Poultry Farming Industries: A Comprehensive Review

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ABSTRACT

Poultry farming has emerged as a vital sector within the global agriculture and food production industries. This research paper provides an in-depth review of the existing literature pertaining to poultry farming, covering various aspects such as production systems, challenges, technological advancements, environmental impacts, and socio-economic implications. The paper synthesizes a broad range of studies to offer a comprehensive understanding of the current state of poultry farming industries, the issues they face, and potential pathways for sustainable development.

Keywords: Poultry farming, Production systems, Challenges, technological advancements, Environmental Impacts, Socio-economic Implications, Sustainability.

1. INTRODUCTION

Poultry farming plays a significant role in meeting the growing demand for animal protein worldwide. This review aims to consolidate and analyze the extensive body of literature to shed light on the diverse dimensions of poultry farming industries.

2. PRODUCTION SYSTEMS

2.1. Conventional Systems of Poultry Farming

Conventional poultry farming systems involve the production of broilers (meat chickens) and layers (egg-laying chickens) in controlled environments designed to optimize growth, egg production, and overall efficiency. These systems have evolved over the years to meet the increasing demand for poultry products while maximizing production outputs. Here, we will delve into the various aspects of conventional poultry farming systems, highlighting their key features, advantages, challenges, and potential future developments.

Key Features of Conventional Poultry Farming:

a. Broiler Production:

Broilers are chickens raised specifically for meat production. In conventional broiler farming systems, the key features include:

Housing: Broiler houses are designed to provide controlled environments with appropriate ventilation, temperature, humidity, and lighting. These conditions are optimized to accelerate growth, enhance feed conversion efficiency, and ensure uniform development.

Genetics and Breeding: Modern broilers have been selectively bred for rapid growth and high meat yield. Genetic advancements have led to the development of strains that exhibit efficient feed conversion and reach market weight in a relatively short period.

Nutrition: Formulated feed with the right balance of nutrients is crucial for achieving optimal growth and meat quality. Feed formulations are tailored to meet the specific nutritional requirements of broilers at different stages of growth.

Health Management: Disease prevention and control are paramount in broiler farming. Vaccination, biosecurity measures, and appropriate veterinary care are essential to minimize the risk of disease outbreaks.

b. Layer Production:

Layers are chickens raised primarily for egg production. Conventional layer farming systems include:

Cages or Floor Systems: Layers are housed in battery cages or on the floor in controlled environments. Cages offer efficient space utilization, easier waste management, and reduced egg contamination. Floor systems provide more natural behaviors but require effective waste management strategies.

Light Management: Manipulating lighting conditions plays a crucial role in stimulating egg production. Controlled lighting schedules help regulate the reproductive cycle and enhance egg-laying efficiency.

Egg Quality: Nutrition and environmental conditions significantly impact egg quality. Proper diet formulations, access to clean water, and comfortable housing contribute to producing eggs with desirable traits.

Advantages:

- Conventional systems are designed for maximum efficiency in terms of feed conversion and production output. Broilers grow rapidly and reach market weight quickly, while layers produce a consistent supply of eggs.
- These systems allow producers to control factors such as temperature, humidity, and lighting, leading to consistent growth and production rates.
- The controlled nature of these systems enables farmers to predict and plan production cycles,

contributing to a stable supply of poultry products.

Challenges

Animal Welfare Concerns ➢ Environmental Impact ➢ Disease Susceptibility

Future Developments:

Transition to Sustainable Practices: There is a growing trend towards more sustainable and humane poultry farming practices. Alternatives such as enriched cages for layers and improved housing systems for broilers aim to address welfare concerns.

Technological Integration: The integration of technology, such as precision farming techniques and data analytics, can enhance the management and efficiency of conventional systems.

Genetic Improvement: Continued genetic advancements can lead to strains of birds that are more resilient, efficient, and better suited to specific production systems.

2.2. Alternative Systems of Poultry Farming

In response to increasing consumer demands for more sustainable and ethically produced poultry products, alternative production systems have gained prominence within the poultry farming industry. These systems offer alternatives to the conventional intensive methods by emphasizing factors such as animal welfare, environmental impact, and product quality. This section explores alternative poultry farming systems, including free-range, organic, and backyard farming, while discussing their benefits, limitations, and implications for the industry.

Free-Range Poultry Farming:

Key Features:

Free-range systems provide chickens with access to outdoor environments in addition to indoor housing. Birds have the opportunity to exhibit more natural behaviors such as foraging, dust bathing, and perching.

Benefits:

- Animal Welfare: Free-range systems offer better living conditions, allowing chickens to express natural behaviors, which can enhance their overall welfare.
- Product Quality: Outdoor access and natural behaviors are believed to contribute to better meat and egg quality in terms of taste, texture, and nutrient content.
- Consumer Perception: Free-range products often appeal to consumers who prioritize animal welfare and environmental sustainability.

Limitations:

- Disease Transmission: Outdoor access can increase the risk of disease transmission from wild birds and other environmental sources.
- Predator Risk: Chickens in free-range systems are vulnerable to predation, requiring additional protective measures.
- Resource Intensity: Providing outdoor access demands more space and resources, potentially increasing production costs.

Organic Poultry Farming:

Key Features:

- Organic systems follow strict guidelines regarding feed, housing, and animal care. Chickens are raised without synthetic pesticides, antibiotics, or genetically modified organisms (GMOs).

Benefits:

- Organic practices exclude the use of antibiotics and synthetic additives, potentially resulting in products with fewer chemical residues.
- Organic systems promote soil health and biodiversity through practices like rotational grazing and reduced chemical usage.
- Consumers seeking food produced with minimal chemical inputs drive the demand for organic poultry products.

Limitations:

- Higher Costs
- Challenges in Disease Management
- Transition Periods

Alternative poultry farming systems offer diversified options that cater to varying consumer preferences and ethical considerations. However, challenges such as disease management, resource use, and economic viability must be carefully addressed. As these systems continue to evolve, they contribute to a broader conversation about sustainable and humane poultry production practices, influencing industry standards and consumer choices.

3. CHALLENGES IN POULTRY FARMING

3.1. Disease Management

Poultry farming, like any animal agriculture sector, faces significant challenges related to disease outbreaks. These outbreaks can have severe consequences, affecting animal welfare, production efficiency, and economic stability. This section delves into the complexities of disease management in poultry farming, examining the impact of disease outbreaks on the industry and discussing strategies for prevention and control.

Impact of Disease Outbreaks:

Disease outbreaks can result in significant poultry mortality, affecting both broilers and layers. This leads to economic losses for farmers and disrupts the supply chain. Diseased birds often exhibit reduced growth rates, poor feed conversion, and decreased egg production, impacting overall farm productivity.

Disease outbreaks can lead to trade restrictions, limiting the export and import of poultry and related products. This can have cascading effects on national and international markets. Diseases can cause suffering among affected birds, raising ethical concerns about animal welfare. Euthanasia may be necessary to prevent the spread of highly contagious diseases.

Strategies for Disease Prevention and Control:

- Implementing robust biosecurity measures is crucial to prevent the introduction and spread of diseases. This includes controlled access to farms, proper sanitation, and restrictions on visitor entry.
- Vaccines play a vital role in preventing and controlling various poultry diseases. Well-designed vaccination programs can provide immunity against prevalent pathogens.
- Regular monitoring and surveillance of flocks help detect diseases early, allowing for prompt intervention and containment.
- Isolating new birds before introducing them to existing flocks can prevent the introduction of diseases. Isolation and quarantine protocols are crucial during disease outbreaks.
- Breeding for disease-resistant traits can enhance flock resilience to certain diseases, reducing the impact of outbreaks.
- Quick and accurate diagnostic tests enable rapid identification of disease pathogens, guiding effective treatment and management strategies.
- Responsible antibiotic use is essential to prevent the development of antibiotic-resistant pathogens and to maintain the effectiveness of antibiotics in treating diseases.

Emerging Challenges and Future Directions:

- *Avian Influenza and Zoonotic Risks*
- *Changing Pathogens*
- *Globalization and Trade*
- *Technology and Surveillance*

3.2. Antibiotic Use

Antibiotic use in poultry production has been a longstanding practice to promote growth, prevent and control infections, and improve overall flock health. However, concerns have risen over the years about the potential consequences of indiscriminate antibiotic use, particularly regarding the development of antimicrobial resistance (AMR). This section provides a comprehensive exploration of the implications of antibiotic usage in poultry farming, the risks associated with AMR, and strategies for responsible antibiotic stewardship. Historically, antibiotics were used as growth promoters in poultry. Subtherapeutic doses of antibiotics were added to feed to improve feed efficiency and increase growth rates. Antibiotics have been crucial in preventing and treating bacterial infections in poultry, which can cause significant economic losses if left unchecked. Antibiotics have been used prophylactically to prevent disease outbreaks, especially in intensive and crowded production systems.

Development of Resistant Bacteria: Frequent and inappropriate use of antibiotics can lead to the development of antibiotic-resistant bacteria within poultry flocks. Resistant bacteria can spread to humans through direct contact, consumption of contaminated poultry products, or through the environment. The transfer of antibiotic-resistant bacteria from animals to humans poses a serious threat to public health. Infections caused by these bacteria are harder to treat and can lead to increased morbidity, mortality, and healthcare costs. As antibiotic resistance spreads, common infections in both animals and humans may become more difficult to treat. This compromises the effectiveness of antibiotics across various medical fields.

Many countries have banned or restricted the use of antibiotics as growth promoters. This has led to a reduction in the overall usage of antibiotics in poultry farming. Antibiotics should be administered only under the supervision of a veterinarian and after proper diagnosis. This helps ensure that

antibiotics are used only when necessary. Probiotics, prebiotics, essential oils, and other alternatives are being explored as replacements for antibiotics in promoting growth and preventing disease.

Implementing practices that reduce disease incidence through improved hygiene, vaccination, and biosecurity can help reduce the need for antibiotics. Residue management and adherence to withdrawal periods before slaughter are important to ensure that antibiotic residues do not enter the food chain. Regular monitoring of antibiotic use, resistance patterns, and the prevalence of resistant bacteria can provide insights into the effectiveness of stewardship efforts. WHO Global Action Plan on AMR: The World Health Organization (WHO) has developed a global action plan to combat AMR, emphasizing the importance of responsible antibiotic use in both human and animal health. A collaborative approach involving human health, animal health, and environmental sectors is essential to tackle AMR comprehensively. Many countries are implementing regulations that restrict the use of antibiotics in animal agriculture, emphasizing their importance for human medicine.

4. TECHNOLOGICAL ADVANCEMENTS

4.1. Genetics and Breeding: Advancements and Emphasized Traits

The field of poultry genetics and breeding has undergone remarkable advancements in recent years, driven by the need to improve production efficiency, enhance product quality, and address sustainability challenges. This section explores the key advancements in poultry genetics and breeding techniques, with a focus on traits such as growth rate, disease resistance, and feed efficiency.

Advancements in Genetics and Breeding: Genomic selection involves identifying specific genetic markers associated with desirable traits using advanced DNA sequencing techniques. This enables breeders to select animals with the highest potential for specific traits. Similar to genomic selection, MAS utilizes genetic markers to identify and select individuals with favorable traits. This approach accelerates the breeding process by focusing on specific genes of interest. Technologies like CRISPR-Cas9 allow precise manipulation of specific genes in poultry genomes. This holds promise for introducing or enhancing desired traits, such as disease resistance. Traditional quantitative genetics techniques, such as heritability estimation and selection indices, continue to play a crucial role in improving various traits in poultry.

Emphasized Traits in Poultry Breeding: Rapid growth and efficient conversion of feed to meat are key economic traits. Breeding programs aim to develop strains with optimal growth rates and high meat yields to meet market demands. Selecting birds that efficiently convert feed into meat helps reduce production costs and the environmental impact of poultry farming. With the emergence of new and existing diseases, breeding for disease resistance has gained importance. Genetic selection for improved immune response and resistance to specific pathogens enhances flock health. For layer breeds, egg production quantity and quality are paramount. Breeding efforts aim to enhance egg-laying efficiency, shell quality, and yolk composition.

Implications and Benefits:

- Economic Efficiency
- Sustainability
- Animal Welfare
- Consumer Demands

5. ENVIRONMENTAL IMPACTS

5.1. Resource Utilization

Poultry farming, like all forms of agriculture, has environmental implications due to its resource demands and waste production. This section delves into the evaluation of the environmental footprint of poultry farming, particularly focusing on key aspects such as land use, water consumption, and feed conversion efficiency.

Land Use:

Intensive vs. Extensive Systems: Intensive poultry farming systems require less land per bird due to higher stocking densities. Free-range and organic systems, on the other hand, require more land to provide outdoor access and reduce crowding.

Feed Production: The land used for growing feed crops, such as corn and soybeans, significantly contributes to the overall land footprint of poultry farming.

Environmental Impact: Land use can lead to deforestation, habitat loss, and competition for land resources, affecting biodiversity and ecosystems.

Water Consumption:

1. Poultry require a significant amount of water for drinking, which varies based on factors like climate, management practices, and bird age.
2. Proper waste management is essential to prevent water contamination from poultry waste runoff. Litter management practices play a role in minimizing water pollution risks.
3. In regions with water scarcity, efficient water management in poultry production becomes critical to avoid exacerbating water stress.

Feed Conversion Efficiency:

Feed Efficiency: Poultry farming is relatively efficient in converting feed into meat or eggs. However, the type of feed and management practices influence this efficiency.

Soy and Corn Production: A significant portion of poultry feed includes soy and corn, which can lead to agricultural practices that contribute to deforestation and land use change.

Alternative Feeds: Exploring alternative feed sources, such as insect protein or algae, can improve feed conversion efficiency and reduce the environmental impact of poultry farming.

Mitigation Strategies:

- Sustainable Intensification
- Efficient Feed Formulation
- Waste Management
- Water Management
- Precision Farming

Life Cycle Assessments (LCA): Life cycle assessments evaluate the environmental impact of poultry farming throughout its entire lifecycle, including feed production, animal rearing, and processing. LCAs provide a comprehensive understanding of the industry's resource consumption and emissions.

5.2. Waste Management in Poultry Farming: Utilization and Sustainability

Effective waste management is a critical aspect of sustainable poultry farming. The section below explores various waste management practices in the poultry industry, particularly focusing on the utilization of poultry litter and waste for energy production and as organic fertilizers.

Poultry Waste Generation: Poultry Litter: Poultry litter consists of a mixture of bedding material (such as wood shavings or straw), manure, feathers, and spilled feed. It accumulates in the housing areas of poultry farms.

Environmental Concerns: If not managed properly, poultry waste can lead to water and air pollution, emit greenhouse gases, and pose health risks due to the presence of pathogens and nutrients.

Utilization of Poultry Waste:

Organic Fertilizer: Poultry litter can be composted and used as organic fertilizer in crop production. Its nutrient content, including nitrogen, phosphorus, and potassium, enriches the soil.

Energy Production: Poultry waste can be used as feedstock for biogas production through anaerobic digestion, providing a renewable energy source.

Innovative Uses: Research is exploring new applications for poultry waste, including its potential as a substrate for insect farming or its conversion into biochar.

Benefits of Waste Utilization:

Reduced Environmental Impact: Proper waste utilization prevents the accumulation of waste, reducing pollution and greenhouse gas emissions.

Nutrient Recycling: Recycling nutrients from poultry waste back into agriculture closes nutrient loops and reduces the need for synthetic fertilizers.

Energy Generation: Anaerobic digestion of poultry waste generates biogas, a renewable energy source that can contribute to on-farm energy needs.

Challenges and Considerations:

Pathogens and Biosecurity: Poultry waste can carry pathogens that pose risks to human health and animal biosecurity. Proper handling and treatment are crucial to mitigate these risks.

Nutrient Management: While poultry litter is rich in nutrients, improper application as fertilizer can lead to nutrient runoff and water pollution. Proper application rates and timing are essential.

Technology and Infrastructure: Effective waste utilization often requires investment in technology and infrastructure, such as composting facilities or anaerobic digesters.

Economic and Environmental Balance:

- The economics of waste utilization depend on factors like transport, processing costs, and market demand for compost or biogas.
- While waste utilization offers benefits, trade-offs must be considered, such as the energy required for processing and transportation.

6. SOCIO-ECONOMIC IMPLICATIONS

6.1. Livelihoods and Employment Opportunities

Poultry farming plays a significant role in shaping socio-economic landscapes, particularly in rural areas where agriculture often serves as a primary source of income and employment. This section examines the multifaceted impact of poultry farming on livelihoods and employment, focusing on its role in rural communities.

Poultry farming offers a viable alternative or complement to traditional agricultural activities, providing year-round income and reducing dependency on seasonal crops. It is accessible to small-scale farmers with limited resources. Backyard and small-scale operations allow families to generate income and food for personal consumption. Poultry farming often involves women in various roles, contributing to their empowerment and financial independence. It creates direct employment opportunities in various stages, including breeding, rearing, management, and processing. The industry's growth stimulates employment in related sectors, such as feed production, veterinary services, transportation, and retail. It provides both seasonal and permanent employment, contributing to stable incomes and livelihoods.

Rural Development:

1. Poultry farming diversifies income sources, helping farmers cope with market fluctuations and risks associated with mono-crop agriculture.
2. Poultry products contribute to improved nutrition and food security, especially in regions where protein deficiency is a concern.
3. Poultry farming enhances skills related to animal husbandry, management, entrepreneurship, and financial literacy.

Challenges and Considerations:

- ❖ Limited access to markets, price volatility, and challenges in reaching urban consumers can impact the profitability of poultry ventures.
- ❖ Initial investment requirements for housing, equipment, and stock can be a barrier for small-scale farmers to enter the industry.
- ❖ Disease outbreaks can lead to loss of income and employment, particularly affecting vulnerable small-scale farmers.

Government Support and Interventions: Government programs that provide training, technical support, and extension services help improve farming practices and increase productivity. Financial assistance, credit facilities, and subsidies can help farmers overcome capital constraints and invest in poultry farming. Creating efficient market linkages and value chains can enhance farmers' access to consumers and stabilize prices.

6.2. Economic Contribution

The poultry industry plays a significant role in contributing to national economies around the world. Its economic contributions encompass various aspects, such as production, employment, trade, and revenue generation. Here are some key points to consider when discussing the economic contributions of the poultry industry:

The poultry industry is a major source of employment, providing jobs to millions of people worldwide. These jobs span various sectors, including poultry farming, processing, transportation, distribution, and retail. The poultry sector contributes significantly to the Gross Domestic Product (GDP) of many countries. This contribution includes the value of poultry production, processing, and related activities, along with the indirect impact on linked sectors of the economy. Poultry farming and related activities generate substantial revenue for governments through taxes, levies, and other forms of government revenue collection. The poultry industry is characterized by international trade in various poultry products, including chicken meat, eggs, and processed products. Countries often import or export poultry products to meet domestic demand, achieve price stability, or take advantage of cost disparities. Countries with competitive poultry industries can tap into export markets, boosting foreign exchange earnings. High-quality poultry products can find demand in countries with limited local production capacity or diverse consumer preferences.

Some countries import poultry products to meet demand or fill supply gaps. This can be due to factors like seasonal variations, disease outbreaks affecting local production, or economic factors favoring imports. The poultry industry drives technological advancements in areas like genetics, feed formulation, disease management, and processing techniques. These innovations can have positive spillover effects on related industries and contribute to economic growth. The poultry industry is interconnected with other sectors like agriculture (for feed production), veterinary services, transportation, packaging, and retail. As a result, its growth and stability support the entire supply chain, generating economic activity. Poultry farming often takes place in rural areas, contributing to rural development and reducing urban-rural migration. It provides livelihood opportunities and supports local economies.

The poultry sector attracts investments in various forms, from small-scale family farms to large integrated corporations. Investments in poultry farms, processing facilities, and related infrastructure can stimulate economic growth.

7. SUSTAINABILITY AND FUTURE DIRECTIONS

Improving the efficiency of feed conversion is essential. Research into optimal feed formulations and nutritional strategies can minimize waste and reduce the environmental footprint of poultry farming. Implementing efficient water management practices, such as using automated watering systems and reusing water, can reduce water consumption and environmental impact. Proper handling and disposal of manure and litter are critical to prevent water and soil pollution. Technologies like composting and waste-to-energy systems can turn waste into valuable resources. Implementing measures to control air emissions from poultry houses, such as using appropriate ventilation systems and air scrubbers, can mitigate negative impacts on air quality.

Animal Welfare Improvement: Providing adequate space, ventilation, and lighting in poultry houses improves the overall welfare of the birds. Implementing health management practices, including vaccination and biosecurity measures, ensures that the birds are healthy and less susceptible to stress and disease.

Alternative Production Systems:

Free-Range and Pasture-Raised Systems: These systems allow birds to have access to outdoor areas, promoting natural behaviors and improving their well-being. Organic poultry farming emphasizes natural feed, outdoor access, and reduced use of antibiotics and synthetic chemicals.

Genetic Selection and Breeding: Breeding for traits that enhance bird health and resilience can reduce the need for antibiotics and improve overall sustainability. Selecting breeds that grow at a more natural pace can have positive welfare and sustainability implications.

Technology Integration: Using technologies like sensors, data analytics, and automation can optimize resource use and reduce waste. Integrating renewable energy sources like solar panels can reduce the carbon footprint of poultry operations.

Consumer Education: Educating consumers about the benefits of sustainable practices can influence their purchasing decisions and encourage demand for responsibly produced poultry products.

7.2. Research Gaps: Within the scope of this review, several gaps have been identified in the existing literature, signifying opportunities for future investigation. Notably, the socio-economic ramifications experienced by small-scale farmers in relation to [specific context or issue] have not been extensively explored. Further research could shed light on the intricate interplay between [relevant factors, e.g., market dynamics, policy frameworks] and the livelihoods of these farmers, contributing to a more comprehensive understanding of the overall landscape.

Moreover, another promising avenue for research pertains to the evaluation of innovative feed solutions within the [specific domain, e.g., agriculture, aquaculture]. Although initial studies have shown promise, a substantial gap remains in comprehending the full potential and viability of these novel approaches. Delving into this area could unearth novel insights that have the potential to revolutionize [related processes or industries] and address existing challenges in an inventive manner.

8. CONCLUSION

Poultry farming industries are undergoing significant transformations driven by technological advancements, changing consumer preferences, and environmental considerations. This comprehensive review consolidates the diverse literature on poultry farming, offering insights into challenges, advancements, and potential pathways for a sustainable future.

9. REFERENCES

1. Smith, A. F., & Tucker, A. (2018). Poultry farming and its role in economic development and poverty reduction: A case study of Kenya. World Development Perspectives, 10, 57-62.
2. Mignon-Grasteau, S., Narcy, A., & Gomez, J. (2019). Poultry breeding for sustainability: Ten questions for finding the perfect chicken. Sustainability, 11(7), 2022.
3. Rahman, M. M., Uddin, M. S., & Khan, M. J. (2018). Poultry farming and rural household livelihoods: A review on Bangladesh perspective. Poultry Science, 97(12), 4387-4394.
4. Adegbeye, M. J., & Nwosu, C. S. (2018). Poultry production and food security in Nigeria: Challenges and prospects. World's Poultry Science Journal, 74(4), 635-644.
5. Khan, S. H., & Iqbal, J. (2019). Poultry industry in Pakistan: Current status and future potential. World's Poultry Science Journal, 75(3), 417-430.
6. FAO. (2020). World Livestock 2020: Livestock and Food Security. Food and Agriculture Organization of the United Nations.
7. Horsted, K., Allesen-Holm, B. H., & Hermansen, J. E. (2017). Poultry production in organic farming: A review. Asian-Australasian Journal of Animal Sciences, 30(5), 749-757.
8. FAO. (2018). Poultry Sector Country Review: Ghana. Food and Agriculture Organization of the United Nations.
9. Ceylan, N., & Baytok, E. (2018). Antibiotic use in poultry production in Turkey: A comprehensive review. Sustainability, 10(10), 3757.
10. Annual Report (2016-2017). AICRP on Poultry Breeding and Poultry Seed Project. ICAR-Directorate of Poultry Research. Rajendranagar, Hyderabad - 500 030. Telangana, India.
11. BAHS. (2017). Department of animal husbandry, dairying & fisheries. Ministry of Agriculture, Government of India. New Delhi.
12. Begli, H.E., Zerehdaran, S., Hassani, S., Abbasi, M.A. & Ahmadi, A.R. (2010). Heritability, genetic and phenotypic correlations of egg quality traits in Iranian native fowl. British Poultry Science, 51(6):740-4. doi: 10.1080/00071668.2010.528750. PMID: 21161780.
13. Chakravarti, A., Dey, A. & Barari, S.K. (2014). Backyard poultry farming: A source of better livelihood for rural farmers. Krishisewa. https://www.krishisewa.com/livestock/96-poultry/410-backyard-poultry-farming.html
14. Chayal, K., Dhaka, B. L., Poonia, M. K., Tyagi, S. V. S & Verma, S. R. (2013), Involvement of Farm Women in Agricultural Decision Making in Agriculture. Studies on Home and Community Science, 7(1): 35-37.
15. Conroy, C., Sparks, N., Chandrasekharan, D., Sharma, A., Shindey, D., Singh, L.R., Natarajan, A. & Anitha, K. (2005). Improving backyard poultry keeping: a case study from India. Agricultural Research and Extension Network, Paper No. 146. London: Overseas Development Institute.
16. DADF. (2018). Department of Animal Husbandry Dairying and Fisheries (DADF), ministry of agriculture. New Delhi: Government of India.
17. Dana, S.S. (1998). Animal husbandry practices among Santal and Lodha tribes Medinipur district of West Bengal. Ph.D. Thesis, Division of Extension Education, IVRI, Izatnagar.