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Factors affecting economic profits of Phon Yang Kham beef cattle farming in Sakon Nakhon province

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ABSTRACT

The study aimed to determine factors affecting economic profits of beef cattle business in Sakon Nakhon Province. A sample of 400 members of Kor Ror Por Klang Phon Yang Kham Livestock Cooperative Limited was determined by using Taro Yamane method, and binary logistic regression analysis was used to analyze the data. The findings showed that the variables with the statistical significance of 0.01 included concentrate feeds, roughage, and the raised period of less than or equal to 12 months. They were statistically significant at 0.001 0.000, and 0.000 respectively, and the odd ratios were 1.387, 0.921, and 5.697 respectively. Additionally, the variables with the statistical significance of 0.05 included Charolais cattle (62.50%) and farm location. The two variables were statistically significant at 0.023 and 0.039 respectively with the odd ratios of 5.083 and 0.595 respectively. If the cows are fed on 1 more kg/day of more concentrated feed, it is likely for the farmers to increase economic profit by 0.921 times and 1.387 times respectively. The probability of economic profit is by 5.697 times if the cattle are raised no more than 12 months. The cross-bred cattle with 62.50% Charolais breed showed the probability for the farmers to gain economic profit by 5.083 times. Finally, those who had farms located next to the farm family's home were more likely to gain less economic profit by 0.595 times.

Keywords: Factors affecting, Economic profits, Phon Yang Kham beef cattle, Logit model.

INTRODUCTION

In the past, Thai farmers raised cattle for agricultural use as labour, but now the cattle farming has been for beef production to meet increasing domestic and international demand. To develop and expand beef cattle farming as sustainable profitability for farmers, the government has promoted it through incentives and policy support (Division of Livestock Extension and Development, 2012). Kho Khun refers to a type of beef cattle through the rearing for rapid growth with the maximum quantity and quality of roughage and concentrate feeds so that the cattle (not more than 3 years of age) deposit fat within muscles which is considered premium beef with higher selling price than those fed on only roughage (Suwanlee, 2012).

The rearing of beef cattle in Sakon Nakhon has been extensively active in order to sell to cooperatives and also to meet local beef consumption demand. Kor Ror Por Klang Phon Yang Kham Livestock Cooperative Limited, registered on June 3, 1980 and located in Ba Phon Yang Kham, Moo 10, Non Hom Sub-district, Mueang District, Sakon Nakhon Province, has its members who are beef cattle farmers. Its objectives are to provide farmers with production inputs and to be a buying source of their cattle. In 2018 there were 6,401 members (Kor Ror Por Klang Phon Yang Kham Livestock Cooperative Limited, 2019). At the beginning, the cooperative gave support to members in the forms of personnel, location, small-scale slaughterhouse and refrigerated trucks by the French government, equipment in cold storage rooms for carcasses by the German government. Although beef consumption demand has increased substantially, the processing system remains conventional, and it results in quality of beef products. It is crucial that Kor Ror Por Klang Phon Yang Kham Livestock Cooperative Limited improves the production system in terms of both quantity and quality (Kor Ror Por Klang Phon Yang Kham Livestock Cooperative Limited, 2001). Phon Yang Kham beef of Sakon Nakhon has been well known for its high quality domestically and internationally. After butchering, beef aging is required to enhance tenderness and flavour. It has been recommended by Sakon Nakhon Provincial Livestock Office and Governor's Office of Sakon Nakhon as one of the provincial top products, and accepted countrywide. Moreover, on June 28, 2016 Phon Yang Kham beef was approved by Department of Intellectual Property to be GI registered product. This contributes to community income distribution and the promotion of sustainable beef farming.

The success of beef farming generally is determined by profits and losses. Therefore making profits is the main objective in livestock farming after deducting production cost from the revenue of sales. It has been discussed that cattle feed is considered the biggest cost in beef farming (Kalangia, 2016). Even though farmers can maximize the use of agricultural or agro-industrial post-production materials during harvest seasons, they have to be responsible for cattle feed during dry seasons, artificial insemination cost, medicine, and supplements, cattle housing and equipment, and household labour cost. In order to succeed in beef farming, the farmers need to be aware of economic profit affecting factors. The achievements contribute to the cooperation stability and the country economy.

The researchers are aware of the significance of cost, return, and net economic profit of beef farming, and aim to determine factors affecting economic profit of beef cattle business. Then the factors can be applied in the commercial improvement of beef cattle farming based on the economic profit the farmers gain. This helps farmers to compete in changing international markets, ensure consumers, and eventually make a good living in beef cattle farming sustainably.

MATERIALS AND METHODS

Population and Sample

This survey research used interviews to collect data. The population of the study included 4,327 beef cattle farmers, and they were members of Kor Ror Por Klang Phon Yang Kham Livestock Cooperative Limited in 2018. The sample size (366.15) was calculated by using Yamane (1973) formula with a static error of 5%. 400 was determined to be the sample size in order to prevent probable errors from the data collection process. The samples were selected based on quota sampling which is a non-probability sampling method by considering the proportion of the pop-

ulation of beef cattle farmers in each district of Sakon Nakhon, and then accidental sampling was used to interview those who were qualified and willing to participate until the total number was reached.

Data Analysis and Interpretation

Binary logistic regression analysis was used with the cases of multiple independent variables by including factors into the model to determine those that affect economic profits of Phon Yang Kham beef cattle farming business as follows (Greene, 2003):

$$Pi = F(Y) = F(\alpha + \beta_i X_i) = 1/(1+e^{-Y})$$

When

Pi = the probability of economic profit farmers gain from Phon Yang Kham beef cattle farming and based on factor X_i

e = 2.718 (based on logarithm)

Y = The possibility of economic profit farmers gain from Phon Yang Kham beef cattle farming: Y = 0 referring to the economic profit from Phon Yang Kham beef cattle farming $\leq$ 0; and Y = 1 referring to the economic profit from Phon Yang Kham beef cattle farming > 0

The equation above can be converted with logarithmic as follows:

$$\text{Log}\,[Pi/(1-Pi)] = Y = \alpha + \beta_1 OC + \beta_2 FA + \beta_3 TR + \beta_4 CB_1 + \beta_5 CB_2 + \beta_6 CB_3 + \beta_7 CON + \beta_8 RO + \beta_9 CER + \beta_{10} EX + \beta_{11} LO + \beta_{12} RP_1 + \beta_{13} RP_2$$

The independent variables used in the study to determine factors affecting economic profit of Phon Yang Kham beef cattle farming business are shown in Table 1.

RESULTS AND DISCUSSION

Regarding economics cost and return of Phon Yang Kham beef cattle farming of average 14.53 months from a sample of 400, the total cost was 73,369.00 THB/head while the average variable cost was 71,289.97 THB/head or 97.17% of the total cost. The highest variable costs included breeding cost of 29,114.16 THB/head (39.68%), roughage cost of 15,075.16 THB/head (20.55%), concentrate cost of 12,591.73 THB/head (17.16%), labour cost of 10,703.73 THB/head (14.59), mo-

Table 1. Description of variables

Independent Variables	Description and Measurement	Symbol
Main occupation	1 = Beef Castle	OC
	0 = Other	
Family labour	1 = Yes	FA
	0 = No	
Training on knowledge of cattle	1 = Yes	TR
	0 = No	
Level of Charolais breeding	CB_4 = 75.00%*	CB
	CB_3 = 62.50%	
	CB_2 = 50.00%	
	CB_1 = Not certain	
Concentrate feed	Quantity Concentrate feed for Beef cattle (Kg./Head/Day)	CON
Roughage	Quantity Roughage for Beef cattle (Kg./Head/Day)	RO
Standard certification	1 = Yes	CER
	0 = No	
Experience	Experience in raising Beef cattle (Year)	EX
Farm location	1 = Next to home	LO
	0 = Away from home	
Beef cattle rearing period	RP_3 = Greater than or equal to 15 month*	RP
	RP_2 = 12 - 15 Month	
	RP_1 = Less than or equal to 12 month	

* Reference groups

lasses of 1,932.90 THB/head (2.63%), utilities of 524.97 THB/head (0.72%), vaccines and medicine of 473.41 THB/head (0.65%), opportunity cost of variable investment of 297.82 THB/head (0.41%), mineral supplements of 267.74 THB/head (0.36%), transportation cost of 258.35 THB/head (0.35%), and cattle fattening cost of 50.00 THB/head (0.07%). The total average fixed cost was 2,079.03 THB/head or 2.83% of the total cost where the highest fixed costs included interest cost of 995.39 THB/head (1.36%), depreciation of 985.24 THB/head (1.34%), land rental cost of 92.26 THB/head (0.13%), and opportunity cost of fixed investment of 6.15 THB/head (0.01%).

In terms of return on investment in Phon Yang Kham beef cattle farming in Sakon Nakhon, the average total return was 78,887.54 THB/head. The number was broken down into the income from selling cattle to the cooperative of 74,755.02 THB/head, financial support for new born calf of 1,499.52 THB/head, and income from selling manure of 2,633.00 THB/head. Consequently, the net return after deducting the costs from total income was 5,518.54 THB/head (Table 2).

Results of the logistic model analysis

The variables that affect economic profitability of Phon Yang Kham beef cattle farming were determined by using Pearson product moment correlation coefficient, and it was found that family labour and concentrates were correlated at the most significant level at -0.236 which was lower than 0.75. Multicollinearity, therefore, did not occur in this case. According to Hosmer-Lemeshow goodness of fit test (Rossi, 2009), the fitting of the model was at 8.230 which was lower than 15.507 ($X^2_{(0.05.\ 8)}$), $_8$and the P-Value was 0.411. It was concluded that the model showed the goodness of fit at the significance level of 0.05 with the accuracy of prediction of 73.80% on average.

The results of binary logistic regression analysis revealed the variables with statistical significance of 0.01 including concentrates (CON), roughage (RO), and the rearing period of no more than 12 months (RP_1) with P-Values of 0.001, 0.000, and 0.000.The variables with statistical significance of 0.05 included the percentage of Charolais breed of 62.50% (CB_3) and the farm location (LO) with P-Values of 0.023 and 0.039. The variables were indicated to affect the economic profit of Phon Yang Kham beef cattle

Table 2. Average economic costs and returns of beef cattle of farmers in Sakon Nakhon Province.

Component	Cash (Baht/Head)	Non Cash (Baht/Head)	Total (Baht/Head)	Percentage
1. Total cost	**49,557.90**	**23,811.10**	**73,369.00**	**100.00**
1.1 Variable cost	48,562.51	22,727.45	71,289.97	97.17
Breed cost	20,416.13	8,698.03	29,114.16	39.68
Roughage	11,630.97	3,444.19	15,075.16	20.55
Concentrate feed	12,591.73	0.00	12,591.73	17.16
Molasses	1,932.90	0.00	1,932.90	2.63
Mineral supplement	267.74	0.00	267.74	0.36
Vaccination and Medication	473.41	0.00	473.41	0.65
Labor	416.32	10,287.41	10,703.73	14.59
Registration fee	50.00	0.00	50.00	0.07
Transportation	258.35	0.00	258.35	0.35
Electricity, water and gasoline	524.97	0.00	524.97	0.72
Opportunity cost of capital	0.00	297.82	297.82	0.41
1.2 Fixed cost	995.39	1,083.65	2,079.03	2.83
Depreciation	0.00	985.24	985.24	1.34
Land rental	0.00	92.26	92.26	0.13
Interest	995.39	0.00	995.39	1.36
Opportunity cost of capital	0.00	6.15	6.15	0.01
2. Total income	**77,864.29**	**1,023.25**	**78,887.54**	
3. Net profit	**28,306.39**		**5,518.54**	

farming in Sakon Nakhon (Table 3).

Discussions

1. Cattle breeds: it has been found that the percentage of Charolais breed of 62.50% (CB_3) with the P-Value of 0.023 and the odd ratio of 5.083 positively affect economic profit at the reliability level of 95.00%. The farmers therefore have more possibility to gain economic profit than those with the Charolais breed to gain economic profit than those with the Charolais breed of 75.00% by 5.083 times. Breeds of beef cattle play a significant role in beef cattle farming. The crossbreeding of Charolais and Brahman or Charolais and native cattle has been growing in number as a result of high economic return farmers earn. This result is consistent with Marshall *et al*. (2020) found that increasing the management level of any of the breed or cross-breed types under consideration, including the indigenous zebu animals, resulted in an increased net benefit of 2.2- to 2.9-fold. Boonprong *et al*. (2008) have also discovered that Tak breed was developed from 37.5% American Brahman and 62.5% Charolais breeds. The Kabinburi breed was developed from 50% German Simmental crossed with 50% Brahman for enhanced heat tolerance, fertility and growth.

2. Concentrates and roughage

2.1 Concentrates: The variables with the P-Value of 0.001 and odd ratio of 1.387 indicate positive effects on economic profit at the reliability level of 99.00%. In other words, if the cattle are fed on 1 more kg of concentrate feed (CON) per day, the probability of economic profit gained is by 1.387 times.

2.2 Roughage: The variables with the P-Value of 0.000 and odd ratio of 0.921 when B is -0.082 confirms the inverse effects on economic profit at the reliability level of 99.00%. This implies that if the cattle are fed on 1 more kg of roughage (RO) per day, the probability of economic profit decreases by 0.921 times.

Concentrates and roughage are significantly related to beef cattle rearing (Ekowati *et al*., 2018) as they play a major role for cattle growth and development. It is evident that the majority of production cost is cattle feed which is 70-80% of the total cost. Considering the growth performance and cost per kg gain of Brahman crossbred growing calves, it concluded that the diet consisting of roughage and concentrates ratio are 55:45 may be used for economic beef production (Rashid *et al*., 2015). According to the results of the study, an increase of concentrates is likely for

Table **3**. The results of binary logistic regression analysis for variables that affect economic profitability of Phon Yang Kham beef cattle farming.

Variables	B	Std.error	Wald	df	Sig.	Exp (B)	95% C.I.for EXP(B)	
							Lower	Upper
Constant	- 0.540	0.862	0.392	1	0.531	0.583		
OC	0.461	0.536	0.740	1	0.390	1.586	0.554	4.539
FA	-0.122	0.255	0.230	1	0.631	0.885	0.537	1.458
TR	-0.467	0.264	3.112	1	0.078	0.627	0.373	1.053
CB_1	0.882	0.716	1.520	1	0.218	2.417	0.594	9.827
CB_2	1.167	0.670	3.035	1	0.081	3.213	0.864	11.944
CB_3	1.626	0.715	5.166	1	0.023*	5.083	1.251	20.654
CB_4			7.114	3	0.068			
CON	0.327	0.099	10.922	1	0.001**	1.387	1.142	1.683
RO	-0.082	0.020	16.638	1	0.000**	0.921	0.886	0.958
CER	0.556	0.301	3.418	1	0.064	1.743	0.967	3.143
EX	0.002	0.017	0.013	1	0.910	1.002	0.970	1.035
LO	-0.519	0.252	4.252	1	0.039*	0.595	0.363	0.975
RP_1	1.740	0.430	16.350	1	0.000**	5.697	2.451	13.241
RP_2	0.534	0.285	3.506	1	0.061	1.706	0.975	2.986
RP_3			16.350	2	0.000			

Chi^2 (13) = 77.636; Prob > chi2 = ** ; Pseudo R^2 = 0.246; * Significant at level 5%, ** Significant at level 1%

the farmers to earn economic profit; on the other hand, economic profit is likely to decrease if the cattle are fed on more roughage. As a result, the farmers should feed cattle with the maximum amount of concentrates and limit roughage to the appropriate amount. McGee *et al.* (2016) confirms that Carcass growth response to concentrate supplementation at pasture is higher where grass supply is low and where grass quality if poorer and, usually declines as concentrate supplementation level increases. Haloho *et al.* (2013) also found that when increasing the cost for concentrates, they gained 4.7% more profit. The cost of concentrates has a significant influence on beef farming profitability ($P<0.05$).

3. Beef cattle farm location: The variables with the P-Value of 0.039 and odd ratio of 0.595 when B is -0.519 indicate the inverse effects on economic profit at the reliability level of 95.00%. In other words, with the beef cattle farms location (LO) that are close to residences, the farmers tend to earn less economic profit by 0.595 times compared to those located away from neighbouring residences because of better air circulation, better cattle growth rate, low epidemic diseases rate, and convenient access to sources of roughage. Muroga *et al.* (2013) claims that the farms with physical limitations of livestock transportation can prevent animal epidemic. On the other hand, the convenient movements of animal, people, and vehicles can possibly risk the outbreak. Kaneene *et al.* (2002) also states that in order for the farms to lower the risk of the epidemic, they are required to be naturally open, and the decrease of entries among different cattle houses. The feeding stations and pasture boundaries may need to be determined by electric fence. Additionally, Persson (2015) has found that good physical location is positively associated with the farm's advantage in competition because of the decrease of feeding cost.

4. Rearing period: The variables were divided into 3 groups: less than or equal to 12 months, 12 - 15 months, and greater than or equal to 15 months. The third group was assigned to be a reference group, and it was found that the rearing period of less than or equal to 12 months had the P-Value of 0.000 and the odd ratio of 5.697. This means that rearing period affects economic profits in a positive way at the reliability level at 99.00%. In other words, the rearing period is less than or equal to 12 months (RP_1), the probability of economic profit is by 5.697 times compared to the rearing period of greater than or equal 15 months. The beef cattle are about 3 years old as they started to be fattened at 2 years old in accordance with Kalangia (2016) that has found that selling 1-year old beef cattle gave lower profits than selling older ones (1-2 years old. However, some farmers chose to sell sterile female cattle or heifers with lower price because of their lower weight and strength.

CONCLUSION

According to the study of factors affecting economic profits of beef cattle business in Sakon Nakhon by using logistic regression analysis, it has found that there are 5 affecting factors: the variables with statistical significance of 0.01 including concentrates (CON) that should be increased in feeding proportion, roughage (RO) that should be reduced, and the effective rearing period of less than or equal to 12 months (RP_1); and the variables with statistical significance of 0.05 including the 62.50% Charolais breed (CB_3) that is suitable for the climate of Thailand and farm location (LO) that should be distant from residences.

REFERENCES

Boonprong, S., Choothesa, A., Sribhen, C., Parvizi, N., and Vajrabukka, C. 2008. Productivity of Thai Brahman and Simmental-Brahman crossbred (Kabinburi) cattle in central Thailand. Intl. J. Biometeor. 52(5): 409–415.

Division of Livestock Extension and Developmentt 2012. Beef Cattle Strategy 2012-2016. Department of Livestock Development, Ministry of Agriculture and Cooperatives. Bangkok.

Ekowati, T., Prasetyo, E. and Handayani, M. 2018. The factors influencing production and economic efficiency of beef cattle farm in Grobogan Region, Central Java. J. Indonesian Trop. Anim. Agric. 43(1): 76-84.

Greene, W. H. 2003. Econometric Analysis. 5th ed.

Prentice Hall. New Jersey.

Haloho, R.D., Santoso, S.I., Marzuki, S., Roessali, W. and Setiadi, A. 2013. Profit function analysis of dairy cattle farming in Getasan and West Ungaran districts, Semarang regency. J. Indonesian Trop. Anim. Agric. 38(2): 116-122.

Kalangia, L.S., Syaukat, Y., Kuntjoro, S.U. and Priyanti, A. 2016. Factors affecting profit analysis of beef cattle farming in East Java, Indonesia. Livest. Res. Rural Dev. 28(12): 1-9.

Kaneene, J.B., Bruning-Fann, C.S., Miller, R., Porter-Spalding, B.A. and Granger, L.M. 2002. Environmental and farm management factors associated with tuberculosis on cattle farms in northeastern Michigan. J. American Vet. Med. Assoc.. 221(6): 837-842.

Kor Ror Por Klang Phon Yang Kham Livestock Cooperative Limited 2001. Handbook of Phon Yang Kham Cooperative. Phon Yang Kham Livestock Cooperative Limited. Sakon Nakhon.

Kor Ror Por Klang Phon Yang Kham Livestock Cooperative Limited. 2019. Annual Report 2019. Kor Ror Por Klang Phon Yang Kham Livestock Cooperative Limited. Sakon Nakhon.

Marshall, K., Salmon, G.R., Tebug, S., Juga, J., MacLeod, M., Poole, J., Baltenweck, I. and Missohou, A. 2020. Net benefits of smallholder dairy cattle farms in Senegal can be significantly increased through the use of better dairy cattle breeds and improved management practices. J. Dairy Sci.. 103(9): 8197-8217.

McGee, M., Riordan, E.O. and Moloney, A. 2016. Concentrate feeding for growing and finishing cattle. Agriculture and food development authority. July: 56-59

Muroga, N., Kobayashi, S., Nishida, T., Hayama, Y., Kawano, T., Yamamoto, T. and Tsutsui, T. 2013. Risk factors for the transmission of foot-and-mouth disease during the 2010 outbreak in Japan: a case-control study. BMC Vet. Res. 9: 150.

Persson, K. 2015. Adding value to gain competitive advantages- agricultural and horticultural firms' corporate strategies to create wealth. BD Project. Swedish University of Agricultural Sciences, Uppsala, Sweden.

Rashid, M.M., Huque, K.S., Hoque, M.A., Sarker N.R. and Bhuiyan, A. 2015. Effect of concentrate to roughage ratio on cost effective growth performance of Brahman crossbred calves. J. Agric. Sci. Technol.. 5(4): 286-295.

Rossi, R.J. 2009. Applied biostatistics for the health sciences. John Wiley & Sons. New Jersey.

Suwanlee, S. 2012. Cattle fattening and meat quality. Department of Animal Science, Faculty of Agriculture, Ubon Ratchathani University. Ubon Ratchathani.

Yamane, T. 1973. Statistics: an introductory analysis. 3rd ed. Harper and Row Publication. New York.