Economic Performance of Madura Beef Cattle Industry in Sapudi Island

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Abstract. Madura beef cattle is a productive species and has high economic contribution. The farming system has uniqueness compared to other beef cattle farming systems. This study was conducted in Sapudi Island as main producer of madura beef cattle. The aims of the study were: 1) to analyze the status of the madura beef cattle industry; 2) to identify the critical aspects in madura beef cattle farming system in small island; and 3) to analyze the economic performance of madura beef cattle. The primary data were collected from the farmers and other actors through interviews using questionnaires. Descriptive analyses were used to analyze the data and phenomenon as well as operational efficiency ratio. The result indicates that the population of beef cattle in Sapudi was 39,977 heads and the number of families in this island was only 18.003 families. They raise the madura beef cattle with traditional technology. The critical aspects are: 1) lack of feed availability mainly forage. The farmers buy forage from Situbondo-East Java, 2) they always move their cage periodically to have more fertile land for their farmland. The economic performance of madura beef cattle is high. It is indicated by the positive operational efficiency ratio.

1. Introduction

There is a great potential for beef cattle intensification in Indonesia due to growing demand for meat. The condition above is due to the awareness of the people for the nutrition and increasing the wealth of the society. However, the demand for meat does not meet its supply [1]. The consequence is the volume of import tends to increase. Indonesia has high dependency to the exporter countries.

Beef cattle population are concentrated in Java, Sulawesi, and Bali. East Java is one of the provinces with the largest beef cattle population in Indonesia. It is about 4.4 million heads or 31.93 percent [2]. Further, the district in East Java that has potency of beef cattle is Madura Island. They have four districts that potential for raising Beef Cattle. According to Statistical Bureau of Sumenep, the population of beef cattle in Sumenep was 144,987 heads. Most of the population is in Sapudi Island. It is about 43,423 heads [3].

Madura Beef Cattle is a productive species of beef cattle in Indonesia. The contribution of this species is high in terms of economic contribution as well as employment. Besides that, the Madura beef cattle farming system has uniqueness compared to other beef cattle farming systems. They have to adjust the system suitable to the environment [3].

There are 4 (four) districts in Madura Island that have high populations of beef cattle, especially in Sumenep. One of the main producer is Sapudi Island. This location has a good environment and climate that support the development of beef cattle. In terms of the community, the farmers in Sapudi Island have traditional competency in raising Madura beef cattle. The population of Madura beef cattle in Sapudi Island is distributed in Nonggunong and Gayam sub-district. In this area, the population of Madura beef cattle is about 30% from beef cattle population in East Java.
Table 1. The Population of Beef Cattle by Sub-District in Sumenep

| Sub-District | 2011  | 2012  | 2013  | 2014  |
|--------------|-------|-------|-------|-------|
| Batuputih    | 16.172| 31.847| 32.182| 34.018|
| Gayam        | 25.522| 26.249| 26.521| 28.714|
| Nonggunong   | 20.815| 13.728| 13.876| 14.709|
| Dungkek      | 14.677| 22.198| 22.417| 18.989|
| Rubaru       | 13.921| 20.710| 20.912| 18.489|
| Lenteng      | 15.162| 18.653| 18.834| 17.014|
| Saronggi     | 11.458| 13.053| 13.211| 13.054|

Source: Statistical Bureau of Sumenep District, 2014

Based on Table 1, the population of beef cattle in Sumenep tends to increase. The average growth rate is about 31% per year. It indicates that the beef cattle sector is one of the dominant sector in Sumenep. The contribution of the beef cattle sector is in the gross domestic product and employment rate. From 2011 to 2014, the total population of beef cattle in Sapudi Islands is highest compared to other sub-districts in Sumenep.

Madura beef cattle is one of the superior species. They have several advantages, i.e. the high quality of meat, low fat, and very adaptive in the dry season. This way, the development of Madura beef cattle will have a positive impact on the meat self-sufficiency program. The government has decided that the Sapudi Island is the conservation area of Madura beef cattle [4]. The objectives of the development of the conservation area is to increase the population of Madura beef cattle and to preserve the locality aspect of Madura beef cattle. Raising Madura beef cattle has integrated into society in the social and cultural aspect. The Madura beef cattle farming system has uniqueness compared to other beef cattle farming systems. They have to adjust the system suitable to the environment. According to Sapudi people, beef cattle has several advantages such as tool for plowing, investment portfolio, source of income, and tourist attraction.

Based on the illustration above, the Madura beef cattle industry in Sapudi has an essential role and high potency to develop. The government has supported through regulations and infrastructure to maintain the Madura beef cattle species. But, there are several problems faced the Madura beef cattle industry. The availability of land for forage production is narrow. They just provided the forage in the wet season, and they will import it from other islands, especially in the dry season, whereas the quality and the quantity of forage have an impact on the productivity of Madura beef cattle [5]. The study about feed availability of Madura beef cattle has important contribution in terms of productivity, continuity, and economic perspective.

2. Materials and Methods

2.1. Location

This study was conducted in Sapudi Island due to this Island is the main producer of Madura beef cattle, and the population is the highest. Sapudi Island was chosen as a study site for three main reasons. First, the population of beef cattle in Sapudi Island was highest in Sumenep. Second, the government has decided that Sapudi Island is the conservation area of Madura beef cattle. The third, there are several uniqueness in raising Madura beef cattle in Sapudi.

This research covered two sub-district in Sapudi Island, Gayam and Nonggunong. Madura beef cattle was relatively distributed in that area. Gayam is the larger-producing area of beef Madura cattle in Sapudi Island and has many land for feed such as grass.

2.2. Data and Sampling

The primary data were collected from beef cattle farmers through personal interviews. Secondary data were gathered from several sources including the Indonesian Statistical Bureau, Directorate General of Livestock, and Central Bureau of Statistics of East Java.
According to the Technical Implementation Unit of livestock in Gayam, the beef cattle smallholder farmers were concentrated in the Sub-District of Gayam with a total population of 9,260 smallholder farmers. The number of samples of the smallholder farmers was determined using the following formula [6]:

\[ n = \frac{N}{1 + N \cdot e^2} \]

\[ n = \frac{9,260}{1 + 9,260(15\%)^2} \]

\[ n = \frac{9,260}{226,045} \]

\[ n = 41 \]

Where:
- \( n \) = the sample size
- \( N \) = the population size
- \( e \) = the level of precision

2.3. Analytical Tools
Descriptive analysis was used to analyze the status of the beef cattle industry as well as the production system and the role of the actors. The use of charts and diagrams and estimation of ratios, percentages, means, variances and standard deviations were employed. Market structure analysis involved the use market concentration ratio. It refers to the proportion of industry sales made by its largest firms. In general, the more concentrated the industry sales, the greater is the likelihood that the market will be imperfectly competitive [7]. Concentration ratio is defined as the number and relative size of distribution of buyers or sellers in a market. It measures the percent of traded value of beef cattle in rupiah accounted for by a given number of participants and is designated by the formula [8]:

\[ CR = \sum_{i=1}^{r} S_i \]

Where
- \( CR \) = concentration ratio
- \( S_i \) = the percentage market share of the \( i^{th} \) participant
- \( r \) = the number of the relatively larger participants for which the ratio is to be calculated

Market performance refers to the impact of structure and conduct as measured in terms of variables such as prices, costs, and volume of output. To evaluate the market performance in this study, cost and return analysis was used to determine the profitability of the beef cattle industry. As a measure of market performance, the profitability ratio measures the efficiency of the inputs used by the firm. It is the value of profit expressed per unit of cost. The profitability ratio is specified as follows:

\[ \text{Profitability ratio} (PR) = \frac{\Pi}{TC} \times 100\% \]

3. Results and Discussion
3.1. Beef Cattle and Livestock Production
The potency of livestock in Sapudi Island was relatively high. The highest population of livestock was beef cattle (Table 2) It was about 39.43%. The number of beef cattle in Sapudi was higher than the number of families in Sapudi. Beef cattle in Sapudi Island have a good quality. Farmers from other districts were willing to buy calves from Sapudi Island because the calves have superior quality, especially for bull race.
Table 2. The Population of Livestock In Gayam Sub-District Sapudi

| Livestock | Population (head) | Percentage (%) |
|-----------|-------------------|----------------|
| Beef Cattle | 26.311 | 39.43 |
| Horse | 42 | 0.06 |
| Goat | 19.330 | 28.97 |
| Sheep | 2.326 | 3.48 |
| Chicken | 18.177 | 27.24 |
| Duck | 541 | 0.82 |
| Total | 66.727 | 100 |

Source: Statistical Bureau of Sumenep, 2017

The population of beef cattle, goat and chicken in Sapudi were high. This condition could be a trigger for economic development in Sapudi Island and support the meat self-sufficiency program. This condition supported by the culture of the society. The Sapudi people have traditional knowledge of how to raise Madura beef cattle since their ancient. They believed that beef cattle industry was a profitable business and prospectus business in the future.

The average growth rate of the beef cattle population from 2009 to 2017 in East Java was 3.18% while the average growth rates in Madura (Bangkalan, Sampang, Pamekasan and Sumenep) were higher at about 4.37% (Table 3). Madura Island is the region with the largest population of beef cattle. The proportion of beef cattle in Madura itself was 21%[9].

In the years 2011 and 2012, the Madura beef cattle population was relatively high but sharply decreased in 2013. The decrease in beef cattle population of 11% was due to the number of slaughtered beef cattle being higher than the birth rate of calves. The same phenomenon was happened in East Java, declining rate of beef cattle was 26.92%. It was highest at the provincial level.

Table 3. Beef Cattle Population by Regency in East Java, 2009-2017 (per head)

| District | 2009 | 2010 | 2011 | 2012 | 2013 | 2014 | 2015 | 2016 | 2017 | Average |
|----------|------|------|------|------|------|------|------|------|------|---------|
| Bangkalan | 155.454 | 164.201 | 193.576 | 205.157 | 186.027 | 191.245 | 197.675 | 200.279 | 206.946 | 188.951 |
| Sampang | 123.597 | 176.076 | 196.414 | 196.807 | 180.849 | 203.863 | 211.176 | 212.776 | 215.020 | 190.731 |
| Pamekasan | 124.597 | 130.576 | 127.674 | 142.445 | 149.855 | 152.045 | 155.086 | 190.635 | 192.455 | 151.708 |
| Sumenep | 295.978 | 316.571 | 357.038 | 360.862 | 345.095 | 349.081 | 353.124 | 357.422 | 361.127 | 344.033 |
| Madura | 699.626 | 787.424 | 874.702 | 905.271 | 861.826 | 896.234 | 917.061 | 961.112 | 975.548 | 875.423 |
| Other Districts | 2.859.322 | 2.958.029 | 3.852.596 | 4.052.206 | 3.087.271 | 3.229.099 | 3.350.264 | 3.446.695 | 3.536.065 | 3.374.616 |
| Total East Java | 3.558.948 | 3.745.453 | 4.727.298 | 4.957.477 | 3.949.097 | 4.125.333 | 4.267.325 | 4.407.807 | 4.511.613 | 4.250.039 |

Percentage

| District | Bangkalan | Sampang | Pamekasan | Sumenep | Madura |
|----------|-----------|---------|-----------|---------|--------|
| 2009 | 4% | 3% | 4% | 8% | 20% |
| 2010 | 4% | 3% | 4% | 8% | 21% |
| 2011 | 4% | 3% | 4% | 8% | 19% |
| 2012 | 4% | 3% | 4% | 8% | 18% |
| 2013 | 5% | 4% | 5% | 9% | 22% |
| 2014 | 5% | 4% | 5% | 8% | 22% |
| 2015 | 5% | 4% | 5% | 8% | 21% |
| 2016 | 5% | 4% | 5% | 8% | 22% |
| 2017 | 5% | 4% | 5% | 8% | 22% |
| Average | 5% | 4% | 5% | 8% | 22% |

Source: Livestock Statistic of Indonesia, 2018

3.2. Beef Cattle Farming System

One factor that contributed to the success of livestock development in Madura is the source of good breed of cattle. Farmers in Sapudi Island preferred to fatten Madura species. As a conservation area of
Madura beef cattle, the farmers should raise Madura species. The advantage is the farmers have good quality of Madura beef cattle. They have the opportunity to sell the beef cattle in the high price.

Figure 1 describes that the farming system was still low. Due to the lack of capital, the farmers in Sapudi implemented the low technology. They could not implement the good farming practices. They only have 2-3 heads of Madura beef cattle. The farmers in Sapudi Island implement a movement cage system. This system moved beef cattle cage periodically. It was about 3-4 years. So, the initial land of beef cattle cage could be utilized as a fertile agriculture land. The farmer could plant forage for their beef cattle.

![Figure 1. Beef Cattle Production System in Sapudi](source: Primary Data, 2019)

The farmers in Sapudi Island also implemented an intercropping system to make sure they could fulfill the need for forage. Some of land could be utilized along the year while most of them were only utilized for three to four months. In Gayam, the land availability was higher compared to the Nonggunong. The topography condition also suitable for forage.

3.3. Core processes in Madura beef cattle farming system

The core processes in Madura beef cattle farming system are input provision, fattening, marketing, and slaughtering. All of these steps should be practiced properly to achieve high quality and productivity. During the input provision stage, several materials must be provided such as calves, feed, and traditional veterinary medicine and infrastructure. Some of the farmer-respondents are knowledgeable in the selection process for calves. They know how to select the good calves based on the species, age, and weight. While the large farmers prefer to buy calves of good quality, the smallholder farmers, on the other hand, buy the cheaper calves.

Based on the “good farming practice”, farmers should provide enough feed to assure the growth of calves. These feeds could be concentrate, polar, molasses, forage, hay, and silage. There is a specific formula of diet needed to gain high average daily gain (ADG) of calves. Veterinary medicine is also an important input in raising the calf’s weight. Foot and mouth disease, anthrax and other animal diseases must likewise be avoided.
The farmers usually raised their calves for 1 – 4 year. It was due to low average daily gain in weight, the farmers, especially the smallholders. So, the had to keep their calves much longer. Farmers also have to take care of the physical condition of the calves and must see to it that there are no physical injuries during the selling process.

There are three levels of market in the commodity chain, i.e., input sub-market, trader sub-market, and processing sub-market. In the input sub-market, the commodities are livestock inputs such as calves, feed, and veterinary medicine. In the trader sub-market and processing sub-market, the commodity is beef cattle. The most important market is the inter-province beef cattle market. The last step is the slaughtering process. The processor slaughters the beef cattle. The product is transformed from live beef cattle into carcass. In this research, only a limited discussion was made on the analysis of meat processing and distribution.

### 3.4. Market Concentration Ratio of Madura Beef Cattle farming system

Market concentration was calculated based on the value of beef cattle in the markets. The four largest participants from farmers were considered in the calculation of the market concentration ratio (CR4) as indicated in Table 4. The result is CR4 of farmers was 15% which also indicates a market type of an unconcentrated industry. It can also be said that the market is generally competitive. The farmers have about the same bargaining position. There is no dominant actor that can influence the market. The economic scale of farmers was small. They have only 2-4 heads of beef cattle.

| Aspect                        | Value          |
|-------------------------------|----------------|
| Number of Participants        | 41             |
| Value of four larger participants (Rp) | 71,000,000  |
| Total value of beef cattle (Rp) | 486,500,000  |
| CR4 (%)                       | 15%            |
| Minimum                       | 6,500,000      |
| Maximum                       | 30,000,000     |
| Sum                           | 486,500,000    |
| Mean                          | 11,865.854     |
| Standard Error                | 82.517.231     |
| Standard Deviation            | 3.240.417      |

Source: Primary Data, 2019

### 3.5. Market Performance of Madura Beef Cattle farming system

To examine the profitability of the beef cattle markets, cost and return analysis was used. Table 5 presents the R/C was about 1,041. It indicated that the beef cattle business have efficient business operation. This result was lower than R/C of beef cattle fattening in Gunung Madu Cooperation. It was 1,18 [10]. It caused due to the difference in beef cattle farming system. The farmers in Sapudi Island was still implemented the traditional technology.
Table 5. Market Performance of beef cattle farmers in Sapudi Island

| Component     | Value     |
|---------------|-----------|
| Depreciation  | 17.113    |
| Fixed Cost    | 36.403    |
| Variable cost | 11.347.952|
| Total cost    | 11.401.469|
| Total Revenue | 11.865.854|
| Profit        | 464.385   |
| R/C (Profit)  | 1.041     |
| Profit/TC     | 4%        |

Source: Primary Data, 2019

In terms of the profitability ratios analysis. The value of the farmer is equal to 0.04. These values mean that for every 100 rupiah invested, the farmer gained a net profit of 4 rupiah. This shows that the farmers have profitable business. This result similar to the research result of profitability ratio of beef cattle marketers in Southwest, Nigeria. The profitability ratio of beef cattle brokers were 0.03. It means the profitability ratio of beef cattle in Sapudi was higher. But, in the retailers level (0.07), the profitability ratio was lower [11].

4. Conclusion
The population of beef cattle in Gayam-Sapudi was 28,714 heads and the number of families in this Island was only 9,260 families. They raise the Madura beef cattle with traditional technology. The critical aspects of raising Madura beef cattle are: 1) lack of feed availability especially forage. 2) they always move their cage periodically to have more fertile land for their farmland. The economic performance of Madura beef cattle in Sapudi Island is high. It is indicated by the positive operational efficiency ratio and profitable

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