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A STUDY OF BEEF PRODUCTION SYSTEM IN PENINSULAR MALAYSIA

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ABSTRACT

Due to slow growth of beef production, it is necessary to find out the way to increase beef production. This study was aimed to estimate future beef production at the existing rate of calving, slaughter and mortality. The ex-post Simulation Matrix (SIMM) model used from the year 1970 to 1996 and ex-ante SIMM model used from the year 1997-2015 in Malaysia. The results indicated that beef production is not profitable and in future beef production will be increased but at slower rate in Malaysia. Female breeding stock of beef population needs to be increased with higher calving rate and lower slaughter rates.

Keywords: beef production, simulation matrix model.

INTRODUCTION

The demand for beef production in Peninsular Malaysia is increasing due to the increasing number of human population and their income. The contribution of livestock to gross domestic production (GDP) increasing actually due to poultry but the GDP contribution to beef sub-sector declined from 16 to 3% for the year 1970 to 2000 (Fauzia, 2001). The higher slaughter rate for female breeding stock is the main reason for lower number of beef animal population.

In this case, the beef price influences the producer's response in determining the retention of replacement heifer for cow breeder's herd, fed-lot cattle and culling. The amount of beef production is related with slaughter number and beef slaughter depends on the number of beef animal population. The higher slaughter rate can increase the amount of beef produced for the first few years but facing many number deficits in beef animal population. The number of beef population may also reduce due to lower calving rate, lower productivity of local breed and higher mortality rate. Interaction between beef animal population and different rates (calving, mortality, slaughter) may be a useful way of estimating future beef production.

Eusof *et al.,* (1999) have reported at 70% existing rate of calf-crop and 37% culling of heifers, beef sub-sector contributes about 77% of the beef supplied. By the year 2010, supply from this sub-sector is expected to be about 86% and up to more than 90% in the year 2020. If problem factors can be removed, there will be a possibility for higher level of beef production. The objective of this study is to develop System Simulation Modeling for estimating the profitability of future beef production in Peninsular Malaysia.

MATERIALS AND METHODS

Selection of Methods

Simulation Matrix (SIMM) model was developed based on system approach method to analyze the objective of the study. System research generally involves the construction of a computer-based simulation model. Models may be in several forms, but system studies, mathematical models are powerful tool. The SIMM model was used to simulate the female breeding stock (FBS), male breeding stock (MBS), male calves (MC) and female calves (FC) and slaughter and production components of the beef production system. The overall SIMM model discussed firstly ex-post SIMM model from

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1960 to 1996 and secondary ex-ante SIMM model from 1997 to 2015. The ex-post SIMM model for beef production system from 1960-1996 was used as a base to simulate the ex-ante component (1997-2015). Root means square percentage error (RMSPE) and U-Theil inequity coefficient (U) showed that the SIMM model correctly represents the real worlds.

The RMSPE is a measure of the deviation of the simulated values y^s from their actual values y^a in percentage term. The acceptable value of RMSE is below 10%. This is mathematically represented by the following equation:

$$RMSPE = [1/n \sum_{t=1}^{n} ((y^s_t - y^a_t)/ y^a_t))^2]^{1/2} \quad (1)$$

The U-Theil inequity coefficient is another test for measuring the deviation of the simulated values from to the actual values.

This mathematically represented as follows:

$$U = \frac{[1/n \sum_{t=1}^{n} (y^s_t - y^a_t)^2]^{1/2}}{[1/n \sum_{t=1}^{n} (y^s_t)^2 + 1/n \sum_{t=1}^{n} (y^a_t)^2]^{1/2}} \quad (2)$$

The value of U will always fall between 0 and 1. If U = 0, predicted value is equal to the actual value, and there is a perfect fit. If U = 1, the predictive performance of the model is bad.

The stochastic elements in SIMM were created through the selection of random variables from defined probability distribution.

$$X = RAND^* (a-b) + b \quad (3)$$

Where,

a = Maximum value, b = Minimum value, X = Stochastic event and RAND = Random

Beef population component, slaughter and beef production component, and management decision-making components were used. Forecasting price of beef are calculated by putting simulated values of produced beef for the period 1997-2015. Beef projected demand for beef was estimated by using projection formula from 1997 to 2015. Net Present Worth (NPW), Benefit-Cost Ratio (BCR) were used to analyze benefit and cost.

Selection of Beef Population

Actual number of female breeding stock (FBS) used on calves and breeding stock which relate the number in the past, resulting in a distribution of beef animal population by age separately for beef cattle, dairy cattle and for buffalo in Peninsular Malaysia. The beef animal population is categorized into types of beef animal population, age and sex. Three types and two categorize of age and sex was used. They are breeding stock and calves (female, male) for beef, dairy cattle and buffalo.

The current number of breeding stock is calculated from the previous number of female/male breeding stock minus the number of slaughter and died female or male breeding stock for each age in a current year separately for beef, dairy cattle and buffalo. The calves (female/male) number is calculated from the previous number of calf-crops, new born calves minus the number of slaughtered and died calves separately for beef, dairy and buffalo.

The total number of female/male breeding stock and calves is the sum of three sources of beef, dairy and buffalo in a current year. Total slaughter is the sum of slaughtered beef, dairy and buffalo in a current year and total beef production is the sum of fresh beef production from beef, dairy and buffalo.

Design and Data collection:

Calving rate at 70-75%, mortality rate at 5-10% and slaughter rate separately, 10-27% for beef, 10-15% for dairy and 15-20% for buffalo from 1970-1996 was used as base to simulate the ex-ante components

Beef Animal Population component

Beef animal population is expected to increase slowly from 725 thousand heads in 1997 to 1469 thousand heads in 2015. The growth rate of beef animal population is affected by the higher rates of slaughter 10-27% for beef, 10-15% for dairy and 15-20% for buffalo.

Slaughtered Beef Animal Population Component

Based on the earlier mentioned calving rate (70-75%), mortality rate (5-10%) and slaughter rate (10-27%) for beef, (10-15%) for dairy and (15-20%) for buffalo of female breeding stock (FBS); the simulated number of slaughtered beef animal population is expected to increase from 119 thousand heads in the year 1997 to 220 thousand heads in the year 2015 which will increase the amount of beef production from 18 thousand metric tonnes in the year 1997 to 31 thousand metric tonnes in 2015. Simulated results indicate due to the lower number of slaughtered beef animal population, beef production is expected to increase very slowly.

Beef Production Component

Beef production is expected to increase very slowly, causing higher amount of beef import from abroad to meet up her beef demand (Fig. 2). Beef production is expected to increase from 18 thousand metric tonnes in 1997 to 31 thousand metric tonnes in 2015 whereas the amount of beef importation is expected to increase from 61 thousand metric tonnes in 1997 to 201 thousand metric tonnes in 2015 in relation to the increased amount of beef demand from 79 thousand metric tonnes in 1997 to 232 thousand metric tonnes to 2015 causing lower self-sufficiency rate in Malaysia and self-sufficiency rate is expected to decrease from 23% in 1997 to 13% in 2015.

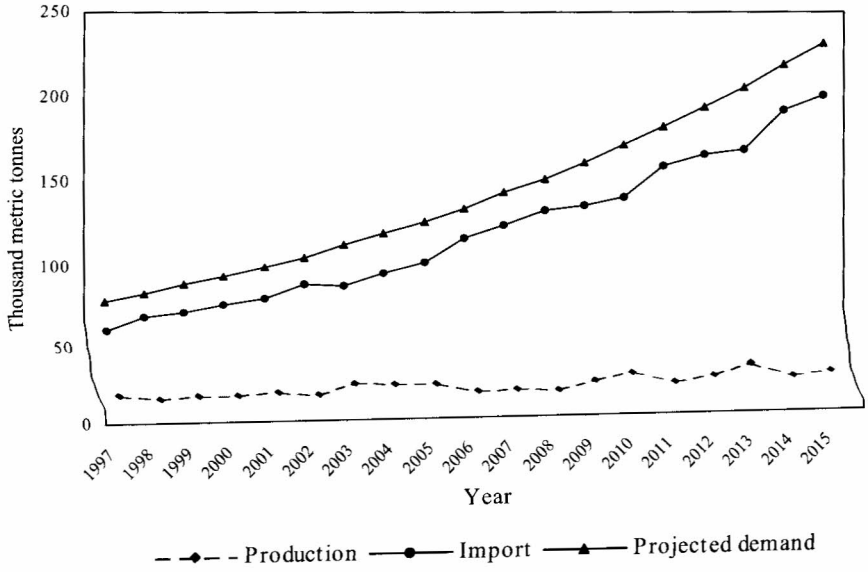

Fig. 2. Ex-ante Simulation Analysis for Beef Production, Import and Projected Demand in Peninsular Malaysia, Thousand Metric Tonnes, 1997-2015

Table 2. Ex-ante analysis under different components in Peninsular Malaysia

Year 1997-2015	Total Beef Animal Population	Slaughtered Beef Animal Population	Beef Production	Beef Import	Beef Demand
1997	725	119	18	61	79
1998	729	105	15	69	84
1999	637	118	17	72	89
2000	792	111	17	77	94
2001	851	124	19	81	100
2002	899	113	17	89	106
2003	948	166	25	88	113
2004	955	165	24	96	120
2005	961	162	24	103	127
2006	964	123	18	117	135
2007	1048	133	19	125	144
2008	1063	124	18	134	152
2009	1144	177	25	137	162
2010	1211	219	31	141	172
2011	1248	163	23	160	183
2012	1315	192	28	166	194
2013	1394	257	37	169	206
2014	1369	194	27	192	219
2015	1469	220	31	201	232

Economic Performance:

The total cost for beef production of 23 thousand metric tonnes / year will require RM 128 million / year while its return will be RM94 million / year indicating a loss of RM 34 million / year. Table 3 shows the results of negative NPW (-646) and BCR (0.73<1) indicate that beef production is not economically accepted in Peninsular Malaysia.

Table 3. Economic Performance for Beef Production in Peninsular Malaysia

Year	Beef Production (Thousand Metric ones)	Total Benefit RM million	Total Cost RM million	Discounted cash flow (RM Million)
1997	18	162	282	-107
1998	15	105	252	-117
1999	17	136	259	-87
2000	17	136	281	-92
2001	19	190	309	-67
2002	17	136	296	-81
2003	25	375	383	-3
2004	24	336	374	-15
2005	24	336	375	-14
2006	18	162	315	-49
2007	19	190	337	-42
2008	18	162	329	-43
2009	25	375	410	-7
2010	31	589	480	+23
2011	23	299	405	-19
2012	28	476	464	+2
2013	37	888	564	+47
2014	27	594	462	+17
2015	31	589	515	+8
	NPW: -646		BCR: 0.73<1	

CONCLUSION

Considering the existing rates of growing beef animal population and producing beef, it can be concluded that beef production could not be economic (BCR: 0.73<1) requires to change in slaughter, mortality and calving rates. Higher slaughter rate can increase beef production but ultimately decrease the number of beef population. That is why government should restrict the rate of higher slaughter mainly for female breeding stock. Results suggested reduced slaughter rate from 10-27% for beef cattle, 10-15% for dairy cattle and 15-20% for buffalo and reduced mortality rate from 5-10% in case of beef cattle, dairy cattle and buffalo also. On the other hand, calving rate should increase from 70-75% in case of beef cattle, dairy cattle and buffalo. This study has actually discussed beef production could not be increase rapidly due to slower beef population growth, that is why needs to increase the number female breeding stock by importing from abroad. It needs further study to improve management strategy for higher beef production.

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