Jurnal Agripet
p-ISSN: **1411-4623** | e-ISSN: **2460-4534**
available online at https://jurnal.usk.ac.id/agripet

Vol 25 (2): 223-234, October 2025
Accredited: 152/E/KPT/2023

Beef Cattle Development Strategy Based on Agricultural By-Products in Lebong Regency Bengkulu

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ABSTRACT. Lebong Regency is one of the areas in Bengkulu with very low beef cattle population covering only 0.189% of the total 161,000 heads. Although ongoing government and stakeholder initiatives have aimed to boost smallholder populations, the outcomes remain suboptimal. This study aimed to evaluate the potential and formulate strategies to increase the beef cattle population in Lebong Regency. It used a descriptive approach through surveys and interviews involving 40 participants, including 32 smallholder farmers and 8 experts from institutions supporting livestock development in the region. Secondary data from Statistics Indonesia supported the assessment of potential and challenges. Data were analyzed using a SWOT matrix, revealing the potential carrying capacity of 10,319 cattle heads, indicating an opportunity for livestock growth in Lebong Regency. The SWOT analysis positioned the strategy in quadrant III (0.33; -0.19), suggesting a turnaround approach. The recommended development strategy emphasizes enhancing knowledge of integrated technology through collaboration between coffee processing industry owners and rice/corn farmers producing agricultural waste. Additionally, utilizing government programs to increase knowledge, scaling up beef cattle farming, and strengthening institutional cohesion are key strategic actions.

Keywords: agricultural waste, beef cattle, development, strategy

INTRODUCTION

Livestock is one of the sources of the rural economy. Smallholder livestock farming remains the dominant contributor to the national cattle population. More than 90% of local beef production comes from small-scale livestock farming (Nuhung, 2015; Widiati, 2015). Although smallholder livestock production dominates, livestock farming has not yet become a primary business for rural communities. Livestock farmers raise beef cattle as a side business or as savings for relatively large family needs at certain period of times (Ramon et al., 2021; Syaiful and Marwiansah, 2022). Generally, small-scale cattle farming is carried out traditionally and passed down through generations, resulting in relatively low productivity and slow population growth. Increasing livestock productivity is a mandatory effort for farmers, which can be achieved through improvements in cultivation systems and government support (Sol'uf et al., 2021). The government should take action by providing technological support and assistance.

Facilitating technology adoption requires strengthening livestock sector institutions. Strengthening institutions within livestock production centers has been shown to accelerate the adoption of new practices and enhance beef cattle productivity (Hajirin et al., 2021; Untung, 2020). The development of beef cattle areas relies heavily on the role of the Regional Government, especially in the era of autonomy, where understanding local potential and effectively applying cattle cultivation technology are crucial. However, one of the main challenges faced by livestock breeders is the need for ongoing technological innovation to support the growth of the cattle population in these development areas. Efforts to increase the productivity of smallholder beef cattle remain hindered because they have not yet adopted an agribusiness-oriented approach (Nofianti et al., 2022). The average scale of beef cattle farming in Indonesia is between 2 and 3 head per farm, with technologies utilized in these operations generally traditional (Rusdiana et al., 2018). Efforts to increase the smallholder beef cattle productivity have started since the New Order government (1960s) until today through livestock assistance schemes, tools and supporting materials for the application of technology including feed and livestock waste processing, forage, artificial insemination, vaccination, etc. However, the

*Corresponding author: zulefendi69@gmail.com
Received: 11 March 2025
Revised: 26 August 2025
Accepted: 17 September 2025
DOI: https://doi.org/10.17969/agripet.v25i2.45046

implementation of these approached have not been able to significantly upscale the cattle business and productivity (Rusdiana, 2019). As a result, to meet national beef demand, Indonesia continues to import beef on an ongoing basis (Danasari et al., 2020).

A comprehensive understanding of site-specific conditions has not been considered in program formulation. Therefore, the planning aspect of a beef cattle development program needs to begin with a comprehensive study utilizing adequate data information. The program, based on research results, will provide a direction for sustainable beef cattle development. Romjali (2018) stated that field laboratories are the starting point for assessing the success of a community beef cattle development program. Field laboratories are ideal for regions where beef cattle populations are being actively developed. However, this is not the situation in Lebong Regency, which has significant potential for beef cattle development but lacks technological innovation in advancing this commodity.

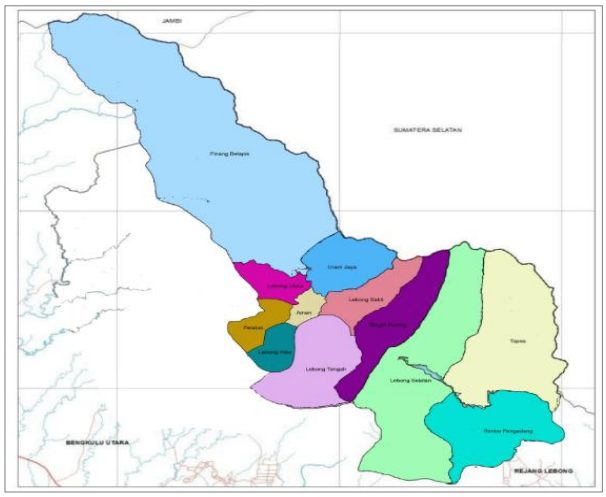

Figure 1. Map of Lebong Regency

Lebong Regency is astronomically located between 02.65^0 - 03.60^0 South Latitude and 101^0 - 102^0 East Longitude. The altitude varies between 500-1,000 meters above sea level, with the northern boundary being Jambi Province, the southern boundary being Rejang Lebong Regency, the western boundary being North Bengkulu Regency, and the eastern boundary being South Sumatra (Figure 1). Topographically, this regency has excellent potential for beef cattle development due to its abundant feed resources. However, the beef cattle population in this regency is very low. Data from the Lebong Regency Agriculture and Fisheries Service in 2023, the beef cattle population was only 305 head kept by 86 breeders with a maintenance scale of 3-4 head, while the population of Lebong Regency was 114,774 people (BPS Lebong Regency, 2024). Efforts to upscale beef cattle farming in Lebong Regency heavily depend on the important role played by the government. The 2021-2026 Lebong Regency Medium-Term Development Plan (RPJMD) outlines that increasing production and added value in business sectors is aimed at increasing economic growth and poverty alleviation in Lebong Regency. The management system for cattle breeding is less profitable than fattening due to the relatively long cultivation time and limited feed supply. The purpose of this study is to develop a strategy for beef cattle development in Lebong Regency, with the expectation that these efforts will contribute to increasing both the population and productivity of beef cattle, as well as improving community welfare.

MATERIALS AND METHODS

Methods

The research was conducted in 10 sub-districts in Lebong Regency, Bengkulu Province. The data included both primary and secondary sources. Primary data was collected through interviews with 40 respondents: 32 beef cattle breeders with more than two years of livestock experience, and 8 officials from the Lebong Regency Agriculture and Fisheries Service. These officials comprised the head of service, head of animal husbandry, head of plantation, head of food crops, head of extension, head of the animal health, head of the slaughterhouse, head of livestock breeding, and two agricultural extension officers who mentor livestock groups that utilize plant waste as feed.

The carrying capacity calculation obtained from the production of rice straw and corn stalks using the Muller (1974) formula: rice straw = (2.5 x harvested area x 0.70) tons DM/year and corn straw = (6.0 x harvested area x 0.75) tons DM/year. Calculation of palm oil waste based on the amount of palm oil frond production with the assumption that 1 palm oil tree produces 22 fronds per tree per year (Efendi et al., 2017) multiplied by the plant population per hectare while the average feed requirement for beef cattle is 5 kg/head/day, while to determine the amount of coffee fruit skin production (tons) is obtained from dividing the percentage of coffee skin by 48%. (Londra and Sutam, 2013) with the percentage of remaining coffee fruit of 52% in the form of coffee bean production (green beans) multiplied by the amount

of coffee bean production (tons/year), this calculation can be represented by the following equation:

$$\text{Coffee skin waste} = \frac{48}{52} \times \text{coffee bean production (green bean)}$$

Secondary data in the form of livestock population, agricultural and plantation land area were obtained from the local government and village services. All qualitative data (cultivation systems, pens, feed sources, types of feed and related factors) were analyzed descriptively and using SWOT analysis (Mukhtar, 2013). A SWOT matrix analysis was utilized to formulate strategy based on key factors identified through discussions guided by interview protocols, followed by a descriptive analysis. The strategy for utilizing plant by-products was determined by assigning weights based on the relative importance of each proposed attribute. The attributes included in the SWOT matrix were formulated using information gathered from interviews guided by a structured interview protocol, the SWOT matrix is shown in Table 1.

Table 1. Illustration of a SWOT matrix scheme for the strategy for utilizing coffee skin by-products

Internal / External	Strength 1. 2. *to - n* *(Obtained from the IFE matrix)*	Weakness 1. 2. *to - n* *(Obtained from the IFE matrix)*
Opportunity 1. 2. *to - n* *(Obtained from the EFE matrix)*	(S – O) Strategy of using strengths to take advantage of opportunities	(S – W) Strategy to minimize weaknesses to take advantage of opportunities
Threats 1. 2. *to - n* *(Obtained from the EFE matrix)*	(O – T) Strategy of using strengths to overcome threats	(W – T) Strategy to minimize weaknesses to overcome threats

Source: Phadermrod et al. (2019)

RESULTS AND DISCUSSION

Identification of Potential Plant By-Products in Lebong Regency

Lebong Regency possesses abundant plant resources for beef cattle farming, but these are underutilized. Lebong Regency covers approximately 8.28% of Bengkulu Province's total area, yet its livestock population is less than 1% of the province's population. Considering Lebong Regency 's potential, beef cattle development is highly feasible. This is evident was obtained from the results of a resource identification survey. The primary agricultural commodities identified were rice, corn, coffee, and palm oil tree (Table 2), while the beef cattle population was only 305 head.

The livestock subsector in Lebong Regency has not been widely utilized as a source of income for the community, unlike the food crops and plantations. However, development of the livestock subsector has significant potential to increase community income by leveraging regional potential (Prawira et al., 2015). Beef cattle, as the primary commodity in the livestock subsector, offered significant potential for development due to the abundant feed potential from agricultural by-products (rice, corn) and plantations (coffee, oil palm).

The total potential carrying capacity for beef cattle in Lebong Regency, based on primary agricultural commodities (rice, corn, and oil palm) used as alternatives to green fodder, is 10.319 head. The market potential based on the results of the market demand survey for beef in Lebong Regency was very large, which were approximately 1.2 tons per day, this was because the need for meat consumption always increasing every year, especially during religious holidays (Eid al-Fitr and Eid al-Adha). Recently, the price of beef in the market has increased by up to 10%, however, the market demand for meat in Lebong Regency was still very high. Lebong Regency has a total of 86 beef cattle breeders, with the highest concentration located in South Lebong District, which has 42 breeders. The area is served by several veterinary personnel, including veterinary medical officers, the Head of UPTD Puskeswan and RPH, the Head of UPTD BPT, three Veterinary Paramedics, and officials for Artificial Insemination (IB), PKB, ATR, and IB services. Thus, the development of beef cattle commodities is still very open, with the application of several examples of technology for utilizing agricultural waste resources Romjali (2018). As part of the livestock development efforts in Lebong Regency, it is essential to provide counselling and training in technologies that support beef cattle advancement. This process is closely linked to farmers' willingness to adopt innovations, which involves a transformation in knowledge, attitudes, and skills from the moment they become aware of an innovation until they ultimately decide to adopt it after receiving relevant information (Rogers and Shoemaker, 1971).

Table 2. Population, potential agricultural by-products and livestock capacity in Lebong Regency

Subdistrict	P	Rice (FS)		Corn (GFS)		Coffee (CF)		PO (FS)		CFG (head)	
	(tail)	Area (ha)	PC/head	Area (ha)	PC/head	Wide	Area (ha)	PC/Head	Area (ha)	PC/head	PC/head
Upper Lebong	17	336.26	356	34	4	505	40,345	27	368,550	27	61
Plabai	70	440.76	466	27	39	371	30,694	21	286,650	21	47
North Lebong	15	403.55	427	2.5	10	110	4,322	6	81,900	6	13
Pinang Belapis	6	695.09	735	9	6	645	58,025	137	1,870,05	137	308
Amen	11	1,193.4	1,262	2	17	484	39,063	0	0	0	0
Uram Jaya	19	473.61	501	57	37	528	48,506	2	27,300	2	4
Central Lebong	17	881.45	932	36	10	1,558	143,939	0	0	0	0
Lebong Sakti	7	1,267.61	1,341	7.8	0	177	9,393	1	13,650	1	2
Bingin Kuning	32	1,399.91	1,480	65.5	21	222	14,909	11	150,150	11	25
South Lebong	106	1,249.76	1,322	45	92	573	37,324	9	122,850	9	20
Jungle Barrier	3	276,376	292	22	3	940	89,061	26	354,900	26	58
Topos	2	392.42	415	8	2	2,046	181,144	5	68,250	5	11
Amount	305	9,010.22	9,528.62	315.8	241	8159		245			550

Note: P= population, FS= forage substitute, PC= potential capacity, GFS= green fodder substitute, CF= concentrated Feed, PO= palm oil, CFG= capacity of fronds and grass

Beef Cattle Development Strategy through the Utilization of Agricultural By-Products as Feed Sources

A viable livestock development strategy for Lebong Regency involves analyzing the internal and external factors influencing the use of crop by-products as feed. The identification and formulation of critical factors, gathered through interviews with key informants, respondents, and literature studies, serve as essential benchmarks for determining appropriate strategies. Therefore, it is necessary to identify the potential of agricultural by-products as feed for beef cattle. One effective approach, as suggested by Rahayu et al. (2019), is to utilize plant by-products as cattle feed. An external factor evaluation matrix helps determine how well Lebong Regency can exploit opportunities and address threats in the external environment, based on the weighting, improvement, and scoring of each external factor. The identification and formulation of the potential use of plant by-products, derived from interviews, literature, and analysis of internal (strengths and weaknesses) and external (opportunities and threats) factors that influence strategy, are described below:

Strengths

Internal factors identified as strengths in the use of agricultural and plantation by-products as feed for beef cattle were as follows:

1. Beef is the largest protein supplier in Lebong Regency. Currently, beef in Lebong Regency remains the largest protein supplier, as evidenced by the increasing public demand for meat products, especially during religious holidays (Eid al-Fitr and Eid al-Adha). Government programs are being implemented with the aim of establishing Lebong Regency as a beef cattle development area. To this end, the Regional Government continues to strive to increase the beef cattle population in Lebong Regency. Supporting programs are being continuously implemented, including cattle cultivation outreach programs, which have been conducted almost annually since the last few years.
2. Agricultural by-products did not compete with human needs, plant by-products in Lebong Regency are found in all sub-districts because each sub-district in Lebong Regency has agricultural land and plantation land covering an area of 17,730.02 Ha with the area of each commodity being (rice 9,010. 22 ha, corn 315.80 ha, palm oil 245.00 ha and coffee 8,159.00 ha). The production of by-products of each commodity is rice straw 108,122, 64 tons/year, corn stalks 1,326.36 tons/year, oil palm fronds 2450 tons/year, coffee skin 2,545.608 tons per year (BPS Lebong, 2022; Field data, 2023). Plant by-products were spread throughout the sub-districts. Thus, the abundance of these by-products has the potential to be a source of feed for the development of beef cattle, but has not been optimally utilized for feed.
3. Farmers had the opportunity to emulate the technology of utilizing agricultural and plantation byproducts as feed. The opportunity for farmers to emulate those who have utilized agricultural and plantation byproducts as feed for beef cattle is wide open, because farmers who have utilized agricultural and plantation byproducts always process concentrates from plant byproducts and are always open to anyone who wants to learn about the technology of processing concentrates based on agricultural and plantation byproducts.
4. Cattle farming was often considered a form of savings that helped families meet their needs. Beef cattle farming was generally seen as a capital

investment (savings), even though most farmers regarded it as a side business. Raising cattle also served as a way to save money, despite not being in the form of cash, and proved to be an effective method of saving. At certain times, these savings (in the form of livestock) could be sold to cover urgent expenses such as children's school fees, celebrations, weddings, medical costs for family members, and as a reserve fund during poor harvests or crop failures.

5. The nutritional composition of feed ingredients from agricultural by-products and plantation by-products was very good for beef cattle feed. Coffee skin contained 89.12% dry matter, 15.23% crude protein, 2.53% fat, 25.28% crude fiber and 6.96% ash (Aswanto et al., 2023). Corn straw contained 89.79% dry matter, 5.85% crude protein, 39.19% crude fiber (Muwakhid et al., 2023). Corn straw is a plant biomass that can be processed as nutritious livestock feed and can be stored for a long time (Wahyudin, 2023), and oil palm fronds contained 97.39% dry matter, 47.00% crude fiber, 2.23% protein, and 3.04% fat (Suryani et al., 2016). Fermented palm oil fronds using *Lactobacillus* mixed with rice bran increased the protein content from 4.72% to 6.70 (Astuti et al., 2017)%. Fermentation of rice straw + banana stem MOL could reduce the levels of organic matter (70.59%) and crude fiber (18.87%) and tends to increase crude protein (8.46%) (Suningsih et al., 2019).

6. Intensive cattle farming was practiced. Efforts were made to increase the utilization of crop byproducts as intensive livestock feed. This system was seen as an effective strategy for livestock development in Lebong Regency, as it provided daily field grass feed of approximately 30 kg per head and required time to process and provide coffee skin-based concentrates and agricultural byproducts, such as rice straw, corn, and oil palm fronds. However, most farmers were generally not accustomed to the method of continuous maintenance in pens. This was because, economically, farmers assumed it had been more profitable to raise livestock with an extensive system. Therefore, naturally available feed ingredients were still continuously provided, although they had not been optimally utilized.

Internal Weaknesses

Factors identified as weaknesses in the use of agricultural by-products as cattle feed were as follows:

1. The local socio-cultural customs and practices were not conducive to beef cattle farming. In Lebong Regency, the indigenous people-especially the Rejang-had a unique lifestyle. They believed Lebong Regency had relatively extensive agricultural land and could clear forest land through shifting cultivation, relying on land inherited from their parents. Furthermore, the indigenous people believed that raising cattle by foraging for green fodder was tantamount to enslaving the cattle (*msoa upan sapai taine ite jijai budok ternok*). This belief was still strongly held by the indigenous population, which made it difficult to implement innovations in the livestock sector.

2. There was no cooperation between farmers, agricultural processing industry players, and livestock breeders in utilizing plant by-products as feed for beef cattle. To supply crop by-products in Lebong Regency, collaboration was needed among beef cattle breeders, coffee mills, rice and corn farmers, as well as coffee and palm oil growers. Until now, no such cooperation agreement had been established. If cooperation had existed, each of these businesses could have integrated and mutually benefited from utilizing crop by-products as feed. Agricultural by-products were continually used by breeders as a substitute for green fodder and as a concentrate for beef cattle, while livestock manure could be utilized as organic fertilizer for agricultural and plantation crops.

3. There was a lack of knowledge and skills among livestock farmers in processing crop byproducts into feed. Utilizing crop byproducts as feed for beef cattle required technology to optimize their use. Feed processing methods that increased the nutritional value of crop byproducts included fermentation, haymaking, ammoniation, and others. Therefore, training was needed to improve knowledge and skills in processing these byproducts into feed for beef cattle.

4. There was a lack of group cohesion in processing plant byproducts as animal feed. When utilizing technology, the institutional unity of farmers was crucial. At that time, the number of farmer groups in Lebong Regency that used plant byproducts as feed for beef cattle remained very low. Out of the 12 sub-districts, only one—South Lebong Sub-district—had farmers who fed their livestock with plant byproducts. Supplying biomass from plant byproducts as cattle feed had not been implemented across the region, so the dissemination of this practice progressed slowly. This situation required institutional and government intervention. Mulijanti et al. (2016) stated that empowering livestock groups through institutional development, including theoretical and practical activities, encouraged livestock farmers to establish feed businesses. Producing complete feed saved

time in meeting forage needs and improved the quality of meat and milk production. Providing complete feed at the group level proved more efficient for sourcing raw materials.

5. Livestock farming was considered a side business, with most focus placed on other fields of work. In Lebong Regency, livestock farmers generally maintained herds on a small scale, typically 2-3 head, while only a few farmers had relatively large-scale operations. This was due to factors such as community habits, as many were not yet skilled or trained in livestock farming. Additionally, farmers perceived the risk of loss in livestock farming to be greater than in other agricultural businesses. As a result, farmers treated beef cattle farming as a supplementary activity and concentrated more on their primary occupations.

6. Time constraints limited the processing of plant byproducts into beef cattle feed. The required processing time was considered a limitation and a weakness in developing a beef cattle business. Since the livestock herd size was still small, ranging from 2 to 4 head, farmers were able to source forage from the surrounding land. On the other hand, farmers in Lebong Regency were among those with middle and relatively low incomes, spending more time on their primary occupations: rice farming, horticultural commodity farming, and coffee farming.

External opportunities

Factors identified as opportunities in the use of plant by-products as feed for beef cattle were as follows:

1. The demand for beef cattle continued to rise. Market demand is driven by population growth, education levels, and social welfare, which were closely linked to the community's protein needs. As stated, Novra (2022) the need for protein from meat was one of the essential nutrients for health, helping to build muscle and body tissue. Market demand was highly dependent on the existing cattle population. Raihan and Harmini (2023) The report stated that stable beef prices can be achieved through population growth, particularly through culled heifers and slaughter-ready bulls. Captive relationships between subsystems could provide market certainty and insurance in running a business. This concept represented a model for the future livestock industry that combines the farming system with a people-based agribusiness system.

2. Livestock development through technology integration with crops was pursued to increase business scale. Beef cattle farming technology in Lebong Regency had not yet been integrated with crops, but the Karya II farmer group had achieved this integration. In Bingin Kuning District, an integrated livestock husbandry system that utilized agricultural byproducts (rice straw) as feed for beef cattle, and used livestock waste (manure) as compost for seasonal crops, had begun to be implemented. This integration technology offered ample opportunities for livestock farmers since the two commodities could be mutually beneficial.

3. The demand for local feed was high. The beef cattle population in Lebong Regency was 305 (Field data, 2023). Through central and local government programs, efforts were being made to increase the livestock population, especially local cattle. Although the potential for beef cattle development was high, if feed did not meet quantity and quality requirements, high production will be difficult to achieve. The goal of providing quality feed in beef cattle farming was to achieve maximum weight gain and optimal reproduction. Therefore, providing quality feed according to livestock needs was necessary.

4. The livestock development program, initiated by both the Central and Regional Governments, aimed to increase the beef cattle population by providing guidance to livestock farmers through livestock officers. Beef cattle development was carried out collaboratively by the government, the community (small-scale livestock farmers), and the private sector. The government established rules, facilitated activities, and monitored the flow and availability of livestock products in terms of both quantity and quality, to ensure they met halal, safe, nutritious, and healthy standards. The central government's UPSUS SIWAB program (local feed utilization development), overseen by the Ministry of Agriculture, also aimed to develop the cattle and buffalo population nationally, and began implementation in 2017.

5. Utilizing crop byproducts directly reduced environmental pollution. The use of byproducts for various community needs in Lebong Regency indirectly decreased the environmental pollution caused by crop byproducts. Burning rice straw on agricultural land produced smoke that polluted the air and killed microorganisms in the soil surrounding the burned area. Increased environmental awareness influenced consumer demand for sustainable and environmentally friendly livestock products (Anwar et al 2024; Therik and Lino, 2021).

6. The livestock business was facilitated by utilizing bank credit (KUR) for livestock development, enabling farmers to take advantage of soft loans from banks at an interest rate of 7%

per year through BRI, BSI, and BPD, specifically for smallholder livestock, as part of the implementation of the economic equality policy. This ease of obtaining credit was used for commercial feed processing to expand business scale and to manage animal feed based on agricultural and plantation by-products.

External opportunities

Factors identified as threats to the use of agricultural by-products as feed for beef cattle were as follows:

1. The cost of processing livestock feed from agricultural and plantation by-products was higher than that of green fodder. In Lebong Regency, farmers continued to believe that producing feed from these by-products was more expensive than using green fodder because agricultural and plantation by-products required technological processing—such as fermentation, making hay, or ammoniation—often with additional feed ingredients (bran), activators, and sugar. Furthermore, these processes required substantial time to complete. The need to prepare all these materials contributed to the increased cost of processing agricultural and plantation by-products.
2. FMD, anthrax, and other diseases recently attacked beef cattle in Lebong Regency. FMD threatened livestock development in 2022 but was successfully managed by breeders and livestock health workers. In 2021, anthrax was transmitted by cattle purchased from breeders in North Bengkulu Regency, and this incident threatened cattle farming businesses in Lebong Regency. To prevent transmission, the government requested that livestock infected with anthrax not be slaughtered and prohibited the sale or distribution of their meat to the surrounding community due to risks and the potential for transmission to humans. Other common diseases affecting cattle in Lebong Regency included parasitic worm infestations and various skin diseases. Whenever outbreaks occurred, breeders responded quickly, using both traditional remedies and medical treatment with assistance from livestock officers when necessary.
3. The development and expansion of both rural and urban areas threatened and reduced the beef cattle farming system. Rapid urban development, which aimed to expand city boundaries, posed a threat to livestock production efforts. This situation narrowed the cultivation areas for rice, corn, coffee, and even cattle farming-especially for livestock businesses located near urban centers and government offices.
4. Religious holidays and weddings reduced the beef cattle population. Demand for beef in Lebong Regency increased year after year, especially during major holidays (Eid al-Fitr, Eid al-Adha, celebrations, and weddings). This threatened the beef cattle population. Cattle were slaughtered in almost every mosque on Eid al-Adha, particularly in the Lebong area.
5. Other ingredients used to process plant byproducts into feed were difficult to obtain. When producing coffee husk-based concentrate feed, livestock farmers in Lebong did not prepare coffee husk feed alone; coffee husk utilization ranged from 50% to 60%, with the remainder mixed with other feed ingredients such as corn cobs, rice bran, and tofu dregs. The availability of these mix ingredients was limited and not continuous. Additionally, farmers had to pay extra costs to acquire them, for example: a) corn cobs required additional expenses for pounding or grinding to achieve a finer size; b) rice bran had to be purchased at a relatively expensive price, specifically Rp. 2,000 to Rp. 3,000 per kg.
6. The utilization of plant byproducts for purposes other than animal feed had occurred. Field observations indicated that the risk of using plant byproducts for these alternative uses existed, due to buyers of coffee husks from other districts and provinces, while their utilization had not yet been investigated. Additionally, farmers had begun using coffee husks as mulch for coffee plants, rice straw was burned and had also started to be used as material for producing organic compost, and corn stover was also burned with the ash then utilized for rice seedbeds.

Evaluation of Internal and External Factors

The external factor evaluation matrix was used to determine the extent to which Lebong Regency was able to capitalize on opportunities and address threats in the external environment. The weights, improvements, and scores for each external factor (opportunities and threats) were presented in Tables 3 and 4.

An evaluation of internal and external factors was conducted using the Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) matrices. During the assessment, each identified factor was assigned a weight and ranking. Experts assigned weights for critical internal factors (strengths and weaknesses) as well as critical external factors (opportunities and threats) using the SWOT method, and provided ratings for each internal and external factor. The

assessment results were located in quadrant III (Figure 1), with a score of (0.33; -0.19), indicating a highly favourable situation for beef cattle development. Although beef cattle development presented considerable potential, weaknesses persisted in Lebong Regency, requiring necessary resources to take advantage of available opportunities. The strategy that needed to be implemented under these circumstances was to support the potential of beef cattle farming by minimizing existing weaknesses.

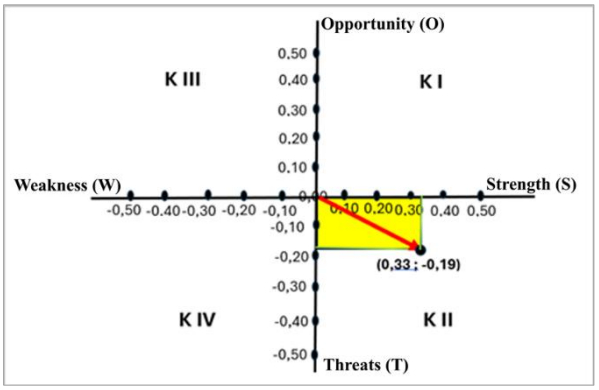

Figure 1. SWOT matrix quadrant for the utilization of agricultural by-products and plantation by-products.

Table 3. Internal matrix of evaluation factors strengths and weaknesses

Internal Strategy Factors	Weight	Rating	Score
Strength			
1. Beef is the highest protein supplier in Lebong	0.010	4	0.24
2. Agricultural and plantation by-products do not compete with human needs	0.007	3	0.12
3. Farmers have the opportunity to emulate the technology of utilizing plant by-products as feed.	0.007	4	0.16
4. Raising livestock is a form of savings that at certain times can help meet family needs.	0.008	4	0.20
5. Sources of feed ingredients from plant by-products are very good for feed and concentrates.	0.010	4	0.24
6. Intensive system maintenance makes it easier for farmers to develop their business.	0.005	3	0.09
Amount			1.05
Weakness			
1. The social and cultural habits of the community are less supportive of beef cattle farming.	0.010	4	0.16
2. There is no cooperation between the coffee processing industry, rice farmers and livestock breeders in providing agricultural by-products as animal feed ingredients.	0.007	3	0.12
3. Lack of knowledge and skills of livestock breeders in processing plant by-products for animal feed	0.005	3	0.15
4. There is no group cohesion in processing plant by-products as animal feed.	0.005	2	0.60
5. Raising livestock as a side business (more focused on work in other fields).	0.008	3	0.15
6. Time constraints for processing feed based on plant by-products	0.007	2	0.08
Amount			0.72
Total	0.088		0.33

Table 4. External evaluation factor matrix opportunities and threats

External Strategy Factors	Weight	Rating	Score
Opportunity			
1. The demand for beef continues to increase.	0.010	4	0.24
2. Livestock development integrated with crops.	0.005	2	0.06
3. The development of livestock cultivation technology with plants increases the scale of the business.	0.005	3	0.09
4. Livestock development program by the central government.	0.008	2	0.10
5. plant by-products directly reduce the impact of environmental pollution.	0.005	2	0.06
6. Facilitating livestock businesses by utilizing credit for businesses from banks (KUR) in managing livestock feed based on plant by-products.	0.008	1	0.05
Amount			0.60
Threat			
1. The processing costs for animal feed based on plant by-products are higher than forage feed.	0.007	3	0.12
2. FMD, Anthrax, and other diseases threaten livestock development	0.008	3	0.15
3. The development and expansion of rural and urban areas threatens/reduces the beef cattle farming system.	0.007	2	0.08
4. Religious holidays, celebrations, weddings reduce the population	0.010	4	0.24
5. Other materials used in processing plant by-products as feed are difficult to obtain.	0.007	2	0.08
6. Utilization of plant by-products for other functions (besides feed)	0.005	3	0.12
Amount			0.79
Total	0.085		- 0.19

An evaluation of internal and external factors was conducted using the Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) matrices. During the assessment, each

identified factor was assigned a weight and ranking. Experts assigned weights for critical internal factors (strengths and weaknesses) as well as critical external factors (opportunities and threats) using the SWOT method, and provided ratings for each internal and external factor. The assessment results were located in quadrant III (Figure 1), with a score of (0.33; -0.19), indicating a highly favourable situation for beef cattle development. Although beef cattle development presented considerable potential, weaknesses persisted in Lebong Regency, requiring necessary resources to take advantage of available opportunities. The strategy that needed to be implemented under these circumstances was to support the potential of beef cattle farming by minimizing existing weaknesses.

Table 5. SWOT matrix of strategies for utilizing coffee processing by-products as feed for beef cattle.

Internal / External	Strength	Weakness
	1. Beef is the highest protein supplier in Lebong Regency 2. Agricultural and plantation by-products do not compete with human needs 3. Farmers have the opportunity to imitate the technology of utilizing plant by-products as feed. 4. Raising livestock is considered as savings at certain times it can help meet family needs. 5. The nutritional content of feed ingredients from plant by-products is very good as feed and concentrate. 6. Intensive system maintenance makes it easier for farmers to develop their business. *(Obtained from the IFE matrix)*	1. The social and cultural habits of the community are less supportive of beef cattle farming. 2. There is no cooperation between the coffee milling industry, rice farmers and livestock breeders in providing by-products as feed ingredients. 3. Lack of knowledge and skills of livestock breeders in processing plant by-products for feed. 4. There is no group cohesion in processing plant by-products for animal feed. 5. Raising livestock as a side business (more focused on work in other fields) 6. Time constraints for processing feed based on plant by-products *(Obtained from the IFE matrix)*
Opportunity 1. The demand for beef cattle continues to increase. 2. Livestock development integrated with crops. 3. The development of livestock cultivation technology with plants increases the scale of the business. 4. Livestock development program by the central government. 5. direct use of plant by-products reduces the impact of environmental pollution. 6. Ease of livestock business by utilizing credit for business from banks (KUR) in managing livestock feed based on plant by-products. *(Obtained from the EFE matrix)*	(S – O) Strategy of using strengths to take advantage of opportunities 1. Utilizing the potential of plant byproducts as a substitute for forage and concentrate for beef cattle to increase business scale to meet market demand. (S2, S3, S5, S6 – O1, O2, O3, O5) 2. Utilizing plant by-products for animal feed with technological innovations to support livestock development programs (S1, S4 – O1, O3, O4). 3. Utilizing intensive cultivation technology by improving animal feed from plant by-products with the support of easy credit (S6, S7, S8 - O5, O6)	(O - W) Strategy to minimize weaknesses to take advantage of opportunities 1. Increasing knowledge about integrated technology that is mutually cooperative between coffee processing industry owners, rice/corn farmers as producers of agricultural by-products (O1, O2, O3 - W2, W3) 2. Utilizing government programs to increase knowledge and scale of beef cattle farming businesses while building institutional cohesion (O4, O5 – W4, W6) 3. Taking advantage of the ease of obtaining business credit to overcome cost limitations to increase business scale (O6 - W1) SWOT said that: The obstacles and limitations of livestock breeders are capital.
Threats 1. The processing costs for animal feed based on plant by-products are higher than for green fodder. 2. FMD, Anthrax and other diseases threaten livestock development. 3. The development and expansion of rural and urban areas threatens/reduces the beef cattle farming system. 4. Religious holidays and wedding celebrations reduce the beef cattle population. 5. Other materials used in processing plant by-products into feed are difficult to obtain. 6. Utilization of plant by-products for other functions (besides feed). *(Obtained from EFE matrix)*	(S – T) Strategy of using strengths to overcome threats 1. Farmers utilize plant by-products as cheap cattle feed that does not compete with human needs (S2, S3, S8 – T3, T6, T5, T7) 2. Using livestock farming as savings reduces livestock slaughter on major holidays (S4 - T4) 3. The increasing need for concentrated feed will increase the economic value of feed ingredients so that it can strengthen livestock farming institutions (S1, S7 - T1)	(W – T) Strategy of exploiting weaknesses to overcome threats 1. Eliminating the use of commercial concentrate feed from outside to save production costs (W1- T5) 2. The need for group counseling for sustainable concentrated feed production (W4 -T2)

Development SWOT Matrix Cattle Cow Cut in Regency Lebong

A SWOT matrix was used to formulate alternative strategies for utilizing agricultural and plantation by-products as feed for beef cattle in Lebong District. These alternative strategies were identified by combining internal and external factors in the use of agricultural and plantation by-products as cattle feed. Four strategies—SO, WO, ST, and WT—were formed, as outlined in the SWOT matrix (Table 5). The results indicated that there were significant opportunities for utilizing these by-products as cattle feed, with no substantial threats or internal weaknesses present. The strategy focused on taking actions to convert potential threats into opportunities that further supported the use of agricultural by-products as feed for beef cattle.

The cattle development strategy based on the SWOT matrix was to utilize byproduct resources from crops, such as rice straw, corn stover, palm oil byproducts, and coffee husk-based concentrates, by leveraging technological innovations within livestock groups that already cultivated cattle using intensive systems. Institutional collaboration between food crop farmers and coffee millers was strengthened. The business scale was increased by using capital from soft loans (KUR). The use of programs from the central and regional governments in beef cattle development was maximized.

CONCLUSION

The strategy for developing beef cattle by utilizing plant by-products in Lebong Regency requires practical implications through:

1. Enhancing knowledge of integrated technology through collaboration between coffee processing industry owners and rice/corn farmers can support development initiatives. Lebong Regency has a potential for beef cattle development totalling 10,319 head.
2. The SWOT analysis indicates that development is situated in quadrant II, with a score of (0.33; -0.19), reflecting a highly favourable condition. The beef cattle industry has substantial opportunities for growth, although certain threats remain. Therefore, the recommended strategy is to leverage existing strengths while minimizing risks. Farmers can use crop byproducts as affordable cattle feed that doesn't compete with human consumption (S2, S3, S8-T3, T6, T5, T7). Treating livestock enterprises as savings helps decrease cattle slaughter, especially during major holidays (S4-T4). A rising demand for concentrate feed will enhance the economic value of feed ingredients, thereby reinforcing farmers' institutions (S1, S7-T1).
3. Leverage market opportunities and central government programs to expand knowledge and the scale of beef cattle farming operations, while fostering institutional cohesion.

CONFLICT OF INTEREST

The author declares that all material presented in this manuscript is free of any financial conflict of interest and has been provided solely as a reference for policymakers developing cattle farming strategies in Lebong Regency.

ACKNOWLEDGEMENT

We would like to extend our sincere gratitude to the Department of Agriculture and Fisheries of the Lebong Regency Government for facilitating the research activities, as well as to all individuals who provided valuable assistance during the fieldwork.

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HOW TO CITE

Ramon, E., Nurhaita, N., Firison, J., Hidayat, T., Ishak, A., Efendi, Z., Rosbarnawan, F., Tresia, G.E., Puastuti, W., Sutedi, E., Kusumaningrum, D.A., Harmini, H., Rahman, T., Yulistiani, D. 2025. Beef Cattle Development Strategy Based on Agricultural By-Products in Lebong Regency Bengkulu. Jurnal Agripet, 25 (2), pp. 223–234. https://doi.org/10.17969/agripet.v25i2.45046