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Viability study of broiler chicken production under closed house system

(Kajian daya maju pengeluaran ayam pedaging menggunakan sistem reban tertutup)

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Abstract

Broiler farming plays a significant role in supplying protein to the Malaysian population. Currently, the government is working on efforts to increase broiler production to meet domestic demand and export markets, while simultaneously addressing issues of odour and environmental pollution. In this context, the transformation to closed houe system (CHS) has been emphasised, particularly for new entrants into the industry. However, the high development costs have deterred farmers from adopting this transformation. This study was conducted to assess the viability of farming using CHS. The results show that farming with CHS is viable with a production capacity of at least 25,000 birds, which can be increased to 185,714 birds over seven production cycles per year. The NPV value is RM2,392,982 with an IRR of 28%. The payback period is projected to be in the third year, with a BCR of 1.09. Given that many farmers are still using OHS, proactive measures by the government is necessary to encourage more farmers to switch to CHS. This would not only increase broiler production but also boost the national economy through exports to other countries.

Introduction

Chicken meat is one of the main sources of protein for Malaysians and is in high demand in the livestock industry. This can be seen based on the value of per capita consumption rate (PCC) of 48.0 kg/year (2022) and is among the highest compared to other livestock (Supply and Utilization Accounts, 2022). The per capita consumption (PCC) is expected to continue increasing to 53.1 kg/person by 2030 (DVS, 2023). Chicken production in Malaysia has shown a decreasing trend in the past five years, resulting in drop of self-sufficiency ratio (SSR). Chicken production has decreased from 1.6 billion mt in 2017 to 1.54 billion mt in 2022. Meanwhile, the SSR has dropped by 9.7% during the same period, indicating that there is an increase in the import of chicken meat from foreign countries. The increase in imports in 2022 was the highest, at 83%, compared to previous years (*Table 1*).

The development within the livestock industry has progressed in tandem with advancements in science and technology. Technology in poultry farming is crucial to ensure the quality and safety of chicken production. Given that chicken farming is often associated with pollution issues,

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various initiatives have been undertaken to address these related problems. Among the initiatives actively pursued by the authorities is the encouragement to transition to CHS. Although this initiative is based on decisions from the state government, the consensus to transform the farming system aligns with the objectives of the Department of Veterinary Services (DVS) to mitigate pollution issues and improve farm management while ensuring quality and safety. As of 2021, only 623 broiler chicken farmers operated using CHS, compared to 1,562 open-house farmers. Johor recorded the highest number of CHS (175), followed by Perak (161) and Selangor (114) (*Table 2*). According to DVS (2023) about 30% of broiler farmers had adopted CHS.

The use of a CHS enable an effective control of odour and fly pollution. It can also be effective in managing the spread of diseases among live chicken through the use of temperature and humidity control system. A study in Malaysia analysed 211 broiler farms and found that CHS significantly impacts profitability. Factors such as lower feed conversion rates and higher body weights contribute to better economic outcomes for farmers using CHS (Majid & Hassan 2024). Pakage et al. (2020) found that the controlled environment in CHS led to higher weight gain and lower feed conversion ratios (FCR), significantly improving overall efficiency. CHS could lead to improving the feed conversion ratio (FCR) of broiler chicken as they feel

Table 1. Chicken meat production, import and export (2017 – 2022)

Item	2017	2018	2019	2020	2021	2022
Production (mt)	1,598,258	1,587,539	1,589,080	1,628,609	1,583,219	1,543,425
Import (mt)	62,897	71,183	72,089	68,2447	96,329	176,191
Export (mt)	87,904	95,498	94,785	95,107	94,745	64,752

Source: Perangkaan ternakan (2023)

Table 2. Broiler farmers using closed-house and open-house systems, 2021

State	Close house system		Open house system	
	No. of farm	Chicken capacity	No. of farm	Chicken capacity
Perlis	3	305,000	6	230,500
Kedah	43	1,652,200	183	10,781,700
P. Pinang	7	326,000	114	6,945,200
Perak	151	14,545,611	168	10,537,400
Selangor	99	10,517,974	108	4,373,400
N. Sembilan	48	8,187,542	106	5,866,550
Melaka	38	9,356,657	63	2,172,300
Johor	162	13,956,560	381	28,513,300
Pahang	30	2,908,000	166	8,576,330
Kelantan	27	1,461,300	144	2,839,430
Terengganu	15	1,072,000	123	2,815,980
Total	623	64,288,844	1,562	83,652,090

Source: Department of Veterinary Services (2022)

more comfortable and eat more, resulting in better conversion of feed to meat. The FCR value for broiler chicken under CHS is lower, ranging between 1.6 – 1.8. CHS also able to encourage higher production as the floor space required for each chicken can be reduced to between 0.7 and 0.9 square feet. The temperature can be controlled to a lower degree (around 24 – 26 °C) and the stocking density can be increased. According to Hasibuan et al. (2023), the optimal environmental conditions in CHS reduce stress and improve feed efficiency. For instance, broilers raised in CHS exhibit better performance due to stable microclimates, leading to improved average daily weight gain and lower mortality rates. Through CHS, broiler chicken farming cycle can be increase to seven times a year because the time to reach market weight (1.8 – 2 kg) is shorter which is 32 – 35 days (Loh Teck Chwen 2020).

Farmers should be aware of CHS and technology transformation in the chicken industry. High development costs are the main factor that prevents many farmers from making the change to modern farming, especially for small-scale farmers. Small scale farmers feel that the adoption of CHS will reduce the profit margins. A study conducted by Nurshuhada (2021) shows that small scale and medium scale will bear higher production costs compared to commercial scale, especially for animal feed which contributed about 60 to 70% of the total production cost. This is due to the commercial-scale farms being managed by big companies that have the ability to buy animal feed in large volumes and at the same time own feed millers. Hence these factors can reduce some costs in their feed supply.

Research into broiler production economics indicates significant cost differences between conventional and alternative systems (e.g., slow-growth broilers). While slower growth systems may improve animal welfare, they result in higher production costs. These costs, if not matched by market price premiums, reduce profitability for producers, affecting the overall market dynamics (Lusk et al. 2019).

However, this cannot be used as an unfounded excuse without evidence related to production costs, output, and income. Therefore, the aim of this is to evaluate the viability of broiler chicken farming using CHS in Malaysia. This assessment is crucial to ensure that the chicken industry remains sustainable to fulfil the domestic demand while maximising profits for industry players.

Methodology

Data collection

The assessment of economic viability was carried out using projected cash flow analysis involving several cost estimates such as production capacity, capital cost, operating cost, and service cost. Primary data were obtained through face-to-face interviews with three farmers involved in CHS of medium scale size, rearing in the range 25,000 to 30,000 birds/cycle.

Cash flow projection

This analysis is used to determine the key indicators in the decision-making of an investment. Investors found that the predictability of future cash flows can be increased by emphasising the analysis of operating cash flows instead of income when making investment decisions (Lee et al. 2019). Investors will estimate the worth of firms, investment opportunities, capital projects, new enterprises, and cost-cutting strategies through cashflow analysis (Ouyang 2023). Through this method, the Net Present Value (NPV), Internal Rate of Return (IRR), Benefit Cost Ratio (BCR) and Pay Back Period (PBP) can be calculated to predict the viability and feasibility of a business. NPV is widely used for investment decisions (Magni et al. 2005). The value of the project will be measure by comparing value of NPV with other similar tools including IRR and PBP. It can illustrate the advantages and disadvantages of the project. The IRR is the

maximum opportunity cost of the capital that can be accepted by the investor. If the discount rate is higher than IRR, the NPV would be negative, which means the project is not worth investing in (Haotian 2022).

Income statement projection

An income statement (profit and loss) shows the income and expenses of a certain period of time. It shows net income (after expenses are taken into account) whether there is a surplus or deficit. The purpose of the income statement is to show how an investment generates profit or incurs a loss over a specific period of time. Income statement provides the company with the situation of earning which can help the company understand the profitability and the return to equity holders, including gross profit, operation profit and profit before taxation (Subramanyam 2009). There are two investment indicators that can be obtained from this income statement, which are Return on Investment (ROI) and Break-Even Point (BEP). BEP is the situation where business is at the stage of not making a profit but not losing. These economic indicators are important and interrelated. Each of these indicators will give a clear picture of the viability and feasibility of the business in terms of the financial investment involved.

Results and discussion

Broiler chicken farming under CHS involves numerous equipment. This equipment is crucial to ensure the needs of the livestock are met, subsequently improving the quality and sales output. The use of automatic feeding equipment is encouraged as it has been found to enhance worker efficiency and minimize management costs. On average, the development cost for a CHS with a size of 50 x 400 square feet is estimated at RM222,488 (*Table 3*).

The capacity of chicken in the CHS depends on the size of the built-up plot. There are various sizes of CHS used by farmers. The common size use is 50 x 400 square feet with an area of 0.5 acre. This size follows the capacity of a semi-commercial scale farm with the floor space for each broiler is between 0.7 and 0.9 square feet. Therefore, the estimated number of broilers is about 28,572 birds per CHS. This floor space is important to ensure the broiler can grow properly and reduce the temperature inside the house. *Table 4* shows

Table 3. Components required for the closed-house system

Components		Unit	Price/unit (RM)	Cost (RM)
Main	Fan	9	1,380	12,420
	Cooling pad	800	95	76,000
	Generator	1	35,000	35,000
Support	Food/water system	200	190	38,000
	Lamp	48	14	668
	Temperature sensor	1	10,000	10,000
	Heater	4	3,000	12,000
	Blinds	4	600	2,400
	CCTV	3	1,000	3,000
	Alarm system	1	1,500	1,500
	Computer	1	1,500	1,500
	Automatic control system panel	2	15,000	30,000
Total				222,488

Source: Department of Veterinary Services (2022)

of the economic viability and feasibility analysis of broiler chicken farming under CHS with a lifespan of 35 years. The lifespan is proportional to the maximum depreciation period for the CHS.

The valuation for this CHS involves high fixed (development) and operating costs. The fixed cost involves building structures that are automated and equipped with temperature control systems which includes food and drinking systems,

Table 4. Economic viability and feasibility analysis of broiler chicken farming under closed house system

Item	Production cost	
House size (feet)	50 x 400	
No. house	1	
No. cycle	6	
Capacity (birds/house)	28,571	
Production capacity/cycle (birds)	28,571	
Production capacity/year(birds)	185,714	
Mortality rate (%)	5%	
Bird weight (kg)	2.2	
Selling price (RM/kg)	7.73	
Item	Cost	Cost per unit
Fix cost (RM/bird)	2,262,716	0.35
CHS (with main equipment)	1,871,968	0.29
Additional equipment	18,000	0.00
Biosecurity dan infrastructure	265,000	0.04
Contigency	107,748	0.02
Operational cost (RM/bird)	90,456,802	13.92
Food	59,878,000	9.21
DOC	16,900,000	2.60
Broiler requirement (risk management, wood dust, gas)	1,950,000	0.30
Salary	1,638,000	0.25
Others (maintenance, depreciation, vehicle rental, utility, administration, contingency)	10,090,802	1.55
Average production cost (RM/bird)		14.27
Average production cost (RM/kg)		6.48
Net margin (RM/kg)		1.24
Net profit (year/CHS)		508,013
Economic indicator		
NPV (RM)	2,392,982	
Internal rate of return (IRR)	28%	
Return on investment (ROI) – first year	72%	
Payback period (PBP)	3.5 year	
Benefit cost ratio (BCR)	1.09	
Break even point (Bird)	733,798	

generators, alarm systems, heaters and automatic control panels. In addition, there are additional equipment that can assist in the farm management such as CCTV and computers. Farm biosecurity is an important component to ensure disease infection in livestock areas can be prevented and controlled from spreading. This is including pest control routes, fences, storages and water tanks. On average, the fixed cost per head for semi-commercial scale is RM0.35.

The operating cost will change in line with the production scale that involves the feed cost, days old chick and broilers need (risk management, woodchips/straws and gas). With a broiler capacity of 28,572 birds/cycle, the labour cost is about RM0.25/head, where the labour ratio is 1:15,000. The ratio is important to ensure the farm can be operated properly. Depreciation and maintenance expenses involve equipment used throughout operations.

The production cost for 1 kg of chicken is RM6.48 or RM14.26/bird with an estimated weight of 2.2 kg/bird. The net margin is estimated at RM2.7 with a net profit of RM508,013/year if the selling price in the farm is RM17.00/bird. The Cash Flow Projection shows that broiler chicken farming under CHS is viable based on the calculated economic indicators. The NPV value is RM2,392,982 with an IRR of 28%. The payback period is budgeted at the third year with a BCR of 1.09 (*Table 4*).

Conclusion and recommendation

The National Agro-Food Policy 2021 – 2030 (NAP 2.0) has set a self-sufficiency ratio (SSR) target for chicken meat supply at 140.0% by 2030, compared to 93.3% in 2022 (NAP 2.0, 2021 – 2030). To achieve this target, increased production is necessary, while simultaneously adopting sustainable farming practices to maintain environmental balance and meet consumer needs, ensuring that growth have a positive impact.

The financial analysis demonstrates the economic viability of broiler chicken farming, with the production cost using the CHS method calculated at RM6.48/kg. This value aligns closely with the production cost of RM6.53/kg reported in a 2022 study by the Department of Statistics Malaysia (DOSM). There are several items that affect the cost of broiler production. Feed costs are a major contributor to operational expenses. According to DVS (2023), CHS can reduce operational costs by 30% compared to OHS. The results of this study found that the cost of animal feed is 65% of the total cost of production and this finding is in line with previous studies (Abdurofi et al. 2017; Santoso et al. 2018; Md Isa et al. 2019) that broiler feed cost aggregates around 60 to 70% of the total production cost.

The development cost for this medium scale is RM1.87 million and it is due to the extensive use of advanced materials and technology. Gobel et al. (2022) and Majid (2024) found that the upfront costs for CHS can be 20 – 40% higher than those for OHS. The capital investment in CHS is considered a long-term expense that enhances operational efficiency and productivity, enabling faster growth rates and better feed conversion ratios, which offset the costs over time through higher yields and market-ready broilers in shorter cycles. However, the increase in development costs in CHS has reduced labour costs by up to 30%, as fewer workers are required for farm management due to automation (Gobel et al. 2022; Majid & Hassan 2024).

The production of chickens is also related to the average mortality for each type of housing. The mortality rate for this study is 5% and it is an estimated rate for CHS. A study conducted by Susanto (2024), the average kept in modern closed house cages has average mortality of 3.927 ± 0.786% and it is are lower compared to OHS which are more than 5%. According to Nuryati (2019), the mortality rate in open house cages is higher due to high heat stress and causes to decrease ability to sustain life. This low mortality rate has contributed to increased production.

The government needs to take proactive steps to encourage existing farmers to transition to CHS. Among them is to provide financial incentives and support. Governments should offer subsidies or low-interest loans to offset the high initial capital costs of CHS infrastructure. This could make the system more accessible to small and medium-scale farmers. Cooperation between private companies and farmers can also open opportunities for farmers to get financial assistance to provide shared investment opportunities in CHS technology and infrastructure. In addition, research institutes and universities need to collaborate in developing cost-effective technologies for CHS, such as energy-efficient ventilation systems and alternative materials for housing construction. High cost is an important factor in farmers' reluctance to transform to CHS. With the existence of cost-effective technologies for CHS, there is no reason for farmers to do this transformation. New policies should be developed by introducing stricter regulations and standards related to hygiene and animal welfare, which can only be met through the use of CHS, thereby compelling farmers to switch to this system. Existing farmers have become comfortable with the current practices, which puts pressure on the authorities to direct the transformation to CHS. By establishing new policies, this compulsion will transform into a sustainable and effective industry.

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Abstrak

Penternakan ayam pedaging memainkan peranan penting dalam membekalkan sumber protein kepada penduduk Malaysia. Pada masa ini, kerajaan berusaha untuk meningkatkan hasil pengeluaran ayam pedaging bagi memenuhi permintaan domestik dan pasaran eksport dan pada masa yang sama berusaha untuk menangani isu pencemaran bau dan alam sekitar. Sehubungan dengan itu, transformasi kepada CHS telah diberi penekanan terutamanya terhadap penternak yang baru menceburi industri ini. Walau bagaimanapun, kos pembangunan yang tinggi telah menghalang penternak untuk terlibat dengan transformasi ini. Kajian ini dijalankan bagi menilai daya maju penternakan menggunakan CHS. Keputusan menunjukkan penternakan menggunakan CHS berdaya maju dengan kapasiti pengeluaran sekurang-kurangnya 25,000 ekor. Kapasiti pengeluaran dapat ditingkatkan sehingga 185,714 ekor dengan pusingan pengeluaran sebanyak tujuh pusingan setahun. Nilai NPV ialah RM2,392,982 dengan IRR sebanyak 28%. Tempoh bayaran balik dianggarkan pada tahun ketiga dengan BCR 1.09. Memandangkan masih ramai penternak yang masih menggunakan OHS, langkah proaktif daripada pihak kerajaan adalah perlu bagi menarik lebih ramai penternak bertukar kepada CHS. Ini bukan sahaja dapat meningkatkan pengeluaran ayam pedaging, malah dapat meningkatkan ekonomi negara melalui eksport ke negara luar.