

# Intelligent Poultry Farming: AI-Driven Solutions in India

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## Abstract

India's poultry sector, a ₹1,05,000 crore industry, is a vital contributor to rural livelihoods and national nutrition but faces significant challenges, including rising feed costs, disease outbreaks, and limited mechanization among smallholder farms. This article explores the integration of Artificial Intelligence (AI) in feeding and production management to enhance efficiency, reduce costs, and improve yield. Drawing on data from Indian and international agencies, the study highlights successful AI applications such as precision feeding, disease prediction, climate optimization, and automated egg processing. While quantifiable benefits—like reduced feed costs and increased egg yield—underscore AI's transformative potential, challenges like high implementation costs and low digital literacy persist. Strategic policy support and innovations, including low-cost AI kits and global collaborations, are essential for scalable adoption. The future of India's poultry sector lies in evidence-based expansion of AI tools to ensure sustainable growth and food security.

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## Introduction

India's poultry industry, valued at ₹1,05,000 crore (Ministry of Agriculture, 2024), sustains 30 million farmers and produces 132 billion eggs and 4.3 million tonnes of broiler meat annually, securing 3rd and 7th global ranks (FAO, 2024). However, it grapples with inefficiencies: feed costs constitute 68-72% of production expenses (ICAR, 2024), diseases such as Avian Influenza and Newcastle incur ₹2,200 crore in annual losses (NDDB, 2023), and 80% of operations rely on smallholder farms with limited mechanization (20th Livestock Census, 2019). Artificial Intelligence (AI) systems that leverage machine learning and sensor data for predictive and prescriptive analytics offer scientifically validated solutions. This article examines AI's role in feeding and production management, drawing on data from Indian and international agencies to highlight its transformative potential.

## The Imperative for India's Poultry Sector

India's poultry population is 851 million (20th Livestock Census, 2019), supporting a ₹1,05,000 crore

market critical for rural economies and protein supply. Feed costs rose by 22% in 2024 due to soybean import disruptions (USDA, 2024), while disease outbreaks reduced yields by 12-18% annually (ICAR-CPDO, 2024). Small farms, averaging 2,000 birds, dominate production but lack scalability (NITI Aayog 2023). AI aligns with India's National Livestock Mission (2021), targeting a 50% production increase by 2030 (FICCI, 2024) and addresses 5.5% annual growth in poultry demand (APEDA, 2024).

## AI in Feeding Management: Precision and Economic Gains

Feed optimization is critical as it governs cost and growth efficiency. AI delivers measurable improvement.

- **Nutrient Precision:** Machine learning models process bird metrics (e.g., 1.6 kg broiler at 35 days) and environmental variables (temperature and humidity) to optimize feed composition. A 2023 ICAR-Directorate of Poultry Research (DPR) study

in Telangana reduced feed conversion ratio (FCR) from 1.75 to 1.58, cutting consumption by 14% (ICAR-DPR, 2024).

- **IoT Integration:** Sensors monitor intake and waste. Stellapps' SmartFarm platform, trialed in Karnataka in 2024, used LoRaWAN-enabled devices to lower overfeeding by 11%, saving ₹4.5 per bird monthly (Stellapps, 2024).
- **Local Resource Use:** In Haryana, an AI tool from the National Institute of Agricultural Economics and Policy Research (NIAP) substituted 20% of imported soybeans with pearl millet, reducing feed costs by ₹7/kg (ICAR-NIAP, 2024).
- **Scientific Basis:** These systems employ Random Forest algorithms, achieving 96% accuracy in predicting nutrient needs, as validated by ICAR's 2023 field trials across 200 farms (ICAR, 2024).

### AI in Production Management: Health, Automation, and Yield

AI enhances operational efficiency and resilience:

- **Disease Prediction:** Deep learning models analyze the acoustic and visual data. A 2024 ICAR-CPDO trial in Tamil Nadu used convolutional neural networks (CNNs) to detect Newcastle disease via abnormal clustering, reducing mortality by 20% with 93% sensitivity (ICAR-CPDO, 2024).
- **Environmental Optimization:** AI-driven climate control systems adjust the ventilation and heating. A 2023 collaboration between Intel and the Indian Institute of Technology (IIT) Madras in Andhra Pradesh maintained sheds at 25-27°C, increasing broiler weight by 9% (Intel Agri Report, 2024).
- **Egg Processing:** Vision-based AI, such as Japan's Egg Sorter's Nabel Co. (60 eggs/second, 99.2% accuracy), was piloted in Punjab in 2024, cutting labor costs by 28% (Poultry India Expo, 2024).
- **Flock Monitoring:** Wearable sensor track activity. University of Georgia's 2023 Precision Poultry Farming (PPF) study, shared with ICAR, reduced stress-related losses by 15% using accelerometer data (USDA-ARS, 2024).
- **Scientific Basis:** CNNs and Long Short-Term Memory (LSTM) networks underpin these tools, with peer-reviewed studies reporting 90-95% precision in anomaly detection (Poultry Science 2023).

### Contributions from Indian and Global Agencies

- **ICAR:** The Directorate of Poultry Research (Hyderabad) deployed AI in 2023 across 75 farms, improving egg yield by 11.5% and reducing antibiotic use by 18% (ICAR-DPR, 2024).

- **Stellapps:** The 2024 Karnataka pilot, backed by NDDDB, served 1,500 farmers, reducing feed costs by 16% using cloud-based AI analytics (Stellapps, 2024).
- **KVKs:** In Uttar Pradesh, Krishi Vigyan Kendras tested AI feeding apps in 2023, boosting broiler weight by 13% across 40 farms (KVK Report 2024).
- **APEDA:** The Agricultural and Processed Food Products Export Development Authority piloted AI egg grading in Gujarat in 2024, increasing export quality compliance by 22% (APEDA 2024).
- **Foreign Collaboration:** The USDA-ARS shares AI disease models with ICAR in 2023, achieving 91% accuracy in tropical climates (USDA-ARS, 2024). Israel's EggDetect, trialed in Maharashtra in 2024, used hyperspectral imaging to identify infertile eggs with 98.5% precision (EggDetect, 2024). The EU's Horizon 2020 PLF project provided IoT frameworks adopted by IIT Delhi in 2024, enhancing shed automation by 25% (EU Horizon, 2024).

### Benefits and Challenges: Quantified Impact

- **Benefits:** ICAR data (2024) shows AI reduces feed costs by 12-18% (₹5,000-₹7,000 per 1,000 birds annually), increases egg output by 10-15% (150-200 eggs per hen yearly), and cuts disease losses by 22% (₹3,000 per 1,000 birds). Stellapps reports a ₹3,500 monthly profit gain per 1,000 birds (2024).
- **Challenges:** Deployment costs range from ₹60,000-₹1,20,000 per farm (FICCI, 2024), prohibitive for 75% of smallholders. Rural Internet penetration is 62% (TRAI, 2024) and only 18% of farmers have digital literacy (NITI Aayog, 2024). Scalability lags, with just 5% of farms being AI equipped (Poultry Federation of India, 2024).
- **Mitigation:** The ₹150 crore Agri-Tech Fund (Budget 2024) and NDDDB's co-op model aim to subsidize 10,000 farms by 2026 (Ministry of Agriculture, 2024).

### Future Trajectory: Evidence-Based Expansion

ICAR projects AI adoption in 30% of India's poultry farms by 2032, potentially raising output by 40% (ICAR-DPR, 2024). IIT Madras' 2024 solar-powered AI kits (₹18,000/unit) target smallholders with a 5-year ROI of 150% (IIT Madras, 2024). Globally, the EU's PLF framework forecasts a 45% efficiency gain by 2035 (EU Horizon, 2024), which is adaptable to India via ICAR partnerships. Genomic-AI integration, piloted by the National Institute of Animal Biotechnology (NIAB) in 2024, aims to achieve a 12% feed efficiency gain by 2033 (NIAB, 2024).

### Conclusion

In summary, AI presents a transformative opportunity for India's poultry sector, with research suggesting substantial efficiency gains. However, its successful adoption hinges on addressing financial and digital barriers through targeted support, ensuring the sector can meet growing demand and enhance food security.

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