

Technical Efficiency of Beef Cattle Production in West Nusa Tenggara

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ABSTRACT

The characteristics of beef cattle business in West Nusa Tenggara province which are dominated by small-scale farmers by semi-intensive and extensive systems are relatively inefficient. The research objectives were to identify the factors that influenced the level of production and analyze the technical efficiency of beef cattle production in West Nusa Tenggara. The research used cross section data taken from the results of the 2014 Livestock Household Survey (ST2013-STU) conducted by the Indonesia Central Bureau of Statistic. The analytical method used in this study was the stochastic frontier production function. The analysis results of the stochastic frontier production function showed that forage fodder input, concentrates, labour, animal health care and herd size are influential factors on beef cattle production. The average level of technical efficiency of beef cattle farmers in West Nusa Tenggara is 0.705. This shows that the average productivity achieved is 70.5 percent, which means that production can still be increased by 29.5 percent to achieve maximum productivity. The policy to reduce the level of technical inefficiency is by providing facilitation to farmers in order to change their production systems from extensive to intensive or semi-intensive.

Keywords: Beef Cattle, Inefficiency Effect, Stochastic Frontier, Technical Efficiency

I. INTRODUCTION

Demand for beef in Indonesia continues to increase, it is shown by the beef consumption per capita from 2010 to 2017 with average annual increase of 7.31 percent. National beef consumption per capita currently reaches 2.88 kg/capita/year (BPS 2017). Meanwhile, beef production has not been able to meet the needs/ consumption of national beef. Beef production was 468 thousand tons in 2017, while its consumption was 729 thousand tons. So that there was a deficit of 261 thousand tons (BPS 2017).

Regionally, the beef production and the beef consumption are not balanced. Especially in Java with a dense population, the demand for meat reaches 417.84 thousand tons while its production is only 156.04 thousand tons. Domestic beef production deficits also occur in Sumatra and Kalimantan. The excess demand for meat is 21.17 thousand in Sumatra and 17.16 thousand tons in Kalimantan. Although in other regions such as Bali, Nusa Tenggara and Sulawesi, the production exceeds the number of needs in each island, but the excess production has not been able to meet national needs (BPS 2017).

One province that has excess beef production is the province of West Nusa Tenggara (NTB). NTB Province has a population of beef cattle 1.01 million heads of beef cattle with beef production of 34.47 thousand tons, while the level of consumption is 26.17 thousand tons. This condition reflects a surplus of 8.3 thousand tons, so that NTB province can be said to be one of the national cattle barns (BPS 2017). However, the excess production is thought not to reflect the maximum production conditions of beef cattle business in the NTB province.

Most beef cattle business in NTB province is carried out by small scale farmers (1-2 heads) of 56.20 percent. The remaining 37.46 percent are medium scale farmers (3-9 heads), and 6.34 percent are large scale farmers (more than 10 heads). The beef cattle production systems in NTB province is 62.64 percent grounded (intensive), 12.75 percent is released (extensive), and 24.16 percent is grounded and released (semi-intensive). While the business purposes of beef cattle in NTB province is mostly for cow-calf operation of 79.49 percent, the remaining 20.33 percent for fattening and 0.18 percent for breeding (BPS 2017).

The characteristics of beef cattle business in NTB province which are dominated by small-scale farmers with cow-calf operation and the existence of semi-intensive and extensive systems are thought to affect production performance. The performance of beef cattle production is reflected by its level of efficiency. Increased efficiency of beef cattle business on an ongoing basis can increase domestic beef production, especially in the province of NTB. Production efficiency is related to the use of production inputs starting from the availability of feed, management and animal health, as well as technological innovation and other external factors (Soekardono 2009).

Research on efficiency in beef cattle business has been carried out abroad. Mlote et al. (2013) conducted a

study on the technical efficiency of small-scale beef cattle fattening business in Tanzania using the stochastic frontier analysis (SFA) method. Trestini (2006) examined the technical efficiency of beef cattle production in Italy using the heteroscedastic non-neutral production frontier approach. However, the study of efficiency in livestock business, especially beef cattle in Indonesia, is still rare. Some of the studies that have been carried out include Indrayani et al. (2012) suggested that the production efficiency of fattening beef cattle in Agam Regency of West Sumatera province was influenced by the use of feed input concentrates, cattle age, and livestock ownership.

The empirical results provide an opportunity to conduct research on the technical efficiency of beef cattle business in Indonesia, especially NTB province, which is a national cattle barn using stochastic frontier analysis. Based on the description of the background and the formulation of the problem described, this study aims to: (1) identify and analyze the factors that influence the level of production of beef cattle production in NTB; (2) identify and analyze factors that affect the technical efficiency of beef cattle production in NTB.

II. METHODS AND MATERIAL

A. Category and Data Sources

This study used cross section data taken from the results of the 2014 Livestock Business Household Survey (ST2013-STU) conducted by the Indonesia Central Bureau of Statistic. The number of samples in the survey for the purposes of this study were 2808 households in beef cattle farms in the NTB province.

B. Data Analysis

This study used the Cobb-Douglas production function model in accordance with Battese et al. (2004). Some of the reasons for using the Cobb-Douglas production function are because they are

relatively simple, can be transformed into additive linear forms, and rarely cause problems. The Cobb-Douglas production function after being transformed into a linear logarithmic form for the farmer-*i* is:

$$\ln Y_i = \beta_0 + \beta_1 \ln X_{1i} + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \beta_4 \ln X_{4i} + \beta_5 \ln X_{5i} + (v_i - u_i)$$

with Y_i = the production value of beef cattle business (Rp.); X_{1i} = amount of forage feed (kg); X_{2i} = amount of feed concentrate (kg); X_{3i} = number of labours (person); X_{4i} = input value of animal health care (Rp); X_{5i} = herd size (heads); β_0 = intercept; $\beta_1, \beta_2, \beta_3, \beta_4,$ and β_5 are the estimated parameter coefficients; $v_i - u_i$ = error term (v_i is noise effect, and u_i is the effect of technical inefficiency in the model); i = beef cattle business household.

The technical efficiency of beef cattle business is defined as the ratio between the actual output and the frontier output, using the available technology, formulated as follows:

$$TE_i = \frac{Y_i}{e^{x_i \beta + v_i}} = e^{-u_i}$$

The value of technical efficiency is in the range of zero and one, $0 \leq TE_i \leq 1$. Technical efficiency is in contrast to technical inefficiency, so the value of technical inefficiency is $1 - TE_i$.

The form of the technical inefficiency function of the farmer-*i* is:

$$u_i = \delta_1 z_1 + \delta_2 z_2 + \delta_3 z_3 + \delta_4 z_4 + \delta_5 z_5 + \delta_6 z_6 + \delta_7 z_7 + \delta_8 z_8 + \delta_9 z_9 + \delta_{10} z_{10} + w_i$$

with u_i = the effect of technical inefficiency; z_1 = age (years); z_2 = business scale dummy (1: small (1-2 heads), 2: medium (3-9 heads), 3: large (≥ 10 heads)); z_3 = beef cattle production systems dummy (1: intensive, 2: extensive, 3: semi intensive); z_4 = education level dummy (1: not graduating from

elementary school, 2: elementary school, 3: junior high school, 4: high school; 5: diploma1/diploma2; 6: diploma3; 7: under graduate; 8: graduate/post graduate); z_5 = financing dummy (1: obtaining financing, 0: not obtaining financing); z_6 = extension dummy (1: obtaining extension, 0: not obtaining extension); z_7 = farmer group membership dummy (1: member of farmer group, 0: not member of farmer group); z_8 = experience dummy (1: <1 year, 2: 1-5 years, 3: 5-10 years, 4: > 10 years); z_9 = business purposes dummy (1: breeding, 2: fattening, 3: cow-calf operation); z_{10} = gender dummy (1: male, 0: female); w_i = random variable; $\delta_1, \dots, \delta_{10}$ = the estimated parameter of the inefficiency variable.

III. RESULTS AND DISCUSSION

A. Characteristics of Farmers and Beef Cattle Business

The age structure of beef cattle farmers in NTB is quite old. Based on Table 1, the largest percentage (around 38.43 percent) of beef cattle farmers in NTB is more than 50 years. The average age of beef cattle farmers in NTB (47 years). The percentage of young farmers (less than 30 years) is only 5.56 percent. If it is assumed that there is no transfer of employment from beef cattle farmers and farmers will stop raising livestock at the age of 60 years, then in the next 10 years NTB will lose almost half of the farmers. Therefore a rejuvenation policy for beef cattle farmers is needed.

The percentage of male farmers as shown in Table 2 is far greater (93.87 percent) than female farmers. In general, the average value of male farmers output is greater than the output value of female farmers. The output value of male farmers is Rp. 7.17 million, while the output value of female farmers is only Rp. 4.82 million. This might be because work as a farmer requires the outpouring of physical energy which is predominantly done by men.

Table 1. The percentage of beef cattle farmers in NTB according to age group

Age group (years)	Percentage
< 30	5.56
30-35	9.05
35-40	13.07
40-45	14.21
45-50	19.69
> 50	38.43
Total	100.00
Average (years)	47.00

The education level by beef cattle farmers in NTB as shown in Table 3 is generally low. 53.95 percent of farmers not finished elementary school. While the percentage of farmers with higher education level is as follows: diploma1/diploma2 (0.28 percent), diploma3 (0.21 percent), under graduated (1.82 percent), and none graduated or post graduated. This is big concern for the government to prepare prospective beef cattle farmers in the future in order to have a higher level of education.

Table 2. Percentage of farmers and average value of output of beef cattle business in NTB by gender

Gender	Percentage	/Value
Male	Percentage of farmers	93.87
	average value of output (000 Rp)	7171.02
Female	Percentage of farmers	6.13
	average value of output (000 Rp)	4821.95
Total	Percentage of farmers	100.00
	average value of output (000 Rp)	7027.13

The sources of financing for beef cattle business can be sourced from their own costs or from loans or financing from financial institutions and non-financial institutions (individuals). Financing can come from banks, rural banks, other financial institutions,

cooperatives or individuals. Farmers who obtain financing (4.34 percent) are less than farmers who do not receive financing (95.66). This indicates that beef cattle farmers in NTB still have difficulty accessing financing for increasing their business capacity.

Table 5 shows that the majority of farmers in NTB did not received extension (91.92 percent), and only 8.08 percent received extension. The results also showed that farmers who received extension had a higher average value of output of beef cattle business than farmers who did not received extension. This shows that extension has an important role in increasing the ability of farmers to increase the value of their business output.

Table 3. Percentage of beef cattle farmers in NTB according to education level

Education	Percentage
not graduating from elementary school	53.95
Elementary school	25.00
Junior high school	9.97
High school	8.76
Diploma1/diploma2	0.28
Diploma3	0.21
Under graduate	1.82
Graduate or post graduate	0.00
Total	100.00

The fact that there are still few beef cattle farmers in NTB who are members of farmer groups (14.74 percent) as presented in Table 6. This is thought to be the cause of at least farmers getting extension because extension agencies usually use farmer groups as a means to disseminate livestock technology. The results showed that farmer members of farmer groups had an average value of output of beef cattle business that were larger than farmers who were not members of farmer groups. This shows that farmer groups act as a place for farmers to improve their abilities and knowledge.

Table 4. Percentage of farmers and the average value of output of beef cattle business in NTB according to financing

Financing		Percentage /Value
Obtaining financing	Percentage of farmers average value of output (000 Rp)	4.34 5853.07
Not obtaining financing	Percentage of farmers average value of output (000 Rp)	95.66 7080.46
Total	Percentage of farmers average value of output (000 Rp)	100.00 7027.13

The beef cattle business in NTB is mostly carried out on a small scale business (56.20 percent) as presented in Table 7. The results of the study also show that farmers with large business scale have an average value of output of beef cattle business that is larger than medium or small scale farmers. This shows that increasing the scale of business is needed to increase the output value of beef cattle business. The role of government is needed in increasing business scale through facilitation and ease of access to finance.

Table 5. Percentage of farmers and the average output value of beef cattle farms in NTB according to the extension

Extension		Percentage /Value
Obtaining extension	Percentage of farmers average value of output (000 Rp)	8.08 9583.15

Not obtaining extension	Percentage of farmers average value of output (000 Rp)	91.92 6802.33
Total	Percentage of farmers average value of output (000 Rp)	100.00 7027.13

The fact that not a few beef cattle farmers in NTB have their livestock raised by extensive system (12.75 percent) or semi intensive systems (24.61 percent) as presented in Table 8. This is caused by the NTB province's landscape which is partly grassland, bush, and Forest. The results showed that the farmers who raised livestock by being semi intensive had an average value of output of beef cattle business that were larger than the farmers who raised livestock by being intensive or extensive.

Most of the beef cattle business in NTB is for cow-calf operation (79.49 percent), the rest is the fattening beef cattle (20.33 percent), and beef cattle breeding (0.18 percent). The results showed that farmers with the aim for cow-calf operation had an average value of output of beef cattle business (Rp. 7.34 million) greater than farmers with the aim for fattening (Rp. 5.81 million) and breeding (Rp. 6.39 million). This shows that there are allegations that farmers with the aim of fattening and breeding have not managed their business efficiently.

Table 6. Percentage of farmers and average output value of beef cattle business in NTB according to farmer group membership

Farmer group membership		Percentage /Value
Member of farmer group	Percentage of farmers average value of	14.74 8529.78

	output (000 Rp)		
Not member of farmer group	Percentage of farmers	85.26	
	average value of output (000 Rp)	5853.07	
Total	Percentage of farmers	100.00	
	average value of output (000 Rp)	7027.13	

Table 7. Percentage of farmers and average value of output of beef cattle business in NTB according to business scale

Business scale		Percentage /Value
Small scale	Percentage of farmers	56.20
	average value of output (000 Rp)	4371.94
Medium scale	Percentage of farmers	37.46
	average value of output (000 Rp)	7793.88
Large scale	Percentage of farmers	6.34
	average value of output (000 Rp)	26034.21
Total	Percentage of farmers	100.00
	average value of output (000 Rp)	7027.13

Farmers with raising experience 1-5 years have the largest percentage (37.18 percent), followed by farmers with more than 10 years experience (30.84 percent), farmers with 5-10 years experience (25.71 percent), and farmers with less than one year experience (6.27 percent). But farmers with more than 10 years of farming experience have the highest average output value of beef cattle business (Rp. 9.73 million) compared to farmers with other farming experiences. This shows that the experience of raising

livestock is needed to increase the value of output of beef cattle business in NTB because the duration of experience is thought to correlate with knowledge of farm management skills. The government needs to overcome the skills gap between farmers who are experienced with less experience. Policies that can be pursued include increasing extension to farmers who have little experience in raising livestock.

Table 8. Percentage of farmers and average value of output of beef cattle business in NTB according to beef production systems

Beef production systems		Percentage /Value
Intensive	Percentage of farmers	62.64
	average value of output (000 Rp)	5844.24
Extensive	Percentage of farmers	12.75
	average value of output (000 Rp)	7729.72
Semi intensive	Percentage of farmers	24.61
	average value of output (000 Rp)	9674.28
Total	Percentage of farmers	100.00
	Average value of output (000 Rp)	7027.13

Table 9. Percentage of farmers and average value of output of beef cattle business in NTB according business purposes

Business purposes		Percentage /Value
Cow-calf operation	Percentage of farmers	79.49
	average value of output (000 Rp)	7340.17
Fattening	Percentage of farmers	20.33

	average value of output (000 Rp)	5809.06
Breeding	Percentage of farmers	0.18
	average value of output (000 Rp)	6390.00
Total	Percentage of farmers	100.00
	average value of output (000 Rp)	7027.13

B. Analysis of Beef Cattle Production

Table 10 presents the average, standard deviation, maximum and minimum values of production, use of forage feed inputs, feed concentrates, labor, animal health maintenance costs, and the number of livestock

Table 10. Value of production and use of inputs for beef cattle production in NTB

Variable	Average	Standard deviation	Maximum	Minimum
Output value (Rp. 000)	7027.13	9835.50	260000	200
Forage fodder (Kg)	12919.93	12129.30	109500	0
Concentrates (Kg)	338.82	3188.08	87600	0
Labour (people)	1.37	0.63	11	1
Animal health care (Rp. 000)	46.72	171.92	6600	0
Herd size (head)	3.65	5.61	120	1

raised in NTB province. The average use of forage feed is greater than concentrate feed. This is because most of the beef cattle business purposes in NTB is cow-calf operation. Feed concentrates are used more for fattening beef cattle. The maximum amount of labor used for beef cattle business in NTB is 11 people, while the minimum number is one person. The maximum number of livestock raised by beef cattle farmers in NTB is 120, while the minimum number is one.

The results of estimating production function parameters as presented in Table 11 show that in general all coefficients of production function variables have a positive and significant effect on beef cattle production. The use of forage feed has a positive and significant effect on the value of beef cattle production with an elasticity of 6.1 percent. This is in accordance with the research of Kalangi et al. (2014) which states that the use of forage feed has an elasticity of 69.1 percent and has a positive effect on

the production of beef cattle breeding business in East Java. Feed concentrate also has a positive and significant effect on the value of beef cattle production with an elasticity of 1.2 percent. This result is in line with previous research conducted by Indrayani et al. (2012) which states that concentrate feed has a positive effect on the production of fattening beef cattle in Agam district, West Sumatera province.

The results of estimating production function parameters as presented in the labor input have a positive and significant effect on beef cattle production in NTB with an elasticity of 12.7 percent. This result is in accordance with the Trestini (2006) study that showed labor input has a positive and significant effect with an elasticity of 22.1 percent for beef cattle production in Italy. The effect of animal health maintenance inputs on beef production is positive and significant. The same thing happened in the study of Otieno et al. (2012) which showed that

the input value of livestock health care has a positive influence with an elasticity of 8 percent for beef cattle production in Kenya.

The variable herd size shows greater elasticity than other inputs. The herd size elasticity is 66.6 percent of beef cattle production in NTB. This result is in line with the research of Mlote et al. (2013) which shows

the variable herd size has a positive and significant effect on the production of small-scale beef cattle fattening businesses in Tanzania. This has implications if the increase in the herd size has a positive and significant effect on increasing beef cattle production. The government needs to issue policies to increase herd size to increase beef cattle production.

Table 11. The results of estimating parameters of the beef cattle production function in NTB

Variabel	Coeffisien	Standard Error	t-ratio
Constant (β_0)	7.657***	0.104	73.48
Forage fodder (β_1)	0.061***	0.011	5.51
Concentrates (β_2)	0.012***	0.005	2.65
Labour (β_3)	0.127***	0.030	4.31
Animal health care (β_4)	0.027***	0.005	5.25
Herd size (β_5)	0.666***	0.021	31.76

Level of significance: ***sig. $\alpha=1\%$, **sig. $\alpha=5\%$, *sig. $\alpha=10\%$.

C. Technical Efficiency of Beef Cattle Production

The value of technical efficiency can be obtained by comparing the actual output with the output frontier function. According to the results of research conducted by Indrayani et al. (2012), the average level of technical efficiency achieved by beef cattle fattening farmers in Agam regency, West Sumatera province is 0.764. While the results of the research by Kalangi et al. (2014), showed that the average level of technical efficiency of breeding business in beef cattle in East Java is 0.80 in the highlands, and 0.64 in the lowlands. Some of the results of overseas research as conducted by Mlote et al. (2013) showed that the average technical efficiency of small-scale beef cattle fattening businesses in Tanzania was 0.91. Whereas the research conducted by Trestini (2006) stated that the average technical efficiency of beef cattle business in Italy is 0.786.

The results of the study stated that the average level of technical efficiency of beef cattle farmers in NTB was 0.705. This shows that the average productivity achieved is 70.5 percent, which means that production can still be increased by 29.5 percent to

reach the frontier, which is the maximum productivity that can be achieved with the best management system. Until now no provisions have been found regarding the minimum limit of efficiency values that can be referred to determine which farms are said to be efficient. Each researcher determines the minimum limit according to the results obtained and adjusted for the objective of his research. Kalangi (2014) stated that a business is said to be technically efficient if its value is close to 100 percent. Whereas Asmara et al. (2016) used three criteria in classifying the distribution of technical efficiency values, namely: category I: 0.80-1, category II: 0.50-0.79, and category III: 0.00-0.49.

Table 12 shows that the largest distribution of farmer efficiency in NTB is in category II, which is 69.02 percent with a total of 1938 farmers. Then as many as 615 farmers or 21.90 percent are in category I, and 255 farmers or 9.08 percent are in category III. These results indicate that the average productivity of beef cattle farmers in NTB is still below category I or which approaches the maximum level of productivity.

Table 12. Distribution of technical efficiency values of beef cattle production in NTB

Technical Efficiency Category	Number of farmers	Percentage
I: 0.80-1.00	615	21.90
II: 0.50-0.79	1938	69.02
III: 0.00-0.49	255	9.08

Most beef cattle farmers in NTB are over 50 years old (38.43 percent) with an average technical efficiency level of 0.703 as shown in Table 14. Whereas for beef cattle farmers aged 45-50 years have an average level of technical efficiency that is larger ie 0.715. But for beef cattle farmers with a younger age category than the previous two categories, they have lower average technical efficiency. But the difference in the level of technical efficiency based on the age of the farmer does not show significant or relatively the same.

Small-scale beef cattle farmers in NTB have an average technical efficiency level of 0.717 greater than medium-scale beef cattle farmers (0.691), and large-scale beef cattle farmers (0.683). These results indicate that the efficiency level of beef cattle farmers based on business scale does not show significant differences or relatively similar.

The results showed that the farmers of beef cattle in NTB by intensive system have an average technical efficiency level of 0.750 greater than the farmers whose extensive systems (0.562), and the farmers by semi intensive system (0.665). This showed that the intensive system is more efficiently than the extensive or semi-intensive systems.

Beef cattle farmers with diploma3 graduate education level have an average level of technical efficiency greater than farmers with other levels of education level which is equal to 0.920. However, differences in the level of efficiency based on education level are not significant or relatively the same. These results indicate that the level of education does not have a

significant effect on the level of efficiency of beef cattle business in NTB.

The results of the study stated that beef cattle farmers in NTB who obtained financing had an average technical efficiency level of 0.683 smaller than farmers who did not obtain financing (0.706). Likewise, farmers who get extension have an average level of technical efficiency of 0.704 smaller than farmers who do not obtain extension (0.705). Whereas farmers who are members of farmer groups have an average technical efficiency level of 0.723 greater than farmers who are not members of farmer groups (0.702).

The average level of technical efficiency of beef cattle farmers in NTB according to the experience of farming shows a significant difference. Farmers with more than 10 years experience have an average technical efficiency level of 0.726 greater than farmers with 5-10 years experience (0.724), farmers with 1-5 years experience (0.696), and less than one year experience (0.581). These results indicate that the longer the experience of raising more efficient beef cattle business. The experience of long-term farming also shows the higher ability or skill of farmers in managing their business.

Table 13 shows that beef cattle farmers in NTB with the aim of fattening businesses have an average technical efficiency level of 0.741 greater than the breeding business (0.740), and cow-calf operation business (0.696). Male farmers have an average level of technical efficiency of 0.706 greater than the female

farmers (0.693). But the average level of technical efficiency of the two variables is not significantly different or relatively the same.

Table 13. The average technical efficiency of beef cattle production in NTB according to influencing variables

Variable	Category	Technical Efficiency
Age of farmer	> 50 years	0.703
	45-50 years	0.715
	40-45 years	0.708
	35-40 years	0.706
	30-35 years	0.699
	< 30 years	0.689
Education level	Not graduating from elementary school	0.713
	Elementary school	0.709
	Junior high school	0.696
	High school	0.668
	Diploma1/diploma2	0.673
	Diploma3	0.920
	Under graduate	0.622
	Graduate or post graduate	-
Business scale	Small scale	0.717
	Medium scale	0.691
	Large scale	0.683
Beef cattle production systems	Intensive	0.750
	Extensive	0.562
	Semi intensive	0.665
Financing	Obtain financing	0.683
	Not obtain financing	0.706
Extension	Obtain extension	0.704
	Not obtain extension	0.705
Farmer group membership	Member of farmer group	0.723
	Not member of farmer group	0.702
Experience	> 10 years	0.726
	5-10 years	0.724
	1-5 years	0.696
	< 1 years	0.581
Business purposes	Breeding	0.740
	Fattening	0.741
	Cow-calf operation	0.696
Gender	Male	0.706
	Female	0.693
Technically efficiency	Maximum	0.939
	Minimum	0.141
	Average	0.705

D. Factors Affecting the Technical Inefficiency of Beef Cattle Production

The variable coefficient of beef cattle production systems showed a negative and significant effect on the technical inefficiency of beef cattle business in the NTB province. This is reflected by the average difference in the value of technical inefficiency of beef cattle farmers whose intensive system are confined to the extensive system is -1,617. Likewise, the average difference in the value of technical inefficiency of beef cattle farmers is how they are semi intensive system with the extensive system of -0,769. The beef cattle production systems to be intensive or semi intensive can reduce the technical inefficiency of beef cattle business. Farmers by intensive or semi intensive systems is more efficiently than farmers by extensive system. According to Aryogi et al. (2005), the condition of beef cattle production which is still largely extensive, plus the temperature of overheated air, especially in the lowlands, causes the level of efficiency of consumption of nutrient rations is low.

The experience of farming shows a negative and significant influence on the technical inefficiency of

beef cattle business in NTB. This is reflected by the average difference in the value of technical inefficiency of farmers, whose experience of raising more than 10 years with less than one year is -1.424. Likewise, the average difference in the value of technical inefficiencies of farmers with experiences of raising 5-10 years with those less than one year is -1.448. Likewise with the average difference in the value of technical inefficiencies of farmers whose experience of raising 1-5 years with less than one year is -1,050. The experience coefficient that has a negative sign indicates that the longer the experience of farmers will be more efficient or the level of technical inefficiency will be lower. The level of experience of farmers will provide knowledge and skills in managing their business. The longer the experience of farming, tends to make it easier for farmers to make decisions related to the technical maintenance of their livestock business. This result is in accordance with the study of Mlote et al. (2013) that showed the experience variable of livestock contributes to reducing technical inefficiency by 4.3 percent for each year increased experience of small-scale beef cattle fattening farmers in Tanzania.

Table 14. The results of estimating the technical inefficiency parameters of beef cattle production in NTB

Variable	Category	Coefficient
Age of farmer		0.006
Education level	Elementary school	-0.027
	Junior high school	-0.003
	High school	0.133
	Diploma1/diploma2	0.230
	Diploma3	-3.350
	Under graduate	0.483
	Gradute or post graduate	-
Business scale	Medium scale	0.066
	Large scale	-0.145
Beef cattle production systems	Intensive	-1.617***
	Semi intensive	-0.769***
Financing	Obtain financing	0.273
Extension	Obtain extension	-0.186

Farmer group membership	Member of farmer group	0.171
Experience	> 10 years	-1.424***
	5-10 years	-1.448***
	1-5 years	-1.050***
Business purposes	Breeding	-0.097
	Fattening	-0.264
Gender	Male	-0.156

Level of significance: ***sig. $\alpha=1\%$, **sig. $\alpha=5\%$, *sig. $\alpha=10\%$; Reference dummy: small scale, extensive systems, not graduating elementary school, not obtaining financing, not obtaining counseling, not member of farmer group, <1 years experience, cow-calf operation, female.

IV. CONCLUSIONS AND RECOMMENDATION

A. Conclusion

Based on the results and discussion, several conclusions can be taken. In this study, all variables or production factors have a positive and significant effect on the value of beef cattle production in NTB. The variable herd size has the most dominant influence in influencing beef cattle production in NTB compared to other input variables. The average level of technical efficiency of beef cattle farmers in NTB is 0.705. This shows that the average productivity achieved is 70.5 percent, which means that production can still be increased by 29.5 percent to achieve maximum productivity. The beef cattle production systems which are intensive or semi intensive as well as the experience of raising more than one year can reduce the technical inefficiency of beef cattle business in NTB.

B. Recommendation

The results of this study have implications for the policy of developing beef cattle business in NTB. The recommended policy is to increase the herd size by facilitating financial access to increase productivity. Policy to reduce the level of technical inefficiency is by providing facilitation for farmers to change their beef cattle production systems from extensive to intensive or semi intensive systems. In addition, extension program are also needed for young farmers

or those with little experience to make their businesses more efficient.

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