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The Optımızatıon Of Balı Cattle Farmıng Busıness Productıon In Gorontalo

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Abstract

Bone Bolango Regency is one of the regencies in the Province of Gorontalo that serves as a center for the development of beef cattle, especially Bali cattle. Livestock feed availability is managed independently by farmers through cultivating forages, and livestock business management activities are carried out in livestock pens. This study aims to analyze the optimization of production and economic scale in Bali cattle farming businesses in Bone Bolango Regency. The method used was a survey. Purposive sampling was used to select respondents with consideration for farmers engaged in Bali cattle fattening businesses in Bone Bolango Regency, totaling 92 individuals. Data analysis was conducted using Cobb-Douglas production function analysis. The results show that 1) The production factor of feeder cattle is inefficient, requiring a reduction in quantity to achieve an optimal value of 86 kg cattle weight. The use of medications is inefficient and needs to be reduced to achieve an optimal value of 1,353.15 mg. Meanwhile, labor is not yet efficient, requiring an increase in production factors to reach an optimal value of 524.04 man-days. The feed production factor is already efficient, with the quantity being appropriate to achieve the optimization of Bali cattle production, which is 3,631 kg. 2) The economic scale of Bali cattle farming businesses in the Kabila District of Bone Bolango Regency is in a position of Decreasing Returns to Scale, as indicated by a return to scale value of less than one, which is 0.852. That implies that any increase in fixed inputs in the long term is always followed by a diminishing increase in output.

Keywords: Optimization, Efficiency, Livestock Business, Bali Cattle

1. INTRODUCTİON

Bone Bolango Regency is one of the regencies in the Province of Gorontalo that serves as a center for the development of beef cattle. The population of beef cattle in Bone Bolango Regency was 35,974 heads in 2018, then increased to 43,007 heads in 2019, and 2020, there was a further increase to 47,384 heads ((BPS), 2022). The predominant breed of beef cattle raised by farmers in Bone Bolango Regency is the Bali cattle. The easy maintenance process and rapid environmental adaptation make Bali cattle a strong choice for farmers engaging in cattle farming. Typically, cattle farmers in this region pursue livestock business as a side business and savings.

Cattle farmers in Gorontalo Regency have now developed into the business of fattening beef cattle. Cattle pens have been constructed behind the farmers' houses, and the farmers' lands have been planted with forage crops. Fattening Bali cattle has become a household business for farmers, contributing to their economic well-being and fulfilling other needs.

Research on the economic efficiency of production factor utilization has been extensively conducted, as seen in studies such as (Wantasen, E., Stevy, P. P., Selvie, D. A., Sahrun. D., 2017) investigating the economic efficiency of forage utilization in beef cattle farming,(Kalangi, 2014) focusing on smallholder beef cattle breeding business, (Setianti, C., T, Ekowati., 2015) examining dairy cattle farming in the Livestock Business Area. (Indrayani, I., 2018) researched the factors influencing the income of beef cattle farming business, (Gill, J.B., 2016) studied farmers' decision-making in choosing integrated crop-livestock business in Brazil, (Gill, 2015) explored the adoption and development of integrated crop-livestock-forestry systems in Brazil, and (Stark, F, A. Fanchone, I.Semjen, 2016) examined the application of the Crop Livestock Integration (CLI) system, leveraging synergy between crop-livestock systems, resilience, efficiency, and productivity. Despite these prior studies, there seems to be a gap in research on production optimization in beef cattle farming. Therefore, this study aims to analyze the optimization of production and economic scale in the beef cattle farming business in Bone Bolango Regency.

2. LİTERATURE REVİEW

The success rate of beef cattle farming can be seen from optimal production results, contributing to increased income for farmers. This is evidenced by the growth in the number of beef cattle ownership by the farmers, the increase in the weight of the beef cattle, and the added value to the farmers' family income. The success of a beef cattle farming business, from the nurturing process until the sale for the farmer's income heavily relies on the available production factors. Production factors are crucial components in operating a beef

cattle farming business. Farmers must efficiently combine the production factors to ensure the farming business yields maximum results. Therefore, the utilization of production factors as essential inputs in beef cattle farming must be optimized to enhance overall production and increase farmers' income. The magnitude of the profit obtained is highly determined by the selling price of the production and the production costs incurred. Maximum profit will be achieved when all production factors are allocated efficiently and optimally, encompassing technical, pricing, and economic efficiency. In other words, farmers must optimize the use of production inputs to achieve high productivity while cost efficiency is maintained (Mandaka, S., and M. Parulian, 2005). Factors such as capital, land, and labor are essential in the production process. Ownership of these production factors is often low or very limited in smallholder farming. Therefore, to maximize profits, there is a need for efficient and optimal allocation of production factors (Astuti, M., Rini, W., and Yustina, 2010).

The magnitude of income obtained by beef cattle farmers is highly dependent on the selling price of the cattle and the production costs incurred during the nurturing period. Farmers must optimize the use of production inputs to achieve high productivity while maintaining cost efficiency. Hence, the maximum profit for farmers can be attained by equating the marginal productivity value of the output with the marginal cost incurred or the input price of the production factors used.

3. RESEARCH METHOD

The study was conducted in Bone Bolango Regency, specifically in the Kabila District, from January to March 2023. The selection of this area was purposive, considering that it is the only district actively developing Bali cattle fattening businesses. The method employed was a survey, collecting both primary and secondary data. Based on 2019 Statistics Indonesia (BPS) data, Kabila District had a population of 3,749 beef cattle and 1,117 farmers. The population consisted of farmers raising Bali cattle in Kabila District. Subsequently, the sample size of respondents was determined using the Slovin formula(Sugiyono, 2004) :

$$n = \frac{N}{1 + N \times e^2}$$

Details:

n = sample size = 92 individuals

N = population size = 1,117 individuals

e = error rate = 10%

Based on the Slovin formula above, the sample size of Bali cattle farmers with a 10% error rate is 92 farmers. The respondent selection was purposive sampling, considering

farmers engaged in Bali cattle fattening businesses in the Kabila District of Bone Bolango Regency. Data collection techniques included observation, interviews, and documentation.

In order to analyze the scale of economy and production optimization in the business of beef cattle farming, the Cobb-Douglas production function analysis was employed, as outlined by (Imran, 2022).

$Y = \beta_0 X_1^{\beta 1} X_2^{\beta 2} X_3^{\beta 3} X4^{\beta 4}. \ldots . Xn^{bn}. e^{u}$

Details:

Y = Production (Kg)
X_1 = Feeder Cattle (Heads).
X_2 = Feed (Kg)
X_3 = Medicine (mg)
X_4 = Labor (Man-day)
β = Estimated coefficients.
u = Disturbance tern
e = Natural logarithm, e = 2,718

According to (Jhon, 2013), for ease of estimation, the equation is transformed into the natural logarithm (ln) form, resulting in:

$LnY = \beta_0 + \beta_1 \ln X_1 + \beta_2 \ln X_2 + \beta_3 \ln X_3 + \beta_4 \ln X_4 + \mu$

Details:

Y = Production (Kg)
β_0 = Constant
β_1- β_4 = Regression coefficients for variables
X_1 = Feeder Cattle (Heads)
X_2 = Feed (Kg)
X_3 = Medicine (mg)
X_4 = Labor (Man-day)
e = Natural number (2,718)
u = Error

1. Optimizing Production

To determine production optimization, the efficiency of factor utilization needs to be calculated by evaluating the marginal product value (NPM) for a given input in relation to the input cost (P). The formula for each production factor(Respikasari., Titik, E., and Agus, 2015) is as follows:

$$\frac{NPMx_1}{Px_1} = \frac{NPMx_2}{Px_2} = \frac{NPMx_3}{Px_3} = \frac{NPMx_4}{Px_4} = 1$$

$$NPM = b_i \cdot \frac{Y\ Py}{Xi}$$

Details:

b_i = Production elasticity

Py = Average production price

Y = Average production result

X_i = Production factor

NPMx is not always equal to Px, and it is not always equal to 1. However, the common occurrences are as follows:

1. $NPMx_i/Px_i > 1$, This indicates that the utilization of the production factor input (X_i) is inefficient, suggesting that the use of the production factor (input) x can be increased.
2. $NPMx_i/Px_i < 1$, This signifies that utilizing the production factor input (Xi) is inefficient. Therefore, a reduction in the usage of the production factor (input) X is needed to achieve efficiency (Soekartawi in Respikasari, 2015).

Subsequently, to calculate the value of production optimization:

Optimal value = Average input X $NPMx_i/Px_i$

2. Business Economies of Scale

Analyzing the economies of scale is conducted using a double-log model estimated through the Cobb-Douglas model applied to variables such as feeder cattle, feed, medications, and labor with the following equation:

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + e$$

Details:

1. If $\beta_1+\beta_2+\beta_3+\beta_4 > 1$, then Bali cattle farming in Bone Bolango District is in a state of Increasing Returns to Scale.
2. If $\beta_1+\beta_2+\beta_3+\beta_4 < 1$, then Bali cattle farming in Bone Bolango Regency is in a state of Decreasing Returns to Scale.
3. If $\beta_1+\beta_2+\beta_3+\beta_4 = 1$, then Bali cattle farming in Bone Bolango Regency is in a state of Constant Returns to Scale.

4. RESULT

4.1 Respondent Characteristics

Respondent characteristics encompass age, educational level, farming experience, and the number of dependents. These are presented in Table 1.

Table 1. Characteristics of Bali Cattle Farmers in Bone Bolango Regency.

	Description	Total (individuals)	Percentage (%)
	20 – 34	7	8
Age (years)	35 – 49	48	52
	50 – 64	35	38
	65 – 79	2	2
Educational	Elementary School	45	49
Level	Junior High School	19	21
(years)	Senior High School	23	25
	Bachelor	5	5
Farming	< 5	0	0
Experience	5 – 10	2	2
(years)	> 10	90	98
Number of	1 – 2	17	18
Family	3 – 4	54	59
Dependents (individuals)	≥ 5	21	23
	Total	**92**	**100**

Source: Primary Data Analysis, 2023.

Based on Table 1, it is evident that most farmers are 35 to 49 years old, with an average age of 47 years. This age is within the productive age criteria of under 65 years. According to (Fitriza, Y., F, Trisakti, H., Suci, 2012), the productive age limit in Indonesia is between 15 and 64 years. Table 1 also reveals that a significant number of respondents have only completed primary school (SD), indicating a generally low level of education in the research location. Limited educational attainment is likely to impact the management of Bali cattle farming, which may be conducted in a simple manner based on traditional practices and shared knowledge among farmers. (Hidayah, N., C. A. Artdita, 2019) asserted that a high level of education among farmers contributes to an enhanced understanding of technology and its effective implementation. Most livestock farmers bear family responsibilities for 3-4 individuals, including spouses and children, with an average family dependency of 4 individuals per respondent. Table 1 indicates that almost all farmers have experience exceeding 10 years, with an average livestock farming experience of 34 years among the

respondents. This suggests that farmers have substantial experience in raising Bali cattle, potentially influencing the productivity of Bali cattle.

4.2 Values and the Impact of Factor Production Utilization

Based on the Cobb-Douglas Production Function analysis, the elasticity values and the impact of factor production utilization in Bali cattle farming in the Bone Bolango Regency are obtained, as presented in Table 2.

Table 2. Elasticity Values and the Impact of Factor Production Utilization in Bali Cattle Farming Business in Bone Bolango Regency.

Production Factor (X_i)	Regression Coefficient s(β)	t-Count	Sig.
Constant	1,462		
Feeder Cattle (X_1)	0,484	1,855	0,067
Feed (X_2)	0,691	3,169	0,002
Medicine (X_3)	0,192	1,300	0,197
Labor (X_4)	- 0,515	-0,614	0,541
F-Count = 38.957	Sig= 0,000		
Coefficient of Determination	(R^2) =0,625		
β_0 Value =	1,462		

Source: Primary Data Analysis, 2023.

Table 1 shows that the significant value of the F-test is 0.000 < 0.01, indicating that collectively, the factors of feeder cattle, feed, medicine, and labor significantly influence Bali cattle production in Bone Bolango Regency, as represented by the equation:

$$Y = 1{,}462.\ X_1^{0{,}484}.\ X_2^{0{,}691}.\ X_3^{0{,}192}.\ X_4^{-\ 0{,}515}$$

Meanwhile, in partial terms, it is observed that only the feed variable significantly influences Bali cattle production in the Bone Bolango Regency, as evidenced by the significant value in the t-test being 0.002 < 0.005. This is attributed to the feed provided, which consists of elephant grass *(Pennisetum purpureum cv. Mott)*, known for its high and easily sustainable production. Additionally, its nutritional quality and crude protein content are high, complemented by the inclusion of rice bran concentrate. Farmers do not face difficulties in terms of feed costs since green feed, such as elephant grass, is cultivated on their individual lands. Thus, feed plays a crucial role in increasing livestock production and ensuring optimal

income for farmers. Feed is a pivotal factor of production in the fattening of Bali cattle. Increasing the volume of feed provided to Bali cattle will enhance the production of these cattle. This aligns with the findings of Sandi et al. (2018), indicating that livestock feed management plays a pivotal role in farm development. Better feed management correlates with improved livestock productivity; hence, the overall success of a farm is influenced by the quality of feed management.

Based on the calculation results in Table 1 using the SPSS program, it can be observed that the adjusted R Square value is 0.625. This indicates that the production factors influencing the production of Balinese cattle are 62.5%, while the remaining 37.5% is influenced by other unexamined factors.

4.3 Production Optimization

In managing the Bali cattle farming business, it is essential to determine whether the conducted cattle farming operation is efficient. The highest economic efficiency will indicate that the production generated in Bali cattle farming in Kabupaten Bone Bolango has reached maximum profitability. Economic efficiency can also serve as a guide for farmers in allocating the use of production factors in the Bali cattle farming business.

To determine the attainment of the highest economic efficiency, it can be observed using the concept of maximizing profits with a profit maximization approach, where the highest economic efficiency occurs when the marginal product value is equal to the price of each production factor used in Bali cattle farming (NPMxi = Pxi). The efficiency values of production factor utilization and optimal values can be found in Table 3.

Table 3. Efficiency and Optimal Values of Production Factor Utilization in Bali Cattle Farming Business in Bone Bolango Regency.

Production Factors	Average	Regression Coefficients (β_{ij})	$NPMx_i$	Px_i	$\frac{NPMx_i}{Px_i}$		Ket.	Optimum Value
Feeder Cattle (X_1)	1	0,484	8.494.200	9.885.870	0,86		Inefficient	0.86
Feed (X_2)	3.631	0,691	3.339,865	3.333	1,00		Efficient	-
Medicine (X_3)	1.455	0,192	2.315,876	25.000	0,93		Inefficient	1.353,15
Labor (X_4)	103,976	- 0,515	- 86.926,310	17.246	5,04		Not efficient	524,04
	Production (Y) = 1							

	Production Price (Py) = 17.550.000

Source: Primary Data Analysis, 2023.

Based on Table 3, the comparison of Marginal Product Value (NPM) with the price of production factors, namely feeder cattle at 0.86, feed at 1.00, medications at 0.93, and labor at -5.04, is revealed. Thus, the following results are obtained:

$$\frac{NPMx_1}{Px_1} \neq \frac{NPMx^3}{Px^3} \neq \frac{NPMx^4}{Px^4} \neq 1 \text{ atau} < \text{dan} > 1$$

$$\frac{NPMx_2}{Px_2} = 1$$

To achieve efficiency in the utilization of production factors, a re-adjustment of the allocation of owned production factors is required to ensure optimal production outcomes. This is aimed at attaining the highest possible profit. In detail, the efficiency values of production factors in Table 3 are as follows:

1. Feeder Cattle (X_1)

The efficiency analysis indicates that the production factor of feeder cattle is inefficient. Therefore, to achieve production optimization, the utilization of feeder cattle production factors should be reduced by 0.14 heads to reach the optimal value of 0.86 heads. Alternatively, if equated with the age range of feeder cattle from 1.8 to -2.5 years, with an average weight of 100 kg, the utilization of feeder cattle with a weight of 100 kg should be decreased by 14 kg to 86 kg for optimal results. The expenses incurred for feeder cattle cannot be increased because the additional economic production yield from Bali cattle would be smaller than the additional cost of Bali feeder cattle. The farmer has not considered the appropriate cost for feeder cattle and has not been selective in choosing proportionate feeder cattle. This oversight quickly affects production in the later period of fattening, as the feeder cattle should ideally be healthy and normal (without defects) according to the criteria suitable for fattening, with an ideal weight that will influence the cost of the feeder cattle themselves. Additionally, the feeder cattle purchased by the farmer in the research location are not above two years old.

2. Feed (X_2)

The efficiency analysis indicates that the utilization of the feed production factor is already efficient. Hence, the amount of feed used is efficient or appropriate for achieving the optimization of Bali cattle production, namely 3,631 kg. Livestock feed management is a crucial factor in the success or failure of the livestock business. The better the feed management, the higher the productivity of the livestock. The feed consumption needs in the research location are adequately met. Farmers no longer face difficulties in the availability

of forage, fiber concentrates, and rice bran since the farmers cultivate forage in their respective lands, and the research area is a rice cultivation region.

3. Medicine (X_3)

The economic efficiency result indicates that the medicine production factor is inefficient. Therefore, to achieve production optimization, the quantity of medicine production factor utilization should be reduced by 101.85 mg to reach the optimal value of 1,353.15 mg. The expenses for medicine cannot be increased because the additional economic production yield from Bali cattle would be smaller than the additional cost of medicine. Animal health can be maintained by ensuring regular cleanliness of the pens and providing regular feeding. The medicines supplied by the farmer are only for preventing livestock from getting diseases, not for increasing livestock production itself.

4. Labor (X_4)

The efficiency analysis indicates that the labor production factor is not yet efficient. Therefore, to achieve production optimization, the amount of labor production factor usage should be increased by 420,064 man-days to reach the optimal value of 524.04 man-days. The labor cost cannot be increased because the additional economic production yield obtained would be smaller than the additional labor cost incurred. This is due to the fact that the livestock business is a family-run business, which can be managed independently without the need to hire additional labor, as it would increase production costs.

4.4 Economic Scale of Bali Cattle Farming Business

Economic scale, also known as Return to Scale, is the phenomenon of decreasing production costs per unit used in Bali cattle farming that occurs concurrently with an increase in the quantity of Bali cattle production. This increase in production is in response to a proportional rise in all production factors utilized. As known in the Cobb-Douglas production function, the coefficients of each independent variable represent the elasticity towards the dependent variable. Detailed results of Return to Scale can be observed in Table 4.

Table 4. Return to Scale Values in Bali Cattle Farming Business in Bone Bolango Regency

No.	Production Factors	Elasticity Value (β_i)
1	Feeder Cattle (X_1)	0,484
2	Feed (X_2)	0,691

3	Medicine (X_3)	0,192
4	Labor (X_4)	- 0,515
RTS ($\beta_1 + \beta_2 + \beta_3 + \beta_4$)		0,852

Source: Primary Data Analysis, 2023.

Based on Table 2, the return to scale value in Bali cattle farming in Bone Bolango Regency is determined to be 0.852. This indicates a condition of decreasing returns to scale in the economic scale of the business, where the sum of Σβ values is less than one, specifically 0.852 < 1. This implies that every additional fixed input in the long term is always followed by an increase in output with diminishing returns. The economic scale of Bali cattle farming in Bone Bolango Regency is illustrated in the following diagram.

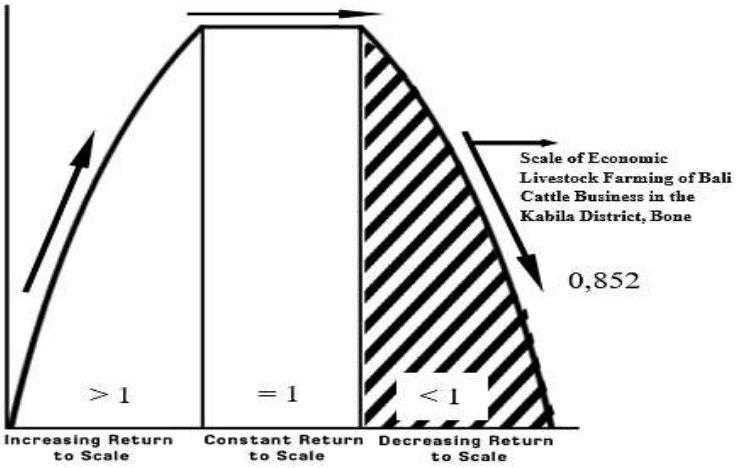

Figure 1. Scale of Economic Livestock Farming of Bali Cattle Business in Bone Bolango Regency.

Figure 1 illustrates the scale of economic livestock farming of Bali cattle in the Kabila District of Bone Bolango Regency, indicating a position of decreasing returns to scale with a value of 0.852. This implies that an increase in production inputs while keeping other factors constant in the long term, will decrease production output. This is attributed to the suboptimal overall efficiency in the use of production factors in Bali cattle farming in the Bone Bolango Regency. Factors such as cattle quality, medication, and labor are not yet efficient, and additionally, the fattening period is excessively prolonged. Farmers have not been able to efficiently combine the production factors, including cattle quality, feed, medication, and labor, leading to suboptimal expenditure and subsequently affecting

production outcomes. The addition of inefficient fixed production inputs over an extended period will not yield increased production outputs.

5 DİSCUSSİON

Factors such as feeder cattle, medicines, and labor do not significantly affect Bali cattle production in the Bone Bolango Regency, as evidenced by the non-significant results in the t-test (> 0.005). This is attributed to the fact that farmers do not consider underweight Bali cattle for use as feeder cattle in this region. As a result, production costs are high, ultimately impacting the suboptimal income of farmers. Despite being a favorable location for developing Bali cattle fattening businesses, these specific factors do not contribute significantly to the overall production outcomes. The availability of green fodder and concentrate serves as a strong rationale. Therefore, adding the number of Bali cattle for fattening is not challenging and will positively impact Bali cattle production.(Jermias, J. A., D. R. Tulle., C. Leo, P., 2009)) stated that adding one fattened cattle would increase the farmer's income. However, the cost of purchasing feeder cattle will also influence the farmer's income. Underweight feeder cattle have a relatively lower purchasing cost, thereby not significantly increasing the production expenses.

Medication plays a role in ensuring the sustainability of Bali cattle from diseases. Medication has a positive but not significant effect on the production of Bali cattle. The administration of vitamins and the cleanliness of Bali cattle pens are also integral aspects that ensure the sustainability of the animal's health. The impact is not significant because, in the research location, farmers typically administer medication to prevent illnesses in Bali cattle, but it does not influence the increase in the livestock's body weight production. Labor has a negative and non-significant impact on Bali cattle production. This is justified by the fact that the increased use of labor will inevitably add to the production costs incurred in running the business, leading to reduced income. The livestock farming activities in the research location are typically family-run businesses that the farmers can manage independently. Feed, commonly grown directly at the livestock pen location, does not pose a challenge for farmers in terms of feeding. The cleanliness of the pens can also be managed independently by the farmers, considering that the average number of fattened cattle is 1 to 2 head.

6 CONCLUSİON

1 Efficiency analysis indicates that the variables of cattle quality and medications are inefficient. Therefore, to achieve production optimization, the use of these production factors should be reduced. Meanwhile, the labor variable is not yet efficient,

necessitating an increase in the use of this production factor. Consequently, to achieve production optimization, the utilization of cattle quality should be decreased by 0.14 heads or 14 kg in weight, reaching an optimal value of 0.86 heads or 86 kg in cattle weight. Similarly, the quantity of medication usage should be reduced by 101.85 mg to attain an optimal value of 1,353.15 mg. Meanwhile, the quantity of labor as a production factor needs to be increased by 420.064 man-days to reach an optimal value of 524.04 man-days. In terms of the feed variable, efficiency analysis indicates that it is already efficient, signifying that the current level of feed usage is optimal for achieving production optimization for Bali cattle, amounting to 3,631 kg.

2 The economic scale of Bali cattle farming in the Kabila District of Bone Bolango Regency is positioned at Decreasing Returns To Scale. This observation is evident in the return to scale value, which is less than one, specifically 0.852 ($\beta_1 + \beta_2 + \beta_3 + \beta_4 < 1$). This signifies that any addition of fixed inputs in the long term is consistently accompanied by an increase in output with diminishing returns.

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