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## Utilization of IoT Technology to Optimize Business Processes in Oyster Mushroom Houses

Andi Ircham Hidayat<sup>1\*</sup>; Nurkhalik Wahdania Asbara<sup>2</sup>

<sup>1</sup>Nobel Indonesia Institute, Indonesia

<sup>2</sup>Nobel Indonesia Institute, Indonesia

\*Correspondence: [hidayat.ircham@gmail.com](mailto:hidayat.ircham@gmail.com)

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**Abstract:** Mushroom cultivation, particularly oyster mushroom farming, often encounters significant challenges in maintaining optimal environmental conditions such as temperature, humidity, and air quality. These factors are critical for mushroom growth, and any imbalance can negatively impact production quality and yield. Traditional mushroom farms largely depend on manual monitoring, which is time-consuming, labor-intensive, and prone to inefficiencies, especially when rapid environmental changes occur. This study examines the potential impact of implementing Internet of Things (IoT) technology to enhance the business processes of oyster mushroom farms that currently rely on manual methods. IoT integration enables real-time monitoring and automated control of environmental parameters, reducing the risks of production failures and improving operational efficiency. By analyzing existing research and simulating IoT implementation in mushroom farming, this study explores how IoT can optimize resource usage, lower operational costs, and improve the consistency of yield quality. This research highlights IoT as a viable solution to overcome traditional challenges in mushroom cultivation and offers insights into the strategic advantages of IoT for small-scale agribusinesses.

**Keywords:** Internet of Things (IoT); Mushroom cultivation; Environmental monitoring; Operational efficiency; Agribusiness optimization.

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### A. Introduction

Mushroom cultivation, particularly oyster mushroom farming, has gained significant attention as a sustainable agribusiness option due to its high market demand and relatively low environmental impact. However, maintaining the optimal environmental conditions required for mushroom growth, such as temperature, humidity, and air quality, remains a critical challenge. Small-scale mushroom farms often rely on manual monitoring and control

methods, which are not only labor-intensive but also prone to inefficiencies. These traditional approaches can result in fluctuating environmental parameters, negatively affecting both the quality and quantity of the yield.

The advent of the Internet of Things (IoT) offers transformative potential for addressing these challenges in agricultural practices, including mushroom farming. IoT technology enables real-time monitoring and



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automated adjustments to environmental parameters, ensuring a stable and optimal growth environment. By integrating IoT devices such as sensors, actuators, and cloud-based analytics, mushroom farmers can mitigate risks associated with environmental imbalances, reduce dependency on manual labor, and streamline their operations. This technological shift aligns with the growing trend of precision agriculture, which emphasizes resource optimization and sustainable farming practices.

This study aims to explore the impact of IoT implementation in oyster mushroom farming, focusing on its ability to enhance operational efficiency, improve yield quality, and lower operational costs. By analyzing current research and simulating IoT-based solutions, this research provides a comprehensive evaluation of IoT's potential to address traditional challenges in mushroom cultivation. The findings are expected to offer valuable insights for small-scale farmers seeking to modernize their operations and leverage technology for better profitability and sustainability.

## **B. Materials and Methods**

This study employs a descriptive qualitative approach, combining literature review, technical simulation, and data analysis to explore the potential implementation of Internet of Things (IoT) technology in oyster mushroom farming. The research methodology includes the following stages:

### **Literature Review**

The initial stage involves collecting and analyzing relevant literature on the application of IoT in agriculture, specifically in mushroom cultivation. The literature includes scientific journals, books, and previous research reports. This review aims to identify critical environmental parameters for oyster mushroom farming, such as

temperature, humidity, and air quality, and to understand the IoT technologies that can be used for monitoring and controlling these parameters.

### **IoT System Simulation and Design**

In this stage, the study simulates the application of IoT technology in oyster mushroom farming. The system design involves the use of sensors to measure environmental parameters, actuators for automated control, and a cloud-based platform to process data and enable real-time management. The simulation utilizes appropriate software and hardware to model how IoT can optimize environmental conditions in mushroom farming operations.

### **Data Analysis and System Evaluation**

The simulation results are analyzed to evaluate the effectiveness of the IoT system in improving operational efficiency, maintaining consistent yield quality, and reducing operational costs. The data from the simulation are compared with the manual methods currently used by oyster mushroom farmers. This evaluation also identifies potential technical and economic challenges faced by small-scale farmers in adopting IoT technology.

## **C. Result and Discussion**

### **Result**

The simulation of IoT implementation in oyster mushroom farming provided several key findings regarding its effectiveness in managing environmental conditions and improving operational efficiency:

### **Environmental Monitoring and Control**

The IoT system effectively monitored critical environmental parameters, including temperature, humidity, and air quality, in real-time. The sensors transmitted accurate data to a cloud platform, enabling farmers to track conditions remotely. Automated

control systems, such as actuators for misting or ventilation, successfully adjusted parameters within the desired range, ensuring optimal conditions for mushroom growth.

### **Yield Quality and Consistency**

Simulated results indicated that maintaining stable environmental conditions through IoT significantly reduced the variability in yield quality. The mushrooms cultivated in IoT-managed conditions exhibited uniform size, texture, and color compared to those in manually monitored environments.

### **Operational Efficiency**

The integration of IoT reduced the need for continuous manual monitoring and interventions, saving time and labor costs. Alerts and automated responses to environmental fluctuations minimized downtime and production risks, resulting in more efficient resource utilization, including water and electricity.

### **Cost Analysis**

While the initial investment in IoT devices and infrastructure was identified as a barrier for small-scale farmers, the long-term benefits in terms of reduced operational costs and improved yield quality outweighed the upfront expenses in the simulation model.

## **Discussion**

The findings confirm that IoT technology is a transformative tool for addressing the traditional challenges in oyster mushroom farming. By automating the monitoring and control of environmental parameters, IoT minimizes the risks associated with fluctuating conditions that often lead to production failures. This aligns with prior research indicating the critical role of precision agriculture in enhancing

productivity and sustainability in small-scale farming operations.

The improvement in yield quality and consistency under IoT management highlights the technology's potential to meet market demands for high-quality produce. Consistency in yield also strengthens the competitiveness of small-scale farmers, allowing them to access premium markets and increase profitability.

However, the study also identified barriers to adoption, particularly the high initial costs of IoT implementation. For small-scale farmers with limited resources, financial support mechanisms such as subsidies or cooperative models may be necessary to facilitate the transition. Furthermore, the integration of IoT requires basic digital literacy among farmers. Training programs and support networks are essential to ensure that farmers can effectively operate and maintain IoT systems.

Finally, while the simulation demonstrated the benefits of IoT in a controlled setting, further field trials are recommended to validate the results under real-world farming conditions. These trials should consider varying climatic conditions, farm sizes, and resource availability to ensure the scalability and adaptability of IoT solutions in diverse agricultural contexts.

The research underscores IoT's potential as a strategic innovation for modernizing mushroom farming, emphasizing the need for targeted interventions to promote its adoption among small-scale agribusinesses.

## **D. Conclusion**

This study demonstrates that IoT technology can significantly enhance oyster mushroom farming by enabling real-time monitoring and automated control of environmental parameters such as temperature, humidity, and air quality. The findings show that IoT systems improve yield consistency, reduce labor dependency, and optimize resource utilization, making them an effective solution for addressing

traditional challenges in mushroom cultivation. These advancements contribute to higher productivity and operational efficiency while reducing risks associated with environmental fluctuations.

However, the adoption of IoT in small-scale farming is hindered by high initial costs and the need for technical knowledge among farmers. To overcome these barriers, financial support mechanisms, training programs, and collaborative frameworks are essential. In conclusion, IoT holds great potential to modernize mushroom farming and improve its sustainability, but its implementation requires strategic interventions to make it accessible and practical for small-scale agribusinesses.

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