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Tiny Circular Economy Practices in the Cagayan Valley Region, Philippines: A Case Study of Native Chicken Farmers

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ABSTRACT

This study investigated the adoption of tiny circular economy (TCE) practices among native chicken farmers in the Cagayan Valley region of the Philippines, examining the influence of farmers' perceptions and motivations on TCE practices. Using a purposive sample of 400 farmers, the research explored how farmers' perceptions of support from government and non-government organizations, alongside their motivations (existence, relatedness, and growth), impact the implementation of TCE in native chicken production. Data were analyzed by using multiple linear regression to quantify these effects. The findings reveal that a significant majority (68.25%) of farmers in the region have adopted sustainable TCE practices, which form a circular system encompassing food production, consumption, and waste management. These practices include utilizing leftover food as chicken feed, allowing chickens to forage naturally, employing organic fertilizers derived from animal manure and plant waste, and selling chickens and eggs for income. Moreover, the results indicated that farmers' perception of the support from government and NGOs had a significant impact on TCE adoption ($p<0.05$), whereas motivation exerted a stronger influence ($p<0.01$). Additionally, TCE adoption leads to reduced production costs (particularly feed and fertilizer), increased income from premium-priced organic products, waste reduction, and overall environmental sustainability. The findings suggest that farmers' perception and motivation have a positive influence on the adoption of smallholder TCE practices, contributing to reducing production costs, increasing income, and promoting sustainable development in native chicken farming.

Keywords: motivation; native chicken farmer; perception; tiny circular economy practices

INTRODUCTION

Poverty in the Philippines is deeply rooted in significant inequalities across income brackets, regions, and sectors, exacerbated by uncontrolled population growth and moderate economic growth over the past four decades. Key factors include limited access to productive jobs and education, which hinder earning capacity among low-income people (Adviento *et al*., 2022; Albert, 2023; Martínez, 2023). Smallholder farmers account for 99.09% of native chicken rearing in the Philippines, whereas only 0.91% is kept by semi-commercial stakeholders. Small household poultry farming is vital in rural families' sources of high-quality animal protein and emergency cash income (Tenza *et al*., 2024). Rural family-based, native chicken production is integrated with circular processes such as vegetable gardening, kitchen food waste recycling through composting, and reuse of available resources and materials, which benefit the native chicken production cycle; the farming method can qualify as small household Tiny Circular Economy Process (Bartolacci *et al*., 2023). When the smallholders are given increased skills in chicken management, the impact on the farmer's economic improvement will be visible and reduce farmers' poverty (Birhanu *et al*., 2023).

A circular economy, emphasizing durability, reuse, remanufacturing, and recycling, offers significant opportunities for economic diversification, environmental sustainability, and social inclusion. By reducing reliance on virgin raw materials through advanced recycling technologies and an efficient waste management system, it minimizes resource use, energy consumption, and greenhouse gas emissions while diverting waste from landfills (Burggraaf *et al*., 2020; Scheel *et al*., 2020). Developing nations are particularly well-positioned to benefit from circular economy practices, leveraging jobs and stimulating growth. Global initiatives, such as the EU's Circular Economy Action Plan and policies in Japan and China, highlight the widespread adoption of circular principles to combat climate change and promote resource

efficiency. This model challenges the traditional "take-make-waste" linear economy by keeping materials in use longer, fostering innovation in sustainable production and consumption systems. However, achieving a fully circular economy requires supportive policies, investment in technology, and equitable access to resources to ensure inclusive benefits across all sectors (Awasthi *et al*., 2022; Johansson, 2021; Rótolo *et al*., 2022; Yamaguchi *et al*., 2020).

The farmers in rural areas of the Cagayan Valley region derived their income primarily from their agricultural-related activities. While the province remains an agricultural peak, most farmers are economically challenged and lack land ownership. Some farmers raise various agricultural animals for consumption, and sometimes, they sell their chickens, pigs, and ducks to raise additional income to help them with their daily financial needs. Among these agricultural animals, native chicken is the most raised by farmers as it is easy to raise native chicken (Padilla *et al*., 2020). In the Cagayan Valley region, native chickens are predominantly raised under an extensive production system, wherein birds are allowed to freely forage around the household or farm environment with minimal inputs in terms of feed, housing, and veterinary care (Sawadan & Tabuyo, 2024). The extensive system aligns naturally with the principles of a circular economy, as farmers often repurpose farm by-products such as crop residues and kitchen waste for feed and utilize chicken manure as organic fertilizer.

Moreover, chickens may also help restore microbial diversity in the soil (Mhuireach *et al*., 2022). Although native chickens are commonly raised under a free-range system, farmers in the study often supplement this with semi-confined areas or night shelters, where chickens are kept during certain periods (e.g., at night or during feed supplementation). These areas allow for partial collection of manure, which can be processed into organic fertilizer or used in vermiculture (e.g., for feeding earthworms) (Abbasi *et al*., 2024). The use of chicken manure waste as fertilizer not only reduces waste but also minimizes environmental impact. The application follows the circular economy perspective; it can be beneficial for the sustainability of integrated farming systems and the environment (Abbasi *et al*., 2024). The adoption of a circular economy has proved that concern in rural communities could have a big impact. The farmers are motivated to adopt the innovation due to several benefits such as time effectiveness, more income, and increased microbial effectivity in the soil (Bian & Liu, 2024). However, the adoption of a circular economy for food should be followed with the stakeholder partnership (government, community organizations, associations, technical support institutions, and non-government organizations) to support the farmers (Howard *et al*., 2022; Liangco *et al*., 2024a,b).

The adoption of a circular economy in small and medium-sized enterprises (SMEs) means integrating these principles into the entire business value chain, starting from design, procurement of raw materials, production, distribution, and consumption to the recovery of products and materials. Although there are many challenges, including financial, technological, market, institutional, supply chain, cultural, knowledge, and awareness barriers, circular economy adoption has been proven to improve the environmental, economic, and social performance of SMEs (Dey *et al*., 2022; Mishra *et al*., 2022). Specifically, a circular economy-based indigenous chicken micro-farming system can serve as a sustainable solution for food security by integrating all actors in the value chain-pre-producers, growers, middlemen, processors, retailers, and consumers (Abbasi *et al*., 2024). Compared to those studies, further evaluation is needed regarding how the circular economy-based indigenous chicken farming system can be implemented at the household level with a smaller scale of less than 20 chickens, which is defined as the tiny circular economy.

To the best of our knowledge, this study presents a novel contribution by applying the concept of tiny circular economy (TCE) to native chicken farming in the Cagayan Valley region of the Philippines—an area and sector that has received limited scholarly attention. Unlike previous research that focuses primarily on large-scale or generalized circular agriculture (Dey *et al*., 2022; Mishra *et al*., 2022), this study emphasizes smallholder practices and examines how TCE can support economic, environmental, and social sustainability at the household level. This research uniquely integrates farmers' perception of institutional support and their personal motivation, providing a quantitative analysis of how these socio-psychological factors influence the adoption of TCE practices in native chicken farming. The study aims to examine these relationships and evaluate the potential of TCE to enhance economic, environmental, and social sustainability, contributing to poverty reduction and sustainable livelihoods in the rural Cagayan Valley region of the Philippines.

METHODS

Sampling Method

The study was conducted in the Cagayan Valley region, located in the northeastern part of Luzon Island, the Philippines. This is a major agricultural region with a tropical monsoon climate, favorable for free-range chicken farming. The Cagayan Valley region includes the provinces of Cagayan, Isabela, Nueva Vizcaya, Quirino, and Batanes. In this region, most farmers practice small-scale chicken farming and reusable resources according to the circular economy model. The respondents of this research were native chicken farmers in the Cagayan Valley region of the Philippines (Figure 1).

This study was conducted by interviews and survey questionnaires about the socio-demographic profile, farmers' perception of the government and non-government organizational' support, their motivation in raising native chickens, and the practice of tiny circular economy (TCE) of the farmer in raising native chicken. The purposive sampling method was used, and the criteria of the farmer in the studied location were to have a minimum of 12 native chickens (10 hens and 2 roosters), experience in raising native chickens, have participated or are currently participating in an empowerment program from the government, NGO, and State Universities

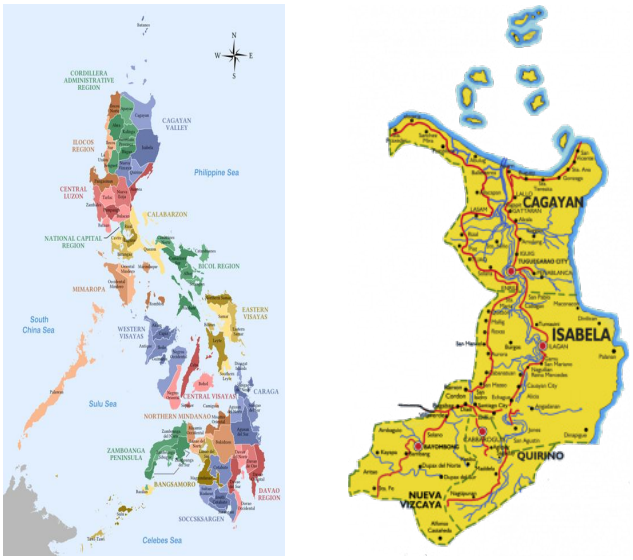

Figure 1. Research site of the study

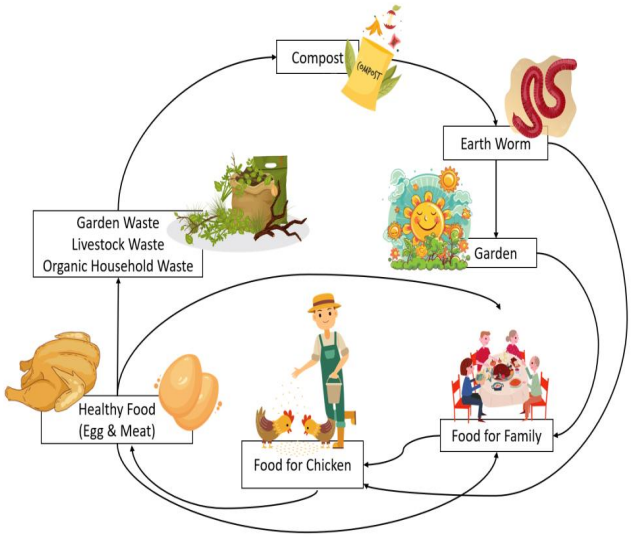

Figure 2. Tiny circular economy practices model for native chicken farmers in the Cagayan Valley

and Colleges (SUCs) in raising native chickens and household (farms-rural or urban) with an area not exceeding 500 square meters. An ideal TCE model for a native chicken farmer with 12 birds is designed to optimize resource use and close nutrient loops at the household level. Twelve chickens represent a manageable flock size for smallholder farmers, enabling them to observe, maintain, and benefit from both egg and meat production without requiring significant land, capital, or labor. The total population of native chicken farmers in the Cagayan Valley is approximately 148,000. To achieve a 95% confidence level with a 5% margin of error, the sample size was calculated to be 399 participants. The number of farmers that would be the research sample was 400 farmers.

Analysis of TCE Practices, Perception, and Motivation in Raising Native Chickens

TCE practices in raising native chickens are related to the application of animal waste management, feed efficiency, and integrated farming system aspects (Figure 2). These practices contribute to sustainability by minimizing waste, optimizing resource use, and improving overall farm productivity. This study evaluated TCE adoption using 21 statements from a structured questionnaire specifically designed to measure farmers' engagement in these key areas. Farmer perception is perceptions of government, NGO, State Universities, and College support are seen as financial support, mentoring, and training in TCE practices. This study assessed the level of awareness through 15 statements, divided into three groups corresponding to the above sources of support. Farmer motivation is analyzed based on values in the aspects of existence, relatedness, and growth. This study assessed farmers' motivation through 15 statements, divided equally into the three groups above. Specifically, the existence dimension refers to a motivational aspect that is based on fulfilling basic life and material needs by raising native chickens in the total score. Relatedness is the motivation aspect based on fulfilling the need to establish relationships or connections with family, colleagues, government, NGO, and SUCs by raising native chickens in the total score. Growth is measured based on the fulfillment of productive and creative activities by raising native chickens in the total score.

The measurement of TCE practices, perceptions, and motivation variables was done using Likert scale score calculations with a score of 1-5. On each point in the TCE practices, respondents will score 1 if they never make the statement point, 2 for rarely, 3 for sometimes, 4 for often, and 5 for always. On the measurement of perception and motivation, a score of 1 states that the respondent strongly disagrees with the statement points, 2 for disagreement, 3 for moderately agree, 4 for agree, and 5 for strongly agree. Furthermore, the determination of the category of TCE practices, perception, and motivation is obtained by calculating the class interval with the following formula:

Interval category= (Maximum value - Minimum value)/ The number of category

The results of the category interval calculation are shown in Table 1.

Table 1. Interval category for tiny circular economy (TCE) practices, perception, and motivation among native chicken farmers in Cagayan Valley, Philippines

Variable and category	Maximum value	Minimum value	Interval category
TCE practices	105	21	
Always			79–105
Not so often			50–78
Sometimes			21–49
Perception	75	15	
Agree			61–75
Moderately agree			36–60
Not Agree			15–35
Motivation category	75	15	
High			61–75
Moderate			36–60
Low			15–35

Regression Analysis

The hypothesis in this study is that perception and motivation affect TCE practices. This hypothesis was tested using multiple linear regression analysis. The formulation of this analysis is as follows:

$Y = a + b_1X_1 + b_2X_2 + e$

Multiple linear regression analysis is one of the statistical methods used to identify the relationship between one dependent variable (Y) and two or more independent variables (X); where: Y is the dependent variable, representing the total score of each farmer's TCE practice; X_1 is the total score of the farmer's motivation, calculated by adding up the scores from 15 motivational statements; each statement was measured on a 5-point Likert scale; and X_2 is the total score of the farmers' perception of support from the government, NGOs, and universities, as determined from 15 statements.

The total score of X_1 and X_2 is calculated by adding up the scores of all statements in each group and then used in the regression model to determine their impact on TCE practices. Multiple linear regression analysis operations were conducted using SPSS version 26 (IBM Corp, Armonk, NY, USA) for this study.

RESULTS

Practices of Tiny Circular Economy

Table 2 presents the different practices of the native chicken farmers in relation to a tiny circular economy. Most statements were rated as "Often" with mean ratings ranging from 3.59 to 4.41, indicating frequent implementation. Farmers often combine native chicken farming with crop production, optimize feed resources, and use waste as fertilizer, demonstrating a strong commitment to circular economy principles. Practices related to food production reveal that farmers often get their food from their environment by planting fruits and vegetables and raising different kinds of animals. The study revealed that they frequently use organic fertilizers derived from dried leaves, grasses, and composted animal manure. Additionally, the results show that farmers feed their chickens with leftover foods, such as corn, rice, and grains, and allow their chickens to scratch the backyard for earthworms. Many farmers also sell their chickens and eggs to supplement their income. The results demonstrate that a significant majority (68.25%) of native chicken farmers in Cagayan Valley have implemented sustainable TCE practices (Table 3). TCE implementation yielded economic benefits, such as reduced feed and fertilizer costs and increased income from organic chicken products.

Farmer Perception

The farmers' perception of the government support, non-government organizations, state universities, and colleges, are presented in Table 4. As to the government, farmers agreed that the government

Table 3. Tiny circular practices category distribution among native chicken farmers in Cagayan Valley, Philippines

Category	Number	Percentage (%)
Always	273	68.25
Not so often	112	28
Sometimes	15	3.75
Total	400	100

Table 2. Native chicken farmers' tiny circular practices among native chicken farmers in Cagayan Valley, Philippines

No	Statements	Mean	SD	Description
1	We get our food from our environment	4.29	1.03	Often
2	We plant fruits and vegetables as the main source of our food	4.34	1.03	Often
3	In our backyard, we have different types of fruits and vegetables	4.32	1.08	Often
4	We raise different kinds of animals for food and we sell them in times of difficulty	4.12	1.14	Often
5	We use inorganic fertilizer for our vegetables	3.88	1.40	Often
6	We use organic fertilizer, such as dried leaves and grasses for our vegetables	4.25	1.09	Often
7	We do not allow our animals to eat commercial feeds	3.88	1.31	Often
8	We feed our chickens with leftover foods like rice, corn, etc.	4.38	1.04	Often
9	We burn the dried leaves and grasses	3.68	1.35	Often
10	We use to feed our chickens and other animals with leftover food from our kitchen	4.41	1.02	Often
11	We use the feces of our chickens and other animals for composting	4.22	1.16	Often
12	We used the decomposed animal feces as organic fertilizer for our vegetables	4.27	1.14	Often
13	Our chickens used to scratch the ground in our vegetable garden to look for earthworms	4.29	1.09	Often
14	We sell our chickens and their eggs	3.82	1.34	Often
15	We use the chicken egg shells as organic fertilizer	4.11	1.24	Often
16	We feed our chickens corn, rice, and other grains	4.42	1.00	Often
17	We have an identified and specific place where we put the feces of our chickens and other animals	4.18	1.21	Often
18	We do not use synthetic and commercial medicine for our chickens to prevent diseases or to make them healthy	3.77	1.37	Often
19	We do not use synthetic and commercial pesticides for our vegetable and fruit garden	3.59	1.41	Often
20	We do not have a specific place for our trash, such as plastic, Styrofoam, and other materials.	3.20	1.58	Sometimes
21	We recycle our trash	4.32	1.21	Often

Table 4. Farmers' perception of the support of the government, non-government organizations, and state universities and colleges

No	Statements	Mean	SD	Description
1	The government provides sufficient understanding of the tiny circular economy	3.50	1.02	Agree
2	NGOs provide sufficient understanding of the tiny circular economy	3.44	1.00	Moderately agree
3	State Universities and Colleges have a sufficient understanding of the tiny circular economy	3.43	0.99	Moderately agree
4	The government provides sufficient financial support for raising native chickens	3.21	1.07	Moderately agree
5	NGOs provide sufficient financial support for raising native chickens	3.16	1.08	Moderately agree
6	State Universities and Colleges provide sufficient financial support for raising native chickens	3.14	1.13	Moderately agree
7	The government provides sufficient material assistance related to raising native chickens	3.16	1.07	Moderately agree
8	NGOs provide sufficient material assistance related to raising native chickens	3.20	1.04	Moderately agree
9	State Universities and Colleges provide sufficient material assistance related to raising native chickens	3.19	1.06	Moderately agree
10	The government provides sufficient training related to raising native chickens	3.29	1.03	Moderately agree
11	NGOs provide sufficient training related to raising native chickens	3.27	1.04	Moderately agree
12	State Universities and Colleges provide sufficient training related to raising native chickens	3.24	1.06	Moderately agree
13	The government provides sufficient training regarding native chicken waste processing	3.24	1.07	Moderately agree
14	NGOs provide sufficient training regarding native chicken waste processing	3.25	1.14	Moderately agree
15	State Universities and Colleges provide sufficient training regarding native chicken waste processing	3.15	1.17	Moderately agree

provides sufficient understanding regarding the tiny circular economy. Farmers have moderately agreed that the government provides sufficient financial support, material assistance, and training in raising native chickens. For non-government organisations (NGOs), all statements were rated as "Moderately Agree" with mean scores ranging from 3.16 to 3.44. Respondents acknowledged that NGOs provide a basic understanding of TCE principles, along with financial assistance, material resources, and training programs in native chicken farming and waste management. Similarly, the respondents also expressed moderate agreement on the role of state universities and colleges (SUCs) in promoting TCE adoption, with mean values ranging from 3.14 to 3.43. The results indicate that more than 50% of farmers moderately agreed that they received sufficient support (Table 5), particularly in gaining a better understanding of the concept and practical application of TCE.

Farmer Motivation

In the aspect of existence, the respondents agreed with all five (5) statements (Table 6). This is based on the mean value from 3.51 to 3.94. The farmers agreed

Table 5. Perception category distribution among native chicken farmers in Cagayan Valley, Philippines

Perception category	Number	Percentage (%)
Agree	51	12.75%
Moderately agree	281	70.25%
Not Agree	68	17%
Total	400	100%

Table 6. Native chicken farmers' motivation in developing free-range chicken

Statements	Mean	SD	Description
Existence			
1. The desire to fulfil food needs	3.94	0.90	Agree
2. The desire to fulfil clothing needs	3.51	1.07	Agree
3. Desire to meet children's school money needs	3.53	1.11	Agree
4. Desire to earn additional income	3.69	1.05	Agree
5. The desire to obtain guarantees for increasing the native chicken population	3.87	0.96	Agree
Relatedness			
1. Desire to cooperate with the government	3.33	1.12	Moderately agree
2. Desire to collaborate with NGOs	3.26	1.13	Moderately agree
3. Desire to collaborate with SUCs	3.21	1.16	Moderately agree
4. Desire to build relationships with fellow breeders	3.55	1.10	Agree
5. The desire to work together in groups during native chicken rearing activities	3.64	1.11	Agree
Growth			
1. Desire to increase the number of native chickens	4.38	1.01	Agree
2. Desire to use plant waste and chicken feces as fertiliser	4.19	1.15	Agree
3. Desire to provide chicken feed from earthworms in the garden/backyard	4.11	1.24	Agree
4. The desire to provide chicken feed from household leftovers	4.30	1.10	Agree
5. Desire to use fertilizer from your compost for plants in the garden/backyard	4.14	1.20	Agree

that they are motivated to raise native chickens as these can fulfill their basic needs, like food and clothes. They also agreed that they are motivated to raise native chickens because such activity can provide additional income for the needs of the family, especially for the school's financial needs of their children, and the desire to increase the number of native chickens in the community. Table 6 also highlights the role of relatedness as a motivating factor for farmers in raising native chickens. Out of the five (5) relatedness-based motivation statements, two (2) were rated as "Agree", with mean scores of 3.44 and 3.64, respectively. This suggests that farmers are primarily motivated by their desire to build relationships with fellow breeders and collaborate in native chicken management. Regarding growth as a motivational factor, Table 6 shows that all five (5) statements received "Agree" ratings, with mean scores ranging from 4.11 to 4.38. Farmers are highly motivated to raise native chickens not only to increase their livestock population but also to maximize resource utilization, such as feeding chickens with household leftovers and allowing them to forage for protein sources like earthworms naturally. Farmers with moderate motivation accounted for 55.5%, while those with high motivation made up more than 30%, indicating a strong overall willingness to implement Tiny Circular Economy (TCE) principles in native chicken farming (Table 7).

The Effect of Perception and Motivation to Tiny Circular Economy Practices

Tiny circular economy practices of native chicken farmers are positively influenced by perception ($p \leq 0.05$) and motivation ($p \leq 0.01$) (Table 8). It can be said that the better the perception of farmers, the more likely farmers will carry out the practices. In the context of the circular economy, high motivation can help farmers identify new opportunities to optimize resources and reduce waste, thereby improving the sustainability and profitability of their business.

Table 7. Motivation category distribution among native chicken farmers in Cagayan Valley, Philippines

Motivation category	Number	Percentage (%)
High	158	39.5
Moderate	222	55.5
Low	20	5
Total	400	100

Table 8. Perception and motivation on tiny circular economy practices among native chicken farmers in Cagayan Valley, Philippines

Independent variables	Coefficients	Standard error	Sig.
Perception	0.136	0.057	0.018**
Motivation	1.048	0.067	0.000***
Number of observations	400		
Constanta	19.693		
R Square	0.616		
Adjusted R Square	0.614		

Note: * p<0.1; ** p<0.05; *** p<0.01

DISCUSSION

The feeding and management practices observed among native chicken farmers in Cagayan Valley align with traditional, low-cost, and resource-efficient farming systems that have long been practiced in rural communities. The utilization of leftover food, grains, and naturally available protein sources, such as earthworms, reflects a sustainable approach to poultry production, minimizing feed costs while reducing household food waste (Parolini *et al*., 2020). The free-range systems not only enhance the nutritional quality of poultry meat and eggs but also contribute to improved soil health by allowing chickens to aerate the soil and control pests naturally (Jeni *et al*., 2021). Moreover, native chicken farming serves as an economic livelihood strategy for smallholder farmers in regions with limited access to formal employment (Loengbudnark *et al*., 2024). However, gaps in waste management practices remain, as improper disposal of waste, such as the burning of dried leaves and grasses, persists. To address this issue, training programs on composting and structured waste recycling could further improve sustainability by enhancing soil fertility and reducing environmental impact (Zhang *et al*., 2022). Processing organic fertilizer from chicken manure is crucial in reducing waste discharge, minimizing pollution, and mitigating its negative impacts. The adoption of TCE principles enhances resource efficiency by ensuring that agricultural by-products are repurposed rather than discarded. This includes using local biomass as an alternative feed source to reduce dependence on commercial feed (Velasco-Muñoz *et al*., 2021).

Perception refers to the cognitive process through which farmers interpret and understand information based on their learning and experiences (Nes *et al*., 2023). In this study, farmers' perceptions reflect their evaluations of institutional support, including financial assistance, training, and technical guidance, which are critical for TCE implementation (Mehmood *et al*., 2021). While knowledge dissemination appears adequate, resource limitations, particularly in material and financial support, hinder the effective implementation of circular economy practices. Research suggests that positive perceptions of institutional backing significantly influence farmers' willingness to adopt innovative farming practices (Deng *et al*., 2024; Mehmood *et al*., 2021). Strengthening institutional support and improving outreach mechanisms could further enhance farmers' confidence and increase adoption rates of TCE practices. Additionally, the moderate level of agreement among farmers on the effectiveness of NGO and SUC interventions suggests the need for stronger collaboration. Expanding financial assistance and improving waste management strategies could bridge the gap between research-driven solutions and practical implementation (Yusuf & Popoola, 2022; Visweswaran & Laerhoven, 2024).

Motivation plays a critical role in enhancing the adoption of TCE practices by driving farmers to optimize resources, reduce waste, and improve the economic efficiency of their farming operations. High levels of motivation enable farmers to recognize new opportunities for sustainable innovation, which, in turn, improves long-term profitability and resilience (Aboobaker *et al*., 2023; Rizzo *et al*., 2024). Farmers are motivated by several factors, including financial, physiological, and relationship-based needs. The desire to increase income, reduce production costs, and improve soil health by utilizing organic fertilizers reflects the multifaceted benefits of TCE adoption. This aligns with findings showing that farmers are more likely to adopt circular economy practices when they perceive tangible benefits from sustainable farming (Kathiravan & Chitrambigai, 2024). Motivated farmers are also more likely to engage in capacity-building initiatives, such as learning about waste recycling techniques, adopting alternative feed sources, and collaborating with other farmers to enhance sustainability outcomes. This collaborative mindset fosters both individual growth and community resilience, contributing to broader social and economic well-being (Maia *et al*., 2021).

The implementation of a tiny circular economy among farmers can be understood as the adoption of innovation in native chicken farming practices. The results indicate that perception and motivation have a positive and significant influence on the adoption of TCE practices by native chicken farmers. An increase in perception enhances farmers' understanding of the TCE concept, increasing their willingness to implement these practices. According to the innovation adoption theory, farmers undergo stages: awareness, interest, evaluation, trial, and adoption. Perception is also influenced by social and cultural values, previous experiences, and the real needs of the farmers (Qui *et al.,* 2021). Innovations that align with the social-cultural context and farmers' needs are more easily accepted and adopted. The implementation of this tiny circular economy also fits the family lifestyle pattern of utilizing by-products from their consumption for chicken farming.

Similarly, an increase in motivation directly contributes to greater adoption of circular economy practices. This is because motivation is an important social capital in the mental decision-making process to adopt new technology. Furthermore, motivation also plays a role in enhancing positive attitudes toward innovation, which then facilitates the adoption process from the awareness stage to full acceptance. Motivated farmers are more likely to implement TCE to fulfill financial needs, optimize resource use, and develop their farming enterprises. This not only improves the sustainability of their operations but also enhances profitability by reducing feed and fertilizer costs and generating additional income from organic fertilizers and compost (Velasco-Muñoz *et al*., 2021). By fostering a positive perception of institutional support and enhancing farmers' intrinsic motivation, stakeholders can strengthen the long-term sustainability of TCE practices. Ultimately, this holistic approach promotes environmental conservation, economic stability, and social well-being in rural farming communities, making TCE a viable strategy for rural development (Kaszycki *et al*., 2021; Lu *et al*., 2022).

CONCLUSION

Most native chicken farmers in the Cagayan Valley region have adopted tiny circular economy practices, which have helped reduce production costs, increase income, and enhance environmental sustainability through effective resource management. Perceived support from the government, NGOs, and SUCs significantly influenced the adoption of TCE, while farmers' motivation, especially the desire to increase production, had a stronger impact. To scale this model effectively, increased financial support, technical training, and collaboration among stakeholders are needed to enhance farmers' capacity and ensure the sustainability of free-range chicken farming.

CONFLICT OF INTEREST

We certify that there is no conflict of interest with any financial, personal, or other relationships with other people or organizations related to the material discussed in the manuscript.

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