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THE IMPACT OF BEEF-POPULATION IMPORT-MANAGEMENT STRATEGIES ON BEEF SELF-SUFFICIENCY IN MALAYSIA

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ABSTRACT

The study has been aimed to evaluate beef self-sufficiency performance under different conditions in Malaysia. Simulation model under five scenarios of different managements was developed to analyze the impact on beef production in Peninsular Malaysia. Scenario 3 was found to be the best management to attain self-sufficiency level at reasonable time frame. Under scenario 3 (76-80% calving rate, 5-7% slaughter rate, 1-2% mortality rate of female breeding stock with 10000, 5000, 500 heads/year importation of female breeding stock for beef cattle, dairy cattle and buffalo respectively), 150% self-sufficiency can be achieved in 2015. The management of female breeding stock is an important component for beef production system in order to achieve the level of self-sufficiency in beef. The results indicated that lower slaughter rate of imported Female Breeding Stock (FBS) could be more suitable management strategy for higher beef self-sufficiency.

Keywords: beef self-sufficiency rate, different management strategies, simulation modeling

INTRODUCTION

The self-sufficiency level for beef has been declining over the years. Efforts have been made to increase beef production, however the program has not been succeed. Self- sufficiency rate has decreased from 82% in 1960 to 22% in 2000. Since the supply of local beef is insufficient to meet the local demand, importation is vital in order to fulfill consumer needs. The quantity of imported beef has increased from 919 metric tonnes (mt) in 1960 to 117800 mt in 2000. The contribution of the imported frozen and chilled beef to the total imported beef was 99.2% and 0.8% respectively. In general, Malaysia lacks a comparative advantage in all types of ruminant production.

In 1973, Hunt developed an annual model to analyse the effects of import quota restrictions on United States beef production and prices. He is able to compare the effects of different hypothetical levels of imports on beef production and prices. In 1975, Freebair and Rausser estimated the effects of changes in the level of United State (US) beef imports on supplies and prices. Roberts and Heady (1980) suggested the increase of beef imports caused the farm prices of all livestock and poultry commodities to decline. They also compared the impact of different hypothetical levels of import on beef price. Fauzia Y. *et al.*, (2000) have reported if the beef cattle female breeding stock import is increased up to 30 thousand heads/year at 15% slaughter can increase self-sufficiency rate up to more than 30% by the year 2015. The impact of 30 thousand imported female breeding stock at 10% slaughter rate can increase the self-sufficiency rate up to more than 40% by the year 2015. The overall simulated results from SIMM model indicate that beef production can be increased by higher number of cattle population through higher female breeding stock beef population. Eusof *et al.* (1999) have reported that increasing the percent calf-crop up to 80% can more than double the self-sufficiency rate by the year 2020. Reducing heifer culled to 10% can increase the rate to more than 15%. Therefore, management for the rates of calving, mortality, slaughter and importation of female breeding stock are the main effective inputs for increasing beef production. In order to not to be dependent on foreign countries for beef, Malaysia needs to increase her beef production to attain self-sufficiency in future. On this

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background, the objective of the study has done to evaluate the impact of beef production on self-sufficiency under different management strategies using Simulation Matrix (SIMM) model.

MATERIALS AND METHODS

Total beef supply for consumption in the market is the sum of imported beef and fresh beef production from beef, dairy cattle and buffalo. Figure 1 shows that the amount of fresh local beef can increase by enhancing the number of breeding stock and calves. The outcome of this component is to reduce the amount of imported beef by increasing local beef production and lastly to come to an equilibrium point with beef demand. Beef supply is calculated by the amount of imported beef and fresh beef production. Equation 1 determines the current beef supply level using the current level local beef production and imported beef.

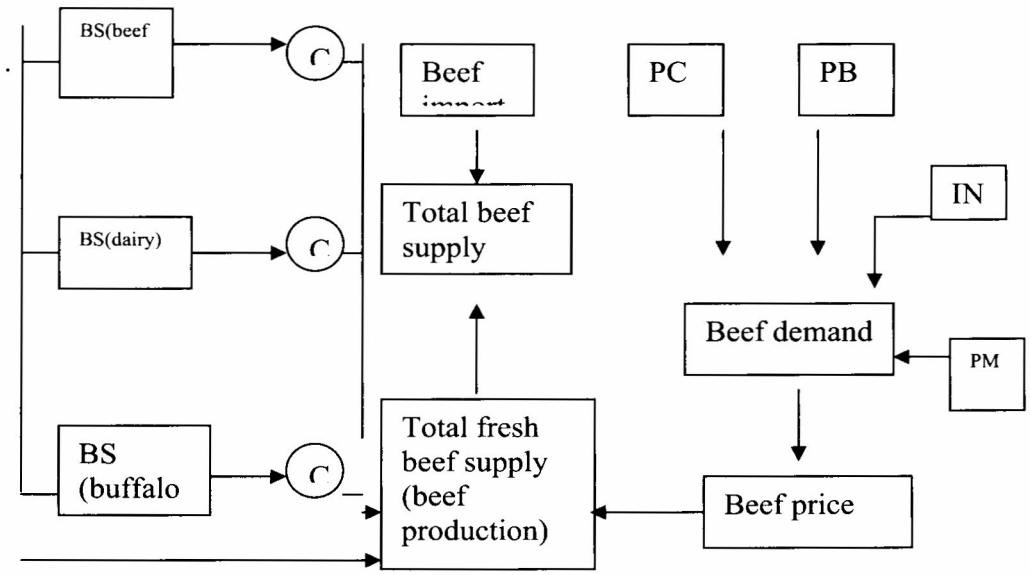

Fig. 1. The Flow Diagram of Beef market model

Note: PB = beef price, PM = mutton price, PC = poultry price, IN= income, C = calves.

The equation:

$SB_{(t+DT)} = PROD_{(t+DT)} + IMB_{(t+DT)} = DB_{(t+DT)}$.....(1)

Where,

$SB_{(t+DT)}$ = Current Supply of beef, $PROD_{(t+DT)}$ = Current Local fresh production of beef

$IMB_{(t+DT)}$ = Current Imported beef, $DB_{(t+DT)}$ = Current Demand for beef $PROD_{(t+DT)}$ is computed in the production component by multiplying the recorded number of cattle for slaughter by 1.23 as a correction factor for unrecorded slaughter and by 0.114 for the meat conversion factor for beef, dairy cattle. To calculate the production of fresh beef from buffalo, the recorded number of buffalo for slaughter is multiplied by 1.20 as a correction factor unrecorded slaughtering and by 0.181 for the meat conversion factor. The correction and conversion factors (equation 2a and 2b) have been put forward and used by Department of Veterinary Services (DVS) for estimating the fresh beef production from cattle and buffalo (Sarmin, 1998).The total amount is calculated from the sum of the three sources such as beef, dairy cattle and buffalo for current year.

The equation :

FBP = (SLC +SLD) * 1.23 * 0.114 + (SLB * 1.2 * 0.181)..... (2a)
or
FBP=(SLC +SLD)*0.14+SLB *0.22.....(2b)
Where,
FBP = Total fresh beef from beef, cattle and buffalo, SLC = Slaughtered beef cattle, SLD = Slaughtered dairy cattle, SLB = Slaughtered buffalo.
Projection of beef consumption for the year 1997 to 2015 is made on the assumption that, the average population growth is 2.3% per annum, and per capita income growth is 8.6% per annum and 1.5% income elasticity (Sarmin 1998). The following formula is used to compute beef comsumption toward the year 2015 (Zainalabidin, 1992).
The equation:
$Q_t = Q_o [(1 + Y_g . E_y) + P_g]$.....(3)
Where,
Q_t = Beef consumption in year t, Q_o = Beef consumption in last year
P_g = Annual rate of population growth, E_y = Income elasticity, Y_g = Annual rate of growth in per capita income.
The market for beef is in equilibrium (100% self-sufficiency) when the total beef supply is equal to the beef consumption, which is specified by:
SB = DB.....(4)

Coming to the point of beef self-sufficiency, this study needs some policy (production and trade) analysis to increase beef production but due to complexity of its reproduction dynamics requires the power of the simulation approach. Simulation model was developed based on system approach methodology to analyze the objective of the study using simulation matrix model (SIMM). The ex-post SIMM model for beef production system from 1960-96 was used as a base to simulate the ex-ante component by changing the rates of such as calving, slaughter, mortality rate and the level of importation of female breeding stock. Three statistical tests were used for validation, are: Root Means Square Error (RMSE), Root Means Square Percentage Error (RMSPE) and U-Theil's inequality coefficient.
The model of the system has been formulated and verified under ex-post simulation before simulation experiment can be performed. The stochastic elements in simulation model were created through the selection of random variables from define probability distribution. The ex-ante simulation allowed the use of IF and THEN statements in order to monitor the objective of the study.
Figure 2 showed the model-performance is directly comparable with the real system.

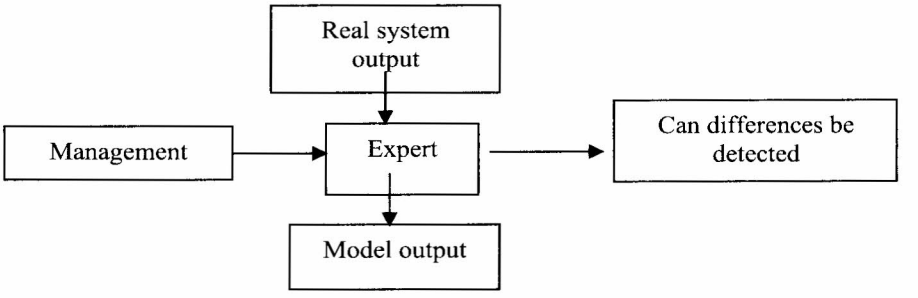

Fig. 2. The Diagram for Subjective Assessment of Real- System Data.

Five scenarios of different managements were developed to analyze the impact on beef production in Peninsular Malaysia.

Different Management Strategies under different scenarios

Different number of imported Female Breeding Stock with different calving, mortality and slaughter rate has taken under different scenarios to reduce beef import by increasing beef production in Malaysia. Scenario 1 showed no importation of female breeding stock and the existing rates of slaughter, calving and mortality to compare with 2, 3, 4 and 5 scenarios. Scenario 2 considered beef production in case of yearly imported female breeding stock with higher slaughter, calving rate and lower mortality rate whereas Scenario 3 considered lower slaughter rate. Only slaughter rate are opposite between Scenario 2 and 3. On the other hand, Scenario 4 and 5 are differed from Scenario 2 and 3 from yearly imported female breeding stock. Scenario 4 and 5 considered beef production in case of not yearly imported female breeding stock with higher slaughter, mortality rate and lower calving rate. All 4 Scenarios have compared with Scenario 1. Among all scenarios, which scenario able to produce more beef is able to reduce beef import; the best "beef population import" management strategy. Five Scenarios are as follows:

SCENARIO 1:

i) No importation of female breeding stock at slaughter rate 10-27%, calving rate 70-75% and mortality rate 5-10% for beef cattle

ii) No importation of female breeding stock at slaughter rate 10-15%, calving rate 70- 75% and mortality rate 5-10% for dairy cattle

iii) No importation of female breeding stock at slaughter rate 15-20%, calving rate 70-75% and mortality rate 5-10% for buffalo

SCENARIO 2:

i) Importation of 10000 heads female breeding stock/year at slaughter rate 30-35%, calving rate 76-80% and mortality rate 1-2% for beef cattle

ii) Importation of 5000 heads female breeding stock/year at slaughter rate 20-25%, calving rate 76-80% and mortality rate 1-2% for dairy cattle

iii) Importation of 500 heads female breeding stock/year at slaughter rate 25-30%, calving rate 76-80% and mortality rate 1-2% for buffalo

SCENARIO 3:

i) Importation of 10000 heads female breeding stock/year at slaughter rate 5-7%, calving rate 76-80% and mortality rate 1-2% for beef cattle

ii) Importation of 5000 heads female breeding stock/year at slaughter rate 5-7%, calving rate 76-80% and mortality rate 1-2% for dairy cattle

iii) Importation of 500 heads female breeding stock/year at slaughter rate 5-7%, calving rate 76-80% and mortality rate 1-2% for buffalo

SCENARIO 4:

i) Importation of 10000 heads female breeding stock/year up to 5 years at slaughter rate 15-20%, calving rate 55-60% and mortality rate 5-10% for beef cattle

ii) Importation of 5000 heads female breeding stock/ year at slaughter rate 15-20%, calving rate 55-60% and mortality rate 5-10% for dairy cattle

iii) Importation of 500 heads female breeding stock/ year at slaughter rate 15-20%, calving rate 55-60% and mortality rate 5-10% for buffalo

SCENARIO 5:

i) Importation of 10000 heads female breeding stock per every 5 years at slaughter rate 15-20%, calving rate 55-60% and mortality rate 5-10% for beef cattle

ii) Importation of 5000 heads female breeding stock /year up to 5 years at slaughter rate 15-20%, calving rate 55-60% and mortality rate 5-10% for dairy cattle

iii) Importation of 500 heads female breeding stock/ year at slaughter rate 15- 20%, calving rate 55-60% and mortality rate 5-10% for buffalo

RESULTS AND DISCUSSION

Beef market modeling

Beef demand will be in increasing trend. Table 1 shows in 1997, beef demand was only 79 thousand metric tonnes and would be it will be 232 thousand metric tonnes in 2015 whereas beef production will be only 31 thousand metric ton in 2015, i.e. beef demand shows an increasing trend due to increasing human population and their income. To meet up the demand, government has to imported beef from abroad. Table 1 shows supply (local production and import) and demand for beef is equal. The amount of beef import actually depends on the local beef production and demand for beef. Under different management strategies, scenario 3 shows the highest amount of beef and lowest amount of import. The effects of changing the calving rate, slaughter rate, mortality rate and importation of female breeding stock on beef import are shown in Table 1. It shows the amount of beef import will be higher for the first few years compared to other scenarios, from year 2002, it will be less compared to all other scenarios and will stop at the year 2012 due to 5-7% slaughter rate under scenario 3 but under scenario 2 at 30-35% slaughter rate, beef import will reduce due to higher beef production for the first few years and after that it will increase rapidly. Scenarios 1, 4 and 5 also show that beef import will increase rapidly up to 2015 due to lower calving, lower import of FBS and higher mortality and slaughter rate. Beef import under all scenarios will increase except for scenario 3.

Table 1. Performance of Beef Importation (Thousand Metric Tonnes) in Peninsular Malaysia

Year	Supply =Demand	Beef Importation (Thousand Metric Tonnes)									
		Scenario1		Scenario2		Scenario3		Scenario4		Scenario5	
		Import	Prod	Import	Prod	Import	Prod	Import	Prod	Import	Prod
1997	79	61	18	55	24	67	12	62	17	63	16
1998	84	69	15	57	27	67	17	68	16	68	16
1999	89	72	17	67	22	73	16	75	14	76	13
2000	94	77	17	63	26	71	23	75	19	76	18
2001	100	81	19	73	27	77	22	83	17	84	16
2002	106	89	17	82	24	81	25	89	17	90	16
2003	113	88	25	85	28	76	37	94	19	95	18
2004	120	96	24	90	30	74	46	99	21	100	20
2005	127	103	24	94	33	67	60	104	23	107	20
2006	135	117	18	106	29	79	56	118	17	120	15
2007	144	125	19	113	31	76	68	123	21	126	18
2008	152	134	18	119	33	75	77	132	20	134	18
2009	162	137	25	123	39	35	127	136	26	140	22
2010	172	141	31	132	40	25	147	147	25	151	21
2011	183	160	23	146	37	54	127	161	22	164	19
2012	194	166	28	148	46	0	217	169	25	173	21
2013	206	179	37	159	47	0	234	181	25	184	22
2014	219	192	27	170	49	0	253	195	24	200	19
2015	232	201	31	175	57	0	348	204	28	209	23

The amount of beef imported is estimated to decline from 67 thousand metric tonnes in the year 1997 to 54 thousand metric tonnes in the year 2011 under scenario 3 due to increase beef production 12 tmt in 1997 to 127 tmt in 2011. Beef import is estimated to increase from 61, 55,62 and 63 thousand metric tonnes in the year 1997 to 201, 175, 204 and 209 thousand metric tonnes under scenarios 1, 2, 4 and 5 respectively.

Beef Self-sufficiency Performance:

Only at 5-7% slaughter rate, self-sufficiency will be increased from 15% in 1997 to 150% in 2015 whereas at 30-35% slaughter rate, self-sufficiency will be decreased 30% in 1997 to 25% in 2015. The results cast that the lowest slaughter rate with imported female breeding stock has a great impact on the rate of beef production self-sufficiency. Therefore, from 1997 it will be increased slowly at 5-7% but from 2002 it will be increased rapidly. The self-sufficiency will be higher under scenario 2 compared to scenarios 4 and 5 (Table 3). At the existing rates, beef production could not be self-sufficient (Figure 3).

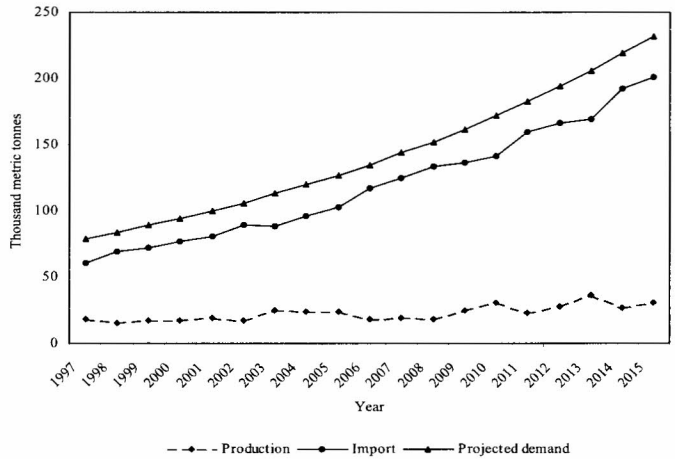

Fig. 3. Ex-ante Simulation Analysis for Beef Production, Import and Projected Demand in Peninsular Malaysia, Thousand Metric Tonnes, 1997-2015, SCENARIO 1

Scenario 1, 4 and 5 show that self-sufficiency will be decreased from 23%, 22% and 20% in 1997 to 13%, 12% and 10% in 2015 respectively. The simulated results illustrate that the 100% rate of beef production self-sufficiency in the year 2011-2012 is possible only under scenario 3 compared to other scenarios (Figure 4).

Table 2. Ex-ante Simulation Analysis for Beef Self-sufficiency Level in Peninsular Malaysia, Percentage (%), 1997-2015, All Scenarios

Year	SCENARIO 1 (%)	SCENARIO 2 (%)	SCENARIO 3 (%)	SCENARIO 4 (%)	SCENARIO 5 (%)
1997	23	30	15	22	20
1998	18	32	20	19	19
1999	19	25	18	16	15
2000	18	28	24	20	19
2001	19	27	23	17	16
2002	16	23	24	16	15
2003	22	25	32	17	16
2004	20	25	38	18	17
2005	19	26	47	18	16
2006	13	21	42	13	11
2007	15	22	47	15	13
2008	12	22	51	13	12
2009	15	24	78	16	14
2010	18	23	85	15	12
2011	13	20	70	12	10
2012	14	24	112	13	11
2013	18	23	114	12	11
2014	12	22	116	11	9
2015	13	25	150	12	10

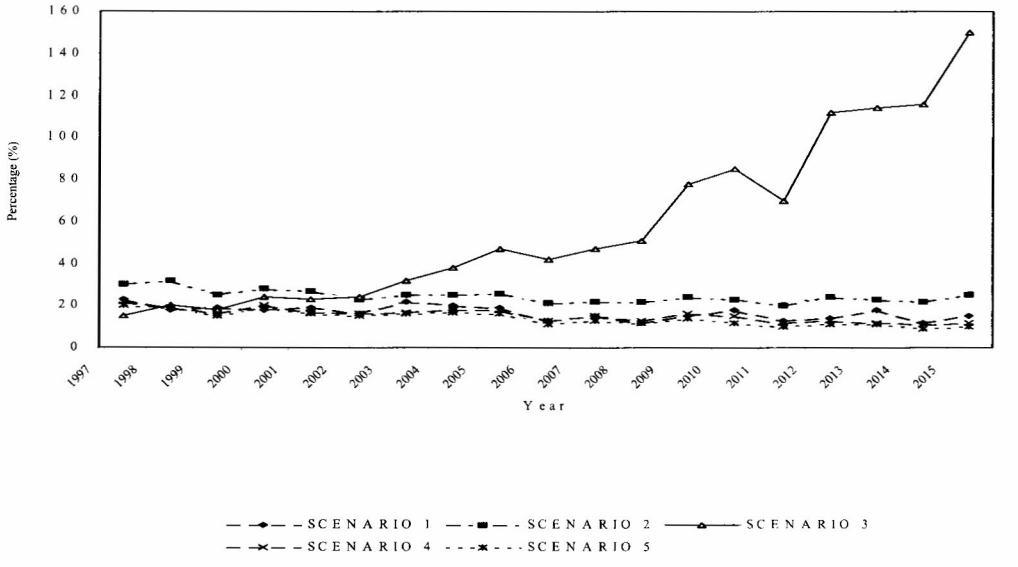

Fig. 4. Ex-ante Simulation Analysis for Beef Self-sufficiency in Peninsular Malaysia, Percentage (%), 1997-2015, All SCENARIOS

CONCLUSION

Simulated results indicated that in order to maintain the higher rate of self-sufficiency, the rates of mortality, slaughter will have to be reduced and the rate of calving and importation of female breeding stock will have to be increased. Self-sufficiency results for beef production also suggest to lessen the rate of slaughter providing strong restriction on FBS slaughter and side by side enhancing the rate of MBS and MC slaughter, thus it is possible to increase beef production. The overall results from simulation model indicate that beef production can be increased through increasing the number of female breeding stock only but this model does not include the effect on higher slaughter of MBS, MC to increase beef production. So policies towards for increasing slaughter rate for MBS and MC need to be seriously considered to boost local beef production. In the case of higher calving rate (76-80%), it needs better management system, animal husbandry, accelerating program for artificial insemination; and continuous importation of high bred female breeding stock (beef, dairy, buffalo) is needed. In addition, it also needs to consider grazing and nutrition intake for increasing the productivity and improve the quality of beef. On the other hand, high breed female breeding stock has very poor resistance power to cope with the local weather. So, it is not so easy to reduce mortality rate up to 1-2%, of course, mortality rate can be reduced from 5-10% by giving government emphasis on medical facilities, quality of feed and intensive care for cross breeding. This will require a large amount of government investment cost but it is possible to cover up by reducing beef importation cost. Therefore, importation of female breeding stock with reducing slaughter rate and mortality rate and increasing calving rate have greater impact on the self-sufficiency level for beef production.

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