



American Journal of Economics and Business Innovation (AJEBI)

ISSN: 2831-5588 (ONLINE), 2832-4862 (PRINT)

VOLUME 4 ISSUE 3 (2025)

PUBLISHED BY
E-PALLI PUBLISHERS, DELAWARE, USA

Circular Economy in Action: A Systems Thinking Analysis of Chicken Production and Consumption in the Philippines

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Article Information

Received: July 07, 2025

Accepted: August 11, 2025

Published: September 26, 2025

Keywords

Circular Economy, Consumption, Production, Systems Thinking

ABSTRACT

This research examines the sustainability of chicken production and consumption in the Philippines through a systems-thinking perspective with the integration of the circular economy principles. Chicken is a vital protein source in Filipino diets and with its growing demand, comes the intricate challenges within the environmental, economic, and social sustainability dimensions. The study utilized a qualitative analytical approach, employing the use of SWOT and Strategic Factor Analysis, to evaluate the current status of both the industrial and backyard poultry settings. Crucial findings emphasize the following factors: the level of dependency on imported feed, improper waste management, erratic animal welfare practices, and constrained support for organic production as major barriers to sustainability. The report prescribes multifaceted and systems-based solutions such as investing in sustainable feed alternatives like insect protein, upcycling chicken wastes into organic fertilizers, augmenting animal welfare situations, and empowering small farmers through financial, knowledge and, methodological support. The research proposes the mobilization of the community through educational campaign mechanisms and reinforcement of sound policy frameworks to uphold responsible consumption and improve stakeholder accountability. Highlighting the importance of an encompassing, collaborative and compelling stakeholder approach to address the challenges emerging from both the production and consumption dimensions, the study provided recommendations to synergistically implement initiatives that are crucial in creating a more resilient, equitable and sustainable Philippine chicken industry.

INTRODUCTION

In the Filipino culinary setting, food is perceived as a nurturing experience and an avenue to express art. Chicken, more than being a vital ingredient to elevate gastronomic experience, is also a medium for culinary art expression. Being regarded as a vital dietary staple for its affordability, accessibility and versatility by both the commercial and consumer viewpoints, escalates the demand for this poultry. This primary protein-source, provides not only nutritional needs but also promotes cultural identity by making its presence known from daily meals to celebratory cuisines. The poultry's popularity is evidence of its massive contribution to meeting dietary requirements, ensuring food security, and exhibiting tradition across diverse socioeconomic demographics.

Consumers want chicken meat and the demand for it is constantly rising. Factors influencing this phenomenon are urbanization, increasing income, and growing population. Moreso, the preparation and cooking of chicken is preferred mostly by consumers due to its convenience that fits the modern lifestyle. These reasons pose a significant threat to the equilibrium in the demand and supply curve of chicken. Hence, the adoption of sustainable strategies in the production of poultry products is now timely and relevant.

This study illustrates a comprehensive understanding of the chicken industry that deviates from mere linear, reductionist approaches. It employs a systems-thinking

approach as it offers an analytical framework for examining complex, interconnected systems such as chicken production and consumption (System Thinking, 2023). This approach posits that each component within a system is not isolated and that they interact dynamically, influencing and being influenced by one another. In the context of chicken production and consumption systems, it can be illustrated that decisions made in one component, for instance production of feeds, can have cascading effects to the entire system that can affect consumer access, pricing, farming practices, and environmental outcomes.

This paper examines the chicken industry of the Philippines using the systems thinking to dive into the complicated web of interactions that mold its sustainability. It primarily analyzes the current condition of chicken production and consumption including various factors like feed production and sourcing, farming methodology and animal welfare, waste management, and consumption patterns. The analysis also identifies challenges related to sustainability in terms of environmental impacts, social development, and economic growth, and proposes concrete and strategic data-based solutions grounded on the available data from the secondary sources and in systems thinking and circular economy principles. With this, the paper aims to offer a holistic view to enhancing the Philippine chicken industry making sure it contributes to the economic development and food security while also minimizing the possible negative environmental impacts.

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LITERATURE REVIEW

The Philippine chicken industry operates within a dual structure, commercial and backyard sectors, making it a component in the country's economy and food security. This dual structure presents opportunities and challenges concerning sustainability and emerging circular economy concepts.

Commercial Sector and Backyard Sector

The commercial sector is large-scale, vertically integrated firms that operate using advanced technology and farming practices to meet the increasing demands of chicken from the urban consumers. Although these enterprises achieve efficiency, scale, and profitability, they also have environmental challenges. Robetson *et al.* (2000) documented that commercial sectors contribute to the increasing greenhouse gas emissions and land-used degradation that were linked to intensive farming. In addition, these firms also contribute to antibiotic resistance as a result of the heavy reliance on antibiotics both in feed and management of bird diseases (Kelbrick *et al.*, 2023). Another issue as identified by Iheanacho *et al.* (2024) is the excessive fat deposition in poultry which is generally undesirable for both producers and consumers. It wastes dietary energy and results in waste products with low market value. All these can contribute to various health issues including diseases linked to fat such as atherosclerosis. Thus, innovative approaches within circular economy principles are needed to mitigate these negative impacts. On the other hand, backyard sectors are small-scale producers who usually operate within the rural areas. These small companies contribute to rural income and food security as they utilize locally available sources (Silva *et al.*, 2024) for feeds, jobs, and among others. However, the potential of this sector is challenged by limited access to financial resources and education that make them vulnerable to changes in market conditions and macro-economic forces. Hernandez *et al.* (2022) indicated that these challenges can be mitigated if these farmers are given training and access to sustainable farming practices. Regardless of whether large or small, both sectors are contributing to the national economy and this illuminates that both should be considered in making action towards a circular economy.

Feed Production and Farming Methods

Just like any other sector, feed production is a critical challenge in chicken production even up to this date. These sectors are heavily reliant on global sourced ingredients that are susceptible to price changes and also exacerbates the carbon footprint due to supply chain activities such as transportation. Producers and farmers often resort to locally sourced feeds in order to reduce the costs which compromise the nutritional quality of chicken meat and productivity (Kpomasse *et al.*, 2023). Hence, Malenica *et al.* (2022) suggested that the promotion of regionally available and sustainable feed alternatives could enhance chicken health and contribute to the circulation of the

chicken production system. Farming methods and animal welfare are interconnected issues within chicken production sectors. Their operations, for instance in the commercial sector, prioritize output through intensive systems that often lead to severe welfare concerns including confinement stress and disease issues due to overcrowding. A system-level analysis is necessary to develop practices that balance efficiency and welfare for chicken farming methodologies. Moreover, Markos *et al.* (2024) emphasized that importance of targeted training in the construction of housing facilities as well as in the management of feeding, watering, cleaning, and disinfection procedures for feeders and waterers, to effectively mitigate the risk of waterborne diseases.

Waste Management

In the context of waste management practices, chicken farms generate substantial quantities of manure that can adversely affect local environments and producers often have inadequate waste management strategies leading to soil and water degradation. Implementing effective waste management solutions such as composting and biogas production presents an opportunity for the sectors to minimize their environmental impacts and enhance resource reuse aligning closely with the circular economy principles (Palese *et al.*, 2020; Cha *et al.*, 2020). This perspective is supported by Sharmin *et al.* (2025) who highlighted that transitioning to a circular economy framework can be transformative for sustainable waste management practices. Developed countries have already made considerable advancement in adopting circular economy principles into the systems of waste management. On the other hand, developing countries like the Philippines are still in the early stages of adoption. As Sharmin *et al.* (2025) study results, the adoption of a circular economy in developing countries is barred by problems with infrastructures, limited education, and political instability. Yet, these disparities can be addressed through policy interventions, innovation investments, and multi-sectoral participation.

Consumer Demand

Espino and Bellotindos (2020) reveal that the current chicken consumption in the Philippines is strongly upward trajectory. This is due to the influence of growth in population, urbanization, and changes in food preferences. Tariga *et al.* (2021) then stressed that sustainable consumption methods should be now put in place to continually meet consumer demand while also minimizing the existing environmental issues. The role of consumer behavior further complicates this problem suggesting a more integrated approach to production and consumption adopting the principles of circular economy (Romana & Leonardo, 2015).

MATERIALS AND METHODS

Research Design

This study employed a qualitative research design,

specifically a case study to investigate the current status, challenges, and opportunities in chicken production and consumption in the Philippines, with distinct focus on sustainability. Case studies are most typically-employed when there exists an identifiable problem validated through research, as is this context, for integrative, sustainability-centered studies in the poultry industry. The design warrants the researchers to utilize a theory-bound approach drawn from multiple sources (e.g observation, interviews and document analysis) to gather preliminary insights and build a groundwork for further studies related to circular economy practices and systems-level mechanisms within the poultry industry.

This design is particularly relevant given the two-fold structure of the chicken industry in the Philippines (commercial and backyard sectors), and the under-explored interrelations of environmental impact, animal welfare, feed dependency, and consumer behavior.

Sampling Technique

The study utilized a criterion-based sampling technique, a form of purposive sampling that efficiently scrutinizes through document contents and selects those that qualifies with specific and pre-established criteria to arrive at the research objectives. In this case, to expand on the knowledge of the Philippine poultry industry. The inclusion criteria dictates the focus and direction of the research while extracting meaningful insights and vital understanding along the way.

This criteria were connected to several important factors such as: relevance (e.g documents that are directly related to the chicken production policies, programs and organizations); credibility (include government published works, institutional reports and other peer reviewed studies that discusses the integrative implementation of systems-thinking and circular economy approaches); timeliness (e.g the publication period of study, specifically its temporal dimension), and accessibility (to ensure verifiability of the study).

Research Instrument

The primary instrument used was a systematic literature review anchored on the criterion-based sampling technique and integrated with self-developed assessment matrix in the form of Strengths, Weaknesses, Opportunities and Threats (SWOT) and Strategic Factor Analysis Summary (SFAS) Matrices. The analysis was crafted around significant domains such as production methods, feed sourcing, waste management, market access, regulatory challenges, and perceptions of sustainability. The matrices systematically-enhanced the organization and evaluation of stakeholder responses, enabling deeper investigation of sector-specific issues. For triangulation, document analysis of secondary sources such as policy papers, national statistics, industry reports, and peer-reviewed studies was also conducted.

Validity and Reliability of the Instrument

To ensure validity, two qualitative validity instruments

were employed namely: Triangulation and Peer debriefing. The Triangulation method synergized findings from SWOT/SFAS matrices, literature reviews and document analysis altogether and ascertain the points where integrative knowledge congregates. This happens when multiple sources are used as a basis to validate findings and establish a conclusive insight. Peer debriefing a.k.a “member-checking” engages multiple researchers, subject experts and/or stakeholders to deliberate interpretations drawn from either the analyses or matrices. This discusses the process taken and analysis arrived at by colleagues as a form of check and balance of logic execution, immensely reducing the emergence of researcher biases. Both instruments are qualitative in nature.

The researchers conducted the data collection in two key phases:

Document Review

A review of existing literature, reports from the Department of Agriculture, and publications from academic journals such as the Asian Journal of Agriculture and Development and Philippine Journal of Veterinary and Animal Sciences was undertaken.

Strategic Factors

Factors were validated and rated using crucial industry factors identified in the SWOT and SFAS matrices. Their inputs were quantified using a an SFAS rating scale for weighting and scoring in the final matrix synthesis.

Data Analysis

Quantitative data derived from the SWOT and SFAS assessments were tabulated and scored to identify strategic priorities, threats, and opportunities. The overall weighted score of 3.00 indicated a moderate industry position, balancing both risk and opportunity.

Scaling and Interpretation of Strategic Factors

The SFAS Matrix Employed a Rating Scale Where

- 4.00 = Very High Influence/Impact
- 3.00 = High Influence/Impact
- 2.00 = Moderate Influence/Impact
- 1.00 = Low Influence/Impact

Ethical Considerations

This study adheres to the ethical principles of qualitative research. It respects the intellectual property of credible sources by attributing them in the paper. There was no direct human participation as the research primarily employed document analysis, literature reviews, and strategic matrix development. In addition, policy documents, journal articles, government and company reports, and other organization records were obtained from the global and local sources with full attribution given to the original authors following the APA 7th edition format. Those sources were used for the study’s purpose only.

Data triangulation was utilized as well to enhance the

credibility of this research. This was done by corroborating the findings of the study from multiple sources that would help the researchers understand the examined chicken production and consumption phenomena. A member-checking was done through soliciting feedback from experts on the interpretation of the data to strengthen the validity of the conclusions drawn.

Documentation and Monitoring

Since the study’s methodology primarily starts with extensive literature review, a search strategy was employed where documents to be included in the analysis were carefully selected from the databases of Scopus, Web of Science, Google Scholar, and some peer-reviewed journals. The document to be considered was published from 2014 to 2025 to synthesize findings that show the latest development in the chicken industry. The paper applied SWOT and SFAS matrices to help visualize and prioritize the strengths, weaknesses, opportunities, threats, and other critical factors that affect the chicken industry within the circular economy framework. This way, the researchers were able to apply systems thinking specifically when interconnecting various dimensions in chicken production such as policy, market, and production.

The study’s monitoring procedures were periodically cross-checking the entries in the matrix against the documented original source just to maintain consistency and accuracy.

RESULTS AND DISCUSSIONS

Examining Consumption Patterns and Trend Analysis

The Philippines’ increasing demand for chicken products is attributed to the steady growth in consumption, catalyzed by expanding population, rapid industrialization and dynamics in dietary preferences. Processed chicken for instance is the main ingredient being served in fast-

food restaurants and ready-to-eat meals making it a popular choice among city-dwellers. Its easy, relatively healthy and quick preparation and cooking time earned the favor of the busy and modern lifestyle. These trends establish the future demand for chicken products, which is crucial in dictating the production and consumption sustainability strategies. Sharma *et al.* (2018) explains how consumption patterns are determined by price, availability, cultural preferences, and health concerns. Moreover, the in-depth understanding of how consumer behaviors aid in crafting targeted interventions to promote sustainable and logical consumption choices. Evaluating the impact of rising incomes, purchasing capabilities of the middle class, the inclination towards more convenient food options (Alam *et al.*, 2020) and how it easily fits in the contemporary lifestyle are vital contributory factors justifying the increase in demand for chicken meat products. Furthermore, the impact of marketing, advertising, and evolving lifestyle preferences offers valuable insights from which policy creation and creation of a more sustainable chicken consumption model could leverage on.

Mapping the Risks and Prospects in Chicken Production and Consumption

The chicken production and consumption pattern requires a crucial balance between overcoming the demand challenges without compromising the sustainability of the industry. The increasing demand for chicken due to rising incomes creates an opportunity for industry expansion but also necessitates careful consideration of environmental and social impacts (Gomez 2024). If the demand for chicken meat cannot be addressed by local production, imports come into the picture. However, overreliance on imported products to solve shortage issues increases strain on the ability to see through supply and demand which poses a threat on food security and long-term sustainability.

Table 1: Strengths, Weaknesses, Opportunities and Threats (SWOT) Matrix

Strengths	Weaknesses
<p>1. Backyard production of native chickens continues to contribute to the poultry industry even through broiler inventory shortfalls during the pandemic (Briones and Espineli 2022).</p> <p>2. New markets for the industry emerge as the Philippines begins to export small volumes of chicken to other Asian countries like Japan and South Korea (Domingo and Olaguera 2017).</p> <p>3. Value of production has, for the most part, been increasing in the last decade. (Domingo <i>et al.</i> 2022).</p> <p>4. Government agencies like DOST and DA support the poultry sector waste and promote environmental protection. (Dili <i>et al.</i>, 2022) through project and programs e.g. DOST established egg innovation hubs. (Dayo, 2022; The Philippine Poultry Layer Industry Roadmap 2020-2040).</p>	<p>1. The rising cost of inputs like feeds, medications, and labor impacts profit margins for producers (Gomez, 2024).</p> <p>2. Lack of registration among producers, especially backyard and smallholder farms, risks the violation of health and safety standards in the production of chicken (Domingo <i>et al.</i> 2022).</p> <p>3. There has been a decline production of chicken eggs e.g. 4.5% decrease in the Cordillera region (Alibuyog, 2024)</p> <p>4. There is limited awareness and support for organic chicken production (Pantoja <i>et al.</i>, 2023)</p> <p>5. The lack of RDE investment to enhance productivity and sustainability of chicken production, especially for backyard farmers, has been noted by numerous studies (Gomez, 2024; Domingo <i>et al.</i> 2022).</p>

<p>1. There are existing poultry waste management practices among producers in some areas of the Philippines like San Jose, Batangas. (Medina <i>et al.</i>, 2019; Dili <i>et al.</i>, 2022)</p> <p>2. There are established ordinances and resolutions to regulate poultry</p>	<p>1. There is limited awareness and implementation of regulations among some poultry owners (Dili <i>et al.</i>, 2022).</p>
<p>Opportunities</p>	<p>Threats</p>
<p>1. Technological advancements within the industry (poultry genetics, breeding, feeding, and disease management) can help increased productivity, efficiency, and overall sustainability in the poultry industry (Gomez, 2024).</p> <p>2. Compost from the broiler production chain for chicken can be used as agricultural input, a strategy for closing the circular economy loop, but only if technologies for proper nitrogen-treating are made more easily accessible (Chiarletto <i>et al.</i>, 2021).</p> <p>3. Food waste can be feasibly recycled and transformed into chicken feed of equal quality to those available in the market if proper household food waste collection, segregation, and treatment systems were developed (Siddiqui <i>et al.</i>, 2021).</p> <p>4. Growing demand for chicken products due to rising income of the domestic market (Gomez, 2024). This can lead to increased domestic production and value-added processing.</p>	<p>1. There have been numerous disease outbreaks like Avian influenza and Newcastle disease disrupt the production leading to shortages and instability of chicken prices (DENR, n.d.)</p> <p>2. High certification costs and inadequate access to organic input plague the industry (Pantoja <i>et al.</i>, 2023).</p> <p>3. Lack of government support and communication in the collection and release of official data on production as well as policymaking (Domingo <i>et al.</i>, 2022). Consumption</p> <p>4. The demand for chicken meat exceeds domestic supply requiring imports to meet the shortage (Gomez, 2024; FSA Manila, 2024).</p> <p>5. Innovations in substitute food technologies will soon affect the demand for chicken, just as it has already done so in developed countries (Espino and Bellotindos 2020).</p> <p>6. Improper poultry waste disposal poses threat to animal health, food security, water sanitation, environment, and public well-being (Dili <i>et al.</i>, 2022; Inciner8, 2024)</p>

This is worsened by outbreaks such as Avian influenza and Newcastle diseases leading to further strain in supply and instability of chicken prices as elaborated by the Department of Agriculture Philippine Roadmap Poultry Layer Industry 2022-2040 (DENR, n.d.). Additionally, the rising cost of input like feeds, medications, and labor impacts profit margins for producers (Gomez, 2024). Another concern is the limited awareness and support for organic chicken production which faces challenges like high certification costs and inadequate access to organic inputs (Pantoja, 2023). An insufficient amount of research and development (RDE) investment

increasingly hampers the industry's ability to craft and employ innovative solutions to enhance productivity and sustainability (Gomez, 2024). Moreover, the lack of technical education and support to organic chicken production underpins the importance of consumer awareness and the impact of government efforts in promoting equitable practices (Pantoja *et al.*, 2023). These issues are made even more highlighted when shifts from commercial to backyard production, only encompasses roughly 20% of the industry contribution and aggravated by relatively lower levels of registration and regulation (Domingo *et al.* 2022).

Table 2: Internal Factor Analysis Summary (IFAS) Matrix on Chicken Production and Consumption

Internal Factors	Weight	Rating	Weighted Score	Remarks
Strengths				
Backyard production of native chickens	0.15	4	0.60	Longevity of production and maintained supply amidst pandemic
New market emergence for the industry	0.11	3	0.33	Key export indicator
Continuous increase in the value of production	0.1	2	0.20	Employment and company empowerment
Support from government agencies through agricultural projects and programs	0.09	2.5	0.23	Enhanced productivity and promotion of innovation
Implementation of waste disposal and management practices	0.08	1.5	0.12	Improved environmental sustainability and reduced health risks

Weaknesses				
The rising cost of inputs	0.13	4	0.52	Rising prices for feeds, medications and labor
Lack of technical knowledge among producers	0.11	3	0.33	Consider mainstream media exposure
Decline of chicken egg production	0.07	3.75	0.26	Specific regions reported dramatic decline in production
Limited awareness and support for organic production	0.05	3.5	0.18	Relative lack of available & implementable knowledge on organic production
Lack of RDE investment	0.04	2	0.08	Lack of research and development on how to increase productivity among backyard farmers
Limited awareness and implementation of waste management regulations	0.07	2.5	0.18	Unsustainable methods of waste disposal increasing risks of diseases
Total	1.00		3.00	

Table 3: External Factor Analysis Summary (IFAS) Matrix on Chicken Production and Consumption

External Factors	Weight	Rating	Weighted Score	Remarks
Opportunities				
Technological advancements within the industry	0.15	2.5	0.53	Longevity of production and maintained supply amidst pandemic
Composting from the broiler production	0.11	3	0.33	Key export indicator
Recycling of food wastes	0.1	1.75	0.20	Employment and company empowerment
Growing demand for chicken products due to rising purchasing power	0.2	2.5	0.6	Increased pressure on production systems to scale sustainably
Threats				
Outbreaks	0.3	3.25	1.13	Increased disease outbreaks, which can compromise animal and human health
Cost of licensing and certification	0.09	1.25	0.27	Consider mainstream media exposure
Insufficient government support	0.06	3	0.21	Specific regions reported dramatic decline in production
Demand for chicken products exceeds supply	0.04	2.75	0.06	Increased pressure on producers to boost output
Access to available substitute innovative food technologies	0.1	2	0.23	Potential shift in consumer behavior and market dynamics (adapt innovation)
Persisting traditional poultry production	0.05	2.15	0.10	Potential hindrances in productivity, and competitiveness
Total	1.00		3.00	

Table 4: Strategic Factor Analysis Summary (SFAS) Matrix on Chicken Production and Consumption

No.	Strategic Factor	Weight	Rating	Weighted Score	Short	Intermediate	Long-term	Remarks/ Influential Factor/s
O1	Technological advancements within the industry	0.09	4	0.36	x			Research and Development

O2	Composting from the broiler production	0.085	2.2	0.187			x	Regulatory guidelines and farmer technical awareness
T1	Disease Outbreaks	0.3	3.25	0.975			x	Prevention and recovery strategies
T2	Cost of licensing and certification	0.075	1.75	0.13125		x		Regulatory requirements, complexity of compliance standards
T5	Availability of substitute food technologies	0.1	2	0.2		x		Advancements in food science and innovation
S1	Backyard production of native chickens	0.075	3.5	0.2625	x			Food security and supplemental income.
S2	New market emergence for the industry	0.1	3	0.3	x			Changing consumer preferences
W1	The rising cost of inputs	0.1	3.5	0.35		x		Supply chain disruptions
W2	Lack of technical knowledge among producers	0.08	3	0.24		x		Constrained access to extension services and training programs
	Total	1.00		3.00				

The Strategic Factor Analysis Summary (SFAS) Matrix of the Chicken Production and Consumption is shown in Table 2. The industry's overall weighted score is 3.00, which is considered within the industry threshold (Wheelen & Hunger, 2012). The matrix shows a well-rounded perspective with reasonable considerations for advantages and risks. The industry must concentrate on managing disease outbreaks as the T1 scores can be interpreted as being a significant threat; however, the industry is under recovery after bouts of incidences relating to disease threats. On the other hand, given the O1 scores, utilizing technology breakthroughs is expected to have a positive impact with continuous advancements within the industry, while tackling financial and regulatory obstacles, as can be derived from T2 and W2, is a moderate concern. Growth is a result of expanding into new markets (T5) and by supporting backyard production (S1), but the sector must put in efforts in overcoming constraints in rising input costs and burdens with producer registration (W1 and W2, respectively) The Philippines can achieve a sustainable chicken industry if the government and producers invest in collaborative research and development efforts to: a) enhance production, b) explore alternative feed sources, c) develop innovative production methods, d) amplify disease surveillance, and d) encourage responsible consumption habits. A holistic approach that engages stakeholders, from producers to consumers, can establish resiliency and sustainability of the chicken industry in the country. Applying the concept of circular economy to address sustainable production and consumption of chicken, certain opportunities are

already available through international best practices that need only be adopted locally (of course, after the conduct and validation of participatory studies for localizing these technologies and strategies). These include strategies such as using the treated compost of organic waste from chicken production as agricultural input, the recycling of household waste into chicken feed given properly instituted collection, transportation, storage, and processing systems, among others (Chiarletto *et al.*, 2021; Siddiqui *et al.*, 2021).

Applying Systems Thinking for Sustainable Solutions

Investing in research and development of sustainable feed alternatives such as insect-based feeds. In different sources, insects have consistently been described to compose the majority of all living things. According to Britton (2020), 75% of all named and described animal species are insects while The Royal Entomological Society UK (n.d.) says it is around 90%. Edible insects are good potential sources of proteins, amino acids, and lipids (Lucas *et al.*, 2020). Lucas *et al.* (2020) also stated that insect farming uses less water and space, and produces fewer greenhouse gas, making it a sustainable choice. Birds and poultry, such as chickens, naturally feed on insects making them a prime candidate as alternative feeds. From a practical standpoint, the acceptance of insect-based food is very low (Giotis, 2021). There are also health hazards related to insect-based foods as contaminant transfer may come from substrates, like kitchen waste and manure, to the insects (European Food Safety Authority Scientific Committee, 2015).

Implementing circular economy principles for waste management by recycling chicken manure as an organic fertilizer to improve soil productivity and crop production (Dikinya, 2010). Verma *et al.* (2020) listed multiple benefits of utilizing chicken manure as an organic fertilizer including high nitrogen, phosphorus, and potassium content, less salt and free of weed seeds, and not having any harsh chemicals that may enter the ground. With the increasing demand for chicken, an abundance of chicken manure will be available for use. Chicken production is significant agricultural activity and one of the major potential drawbacks of using chicken manure is its contribution to air pollution. According to Fakkaew *et al.* (2022), there is a diverse range of chemicals found in chicken manure wastewater, which can constitute health risks. The importance of effective air pollution measures couldn't be more reiterated to minimize the adverse impact on human health.

Prioritization of overall well-being, health, and natural behaviors of animals in order to improve animal welfare is also a key aspect of sustainability. This entails creating an environment that regards animal welfare. For example, chickens given more space for mobility and in engaging in natural activities (roaming and foraging) are essential as it lessens their stress levels making them more resilient. This results in yielding better growth rates due to lower rates of disease and injury (Rodenburg *et al.*, 2005). This can also be a predictive indicator for higher egg production and improved feed conversion ratios.

Having healthier chickens would also mean fewer veterinary costs in the long term. Ensuring that poultry are raised in humane conditions equate to abiding by the ethical concerns about animal welfare while adopting higher standards from consumers that are concerned with animal rights (Pakseresht *et al.*, 2022).

Advocacy, communication and mobilization (ACSM) campaigns in the form of public awareness initiatives, sound government policies, and incentivization mechanisms for sustainable purchasing practices, increases inclination towards responsible consumption. Manifestations of heightened awareness on the environmental and health impacts of certain food choices is evident in practices such as reducing food wastes, choosing ethically produced meat, and supporting sustainable brands. Changing consumer behavior is similar to transforming a pre-existing culture and perceiving it as a challenge would be an understatement, for everyone has their own habits and preferences that lead to unsustainable consumption patterns. Sending the message of responsible consumption is essential as it greatly reduces customer demand for environmentally harmful practices. This motivates people to look at the health benefits of responsible consumption as it is often aligned with healthier eating habits. Nevertheless, changes in consumer behavior is not enough to resolve sustainability industry challenges. It also demands for structural changes within the food industry. Policies that make sustainable products more affordable and accessible

for example, can help trigger a normalized integration of sustainability practices in the individual's daily life. Tilman and Clark (2014), explains how the economy could transition toward more sustainable and resilient food systems by focusing on waste reduction, enforcing government regulations, and increasing ownership of the concept within the communities in their own production and consumption causes.

CONCLUSIONS

The Philippine poultry sector plays a critical role in ensuring national food security while encouraging economic growth, but is continuously in competition with interwoven social, economic and environmental challenges. Heavy dependence of farmers to imported feeds puts the sector to vulnerable position in facing highly-volatile global market prices, driving up consumer expenses and reducing producer profit margins. Moreover, inefficient waste management habits of both large-scale and backyard operations are great contributors to water and soil contamination exacerbating ecological degradation. Limited access to resources and technical expertise among smallholders result to suboptimal poultry management and reduced overall product quality. The limited public awareness about sustainable habits intensifies the adverse effects of production and consumption. The industry's dual structure of operating in commercial and backyard setting, requires tailor-fitted strategies that motivates collaboration across the value chain. Systems-thinking and circular economic approaches in poultry-farming can achieve the transformative shift needed by the poultry industry to minimize wastes and optimize resource efficiency. The study recommends designing a waste conversion facility, turning chicken manure to organic fertilizers or biogas, developing local insect-based feed substitutes, and incentivizing eco-friendly feed adoption. Reinforcing vigorous waste management regulations to ensure humane animal treatment and boosting small-scale farmer education are prioritized. Additionally, the establishment of a national and regional sustainable poultry council can bridge the gaps and drive change in terms of policy-making, infrastructure investment, upholding global standards and fostering resilient, lucrative and environmentally-sustainable poultry sector.

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