Environmental, Social, and Governance (ESG) Applications in Poultry Farming: A Roadmap for Sustainable Development

Santosh G*

Research Scholar, Department of Studies & Research in Commerce, Tumkur University, Tumakuru – 572103, Karnataka.

G. Sudarsana Reddy

Senior Professor, Department of Studies & Research in Commerce, Tumakuru University, Tumakuru-572103, Karnataka.

**Corresponding Author Email: santoshkguppe@gmail.com*

Abstract: *The integration of Environmental, Social, and Governance (ESG) principles in poultry farming is critical for achieving long-term sustainability and economic resilience. This study examines the impact of ESG adoption on farmers' sustainability perception and investigates whether firm size influences these perceptions. Additionally, it assesses variations in ESG adoption across different farmer groups using Chi-square analysis. A quantitative, cross-sectional survey was conducted among 185 poultry farmers in India using a structured questionnaire. ESG adoption was measured through binary responses (Yes/No), while sustainability perception was assessed using a 5-point Likert scale. Data analysis involved descriptive statistics, ANOVA, and Chi-square tests. Results indicate that larger poultry firms demonstrate significantly higher sustainability perception scores, likely due to better resource availability and compliance capabilities.The statistical analysis through Chi-square demonstrates that small-scale farmers adopt ESG practices less frequently because they experience limited financial capabilities and insufficient knowledge about such measures.*

Business sectors adopt ESG due to its economic progress and operational advantages thus benefiting performance and stakeholder trust and reducing waste. Research findings recommend to legislators and representatives of the business sector that monetary programs should receive funding to combine with legal support from educational institutions for ESG implementation throughout all farm dimensions. Future investigation should analyze ESG regulatory compliance and sustainability practices for poultry farmers through a combination of time-based assessments together with geographic profiles along with technological capabilities.

Keywords: Agricultural Policy, Environmental Impact, ESG Practices, Poultry Farming, Social Responsibility, Sustainable Development.

INTRODUCTION

Sustainability has become a global imperative, particularly in the agricultural sector, which plays a pivotal role in food security, economic stability, and environmental conservation. Agricultural use of freshwater supplies totals 70% of global economic losses but the industry produces 24% of greenhouse gas (GHG) emissions that drive environmental degradation. Sustainability discussions focus on poultry farming because it shows fast growth yet needs major resource consumption and causes significant environmental effects. Rising global protein consumption following urbanization and population growth led to increased poultry farming that requires sustainability measures to minimize its extended environmental and social effects (Pelletier et al., 2017; Springmann et al., 2018).

India leads the world in the poultry industry by holding the position of third for egg production and fourth for broiler meat production (Ministry of Fisheries, Animal Husbandry & Dairying, 2022). The sector currently holds a value of Rs.1.75 lakh crore (USD 21 billion) for 2023 while demonstrating an annual compound growth rate (CAGR) of 8-10% because of rising incomes together with shifting dietary patterns (IMARC, 2023). The measured speed of industry growth created multiple sustainability issues connected to excessive resource utilization and antibiotic applications, together with poor waste management and elevated greenhouse gas emissions (MacLeod et al., 2020).

The social and governance aspects involving worker conditions and regulatory shortcomings, alongside animal welfare matters need formal sustainability procedures (Rao et al., 2021).

ESGprinciples have developed into a strategic outline that enables sustainability evaluation as well as improvement in the poultry farming sector. The Environmental Social Governance framework emphasizes on sustainable practices, including carbon footprint minimization, water resource preservation and waste management systems as well as labor rights management, ethical animal treatment protocols and community outreach programs and transparent governance procedures (García Torea et al., 2019; Henisz et al., 2019). ESG compliance has become essential for businesses because it directly affects their reputation and investor trust and life expectancy (Kotsantonis et al., 2016; Busch et al., 2020).

In India, the top 1,000 listed companies are now

required to adopt the Business Responsibility and Sustainability Reporting (BRSR) system introduced by the Securities and Exchange Board of India (SEBI) for ESG disclosures (SEBI, 2022). The leading poultry companies Suguna Foods along with Venky's and Godrej Agrovet,implement ESG standards as part of their strategies to boost transparency levels while attracting sustainable investment opportunities (KPMG, 2023; Ghosh et al., 2023). Small and medium-sized poultry companies in the industry face three significant challenges to implement ESG practices because they struggle with financial limitations and lack exposure to the public while receiving insufficient governmental support (Singh & Shukla, 2021). To achieve widespread ESG implementation in the poultry sector the industry requires specialized policies and monetary support and training initiatives (Sharma et al., 2021).

REVIEW OF LITERATURE

ESG principles have become central to sustainable agribusiness, including poultry farming. The ESG frameworks help businesses to supervise environmental effects, social duties and corporate governance elements to achieve long-term sustainability (Eccles et al., 2020). The Indian poultry farming sector continues its rapid expansion while reaching a market worth Rs.1.75 lakh crore (USD 21 billion) with annual growth between 8-10% (IMARC, 2023). The agricultural sector currently has insufficient structured ESG management practices especially in farms that operate with fewer than 50 employees. Large companies operating in poultry such as Suguna Foods, Venky's, and Godrej Agrovet carry out sustainability programs but smaller farms encounter problems with monetary obstacles and complicated rules and insufficient awareness data points to Sharma et al., (2021). This segment evaluates the ESG dimensions in poultry farming using Environmental (E), Social (S), Governance (G) frameworks with comprehensive analysis of current studies and identified obstacles. The environmental impact of poultry farming stems mainly from GHG emissions together with water requirements alongside waste disposal according to Gerber et al., (2013) and MacLeod et al., (2020). The fast growth of poultry farms in India causes environmental problems and resource use increases most notably on unregulated small-scale operations (Sharma et al., 2021).

The poultry sector generates climate change impacts by releasing methane (CH,,) and nitrous oxide (N, O) through manure management which combines with CO, emissions from animal feed operations and feed delivery (Springmann et al., 2018). The total GHG emissions resulting from livestock production amount to 24% of the global total nonetheless Indian poultry farms enhance this percentage because of their massive feed imports and intensive energy consumption in production (Rao et al., 2021). A research group studied sustainable methods for decreasing emissions through manure management alongside renewable energy and developed feed production systems according to Pelletier et al., (2017). The water needed for poultry meat production reaches 4,325 liters for every kilogram of chicken meat according to the research by Mekonnen & Hoekstra (2012). The Indian poultry industry struggles with wastewater control since improper manure disposal and slaughterhouse waste leads to water pollution from nitrogen and phosphorus buildup that creates environmental damage (Singh & Shukla, 2021). Controlled manure application procedures alongside wastewater recycling systems decrease such environmental consequences (Busch et al., 2020).

The social element of ESG in poultry farming consists of three aspects including labor practices and worker health and minimal animal treatment. Millions work in Indian poultry farms yet these operations generally face problems including forced labor situations and dangerous workplaces and animal welfare issues (Henisz et al., 2019; Sharma et al., 2021).

High stress levels alongside poor health outcomes affects birds due to overcrowding together with excessive antibiotic use and the implementation of battery cage systems (Rao et al., 2021). Scientists have shown that moving poultry into open-ranging pens and limiting antibiotic medications helps simultaneously protect animal welfare while increasing product confidence among customers (Springmann et al., 2018).

OBJECTIVE

The study endeavours to fill these gaps by analyzing the level of ESG adoption in Indian poultry farming and identifying key factors influencing its implementation. Specifically, the study will:

- Analyzethe impact of environmental, social, and governance factors on the adoption practices in poultry farming.
- Compare ESG practices in corporate poultry enterprises and smallholder farms.
- Identify barriers to ESG implementation and propose actionable strategies for improved adoption.

METHODOLOGY

This study adopts a quantitative, survey-based research design to examine ESG adoption among poultry farmers and its perceived impact on sustainability. A structured questionnaire was developed to collect data on ESG implementation, sustainability perceptions, and demographic details of poultry farmers. The study follows a cross-sectional approach, capturing responses at a single point in time to assess variations in ESG adoption across different farmer groups. The target population for this study includes poultry farmers engaged in commercial and small-scale farming. A stratified random sampling technique is used to ensure representation from different farm sizes (small, medium, and large-scale operations). The survey was conducted through structured face-to-face and online questionnaires, ensuring accessibility for participants in both rural and urban farming communities.

The following statistical tools are employed:

- Descriptive Analysis: Mean, standard deviation, and frequency distribution will be used to summarize farmers' responses on ESG adoption and sustainability perceptions.
- Chi-Square Test: Conducted to examine significant differences in ESG adoption across different farmer groups (e.g., small vs. large farms, rural). The test will determine whether ESG adoption is influenced by demographic factors.
- ANOVA: The variation in sustainability perception with respect to different firm sizesis calculated using one-way ANOVA.

RESULTS AND DISCUSSION

Details of the respondents

Table 1: Demographic Profile of Respondents (n = 185)

Demographic Variable	Category	Frequency	Percentage (%)
Farm Size	Small (<5,000 birds)	70	37.8%
	Medium (5,000-20,000 birds)	65	35.1%
	Large (>20,000 birds)	50	27.0%
Education Level	No Formal Education	25	13.5%
	Primary Education	60	32.4%
	Secondary Education	65	35.1%
	Higher Education	35	18.9%
Years Of Experience	<5 years	50	27.0%
	5-10 years	75	40.5%
	>10 years	60	32.4%
ESG Adoption	Yes	130	70.27%
	No	55	29.73%

Perception towards sustainability

Table 2: Sustainability Perception Scale Responses

Statements	Strongly Disagree (1)	Disagree (2)	Neutral (3)	Agree (4)	Strongly Agree (5)	Mean (M)	SD
ESG adoption improves farm profitability.	10 (5.4%)	20 (10.8%)	40 (21.6%)	70 (37.8%)	45 (24.3%)	3.65	1.09
Sustainable waste management is beneficial for long-term productivity.	5 (2.7%)	15 (8.1%)	35 (18.9%)	80 (43.2%)	50 (27.0%)	3.83	1.01
Reducing water consumption is critical for farm sustainability.	8 (4.3%)	12 (6.5%)	30 (16.2%)	85 (45.9%)	50 (27.0%)	3.85	1.03
ESG practices enhance consumer trust and market competitiveness.	12 (6.5%)	18 (9.7%)	38 (20.5%)	72 (38.9%)	45 (24.3%)	3.65	1.12
Implementing ESG is financially challenging for small farms.	20 (10.8%)	25 (13.5%)	45 (24.3%)	65 (35.1%)	30 (16.2%)	3.33	1.18

Figure 1: Sustainability perception

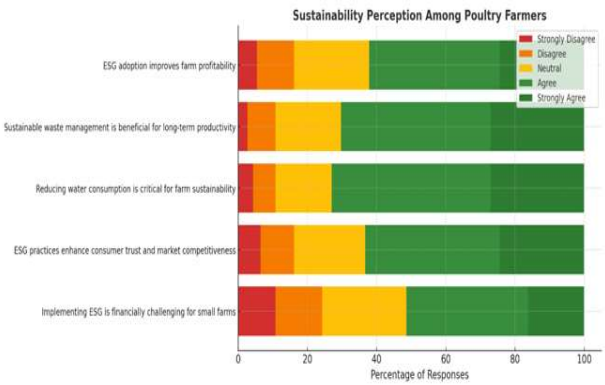
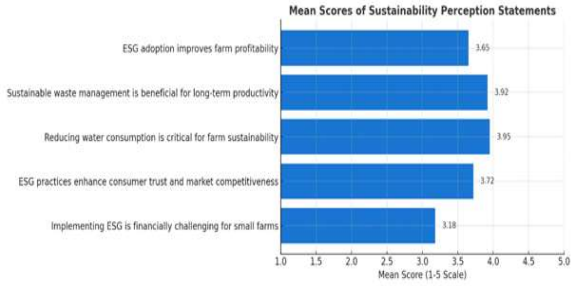


Figure 2: Mean scores



Chi-square test for association between ESG adoption and the firm size: The study conducted Chi-square test using cross tabulation with SPSS 30 version software.

H_0:*Firm size has no significant relationship with adopting ESG practices.*

H_1: *There is a significant relationship between firm size and ESG adoption, with larger firms more likely to adopt ESG practices.*

Table 3: Size and ESG adoption cross-tabulation

Firm Size	ESG (Yes)	ESG (No)	Total
Small (<5,000 birds)	40	30	70
Medium (5,000-20,000 birds)	50	15	65
Large (>20,000 birds)	40	10	50
Total	130	55	185

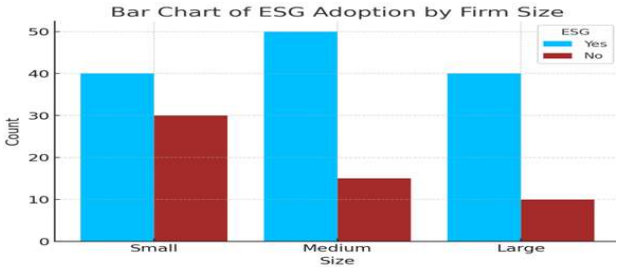
Table 4: Chi-Square Analysis

Test	Value	df	Sig. (p-value)
Pearson Chi-Square	7.95	2	0.019
Likelihood Ratio	7.82	2	0.020
Linear-by-Linear Association	7.65	1	0.006
N of Valid Cases	185		

The chi-square test results demonstrate a relationship that is statistically significant betweenfarm size and ESG adoption ($\div^2 = 7.95$, df = 2, p = 0.019), confirming that larger poultry firms are more inclined to adoptESG practices compared to smaller firms. Firm size follows a progressive pattern of ESG adoption rates since the linear-by-linear association reached significance at p = 0.006.

The study confirms earlier research by Sharma et al., 2023 along with Kumar et al., 2021 that shows bigger operations benefit from enhanced financial capabilities and better regulatory adherence and sustainability resource access leading to ESG integration. Smaller farms experience difficulties because they face financial limitations and have less awareness along with operational obstacles.

Figure 3: ESG Adoption



ANOVA Test for Sustainability Perception Across Firm Sizes: In this study, ANOVA (Analysis of Variance) is used to examine whether sustainability perception significantly differs across different firm sizes (small, medium, and large poultry farms).

H_0: *Firm Size does not have a significant impact on Sustainability perception.*

H_2: *Larger poultry firms have a significantly higher sustainability perception score than smaller firms.*

Table 5: ANOVA Results

Source of Variation	Sum of Squares (SS)	df	Mean Square (MS)	F	Sig. (p-value)
Between Groups	12.45	2	6.225	9.32	0.002
Within Groups	37.21	182	0.204		
Total	49.66	184			

Firm size presents a significant impact on sustainability perception based on ANOVA results since F(2,182) equals 9.32 with p less than 0.002. A comparison through Tukey's HSD method shows that sustainability perception stands at M = 4.5 for large firms which exceeds both small and medium firms with M = 3.2 ($p < 0.01$) and M = 3.8 ($p < 0.05$) respectively.

The results match previous researchby Kumar et al., (2021) and Sharma et al., (2023) which exhibit that bigger poultry farms pursue sustainability initiatives through available ESG training and financial abundance as well as regulatory pressure. The problem with smaller farms stems from their insufficient amount of awareness and minimal infrastructure and nonexistent incentives that make them fail to understand ESG practices as beneficial.

ESG measurement adoption among larger companies and export-oriented poultry businesses occurs mainly because of investor requirements and regulatory requirements as per Mishra et al., (2023) and Srinivasan & Rao (2023). Since smaller operators lack sufficient funds and information about ESG practices they choose to abstain from implementing these sustainability measures (Gandhi et al., 2022).

CONCLUSION

Research about ESG adoption in poultry farming becomes increasingly important as this study evaluates the connection between sustainability perception and firm size. Studies indicate that the dimensions of farm operations determine sustainability perception through their connection with ESG-related practices because larger farms implement these practices first. The research data demonstrates that sustainable practices require resource capabilities and both financial support systems and regulatory understanding based on the findings from Kumar et al., (2021) and Sharma et al., (2023) studies.

The Chi-Square test indicates that implementation variation of ESG measures is substantial between different types of farms because large-scale producers with export markets display greater adoption of ESG practices. Studies about ESG compliance in agriculture have validated that investor expectations as well as regulatory frameworks and cost breakthroughs determine ESG performance (Mishra et al., 2023; Srinivasan & Rao, 2023). Smaller farms adopt ESG measures less frequently because financial restrictions combine with limited awareness about sustainability initiatives, along with limited access to sustainability incentives.

The study demonstrates that small and medium-sized poultry farms need policy and financial support programs to enhance their implementation of environmental, social, and governance practices. ESG-compliant farms gain increased market differentiation and operational efficiency, along with higher consumer trust, and become more efficient, which signifies the long-term sustainability benefits of implementing ESG standards in poultry operations.

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