful for:
   - Business financial reports.
   - Credit application to financial institutions.
   - Internal audit or training of new farmers.

Table 11. Example of daily notes with the following sample

Date (hr/mm/yr)	Chicken Population	Normal Egg Count (item)	Number of Broken Eggs (item)	Small Egg Count (item)	Large Number of Eggs (item)	Total (item)	Total Weight (kg)	Information
Etc.								

Hygienic quality and food safety standards

Table 12. Microbiological quality requirements for consumption chicken eggs

No	Types of microbial contamination	Unit	N	c	M	M
1	Total Plate Count (TLC)	cfu/g	5	2	1x103	1x105
2	Enterobacteriaceae	cfu/g	5	2	1x10 [1]	1x10 [2]
3	Salmonella spp.	Per 25 g	5	0	Negative	NA
Notes : N : the number of samples to be taken and analyzed from one lot/batch C : the number of examples of analysis results from n that may exceed m but must not exceed M to determine acceptability M : acceptable microbial limits that indicate that the handling process has met good *practices* M : maximum microbial limit NA : *Not Applicable*						

If required in trade, for additional parameters related to microbiology and chemistry

Table 13. Additional microbiological parameters

No	Parameter	Unit	N	C	m	M	Test method
1	Salmonella enteritidis	Per 25 g	5	0	Negative	NA	SNI ISO 6579-1
2	Salmonella typhimurium	Per 25 g	5	0	Negative	NA	SNI ISO 6579-1
Information :							
N	: the number of samples to be taken and analyzed from one lot/batch						
C	: the number of examples of analysis results from n that may exceed m but must not exceed M to determine acceptability						
M	: acceptable microbial limits that indicate that the handling process has met good *practices*						
M	: maximum microbial limit						
NA	: Not Applicable						

Table 14. Additional microbiological parameters

No	Parameter	Test results	Test method
1	Antibiotic residues (*penicillin* , *tetracycline* , *aminoglycosides, macrolides*)	Negative	SNI 7424

Product Labels and Identity:

1. Cage-free eggs can be labeled " Cage-Free Egg " with the farm identification and harvest date.
2. Certification from an authorized agency (e.g. Certified Cage-Free or Animal Welfare Approved) can increase sales value and consumer confidence.
3. Information on the packaging label includes:

    a. Product name;
    b. Trademark;
    c. Production date;
    d. Best before;
    e. Name and address of manufacturer;
    f. Number of grains;
    g. NKV;
    h. Animal product registration number; and
    i. Quality level.

6.4 Strategy to Maintain Production Consistency

Production consistency is a major challenge in cage-free systems due to the greater environmental and behavioral variability of chickens compared to battery cage systems. Some key strategies for maintaining production stability include:

1. Lighting management:
2. Use a stable, automatic lighting schedule, without fluctuations in intensity or duration, as light plays a direct role in the hormonal rhythm of egg production.
3. Feed and water quality:
4. Ensure a constant supply of quality feed and water. Regularly evaluate feed formulations with a nutritionist.
5. Maintenance of the cage environment:
6. Maintain stable ventilation, temperature, and humidity. Extreme fluctuations can reduce feed consumption and egg production.
7. Chicken health:
8. Conduct vaccination programs, daily monitoring, and health records to prevent production losses due to disease.
9. Stress management:
10. Avoid noise, sudden changes in routine, or overcrowding. Provide enrichment (perches, comfortable nests, exploration areas) to encourage natural chicken behavior.
11. Performance evaluation:
12. Conduct weekly analysis of production, feed consumption, and mortality data to detect problems early and take corrective action.

Egg production in a cage-free system not only demands quantitative results but also emphasizes quality and welfare values. With proper management of feed, lighting, health, and post-harvest handling, farmers can produce high-quality eggs that are safe, ethical, and desirable to modern consumers.

Consistent application of technical and hygiene standards is key to the success of this system, leading to sustainable production.

CHAPTER VII. BUSINESS ANALYSIS AND SUSTAINABILITY

Cage-free laying hen farming not only emphasizes animal welfare but also has significant economic potential and socio-environmental impacts. In the context of sustainable livestock development, this approach is part of the transformation toward responsible, ethical, and adaptive food production that meets global market demands.

The success of a cage-free system is determined by economic efficiency, marketing strategies, policy support, and the ability of farmers to maintain a balance between profitability, environmental sustainability, and the welfare of the surrounding community.

7.1 Cost and Benefit Analysis

Implementing a cage-free system requires different initial investment and operational costs than conventional (battery) systems. While the initial costs are higher, long-term benefits can be achieved through increased sales value, premium market access, and a strong business reputation.

Main cost components:

1. Initial Investments:
    a. Construction of a cage with ample space for movement and natural ventilation.
    b. Cage equipment such as food, drink, nest, perch, and automatic lighting system.
    c. Supporting facilities (feed warehouse, egg sorting room, enrichment area).

2. Operational Costs:
    a. Feed and water (higher due to increased chicken activity).
    b. Additional labor for daily monitoring, manual egg collection and environmental maintenance.
    c. Vaccination, biosecurity, and cage care.
    d. Replacement of litter and cleaning materials.

3. Management and certification fees:
   Animal welfare audits, employee training, and production documentation.

Potential Profits:

a. Higher selling price: Cage-free eggs can be sold for 20–40% more in premium markets, especially to hotels, restaurants, and urban consumers concerned about production ethics.
b. Long-term efficiency: Reduced health costs and mortality due to low stress and facilitated natural behavior of chickens.
c. Reputation and consumer trust: Products with an animal welfare label have strong appeal and increase buyer loyalty.
d. New market access: Demand from export markets or modern retail chains that have committed to sourcing cage-free eggs (e.g., global fast food brands and international retailers).

Economic Challenges:

a. The payback period is longer, generally 4–6 years.
b. Fluctuations in feed prices and labor costs.
c. The domestic market is still limited due to its price sensitivity.

Cage - Free Egg Business Analysis

Pullet (Pre-Production)

DESKRIPSI			
DOC Price	Rp	9.100	/ekor
Initial Population	Rp	10.310	ekor
End Population	Rp	10.014	ekor
End Age	Rp	18	minggu
Starter Feed Price	Rp	8.135	/kg
Grower Feed price	Rp	7.935	/kg

PARAMETER	RP	Rp /ekor
HPP		
DOC	Rp 93.821.000	Rp 9.100
Feed	Rp 522.966.484	Rp 52.224
OVK	Rp 72.258.723	Rp 7.216
TKL	Rp 25.082.786	Rp 2.505
Electricity	Rp 31.898.659	Rp 3.185
Water	Rp 10.081.580	Rp 1.007
Other	Rp 18.322.278	Rp 1.830
Total HPP (Pullet)	**Rp 774.431.510**	**Rp 77.066**

Production

DESKRIPSI		
Population	10.014	ekor
Laying Age	81	minggu
Peak of Production	96,0	%
Egg Weight	64,9	gram
Egg Mass	52,8	
FCR	2,33	
HD/HH	461	butir/ekor
Cost of Feed	Rp 6.750	per kg
Feed Intake	123	g/per ekor
Total Feed	698.386	kg
Total Production	299.608	kg
Value pre production	Rp 774.279.183	

PARAMETER	Rp	Rp/kg	%
SALES			
Cage Free Eggs	Rp 4.194.510.104	Rp 28.000	50%
Bulk Eggs	Rp 3.595.294.375	Rp 24.000	50%
Total Sales	**Rp 7.789.804.480**	**Rp 26.154**	**100%**
HPP			
Cost of Feed	Rp 4.714.108.025	Rp 15.734	60,2%
Depreciation cost of Pre Production	Rp 774.279.183	Rp 2.584	9,9%
Depletion expenses	Rp 176.768.640	Rp 590	2,3%
Cost of OVK	Rp 72.632.498	Rp 242	0,9%
Cage electricity	Rp 179.963.555	Rp 601	2,3%
Building Depreciation & equipment	Rp 89.865.449	Rp 300	1,1%
Direct Workers (cage)	Rp 357.526.074	Rp 1.193	4,6%
Direct Workers (general)	Rp 81.861.874	Rp 273	1,0%
Overhead	Rp 201.759.401	Rp 673	2,6%
Total HPP (Produksi)	**Rp 6.648.764.697**	**Rp 22.192**	**85%**
Gross Profit	**Rp 1.141.039.783**	**Rp 3.962**	**15%**
Cost of Business			
Human Resources Cost	Rp 162.020.522	Rp 541	2,1%
Marketing Cost	Rp 89.882.359	Rp 300	1,1%
Admin & General Cost	Rp 165.708.509	Rp 553	2,1%
Total Cost of Business	**Rp 417.611.391**	**Rp 1.394**	**5%**
Operating Profit	**Rp 723.428.392**	**Rp 2.568**	**10%**

7.2 Marketing Cage-Free Eggs

The economic success of cage-free farming depends heavily on the right marketing strategy. The product needs to be positioned not simply as a consumer egg, but as an **ethical and high-quality product .**

Consumers within a specific segment are willing to pay higher prices for egg products labeled with animal welfare. Research using Partial Least Squares Path Modeling (PLSPM) found that animal welfare practices positively influence willingness to pay. Willingness to pay is also determined by the implementation of animal welfare practices, which can improve egg quality and consumer satisfaction. This research suggests that consumers will appreciate the implementation of animal welfare practices in egg production in Indonesia if animal welfare practices are accompanied by improved egg quality.

1) Branding and consumer education:
   a. Use the " Cage-Free Egg " label with a narrative about chicken welfare and food safety.
   b. Promote the added value of products through social media, exhibitions, and informative packaging.

2) Potential market segment:
   a. **Modern market** - One market segment for cage-free eggs is the retail market (modern market). Eggs sold in retail markets must have a Veterinary Control Number (NKV) and be certified in accordance with statutory regulations. Modern markets have implemented government-recommended food safety standards. They also encourage their micro, small, and medium-sized enterprises (MSMEs) partners to adopt global standards for food safety and social compliance. To improve the product quality of their partners, supermarket chains are collaborating with the British Retail Consortium Global Standard (BRCGS) to provide internationally recognized training and certification for MSME supplier partners on food safety and social compliance standards in the supply chain.
   b. **Premium restaurants, hotels, cafes and supermarkets.**
   c. **Middle to upper class urban household consumers.** Increasing awareness and concern among middle- to upper-class urban consumers in large cities (Jakarta, Surabaya, Bandung, Bali) regarding food health and safety, animal ethics and welfare, and sustainable lifestyle trends.
   d. **Institutional markets** such as international schools, hospitals, and companies that implement sustainable sourcing policies .

3) Partnerships and supply chains:

One way to ensure market uptake is to build partnerships between cage-free chicken farmers and various distributors and consumers of cage-free eggs. In addition to ensuring market certainty, these partnerships also help farmers plan production and ensure the availability of cage-free egg products in the retail market (distributors) . Some possible efforts include:

1. Build partnerships with offtakers , distributors, or livestock cooperatives.
2. direct marketing models such as weekly subscriptions or online sales (e-commerce).
3. hotels, restaurants, and bakeries . Processed food producers (mayonnaise, cakes) who want to improve their sustainability image .

Furthermore, to ensure the quality of cage-free eggs, cage-free certification is also necessary . One association that carries out this certification in Indonesia is the Indonesia Cage-Free Association (ICFA), which collaborates with Humane Farm Animal Care (HFAC), an internationally recognized certification body, to implement the cage-free certification program .

cage-free farmers to obtain certification, thereby opening up wider market access.

This certification is free of charge for the first 2 (two) years, namely in the 2024-2025 period, with the following conditions:

1. The breeders have joined as members of the association.
2. Farmers have implemented a cage - free rearing system on a small to medium scale (populations under 10,000 head).
3. Farmers are willing to make improvements suggested by our team to meet HFAC standards.
4. Farmers are willing to have their livestock visited or audited.
5. Farmers are willing to pay the logistical costs required for the audit process, with costs varying depending on the farmer's location.

Some business actors in several regions include:

1. Telur ayam Bahagia in D.I. Yogyakarta
2. Rossa farm in East Java
3. Jatam Difabel MPM Muhammadiyah
4. Hans Chicken Brahrang In North Sumatera
5. Ladang berkah Tri Tunggal in East Java
6. I Nyoman Merta Cage-Free in Bali
7. PT. Cahaya Adi Surya
8. Telur Saudara in Bali
9. Temar Farm in D.I Yogyakarta
10. PT. Widodo Makmur Unggas in D.I Yogyakarta
11. Telur Gembira in Bali
12. PT. Girijaya Budiman Agro in West Java
13. PT. IPSS in West Java
14. Saung Ciwidey
15. Natu no Cage-Free egg in North Sulawesi
16. Cage-free Innovation and Welfare Hub in D.I Yogyakarta
17. Jero Farm in Bali
18. PT. Talun Indonesia Baharu in West Java
19. Sinergi Farm in East Java
20. Telur Saudara in Bali

With the existence of training and associations that support business stakeholders, marketing is made easier and partnership networks with the market are strengthened.

Pricing Strategy:
Cage-free production systems are gaining popularity in the global market due to their emphasis on animal welfare and improved egg quality. Indonesia aims to not only meet domestic demand but also compete in the international market.

The government is encouraging various training programs for local government officials and egg-laying chicken farmers. These programs encourage farmers to improve their skills in cage management, feed management, chicken health, and animal welfare standards.

This initiative not only supports scientific progress but also enables wider adoption of cage-free production systems in Indonesia and capitalizes on growing domestic and international market opportunities for cage-free eggs.

1. Use a value-based pricing approach (based on ethical values and quality).
2. Set a reasonable margin taking into account market segment and production costs.
3. Consider promotions and bundling with other products to expand market reach.

7.3 Government Program Support and Certification

The government and relevant institutions have an important role in encouraging the adoption of cage-free systems through policies, facilitation, and technical assistance.

Forms of government support:

1. Farmer development program: Training on cage-free management , animal welfare, and biosecurity.
2. Certification facilitation: Cost support or assistance to obtain animal welfare, Good Farming Practices (GFP), and food safety certification.
3. Investment incentives: Soft credit schemes, infrastructure assistance, or partnerships with state-owned enterprises and microfinance institutions.
4. Research and development: Strengthening collaboration with universities and research institutions to produce innovations in efficient cages and functional feed.

Relevant certification:

1. Certificate of Good Breeding and Cultivation Practices (Good Breeding/Farming Practice).
2. Food Safety Certificate (NKV and Product Registration).
3. Animal Welfare Certification is an example of HFAC Certification.

This certification not only increases the selling value of the product, but also becomes a prerequisite for entering modern markets and exports.

Certification and labeling:
Obtaining animal welfare, food safety, or halal certifications increases consumer confidence. The following certifications are available:

Table 15. Types of Certificationi

Types of Certification	Institution	Relevance
NKV (Veterinary Control Number)	Ministry of Agriculture of the Republic of Indonesia	Mandatory to ensure the safety of food of animal origin (*biosecurity* & *hygiene*)
Organic Food Certification (LSPO)	Organic Certification Authorities (Examples: Inofice, LeSOS)	Some *Cage-Free breeders* also take the "organic" label.
Halal (MUI)	LPPOM MUI	To ensure that feed and maintenance processes comply with halal principles.
Animal Welfare Guidelines (non-certified)	Directorate General of Animal Husbandry and Animal Health (Ministry of Agriculture Regulation No. 14/Permentan/OT.140/ 1/2017)	General guidelines for animal welfare in poultry farming, including laying hens

1. Use labels that consumers trust, including:
   - Certificate from Global Animal Partnership (GAP), Certified Humane, or Animal Welfare Indonesia (if available).
   - Add QR code to show farm transparency.

2. Product Packaging and Design.
   - Use modern, eco-friendly packaging designs that highlight the value of cage-free farming . Examples include natural colors, images of free-range chickens, and taglines like "Eggs from Happy Chickens" or "Cage-Free for a Kinder Future ."

3. Free Chicken Project (NGO): educational campaign about the welfare of laying hens

7.4 Environmental and Social Impacts

Cage-free farming contributes to sustainability not only from an economic perspective, but also in environmental and social dimensions.

a. Environmental impact:

1. Solid waste reduction: Litter can be used as organic fertilizer, improving resource cycling.
2. Natural ventilation reduces the need for electrical energy compared to a closed battery system.
3. Good litter management and drainage prevent water and soil pollution.
4. Potential integration with organic farming: Chicken waste can be used as fertilizer, while plants provide litter material .

b. Social impact:

1. Improving livestock welfare: High-value products increase income and competitiveness.
2. Local job creation: Cage-free systems require more labor for supervision, egg collection, and cage cleaning.
3. Increased public awareness: Adoption of this system encourages public education about the importance of animal welfare and responsible consumption.

c. Principle of sustainability:

Cage-free systems support the triple bottom line principle:

1. Profit (Economic profit) – increasing product value and competitiveness of farmers.
2. People (Social impact) – creating jobs and raising ethical awareness.
3. Planet (Environmental sustainability) – reducing negative impacts on nature.

a cage-free system depends heavily on the quality and competence of the staff implementing it. Compared to cage-free systems, cage-free systems require staff with more intensive observation skills and daily interaction with the flock .
re a long-term investment in ethical, healthy, and sustainable food production. While requiring higher initial costs, this approach opens new market opportunities, strengthens a business's reputation, and supports global commitments to animal welfare.

The economic success and sustainability of this system will be achieved through synergy between farmers, the government, certification bodies, and consumers in building a transparent, fair, and responsible egg supply chain.

Business Benefits & Market Demand

1. Access to new buyers: More and more retailers, hotels, restaurants, and food brands now prefer or require cage-free eggs. Farms that meet clear welfare criteria are the first to supply these eggs.
2. Early mover advantage: Farms that switch to cage-free systems now will gain a competitive advantage as local buyers, tourism operators and exporters increasingly require cage-free compliance.
3. Rising regional and global demand: Many buyers have announced cage-free schedules; supermarkets and hospitality brands are increasingly requesting housing and welfare documentation.
4. Part of the sustainability goals: Better well-being, cleaner air, and smarter coverage design (trees, windbreaks, drainage) in line with the UN Sustainable Development Goals (SDGs) and the One Health/One Well-being priorities.

Human Resources (HR) in a Cage-Free System

a cage-free system depends heavily on the quality and competence of the staff implementing it. Compared to cage-free systems, cage-free systems require staff with more intensive observation skills and daily interaction with the flock .

Table 16. HR Key Competencies and Roles

Competence Area	Description of Needs
Animal Welfare	Understand and be able to identify all natural chicken behaviors (dust bathing, roosting, nesting, foraging). Staff should be trained to look for indicators of stress or frustration, not just physical illness.
Early Health	Able to perform early detection of diseases or minor health problems (e.g. lameness, dirty coat, or minor injuries) before they spread or worsen.
Flock Management	Proficient in managing large, free-moving flocks , including encouraging chickens to use the provided facilities (nests and perches) and controlling cannibalism.
Cage Techniques	Understand the basic operation and maintenance of complex mechanical systems (e.g.: aviary systems , ventilation systems, and automatic egg collection systems).
Interpersonal Skills	Able to work in a team and communicate effectively with managers and veterinarians.

Recruitment, Training, and Development

1. Skills-Based Recruitment: Prioritize applicants who demonstrate empathy for animals, keen observational skills, and a willingness to work in a dynamic environment.

2. Initial Training (Induction Training):
   a. Includes in-depth training on the Five Freedoms and their application in cage-free housing .
   b. Practical training on how to encourage chickens to lay eggs in the nest, not on the floor (floor eggs).
   c. Training on biosecurity and sanitation specific to cage-free systems (litter management).

3. Continuous Development :
   a. refreshment program regarding Good Animal Husbandry Practices (GAHP).
   b. Special training for technical operators in maintaining and troubleshooting automatic equipment.

Staff Ratio and Workload

- **Ideal Ratio:** The recommended staffing ratio in cage-free systems is generally higher than in cage systems. The specific ratio will vary depending on the housing design (Barn vs. Aviary) and the level of automation.
- **Ratio Objective:** Ensure that each staff member has sufficient time to:
    - Cage Patrol: Regular patrols at all levels of the aviary to detect problems.
    - Floor Egg Collection : Collecting eggs that did not enter the nest on time to maintain quality and sanitation.
    - Interaction: Building flock calmness with regular interaction, which is important for reducing stress and aggressive behavior.

Emergency Planning (Emergency Plan) and Follow-up

indoor cage-free systems , an Emergency Plan is a vital component to ensure flock survival and prevent major losses.

The emergency plan must be documented, socialized, and tested periodically.

Table 17. Emergency Standard Operating Procedures (ESOP)

Types of Emergency Situations	Preventive measure	Immediate Follow Up
A. Electrical/Ventilation Failure	Provide a well-maintained and tested generator set . Provide an automatic power failure alarm that sounds outside of business hours.	Immediately switch to a backup power source. Manually open emergency doors and windows (emergency curtains) to create natural/cross ventilation. Keep the flock calm .
B. Fire	Install smoke detectors. Maintain a safe distance between cages. Provide portable fire extinguishers (APAR) in strategic locations.	Sound the alarm, immediately evacuate staff and open the coop door (if safe) to let the chicken out. Call the fire department.

Types of Emergency Situations	Preventive measure	Immediate Follow Up
C. Sudden Disease Outbreak	Implement strict biosecurity. Monitor the chickens' temperature and behavior hourly. Contact your nearest veterinarian.	Isolate the affected area. Contact a veterinarian immediately for diagnosis and emergency medical treatment (emergency vaccination/treatment). Increase disinfection.
D. Water/Feed Supply Failure	Provide adequate backup water tanks. Ensure a backup feed stock for ≥ 3 days. Check the nipple system daily.	Repair any supply damage as soon as possible. If repairs take longer, provide water and hand-feed in temporary drinking troughs and feeders.
E. Natural Disasters (Earthquakes/Floods)	Build the coop to earthquake-resistant standards. Determine evacuation routes for chickens and staff.	Move the flock to a safer, drier area. Distribute water and feed to the temporary holding area. Assess for structural damage.

Preventive and Remedial Actions

1. PSOD Training: All staff, from managers to barn workers, should receive regular training on emergency procedures, including simulation exercises (drills).
2. Chicken First Aid Kit: Have an emergency kit stocked with essential medications, a strong disinfectant, and simple medical aids (e.g., splints for lameness).
3. Emergency Contact List: Post a clear list of contacts: Veterinarian, Electricity, Fire Department, and Farm Manager.

By integrating high human resource standards and solid emergency plans, cage-free farms can ensure that animal welfare remains assured even under the most challenging operational conditions.

CHAPTER VIII. REFERENCES

1. Edgar JL, Mullan SM, Pritchard JC, McFarlane UJC and Main DCJ 2013. Towards a 'good life' for farm animals: development of a resource tier framework to achieve positive welfare for laying hens. Animal 3, 1-10 http://www.mdpi.com/2076-2615/3/3/584
2. Reference: Global Animal Partnership. 2020. GAP's Animal Welfare Pilot Standards for Laying Hens v1.1. Global Animal Partnership, May 2020. https://globalanimalpartnership.org/wp-content/uploads/2020/05/GAPs-Animal-Welfare-Pilot-Standards-for-Laying-Hens-v1.1.pdf
3. Reference: RSPCA. 2017. Welfare Standards for Laying Hens 2017. RSPCA Science Group / RSPCA, 2017.
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5. Reference: AssureWel. (nd). Feather Loss in Laying Hens. AssureWel / SRUC. http://www.assurewel.org/layinghens/featherloss.html

Appendix 1. Feather Record Sheet

Farm/Unit Name			
System Type	☐Organic ☐Free-range ☐Barn ☐Flat-deck ☐Multi-tier		
Flock Size		House ID	
Flock Age		Breed	

Assessor	
Date	
Any other comments?	

Bird	Feather Loss		Dirtiness
	Head/ Neck	Back/ Rump	
1			
2			
3			
4			
5			
6			
7			
8			
9			
10			
11			
12			
13			
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24			
25			
26			
27			
28			
29			
30			

Bird	Feather Loss		Dirtiness
	Head/ Neck	Back/ Rump	
31			
32			
33			
34			
35			
36			
37			
38			
39			
40			
41			
42			
43			
44			
45			
46			
47			
48			
49			
50			

Beak trimming
☐ Not beak trimmed
☐ Beak trimmed before 10 days of age
☐ Beak trimmed emergency
No. birds >1/3 beak removed

Aggressive behaviours (number of incidents)

No. sick/injured birds

Comments

Total scores

Head/ Neck	
0	
1	
2	

Back/ Rump	
0	
1	
2	

Dirtiness	
0	
1	
2	

Scoring guide	
Feather loss	
0 = No/Minimal	No bare skin visible, no or slight wear, only single feathers lacking
1 = Slight	Slight wear i.e. damaged feathers or more than single feathers lacking, or bare skin visible any size < 5cm maximum dimension
2 = Moderate/Severe	Bare skin visible ≥ 5cm maximum dimension
Dirtiness	
0 = Clean	The bird is clean
1 = Moderate	There is soiling on at least one part of the bird but no area ≥ 5cm maximum dimension
2 = Substantial	There is soiling on one or more parts of the bird ≥ 5cm maximum dimension

Appendix 2. Good Life Hen Framework Checklist

Catalyst Good Life Hen Framework Checklist

Hens are jungle birds that spend most of their day foraging for a variety of plant and insect foods in small familiar groups. Farmed hens have been selectively bred to produce many eggs/ year but have retained the innate behavior needs of their wild ancestors. Hens are highly motivated to walk around exploring their environment to forage for food (pecking and scratching), dustbathe, perch at height, especially at night, lay their eggs in a secluded nest area with a substrate. When hens have opportunities to perform these behaviors and their other basic needs for nutrition, thermal comfort and good health are met they will have good welfare.

Positive Welfare Opportunity for Comfort by choice of physical environment	Birds should be able to exercise individual preferences for their physical comfort at all times	Tick	Score
+Are perches of sufficient length to allow all birds to roost at the same time? Hens have a strong preference for perching at height when resting, particularly at night. Gripping suitable perches allows hens to 'lock' their legs in a comfortable resting position. There must be at least 15cm of aerial perch available per hen, which must be at least 35cm above the floor or any platform.			
+Is the litter maintained in a friable condition and at least 10cm deep? Solid floors must be covered with litter at all times. The litter should be of a substrate that is safe and non-toxic and allows dust-bathing and foraging. Examples of suitable litter include rice hulls, sawdust, wood shavings, straw, corn stalks. No more than 10% of the litter can be caked (hard-packed). Additional litter should be added as required. Hens are strongly motivated to forage and dustbathe, often in groups. The litter in a house is very important in facilitating these behaviors, especially where there is not access to a range.			
+ Is there are separate resting area and a choice of 2 or more types of suitable flooring (e.g. wood based litter, peat substitute, straw, sand)? or local agricultural waste materials			
+ Is there a choice of 2 or more types of perches e.g. different diameters, shapes and materials?			
Positive Welfare Opportunity for Comfort by choice of physical environment	Birds should be able to exercise individual preferences for their physical comfort at all times	Tick	Score
++ Is there a choice of 2 or more types of suitable flooring and choice of 2 or more types of perches?			
++ Have pullets had access to perch types and 2 or more suitable flooring types during rearing?			
+++ Is there a choice of 2 or more types of suitable flooring and a choice of 2 or more types of perches and the depth of friable litter is more than 10cm deep?			
Positive Welfare Opportunity Comfort by choice of thermal environment	Birds should be able to exercise individual preferences for their thermal comfort at all times	Tick	Score
+Do the birds have a choice of temperatures during the day within their indoor environment including protection from draughts in the			

resting/perching area? The environment shall be suitable for poultry welfare including ventilation, temperature and relative humidity, in compliance with the manual of farm management. Acceptable gas level (measured at the level of the laying hen head): Ammonia not exceeding 20 ppm. Humans can detect ammonia smells above 5ppm. If ammonia is smelt, an ammonia reading should be taken. A choice of temperature could be provided by having air flow through one part of a building (e.g. one open side), or areas in the building that have shade or sunlight.			
++ Do birds have a choice of temperatures at all times including protection from weather on the range (if applicable) e.g. shade and windbreaks? Trees or bushes are an excellent source of shade and shelter on the range, or an artificial shelter can be provided.			
+++Do birds have a choice of temperatures at all times including shade, windbreaks on range and shelter around access points e.g. pop hole roof and cover from wind and rain outside pop holes? There is a ventilation according to the climate in the area.			
Positive Welfare Opportunity Comfort by choice within environment while minimizing harms	Birds should be able to exercise individual preferences within their environment with minimum risk of harm	Tick	Score
+ Is the position of the perches safe e.g. above bird head height and less than 1m above ground, adequate lighting around perches, no flight path			
obstructions, angle between different perches at different heights less than 45 degrees?			
++ Are there resources to allow birds to safely move between levels e.g. ramps between litter and slatted area (if applicable)?			
++ Can pop holes be accessed safely if provided? Hens need to feel safe and motivated to use a range. Providing trees or other vegetation that starts close to the house helps them to feel safe. Providing pasture or other foraging opportunities, as well as dustbathing areas, increases their motivation. If the natural vegetation has been eaten then providing other forms or forage food on the tange will provide interest.			
+++ Is the incidence of injury, wound, bone injury or damage measured, recorded and corrective action taken?			
Positive Welfare Opportunity Pleasure by cognitive enrichment	Birds should be able to experience positive emotional states through cognitive enrichment	Tick	Score
+ Is at least 1 type of complex structure available on a daily basis, to stimulate birds to explore and investigate e.g.car wheels, nylon rope, straw rope, dolls, plastic water bottles, mazes, branches, evenly distributed log piles, fallen trees on range and changed every week?			
++ Is there daily access to 2 or more types of complex structures and are the structures changed every week?			

+++Do birds have daily access to 2 or more types of complex structure and learning enrichments e.g. even distribution of feeding devices and task?			
Positive Welfare Opportunity Pleasure by food choices	Birds should be able to exercise individual preferences for food and how it is obtained	Tick	Score
+ Is whole grain and/or insects scattered over the litter or set a feeding programe such as every week. If the chickens are released to walk outdoors, there will be worms in nature?			
+ If birds are fed a complete diet or supplementary food or agricultural waste, depending on by-product in the area e.g. rice husks, corn husk, water fern, palm fruit bunches, palm kernel cake, palm kernel, coconut husk, but should not exceed 5-10%			
+ Is insoluble grit provided separately?			
++ Is grit available separately and a complete diet with even whole grain scatter fed evenly or fed using a foraging device e.g. pecking block to provide interest to birds?			
++ Are feeders and drinkers provided at each level e.g. litter and tiers?			
+++ Are forage crops available (either growing or scattered) throughout the range e.g. pangola grass, brazil nuts, nuts, vegetables, and fruits for pecking. If using supplements from outside the farm, be careful about pesticides.			

+++ Is there a choice of 1 or more feeder types e.g. chain and pan feeders?			
+++ Is there a choice of heights of feeders and drinkers?			
Positive Welfare Opportunity Pleasure by breeding and nurturing experiences	Birds should be able to have positive reproductive and nurturing experiences	Tick	Score
+ Are dark brooders used for chicks?			
++ Is there a provision of adult hens for chicks and pullets?			
+++ Are chicks allowed to imprint on adult hens and be reared with the hen?			
Positive Welfare Opportunity Confidence by positive experience with stock keepers	Birds should be able to have positive experiences of people when encountered	Tick	Score
+ Are stock keepers calm (e.g. slow movements) and quiet around the birds?			
+ Are all stock keepers and contract catching teams thoroughly trained on handling and catching?			
+ Is handling by people gentle and commences from an early age (during pullet rearing phase?) or from arrival at the unit?			
+ Are stressful events e.g. stock person entering the shed pre-empted by knocking on door?			

++Do birds experience different routines on regular basis e.g. different people, number of people, different clothes and/or routes around the shed, playing the radio.			
+++ From the rearing period do stock keepers interact with the birds, particularly in the initial production period on a regular basis e.g. talking to birds, maintaining visual contact, gentle touching, feeding from hand?			
Positive Welfare Opportunity Confidence by nesting choices	Birds should be able to experience individual preferences for nest type and location	Tick	Score
+ Do nests have a floor substrate which encourages nesting behaviour? e.g. shavings, husks? Hens prefer nesting substrates that they can move around and manipulate with their beaks, for example long fibers such as straw, or soft wood shavings. Increasing the number of nestboxes, for example 1 per 5 hens reduces competition at peak laying times and the chance of floor eggs.			
+ Is there at least 1 nest box per 5 hens or if group nest boxes are used there are partitions?			
++ Are there different banks of nest boxes or different colored or different shaped nest boxes to help birds identify individual preferred nesting areas?			
+++ Are there 2 or more different nesting floor substrates used e.g. wood shavings, rice straw?			

+++ Do nest boxes have different depths of floor substrate to allow choice?			
Positive Welfare Opportunity Confidence by positive social experiences within the flock	Birds should be able to have positive social experiences within the flock	Tick	Score
+ Are all resources (food, water, enrichment) spread out evenly to avoid competition between birds?			
+ Is there a policy for removing 'pariah birds' e.g. sick, injure, aggressive behavior by removing/animal welfare principle			
++ Are there visual barriers (e.g. bales of plastic wrapped shavings) vertical panels and/or raised platforms to allow birds to avoid negative social interactions and create the perception of smaller group sizes?			
++ Are there fewer, longer pop holes rather than lots of smaller ones?			
++ Is there provision of a range of perch types?			
+++ Is sufficient space available to allow birds to avoid negative social interactions?			
+++ Are there small (approx. 100 birds or fewer) flock sizes to enable individual recognition and a stable hierarchy?			
+++ Are there cockerels within the flock or are cockerels housed separately but within sound/sight of hens?			

Positive Welfare Opportunity Interest by a positively enriched environment	Birds should have opportunities to explore and play in an enriched environment throughout their lives	Tick	Score
+ Is there at least 1 type of item provided and evenly distributed around the shed and/or range and rearranged/moved every week to encourage foraging e.g. breeze blocks, forage/lucerne blocks, chopped carrots, nets for chopped hay/straw or vegetable such as papaya, guava , banana evenly distributed and rearranged /moved weekly to encourage manipulation e.g hanging objects, CDs, stationary baler twine/string bunches, spherical objects?			
++ Are there 2 or more foraging items available to the birds and 2 or more items available to encourage manipulation?			
++ 2 foraging items and 2 manipulation items provided for pullet rearing period?			
+++ Are there 2 or more items for foraging and 2 or more for manipulation plus extra measures to interest the birds e.g. projecting televised stimuli onto walls, introducing new objects on a weekly basis?			
Positive Welfare Opportunity Interest by positive experiences of the outdoor environment	Birds should be able to have positive experiences of the outdoor environment	Tick	Score
+ Is daily access given to a well-drained range with covered structures e.g. shade and shelter panels and hedges/shribs?			

+ Are covered structures and hedges/shrubs visible from the pop holes and distributed evenly throughout the range?			
+ Do covered structures and vegetation start no further than 3 m from the pop holes?			
++ Is shelter/cover provided in the form of dense vegetation, including trees?			
++ Are there covered dustbathing opportunities e.g. roofed sandpit distributed evenly on the range?			
++ Do covered dustbathing opportunities start no further than 10m from the pop hole?			
++ Are there other animals (ruminants) using the range either at the same time as the birds or at different times?			
++ Are all resources from + and ++ tiers provided before the onset of lay?			
+++ Is there a substantial woodland/forest area (at least 25% of range area) for ranging including some mature trees (>2 years)?			
+++ Is there access to edible vegetation e.g. grass, ripe papaya, watermelon rinds, sweet potatoes either scattered or growing on the range?			
+++ Are all resources from +,++ and +++ tiers provided to birds during the rearing period or where this is not possible does the farm manager advocate for this?			

Positive welfare Opportunity Interest by dustbathing choices	Birds should be able to exercise individual perferences for dustbathing substrate and location	Tick	Score
+ Is there continuous access to sheltered access to sheltered, naturally lit areas e.g veranda or shelter, with dustbathing substrate (e.g. wood based litter, peat substitute, straw, sand, oat hulls/husks or equivalent) and sufficient drinkers?			
++ Is there sufficient lighting in the dustbathing area during all seasons and all-weather conditions? e.g. daylight simulation bulbs in winter.			
+++Is there a choice of more than 1 dustbathing substrate in the dustbathing area?			
+++ Is the dustbathing substrate friable and > 10cm deep?			
Positive welfare Opportunity Healthy Life by effective management of day to day health and welfare	Stock keepers should manage the day to day bird health and welfare	Tick	Score
+ Is a health and welfare plan implemented and reviewed frequently? i.e. every 6 months or more often.			
+ Is action taken immediately to reduce or alleviate the cause of any health and welfare problems?			
+ The routine use of medicines is not a substitute for good management - is this true?			

+ Routine procedures e.g. beak trimming are not used as a substitute for good management - is this true?			
++Is there regular dialogue i.e.every 3 months with vet and/or scheme welfare advisor?			
+++ Do farm staff take active part in welfare activities with wider benefits (e.g.member of scheme policy/management group, peer advisor,on farm welfare research)?			
Positive welfare Opportunity Healthy Life by positive genetic selection for long term health and welfare	Stock keepers should influence long term health and welfare of birds	Tick	Score
+ Does the farm manager recognize undesirable side effects of genetic selection for production efficiency and choose replacement birds to reduce/mitigate for current health and welfare problems within flock (e.g. bone fractures, feather pecking) where the farm manager has control over choice of replacements?			
+ If own replacements are not selected /bred by the unit manager is feedback given to the breeders/genetic companies/rearers which supply the chicks, as to what traits are important to the manager?			
++ Are breed/bird choices made to mitigate potential issues for future flock health and welfare valued equally to choices made for egg production and other production factors?			

+++ Are replacements chosen for long term improvement of flock health and welfare, resilience and metabolic normality, valuing these more than choices made for egg production and other production factors?			
Positive welfare Opportunity Healthy Life by promoting natural body type	Birds should be able to live a life without changing their nature	Tick	Score
+ Is beak trimming carried out on chicks no older than 24 hours, using infra-red, with anesthesia?			
++ Are the majority (>50%) of birds on the farm not beak trimmed?			
+++ There is no beak trimming of birds on the farm - is this true?			

Scoring
+ = 1 score
++ = 2 score
+++ = 3 score
Total 150 score

3 Level
+++ 101 – 150 score
++ 51 – 100 score
+ ≤ 50 score

Appendix 3. Daily and Weekly Recording Forms

Daily Recording in the Cage

Date :
Age :
Week :

Kandang	Pop.	Died	Culled	Deplesi		Feed Intake		Egg Production								FCR	weight of 30 eggs	TREATMENT					Explanations	
								Normal			Ab Nor	cracked	broken	TOTAL				Vaccine			Meds warms	Lain-lain		
	(ekor)				(%)	(gr/ek)	(kg)	(Butir)	(kg)	gr/btr	(Butir)				(%EP/HD)		(gr)	1	2	3				
Cage 1				-	0,0%	0				0,0				0	0%	0,0								
Cage 2				-	0,0%	0				0,0				0	0%	0,0								
Cage 3				-	0,0%	0				0,0				0	0%	0,0								
Cage 4				-	0,0%	0				0,0				0	0%	0,0								
Cage 5				-	0,0%	0				0,0				0	0%	0,0								
Cage 6				-	0,0%	0				0,0				0	0%	0,0								
Cage 7				-	0,0%	0				0,0				0	0%	0,0								
Cage 8				-	0,0%	0				0,0				0	0%	0,0								
Cage 9				-	0,0%	0				0,0				0	0%	0,0								
Cage 10				-	0,0%	0				0,0				0	0%	0,0								
				-	0,0%	0				0,0				0	0%	0,0								
	0	0	0	0	0,0%	0	0,0	0	0,00	0,0	0	0	0	0	0%	0,0	-							

Daily Cage Report

Date	Age (wk)	Populasi	Depletion (%)	FI (g/ek/d)	Std. FI	HD (btr)	HD (%)	Std. HD	EW (g/btr)	EM (Kg)	FCR	BW	Std. BW

Weekly Report Per Cage

Date	Age (mg)	Population (ekor)	Cum. Deplesi (%)	FI (gr/ek/hr)	HD (btr)	HD %	EW (gr/btr)	EM (kg)	FCR	BW (gram)	Uniformity (%)
	1										
	2										
	3										
	4										
	5										
	s.d 100										

Directorate General of Livestock and Animal Health
Ministry of Agriculture of the Republic of Indonesia