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Strategy and planning for beef cow development based on land carrying capacity in South Tapanuli District

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ABSTRACT

South Tapanuli District has quite potential in developing beef cattle by maximizing the potential of land with various types of plantation and agricultural plants as a source of animal feed. The objectives to be achieved in this research are to analyze the availability of feed based on plantation crops and food crops that support beef cattle feed sources, analyze variables in beef cattle development in influencing the number of beef cattle populations, and analyze strategic factors that influence the success of developing beef cattle and formulating strategies to increase beef cattle production in South Tapanuli District. Multiple linear regression analysis was used to examine the data. The study's findings demonstrate the abundance of potential carrying capacity of the region's land, with plantation area having the capacity to support 1,420 beef cattle annually and agricultural land having the capacity to support 14,508 cattle annually.

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1. INTRODUCTION

Using information obtained in 2022 from the Central Statistics Agency (BPS), beef consumption in North Sumatra in 2022 will reach around 59.69 thousand tons. These figures show that beef is an important food ingredient for the people of North Sumatra. Beef production in North Sumatra has the largest cattle farming potential in Indonesia. Drawing from Ministry of Agriculture data, beef production in North Sumatra in 2022 will reach around 37.7 thousand tons. However, this production is still not sufficient to meet local consumption needs. Along with increasing beef consumption in North Sumatra, the government is also importing beef from abroad. Using information from the Directorate General of Excise and Customs, beef imports in North Sumatra in 2022 will reach around 23.12 thousand tons [1].

One of the challenges in meeting the need for beef in North Sumatra is its uneven distribution[2], [3]. Most beef production is still concentrated in certain regions, while beef consumption is throughout the province of North Sumatra. Thus, to meet beef needs in North Sumatra, efforts are needed to increase local cattle production, increase distribution efficiency, and reduce dependence on beef imports. Apart from that, the government can encourage the development of cattle farming businesses in areas that have the potential to increase beef production in a sustainable manner.

South Tapanuli Regency is one of the districts that has the potential to support beef self-sufficiency for North Sumatra Province because the development of beef cattle in South Tapanuli

Regency has increased quite a lot. Data shows that beef production in South Tapanuli Regency has increased in the last 3 years (2019 - 2021) based on data from the South Tapanuli Central Statistics Agency for 2021 [4].

Although the support for beef production in South Tapanuli Regency in 2021 amounted to 268,144 Kg compared to the total beef production in North Sumatra Province in 2021 amounting to 13,286,017 Kg, or statistically it only supports 2.02% of the total beef production in the Province. . This can be caused by the population percentage in South Tapanuli Regency (303,685 people) being only 2.03% of the total population of North Sumatra Province (14,936,148 people). In terms of the potential for increasing the cattle population in Tapanuli Regency, the potential of available land is an important factor in determining the number of cattle that can be kept in an area [5]. South Tapanuli Regency has a lot of land suitable for cattle farming, such as large and fertile grasslands [6].

The infrastructure needed for cattle farming, such as pens, irrigation systems and adequate roads, is also an important factor in increasing the cattle population [7], [8]. South Tapanuli Regency has several livestock facilities, but they still need to be improved. Access to adequate and high-quality feed is crucial to the growth of the cattle farming industry [9], [10]. South Tapanuli Regency has a lot of fertile land, so feed for cattle can be produced in the area. Market demand also needs to be considered in developing cattle farming [11], [12]. In this case, research needs to be carried out to find out how much demand there is for cattle in the area.

These factors show that South Tapanuli Regency has quite large potential for increasing the cattle population. However, this needs to be supported by good planning, as well as support from the government and local communities in developing cattle farming. Based on the problem formulation that has been stated above, the objectives to be achieved in this study can be set, namely analyzing the availability of feed based on plantation crops and food crops that support feed sources for beef cattle in South Tapanuli Regency, analyzing variables in the development of beef cattle in influencing the number of beef cattle population in South Tapanuli Regency, and analyzing the formulation of strategies that influence the success of beef cattle development as well as formulating strategies for increasing beef cattle production in South Tapanuli Regency.

2. RESEARCH METHOD

2.1 Research Location and Time

This research was carried out in South Tapanuli Regency with stages including data preparation and collection, data analysis and writing, and considerations for selecting this location were land potential, integration of food/agricultural crops and land that could be utilized.

2.2 Research methods

This research consists of two stages, namely research stage 1 to see the production potential and supporting capacity of plantations and agricultural development of beef cattle. Phase 2 research is to look at the factors that influence the increase in the beef cattle population. Stage 3 research is strategy formulation (SWOT Analysis).

2.3 Sample Determination (Respondents)

Determination of sampling in the research area is done intentionally (purposive) based on the area with the largest, medium and small cattle population. Sampling in areas with large cattle populations (>500 cattle) was conducted in Angkola Sangkunur sub-district. Sampling in moderate cattle population areas (0 - 150 cattle) was conducted in Batang Angkola sub-district. Sampling in small cattle population areas (< 20 cattle) was conducted in Merancar sub-district,

Determination of the sampling of each farmer in each sub-district was done using the following slovin [13] formula:

$$n = N / (1 + (N \times e^2)) \quad (1)$$

Description:

N : the number of samples sought

N : the total population (Number of Beef Cattle Breeders in Angkola Sangkunur, Batang angkola and Merancar sub-districts)
E : the margin of error that is tolerated as much as 5%.

2.4 Data Collection Method

The data collection technique used to obtain data relevant to the problem under study is through a survey method [14] which is a way of obtaining primary data on the object of research by directly reviewing the object of research. Primary data can be obtained by means of Field Studies (field research), namely data collection techniques by visiting the beef cattle farmers concerned to make direct observations of beef cattle breeding activities to obtain data and information about the problem under study [15].

To obtain this data, researchers used the following methods:

a) Questionnaire / questionnaire, which is a data collection technique that is done by giving a set of questions or written statements to respondents to answer.
b) Interview (Interview) is the process of obtaining information for research purposes by means of question and answer, while meeting face to face between the questioner or interviewer and the answerer or respondent.
c) Documentation is looking for data on things or variables in the form of notes, photos of livestock conditions and other things that support data for this study.

2.5 Data analysis

The data that has been obtained will be analyzed by Validity and Reliability Test [16], Classical Assumption Test [17], Multiple Linear Regression [18], Hypothesis Test, Partial Effect Significance Test (T Test) [19].

3. RESULTS AND DISCUSSIONS

3.1 Production Potential of Plantation and Agricultural Crops

A recapitulation of the production potential of plantation crops including rice straw, corn straw, cassava shells and peanut straw as supporting capacity for beef cattle feed sources in South Tapanuli Regency can be seen in Table 1.

Table 1. Carrying capacity of plantation crops in South Tapanuli Regency

No	Agricultural Crops	Plantation Plant Carrying Capacity (st/year)
1	Forage between oil palms	379.62
2	Forage between rubber plants	925.45
3	Forage between coffee plants	66.00
4	Forage between cocoa plants	49.32
	Total	**1,420.39**

Based on Table 1, the carrying capacity of plantation crops has the potential to be used as animal feed with a sufficient capacity of 1,420 heads/year. Varieties of forage between plantation crops consist of forage between oil palm plants amounting to 379 animals/year, forage between rubber plants amounting to 925 individuals, forage between coffee plants amounting to 66 individuals/year and forage between cocoa plants amounting to 49 individuals/year.

BusinessPlantations, especially oil palm, have great potential to be integrated with cattle cultivation. Beef cattle are able to consume high fiber feed such as forage and concentrate in large quantities, where these feed ingredients can be provided by the palm oil industry [20], [21] .Existing technological innovations that can utilize waste and by-products from the palm oil industry can increase daily body weight gain (PBBH) of beef cattle by up to 72%. Various studies also show that palm oil-cattle integration has promising prospects to support the development of beef cattle in the future [22].

3.2 Agricultural Crop Production Potential

A recapitulation of the production potential of agricultural crops including rice straw, corn straw, cassava shells and peanut straw as supporting capacity for beef cattle feed sources in South Tapanuli Regency is shown in Table 2.

Table 2. Carrying Capacity of Agricultural Crops in South Tapanuli Regency

No	Agricultural Crops	Carrying Capacity of Agricultural Crops (st/year)
1	Rice Straw	11,251.53
2	Corn Straw	2,650.49
3	Cassava Skin	126.53
4	Peanut Straw	29.94
	Total	**14,058.49**

Based on Table 2, the carrying capacity of agricultural plants has a high potential for use as animal feed with sufficient capacity of 14,058 heads/year. Various agricultural wastes such as rice straw with 11,251 heads/year, corn straw with 2,650 heads/year, cassava shells with 126 heads/year and peanut straw with 29 heads/year. The carrying capacity of land for the development of food crop and livestock businesses needs to be worked on. Agricultural and plantation waste can improve livestock production as well as a source of feed availability for livestock. Providing animal feed from agricultural and plantation waste really depends on the farmer's ability and livestock habits to consume it [23].

3.3 Multiple Regression Analysis of Beef Cattle Farmers in South Tapanuli Regency

As a result of the multiple linear regression equation, an equation function was formed which was included in the variables that were considered to have an influence on the productivity of South Tapanuli beef cattle breeders, namely animal feed (X1b1), labor (X2b2), breeding experience (X3b3) and productive female broodstock (X4b4). These variables will have an influence on beef cattle productivity and are included in the multiple regression equation. Apart from that, in measuring and explaining variations in these variables, the value of the coefficient of determination (R2) is obtained.

The analysis's R value, which indicates that the independent and dependent variables are related, is displayed in the study results. The R value of 0.675 indicates a strong level of relationship. This means that the productivity of beef cattle breeders in South Tapanuli Regency has a strong relationship with factors that influence it, such as animal feed, labor, breeding experience and productive female breeders.

The results of the analysis show that the coefficient of determination for R2 is 0.456. This indicates that the productivity of beef cattle in South Tapanuli Regency is 45.6% influenced by animal feed, labor, breeding experience and productive sires and 54.4% is influenced by other factors outside of that. The regression model in the research has an F-count value of 5.86 and an F-table value (5%) is 2.71. Based on this, the hypothesis is accepted because the F-count is greater than the F-table. This means that the variables of animal feed, labor, breeding experience and productive sires collectively have a significant influence on beef cattle productivity in South Tapanuli Regency.

Table 3. Results of multiple linear regression analysis for beef cattle in South Tapanuli Regency

Variable	Coefficient	t - count	Significant	Information
Constant	17,918			
Animal feed	,928	2,987	,006	*
Labor	-.199	-.071	,944	Mr
Breeding experience	,168	,626	,537	Mr
The female breeder is productive	-5,366	-4,154	,000	*
R2	0.68			
t-table	1.69			
F-count	5.86			
F-table	2.71			

Note: tn: not significantly different, *: significantly different at P level ≥ 5%.

Based on Table 3, the results of multiple linear regression analysis can be written in the equation below:
Y = 17.918 + 0.928 (X1B1) – 0.199 (X2B2) + 0.168 (X3B3) – 5.366 (X4B4)

a) The constant (b0) is 17.918. This means that animal feed, labor, productive females and breeding experience are worth 0, so the productivity of beef cattle breeders in South Tapanuli Regency will remain at 17,918.
b) The regression coefficient X1 (b1) is 0.928 and is positive. This shows that if there is a one unit increase in animal feed, the productivity of beef cattle in South Tapanuli Regency will increase by 92.8%. Based on decision making, Ho is rejected because the t-count has a greater value than the t-table.
c) The regression coefficient X2 (b2) is 0.199 and is negative. This shows that if there is a one unit reduction in labor, the productivity of beef cattle in South Tapanuli Regency will decrease by 19.9%. Based on decision making, Ho is accepted because the t-count has a smaller value than the t-table.
d) The regression coefficient X3 (b3) is 0,168and has a positive value. This shows that if there is a one unit increase in breeding experience, the productivity of beef cattle in South Tapanuli Regency will increase by 16.8%. Based on decision making, Ho is accepted because the t-count has a smaller l value than the t-table.

Regression coefficient X4 (b4) =5,366and has a negative value. This shows that if there is a one unit decrease in productive female breeders, the productivity of beef cattle in South Tapanuli Regency will decrease by 536.6%. Based on decision making, Ho is accepted because the t-count has a smaller value than the t-table.

Animal feed has an influence of 92.8% on the level of beef cattle productivity in South Tapanuli Regency. Animal feed is important to give to livestock with good quality. The feed given to cattle can be in the form of fortifying feed ingredients (concentrate), fibrous feed (grass) and additional feed ingredients (vitamins and minerals) [24]. The profits obtained by farmers are influenced by the feeding and the feed given to livestock must be considered economical and quality. The feed ingredients given to livestock in fresh form are forage, feed consisting of waste from food processing industry processes and grains which are able to make low quality feed into feed that has a high nutritional content so that it can fulfill the nutritional content of livestock is concentrate [25], [26]. The feed given by farmers to beef cattle consists only of grass.

The grass given is elephant grass, field grass and odot grass. Farmers in Langkat Regency only give grass to livestock due to limited capital to buy concentrate and farmers' lack of knowledge about the effects of giving concentrate to livestock. Feeding with forage has been passed down from generation to generation. Farmers who are still traditional require regular counseling to introduce concentrates to livestock [27], [28].

Labor has an influence of 19.9% on the level of beef cattle productivity in South Tapanuli Regency. Labor is an important aspect in increasing the number of breeders' beef cattle population. The labor productivity of livestock breeders is influenced by the number of livestock kept and the number of family members. Farmers can still increase the productivity of livestock farmers, namely by increasing the number of livestock kept so that the use of labor can be optimal [29], [30].

Breeding experience has an influence of 16.8% on the level of beef cattle productivity in South Tapanuli Regency. Most farming experience (>50%) in South Tapanuli Regency ranges from 6 – 15 years. This has the potential to increase beef cattle productivity in South Tapanui Regency. This is in accordance with research [31] stated that farming experience is dominated by 6 years to 10 years with the number of breeders being 34 people, the percentage is 49.27%. This shows that the respondent's level of farming experience can be said to be sufficient, but they lack mastery and following technological developments in managing their cattle farming business.

Breeding experience has an influence of 536.6% on the level of beef cattle productivity in South Tapanuli Regency. The number of productive broodstock will be influenced by the cutting of productive broodstock by breeders. Breeders generally cut productive broodstock due to urgent economic problems or because of a lack of knowledge. Apart from that, the selling price can also

influence the slaughtering activities of this productive broodstock. This is in accordance with research [32], [33] which states that the results of analysis using multiple linear regression show that the factor that significantly influences the slaughter (sale) of productive females by breeders is the price of productive female cattle themselves. Breeders sell productive females because of family needs, even though the price of productive females is not as expensive as male cattle [34]. The breeder's overall income does not affect the number of slaughter (sales) of productive females. The sale of productive females is not permanent, but only due to urgent family needs.

3.4 Determining Beef Cattle Development Strategy in South Tapanuli Regency

Finding strategic alternatives is the last step in the SWOT analysis process. It is possible to create the SWOT matrix using both internal and external considerations. Four primary strategies Strengths-Opportunities (SO), Weaknesses-Opportunities (WO), Strengths-Threats (ST), and Weaknesses-Threats (WT) will be determined based on the SWOT matrix.

The next step in the development of beef cattle in South Tapanuli Regency is the strategy review stage. The internal and external strategic factor assessment matrix table can be used to carry out the evaluation stage of internal and external elements. Completing the computation of the multiplication between the score and the weight is the first step in evaluating the internal and external factors. The method of comparing one factor with another in each group of internal and external factors known as the pair comparison technique is the basis for determining the weights. It is possible to obtain the score using predefined parameters. Based on information gathered from research participants' interviews, these parameters were established. In the scoring stage, each strategic factor's score is determined using the preset parameters. Scores 1 and 2 indicate internal factor deficits, whereas scores 3 and 4 indicate strengths. Scores 1 and 2 represent dangers to external variables, and scores 3 and 4 represent opportunities. The calculation of the weights and scores is then performed.

In Table 4 below it is known that in the internal factors there are 2 strengths and 3 weaknesses. The strength has the highest weight score, namely farming experience of 1.13 and the weakness is that the highest weight score is information about business capital of 0.32. Based on these results, it is known that breeding experience is the most important factor in developing beef cattle in South Tapanuli Regency.

Table 4. Internal factor evaluation matrix based on IFAS

No	Internal Factors	Weight	Score	Weight Score
Strength				
1	Breeding Experience	0.28	4	1.13
2	Productive female breeding population	0.28	3	0.85
Total S				**1.98**
Weakness				
1	Venture capital	0.16	2	0.32
2	Minimal supplementary feeding	0.13	2	0.27
3	Maintenance system	0.14	2	0.28
Total W				**0.87**
Total IFAS		1.00		
Difference in Strengths and Weaknesses (IFAS)				**1.11**

There are four opportunities and four threats, as can be seen from the external factors in Table 5 below. The selling price is the opportunity that has the highest weight score, namely 0.73, while the cage has the highest threat weight score, namely 0.17. Based on these results, it can be seen that selling price is the most important external factor in the development of beef cattle in South Tapanuli Regency.

The difference in score weights on internal factors states the IFE (Internal Factors Evaluation) value, which is 1.12 with a positive sign, while the difference in score weights on external factors states

the value and EFE (External Factors Evaluation), namely 1.85 with a positive sign. On the x-axis, the IFE value is expressed, and on the y-axis, the EFE value.

Table 5. External factor evaluation matrix based on EFAS

No	External factors	Weight	Score	Weight Score
Opportunities				
1	Carrying capacity of plantation and agricultural land	0.17	4	0.67
2	Selling price	0.18	4	0.73
3	Consumer demand	0.17	3	0.51
4	The marriage system uses IB	0.16	3	0.49
	Total odds			**2.40**
Threatened				
1	Cage availability	0.09	2	0.17
2	Change of land use	0.08	2	0.16
3	Disease attack	0.08	1	0.08
4	High rainfall	0.07	2	0.14
	Total threat			**0.56**
Difference between Opportunities and Threats				**1.84**

The intersection of IFE and EFE values is in quadrant I, namely aggressive strategy (growth oriented strategy). An aggressive strategy is a strategy that supports maximizing existing strengths and opportunities. Aggressive strategy is a strategy that can be used in developing beef cattle by cattle breeders in South Tapanuli Regency. The IFE and EFE values can be included in the SWOT matrix in Figure 1 as follows:

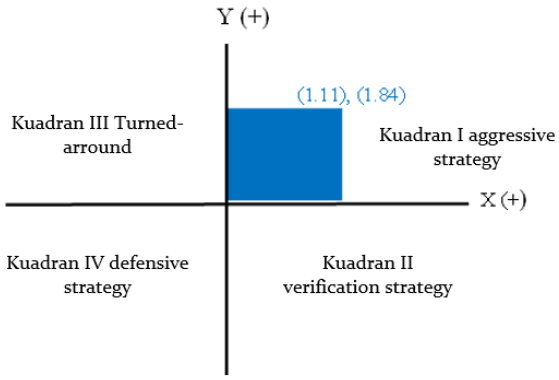

Figure 1. Matrix of quadrant positions in beef cattle development in South Tapanuli Regency

Breeding experience and a productive female breeding population are the focus of strengths that can be maximized in developing the beef cattle business in South Tapanuli Regency. Apart from that, opportunity factors such as high selling prices and demand, carrying capacity of plantation and agricultural land and a mating system using artificial insemination are also main factors in maximizing the development of beef cattle in South Tapanuli Regency.

Based on the SWOT matrix above, several strategies can be formulated in developing beef cattle business in South Tapanuli Regency as outlined in the preparation of a strategy to increase beef cattle productivity in South Tapanuli Regency.

a) Strategy S-O (Strengths - Opportunities)

The S-O strategy is a strategy that uses internal strengths to take advantage of external opportunities [35]. The potential that can be done are: The potential of agricultural and plantation waste can be maximized into alternative feed sources such as utilizing forage among plantation crops or fermenting agricultural waste from rice straw, corn straw, peanut straw and cassava skin so as to increase beef cattle productivity (S1 - O2). The success of minimal IB (1 or 2 times) by maximizing the potential population of high productive females can increase the number of beef cattle population so that it will increase beef cattle productivity (S2 - O4). Stabilize the selling price of beef cattle by not

drastically increasing the selling price (unit head or per Kg) when the population increases so that consumer demand will increase and remain fulfilled with a high level of confidence. (S1,S2 - O1,O2,O3,O4)

b) W - O Strategy (Weakness - Opportunities)

The W - O strategy aims to improve internal weaknesses by taking advantage of external opportunities [36]. Strategies that can be used by beef cattle farmers in South Tapanuli Regency are: KUR-based loans (Kredit Usaha Rakyat) or with a profit-sharing system from investors can increase business capital in the purchase of seedlings, cage construction, optimization in the IB system and other factors so as to increase beef cattle productivity (W1, W4 - O1, O4). Alternative feed sources from the carrying capacity of plantation and agricultural land (e.g. feed ingredients from fermented corn/paddy straw) can reduce business capital in purchasing production costs for feed ingredients (W1, W2 - O1).

c) S-T Strategy (Strengths - Threats)

The S-T strategy is a strategy that uses the farmer's internal strengths to avoid or reduce external threats [37]. Strategies that can be used by farmers are as follows: Administering dewormers or antibiotics by farmers can reduce and prevent the occurrence of disease in beef cattle with climate support will potentially minimize disease attacks (S1 - T2). Feeding during high rainfall levels is done by drying or aerating or after sunrise to avoid the risk of worm larvae sticking to the top of the grass (S1 - T2, T3).

d) W - T (Weakness - Threats) Strategy

W - T is a defensive tactic directed at reducing internal weaknesses and avoiding external threats [38] as follows: Supplementary feeding in the form of UMB will effectively streamline land with limited grazing fields due to land conversion (W2 - T2). The extensive rearing system can be optimized by building adequate cages when obtaining additional business capital from KUR loans or funds from investors so as to increase the population and reduce the potential for disease attacks (W1, W3, W4 - T2).

4. CONCLUSION

The potential carrying capacity of land as a source of feed in South Tapanuli Regency is included in the abundant category with the carrying capacity of plantation land being able to meet the needs of 1,420 beef cattle/year and the carrying capacity of agricultural land being 14,508 cattle/year. 2. The SO (Strengths-Opportunities) strategy is a livestock development strategy that can be carried out by breeders in South Tapanuli Regency, namely combining the potential carrying capacity of plantation and agricultural land with the experience of breeders so that they can optimize beef cattle productivity (S1-O2) , and implementing a mating system using AI by maximizing the potential of the productive female breeding population so that the number of beef cattle population will increase (S2-O4). In-depth research needs to be conducted to quantitatively evaluate the impact of combined farming and ranching systems (SO Strategy: S1-O2). The focus should be on the extent to which integration of farmer experience and land use optimization can improve beef cattle productivity. Field studies and farmer surveys can provide empirical data on the effectiveness of this strategy.

REFERENCES

[1] B. P. S. Indonesia, "Statistik-Indonesia-2020 Catalog : 1101001," Jakarta, 2021. doi: : ISSN 0126-2912.

[2] S. Arif, W. Isdijoso, A. R. Fatah, and A. R. Tamyis, "Tinjauan Strategis Ketahanan Pangan dan Gizi di Indonesia," 2020. [Online]. Available: https://smeru.or.id/sites/default/files/publication/rr_fsn_indonesia_finalreport_ind.pdf

[3] S. Sutawi, "Wacana Agribisnis Pertanian dan Peternakan," CV. Zahra Publisher Group, 2022. [Online]. Available: http://repository.um.ac.id/id/eprint/1495

[4] Badan Pusat Statistik Kabupaten Tapanuli Selatan, "Kabupaten Tapanuli Selatan Dalam Angka Tapanuli Selatan Regency in Figures 2021," 2021. [Online]. Available: https://etd.uinsyahada.ac.id/10711/

[5] Z. N. Muhammad, "Potensi dan strategi pengembangan peternakan sapi potong dilahan bekas tambang emas martabe PT. Agincourt Resources Kecamatan Batang Toru Kabupaten Tapanuli Selatan," 2021,

Universitas Andalas. [Online]. Available: http://scholar.unand.ac.id/79016/

[6] A. S. Harahap, H. Mulyono, N. Purba, and T. Siregar, "Perlindungan Lingkungan Hidup Melalui Pranata Surat Tumbaga Holing Pada Masyarakat Batak Di Tapanuli Selatan," *Bina Huk. Lingkung.*, vol. 6, no. 2, pp. 258–282, 2022, [Online]. Available: http://repository.umnaw.ac.id/jspui/handle/123456789/2527

[7] S. N. S. Mustainah and A. Amrawaty, "Strategy to Increase the Role of Extension in Beef Cow Waste Management in Bone Regency, South Sulawesi Province, Indonesia," *Am. J. Sustain. Agric.*, vol. 15, no. 4, pp. 1–5, 2021, doi: 10.22587/aejsa.2021.15.4.1.

[8] A. D. Ologhobo, "Sustainable livestock production and the vagaries of climate change," *Niger. J. Anim. Prod.*, vol. 48, no. 4, pp. 39–58, 2021, doi: https://doi.org/10.51791/njap.v48i4.3015.

[9] D. A. Meliana and O. N. Rohmawati, "Literature Review: Analisis Usaha Peternakan Sapi Perah di Eks Keresidenan Kediri Jawa Timur," *J. Ilm. Peternak. Halu Oleo*, vol. 5, no. 3, pp. 246–251, 2023, doi: http://dx.doi.org/10.56625/jipho.v5i3.40747.

[10] S. P. Hamdi Mayulu, *Sapi Potong dan Manajemen Usaha*, 1st ed. Depok: PT. RajaGrafindo Persada-Rajawali Pers, 2023.

[11] P. L. Greenwood, "An overview of beef production from pasture and feedlot globally, as demand for beef and the need for sustainable practices increase," *Animal*, vol. 15, no. 1, p. 100295, 2021, doi: https://doi.org/10.1016/j.animal.2021.100295.

[12] A. J. Musagaliev and B. T. Shodiev, "Issues of Efficient Usage of Pastures in the Development of the Cattle Farming Network," *Uttar Pradesh J. Zool.*, vol. 44, no. 1, pp. 81–87, 2023, doi: https://doi.org/10.56557/upjoz/2023/v44i13394.

[13] J. J. Tejada and J. R. B. Punzalan, "On the misuse of Slovin's formula," *Philipp. Stat.*, vol. 61, no. 1, pp. 129–136, 2012, [Online]. Available: https://www.psai.ph/docs/publications/tps/tps_2012_61_1_9.pdf

[14] F. J. Fowler Jr, *Survey research methods*, 5th ed. Singapura: Sage publications, 2013.

[15] G. Guest, E. E. Namey, and M. L. Mitchell, *Collecting qualitative data: A field manual for applied research*, 1st ed. Singapura: Sage publications, 2013.

[16] R. Heale and A. Twycross, "Validity and reliability in quantitative studies," *Evid. Based. Nurs.*, vol. 18, no. 3, pp. 66–67, 2015, doi: https://doi.org/10.1136/eb-2015-102129.

[17] S. Alagumalai and D. D. Curtis, "Classical test theory," in *Applied Rasch Measurement: A Book of Exemplars*, Springer, 2005, pp. 1–14. doi: https://doi.org/10.1007/1-4020-3076-2_1.

[18] G. K. Uyanık and N. Güler, "A study on multiple linear regression analysis," *Procedia-Social Behav. Sci.*, vol. 106, no. 10, pp. 234–240, 2013, doi: https://doi.org/10.1016/j.sbspro.2013.12.027.

[19] Q. F. Gronau, A. Ly, and E.-J. Wagenmakers, "Informed Bayesian t-tests," *Am. Stat.*, vol. 74, no. 2, pp. 137–143, 2020, doi: https://doi.org/10.1080/00031305.2018.1562983.

[20] N. D. Rusli, A. A. A. Ghani, K. Mat, M. T. Yusof, M. Zamri-Saad, and H. A. Hassim, "The potential of pretreated oil palm frond in enhancing rumen degradability and growth performance: A review," *Adv. Anim. Vet. Sci.*, vol. 9, no. 6, pp. 811–822, 2021, doi: https://doi.org/10.17582/journal.aavs/2021/9.6.811.822.

[21] S. Setyahadi, "Animal Feed from Oil Producing Plants," *Biorefinery Oil Prod. Plants Value-Added Prod.*, vol. 2, no. 3, pp. 631–651, 2022, doi: https://doi.org/10.1002/9783527830756.ch31.

[22] J. A. Bremer, L. A. Lobry de Bruyn, R. G. B. Smith, W. Darsono, T. D. Soedjana, and F. C. Cowley, "Prospects and problems: considerations for smallholder cattle grazing in oil palm plantations in South Kalimantan, Indonesia," *Agrofor. Syst.*, vol. 96, no. 7, pp. 1023–1037, 2022, doi: https://doi.org/10.1007/s10457-022-00759-2.

[23] S. Rusdiana and B. Martono, "Analisis finansial diversifikasi usaha perkebunan kakao rakyat dan ternak di tingkat petani," *J Sirkuler Inov Tanam Ind. dan Penyegar*, vol. 2, no. 3, pp. 157–170, 2014, [Online]. Available: https://repository.pertanian.go.id/handle/123456789/23138

[24] S. Garmashov, O. Bagno, E. Izhmulkina, and O. Konstantinova, "Impact of extruded feed supplements on the productivity of lactation cows," *Egypt. J. Vet. Sci.*, vol. 51, no. 2, pp. 203–213, 2020, doi: https://dx.doi.org/10.21608/ejvs.2020.23132.1149.

[25] K. Murugesan, K. R. Srinivasan, K. Paramasivam, A. Selvam, and J. Wong, "Conversion of food waste to animal feeds," in *Current Developments in Biotechnology and Bioengineering*, Elsevier, 2021, pp. 305–324. doi: https://doi.org/10.1016/B978-0-12-819148-4.00011-7.

[26] S. K. Mahanta, S. C. Garcia, and M. R. Islam, "Forage based feeding systems of dairy animals: issues, limitations and strategies," *Range Manag. Agrofor.*, vol. 41, no. 2, pp. 188–199, 2020, [Online]. Available: https://www.researchgate.net/publication/354761768

[27] L. Craighead *et al.*, "'Everything in this world has been given to us from cows', a qualitative study on farmers' perceptions of keeping dairy cattle in Senegal and implications for disease control and healthcare delivery," *PLoS One*, vol. 16, no. 2, p. e0247644, 2021, doi: https://doi.org/10.1371/journal.pone.0247644.

[28] E. Ahikiriza, J. Wesana, X. Gellynck, G. Van Huylenbroeck, and L. Lauwers, "Context specificity and time dependency in classifying sub-saharan africa dairy cattle farmers for targeted extension farm advice: the case of uganda," *Agriculture*, vol. 11, no. 9, p. 836, 2021, doi: https://doi.org/10.3390/agriculture11090836.

[29] S. Mastuti, L. A. Sukmono, E. Yuwono, N. N. Hidayat, and R. Widiyanti, "Analisis Produktivitas Tenaga Kerja Peternak Pada Usaha Ayam Niaga Pedaging Pola Kemitraan Di Kabupaten Banyumas," in *Prosiding Seminar Nasional Teknologi Agribisnis Peternakan (STAP)*, 2023, pp. 598–606. doi: https://doi.org/10.3390/agriculture11090836.

[30] G. Siregar, "Analisis kelayakan dan strategi pengembangan usaha ternak sapi potong," *AGRIUM J. Ilmu Pertan.*, vol. 17, no. 3, pp. 192–201, 2012, doi: https://doi.org/10.30596/agrium.v17i3.320.

[31] H. F. B. Faborode, "Gender assessment of poultry waste utilisation among small-scale poultry farmers in Osun State, Nigeria: Exploring the untapped potentials," *African J. Food, Agric. Nutr. Dev.*, vol. 22, no. 4, pp. 20259–20279, 2022, [Online]. Available: https://www.ajol.info/index.php/ajfand/article/view/231169

[32] T. L. Marshall, K. T. Coatney, J. A. Parish, R. D. Little, J. G. Maples, and B. R. Williams, "Factors impacting reproductive success and asset value of beef breeding females in Mississippi auctions," *J. Agric. Appl. Econ.*, vol. 53, no. 1, pp. 110–133, 2021, doi: https://doi.org/10.1017/aae.2020.29.

[33] A. De Vries and M. I. Marcondes, "Overview of factors affecting productive lifespan of dairy cows," *Animal*, vol. 14, no. S1, pp. s155–s164, 2020, doi: https://doi.org/10.1017/S1751731119003264.

[34] T. C. Davis and R. R. White, "Breeding animals to feed people: The many roles of animal reproduction in ensuring global food security," *Theriogenology*, vol. 150, pp. 27–33, 2020, doi: https://doi.org/10.1016/j.theriogenology.2020.01.041.

[35] R. W. Puyt, F. B. Lie, and C. P. M. Wilderom, "The origins of SWOT analysis," *Long Range Plann.*, vol. 56, no. 3, p. 102304, 2023, doi: https://doi.org/10.1016/j.lrp.2023.102304.

[36] I. Farida and D. Setiawan, "Business Strategies and Competitive Advantage: The Role of Performance and Innovation," *J. Open Innov. Technol. Mark. Complex.*, vol. 8, no. 3, pp. 1–16, 2022, doi: 10.3390/joitmc8030163.

[37] M. Savari and M. S. Amghani, "SWOT-FAHP-TOWS analysis for adaptation strategies development among small-scale farmers in drought conditions," *Int. J. Disaster Risk Reduct.*, vol. 67, p. 102695, 2022, doi: https://doi.org/10.1016/j.ijdrr.2021.102695.

[38] W. Steingartner, D. Galinec, and A. Kozina, "Threat defense: Cyber deception approach and education for resilience in hybrid threats model," *Symmetry (Basel).*, vol. 13, no. 4, p. 597, 2021, doi: https://doi.org/10.3390/sym13040597.