Research Article
A Comparative Study Between Returns to Technology and Scale of Broiler Production in Peninsular Malaysia

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Abstract

Background and Objective: The economic analysis of broiler production under various systems of production and scales of operation are considered in this study. In particular, the study aimed to describe the net return of broiler industry based on number of broiler production and its associated technological application. **Materials and Methods:** A sample of 310 farmers was drawn in Peninsular Malaysia based on stratified sampling technique; with system of production (technology) and scale of production as strata. The production-returns analysis technique was used to estimate costs of broiler production and net returns under both tax-paying and tax-exemption scenarios. The analyses in this study have repeatedly demonstrated the power of economy of scale in many spheres. **Results:** The findings showed that the medium and large scale farms under open system to be better compared to its peers in the closed system in terms of total output, low mortality rate, low feed conversion rate, low variable cost per bird and high net returns per bird. However, the closed system is more favorable in terms market weight of broilers. Generally, the small scale farmers across both farming systems produced with marginal net returns but others have better magnitude of net returns. **Conclusion:** It may be concluded that current technology in the broiler industry did not affect net returns much as did the scale of production.

Key words: Broiler production, broiler industry, production return analysis, open system, close system, cost-benefit analysis, Peninsular Malaysia

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Competing Interest: The authors have declared that no competing interest exists.

Data Availability: All relevant data are within the paper and its supporting information files.

INTRODUCTION

The Malaysian poultry industry has undergone a transformation over the last decade. Currently, Malaysia is exporting live birds and processed poultry products to Singapore and some Middle East countries. As a major producer of poultry in the Asia Pacific region, the country is self-sufficient. According to Department of Veterinary Services (DVS)[1], self-sufficiency level in Malaysia reached at 104.85% in 2016 (Table 1). Although self-sufficiency level is relatively low to previous years, its performances still stable and poultry meat production remains one of the government's agenda for ensuring food security in the context of reducing food trade deficit where Malaysia plans to gradually stop relying on imports of food products and focuses on increasing local food production. In Malaysia, chicken meat sold in the markets can be categorized into four types, namely: Ordinary/regular chicken meat, village chicken, old layer chicken and organic chicken. This study focused on regular chicken meat as the regular chicken meat sales is among the highest in Malaysia while the others are mere complements.

Malaysia is the third largest producer of chicken meat in Asia, after Thailand and Indonesia. Malaysia produced 1,460 Mt of chicken meat[2] in 2015. This mass production is supported by 2403 farms in the West Malaysia and 569 operators in the East Malaysia[1,3]. According to DVS[1], broiler breeders in Malaysia produce approximately 1.8 million day-old-chicks (DOC) every day. Majority (1,692,000) of the daily live chicken production is intended for the local market and the rest of about 108,000 for export to other countries.

As the population of Malaysia grows, the demand for energy and protein in their daily diets will also increase, but along the increase in population, cost of living is also rising. Chicken has become a major source of animal protein and it is gaining importance in the Malaysian diet, compared to beef, mutton and pork. This is mainly owing to cheaper prices of chicken meat compared to other meat as sources of protein (Fig. 1). The main influence on broiler prices is feed costs which constitute roughly 70% of the total cost of production. Feed cost is indeed a major constraint to potential small scale producers in terms of allocation of investment in the production.

Chicken feed is the most important input in livestock production, especially if it relates to the cost of production of broilers. Chickens need feeds containing protein content and energy density to ensure optimum growth. The cost of feeds for chickens reared commercially may reach up to 70% of production costs[4]. In poultry, providing quality food at a low price is an important pre-requisite in the process of production of broiler chickens. Therefore, the changes in the price of feeds or main ingredients of feed may alter the structure of chicken production[5]. In Malaysia, a report issued by the Federation of Livestock Farmer's association[3] also noted that chicken feed is a major cost in the production of broiler chickens. Two main inputs record more than 90% of the overall cost of production, which are day's-old-chick (DOC) and chicken feeds. Furthermore, the cost of chicken feed is more than half of the overall cost[6]. Even some other sources of literature claim a higher percentage of the cost of feeds for broiler production. Thus, the price of feeds plays a major role

Table 1: Self-Sufficiency of poultry meat products in Malaysia (%), 2008-2016

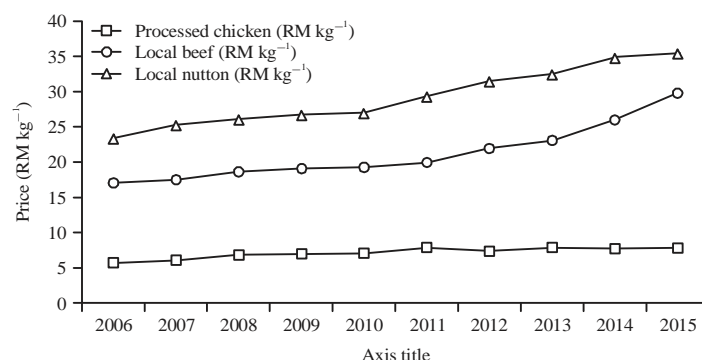| Commodity	Region	2008	2009	2010	2011	2012	2013	2014	2015	2016
Poultry meat	Peninsular Malaysia	106.54	106.43	106.86	106.50	105.84	105.91	105.09	104.78	104.85
	Sarawak	87.79	88.67	88.87	87.35	88.55	84.80	83.44	89.00	85.05
	Sabah	78.85	91.24	101.09	112.16	107.41	112.72	119.49	112.19	132.83

Sources: DVS[1]

Fig. 1: Price of local meat source in Malaysia from 2006-2015
Source: DVS[1]

in determining the levels of broiler output, its production costs and also the market price of chicken. Therefore, the costs of broiler feed formulation should put as a priority in order to sustain lucrative business. In many articles the tax-exemption scenario is always linked to a government incentive[7].

The two systems of broiler production abound in Malaysia which are open and closed system. The open system is the dominant system that is practiced by majority of farms owing to its low initial capital requirement relative to the closed system that is highly capital intensive. Moreover, small and medium enterprise of broiler farms constitutes as a high proportion, while the farms rely on the large farming or integrators in supplying full-grown in the production system. Therefore, the objective of the study presents net return analysis based on the current high feed cost regime for both closed and open systems under small, medium and large scale and in both tax-paying and tax-exemption scenarios.

MATERIALS AND METHODS

The study was conducted in 9 states of Peninsular Malaysia namely: Johor, Malacca, Negeri Sembilan, Selangor, Pahang, Kelantan, Perak, Penang and Kedah. In terms of both demand and production of broiler, Peninsular Malaysia is unparalleled relative to the East Malaysia, hence selection of the former as study area is well justified. In order to facilitate clearly the distinction in economic return between scale of production, the study analyzed broiler returns under three distinct scales. The distinction in technological adoption for broiler production is another factor in determining the level and returns to broiler production.

Thus, a stratified sampling technique was used with system of production (close and open) and scale of production (small, medium and large) as strata (Table 2). Broiler production was scaled into 3 scales as 1-30,000, 30,001-125,000 and above 125,000 birds as small, medium and large scale, respectively. The study used both primary and secondary means of data collection. The primary data involved administering questionnaires to the respondents to elicit data via personal interview, while data from texts, journals and government reports were the major sources of secondary data. Since outsiders are not allowed to enter broiler farms, the interview was 100% done by the DVS personnel. The data has been taken in 2015 and solely used 1 year period of data observation.

The analytical techniques of this research was centralized on costing analysis, where the basic components of input (fixed, variable and depreciation cost) and the output (revenue or return) are elucidated. The economic analysis as helpful in acquiring the relationship among fixed costs, variable costs and net returns[8]. The technique also provides

Table 2: Number of samples based on states, technology and scale

States	No. of samples	Technology and scale	No. of samples
Johor	94	Closed systems	
Malacca	21	• Small	62
Negeri Sembilan	43	• Medium	51
Selangor	25	• Large	5
Pahang	6	Open systems	
Kelantan	16	• Small	94
Perak	45	• Medium	73
Penang	36	• Large	25
Kedah	24		
Total	310	Total	310

beneficial outcomes to define net returns from all outputs and computes the volume of production at a given price necessary to cover all costs. In this study, the variable cost and net return pattern were evaluated explicitly in terms of both per average farm and per bird basis. Furthermore, the calculation of feed conversion ratio (FCR) was computed to take into consideration the level of ingredients in feed consumption. Feed Conversion Ratio equation is expressed as follows:

$$\text{Feed conversion ratio (FCR)} = \frac{\text{Total feed (kg)}}{\text{Total weight (kg)}}$$

RESULTS AND DISCUSSION

Production description: Results in Table 3 have shown that the open system under large scale as producing the highest broiler for the cycle under consideration. Except for the small scale broiler, the medium and large scale productions have shown higher production under the open system relative to the closed system. This is not surprising, since the closed system is supposedly an organized system; stock limitations are strictly adhered to contrary to the open system where overstocking likely occurs.

Results also showed the open system consistently produced with higher DOC price relative to their peers in the closed system. Except in small scale, broiler production has shown higher mortality in medium and large scale closed system of production relative to its peers in the open system. However, a priori expectation was that the closed system should show lower mortality since it is better organized and more environmentally friendly than the open system. Relative to its peers in the closed system, the open system have shown better feed conversion rate under the medium and large scale with the exception of small scale. The lower value of FCR indicated that feed cost would be considerably less[9]. Ironically, relative to its peers in the open system, the average market weight of broiler in the closed system have shown better weight gain in large scale but in different under both small and medium scales of production.

Table 3: Production costs description for close and open systems

Variables	Close system (RM)			Open system (RM)		
	Small	Medium	Large	Small	Medium	Large
Total DOC per round	17,942	62,272	195,400	16,782	67,619	214,252
Price of DOC (RM)	1.59	1.55	1.56	1.70	1.58	1.68
Mortality rate (%)	3.17	4.77	6.40	3.29	4.57	6.08
Avg. weight of broiler (kg)	2.10	2.25	2.49	2.10	2.25	2.42
Chicken Price (RM/kg)	4.17	4.46	4.68	4.44	4.32	4.67
FCR (kg of feed)	1.47	1.48	1.49	1.57	1.32	1.29

Source : Survey data (2015)

Table 4: Capital investment pattern for close and open systems

Investment items	Close system (RM)			Open system (RM)		
	Small	Medium	Large	Small	Medium	Large
Building and equipments						
Coop	389,414	675,708	858,800	156,020	492,358	575.428
Feed box	8,220	13,386	34,000	7,926	11,036	13,321
Drinker	2,947	10,983	30,000	8,464	12,641	14,007
Preventive room	-	-	-	1,076	8,000	12,000
Trench/drainage	4,340	11,567	20,000	5,353	9,185	10,900
Plywood	1,963	1,157	2,900	722	1,242	2,479
Generator	14,146	27,000	42,400	37,817	15,920	35,800
Fence	1,809	9,889	33,333	10,367	10,396	12,333
Lorry or 4x4 wheel	76,500	79,033	322,600	79,900	77,400	180,000
Farm road	4,166	14,750	30,000	8,486	10,875	12,000
Tyre treatment	3,020	4,524	10,000	6,290	9,544	12,000
Working capital	151,902	596,011	2,134,762	151,486	628,354	2,272,084
Total investment	658,430	1,444,007	3,518,762	473,605	1,286,951	3,152,352

Source : Survey data (2015)

Capital investment pattern on different scale and technology of broiler farms: Capital investments refers to the funds invested on permanent assets whose contribution spans over many years in the broiler farm. Table 4 illustrated the differences in the types of broiler production which is based on scale and technological usage. In terms of total investment, it showed direct proportionality with broiler stock in their initial investment and owing to its requirements, the closed system in general displays higher investments relative its open counterpart. The high initial capital sometimes can be a barrier to entry to new investors. The results showed building a broiler house accounts for 65% of total investments but the cost is less under the open system, particularly its small scale sub-set that operates on small sized-buildings.

After the assets, working capital is the next essential item of business process to ensure the adequacy of firm's capital in paying its current production obligations. Working capital affects the firm's revenue and profitablity[10]. In the context of working capital, the highest is recorded in large farms, which indicates that the cash availability is sufficient to fulfill company's payables and results into more stable and profitable business.

Cost pattern on different scale and technology of broiler farms: The list of total costs in broiler production are presented in Table 5. The total cost includes fixed and variable cost, as only the cost of electricity/diesel is categorized as fixed cost during the operation. The results showed that the primary cost is reflected in expenses on feeds in both systems and across all scales of production. However, the findings showed almost similar from the previous studies[4,11,12] that the high cost in broiler production is represented by feeding proportion. In terms of cost per kg, the open system under small scale showed higher costs relative to its peers as RM 4.26, while the large scale under open system has demonstrated lower cost per kg at RM 3.41, it assumed that in order to produce 1 kg of chicken, it costs about RM 3.41.

Net returns from different scale and technology of broiler farms for tax paying enterprises: The net return of broiler production in Table 6 has adopted the procedure of calculating net cash flow method, where depreciation cost and tax obligation are imposed to obtain the absolute value of net return. Then, rate of return is calculated without total investments in order to avoid estimation bias[13]. Furthermore.

Table 5: Total cost pattern for close and open systems

Investment items	Close system (RM)			Open system (RM)		
	Small	Medium	Large	Small	Medium	Large
Cost items						
Day old chicks	142,337	484,069	1,528,028	142,697	533,308	1,797,485
Feed	469,995	1,702,104	5,931,899	464,596	1,782,029	5,853,226
Labour charges	51,937	92,025	376,000	78,238	65,853	350,000
Medicines/vaccines	8,952	58,982	249,500	7,171	62,823	129,435
Electricity/diesel	12,136	42,992	139,000	5,820	22,227	31,998
Miscellaneous items	24,697	66,962	169,888	28,284	45,258	137,979
Total cost	710,024	2,447,134	8,394,315	726,806	2,511,499	8,300,124
Cost per kg						
Day old chicks	0.78	0.72	0.67	0.84	0.73	0.74
Feed	2.58	2.55	2.60	2.72	2.45	2.41
Labour charges	0.29	0.14	0.16	0.46	0.09	0.14
Medicines/vaccines	0.05	0.09	0.11	0.04	0.09	0.05
Electricity/diesel	0.07	0.06	0.06	0.03	0.03	0.01
Miscellaneous items	0.14	0.10	0.07	0.17	0.06	0.06
Total cost per kg	3.90	3.66	3.68	4.26	3.45	3.41

Source : Survey data (2015)

Table 6: Net return to broiler farms for tax paying firms

Investment items	Closed system (RM)			Open system (RM)		
	Small	Medium	Large	Small	Medium	Large
Per farm net profit						
Total revenue	759,508	2,980,053	10,673.644	757,429	3,141,768	11,360,418
Total investment	658,430	1,444,008	3,518,762	473,605	1,286,951	3,152,352
Total cost	710,024	2,447,134	8,394,315	726,806	2,511,499	8,300,124
Total depreciation	43,933	98,785	101,416	22,369	43,534	56,973
Total cost (c+d)	753,957	2,545,918	8,495,732	749,175	2,555,033	8,357,097
EBT (a-e)	5,550	434,134	2,177,912	8,253	586,735	3,003,320
Tax (EBT*25%)	1,388	108,533	544,478	2,063	146,683	750,803
EAT (f-g)	4,164	325,601	1,633,434	6,190	440,051	2,252,491
Depreciation	43,933	98,785	101,416	22,369	43,534	56,973
Net Cash Flow (h+i)	48,097	424,385	1,734,850	28,559	483,586	2,309,463
Per bird net profit						
Net profit per kg	0.26	0.63	0.76	0.17	0.66	0.95
Net profit per chicken	0.55	1.43	1.90	0.35	1.50	2.30

Net Cash flow equals depreciation plus earning after tax, Net profit per kg equals net cash flow divided by total kilogram sold per year, Net profit per chicken equals net cash flow divided by total chicken sold per year, EBT: Earnings before tax and EAT: Earnings after tax, USD1: RM4.22 (11 October 2017), Source : Survey Data (2015)

the use of initial investment focused on evaluating the long run business plan or capital budgeting techniques. Therefore, the calculation of net profit in this study did not include the initial investment but it was represented as depreciation expenses. Since depreciation expense was a non-cash charge, it was added back to earnings after tax to obtain net cash flow.

The finding from Table 6 revealed that the best categories in terms of net returns in decreasing order of magnitude are: Large scale (open), large scale (closed), medium scale (open), medium scale (closed), small scale (closed) and small scale (open). However, small scale farmers in both categories produce with marginal profits of RM 0.55 and 0.35/bird, respectively. The implication is if this scenario persists, it may not permit sustainable operation particularly in the long run, while these small-scale farmers could be better off to join contract farming offered by many broiler integrators.

Net returns from different scale and technology of broiler farms for tax exempt firms: Table 7 showed the net return of broiler farms under tax exemption scenario. In a business, paying tax after obtaining a gross return per year is a common obligation. This condition ordinarily occurs in a company which has been registered officially. Nevertheless, the tax responsibility sometimes overburdens the company's return, particularly to a small business category. Furthermore, in order to boost the agriculture sector, Malaysian government

Table 7: Net return to broiler farms for tax exempt firms

Investment items	Closed system (RM)			Open system (RM)		
	Small	Medium	Large	Small	Medium	Large
Per farm net profit						
Total revenue	759,508	2,980,053	10,673.644	757,429	3,141,768	11,360,418
Total investment	658,430	1,444,008	3,518,762	473,605	1,286,951	3,152,352
Total variable cost	710,024	2,447,134	8,394,315	726,806	2,511,499	8,300,124
Net cash flow (a-c)	49,483	532,919	2,279,328	30,622	630,269	3,060,293
Per bird net profit						
Net profit per	0.27	0.80	1.00	0.18	0.87	1.26
Net profit per chicken	0.57	1.80	2.49	0.38	1.95	3.04

Net profit per kg equals net cash flow divided by total kilogram sold per year, Net profit per chicken equals net cash flow divided by total chicken sold per year, USD1: RM4.22 (11 October 2017), Source : Survey Data (2015)

introduced partial exemption from income tax payment and recently imposed GST (the good and service tax) at zero rate to the industry or company which involved in producing agricultural products. Therefore, the study as well illustrated how the profit of broiler industry under tax exemption scenario behaves. Relative to tax-paying scenario, the tax-exemption scenario portrays all categories of farms to enjoy increase in net return. But the increase in net return is more beneficial to the large scale farms relative to other scale of production. For instance, while the net return per kg increased by 30 cent in large scale farms, the impact is just 1 cent in small scale farms. However, in order to be granted with this incentive, these firms must get prior approval from the government. Net profit per chicken was higher in open system (medium and large scale) relative to their peers.

CONCLUSION

The result showed that large and medium scale farms under open system was better as compared to their peers in closed system. Evidence abound that the small scale producers both in open and closed systems produce with marginal net profit per bird even under tax exemption scenario. The fact that feed cost accounts high cost of production is quite worrisome. Hence, more research in developing cheaper alternative source of feeds from local raw materials needs to be developed in order to improve net returns.

SIGNIFICANCE STATEMENT

This study focuses on describing the cost and return of broiler farming in different technology and scale. This study will assist farm management, researcher and policy maker to attain potential farm in adapting close system, open system, small farm, medium farm and large farm in Malaysia. Hence, the study represents an informative figure of lucrative comparison in broiler farming under different coop system and business scale.

ACKNOWLEDGMENT

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