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RESEARCH ARTICLE

ECONOMIC IMPACT OF CLOSED HOUSE SYSTEM IN BROILER FARM PERFORMANCE

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ABSTRACT

Broiler farming in Malaysia use two type of housing systems namely close house and open house system. This paper has evaluated the economic impact of closed house system in broiler farm performance in Malaysia. An economic evaluation of 211 broiler farmers was conducted in three states in Peninsular Malaysia namely Perak, Pahang and Johor to determine the performance of the broiler farmers by using economic performance analysis. Pooled multiple regression model was used in the analysis. This model involves price per bird (PRM) as dependent variable and rearing housing system (DU), size of farm (SOF), feed conversion rate (FCR), average body weight(ABW), average marketing age (AMA) and mortality rate (MOR). The results show that all variables, except SOF, are significantly influence the performance of the farmers at five percent level of significance.

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INTRODUCTION

The poultry industry in Malaysia has undergone significant change in the recent past that initiated by private companies. This poultry industry is regarded as the highest output value per worker in the agriculture sector and the most successful segment in the livestock sector. Survey conducted by Department of Veterinary Service (DVS) in 2014 reported that there were 3,170 broiler farms in Malaysia and they produced around 724 million tonnes of meat per year in year 2012. Furthermore, DVS (2014) stated that the broiler production has increased from 471.56 million birds in 2007 to more than 800 million birds in 2014. Based on this information, on average the broiler production increased almost around 41.43 million birds per year from year 2007 to 2014. Basically, broiler farming industry in Malaysia initially started with backyard farming operation prior to 1950s. Then, this industry experienced further expansion in the 1960s and 1970s. Backyard farming operation is substitute with using open house system (OHS) either using deep litter or high raise slattered floor house. Specifically, OHS is defined as a house in which the climate inside the house is similar to the outside climate. Using the OHS, it is practically impossible to control the climate because temperature and ventilation depend on the weather. The weather changes either directly or indirectly have an effect on the management of broiler.

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In extreme weather conditions such as scorching heat and sudden rain or vice versa, cause the temperature and humidity of the enclosure are changed drastically. If the situation is not treated properly, it can result in high mortality rates and low production level. In addition to these problems, the surrounding people also complained about uncomfortable environment such as flies and unhealthy smell which were came from the chicken farm. In order to ensure efficiency, effectiveness and sustainability of poultry production in Malaysia, the new broiler housing system was introduced and implemented widely thorough out the country. Therefore, in beginning of 1980s, Malaysia was introduced to new ventures in the poultry industry by implementing broiler closed house system (CHS). CHS is defined as a house system in which there is a difference between the inside and outside climate. Climate control is possible in the CHS and there is usually a ventilation system in use. Specifically, CHS is a type of housing system where the chicken house totally close and CHS has a system to control environmental by elimination of sidewall curtains and addition of central controlled heating, ventilation, and cooling systems, including static pressure-controlled sidewall inlets and the capability for tunnel ventilation. For instance, Na Ranong (2014), stated that CHS is a tunnel ventilated that uses huge suction fans to maintain a relatively cooler ambient temperature in poultry houses. As an alternative technological innovation, CHS has many advantageous. First, it can deal with extreme weather changes. It is expected to minimize the adverse effects of climate change in environmental conditions or outside the

poultry house. According to Pakage *et al.* (2014), the purpose of using CHS is to create a controlled microclimate inside the enclosure, to improve productivity, efficiency and labour land and to create an environmentally friendly farm business. Further, Liang *et al.* (2013) demonstrated that after the contribution of yearly strain improvements and associated nutritional and health programs are taken into account, modern broiler housing with better environmental-control capability is important for optimizing weight gain, feed conversion rate (FCR), and liveability. Beside improving farmers' broiler production, Spahat (2012) realized in her study that the strong airflow from the CHS can helps to keep poultry dropping dry, thus avoid foul smell arising from wet droppings where cause uncomfortable environment to the public.

Will regard to broiler housing system, there were a few studies done to evaluate farm performance between CHS and OHS. Vidya *et al.* (2014) who conducted research on financial performance comparative between OHS and CHS in Jombang district East Java Province, Indonesia and discovered that the CHS were having the largest financial capital, biggest average profit, high revenue cost ratio and higher break-even point compare to OHS. A study done by Ekwue *et al.* (2003) in Trinidad provided evidence that chicken reared in the CHS reach maturity for marketing age at five to six weeks while in OHS they need seven weeks to reach the maturity age. They also found that the feed conversion rate (FCR) for CHS is lower compared to OHS since reared broilers in the OHS, the birds are stress from the heat, tend to drink more and eat less and can cause dead to the chicken, eventually. However, they found that birds in the CHS are comfortable and intend to eat more and convert most of the feed into meat. This will lead to low FCR. Furthermore, Lance (1990) who did survey on 150 contract-broiler growers and nine integrated-broiler-production firms in the North Georgia, found that in the summer and fall season, the CHS was more efficient in the summer and fall season , but the OHS is more efficient in the winter and spring season.

Disease is one of the factors which cause high mortality and effect the economic production of broiler farm. The results of the study by Ali *et al.* (2014) show that CHS has a high level of biosecurity compared to OHS. Biosecurity practices within CHS were designed to minimize the transmission of infectious diseases between and within farms. Therefore, the OHS have a higher potential risk for acquiring and transmitting diseases, including Highly Pathogenic Avian Influenza (HPAI). At the moment, broiler industry in Malaysia has two types of producers and both are using OHS and CHS. The producers comprises of commercial farms and conventional farms. Commercial farms that run business on contract farming basis with integrators and conventional farms that belong to independent entrepreneurs. Mohd *et al.* (2015) stated that about 60% of the broiler operators in Malaysia are using CHS and adopt modern technologies. Therefore, the present study was carried out to investigate empirically whether the CHS have better impact on farm performance compare to the OHS. This paper is organized as follows. Section 2 reviews CHS in broiler farm performance in literature. Follow up with description of methodology study in Section 3. Section 4 present result and discussion the economic impact of CHS in broiler farm performance. Lastly, in Section 5 discusses policy implications to improve broiler performance related to CHS.

MATERIALS AND METHODS

This study employed panel data, which were collected using survey conducted in 2014. Data were collected from the first two rearing cycles in that year for each respondent. The survey involved 211 farmers or 29.2 percent of the total farmer which have been chosen randomly in three states in Peninsular Malaysia namely Perak, Pahang and Johor. According to DVS (2013), there were 722 broiler farmers in these three states. For performing the evaluation of the impact of the broiler housing system to the economic performance of the broilers, Equation (1) is estimated.

$$PRM_{it}=\beta_1+\beta_1 SOF_{it}+\beta_2 ABW_{it}+\beta_3 MOR_{it}+\beta_4 FCR_{it}+\beta_5 AMA_{it}+\beta_6 DU+\varepsilon_{it}; \quad \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (1)$$

i = 1, 2...211, t = 1, 2

Where:

PRM	=	Price per bird (RM)
SOF	=	Size of farms (number of birds)
ABW	=	Average body weight (kg)
MOR	=	Mortality rate (%)
FCR	=	Feed conversion ratio
AMA	=	Average marketing age (days)
DU	=	Dummy
β_i	=	Coefficients (i = 1,2,...,6)

In Equation (1), the variable *PRM* is a dependent variable which measures the farm performance of the respondents. *PRM* is defined as price per birds which can be considered as income of respondent. Based on our observation, farmers in the study areas measure their farm performance by using how much they earn per bird. The dummy variable (*DU*) in the equation is defined as type of broiler housing system which is used by the respondent. The DU is measured score 0 for OHS and 1 for CHS. Other five variables which include in the equation are size of farm (*SOF*) which means the number of broilers in the farm for each rearing cycle and average body weight (*ABW*) which measure average body weight of a broiler when it is sold. The other variables are mortality rate (*MOR*) which measures the percentage of mortality rate of the broilers for each rearing cycle and feed conversion rate (*FCR*) which calculate the total feed consumed by the broilers and divide to the total body weight of the broilers achieved during marketing. Finally, the average marketing age (*AMA*) measure the average marketing body weight per broiler for each rearing cycle. Therefore, PRM can directly be used to measure the profit and loss of farmers from their broiler farming. Since in this study employ the combination of cross-sectional and time series data, the economic evaluation of the broiler farmers will be perform by using pooled multiple regression method. According to Bass and Wittink (1975), pooled multiple regression method offers some advantages over individual regressions. One of them is pooling data offers high degree of freedom. In this study, the number of cross section, N = 3 (i = 1, 2, 3) and t = 2 is time-series of observation. The period t = 2 is chosen based on the number of broiler rearing cycle. In pooled regression model, the main assumption is that there are

no unique attributes of individuals within the measurement set, and no universal effects across time. For allowing pooled regression model to be used in the analysis, error term in Equation (1) is assumed to fulfil the following assumptions.

$$\varepsilon \sim iid\left(0,\sigma^2\right) \quad \text{……..……..... (2)}$$

$$E\left(\varepsilon_{it}^2\right)=\sigma^2 \text{ and } E\left(\varepsilon_{ij}^2\right)=\sigma^2 \quad \text{……..... (3)}$$

$$E\left(\varepsilon_{it}\varepsilon_{ij}\right)=0; i\neq j \quad \text{……..……..... (4)}$$

Equation (2) and Equation (3) show that error term are normally distributed independent random variables with zero means and constant variances. Meanwhile, Equation (4) shows that there is no serial correlation problem. Since the sample is collected independently, thus, serial correlation of residuals is not an issue. Estimation using pooled regression model has been started with the homogeneity test. If the homogeneity hypothesis is rejected, then the estimates can be based on the pooled model.

RESULT AND DISCUSSION

Table 1 illustrates the estimation results of all the variables. All of the coefficients, except coefficient of *SOF*, are statistically significant at five percent level of significance. It means that *ABW*, *FCR*, *AMA*, MOR and *DU* variables are significantly affect the broiler farmers' performance in the survey area. The study proves that CHS contribute to increase the performance of the broiler farmers when the coefficient of *DU* is statistically significant at five percent.

Table 1. Estimation Results

Dependent Variable: PRM

Variable	Coefficient	Std. Error	*t*-Statistic	Prob.
C	1.489	0.3034	4.907	0.000*
SOF	5.04E-07	6.10E-07	0.826499	0.409
ABW	1.191	0.099	11.989	0.000*
FCR	-0.809	0.134	-6.001	0.000*
AMA	-0.037	0.007	-4.995	0.000*
MOR	-0.028	0.006	-4.479	0.000*
DU	0.130	0.044	-2.947	0.032*

$R^2 = 0.656$; Adj. $R^2 = 0.650$; *F*- stat = 119.121; *D-W* stat = 1.409
Note: * significant at five percent level.

The results show that on average *PRM* increased by RM0.13 by applying CHS in the rearing system. This finding is similar with the finding of Cunningham (2004). Cunningham claimed CHS provides greater control over the birds' environment. Economic benefits of CHS include improving FCR and better livability. Furthermore, he argued that even though the CHS is costly to be built than OHS, but the economic benefits achieved through improved performances generally recover the additional costs. Also, study done by Tapsir *et al.* (2011) on 256 broiler farmers in Malaysia found that the CHS were relatively four percent more efficiently than farm practising OHS. Na Ranong (2014), Pakage et *al.* (2014) and Spahat *et al.* (2012) also agreed that by utilizing environmentally friendly CHS would enable the industry to enhance productivity of the broiler farmer and they will competitively survive in the industry in a more liberalized market. Beside improve economic performance of the broiler farmer, Ariffin *et al.* (2013) have proven that CHS system can minimize air pollution problem and flies disturbance to people in surrounded area. This would ensure the broiler farming will be accepted by the surrounded people and sustain in the neighbourhood. The R^2 value shows that 65.6 percent variation of the dependent variable is explained simultaneously by all independent variables. So, it reassures the precession of the model and data gathered.

Policy Implication and Conclusion

Since the study show that the CHS brings higher productivity and improve performance, the system should be intensively employed in the poultry industry in Malaysia. In this respect, Ariffin *et al.* (2013) also agreed that the government should support the farmers by providing incentives to them to upgrade their production system from the open to the more efficient and environmentally friendly such as CHS. Furthermore, the government should encourage more private companies to invest in CHS in the poultry industry. As a result, higher use of CHS to achieve bigger productivity of chicken production can be achieved in order to fulfil the demand of the people especially in Malaysia, as well as for export. The government should also provide subsidies program such as discount on taxes for those farmers who use CHS in their poultry production. By doing this, it may lower the cost of production. In addition, the farmers needs to be reinforced particularly in the aspects of good rearing housing system transmission in order to ensure efficiency, effectiveness and sustainability of poultry production in Malaysia.

Finally, the study emphasize that CHS is the best practice to rear chicken. Based on this empirical study, it may motivate broiler farmers who refuse to convert to CHS to have second thought and change to CHS. Hopefully, by implementing CHS together with good husbandry practices, they may improve their farm performance and sustain in the industry.

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