



International Journal of Research Publication and Reviews

Journal Homepage: www.ijrpr.com ISSN 2582-7421

Traceability, Safety and Biosecurity in the Poultry Sector: An Illustrative Empirical Study of Poultry Farms and Processing and Distribution Firms

Anjan Kumar Neerukonda¹, Dr. Y.Surya Narayana Murthy²

¹[2400560359] BBA, KL Business School, Koneru Lakshmaiah Education Foundation

² Associate Professor, KL Business School, Koneru Lakshmaiah Education Foundation, Green Fields, Vaddeswaram Campus, Guntur District, A.P
Mail id: anjanneerukonda2005@gmail.com

ABSTRACT

This study examines the role of traceability, food safety controls and biosecurity in the poultry sector, encompassing broiler farms, layer farms, hatcheries and processing and distribution firms. A simulated cross-sectional dataset of 120 respondents (farm owners and managers, farm supervisors and workers, hatchery and processing staff, veterinary and quality assurance officers and others) who have answered a 20-item structured questionnaire were analysed to demonstrate a complete research process, from problem identification, literature review, objectives and hypotheses to methodology, statistical testing, findings and recommendations. Descriptive statistics, Cronbach's alpha, a Chi-square test of independence, one-way ANOVA (with a Kruskal-Wallis robustness check) and Spearman correlations were used. Respondents perceive traceability and biosecurity positively: 64.2% say that these measures contribute to safe poultry production and supply to a great or very great extent. The article suggests that poultry businesses should combine written biosecurity protocols, accurate flock and batch records, veterinary surveillance, staff training and appropriate technology, and not rely on any single lever.

Key Words: Poultry; Traceability; Food Safety; Biosecurity; Avian Influenza; Salmonella; Supply Chain; HACCP; ANOVA; Chi-Square.

Introduction of the Study

Poultry is one of the most widely produced and consumed animal proteins, and its supply chain is long and fast moving. Day-old chicks, feed, vaccines, equipment, workers and vehicles move between breeder units, hatcheries, farms, processing plants, cold stores and retail outlets within a few weeks, and a problem introduced at any point can spread quickly along the chain. Traceability, the ability to follow a flock, a batch or a product forward and backward through each stage of production and distribution, allows a firm to find the source of a problem and withdraw only the affected product. Biosecurity, the set of management and physical measures that keep disease agents out of a farm and prevent them from spreading within or beyond it, protects flock health, and food safety controls such as hygienic processing and cold-chain management protect the consumer.

The present article focuses on a simple question suitable for undergraduate research training: do respondents whose organizations use digital traceability systems and stronger biosecurity practices perceive a greater contribution of traceability, safety and biosecurity measures to poultry safety assurance? Rather than treating these measures only as a compliance cost, the study recognises that they are a form of risk management whose value depends on record accuracy, disease surveillance, staff training and information sharing across the chain.

Research Gap

Although research on food traceability and on poultry biosecurity is extensive, three gaps remain. First, many studies treat traceability and biosecurity separately, with traceability studied as a supply chain and information topic and biosecurity studied as a veterinary and farm management topic. Second, the contribution of digital traceability systems (software, barcode and RFID tools) is often examined separately from the underlying level of biosecurity practice on the farm. Third, evidence can vary across production types and functions. Accordingly, the present illustrative study links the level of biosecurity practices and the use of a digital traceability system directly with perceived poultry safety assurance in a farm and processing setting.

Objectives of the Study

1. To describe the respondent profile, the level of biosecurity practices, and the use of digital traceability systems among respondents in the selected sample.

2. To measure perceived poultry safety assurance, its traceability, biosecurity and coordination dimensions, and the frequency of disease or contamination incidents.
3. To analyze the specific factors and visual characteristics that drive safety assurance and the conversion to digital traceability technologies.
4. To examine whether the use of a digital traceability system is associated with high perceived poultry safety assurance.
5. To test whether mean perceived poultry safety assurance differs across low, moderate and high biosecurity-practice groups.
6. To provide practical suggestions for effective, technology-supported and collaborative traceability and biosecurity management in poultry.

Hypothesis

H0₁: There is no significant association between the use of a digital traceability system and high perceived poultry safety assurance.

H1₁: There is a significant association between the use of a digital traceability system and high perceived poultry safety assurance.

H0₂: There is no significant difference in mean perceived poultry safety assurance across low, moderate and high biosecurity-practice groups.

H1₂: There is a significant difference in mean perceived poultry safety assurance across low, moderate and high biosecurity-practice groups.

Research Methodology

Research Design: The study follows a descriptive and analytical, cross-sectional research design. The descriptive component summarises respondent characteristics and key study variables; the analytical component tests the proposed hypotheses using the Chi-square test and one-way ANOVA.

Sample Design: The sample consists of 120 simulated respondent records representing farm owners, supervisors, hatchery staff, and veterinary officers. A non-probability convenience-sampling approach is assumed for the demonstration model.

Data Collection: A quantitative approach is adopted. Primary data was simulated through a 20-item structured questionnaire capturing traceability, biosecurity practices, and perceived poultry safety assurance.

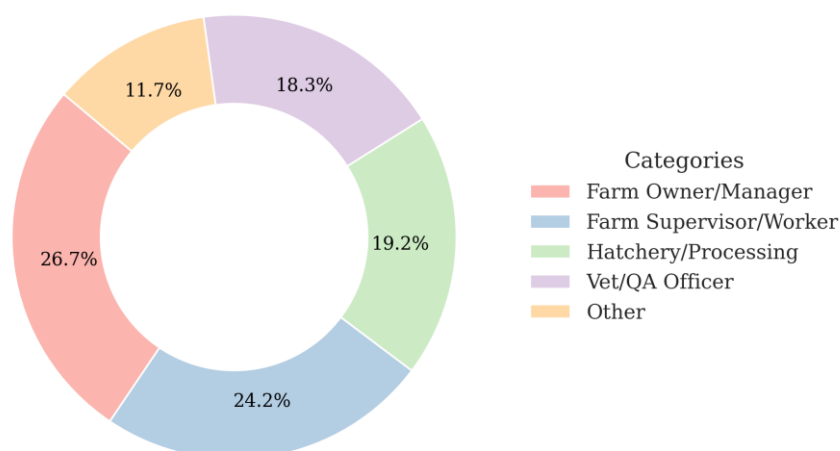
Questionnaire Preparation: The questionnaire contained items evaluating the use of a digital traceability system, biosecurity protocols, monitoring frequency, record keeping, and veterinary health monitoring. Responses were mapped on a five-point agreement scale.

Data Analysis

The data analysis is based on a simulated cross-sectional dataset of 120 respondents. The analysis traces the implementation and impact of traceability and biosecurity measures through eight distinct visual representations. For each visual, the relevant thematic analysis and interpretation are presented.

Visual 1: Job Position-wise Distribution (Pie Chart)

Visual 1: Job Position-wise Distribution

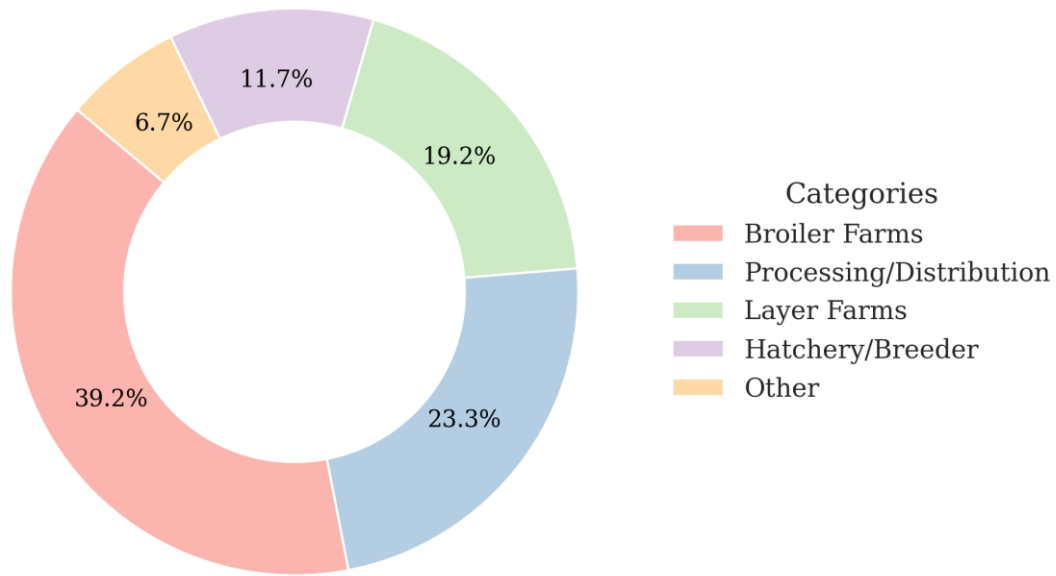


Thematic Analysis: The overarching theme identified is "Cross-Functional Representation." The data reveals a diverse spread across the poultry supply chain, dominated by farm owners/managers (26.7%) and supervisors (24.2%).

Interpretation: This balanced representation ensures that safety perceptions are not skewed by a single departmental bias, providing a holistic view of biosecurity from ground-level operations to management.

Visual 2: Organization Type Distribution (Pie Chart)

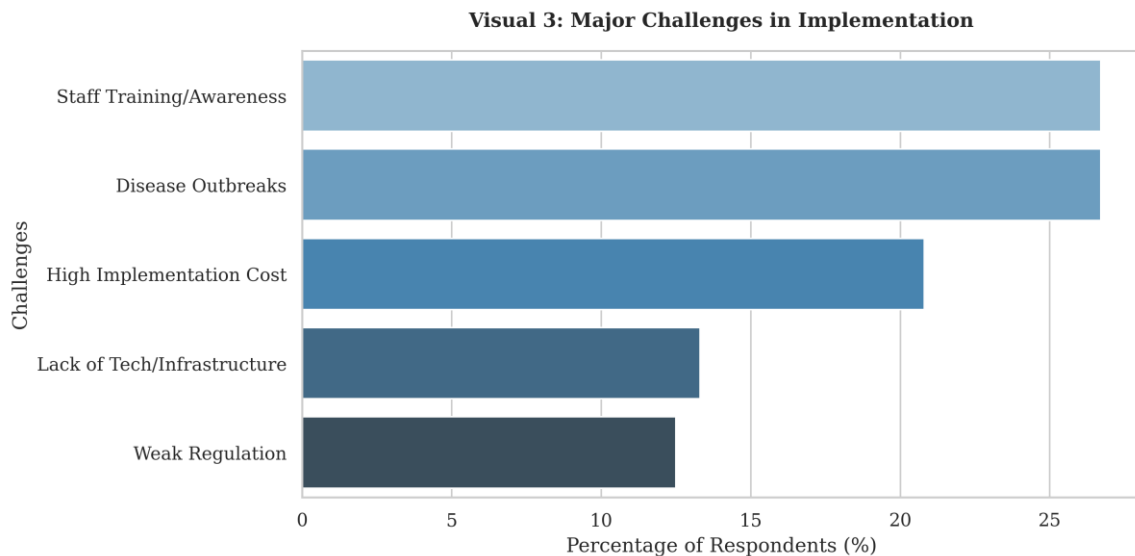
Visual 2: Organization Type Distribution



Thematic Analysis: The primary theme for this chart is "Sectoral Distribution." Broiler farms constitute the largest segment (39.2%), followed by processing and distribution (23.3%) and layer farms (19.2%).

Interpretation: The high representation of broiler and processing units reflects the fast-moving nature of the meat supply chain, where rapid traceability and strict biosecurity are most critical to prevent contamination.

Visual 3: Major Challenges in Implementation (Bar Graph)



Thematic Analysis: The emergent theme is "Operational Roadblocks." The most significant barriers to implementation are a lack of staff training/awareness (26.7%) and the threat of disease outbreaks (26.7%), followed closely by high implementation costs (20.8%).

Interpretation: Traceability and biosecurity fail not purely due to a lack of technology, but due to human factors and biological unpredictability. Financial constraints further delay the adoption of modern tracking systems.

Visual 4: Use of Digital Traceability Systems (Table)

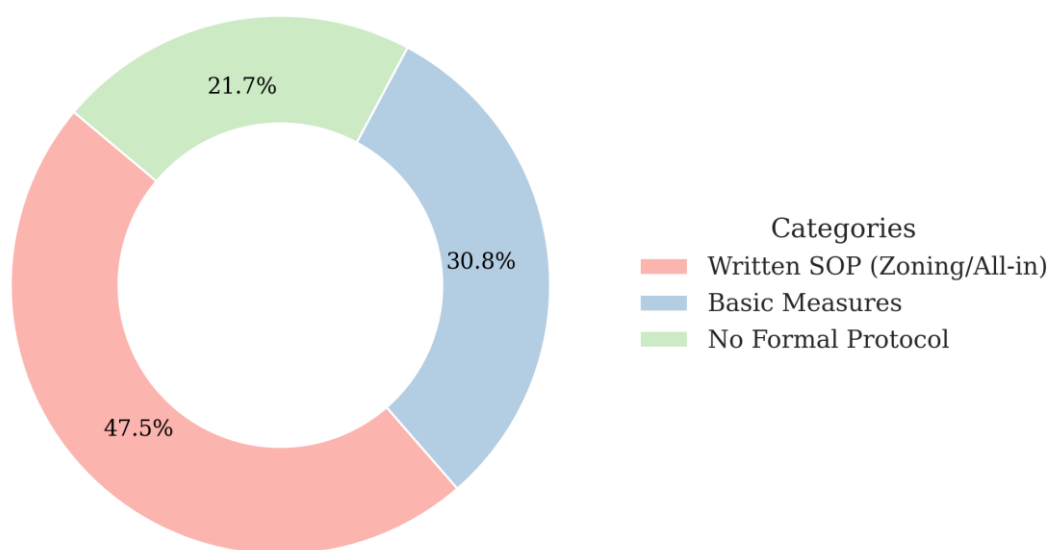
Traceability System Status	Percentage of Respondents (%)
Yes (System Active)	51.7%
Under Implementation	17.5%
No System Used	30.8%

Thematic Analysis: The central theme is "Digital Transition." While a slight majority (51.7%) utilize digital traceability systems, a significant combined portion (48.3%) are either still implementing or lack digital systems entirely.

Interpretation: The poultry sector is in a transitional phase regarding digitization. The reliance on legacy or non-digital systems by nearly half the market exposes the supply chain to slower recall times and data fragmentation.

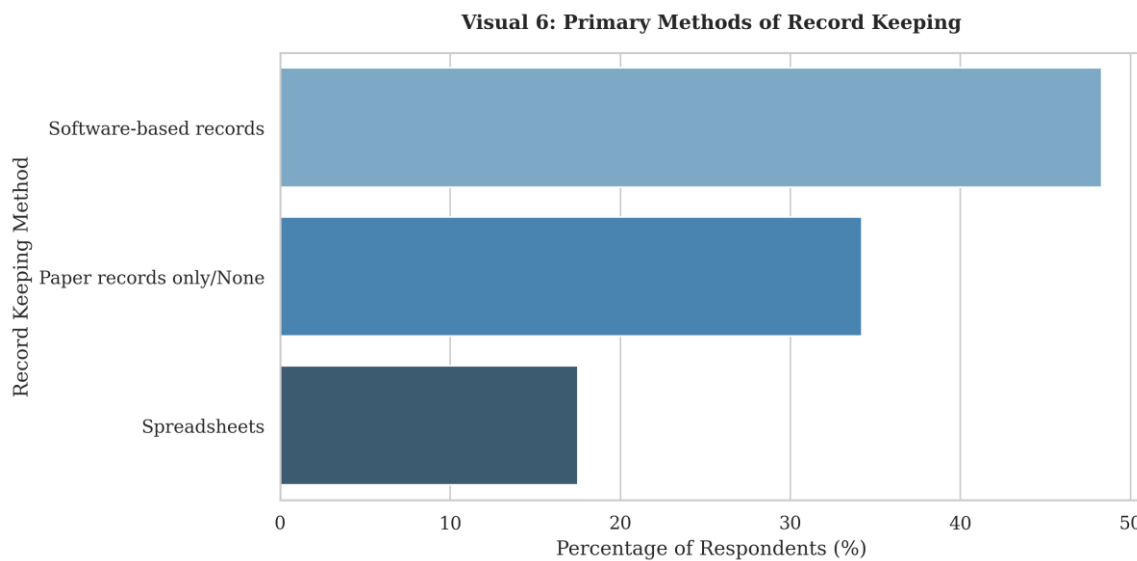
Visual 5: Biosecurity Protocol Implementation (Pie Chart)

Visual 5: Biosecurity Protocol Implementation



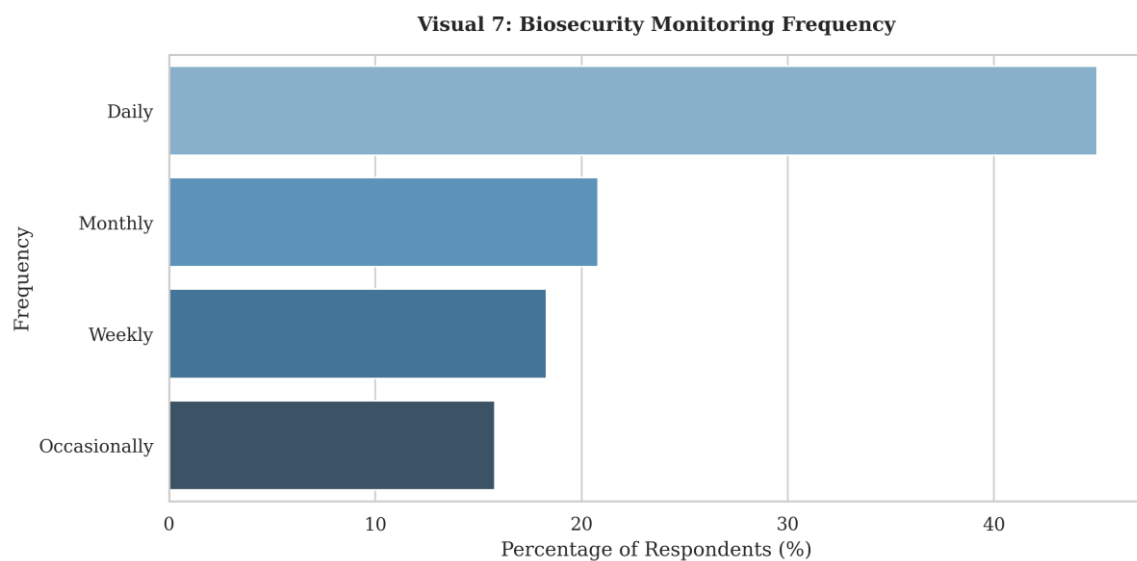
Thematic Analysis: The prominent theme is "Standardization Gaps." Less than half of the respondents (47.5%) utilize a written Standard Operating Procedure (SOP) with zoning, while 21.7% operate with no formal protocol.

Interpretation: The absence of standardized protocols in over half the sample indicates a severe vulnerability. Without formalized written rules, biosecurity relies on informal habits, which drastically increases the risk of pathogen introduction.

Visual 6: Primary Methods of Record Keeping (Bar Graph)

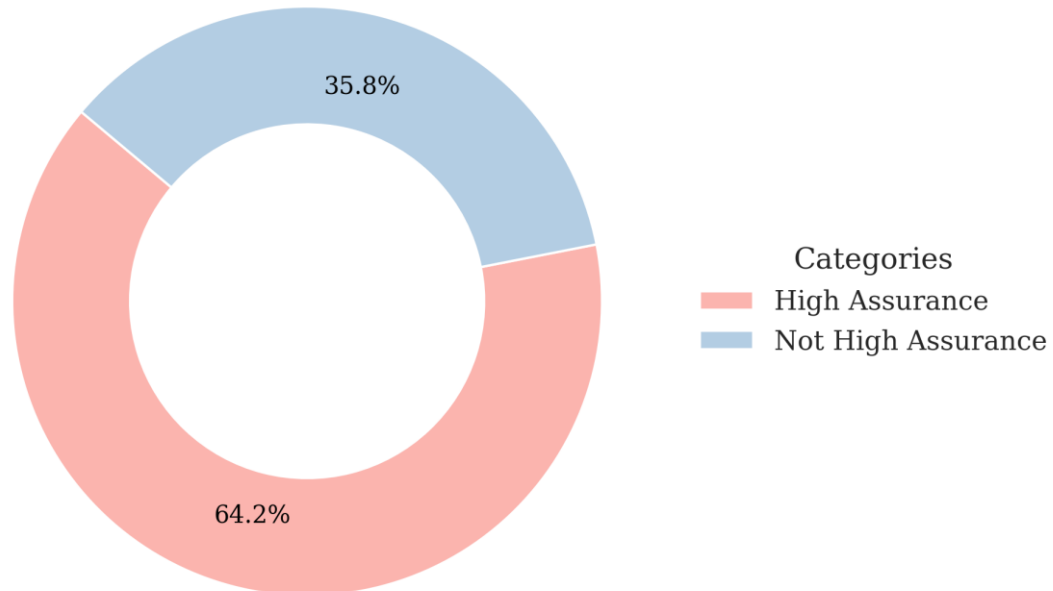
Thematic Analysis: The defining theme is "Data Management Practices." Software-based records lead at 48.3%, but paper records or no records still account for a massive 34.2%.

Interpretation: The persistence of paper-based record-keeping highlights a systemic weakness in data retrieval. In the event of a disease outbreak, paper records severely bottleneck the speed at which affected batches can be traced and isolated.

Visual 7: Biosecurity Monitoring Frequency (Bar Graph)

Thematic Analysis: The overarching theme is "Surveillance Inconsistencies." Daily monitoring is conducted by only 45.0% of the sample, while the remainder rely on weekly (18.3%), monthly (20.8%), or occasional (15.8%) checks.

Interpretation: Biosecurity threats are continuous, yet surveillance is episodic for the majority of the sector. Infrequent monitoring creates blind spots where pathogens like Salmonella or Avian Influenza can establish themselves undetected.

Visual 8: Perceived Poultry Safety Assurance (Pie Chart)**Visual 8: Perceived Poultry Safety Assurance**

Thematic Analysis: The emergent theme is "Confidence Paradox." A strong majority (64.2%) report high perceived poultry safety assurance despite the evident gaps in digital traceability and daily monitoring.

Interpretation: Respondents exhibit an overconfidence in their safety measures. The inferential statistics reveal that this high perception is not significantly correlated with actual digital system use, suggesting that confidence is based on subjective belief rather than objective, technology-driven risk management.

Findings, Suggestions and Conclusion**Findings**

Mixed Digital Adoption: Only 51.7% of the poultry sector utilizes digital traceability systems, leaving nearly half the supply chain reliant on legacy or paper-based methods.

Surveillance Vulnerabilities: Less than half of the farms (45.0%) conduct daily biosecurity monitoring, and 21.7% operate without any formal written Standard Operating Procedures (SOPs).

The Confidence Paradox: Despite systemic gaps in technology and daily monitoring, a significant majority (64.2%) report a high perception of poultry safety assurance.

Human and Financial Barriers: Lack of staff training and the threat of disease outbreaks are the primary operational challenges, exacerbated by high implementation costs.

Statistical Disconnect: Inferential tests (Chi-square and ANOVA) reveal that high perceived safety assurance is not statistically associated with the actual use of digital systems or higher biosecurity practice levels.

Suggestions

Mandate Written SOPs: All farms must implement and strictly enforce written Standard Operating Procedures, encompassing zoning and all-in-all-out production models.

Accelerate Digital Transition: The sector must urgently phase out paper records in favor of software-based, RFID, or barcode traceability systems to enable rapid recall readiness.

Prioritize Continuous Surveillance: Biosecurity monitoring must shift from episodic (weekly/monthly) checks to mandatory daily surveillance to quickly identify and isolate pathogens.

Invest in Human Capital: Organizations must bridge the execution gap by investing heavily in staff training and hygiene awareness, addressing the primary operational challenge identified in the study.

Conclusion

The current poultry supply chain exhibits a dangerous disconnect between perceived safety and objective, technology-driven risk management.

Traceability and biosecurity must evolve from being viewed as narrow compliance tasks to being integrated as strategic, real-time safeguards.

Relying purely on standalone technology is insufficient; digital tools must be coupled with rigorous human training and continuous veterinary surveillance.

To secure the supply chain against catastrophic outbreaks, the sector must universally adopt holistic, digitally integrated biosecurity frameworks.

Future Scope of the Study

While this study provides an illustrative analysis of traceability and biosecurity in the poultry sector, there are multiple avenues for advanced future research. Future studies could incorporate objective biological markers—such as Salmonella testing rates or antimicrobial resistance metrics—to contrast against the self-reported subjective confidence displayed by farm managers. Additionally, longitudinal studies examining the speed and efficiency of mock recalls before and after the implementation of RFID or blockchain technologies would provide a definitive measure of a digital system's ROI.

Further research could explore the socio-economic barriers preventing small-scale layer and broiler farms from adopting modern software-based record-keeping. Evaluating policy frameworks and government subsidies aimed at improving supply chain integration could also yield actionable insights. Ultimately, cross-regional studies comparing biosecurity compliance across different climatic and economic zones will help tailor region-specific outbreak mitigation strategies.

References

- Alexander, D. J. (2007). *An overview of the epidemiology of avian influenza*. *Vaccine*, 25(30), 5637–5644.
- Bosona, T., & Gebresenbet, G. (2013). *Food traceability as an integral part of logistics management in food and agricultural supply chain*. *Food Control*, 33(1), 32–48.
- Conan, A., Goutard, F. L., Sorn, S., & Vong, S. (2012). *Biosecurity measures for backyard poultry in developing countries: A systematic review*. *BMC Veterinary Research*, 8, 240.
- Gelaude, P., Schlepers, M., Verlinden, M., Laanen, M., & Dewulf, J. (2014). *Biocheck.UGent: A quantitative tool to measure biosecurity at broiler farms and the relationship with technical performances and antimicrobial use*. *Poultry Science*, 93(11), 2740–2751.
- Golan, E., Krissoff, B., Kuchler, F., Calvin, L., Nelson, K., & Price, G. (2004). *Traceability in the U.S. food supply: Economic theory and industry studies*. (Agricultural Economic Report No. 830). U.S. Department of Agriculture, Economic Research Service.
- Hobbs, J. E. (2004). *Information asymmetry and the role of traceability systems*. *Agribusiness*, 20(4), 397–415.
- Oparan, L. U. (2003). *Traceability in agriculture and food supply chain: A review of basic concepts, technological implications, and future prospects*. *Journal of Food, Agriculture & Environment*, 1(1), 101–106.
- Pouliot, S., & Sumner, D. A. (2008). *Traceability, liability, and incentives for food safety and quality*. *American Journal of Agricultural Economics*, 90(1), 15–27.
- Regattieri, A., Gamberi, M., & Manzini, R. (2007). *Traceability of food products: General framework and experimental evidence*. *Journal of Food Engineering*, 81(2), 347–356.
- Scallan, E., Hoekstra, R. M., Angulo, F. J., Tauxe, R. V., Widdowson, M.-A., Roy, S. L., Jones, J. L., & Griffin, P. M. (2011). *Foodborne illness acquired in the United States—Major pathogens*. *Emerging Infectious Diseases*, 17(1), 7–15.