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Analytical Study on The Use of Biosecurity Systems in Chicken Farming to Prevent Disease

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ABSTRACT

Objective: *This research aims to analyze the implementation of biosecurity systems in chicken farms and provide strategies to improve their effectiveness. The goal is to support a safer, more productive, and sustainable farming ecosystem while reducing the risk of disease outbreaks that could threaten the livestock sector.* ***Method:*** *A qualitative approach was used with library research or literature study as the primary method. Data sources were collected from scientific journal articles and research reports to gain a comprehensive understanding of biosecurity practices in chicken farming.* ***Results:*** *The study found that the application of biosecurity systems in chicken farms varies based on farm size, with large-scale farms demonstrating better implementation due to greater resources, knowledge, and technical support. Effective strategies for improving biosecurity include training programs for farmers, providing adequate facilities, financial assistance, and supervision. However, small-scale farms face significant challenges, including limited funds, lack of knowledge, inadequate facilities, and resistance to change, which hinder optimal biosecurity implementation.* ***Novelty:*** *This study highlights the importance of a collaborative approach involving farmers, governments, and stakeholders to improve biosecurity practices. It also emphasizes the need for tailored strategies that address the unique challenges faced by small-scale farms, offering actionable solutions to enhance sustainability and disease prevention in the poultry industry.*

INTRODUCTION

The use of biosecurity systems in chicken farming is a crucial aspect in preventing the spread of diseases that can have negative impacts on animal and human health. Biosecurity includes a series of measures and practices designed to prevent the introduction of pathogens into poultry populations, as well as control the spread of disease among individuals and populations. In this context, it is important to analyze how the application of biosecurity can reduce the risk of disease, as well as the challenges faced in its implementation.

One study showed that the implementation of strict biosecurity measures can significantly reduce the risk of infectious diseases, such as avian influenza and Newcastle disease, which are serious threats to the poultry industry [1], [2]. In a study conducted in Egypt, Fasina et al. emphasized the importance of biosecurity in an interconnected poultry farm network, where biosecurity measures at the farm and community levels are essential for disease prevention and control [3]. This shows that biosecurity not only functions at the individual level, but also at the community level, strengthening protection against the spread of disease.

Furthermore, Ornelas-Eusebio et al. identified that stricter biosecurity practices were implemented in broiler farms compared to layer farms, indicating variation in biosecurity implementation by farm type [4]. The study also noted that farms

implementing stricter biosecurity protocols tended to have lower infection rates, supporting the argument that good biosecurity can contribute to better animal health and higher production yields [5].

However, challenges in implementing biosecurity remain. In Nepal, Poudel et al. reported that poor biosecurity practices and indiscriminate use of antibiotics hinder disease control efforts [6], [7]. This suggests that although biosecurity has great potential to prevent disease, lack of compliance with biosecurity procedures can be a major barrier. Additionally, research in the Philippines shows that approximately 60% of broiler farms receive shipments of chicks several times a year, which increases the risk of introducing new diseases [8]. This indicates the need to implement more stringent biosecurity measures, especially in the context of the introduction of new animals into existing populations.

In a broader context, biosecurity also plays a role in controlling zoonotic diseases, which can be transmitted from animals to humans. Research by Tanquilut et al. shows that good biosecurity practices can reduce the risk of transmission of zoonotic diseases such as Salmonella and Campylobacter, which are often associated with poultry products [1], [9]. Thus, biosecurity not only protects animal health, but also public health as a whole.

The importance of biosecurity was also emphasized in research conducted in Ghana, where biosecurity was recognized as a vital step in controlling highly pathogenic avian influenza [2]. This study shows that implementing effective biosecurity measures can reduce the risk of introducing other infectious diseases into poultry populations. This shows that biosecurity should be viewed as an integral part of animal health management.

However, despite awareness of the importance of biosecurity, many farms still struggle to implement the necessary practices. Lestari et al. noted that adoption of biosecurity measures among smallholder farmers is often inadequate, which can lead to increased disease risk [10]. This study shows that there is an urgent need to increase awareness and education about biosecurity practices among livestock farmers, especially in areas with low levels of knowledge about disease risks.

In this case, education and training are key to improving the implementation of biosecurity. Research by Tilli et al. showed that compliance with biosecurity measures can contribute to reduced antibiotic use in poultry farms, which in turn can reduce the development of antibiotic resistance [11]. This shows that good biosecurity is not only beneficial for animal health, but also for public health and the environment.

Thus, the analysis of the use of biosecurity systems in chicken farming shows that despite the challenges in their implementation, effective biosecurity measures can significantly reduce the risk of disease and improve animal health. Therefore, it is important for stakeholders in the livestock industry to continue to invest in good biosecurity practices, as well as increase education and awareness among farmers to ensure success in disease prevention.

RESEARCH METHOD

This research uses a qualitative approach with the type of library research or literature study. This method aims to analyze the use of biosecurity systems in chicken farming to prevent disease based on relevant literature, such as scientific journal articles, research reports and other credible documents. This research also focuses on collecting and analyzing data from library sources without conducting direct observations in the field. This method was chosen because it allows researchers to understand the concepts, strategies, and constraints of implementing a biosecurity system through data that is already available from various literature.

The data sources in this study consist of: 1). Scientific journal articles discussing biosecurity systems, their application in chicken farming, and their impact on disease prevention and 2). Research reports from academic institutions, animal health organizations, or related government agencies. Data is taken from reliable sources, such as indexed journals, university repositories, and official reports.

Data collection techniques are carried out through documentation. Researchers identify, collect, and review literature relevant to the research topic. This process includes searching for journal articles and research reports through online platforms, digital libraries, and other valid sources.

The data analysis technique obtained was analyzed using the content analysis method. This process involves: 1). Identifying key themes, such as the level of biosecurity implementation, strategies for increasing effectiveness, and obstacles faced by farmers. 2). Organizing data based on categories that are in accordance with the research objectives and 3). Analyzing patterns, relationships, and key findings from the literature to answer research questions.

Data validity testing techniques are guaranteed through: 1). Source triangulation, which is comparing data from various journal articles and research reports to ensure consistency and validity of information. 2). *Peer review,* which is asking for input from colleagues or experts in the field of animal husbandry or animal health to validate research findings and 3). Audit trail, which is recording the entire process of data collection, analysis, and interpretation systematically to ensure research transparency.

Thus, this research method provides a strong basis for gaining a comprehensive understanding of the use of biosecurity systems in chicken farming, including the level of implementation, improvement strategies, and constraints encountered. This approach also allows researchers to formulate recommendations based on reliable and relevant literature

RESULTS AND DISCUSSION

A. Level of Implementation of Biosecurity Systems in Chicken Farming to Prevent Disease

The results of the study showed that the level of implementation of biosecurity systems in chicken farming varies greatly depending on the scale of the farming business,

the level of knowledge of farmers, and the availability of resources. Large-scale farms generally have better implementation rates because they have the resources to implement comprehensive biosecurity measures, such as strict controls on entry, environmental sanitation, and the use of personal protective equipment (PPE) for workers.

However, in small and medium-scale farms, the implementation rate tends to be lower. Many farmers do not fully understand the importance of biosecurity, so they often ignore basic procedures, such as regular disinfection of pens or strict control of animal and human movement in the farm area. Limited knowledge, coupled with minimal training, are the main factors influencing low levels of implementation.

Implementing a biosecurity system in chicken farming is a crucial step to prevent the spread of disease which can result in economic and animal health losses. Biosecurity includes a variety of practices designed to reduce the risk of infection and spread of pathogens on and off the farm. Research shows that a good level of biosecurity implementation can increase chicken productivity, as expressed by Haqiqi et al. who found a positive relationship between biosecurity implementation and laying hen productivity in Jember Regency [12]. This study used quantitative descriptive methods and direct observation, which showed that farmers who implement good biosecurity tend to have better production results.

One important aspect of biosecurity is farmer education and knowledge regarding appropriate practices. Astuti showed that the level of education of farmers has a significant influence on their knowledge of biosecurity [13]. Good knowledge of biosecurity enables farmers to identify and implement effective preventive measures, such as maintaining clean pens and carrying out regular vaccinations. Pratama also emphasized the importance of farmer knowledge in implementing biosecurity in quail farms, indicating that increased knowledge can contribute to better biosecurity practices [14].

On the other hand, Sandriya reported that the implementation of biosecurity in Palangka Raya City was quite adequate, but still needed to be improved to prevent the entry of diseases [15]. This shows that although some steps have been taken, there is still room for improvement in the implementation of biosecurity. The implementation of stricter biosecurity measures, such as the use of special footwear and physical barriers in the farm area, can help reduce the risk of infection, as stated by Smith et al. who found that certain biosecurity measures were associated with a decrease in the prevalence of Campylobacter in broiler farms [16].

Expert systems can also play a role in improving biosecurity implementation. Sare explained that technology can help in the diagnosis of diseases in broiler chickens, which in turn can improve animal health management and biosecurity implementation [17]. By using a web-based system, farmers can quickly get information about diseases and preventive measures that must be taken. This is important given that the disease can spread rapidly among chicken populations, and a quick response can prevent a larger outbreak.

The importance of biosecurity is also seen in the context of public health. Newell et al. highlighted that biosecurity-based interventions can reduce the risk of zoonotic infections, which can be transmitted from animals to humans [18]. Therefore, the implementation of biosecurity is not only beneficial for animal health, but also for human health as a whole. In this context, continuing education for farmers and farm staff is essential to ensure that biosecurity practices are consistently followed.

In addition, environmental factors also play a role in the implementation of biosecurity. Ismael et al. showed that the risk of infection may increase with the presence of pathogens transmitted vertically from parent to chick, indicating the need for strict biosecurity in hatcheries [19]. This shows that biosecurity should be applied not only on the farm, but also at all stages of production, including the hatchery and transportation. Thus, a holistic approach to biosecurity is necessary to reduce overall disease risk.

Compliance with biosecurity practices is also related to the economic performance of farms. Tilli et al. reported that farms that adhere to strict biosecurity measures tend to experience fewer disease outbreaks, which has a positive impact on antibiotic use and overall animal health [11]. This shows that investing in biosecurity not only reduces the risk of disease, but can also reduce animal health care costs and increase farm profitability.

However, challenges in implementing biosecurity remain, especially in developing countries. Gelaude et al. noted that many farms in developing countries have low biosecurity scores, which is due to socioeconomic factors and a lack of incentives for farmers to implement strict biosecurity measures [20]. Therefore, it is important to develop programs that support farmers in implementing biosecurity practices, including training and providing necessary resources.

In this context, government policies also play an important role. Alhaji and Odetokun showed that lack of enforcement of laws regarding animal disease control can increase the risk of disease spread in small farms [21]. Therefore, there needs to be collaboration between governments and farmers to ensure that biosecurity measures are implemented effectively and that there are mechanisms to monitor and enforce compliance with these practices.

So, implementing a biosecurity system in chicken farming is an important step to prevent the spread of disease. Farmer knowledge, compliance with biosecurity practices, and support from government and related agencies all contribute to the success of biosecurity implementation. By increasing awareness and education about the importance of biosecurity, as well as providing the necessary resources, we can reduce the risk of disease and increase productivity in the chicken farming industry.

B. Strategies for Increasing the Effectiveness of Implementing Biosecurity Systems on Chicken Farms to Prevent Disease

This study identified several key strategies that can improve the effectiveness of biosecurity system implementation. First, education and training for farmers is a priority. Structured training programs, especially those facilitated by the livestock service or

related institutions, will help improve farmers' understanding of the importance of biosecurity. Training materials should include disease risk identification, preventive measures, and biosecurity protocols appropriate to the scale of the livestock business.

Second, technical and financial support from the government or private sector is also needed to help farmers access biosecurity facilities, such as disinfection equipment, provision of cleaning materials, or construction of fences around the livestock area. Third, increased supervision and monitoring by related parties can help ensure that biosecurity implementation is carried out consistently. Implementing an incentive system for farms that are able to maintain biosecurity standards can also be an additional motivation.

Implementing an effective biosecurity system on chicken farms is very important to prevent the spread of diseases that can harm animal and human health. Biosecurity includes a variety of measures and practices designed to prevent the introduction of pathogens into poultry populations and reduce the risk of disease spreading among them. In the context of chicken farming, the right strategy to increase the effectiveness of biosecurity implementation must consider various factors, including farmer knowledge, environmental conditions, and community involvement.

One of the main strategies in increasing the effectiveness of biosecurity is education and training of farmers. Research shows that farmers' knowledge of biosecurity practices is directly related to the implementation of these measures in the field. For example, a study in Kediri, Indonesia, showed that increasing farmers' knowledge about biosecurity can increase the adoption of these practices, which in turn can reduce the risk of disease in poultry [14]. In addition, ongoing training and extension programs can help farmers understand the importance of biosecurity and how to implement it effectively [22].

Community involvement is also an important factor in implementing biosecurity. In a study conducted in Bangladesh, it was found that smallholder farmers were more motivated to implement biosecurity measures when they felt that these measures protected their investment and maintained the health of their herds [23]. Therefore, a community-based approach that involves livestock farmers in decision-making and biosecurity planning can increase compliance with these practices. By involving farmers in this process, they will better understand the benefits of biosecurity and be more likely to implement it.

In addition to education and community engagement, it is also important to develop and implement policies that support biosecurity. Governments and relevant agencies should provide clear guidance and financial support to help farmers implement effective biosecurity practices. For example, a study in Ethiopia showed that many commercial farms had poor biosecurity scores, indicating the need to implement biosecurity procedures to prevent the spread of pathogens [5]. Policies that encourage the use of technology and innovation in biosecurity can also help improve the effectiveness of these practices.

The use of modern technology in biosecurity monitoring and evaluation can also make a significant contribution to the effectiveness of biosecurity system

implementation. Tools such as Biocheck.UGent, which is used to assess the level of biosecurity on farms, can help farmers identify weaknesses in their practices and take necessary corrective actions [8]. By utilizing this technology, farmers can make more accurate and targeted assessments of existing risks, and develop more effective strategies to reduce these risks.

Additionally, it is important to consider environmental factors in implementing biosecurity. Research shows that distance between farms and residential areas, as well as practices such as sharing equipment and visits between farms, can increase the risk of disease transmission [24]. Therefore, good spatial planning and spacing between farms can help reduce the risk of disease spread. In this context, collaboration between farmers, government and research institutions is essential to create an environment that supports the implementation of effective biosecurity.

The implementation of biosecurity must also be supported by ongoing research to understand disease spread patterns and the effectiveness of the steps taken. Research conducted in various countries shows that poultry diseases, such as HPAI and Newcastle disease, are still a serious threat to the livestock industry [3], [21]. Therefore, it is important to continuously monitor and evaluate the epidemiological situation and adapt biosecurity strategies according to the latest developments.

In order to increase the effectiveness of implementing a biosecurity system, it is also important to pay attention to economic aspects. Research shows that implementing biosecurity measures can provide significant economic benefits for livestock farmers, such as increasing production and reducing losses due to disease [19], [22]. Therefore, providing economic incentives for livestock farmers to implement biosecurity practices can be an effective strategy to increase compliance with such measures.

It is important to create awareness among the public about the importance of biosecurity in chicken farming. Public education about the risks of zoonotic diseases and their impact on human health can increase support for the implementation of biosecurity practices at the farm level. By increasing public awareness, it is hoped that there will be increased support for farmers in implementing the necessary biosecurity measures.

So, increasing the effectiveness of implementing biosecurity systems on chicken farms requires a comprehensive and integrated approach. Through education, community engagement, policy support, use of technology, environmental planning, ongoing research, economic incentives, and public awareness, it is hoped that a more effective and sustainable biosecurity system can be created. This will not only protect the health of poultry, but also the health of the community and the sustainability of the livestock industry as a whole.

C. Constraints for Livestock Farmers in Implementing Biosecurity Systems to Prevent Disease

The results of the study revealed several major obstacles faced by farmers in implementing biosecurity systems. The first obstacle is limited funds. Many farmers, especially on a small scale, feel that the costs required to implement biosecurity measures,

such as routine disinfection and fencing areas, are too high. This condition is exacerbated by fluctuations in the prices of feed and livestock products, which makes their budget even more limited.

The second obstacle is the lack of knowledge and awareness about the importance of biosecurity. Many farmers do not fully understand the relationship between implementing biosecurity and disease prevention, so they tend to ignore the protocols that should be implemented. Third, the absence of regulations or policies that explicitly regulate the implementation of biosecurity at the farm level is also an obstacle. Without adequate oversight, many farms do not feel committed to implementing biosecurity standards.

Another identified obstacle is the lack of access to biosecurity facilities and infrastructure, such as disinfection equipment, PPE, or sanitation facilities. In some areas, the long distance from the distribution center of equipment and materials is also a limiting factor. Finally, livestock workers' resistance to changes or new habits in implementing biosecurity protocols is often a challenge, because they feel these measures require additional effort that is disproportionate to the perceived immediate benefits.

The obstacles faced by livestock farmers in implementing biosecurity systems to prevent animal diseases are important issues that affect livestock health and the sustainability of livestock businesses. Various studies have shown that there are several factors that are barriers to the implementation of biosecurity, including livestock farmers' knowledge, limited resources, and traditional habits in livestock management.

First, farmers' knowledge of biosecurity greatly influences the implementation of this system. A study by Astuti showed that there was a significant influence between the level of education of farmers and their knowledge of biosecurity, although there was no significant influence of age or type of main job [13]. This shows that farmers with a better educational background tend to have a better understanding of the importance of biosecurity. However, many livestock farmers in rural areas still have limited knowledge regarding effective biosecurity practices, which can cause them to neglect the preventive measures necessary to protect their livestock from disease [14].

Second, limited resources are also a major obstacle in implementing biosecurity. Simamora noted that livestock farmers often face problems in providing quality green fodder, especially during prolonged dry seasons [25]. These limitations not only affect livestock health but also hinder farmers' ability to implement adequate biosecurity practices, such as keeping pens clean and providing healthy feed. In addition, Kartadjumena highlighted that farmers' understanding of sustainability and biosecurity is still limited, indicating the need for more intensive socialization and training to increase their awareness and knowledge [26].

Third, traditional habits in livestock management often become a barrier to the implementation of biosecurity practices. Rinca reported that farmers still sell sick livestock, which contributes to the spread of diseases such as African Swine Fever (ASF) in the community [27]. This practice is often driven by economic necessity, with farmers

trying to reduce losses by selling infected livestock, even though this action can worsen the overall health situation of the animals. Therefore, it is important to educate farmers about the risks associated with these practices and the benefits of implementing stricter biosecurity.

Fourth, the lack of support from the government and related institutions is also an obstacle in implementing biosecurity. Research by Fahmi shows that the implementation of agrosilvopasture systems can increase the productivity and welfare of local farmers, but requires strong policy support to ensure success [28]. Without adequate support, farmers may feel unmotivated to implement better biosecurity practices, especially if they do not see immediate benefits from these actions.

Fifth, socio-economic factors also play an important role in the implementation of biosecurity. Alam notes that factors such as the age of the farmer, level of education, livestock experience, and number of family dependents can influence the livestock maintenance system [29]. Farmers from lower socioeconomic backgrounds may not have access to the resources or information necessary to implement effective biosecurity practices. This highlights the need for a more inclusive approach in training and extension programs to ensure that all farmers, regardless of their background, can access the necessary information and resources.

Sixth, challenges in implementing technology are also an obstacle. For example, the use of automation systems in feeding and monitoring livestock health can help increase the efficiency and effectiveness of biosecurity practices, but many farmers still use traditional methods [30]. This highlights the need for training and technical support to help farmers adapt to new technologies that can improve their biosecurity practices.

Seventh, lack of understanding of disease risks and how to prevent them is also an obstacle. Research by Takamokan shows that farmers who implement a semi-intensive system have a better understanding of health problems in chickens, but many farmers are still unaware of the importance of disease prevention [31]. Therefore, continuous extension that is tailored to the characteristics of farmers is highly recommended to increase their knowledge and awareness of biosecurity.

Eighth, the lack of incentives to implement biosecurity is also a problem. Rinca proposed that providing incentives to farmers who implement biosecurity practices could be an effective strategy to increase compliance with disease prevention measures [27]. These incentives can take the form of financial assistance, access to training, or support in the form of animal health facilities. By providing incentives, farmers may be more motivated to adopt better biosecurity practices.

Ninth, challenges in communication and collaboration between farmers and related parties are also obstacles. Research by Winarni shows that a good information system can help in data management and communication between farmers and related institutions [32]. Without effective communication, information about biosecurity practices and disease prevention measures may not reach farmers, which can hinder disease prevention efforts.

Tenth, cultural factors and local habits can also influence the implementation of biosecurity. Some farmers may have traditional beliefs or practices that conflict with biosecurity principles. Therefore, it is important to understand the local context and involve farmers in the process of developing a biosecurity program so that they feel ownership and commitment to implementing it.

Thus, the obstacles faced by farmers in implementing a biosecurity system to prevent animal diseases are very complex and influenced by various factors. To overcome these obstacles, a holistic approach is needed that includes increasing knowledge, providing resources, policy support, and collaboration between all stakeholders. Thus, it is hoped that biosecurity practices can be implemented effectively, so that livestock health can be maintained and sustainability of livestock businesses can be achieved.

CONCLUSION

Fundamental Finding : The adoption of biosecurity systems in chicken farming is critical to preventing disease spread but varies significantly based on farm scale, farmer knowledge, and available resources. Large-scale farms benefit from better implementation due to financial and technological access, whereas small-scale farms struggle with constraints like limited knowledge and resources. **Implication :** Improving biosecurity requires multi-faceted efforts, including farmer education, government and private sector support, and consistent monitoring. These measures should be accompanied by incentives to ensure farmers remain motivated to apply biosecurity practices regularly. **Limitation :** The main barriers to effective biosecurity system implementation are financial limitations, insufficient farmer awareness, inadequate infrastructure, and weak regulations. Additionally, resistance to adopting new practices among farm workers hinders widespread adherence to protocols. **Future Research :** Further studies should focus on developing cost-effective biosecurity solutions tailored to small-scale farms, evaluating incentive mechanisms for farmers, and exploring innovative education models to enhance awareness and compliance across all farm sizes.

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