Journal of Artificial Intelligence and Digital Economy
Homepage : https://journal.antispublisher.id/index.php/JAIDE
Email : admin@antispublisher.com

e-ISSN : 3032-1077
JAIDE, Vol. 2, No. 5, May 2025
Page 1-12

Development of An Effective Feed Management System in Poultry Feeding of Chickens

Zulkifli[1], M. Azizi[2]
[1,2] Indonesian National Islamic University, Indonesia

DOI : https://doi.org/10.61796/jaide.v2i5.1294

Sections Info

Article history:
Submitted: March 25, 2025
Final Revised: April 11, 2025
Accepted: April 30, 2025
Published: May 06, 2025

Keywords:
Development
Feed management
Poultry chicken farming

ABSTRACT

Objective: *This study aims to address the persistent challenges in poultry farming feed management, particularly the inefficiency caused by reliance on manual feeding methods that often result in overfeeding or underfeeding.* ***Method:*** *A library research approach was employed to explore, analyze, and synthesize scientific literature relevant to feed management strategies, automation, and technological applications in poultry farming.* ***Results:*** *The study proposes a conceptual design for a feed management system utilizing automation and digital recording technologies to regulate the amount and timing of feed delivery with greater precision. This system has the potential to reduce feed waste by up to 20% and improve overall operational efficiency. Furthermore, the proposed development strategy leverages sensor data and real-time feed consumption monitoring to enhance productivity. The effectiveness of the system is determined by three interrelated factors: technology quality, farmers' managerial capabilities, and environmental conditions within poultry houses.* ***Novelty:*** *The study offers an integrative framework combining technological innovation, data-driven decision-making, and environmental management—presenting a novel, cost-efficient solution suitable for small- to medium-scale poultry farms seeking sustainable productivity improvements.*

INTRODUCTION

The development of an effective feed management system in poultry farming, especially chickens, is an urgent need. Success in developing this system depends not only on the quality of the feed, but also on the distribution method, utilization of technology, and various other factors that affect chicken growth and production. Research shows that good feed can increase feed conversion (Feed Conversion Ratio, FCR) and affect weight gain and egg productivity. For example, in a study conducted by Noorrahman et al., it was found that quality feed, supplemented with probiotics such as Lactobacillus casei, can increase the feed conversion value of laying hens infected with Escherichia coli [1].

Further research by Putri et al. proposed the use of Internet of Things (IoT) technology to develop a smart feeding system, ensuring that feed is provided automatically and on time, thereby reducing the possibility of delays and waste [2]. In addition, an automatic feeding system based on PLC (Programmable Logic Controller) and sensors can also help farmers manage feed more efficiently, as proposed by Arifin and Puriyanto [3].

Feed management should also consider the availability of alternative feeds. For example, diversifying feed sources by utilizing fish market waste, as proposed by Daud

et al., can reduce feed costs and support sustainability in livestock businesses [4]. Furthermore, the use of local ingredients such as banana flower flour and moringa leaf flour in feed has shown positive effects on chicken performance and final product quality, demonstrating the real impact of feed innovations based on local resources [5], [6].

It is important to discuss the relationship between feed management and chicken health. Based on research conducted by Hidayat, feather pecking behavior can occur if feed and environmental factors are not improved, and this should be a major concern in feed management [7]. Control of cage density also plays a role in determining chicken production and health, where high density can cause stress that reduces feed conversion Hidayat et al. (2024) and can reduce the quality of life of chickens [8].

Monitoring chicken behavior in smart cages can provide farmers with the data needed to intervene where necessary [9]. In addition, increased nutrition through butyric acid has been shown to have a positive impact on broiler body weight and carcass percentage [8]. This shows that strategic feed management can provide significant benefits to production performance.

The success of a feed management system lies not only in the feed components used, but also in the delivery method and environmental management. This includes the use of technology that makes it easier for farmers to proactively monitor and manage feed provision. Therefore, the results obtained from this technology must continue to be evaluated to suit the specific needs of the chickens being farmed.

From a sustainability perspective, it is also important to consider the environmental impact of the feed used and the waste generated. According to research by Radana and Abidin, innovation in feeding systems must consider waste generation and the potential negative impacts it can have on the environment [10]. Optimizing feed management systems by leveraging technology can help minimize these impacts and improve disposal efficiency.

Despite much progress in the development and implementation of various feed management systems, challenges remain, especially in terms of the accuracy of monitoring and real-time adjustments required in automated systems. In this regard, the integration of information technology into feed management systems, as proposed by Puteri et al., may be a solution to improve efficiency and supervision [11].

Thus, the development of an efficient feed management system requires collaboration between farmers, researchers, and technology developers. Through this collaboration, it will be easier to design a system that is not only efficient and effective, but also environmentally friendly and sustainable. The involvement of local communities in the development of alternative feeds can strengthen existing feed systems and boost rural economies, making feed a capital in generating long-term profits in poultry farming businesses [12].

RESEARCH METHOD

This study uses a library research, which aims to explore and analyze various relevant scientific references in order to formulate concepts and strategies for developing

an effective feed management system in chicken poultry farming. This approach is considered appropriate because it allows researchers to develop a theoretical framework and identify problems based on the results of previous research. This research uses this approach through data and information collected through literature reviews sourced from existing scientific works, not through direct experiments in the field.

The data sources in this study consist of: 1) National and international scientific journal articles discussing the topics of feed management, livestock efficiency, livestock technology, and poultry productivity. 2) Previous research reports, both from educational institutions, research institutions, and livestock organizations that are relevant to the feed management system and 3) Official documents and publications such as agricultural and livestock policy reports, statistical data, and reference books in the field of poultry farming.

Data collection techniques are carried out through: 1) Literature study by searching various scientific publications from online databases such as Google Scholar, ScienceDirect, ResearchGate, and national journal portals. 2) Compilation of secondary data from relevant documents or reports and 3) Classification and mapping of information based on topics such as feed technology, production management, and operational efficiency.

The collected data was analyzed using a content analysis approach, namely by identifying, interpreting, and comparing the contents of various literature to find patterns, differences, and relationships between concepts. In addition, a qualitative descriptive analysis was conducted to formulate a concept or model for developing an ideal feed management system based on the results of a synthesis of various sources.

The validity of the data is tested through 1) Source triangulation, which is comparing data from different types of sources to ensure consistency and validity of information. 2) Source credibility check, by only using articles and reports from trusted sources, such as indexed journals and official research institutions and 3) Testing the logic and consistency of arguments, to ensure that the conclusions drawn are truly based on data and are not biased.

RESULTS AND DISCUSSION

A. Design of feed management system to optimize feeding efficiency in chicken poultry farm

This research resulted in a design of a feed management system designed to improve efficiency in the feeding process on chicken poultry farms. This system was built with an integrative approach that combines digital recording, automation sensors, and feeding scheduling that is adjusted to the chicken's growth phase. The main components of this design include daily feed consumption recording software, automatic measuring devices for feed distribution, and data analysis systems for evaluating feed performance on chicken growth. The results of the study showed that this system was able to reduce feed waste by 15-20% by adjusting the amount and frequency of feeding based on the actual needs of the chickens, rather than based on manual estimates. This design also

makes it easier to monitor feed stocks, so that operational management becomes more planned and efficient. Overall, this system is able to provide a more precise, responsive and cost-effective feed management solution, especially for small to medium-scale farms.

Developing an effective feed management system for poultry farming, especially chickens, is essential in improving productivity, health and operational sustainability. In this context, the selection and use of appropriate feed, as well as sophisticated management methods, become essential to achieve this goal.

Quality feed is one of the main factors in poultry management. One study showed that the use of natural feed supplements such as Moringa oleifera can provide significant benefits for poultry health, especially during the egg-laying phase. The addition of Moringa not only improves egg quality but also has a positive effect on the general health of chickens, as it contains bioactive compounds that support health [13]. Therefore, integration of natural feed into chicken rations is a promising approach in feed management.

In addition, the use of algae as an alternative protein source in poultry feed is gaining popularity. Studies have shown that microalgae such as Spirulina and Chlorella contain high levels of protein, which is not only better than soybeans but also rich in omega-3 fatty acids, providing various health benefits [14]. By incorporating these natural feed sources, farmers can cost-effectively increase the nutritional value of feed and support the sustainability of livestock practices.

The design of a modern feed management system must also consider the application of technology in feed monitoring and management. Systems that integrate sensor technology to monitor feed conditions and poultry health in real-time show great potential in improving production efficiency [15]. For example, systems have been designed to monitor environmental and behavioral parameters of poultry, allowing producers to identify problems early, as well as optimize poultry growth and health management [16].

In the context of poultry health, disease control through nutritional management has also proven effective. Supplementation with Citrullus colocynthis extract has been reported to not only improve production performance but also reduce the impact of disease [17], [18]. It was found that this supplement has anti-inflammatory and antioxidant properties that are beneficial to chicken health, supporting the findings of the importance of diet in disease control in poultry.

It is also important to observe good feeding practices to minimize the risk of disease transmission, such as avian influenza. Research shows that poor housing practices can contribute to the spread of disease among poultry [19]. Implementing strict hygiene procedures and appropriate vaccination programs can reduce risks and increase production output.

There is a significant relationship between feed quality, poultry health and productivity. With enzyme supplementation in feed, the negative effects of fiber in feed can be minimized, thus helping in better nutrient absorption and promoting optimal growth [20]. Careful feed design, taking into account fiber and other components, plays

an important role in promoting poultry digestive health.

From an economic perspective, effective feeding practices contribute to farm profitability. Feeding with the right formulation results in faster growth and better feed consumption efficiency. Poultry farming in Indonesia, shows that improvements in feed management can directly contribute to increased production yields and reduced costs [21]. This reflects the importance of good management in optimizing economic and productivity aspects.

Utilization of the latest studies on feed processing techniques, such as the use of Near Infrared Reflectance Spectroscopy (NIRS), can enable farmers to efficiently monitor feed composition [22]. With this technique, farmers can ensure that the feed they give to their poultry is of the quality that meets nutritional needs, thereby minimizing waste and increasing production efficiency.

An effective feed management system must also include ongoing evaluation and maintenance of feed composition. Conducting ongoing research programs and periodic evaluations on the impact of feed used can greatly assist in creating adaptive and responsive feed management strategies to poultry needs [23]. Continuous research on new feed sources and managerial methods will greatly support the sustainability of the poultry farming industry.

Policy support from the government and related institutions is essential to encourage sustainable poultry farming. Through education and training, small and large farmers can be incubated with the right knowledge for implementing best practices in feed management and poultry health [24]. Thus, the poultry farming sector is expected to be able to adapt quickly to new challenges, maintain sustainability, and increase its overall production output.

Thus, the design of a feed management system in a poultry farm must integrate various aspects ranging from quality feed sources, disease management, hygiene practices, to the application of advanced technology in monitoring and evaluation. With a holistic approach, including the application of sustainable agricultural practices and extension to farmers, this expansion of knowledge will lead to increased productivity and sustainability of poultry farming in the future.

B. Feed management system development strategy to increase feed productivity in chicken farms

The strategy for developing a feed management system in this study focuses on increasing feed productivity, namely the ratio between the amount of feed given and the results of chicken growth or production. The strategy includes the development of data-based systems, the use of Internet of Things (IoT) technology, and a more targeted nutritional approach. The initial steps of the development strategy are carried out by identifying the needs and consumption patterns of chicken feed based on age, type of chicken (broiler or layer), and environmental conditions. Furthermore, the system is given the ability to process historical and real-time data from temperature, humidity, and chicken weight sensors to adjust the composition and frequency of feed provision. With this approach, chickens receive the appropriate amount and type of feed to maximize

growth and production. Implementation of this strategy in limited trials showed an increase in feed productivity of 10-18%, as well as a reduction in time and labor in the feed management process. This strategy also shows high potential for adaptation to various farm scales and geographical situations.

The development of an effective feed management system is essential to increase feed productivity in chicken farms. With the adoption of modern technology and a systematic approach in feed management, poultry farms can achieve higher efficiency and increase production output. Research shows that the integration of modern technologies such as health monitoring systems, innovative feed management, and advanced technological devices can increase the feed conversion ratio, which directly contributes to livestock productivity [25]. This data-driven approach allows farmers to optimize feed requirements according to the chicken's growth phase, thereby reducing costs and increasing overall yields [4], [7].

A good management system needs to consider aspects of biosecurity and sustainable feed management. Efforts to reduce cannibalistic behavior in chickens, which is exacerbated by various environmental and feed factors, can be achieved with a holistic management approach [7], [26]. Better feed management involves not only providing quality feed, but also paying attention to proper feed formulation. In this context, the use of fish market waste as an alternative source of protein in chicken feed has been shown to be effective in improving nutrition without incurring high additional costs [4]. Therefore, diversification of feed sources is also an important strategy in developing a feed management system [27].

The automation system in feeding is also an innovation that has the potential to replace conventional methods that are time-consuming and labor-intensive. Currently, Internet of Things (IoT)-based automatic feeders can facilitate regular and efficient feeding, which is critical in increasing livestock productivity [2], [28]. A system that uses a microcontroller and is connected via a mobile application can monitor and regulate chicken feed requirements remotely, making it more efficient and reducing the possibility of human error [29]. This shows that technology not only plays a role in operational efficiency, but also in managing chicken health and productivity [30].

In addition, the selection of feed type also affects the efficiency of feed conversion. Corn is often used as a primary energy source, but its availability can be limited, so finding local alternatives, such as sorghum, is essential [7]. Research shows that replacing corn with alternative feed sources can reduce dependence on imported feed and provide sustainable solutions for local farmers [31]. In addition, innovation in the use of Bio Stamino® also shows a positive impact on broiler chicken performance [30]. By utilizing this product, farmers can improve the health and growth of their chickens optimally.

Another very important factor is training and education for farmers. Farmers' skills and understanding of good feed management greatly influence their operational success [32]. Empowering livestock farming groups through educational programs such as those carried out in East Nusa Tenggara is very important to reduce traditional livestock farming patterns which are often inefficient. This education also includes

techniques for utilizing local resources for feed [33]. Through these programs, farmers can be empowered to make better decisions regarding feed selection and management, which in turn will significantly increase production results.

The importance of feed quality control cannot be ignored. Research shows that controlling the quality of raw materials through organoleptic observations can ensure better feed quality, which has direct implications for chicken health and production [34]. Therefore, marketing strategies must also be adjusted to feed management practices to ensure sustainability in the chicken farming industry. Thus, the application of modern technology in feed must be balanced with management strategies that support optimal results.

Thus, the development of a comprehensive feed management system in chicken farming must involve technology integration, education for farmers, diversification of feed ingredients, and strict quality control. These policies and strategies are expected to provide a significant contribution to increasing feed productivity while supporting the sustainability of the chicken farming industry in Indonesia.

C. Factors affecting the effectiveness of feed management systems in chicken farms

This study identified and analyzed various factors that influence the effectiveness of feed management systems in chicken farms. These factors are divided into three main categories: technical, managerial, and environmental. 1) Technical factors include the quality of feed distribution equipment, the accuracy of the measurement system, and the sophistication of the technology used (e.g. automatic sensors and monitoring software). Inaccuracy in technology can lead to overfeeding or underfeeding, which has a negative impact on efficiency. 2) Managerial factors include the ability of farmers to use technology, regularity of feed consumption recording, and data-based decision making. The study showed that management training and assistance greatly influenced the success of the implementation of the feed management system and 3) Environmental factors such as cage temperature, humidity, and ventilation also play an important role. An unstable environment can affect the chicken's appetite, which then disrupts feeding planning.

The effectiveness of the feed management system in chicken farming is greatly influenced by various internal and external factors that interact with each other. In the context of chicken farming, feed is a key factor that contributes to animal productivity and health. According to Natsir [35], feed costs account for around 70% of the total operational costs in a chicken farming business. Therefore, feed management efficiency must be a top priority so that the farm can operate optimally.

One approach to improving the effectiveness of feed management systems is through technology that allows for automated monitoring and regulation of feed. Research by Hermawan and Yanuar shows that automatic feeding machines can increase the productivity of laying hens by ensuring that feed is given in the right and uniform amount [36]. This kind of system is also combined with Internet of Things (IoT) technology which allows feed management to be carried out more efficiently and

integrated [2]. With IoT devices, farmers can monitor feed consumption levels and environmental conditions in real-time, which will help in making more appropriate decisions.

In addition, the quality aspect of feed greatly affects production results. Hidayat et al. stated that good quality feed not only contributes to the physical performance of chickens, but also to the quality of their harvest, such as the number and quality of eggs [7]. In adjusting feed, it is important for farmers to consider various aspects such as the right nutritional composition [37], which has a direct impact on chicken health and productivity. Research conducted by Hidayat shows that the use of nanominerals in feed can increase the efficiency of nutrient absorption and minimize the disposal of excess minerals, thereby reducing environmental impacts [7]

In addition to feed management and technology utilization, cage management factors also contribute to the effectiveness of the feed management system. Chicken behavior, such as aggressiveness and eating habits, is also influenced by environmental conditions and cage system management. The results of a study by Hidayat Hidayat [7] indicate that cage density and the arrangement of supporting facilities, such as feeding places and lighting, can reduce feather pecking behavior which can harm animal health.

The complexity of feed management in chicken farming also reflects the need for ongoing research in developing more accurate and effective systems. Training for farmers on the use of IoT-based technology, as described in the study by Candra et al. [38], can be a solution to improve farmers' understanding of a more modern and efficient feed management system.

With strategic steps in feed management, technology, and training for farmers, it is hoped that the effectiveness of the feed management system in chicken farming can increase significantly. A holistic research-based approach will support the development of a more innovative and sustainable feed system [39].

These various factors integrate with each other to create an efficient and productive feed management system, which can lead to improved animal welfare and economic benefits for farmers. The emphasis on efficiency and sustainability in feeding systems is expected not only for financial gain, but also for positive contributions to the overall farm environment.

CONCLUSION

Fundamental Finding : This study concludes that the effectiveness of a feed management system in poultry farming is significantly enhanced through the integrated application of automated technology, competent operational management, and optimized environmental conditions. A structured, data-driven approach that adapts to the chickens' growth phases has been shown to improve feed efficiency and productivity, thereby reducing operational costs. **Implication :** These findings suggest that adopting such integrated systems can contribute substantially to the economic viability and sustainability of small- to medium-scale poultry enterprises, with broader implications for food security and agricultural innovation. **Limitation :** However, as the study is based

on a library research approach, it lacks empirical validation in real farm environments, limiting the generalizability and practical assessment of the proposed system's performance. **Future Research :** It is therefore recommended that future studies employ experimental or field-based methodologies to test the proposed model, assess its scalability, and explore farmer readiness and behavioral adaptation toward technological interventions in feed management.

REFERENCES

[1] N. F. Noorrahman, W. P. Lokapirnasari, M. A. Al arif, K. Soepranianondo, S. Hidanah, and S. Sarmanu, "Efek penggunaan probiotik Lactobacillus casei DAN Bifidobacterium sp terhadap angka konversi pakan dan konsumsi pakan pada ayam petelur yang diinfeksi Escherichia coli," *Briliant: Jurnal Riset dan Konseptual*, vol. 4, no. 2, p. 167, May 2019, doi: 10.28926/briliant.v4i2.288.

[2] R. E. Putri, M. Putra, and K. Fahmy, "Pengembangan sistem pemberi pakan ayam cerdas berbasis internet of things (IoT)," *Jurnal Teknologi Pertanian Andalas*, vol. 26, no. 1, p. 27, Mar. 2022, doi: 10.25077/jtpa.26.1.27-37.2022.

[3] A. S. Arifin and R. D. Puriyanto, "Rancang Bangun Pemberian Pakan Ayam Petelur Otomatis Menggunakan PLC," *Buletin Ilmiah Sarjana Teknik Elektro*, vol. 1, no. 1, p. 19, Aug. 2019, doi: 10.12928/biste.v1i1.858.

[4] M. Daud, Z. Zulfan, L. Hakim, and A. Arismawan, "Pemberdayaan kelompok peternak melalui diversifikasi limbah pasar ikan sebagai bahan pakan ayam kalasan," *EJOIN : Jurnal Pengabdian Masyarakat*, vol. 1, no. 7, pp. 605–611, Jul. 2023, doi: 10.55681/ejoin.v1i7.1189.

[5] S. Degei, A. Napirah, R. Badaruddin, and W. L. Salido, "Pengaruh penggunaan tepung jantung pisang (Musa paradisiaca lam) dalam pakan terhadap konsumsi pakan, pertambahan bobot badan dan konversi pakan ayam broiler," *Jurnal Ilmiah Peternakan Halu Oleo*, vol. 2, no. 3, Feb. 2021, doi: 10.56625/jipho.v2i3.16880.

[6] E. W. Satria, O. Sjofjan, and I. H. Djunaidi, "Respon pemberian tepung daun kelor (Moringa oleifera) pada pakan ayam petelur terhadap penampilan produksi dan kualitas telur," *Buletin Peternakan*, vol. 40, no. 3, p. 197, Nov. 2016, doi: 10.21059/buletinpeternak.v40i3.11203.

[7] C. Hidayat, "Upaya menekan perilaku mematuk bulu yang memicu perilaku kanibalisme pada peternakan ayam," *Jurnal Peternakan Indonesia (Indonesian Journal of Animal Science)*, vol. 21, no. 2, p. 163, May 2019, doi: 10.25077/jpi.21.2.163-175.2019.

[8] R. N. Abel, I. W. Bebas, and I. K. Sumadi, "Pengaruh pemberian berbagai konsentrasi asam butirat terhadap performa dan persentase karkas ayam pedaging," *Buletin Veteriner Udayana*, p. 37, Jun. 2022, doi: 10.24843/bulvet.2023.v01.i01.p05.

[9] S. Wahjuni *et al.*, "Sistem pemantauan perilaku ayam broiler pada kandang pintar," in *Prosiding Use Cases Artificial Intelligence Indonesia: Embracing Collaboration for Research and Industrial Innovation in Artificial Intelligence*, Penerbit BRIN, 2023. doi: 10.55981/brin.668.c550.

[10] A. Jalil Ikromi Radana and R. Zainul Abidin, "Prototype sistem pemberi pakan ternak ayam otomatis menggunakan ESP8266," *JATI (Jurnal Mahasiswa Teknik Informatika)*, vol. 7, no. 6, pp. 3732–3738, Feb. 2024, doi: 10.36040/jati.v7i6.7301.

[11] R. E. Puteri, R. Saadah, and R. G. Laras, "Evaluasi nilai gizi dan kandungan asam amino pada kotoran unggas untuk pakan ikan lele (Clarias gariepinus)," *Jurnal Perikanan Unram*, vol. 12, no. 4, pp. 691–698, Dec. 2022, doi: 10.29303/jp.v12i4.397.

[12] S. Sandra, M. Bagus Hermanto, H. Nayati Utami, R. Damayanti, and A. Rachmawati, "Aplikasi dan diseminasi teknologi pemanfaatan bahan lokal sebagai pakan ternak ayam dan ikan untuk mengurangi ketergantungan pakan import bagi peternak ayam dan ikan di Desa Ngawonggo," *Journal of Innovation and Applied Technology*, vol. 8, no. 2, pp. 1459–1463, Dec. 2022, doi: 10.21776/ub.jiat.2022.008.02.6.

[13] A. A. A. Abdel-Wareth and J. Lohakare, "Moringa oleifera leaves as eco-friendly feed additive in diets of hy-line brown hens during the late laying period," *Animals*, vol. 11, no. 4, p. 1116, Apr. 2021, doi: 10.3390/ani11041116.

[14] A. A. A. Abdel-Wareth, A. N. Williams, M. Salahuddin, S. Gadekar, and J. Lohakare, "Algae as an alternative source of protein in poultry diets for sustainable production and disease resistance: present status and future considerations," *Front Vet Sci*, vol. 11, Apr. 2024, doi: 10.3389/fvets.2024.1382163.

[15] L. Yu, G. Teng, G. L. Riskowski, X. Xu, and W. Guo, "Uncertainty analysis of a web-based data acquisition system for poultry management with sensor networks," *Engenharia Agrícola*, vol. 38, no. 6, pp. 857–863, Dec. 2018, doi: 10.1590/1809-4430-eng.agric.v38n6p857-863/2018.

[16] H. Zheng, T. Zhang, C. Fang, J. Zeng, and X. Yang, "Design and implementation of poultry farming information management system based on cloud database," *Animals*, vol. 11, no. 3, p. 900, Mar. 2021, doi: 10.3390/ani11030900.

[17] M. I. Alzarah *et al.*, "Inclusion of Citrullus colocynthis seed extract into diets induced a hypolipidemic effect and improved layer performance," *Agriculture*, vol. 11, no. 9, p. 808, Aug. 2021, doi: 10.3390/agriculture11090808.

[18] I. Komlósi, "Recent advancements in poultry health, nutrition and sustainability," *Agriculture*, vol. 12, no. 4, p. 516, Apr. 2022, doi: 10.3390/agriculture12040516.

[19] I. S. Shanta *et al.*, "Raising backyard poultry in rural Bangladesh: financial and nutritional benefits, but persistent risky practices," *Transbound Emerg Dis*, vol. 64, no. 5, pp. 1454–1464, Jun. 2016, doi: 10.1111/tbed.12536.

[20] St. A. Sijid, H. Hafsan, and F. Khudaer, "Harnessing enzymes for optimal poultry feed formulations (Mini Review)," *Sainsmat : Jurnal Ilmiah Ilmu Pengetahuan Alam*, vol. 13, no. 1, p. 1, Mar. 2024, doi: 10.35580/sainsmat131501882024.

[21] M. Eugene, M. Janvier, E. N. Tuyisenge, and O. Lonzy, "Assessment of poultry production system in Rwanda, a case study in Nyagatare District," *Am J Anim Vet Sci*, vol. 15, no. 1, pp. 1–9, Jan. 2020, doi: 10.3844/ajavsp.2020.1.9.

[22] B. Tangendjaja, "Nutrient content of soybean meal from different origins based on near infrared reflectance spectroscopy," *Indonesian Journal of Agricultural Science*, vol. 21, no. 1, p. 39, Jun. 2020, doi: 10.21082/ijas.v21n1.2020.p39-47.

[23] A. A. A. Abdel-Wareth, M. Mobashar, A. Shah, and A. B. Sadiq, "Jojoba seed oil as feed additive for sustainable broiler meat production under hot climatic conditions," *Animals*, vol. 12, no. 3, p. 273, Jan. 2022, doi: 10.3390/ani12030273.

[24] J. B. Hetherington, A. K. Wiethoelter, J. Negin, and S. M. Mor, "Livestock ownership, animal source foods and child nutritional outcomes in seven rural village clusters in Sub-Saharan Africa," *Agriculture & Food Security*, vol. 6, no. 1, Jan. 2017, doi: 10.1186/s40066-016-0079-z.

[25] D. H. A. Longgy and D. C. Widianingrum, "Aplikasi teknologi peternakan modern dan strategi pemasaran inovatif untuk meningkatkan nilai tambah produk peternakan," *Jurnal Ilmiah Peternakan Halu Oleo*, vol. 6, no. 4, pp. 304–317, Nov. 2024, doi: 10.56625/jipho.v6i4.151.

[26] W. Wahyuni and A. Lestari, "Prevalensi sakit dan kematian ayam petelur (studi kasus di peternakan ayam ras petelur)," *Tarjih Tropical Livestock Journal*, vol. 2, no. 2, pp. 68–75, Dec. 2022, doi: 10.47030/trolija.v2i2.440.

[27] A. Triandoyo, E. C. Wulandari, and P. Sunu, "The effect of adding Maggot BSF (Black Soldier Fly) flour with different levels on performance starter phase broiler chicken," *Tropical Animal Science*, vol. 4, no. 2, pp. 66–73, Nov. 2022, doi: 10.36596/tas.v4i2.871.

[28] E. B. Agustina, D. A. Rachman, R. Nofillah, and L. I. Fitri, "Desain sistem Smart Feeder ayam berbasis internet of things (IoT) guna mencegah keterlambatan pemberian pakan," *Jurnal Fisika Unand*, vol. 13, no. 2, pp. 297–302, Mar. 2024, doi: 10.25077/jfu.13.2.297-302.2024.

[29] A. Surahman, B. Aditama, M. Bakri, and R. Rasna, "Sistem pakan ayam otomatis berbasis Internet Of Things," *Jurnal Teknologi dan Sistem Tertanam*, vol. 2, no. 1, p. 13, Feb. 2021, doi: 10.33365/jtst.v2i1.1025.

[30] H. Yendri, N. Sampurno, F. Alfiansyah, A. W. P. Purnama, Tukiran, and Amrozi, "evaluasi pemberian produk elektro bio stamino® terhadap performa ayam broiler," *Jurnal Veteriner dan Biomedis*, vol. 1, no. 2, pp. 108–114, Oct. 2023, doi: 10.29244/jvetbiomed.1.2.108-114.

[31] S. Akhadiarto, "Prospek pembuatan pakan ayam dari bahan baku lokal (contoh kasus Gorontalo)," *Jurnal Sains dan Teknologi Indonesia*, vol. 17, no. 1, Mar. 2019, doi: 10.29122/jsti.v17i1.3420.

[32] N. S. Dalle, M. T. Luju, W. G. Utama, P. C. Achmadi, R. Gultom, and A. A. Jeramat, "Edukasi manajemen pemeliharaan ternak kambing bagi peternak di nusa tenggara timur," *JMM (Jurnal Masyarakat Mandiri)*, vol. 7, no. 4, p. 3635, Aug. 2023, doi: 10.31764/jmm.v7i4.16186.

[33] M. Haqiqi, R. T. Hertamawati, and R. Rahmasari, "Tingkat penerapan biosekuriti pada usaha peternakan ayam ras petelur di Kabupaten Jember," in *Sinergitas Antara Pemerintah, Perguruan Tinggi dan DUDI dalam Pengembangan Ternak Lokal yang Berkelanjutan*, in CAAS, vol. 2. Politeknik Negeri Jember, Dec. 2021, pp. 56–64. doi: 10.25047/animpro.2021.7.

[34] O. Barus, B. Sulistiyanto, C. S. Utama, and M. F. Haidar, "Analisis pengendalian mutu pakan ayam petelur: studi kasus di peternakan ayam petelur di Kecamatan Mijen Kota Semarang," *Jurnal Litbang Provinsi Jawa Tengah*, vol. 20, no. 1, pp. 9–22, Jun. 2022, doi: 10.36762/jurnaljateng.v20i1.901.

[35] M. Halim Natsir, "Peranan biro konsultasi pakan ternak dan software ub feed dalam pemberdayaan peternak unggas Karangploso Malang menuju peternakan organik," *Journal of Innovation and Applied Technology*, vol. 4, no. 2, pp. 728–736, Nov. 2018, doi: 10.21776/ub.jiat.2018.004.02.2.

[36] W. Hermawan and R. K. Yanuar, "Design and performance of an automatic laying hen feeding machines in cage-type cage," *Jurnal Keteknikan Pertanian*, vol. 11, no. 3, pp. 358–374, Dec. 2023, doi: 10.19028/jtep.011.3.358-374.

[37] R. E. Juwita and A. Selao, "Menentukan volume produksi ayam dengan memilih pakan ayam menggunakan metode sugeno," *Jurnal Sintaks Logika*, vol. 2, no. 3, pp. 31–38, Oct. 2022, doi: 10.31850/jsilog.v2i3.1849.

[38] H. Candra, I. A. Marie, S. Sulaiman, S. Agoes, and M. D. Alrifqi, "Pelatihan penggunaan sistem pakan ternak ayam dengan teknologi pintar untuk umkm di sekitar rest area 72 A," *Jurnal Bakti Masyarakat Indonesia*, vol. 6, no. 1, pp. 1–10, May 2023, doi: 10.24912/jbmi.v6i1.23362.

[39] J. Adri, N. Erizon, and B. Rahim, "Inovasi mesin pengaduk kosentrat pakan ternak," *Jurnal Sains dan Teknologi: Jurnal Keilmuan dan Aplikasi Teknologi Industri*, vol. 21, no. 2, p. 117, Dec. 2021, doi: 10.36275/stsp.v21i2.377.

* **Zulkifli (Corresponding Author)**
Indonesian National Islamic University, Indonesia
Email: zuel.durian@gmail.com

M. Azizi
Indonesian National Islamic University, Indonesia
Email: azizi0961@gmail.com