



## Community Empowerment of Household Duck Farmers through Economic-Based Assistance in Cambodia

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### ABSTRACT

Artikel penelitian ini menyajikan analisis ekonomi komprehensif tentang peternakan bebek rumahan di kotamadya Serei Sophon, provinsi Banteay Meanchey, Kamboja. Studi ini didasarkan pada pemeriksaan rinci catatan produksi peternakan representatif selama satu siklus produksi penuh, dengan menggunakan metrik ekonomi pertanian standar untuk mengevaluasi profitabilitas, efisiensi ekonomi, dan kelayakan finansial. Studi ini menggunakan pendekatan studi kasus yang berfokus pada satu operasi peternakan bebek rumahan representatif yang terletak di sub-distrik Phneat, kotamadya Serei Sophon, provinsi Banteay Meanchey. Peternakan tersebut mengkhususkan diri dalam produksi telur, memelihara kawanan 3.500 bebek petelur selama siklus produksi satu tahun. Data primer dikumpulkan langsung dari catatan keuangan dan produksi peternakan, mencakup semua biaya yang dikeluarkan dan pendapatan yang dihasilkan selama periode studi. Temuan menunjukkan bahwa peternakan bebek rumahan merupakan usaha yang sangat menguntungkan. Untuk setiap 1 riel yang diinvestasikan dalam total biaya produksi, peternakan tersebut menghasilkan pendapatan sebesar 4,50 riel, menghasilkan rasio efisiensi ekonomi sebesar 4,50 dan laba bersih sebesar 328.992.600 riel per siklus produksi. Analisis titik impas menetapkan bahwa produksi minimum 14.810 butir telur diperlukan untuk menutupi semua biaya, ambang batas yang jauh di bawah produksi tahunan aktual peternakan sebesar 960.000 butir telur. Analisis SWOT mengidentifikasi kekuatan internal utama, termasuk swasembada modal dan kebutuhan tenaga kerja yang rendah, di samping kelemahan seperti pelatihan teknis yang terbatas dan ketergantungan pada pemasok eksternal untuk anak itik.

This article outlines a community service activity aimed at empowering rural households in the Phneat sub-district of Serei Sophon municipality, Banteay Meanchey province, Cambodia, through the optimization of household duck farming. The community faces challenges related to poverty, limited access to formal technical training, and vulnerability to market fluctuations. The objective of this intervention was to enhance the livelihoods and financial resilience of local farmers by providing targeted mentoring and assessing the economic viability of their current practices. The implementation method involved direct mentoring, technical training on farm management, and the application of standard agricultural economics metrics to a representative farm maintaining a



flock of 3,500 laying ducks. The intervention resulted in improved knowledge of cost management, biosecurity, and operational efficiency among the participating farmers. Furthermore, the economic analysis served as a crucial tool for empowerment, demonstrating that the enterprise is highly profitable. Findings showed that for every 1 riel invested, the farm generated 4.50 riels in revenue, with a break-even threshold of only 14,810 eggs against an annual output of 960,000 eggs. The impact on the community includes strengthened financial self-sufficiency, improved strategic planning against external threats like feed price volatility and disease outbreaks, and a sustainable pathway for poverty reduction and job creation in the region.

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## INTRODUCTION

Agriculture constitutes the backbone of the Cambodian economy and continues to be the primary source of livelihood for the majority of the country's rural population (MAFF, 2025; Ministry of Planning, 2019). Within the agricultural sector, livestock production—and poultry farming in particular—plays an indispensable role in household food security and income generation (Pangemanan et al., 2014). Duck farming has long been embedded in the cultural and economic fabric of Cambodian rural life, offering families a dual source of income through the sale of both eggs and meat (GDAPH, 2006; MAFF, 2024b). In the Serei Sophon municipality of Banteay Meanchey province, household-level duck farming is a common and economically significant activity, practiced by families who rely on it as either a primary or supplementary source of income (Banteay Meanchey Province PDAFF, 2025). Despite its prevalence, however, many of these household farmers continue to operate under considerable constraints. The majority lack systematic financial record-keeping practices, limiting their ability to assess profitability or make informed, data-based business decisions. Access to formal technical knowledge in areas such as disease management, biosecurity, and modern feed practices remains limited, with most farmers relying primarily on traditional experience. Furthermore, a significant dependency on external suppliers for essential inputs—particularly ducklings—exposes these households to supply chain vulnerabilities and cost pressures beyond their control. These conditions collectively constrain the productivity, resilience, and long-term sustainability of household duck farming operations in the community.

Despite the widespread practice of duck farming at the household level, farmers in communities such as Serei Sophon municipality continue to receive insufficient practical support to strengthen and sustain their operations. While general agricultural extension services exist, they rarely translate available knowledge into accessible, actionable tools that farmers can apply directly to their day-to-day decision-making. The gap between what is known about profitable duck farming and what is actually practised in the field remains considerable—most smallholder farmers have little exposure to systematic cost tracking, profitability assessment, or strategic planning frameworks. As a result, support programmes and extension activities risk being misaligned with the real financial realities and operational constraints of the farming community (Royal Government of Cambodia, 2025; William, 2001). There is therefore a pressing need for community service interventions that go beyond awareness-raising to deliver practical economic tools—such as cost-benefit analysis, break-even assessment, and SWOT-based planning—directly into the

hands of farmers, empowering them to make informed, evidence-based decisions that improve their livelihoods.

This community service activity responds to the identified needs of household duck farmers in the Phneat sub-district of Serei Sophon Municipality by delivering economic-based mentoring and practical training directly to the farming community. The primary objective is to enhance the capacity of household duck farmers to understand and apply cost and profit analysis as tools for better, more informed business decision-making. Specifically, the activity assists farmers in systematically examining their fixed and variable costs, revenue sources, and net profit, and in using break-even analysis to determine the minimum production threshold required for financial sustainability. A SWOT-based planning framework is further employed to help farmers recognise their own strengths, address operational weaknesses, and respond strategically to external opportunities and threats. What distinguishes this activity is its integration of rigorous economic analysis with a community empowerment approach—moving beyond the generation of academic findings to translate financial knowledge into practical, farmer-accessible tools. The outcomes are intended not only to improve the operational decisions of individual farming households, but also to provide a replicable model for policymakers and development organisations seeking to support the sustainable growth of Cambodia's rural poultry sector.

## METHOD

### Study Area and Data Collection

The methodology was structured across four interconnected stages. The first stage involved the identification of community problems through direct engagement with the farmer, revealing key challenges including the absence of systematic financial record-keeping, limited technical knowledge in cost management and disease prevention, and a heavy dependence on external suppliers for ducklings. These findings established the foundation for a targeted intervention.

In the second stage, the service team delivered structured mentoring and training sessions conducted over a period of four weeks between October and November 2025, comprising three face-to-face visits to the farm (each lasting approximately three to four hours) supplemented by two follow-up consultation sessions conducted via telephone covering the principles of agricultural cost-benefit analysis, break-even assessment, and strategic farm planning using a SWOT framework. The farm, which specialises in egg production and maintains a flock of 3,500 laying ducks operated by one farm owner and two hired workers, all of whom participated as direct beneficiaries of the mentoring and training sessions — over a one-year production cycle, served as the practical case through which all concepts were applied. Primary data were collected directly from the farm's financial and production records, covering all costs incurred and revenues generated during the activity period, and were supplemented by information from the Ministry of Agriculture, Forestry and Fisheries (MAFF) and local agricultural offices (PDAFF, 2025).

The third stage involved guided application, in which the farmer was supported in constructing and interpreting their own financial records using the tools introduced during training.

The fourth stage comprised evaluation of outcomes, with success assessed against indicators including the farmer's demonstrated ability to calculate net profit and break-even quantity, improved understanding of cost structure, and enhanced capacity to identify strategic opportunities and threats affecting the operation.

### Cost and Revenue Analysis

Production costs were categorised into two distinct components. Fixed costs (TFC) represent the annualised depreciation of long-term capital assets employed in the production process,

including duck housing structures, water pumps, water tanks, motorcycles, and other durable equipment. Depreciation was calculated on a straight-line basis according to the expected useful life of each asset. Variable costs (TVC) encompass all inputs that are consumed within the production cycle, including the purchase of ducklings, commercial feed, vaccines and medicines, hired labour, electricity, transportation fuel, and mobile phone credit used for business communication (Harbanssingh, 1978).

The total cost (TC) of production is the arithmetic sum of total fixed costs and total variable costs:  $TC = TFC + TVC$

Total revenue (TR) was calculated by multiplying the quantity of each product sold by its respective market price. The farm's revenue streams included the sale of eggs, the sale of culled ducks, the sale of duck manure, and the sale of broken eggs.

### Profitability and Economic Efficiency Analysis

Net profit (NP) was determined by subtracting total production costs from total revenue:  $NP = TR - TC$

Economic efficiency (E) was calculated as the ratio of total revenue to total cost, providing a measure of the financial return generated per unit of investment:  $E = TR / TC$

This ratio indicates how many riels of revenue are generated for each riel of total cost incurred. A value greater than 1 indicates a profitable operation. The study further decomposed this analysis to examine the efficiency of fixed capital ( $TFC/TR$ ) and variable capital ( $TVC/TR$ ) separately, revealing the relative contribution of each cost category to the overall revenue.

Labour productivity was assessed by dividing total revenue by the number of workers employed, yielding the revenue generated per worker per production cycle. Land productivity was similarly calculated by dividing total revenue by the total land area used for the farm.

### Break-Even Analysis

A break-even analysis was conducted to identify the minimum production level at which the farm's total revenues equal its total costs—the point at which the enterprise neither earns a profit nor incurs a loss. The unit cost (UC) of producing one egg was first calculated by subtracting by-product revenue from total cost and dividing by the total quantity of eggs produced:  $UC = (TC - BP) / Q$

Where BP is total by-product revenue and Q is the total quantity of eggs. The break-even quantity (Q) was then determined using the standard formula:  $Q = TFC / (P - VC)$

Where P is the market price per egg and VC is the variable cost per egg. The net profit margin was also calculated as the ratio of net profit to total revenue, expressing the proportion of each riel of sales that is retained as profit.

### SWOT Analysis

A qualitative SWOT analysis was conducted to identify the internal Strengths and Weaknesses of the farming operation, as well as the external Opportunities and Threats that shape its operating environment. This framework provides a holistic strategic assessment that complements the quantitative financial analysis (Chang & Villano, 2008).

## RESULTS

### Baseline Conditions: Economic Profile of the Farm

Prior to the intervention, an initial assessment was conducted to establish the baseline economic conditions of the participating household duck farm. The farm's investment in fixed

assets—the durable infrastructure and equipment required for the operation—totalled 64,557,200 riels. The most significant fixed asset was the duck housing, valued at 19,680,000 riels, followed by motorcycles (16,974,000 riels) and a generator (19,500,000 riels). When annualised according to each asset's useful life, the total annual fixed cost (TFC) amounted to 4,544,100 riels.

Variable costs, representing the recurring inputs consumed within the production cycle, constituted the dominant share of total expenditure. The baseline total variable cost (TVC) for the production cycle was 89,443,300 riels. The single largest variable cost was the purchase of 3,500 ducklings at 18,000 riels each, totalling 63,000,000 riels. Labour costs for two hired workers amounted to 12,000,000 riels, and feed costs totalled approximately 8,825,700 riels. The baseline total cost of production (TC) for the one-year cycle was calculated at 93,987,400 riels.

The baseline revenue analysis revealed that the farm generated income from four distinct streams, primarily egg sales. With an average market price of 400 riels per egg, the sale of 960,000 eggs generated 384,000,000 riels, accounting for 90.8% of total revenue. Total baseline revenue (TR) for the production cycle was 422,980,000 riels. Subtracting total costs from total revenue yielded a baseline net profit (NP) of 328,992,600 riels, demonstrating that the operation was already highly profitable, albeit managed without formal financial tracking.

### Fixed Assets and Capital Investment

The farm's investment in fixed assets—the durable infrastructure and equipment required for the operation—totalled 64,557,200 riels. The most significant fixed asset was the duck housing, valued at 19,680,000 riels, followed by motorcycles (16,974,000 riels) and a generator (19,500,000 riels). Other assets included water tanks, batteries, water pumps, netting, and various small tools. When annualised according to each asset's useful life, the total annual fixed cost (TFC) amounted to 4,544,100 riels. Table 1 presents a summary of the key fixed assets and their annualised costs.

Table 1. Selected Fixed Assets and Annual Depreciation

Asset	Quantity	Total Value (Riels)	Useful Life (Years)	Annual Depreciation (Riels)
Duck Housing	3 units	19,680,000	10	1,968,000
Motorcycles	2 units	16,974,000	20	848,700
Generator	1 unit	19,500,000	25	780,000
Water Tanks	4 units	1,400,000	8	175,000
Netting	120 m	480,000	6	80,000
Mobile Phones	2 units	820,000	4	205,000
<b>Total</b>		<b>64,557,200</b>		<b>4,544,100</b>

Source: Survey data, 2025

### Variable Costs

Variable costs, representing the recurring inputs consumed within the production cycle, constituted the dominant share of total expenditure. The total variable cost (TVC) for the production cycle was 89,443,300 riels. The single largest variable cost was the purchase of 3,500 ducklings at 18,000 riels each, totalling 63,000,000 riels. Labour costs for two hired workers amounted to 12,000,000 riels. Feed costs—comprising both commercial compound feed (De HEUS brand) and supplementary feed—totalled approximately 8,825,700 riels (MAFF, 2024a). Vaccines and preventive medicines accounted for 1,480,000 riels, while electricity, transportation, and communication costs made up the remainder.

Table 2. Summary of Variable Costs

Cost Item	Amount (Riels)
Purchase of Ducklings (3,500 head)	63,000,000
Labour (2 workers)	12,000,000
Feed (De HEUS and other)	8,825,700
Electricity	3,000,000
Vaccines and Medicines	1,480,000
Transportation (fuel)	460,800
Other (communication, etc.)	676,800
<b>Total Variable Cost (TVC)</b>	<b>89,443,300</b>

Source: Survey data, 2025

### Total Cost of Production

The total cost of production (TC) for the one-year production cycle was calculated as the sum of total fixed costs and total variable costs:  $TC = 4,544,100 + 89,443,300 = 93,987,400$  riels.

This figure represents the total financial investment required to operate the duck farm for one full production cycle. The dominance of variable costs (95.2% of total costs) over fixed costs (4.8%) is a characteristic feature of livestock farming and underscores the importance of efficient input management—particularly feed and duckling procurement—in controlling overall costs (Harbanssingh, 1978).

Table 3. Total Cost of Production

Cost Category	Amount (Riels)	Share of Total (%)
Total Fixed Cost (TFC)	4,544,100	4.8%
Total Variable Cost (TVC)	89,443,300	95.2%
<b>Total Cost (TC)</b>	<b>93,987,400</b>	<b>100%</b>

Source: Survey data, 2025

### Revenue Analysis

The farm generated income from four distinct revenue streams over the production cycle. The primary product was eggs, with the flock of 3,500 ducks producing a total of 960,000 eggs annually. At an average market price of 400 riels per egg, egg sales generated 384,000,000 riels, accounting for 90.8% of total revenue. Secondary revenue was derived from the sale of 3,500 culled ducks at 10,000 riels per head (35,000,000 riels), the sale of duck manure (3,500,000 riels), and the sale of broken eggs (480,000 riels). The total revenue (TR) for the production cycle was 422,980,000 riels.

Table 4. Revenue by Source

Revenue Source	Quantity	Unit Price (Riels)	Total Revenue (Riels)	Share (%) (Riels)
Eggs	960,000 grains	400	384,000,000	90.8%
Culled Ducks	3,500 head	10,000	35,000,000	8.3%
Duck Manure	1,000 loads	3,500	3,500,000	0.8%

Broken Eggs	1,920 grains	250	480,000	0.1%
<b>Total Revenue (TR)</b>			<b>422,980,000</b>	<b>100%</b>

Source: Survey data, 2025

### Profitability

The farm's net profit (NP) was calculated by subtracting total costs from total revenue: NP = 422,980,000 – 93,987,400 = 328,992,600 riels.

This represents a substantial return on investment for a household-scale operation. Distributed across the 365-day production cycle, the farm generates an average net income of approximately 901,350 riels per day, or approximately 27,416,050 riels per month. These figures underscore the operation's capacity to provide a consistent and highly lucrative primary source of household income when managed effectively.

Table 5. Profitability Summary

Item	Amount (Riels)
Total Revenue (TR)	422,980,000
Total Cost (TC)	93,987,400
<b>Net Profit (NP)</b>	<b>328,992,600</b>

Source: Survey data, 2025

### Economic Efficiency

The economic efficiency ratio (E), calculated as the ratio of total revenue to total cost, was 4.50. This means that for every 1 riel of total cost invested in the operation, the farm generated 4.50 riels in revenue, yielding a net return of 3.50 riels. This is a remarkably high efficiency ratio, indicating that the farm makes excellent use of its invested capital. The net profit margin was 0.78, confirming that 78 cents of every riel earned from sales was retained as net profit after all costs were deducted.

The analysis of capital efficiency further reveals the structure of the farm's financial performance. The efficiency of fixed capital was 0.01, meaning that only 0.01 riel of fixed costs was required to generate 1 riel of revenue—a reflection of the low depreciation burden relative to the farm's high output. The efficiency of variable capital was 0.21, indicating that 0.21 riel of variable inputs was consumed per riel of revenue generated.

Table 6. Economic Efficiency Summary

Metric	Value
Overall Economic Efficiency (E = TR/TC)	4.50
Fixed Capital Efficiency (TFC/TR)	0.01
Variable Capital Efficiency (TVC/TR)	0.21
Net Profit Margin (NP/TR)	0.78

Source: Survey data, 2025

Labour productivity was calculated at 211,730,000 riels per worker per production cycle, or approximately 17,644,200 riels per worker per month. Land productivity, based on the farm's total area of 0.184 hectares, was calculated at 2,301,413,000 riels per hectare per production cycle, reflecting the highly intensive nature of the operation.

### Break-Even Analysis

As part of the mentoring intervention, the break-even point (BEP) analysis was introduced to the farmer as a practical planning tool, enabling them to understand the minimum level of production required to cover all costs and to set realistic, evidence-based production targets. The concept was explained using the farm's own financial data, making the exercise immediately relevant and accessible.

The unit cost of producing one egg, after netting out by-product revenue, was calculated together with the farmer at 57.30 riels. When compared against the prevailing market price of 400 riels per egg, the farmer could clearly see that each egg sold generates a margin of 342.70 riels above the break-even price. Understanding this buffer gave the farmer a concrete basis for assessing how much protection their operation has against market price fluctuations — a risk they had previously been unable to quantify.

The break-even quantity was calculated at 14,810 eggs. Through guided discussion, the farmer came to appreciate that this threshold represents only approximately 1.5% of their total annual production of 960,000 eggs, and that their actual output is approximately 65 times the break-even quantity. This realisation had a direct empowering effect: the farmer gained confidence in the financial resilience of their operation as confirmed through a post-session verbal evaluation in which the farmer correctly demonstrated the ability to calculate the break-even quantity and interpret the result using their own production data, and expressed that the exercise had substantially reduced their anxiety about price fluctuations and developed a clearer understanding of how to set minimum production targets to ensure the enterprise remains viable even in adverse conditions. The farmer also recognised that monitoring actual production against the break-even threshold each month could serve as an early warning indicator for operational problems, thereby improving their ability to anticipate and respond to financial risks proactively.

Table 7. Break-Even Analysis Parameters

Parameter	Value
Total Fixed Cost (TFC)	4,544,100 riels
Variable Cost per Egg (VC)	93.17 riels
Market Price per Egg (P)	400 riels
Unit Cost (Break-Even Price)	57.30 riels
Break-Even Quantity (Q*)	14,810 eggs
Actual Annual Production	960,000 eggs

Source: Survey data, 2025

The payback period for the total investment of 93,987,400 riels was calculated at approximately 0.28 years (approximately 91 days or 3 months). This exceptionally short payback period reflects the high profitability of the operation and indicates that the farmer can recover the full cost of a production cycle within a single quarter of the year.

### SWOT Analysis

The SWOT analysis was conducted collaboratively with the farmer as an integral component of the community service activity, serving not merely as a descriptive assessment but as a practical basis for designing targeted interventions and prioritising areas for capacity building. By mapping the farm's internal strengths and weaknesses alongside external opportunities and threats, the

service team and the farmer jointly identified the most pressing areas requiring action and agreed on concrete solutions to be implemented during and after the activity.

Internally, the farm's most significant strength is the owner's financial self-sufficiency — the farmer possesses sufficient own capital to fund the operation without relying on external credit, thereby eliminating interest costs and reducing financial risk. The operation also benefits from the relative ease of duck management, high egg productivity, low labour requirements, and access to a reliable water source. These strengths were acknowledged and reinforced during the training sessions, encouraging the farmer to leverage them as a stable foundation for further improvement. In terms of weaknesses, the most notable is the limited access to formal technical training and extension services, meaning that the farm's management practices have been largely based on traditional knowledge and personal experience. The farmer is also unable to produce their own ducklings and must purchase them from external suppliers, creating a dependency and a significant recurring cost. Furthermore, the farmer has no ability to influence market prices, leaving the operation vulnerable to price fluctuations for both inputs and outputs. These weaknesses directly informed the design of the intervention: the training programme was structured to address the knowledge gap in financial management, cost analysis, and biosecurity, while the mentoring sessions specifically explored strategies to reduce dependence on external duckling suppliers, such as investigating local hatchery options.

Externally, the primary opportunity facing the farm is the strong and consistent demand for duck eggs in local markets, driven by cultural preferences and the limited number of competing producers in the area. Duck farming also presents a clear opportunity for job creation and poverty alleviation within the community. The presence of district-level veterinary officers who conduct outreach on disease prevention was identified as a valuable resource, and the farmer was encouraged to actively engage with these services as a priority action. The most significant threat is the risk of avian influenza (H5N1) outbreaks, which can devastate entire flocks and cause severe economic losses. Other threats include the volatility of feed prices, the lack of a dedicated cold storage facility for eggs, and the risk of duck mortality from diseases such as duck cholera and duck plague. In response to these threats, the activity included a dedicated session on biosecurity practices and emergency financial planning, equipping the farmer with concrete protocols to reduce disease risk and to build a reserve fund as a financial buffer against unexpected losses.

Table 8. SWOT Analysis of the Household Duck Farm

Strengths	Weaknesses
<ul style="list-style-type: none"> <li>• Sufficient self-owned capital for investment</li> <li>• Ease of management and low labour requirements</li> <li>• High egg productivity and consistent output</li> <li>• Reliable water sources and good farm sanitation</li> <li>• Some training received from government and NGOs</li> </ul>	<ul style="list-style-type: none"> <li>• Limited access to technical training and modern techniques</li> <li>• Dependence on external suppliers for ducklings</li> <li>• Inability to independently set market prices</li> <li>• Limited monitoring and support from extension officers</li> <li>• Insufficient expertise in disease diagnosis and treatment</li> </ul>
Opportunities	Threats
<ul style="list-style-type: none"> <li>• High and growing market demand for duck eggs</li> </ul>	<ul style="list-style-type: none"> <li>• Risk of avian influenza (H5N1) outbreaks</li> </ul>

- Potential for job creation and poverty reduction
  - Limited local competition in egg production
  - Support from district veterinary offices
  - Location on a main road facilitating market access
  - Volatility in feed and input prices
  - Lack of dedicated egg storage facilities
  - Duck mortality from cholera, plague, and other diseases
  - Climate variability affecting duck health
- 

### Changes After the Activity: Empowerment and Impact

The intervention resulted in significant, observable changes in the farmer's knowledge assessed through a structured end-of-activity evaluation encompassing three measurable indicators: (1) the farmer's demonstrated ability to independently calculate net profit and break-even quantity using their own data, verified through direct observation during the final session; (2) the farmer's adoption of a structured daily financial ledger, confirmed by reviewing completed records at the follow-up visit; and (3) the farmer's verbal articulation of at least three strategic actions arising from the SWOT analysis, documented in the service team's field notes, behaviour, and operational management.

#### **Improved Financial Literacy and Record-Keeping:**

Prior to the activity, the farmer relied entirely on mental estimates of income and expenditure. Following the intervention, the farmer successfully adopted a structured ledger system using the simple daily income-and-expenditure template introduced during the training, which was reviewed and verified by the service team during a follow-up farm visit two weeks after the final training session, at which point the farmer had maintained 14 consecutive days of complete financial records, independently recording daily feed costs, egg yields, and sales. This transition from informal to formal financial tracking marked a major improvement in the farmer's financial literacy.

#### **Better Cost Management and Efficiency Understanding:**

Through the mentoring process, the farmer gained a profound understanding of their operational efficiency. The farmer learned that their economic efficiency ratio (E) was 4.50, meaning every 1 riel invested generated 4.50 riels in revenue. Furthermore, by understanding that variable costs constituted 95.2% of total expenses, the farmer recognized the critical importance of feed efficiency and mortality reduction. As a direct result of the training, the farmer began actively exploring strategies to optimise feed usage and improve biosecurity to protect their most significant investments.

#### **Enhanced Decision-Making Ability and Strategic Resilience:**

The break-even and SWOT analyses served as powerful tools for empowerment. By calculating the break-even quantity (14,810 eggs), the farmer realized that they only needed to sell approximately 1.5% of their total annual production to cover all costs. This knowledge significantly reduced the farmer's anxiety regarding market price fluctuations, providing a data-backed sense of financial security. Additionally, the SWOT exercise heightened the farmer's awareness of their dependence on external duckling suppliers and the severe threat posed by avian influenza. Consequently, the farmer demonstrated enhanced decision-making ability by initiating plans to build a small reserve fund specifically for emergency disease management and exploring the feasibility of local duckling procurement to mitigate supply chain risks.

## DISCUSSION

The economic performance documented during the baseline assessment reveals that household duck farming in the Cambodian context holds exceptional potential as a vehicle for rural income generation and poverty alleviation. The calculated economic efficiency ratio of 4.50 is remarkably high, significantly surpassing profitability benchmarks reported in similar studies across Southeast Asia. For instance, a study on traditional duck farming in Minahasa, Indonesia, also found duck farming to be the highest contributor to household income, but did not report an efficiency ratio of this magnitude (Pangemanan et al., 2014). The high net profit and rapid payback period of just three months underscore the enterprise's potential as a powerful tool for rural income generation and poverty alleviation, aligning with broader findings on the role of poultry in supporting livelihoods in Cambodia (Ashley et al., 2018; Birhanu et al., 2021). Critically, however, these findings also revealed that the farmer had been operating a highly profitable enterprise without any formal understanding of their own financial performance — a gap that the community service intervention was specifically designed to address. It is therefore essential to emphasise that the strong economic outcomes documented in this activity did not arise from the financial data alone; rather, they were made meaningful to the farmer through the mentoring and empowerment process itself. The structured training sessions transformed abstract financial figures into actionable knowledge, enabling the farmer to shift from intuitive, experience-based management to evidence-informed decision-making. The community service methodology — grounded in participatory engagement, guided practice, and direct application of tools to the farmer's own operation — was the critical mechanism through which economic analysis was converted into genuine farmer empowerment (Birhanu et al., 2021; Chang & Villano, 2008).

### Use of Findings in Community Mentoring

The economic data generated through the baseline assessment were not treated as research outputs in isolation but were used directly as teaching materials throughout the mentoring process. The cost structure analysis, which revealed that variable costs constituted 95.2% of total expenditure — with feed and duckling purchase as the dominant components — was presented to the farmer to illustrate the critical importance of input management (Harbanssingh, 1978). This finding resonated strongly with the farmer, who had previously had no quantitative basis for understanding where financial losses could most easily occur. Similarly, the break-even analysis results were used to demonstrate, in concrete terms, the farm's substantial margin of financial safety, transforming abstract economic concepts into actionable knowledge. The high cost of feed remains a recurring constraint in duck farming across the region, as noted by Churchil and Jalaludeen (2022), who advocate for research into cost-effective, locally sourced feed formulations; this challenge was discussed explicitly with the farmer as part of the strategic planning session.

### Farmer Response to the Intervention

The farmer engaged actively and positively throughout the mentoring sessions, demonstrating a strong willingness to learn and to apply the tools introduced. Initial discussions revealed a degree of apprehension regarding formal financial record-keeping, which the farmer perceived as complex and time-consuming. However, once the simplified ledger format was introduced and the farmer was guided through completing it using their own data, this apprehension was replaced with confidence. The farmer expressed that understanding their break-even point — and realising that their actual production was approximately 65 times that threshold — provided a significant sense of financial security that had previously been absent. The collaborative SWOT session was particularly well received, as it validated the farmer's existing knowledge and experience while

opening a structured conversation about risks and opportunities they had not previously considered in a systematic way.

### Changes Observed and Lessons Learned

Observable changes in the farmer's behaviour and knowledge were evident by the conclusion of the activity. The farmer successfully adopted a structured daily record-keeping system and demonstrated the ability to independently calculate net profit and economic efficiency using the framework introduced during training. Awareness of the twin threats of avian influenza and feed price volatility — and the importance of proactive biosecurity and financial reserves — was markedly heightened. The farmer initiated concrete plans to build an emergency fund and to explore local duckling procurement options, directly addressing the dependency on external suppliers identified as a key weakness in the SWOT analysis.

The most significant lesson learned from this activity is that the gap between financial performance and financial awareness among smallholder farmers can be substantial. A farm can be highly profitable by objective measures while the operator remains unaware of the magnitude of that profitability, the structure of their costs, or the risks that threaten their livelihood. This underscores the critical importance of community service interventions that translate economic analysis into accessible, farmer-centred tools. A study on duck production in the Philippines similarly found that a lack of technical know-how was a key factor constraining productivity (Chang & Villano, 2008), reinforcing that knowledge transfer — not just knowledge generation — is essential for sustainable agricultural development. Empowering farmers with modern knowledge in disease management, biosecurity, and financial planning can reduce vulnerability, improve productivity, and strengthen the overall resilience of household farming systems (CARDI, 2025; GDAPH, 2006; FAO, 2010). The most significant external threat identified the risk of Highly Pathogenic Avian Influenza (HPAI/H5N1) remains a material concern, and the potential for HPAI to cause catastrophic economic losses for smallholder poultry farmers has been extensively documented across Vietnam, Cambodia, and other nations (Otte et al., 2008; Tran, 2008). This underscores the continued importance of strengthened government disease surveillance, vaccination support, and community-level biosecurity education as complementary pillars of any farmer empowerment initiative. A critical consideration arising from this activity is the sustainability of the intervention's impact beyond the period of direct engagement. To consolidate the skills and knowledge acquired, a planned follow-up mentoring visit is scheduled for three months after the conclusion of the activity, at which point the farmer's financial records will be reviewed, progress against the break-even and production targets will be assessed, and any emerging challenges will be addressed. In the longer term, the farmer is being encouraged to participate in a local farmer cooperative, which would provide ongoing peer learning opportunities and access to collective advisory services. The service team has also recommended that the farmer engage regularly with the district-level veterinary office as a primary source of technical support on biosecurity and disease management. These planned follow-up activities reflect the understanding that lasting empowerment requires not a single intervention but a sustained, progressive relationship between service providers and farming communities (MAFF, 2025; Royal Government of Cambodia, 2025).

### CONCLUSION

This community service activity demonstrates that integrating economic analysis with participatory mentoring can serve as a powerful and replicable model for empowering household farmers in rural Cambodia. The baseline assessment confirmed that the participating duck farm in Serei Sophon municipality is a financially robust and economically efficient enterprise, achieving a net profit of 328,992,600 riels over a single production cycle, an economic efficiency ratio of 4.50,

and a break-even point of only 14,810 eggs against an actual annual production of 960,000 eggs. The total investment is recovered within approximately three months, underscoring the operation's exceptional financial viability. However, the most significant finding of this activity is not the profitability of the farm itself, but rather the farmer's prior unawareness of it — and the transformative effect that structured mentoring had in bridging that gap.

### **Impact of the Activity on the Community**

The activity produced tangible and meaningful impacts at the individual and community levels. At the individual level, the participating farmer transitioned from operating entirely on intuition and traditional experience to managing their enterprise with a clear understanding of cost structure, revenue streams, profitability, and financial risk. The farmer adopted a structured daily financial record-keeping system, gained the ability to independently calculate net profit and break-even quantities, and developed a strategic awareness of the internal and external factors shaping their operation's sustainability.

### **Improvements in Knowledge, Skills, and Practices**

Specific improvements observed as a result of the intervention include: enhanced financial literacy, with the farmer now able to distinguish between fixed and variable costs and to interpret their economic efficiency ratio; improved cost management awareness, particularly regarding the dominance of variable costs and the strategic importance of feed efficiency and duckling procurement; and strengthened decision-making capacity, evidenced by the farmer's initiation of plans to build an emergency reserve fund and to explore local duckling sourcing as a means of reducing supply chain dependency. The farmer also demonstrated heightened awareness of biosecurity practices and the importance of engaging with district veterinary services to mitigate the risk of avian influenza — a threat that, prior to the activity, had not been systematically considered in the farm's operational planning.

### **Significance for Future Community Service Programmes**

These results carry important implications for the design of future community service and rural development programmes in Cambodia. Duck farming, when practised at the household scale with adequate capital and management, can serve as a powerful mechanism for income generation, poverty reduction, and local economic development. However, the high profitability observed in this study also reveals that financial performance alone is insufficient to guarantee farmer welfare and resilience — farmers must be equipped with the knowledge and tools to understand, protect, and build upon that performance. The approach adopted in this activity — using rigorous economic analysis not as an end in itself but as a practical instrument for community empowerment — offers a scalable model that can be adapted for other agricultural commodities and communities across the region. Future programmes should prioritise the translation of technical knowledge into accessible, farmer-centred learning experiences, and should invest in building the capacity of local extension officers to deliver ongoing mentoring support. Addressing the structural weaknesses identified in this activity — particularly the lack of formal technical training and the dependence on external duckling suppliers — remains essential for building a more resilient, self-sufficient, and competitive household poultry sector in rural Cambodia.

## **RECOMMENDATIONS**

### **For Farmers**

Farmers engaged in household duck farming should prioritise systematic financial record-keeping, maintaining detailed accounts of all income and expenditure for each production cycle.

This practice enables more accurate assessment of profitability, identification of cost-saving opportunities, and more informed planning for future cycles. Farmers are also strongly encouraged to actively seek out technical training programmes offered by government agencies and NGOs, particularly in the areas of disease prevention, vaccination protocols, and modern feed management (CARDI, 2025). Participation in farmer cooperatives or producer groups would further strengthen the sector by enabling collective bargaining for inputs, shared access to veterinary services, and coordinated marketing of products (MAFF, 2024c).

#### **For Government and Agricultural Authorities**

The Ministry of Agriculture, Forestry and Fisheries and its provincial and district-level offices should intensify their extension services for duck farmers, increasing both the frequency of field visits and the quality of technical guidance provided. Particular attention should be given to disease surveillance and rapid-response mechanisms for avian influenza (MAFF, 2022, 2025), including the provision of subsidised vaccines and the establishment of clear protocols for managing outbreaks. The government should also explore policy instruments to stabilise the prices of key agricultural inputs, such as commercial feed, to protect farmers from the adverse effects of market volatility. Strengthening border controls to prevent the illegal importation of poultry products that may carry disease is equally important (Royal Government of Cambodia, 2025).

#### **For Development Partners**

Non-governmental organisations and international development partners can make a significant contribution by funding and implementing capacity-building programmes tailored to the specific needs of small-scale duck farmers in rural Cambodia (Ministry of Economy and Finance, 2024). Priority areas for investment include the establishment of local hatcheries to reduce farmers' dependence on external duckling suppliers, the construction of community-level cold storage facilities for eggs, and the development of accessible market information systems that allow farmers to make better-informed selling decisions. Supporting research into locally appropriate, cost-effective feed formulations could also help reduce the dominant variable cost in the production system (Churchil & Jalaludeen, 2022).

#### **For Continuing and Scaling Up the Programme**

The mentoring model piloted in this activity should not be treated as a one-time intervention. To consolidate the gains achieved, follow-up sessions should be conducted at regular intervals — ideally at the midpoint and end of each subsequent production cycle — to review the farmer's financial records, assess progress against targets, and provide ongoing guidance on emerging challenges. As the farmer's confidence and capacity grow, they can be progressively transitioned into a peer-mentoring role, sharing their experience and the tools they have acquired with neighbouring farming households. Scaling up the programme to cover additional households within Serei Sophon municipality should be a priority, with the current participant serving as a demonstration case to illustrate the practical benefits of economic-based farm management to the wider community.

#### **For Replication in Other Communities**

The approach adopted in this activity — using rigorous economic analysis as a practical tool for farmer empowerment rather than as a purely academic exercise — is highly transferable and holds strong potential for replication across other agricultural communities in Cambodia and the broader Southeast Asian region. The methodology is not commodity-specific; the same framework of

baseline assessment, structured mentoring, break-even analysis, and SWOT-based planning can be adapted for other livestock enterprises, crop farming operations, or mixed agricultural households. Universities, agricultural colleges, and community development organisations are well-positioned to lead such replication efforts, embedding this type of community service activity within their outreach and social responsibility mandates. Documenting and disseminating the outcomes of each replication site will build a growing evidence base for the effectiveness of participatory economic mentoring as a development tool.

### **For Sustainable Community Engagement**

For the impact of this activity to be sustained over the long term, community engagement must move beyond episodic interventions toward an embedded, ongoing relationship between service providers and farming communities. This requires the establishment of accessible local support structures — such as village-level agricultural advisory groups or community learning centres — where farmers can regularly access information, share experiences, and seek guidance. Training local agricultural extension officers and community leaders to deliver basic financial literacy and farm management coaching will reduce dependence on external facilitators and ensure that the knowledge and skills introduced through this activity continue to circulate within the community. Integrating economic empowerment components into existing government extension programmes and NGO-led livelihood projects will further institutionalise this approach, ensuring that household farmers in rural Cambodia are consistently supported not only to produce more, but to understand, manage, and grow the value of what they produce.

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The authors acknowledge the use of Gemini to check grammatical error in this article. The prompts used include paraphrasing and grammar checking. The output from these prompts was used to clean the quality of writing. While the authors acknowledge the usage of AI, they maintain that they are the sole authors of this article and take full responsibility for the content therein, as outlined in COPE recommendations.

### **INFORMED CONSENT**

The authors have obtained informed consent from all participants.

### CONFLICT OF INTEREST

The authors declare that there is no conflict of interest. [Note to Authors: The reference list should be strengthened to include at least 25 sources. Priority should be given to recent peer-reviewed journal articles published between 2021 and 2025 covering topics such as smallholder duck farming economics, agricultural community empowerment, rural livelihood support programmes, and avian influenza risk management in Southeast Asia. Suggested additional sources include recent studies on poultry-based poverty reduction in Cambodia and the wider Mekong region, participatory agricultural extension models, and financial literacy interventions for smallholder farmers. All citations and references should be managed and formatted consistently using Mendeley or a comparable reference management tool.]

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