

Closed and Sustainable: Innovative Solution for Modern Farming in Badung Regency

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ABSTRACT

The development of closed-system farming presents promising solution enhance agricultural productivity, animal welfare, and food security in rural areas. This study aims to analyze the challenges, potentials, and strategies for developing closed-system farming in the Sangeh Region, Badung Regency, Bali. The research method involved conducting in-depth interviews with farm owners, managers, and farmers in one of the closed-system farms in the region. The interview results indicate that closed-system farming faces challenges such as resource availability, limited infrastructure, and inadequate understanding of technology. However, closed-system farming also holds significant potential for improving resource efficiency, product quality, and agricultural sustainability. Based on these findings, it is recommended that local government, agricultural industries, research institutions, and local communities collaborate to provide the necessary financial, technical, and educational support to develop closed-system farming in the region. Thus, the implementation of closed-system farming in Badung Regency enhance farmer welfare, food security, and environmental protection.

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INTRODUCTION

It is impossible to discuss the modernization of the local economy without considering the aspects related to bioresources (Belykh, 2023). The modern agricultural industry has undergone a paradigm shift towards more sustainable and efficient practices, driven by increasing demand for food security, environmental concerns, and technological advancements. The agri-food industry acknowledges the environmental impact of resource exploitation and waste, driving the search for sustainable alternatives based on circular bioeconomy principles (Hamam et al., 2024). Subsistence farmers and global food security rely on adequate food production (Shafik et al., 2024). One of the appropriate technologies to address macro and microclimate conditions is the closed house system. In broiler farming, commonly used housing systems include the open house and closed house systems. The advantages of broilers include having high protein content, relatively affordable prices, tender meat, large body size, large breast size, dense and well-filled body structure, and relatively rapid weight gain. Broilers also have a short harvesting period, typically ranging from 4 to 6 weeks (Jaya et al., 2022). The closed house system is particularly effective in mitigating climate conditions, offering benefits for both macro and microclimate regulation (Patria, 2022) and (Nisa et al., 2023) said the best interaction is achieved in a closed house type of cage. In this context, closed farming systems, characterized by controlled environments and optimized resource management, have emerged as a promising solution to address these challenges. With the right technology, closed farming can enhance animal welfare and minimize the risk of diseases, thereby producing more consistent and high-quality products. Agriculture is characterized as a sustainable farming approach that prioritizes the utilization of natural substances and methods (Sacchi et al., 2024).

The implementation of closed farming systems can be a solution to boost agricultural productivity in areas with limited land or unfavorable environmental conditions. One appropriate technology to address climate conditions at both macro and micro levels is the closed-house coop (Patria, 2022). By leveraging advanced technologies such as hydroponics, aquaponics, and vertical farming, closed farming reduces resource wastage, mitigates environmental impacts, and enhances productivity compared to traditional open farming methods. A radical overhaul of the global food systems is essential to preserve both environmental and human health (Keller et al., 2024). Closed farming can optimize the use of resources such as water and feed, produce cleaner and safer products, and reduce environmental impact. Because drought and heat stress pose significant challenges to food security in arid and semi-arid regions, with the predicted increase in frequency and severity due to global warming (Bolat et al., 2024). To anticipate future challenges, livestock development in Indonesia is focused on improving livestock-originated food through the establishment of advanced, resilient, professional, and efficient farms (Purnomo & Santosa, 2017). The increasing demand for healthy products necessitates a diverse range of offerings to meet various consumer preferences (Nur Kholida Wulansari et al., 2023), including poultry farming as one of the options. In Indonesia, there are good prospects for raising chickens on both small and large scales (Viasika, 2021). Badung Regency, located in Bali, Indonesia, stands out as an area with great potential for implementing closed farming practices. With fertile land, a tropical climate, and proximity to local and international markets, Badung offers favorable conditions for the development of modern farming systems. The integration of information and communication technology in closed farming can improve management efficiency and enable more accurate monitoring of environmental conditions and animal health. However, despite these advantages, the adoption of closed farming in Badung faces several challenges, including limited awareness among farmers, inadequate infrastructure, and regulatory constraints.

Dramatic improvements in measuring genetic variation across agriculturally relevant populations (genomics) must be matched by improvements in identifying and measuring relevant trait variation in such populations across many environments (Tuggle et al., 2024). The use of innovative technologies and

practices in closed farming can significantly contribute to improving the production and quality of livestock products in Badung Regency. Investment in infrastructure and technology for closed farming can create new opportunities for economic growth and job creation in rural areas. The implementation of these systems will not only provide economic benefits to farmers but also have a positive impact on the environment and the well-being of the local community. For example, closed farms can reduce water consumption by up to 90% and greenhouse gas emissions by 50% compared to traditional farms. Thus, Badung Regency has great potential to become a hub of innovation in the application of sustainable modern farming technology. Understanding the potential and challenges of implementing closed farming in the Bali region is key to strengthening local food security.

The economic benefits of closed farming extend beyond increased productivity to include operational cost efficiency and added value to products. From an economic standpoint, raising broiler chickens in a closed-house system is advantageous (I M. et al., 2019). However, amidst the great potential, the implementation of closed farming in Badung Regency also faces several challenges. Factors such as resource availability, limited infrastructure, and the lack of knowledge and skills among local farmers may hinder the widespread adoption of this technology. Therefore, collaborative efforts between government, research institutions, industry, and local communities are needed to overcome these barriers and accelerate the adoption of modern closed farming in Badung Regency.

Proper education and training are crucial in introducing closed farming to local farmers and ensuring its successful implementation. As an effort to address challenges and leverage existing opportunities, this research will delve deeper into the potential and implications of implementing closed farming in Badung Regency. Empowering communities through training and mentoring is key to increasing participation and sustainability of closed farming at the local level. Continuous evaluation of the sustainability of closed farming implementation is necessary to ensure that adopted practices are sustainable in the long run. Through a collaborative approach between academia, farming practitioners, and local government, this research is expected to provide concrete and sustainable recommendations to enhance productivity, sustainability, and food security in this region. The research will explore in-depth the challenges faced in implementing closed farming in Badung Regency, Bali.

METHODS

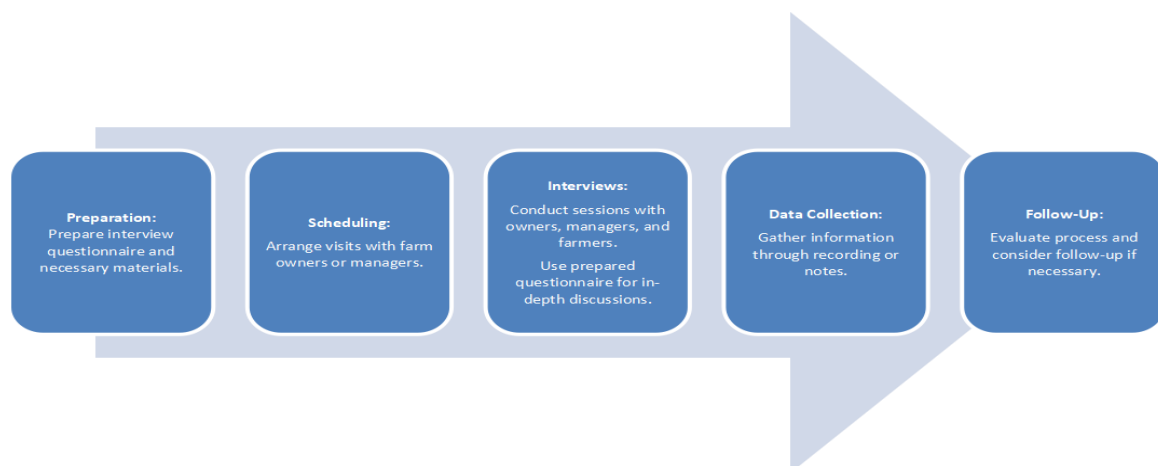


FIGURE 1. Process Scheme for Interviews at Closed Farms

The interview will be conducted at one of the closed farms in the Sangeh area, Badung Regency, Bali. Participants will include farm owners, managers, and farmers directly involved in the operation of the

closed farm. Required materials will include a pre-prepared interview questionnaire, audio recording or written notes, and presentation aids if necessary. The implementation method of this activity will involve scheduling visits to closed farms agreed upon beforehand with the owners or managers. Upon arrival at the location, respondents will be interviewed individually or in small groups depending on their preferences and availability. Data will be collected through in-depth interviews using the pre-prepared questionnaire. The interviews will focus on understanding the challenges faced, efforts made to overcome these challenges, and their views on the potential and expectations related to the development of closed farms in the Sangeh area.

RESULTS AND DISCUSSION

The results from the continued interviews at closed farms in the Sangeh area, Badung Regency, revealed several key findings regarding the challenges, potential, and expectations related to the development of closed farms in the region. Firstly, the interviews uncovered that farm owners, managers, and farmers face various challenges in managing closed farms. Major challenges include resource availability, such as water and feed, waste management, and limited infrastructure. Additionally, limited understanding of modern farming technologies and practices also hinders the adoption of closed farms. The findings are consistent with the results of research conducted by (Sumarno et al., 2022) where in broiler farming, environmental factors influence the condition of the housing, which serves as the resting or activity area for the chickens. Good housing conditions play a crucial role in achieving livestock production performance.

Secondly, the interviews also indicated that closed farms have significant potential to enhance agricultural productivity, animal welfare, and product quality. With appropriate technology, closed farms can reduce resource wastage, improve water and feed efficiency, and produce cleaner and safer products for consumers. The findings are consistent with the results of research conducted by (Suryanti, 2020), where it was found that there is a significant relationship between technical, entrepreneurial, and managerial abilities and the sustainability of economic, ecological, and social aspects. This is consistent with research from (Tantalo et al., 2023) stating that in response to the growing demand for free-range chickens, improvements in farming management are necessary to achieve optimal production. This underscores the importance of paying attention to and developing these capabilities in outreach activities. It indicates that a holistic approach involving technical, entrepreneurial, and managerial aspects is crucial in promoting economic, ecological, and social sustainability. By enhancing understanding and skills in these areas through outreach activities, a strong foundation can be laid for building a more sustainable and adaptive society overall.

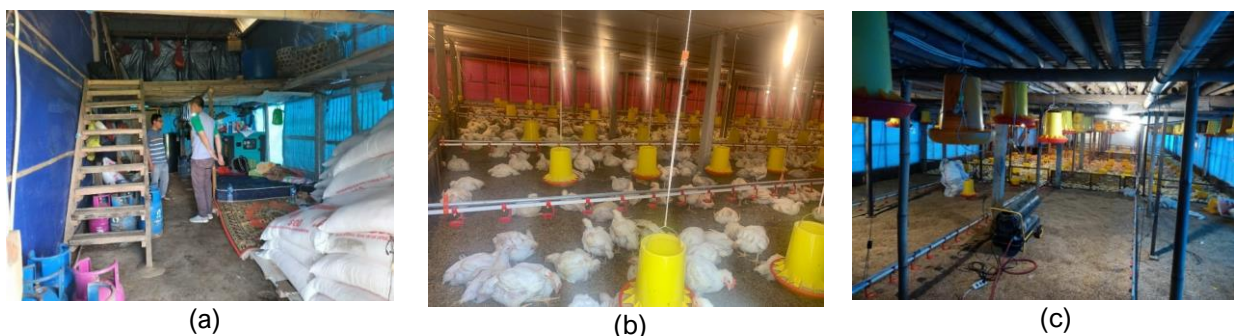


FIGURE 2. Field Study and Interviews

Discussion of the interview results highlights the importance of supporting the development of closed farms in the Sangeh area, Badung Regency. Efforts to address challenges such as resource availability, infrastructure, and technological knowledge need to be supported by the local government, research

institutions, and industry. Empowering communities through education and training is also crucial to increase participation and sustainability of closed farms at the local level.

Furthermore, policy recommendations can focus on providing support and incentives for farmers willing to adopt modern farming technologies, including closed farms. Developing regulations that facilitate the sustainable implementation of closed farms is essential. Thus, the implementation of closed farms in the Sangeh area, Badung Regency, could be one solution to enhance food security, farmer welfare, and environmental protection in the region.

Proposed solutions based on the interview results include:

- **Providing Support and Incentives:** Local governments can provide financial, technical, and infrastructural support to farmers willing to adopt modern farming technologies, including closed farms. Incentives such as financing assistance, agricultural input subsidies, or tax exemptions for closed farm investments can encourage more farmers to switch to sustainable farming practices.
- **Education and Training:** Education and training programs should be enhanced to improve farmers' knowledge and skills related to modern farming technology, resource management, and sustainable farming practices. Training can be regularly conducted locally involving experienced industry experts and academics.
- **Infrastructure Development:** Local governments can allocate budgets to improve infrastructure in agricultural areas, including better water access, efficient waste management, and road improvements to farms. Adequate infrastructure will help strengthen the resilience of closed farms and improve the quality of production.
- **Developing Supportive Regulations:** Local governments need to develop regulations that support the implementation of closed farms, including environmental policies, animal health regulations, and food safety standards. Clear and science-based regulations will provide legal certainty for farmers and enhance public trust in agricultural products.
- **Collaboration between Government, Industry, and Community:** Collaborative efforts between local governments, research institutions, agricultural industries, and local communities are essential to create an ecosystem that supports the growth of closed farms. Through good cooperation, various parties can support each other and accelerate the adoption of more sustainable farming practices in Badung Regency.
- By comprehensively implementing these solutions, it is expected to enhance the implementation of closed farms in the Sangeh area, Badung Regency, Bali, and have a positive impact on farmer welfare, food security, and environmental protection in the region.

Limitations:

- The interviews were conducted in the Sangeh area, Badung Regency, which may limit the generalization of findings to that specific region.
- Time and resource constraints may have limited the number of respondents interviewed, thus potentially not capturing all relevant perspectives.
- Reliance on qualitative data from interviews may result in subjective interpretations that are not fully representative.

Future Research:

- Conduct broader surveys to extend the research scope to other regions in Indonesia and compare findings with conditions in Sangeh, Badung Regency.
- Further research to explore the direct impacts of implementing closed farms on farmer welfare, agricultural productivity, and environmental health.

Comparative studies to assess the effectiveness of various modern agricultural technologies in enhancing food security, including closed farming, hydroponics, and vertical farming.

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