Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan
ISSN 2303-2227 eISSN 2615-594X
Accredited by National Journal Accreditation No. 105/E/KPT/2022

Vol. 14 No. 2 June 2026, Page: 96-108
DOI: https://doi.org/10.29244/jipthp.14.2.96-108
Available online at https://journal.ipb.ac.id/index.php/ipthp/index

Analysis of Breeding Strategies to Improve Beef Cattle Productivity in Lowland Areas of West Java

A. Mawarni[1], B. W. Putra[2], & L. Cyrilla[2]
[1]Graduated School of Animal Science and Technology, Faculty of Animal Science, IPB University.
[2]Department of Animal Science and Technology, Faculty of Animal Science, IPB University.
Jl. Agatis, Kampus IPB Darmaga Bogor 16680, Indonesia
*Corresponding author: aninditamawarni@apps.ipb.ac.id
(Received 26-09-2025; Revised 2-05-2026; Accepted 29-06-2026)

ABSTRACT

The Indonesian population's increasing need for animal protein has yet to be addressed by the country's existing beef cattle population. The development of the livestock sector is critical for increasing farmer welfare and boosting agricultural expansion. This study seeks to design a development strategy for smallholder beef cattle breeding farms in Cikedung Subdistrict, Indramayu Regency. The study was carried out on 51 farmers, 36 semi-intensive and 15 intensive farmers, using observation and interviews with questionnaires. The data was analyzed using IE, SWOT, and QSPM matrices. The majority of farmers were over 50 years old, had a primary school education, and saw cattle ranching as a secondary occupation. The Peranakan Ongole (PO) cattle were the most widely grown breed. Strategies to enhance the productivity of smallholder beef cattle breeding farms can be achieved through the optimization of resource utilization, improvement of product quality, and strengthening of partnerships. This should be accompanied by leveraging external opportunities, particularly support from local governments, and implementing regular evaluations to anticipate challenges. Strategic targets include increasing feed quality and availability, forming partnerships with stakeholders to minimize inbreeding and secure the procurement of breeding stock and market certainty, and enhancing livestock housing and security systems. It is anticipated that these strategies will improve smallholder cattle farming enterprises' sustainability and production.

Keywords: Cattle Breeding, Semi-Intensive, Strategy, SWOT, QSPM

ABSTRAK

Kebutuhan masyarakat Indonesia akan protein hewani yang meningkat belum dapat dipenuhi oleh populasi sapi pedaging yang ada di Indonesia. Pembangunan sektor peternakan menjadi bagian penting dalam meningkatkan kesejahteraan petani dan mendorong pertumbuhan sektor pertanian. Penelitian ini bertujuan merumuskan strategi pengembangan usaha pembiakan sapi pedaging di Kecamatan Cikedung, Kabupaten Indramayu. Penelitian dilakukan pada 51 peternak, terdiri dari 36 peternak semi intensif dan 15 peternak intensif, melalui observasi dan wawancara menggunakan kuesioner. Analisis data menggunakan matriks IE, SWOT, dan QSPM. Mayoritas peternak berusia di atas 50 tahun, pendidikan tingkat dasar, dan menjadikan beternak sebagai usaha sampingan. Sapi yang dominan dibudidayakan adalah sapi Peranakan Ongole (PO). Strategi peningkatan produktivitas usaha pembiakan sapi pedaging dapat dilakukan melalui optimalisasi pemanfaatan sumber daya, peningkatan kualitas produk, dan penguatan kemitraan, disertai pemanfaatan peluang eksternal, khususnya dukungan dari pemerintah daerah, serta pelaksanaan evaluasi berkala untuk mengantisipasi tantangan yang dihadapi. Prioritas strategi mencakup peningkatan kualitas dan ketersediaan pakan, kerja sama dengan pihak terkait untuk mencegah inbreeding dan menjamin pengadaan bibit serta pemasaran, serta perbaikan kandang dan sistem keamanan. Strategi ini diharapkan dapat meningkatkan produktivitas dan keberlanjutan usaha peternakan rakyat.

Kata kunci: Peternakan Sapi, Semi Intensif, Strategi, SWOT, QSPM

INTRODUCTION

Indonesia's agri-food market is undergoing major upheaval, owing to factors such as economic expansion, urbanization, and demographic shifts. These changes have resulted in a steady growth in demand for high-value agricultural products, particularly animal protein. However, Agus and Widi (2018) remark that the domestic beef cow population has been insufficient to supply this increasing demand. The Indonesian government is forced to import beef every year due to a supply-demand discrepancy. From 2019 to 2023, the volume of these imports fluctuated, peaking in 2022 at 287.53 thousand tons worth around $1.056 million (Kementan 2023).

The development of the livestock sector constitutes an integral part of agricultural development with the objective of creating resilient livestock farmers who have the capacity to improve their welfare and contribute to the overall growth of the agricultural sector. Cattle fattening and breeding are alternative enterprises commonly chosen by farmers. This preference is due to the fact that local cattle have several advantages, including high adaptability to extreme conditions, rapid reproductive rates, low carcass fat content, high fertility and reproductive performance, and the ability to utilize low-quality feed resources. Cattle fattening requires a relatively short production period. This differs from cattle breeding, which requires a relatively longer period of about five years per production cycle. The breeding cycle includes producing calves, raising them until they reach slaughter age, fattening male cattle, and rearing young female cattle as replacement breeding stock (Perwitasari *et al.* 2024).

Cattle breeding activities in Indonesia have been carried out in several areas, one of which is Indramayu District. The district is characterized by community-led smallholder livestock systems that employ a combination of intensive (zero-grazing) and semi-intensive (supplementary grazing) production methods. Cikedung subdistrict also has several areas of vacant land and provides opportunities to develop livestock farming enterprises using both systems. The differences in livestock management systems can influence cattle performance, including productivity, body weight, and body size productivity, body weight, and body size (Angerer *et al.* 2021).

Effective management practices are essential for the development of smallholder beef cattle production systems, including the optimal use of natural resources, efficient labor, and a sustainable feed supply (Saputra *et al.*, 2019). Therefore, this study aims to prioritize strategic actions for intensive and semi-intensive systems using a SWOT–QSPM approach in Cikedung Subdistrict, Indramayu District. By analyzing strategic priorities, this research identifies development strategies that can enhance smallholder production and contribute to meeting national beef demand while improving the sustainable welfare of livestock farmers.

MATERIALS AND METHODS

This study was conducted in Cikedung District, Indramayu Regency, West Java, in December 2022. A case study approach was employed in Cikedung District, a prominent center for beef cattle breeding in West Java, with a focus on parameters for development strategies. The data collected comprised both primary and secondary data. Primary data were obtained through field observations and interviews with livestock farmers, using structured questionnaires. The study included 51 respondents, consisting of 36 semi-intensive farmers and 15 intensive farmers. Secondary data were gathered from a literature review and information from relevant institutions, including the Central Statistics Agency (Badan Pusat Statistik), the Indramayu Regency Livestock and Fisheries Office (Dinas Peternakan dan Perikanan Kabupaten Indramayu), the Cikedung Sub-district Office (Kantor Camat Cikedung), the Situ Village Office (Kantor Desa Situ), and various other pertinent organizations.

Strategy formulation and recommendations in this study were developed by identifying critical internal and external factors, which were then evaluated using the Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) matrices (David & David, 2016). In this process, each identified factor was assigned a weight reflecting its relative importance to the system's success and a rating to indicate the effectiveness of current strategies in responding to that factor. The resulting weighted scores provided a quantitative basis for the subsequent Strengths, Weaknesses, Opportunities, and Threats (SWOT) matrix analysis. This framework enabled the systematic matching of internal capabilities with external market conditions to derive viable development strategies (David & David, 2016).

The Quantitative Strategic Planning Matrix (QSPM) was used for the objective prioritization of strategies. This was based on the strategic recommendations derived from both the Internal-External (IE) matrix and SWOT analysis. The aim of this approach is to identify the most suitable and applicable strategies for developing beef cattle breeding businesses in the research location.

RESULTS AND DISCUSSION

Characteristics of Beef Cattle Farmers

Identifying the characteristics of beef cattle farmers in Cikedung District, Indramayu, involves examining various aspects relevant to their profiles and farming practices. Demographic aspects, such as age, education level, and economic conditions, significantly influence decision-making and the specific husbandry methods employed. Experience in farming is also a crucial element. The longer a farmer has been involved in livestock, the greater their knowledge and skills in managing cattle and overcoming various field challenges. Additionally, the number of livestock owned reflects the scale of the operation and the production capacity of the farm. Finally, livestock ownership status provides insight into the farmer's level

of investment and commitment to the beef cattle breeding business. Table 1 details the demographic aspects used in this study.

Table 1 reveals key demographic insights into beef cattle farmers in Cikedung. A significant portion of farmers are over 50 years old, with 60% in intensive farming and 55.56% in semi-intensive farming. While the productive age for workers, according to BPS and WHO, ranges from 15-64 years, the age of farmers is crucial. Productive age plays an important role in decision-making, openness to innovation, and cognitive ability in running a livestock business (Fadli *et al.*, 2020). In terms of gender, the vast majority of farmers are male, accounting for 94.44% in semi-intensive systems and 93.33% in intensive systems.

Regarding education levels, a notable portion of farmers have a primary school education, with 46.67% of semi-intensive farmers and 33.33% of intensive farmers falling into this category. A farmer's education level impacts their performance in cattle farming, as higher education tends to correlate with an easier adoption of innovations (Makatika 2021). Employment status indicates that most respondents engage in farming as a secondary occupation, with 86.11% in semi-intensive and 93.33% in intensive systems. This is largely due to the perception that cattle

Table 1. Demographic characteristics of beef cattle farmers in Cikedung District, Indramayu Regency

No	Demographic Aspect	Number of Farmers (persons)		Percentage (%)	
		Semi intensive	Intensive	Semi intensive	Intensive
1	Age (years old)				
	a. 15-30	0	0	0.00%	0.00%
	b. 30-50	16	6	44.44%	40.00%
	c. >50	20	9	55.56%	60.00%
2	Gender				
	a. Male	34	14	94.44%	93.33%
	b. Female	2	1	5.56%	6.67%
3	Education Level				
	a. No Formal Schooling	1	2	2.78%	13.33%
	b. Primary School	12	7	33.33%	46.67%
	c. Junior High School	8	4	22.22%	26.67%
	d. Senior High School	5	2	13.89%	13.33%
	e. Bachelor's Degree	10	0	27.78%	0.00%
4	Marriage Status				
	a. Single	2	0	5.56%	0.00%
	b. Married	34	15	94.44%	100.00%
5	Number of Family Dependents (persons)				
	a. 1 - 2	15	4	41.67%	26.67%
	b. 3 - 4	19	10	52.78%	66.67%
	c. >4	2	1	5.56%	6.67%
6	Employee Status				
	a. Primary	5	1	13.89%	6.67%
	b. Secondary	31	14	86.11%	93.33%

Source : n = 51 (semi intensive 36 dan intensive 15)

Table 2. Beef cattle population structure in Cikedung District as of Januari 2023

Livestock Categories	Total Ownership (head)
Calves	
a. Male	201
b. Female	223
Heifers	204
Adult Females	696
Adult Males	186
Total	1.510

Source : Mitra Mandiri Cooperative Data

farming serves as a long-term investment or savings rather than a primary source of income.

Beef cattle raised in Cikedung Subdistrict are primarily local breeds, specifically Peranakan Ongole (PO) cattle. The population structure of beef cattle in Cikedung Subdistrict as of January 2023 is shown in Table 2.

According to 2024 data from the Central Statistics Agency (BPS), the total beef cattle population in West Java Province, including cattle for both fattening and breeding, reached 366,389 head. Of this total, Indramayu Regency accounted for 11,364 head, representing approximately 2.74% of the province's total beef cattle population. A significant contributor to Indramayu's cattle breeding sector is the Mitra Mandiri Situbolang Cooperative located in Cikedung District. This cooperative manages a total cattle population of 1,518 head, with a primary focus on Cow Calf Operations (CCO). This contributes 13.36% of Indramayu Regency's total beef cattle population.

Based on a survey of 51 farmers, a total of 1,149 cattle were recorded (Table 3) revealed a total beef cattle ownership of 1,149 head. This data highlights the substantial role Cikedung District plays, particularly through its cooperatives and smallholder farmers, in supporting the development of beef cattle in Indramayu Regency.

Table 3 reveals that the highest numbers of cattle are Adult Females and Male Calves. This suggests that semi-intensive farming systems tend to have more productive livestock compared to intensive systems. The significant percentage of adult female cattle, reaching 36.3% of the total beef cattle population, indicates that farmers predominantly raise adult female cattle to support breeding activities and produce offspring or calves (Kusuma *et al.* 2017).

Internal and External Factors Identification

Internal factors illustrate the conditions within a business that can be either strengths or weaknesses. These factors typically encompass several key aspects: production, marketing, human resource management, and finance.

1. **Production Aspect**

Beef cattle production in Cikedung District utilizes two main rearing patterns: semi-intensive and intensive. Intensive rearing involves keeping breeding cattle in pens full-time, with specific feed provided. In contrast, semi-intensive rearing involves cattle that are housed and fed, but are occasionally allowed to graze (Burrow 2019). Beef

Table 3. Beef cattle population structure of studied farms

Categories	Quantity (head)		Total (head)
	Intensive	Semi intensive	
Male Calves	15	186	201
Female Calves	14	139	153
Heifers	7	165	172
Adult Females	48	417	465
Adult Males	9	149	158
Overall Total	93	1.056	1.149

Table 4. Feed management in semi-intensive and intensive rearing systems

Feeding Aspect	Management Practices	Number of Farmers		Percentage (%)	
		Semi Intensive	Intensive	Semi Intensive	Intensive
Feeding Methods	a. Grazing only	25	0	69	0
	b. Fed twice daily in the pen	0	7	0	47
	c. Grazing with supplemental feeding	11	0	31	0
	d. Fed once daily in the pen	0	8	0	53
Type of Feed	a. Dry	36	15	100	100
	b. Wet	0	0	0	0
Source of Feed Ingredients	a. Grazing	20	0	56	0
	b. Grazing + supplemental feed	31	0	86	0
	b. Field grass	0	15	0	100
Feed Processing or Preservation	a. Yes	5	0	14	0
	b. No	31	15	86	100
Drinking Water Sources	a. Groundwater	0	0	0	0
	b. PDAM	36	15	100	100
Watering Frequency	a. Ad libitum	17	9	47	60
	b. 1-2 times daily	19	6	53	40
	c. Not provided	0	0	0	0

Source : n = 51 (semi intensive 36 and intensive 15)

cattle production is evaluated based on several factors: dam reproduction, breeding stock selection, feeding, and health management.

Reproduction methods in Cikedung District, Indramayu, vary depending on the rearing pattern. Semi-intensive systems primarily use natural mating, while intensive systems utilize artificial insemination (AI) performed by inseminator officers. Recording the number of calves born per dam in semi-intensive systems tends to be challenging due to the difficulty in identifying specific male and female pairings during natural mating. Under normal conditions, a dam typically gives birth to one calf per year. After birth, the health of both the dam and calf is monitored with several treatments. Immediately post-calving, dams are given molasses to replenish their energy. The dam's condition is continuously monitored for 8 hours after birth to ensure placental expulsion.

Based on livestock ownership data from the Mitra Situbolang Cooperative in Cikedung District for semi-intensive rearing, the ratio of 186 adult males to 908 adult females (including heifers ready for breeding, dry cows, lactating cows, and non-pregnant cows) is 1:5. This means that in a pen containing five adult females, one male is introduced, either sourced from other farmers within Situbolang or brought in from outside Situbolang village.

Feed provided to livestock is categorized into concentrates, typically grain or pellet products, and fibrous materials, such as straw or grass (Dahlanuddin *et al.*, 2016). The feeding management practices employed in both rearing patterns are presented in Table 4.

There are notable differences between semi-intensive and intensive beef cattle rearing patterns in Cikedung District. In the semi-intensive system, the majority of farmers (69%) exclusively graze their cattle, while the remaining 31% supplement grazing with additional feed. Conversely, in the intensive system, 53% of farmers feed their cattle once a day in the pen, and 47% feed them twice daily; all intensive farmers use dry feed. Regarding feed sources, semi-intensive farmers largely rely on grazing (56%) and a combination of grazing with supplementary feed (86%), whereas intensive systems depend entirely on cut field grass.

Feed processing and preservation are minimal; only 14% of semi-intensive farmers engage in this, and no intensive farmers do. For drinking water, all farmers use water from PDAM (local water utility). In semi-intensive systems, 47% provide water ad libitum (free access), and 53% provide it 1-2 times per day. In intensive systems, 60% provide water ad libitum, and 40% provide it 1-2 times per day. This indicates that intensive rearing relies more on controlled feed and water management within the pen, while semi-intensive rearing is more flexible and dependent on grazing.

Animal care and treatment are another critical aspect of beef cattle production, aiming to prevent contagious diseases (Burrow 2019). Farmers in Cikedung District manage sick livestock through regular health checks by veterinarians, supplemented with traditional medicine. Details on animal health practices in Cikedung District are provided in Table 5.

When it comes to animal health, all farmers, whether operating semi-intensive or intensive systems, utilize a combination of traditional remedies and veterinary services (100%). The administration of vitamins or herbal supplements is more prevalent in intensive farms (100%) compared to semi-intensive ones (78%). Routine vaccinations are also consistently performed by all farmers, with no distinction between the two rearing systems.

However, there's variation in deworming practices. In semi-intensive farming, 50% of farmers administer deworming medication regularly, while this figure is slightly lower in intensive systems at 47%. A significant portion of both intensive (53%) and semi-intensive (28%) farmers administer deworming medication fairly regularly. Notably, 22% of semi-intensive farmers are still inconsistent with deworming, a condition not observed in intensive systems.

2. **Marketing Aspect**

Beef cattle farmers in Cikedung District typically sell their livestock to long-standing middlemen (collectors), who then distribute the cattle to various livestock markets, including Jatibarang, Karangampel, Kedokan, Kertamaya, Bondan, and Leger. Common marketing strategies remain quite basic, primarily relying on word-of-mouth promotion and networking to build marketing relationships. Some farmers also use social media to display photos of their livestock to attract buyers. Research by Said (2020) indicates that local farmers generally market beef by selling livestock to slaughterhouses (RPH), which then distribute the meat to traditional markets. Meanwhile, the demand for beef from large restaurants, hotels, catering services, and the food industry is met through a combination of local production and imported frozen beef from Australia.

Table 5. Health management for both semi-intensive and intensive livestock farming systems

Health Management Aspect	Management Practices	Management Systems		Percentage (%)	
		Semi Intensive	Intensive	Semi Intensive	Intensive
Prevention through vitamins or herbal remedies	a. Provided	28	15	78	100
	b. Not Provided	8	0	22	0
Disease prevention through vaccination	a. Regularly	36	15	100	100
	b. Irregularly	0	0	0	0
Deworming medication Administration	a. Regularly	28	15	78	100
	b. Irregularly	8	0	22	0

Significantly, 16 semi-intensive farmers and 15 intensive farmers reported that holidays, particularly Eid al-Adha, are strategic times to sell cattle at higher prices. Regarding distribution channels, 11 semi-intensive farmers prefer selling to collectors, while the remaining 9 utilize a combination of direct sales, sales through collectors, and sales during Eid al-Adha.

Two primary valuation systems are utilized for price determination: subjective estimation by buyers and sellers, and standardized weighing. The estimation system involves approximating the cattle's weight without actual weighing, commonly used in markets or seasonal sales, such as leading up to Eid al-Adha. Conversely, the weighing system involves first weighing the cattle and then determining the price based on the actual weight multiplied by the price per kilogram of live cattle. This method is typically used at the farm.

3. **Human Resources Aspect**

In the intensive farming system, the majority of labor is provided by family members, including the husband, wife, and children. The husband typically assumes primary responsibility for all daily tasks, such as sourcing and providing feed, cleaning the barn, and bathing the cattle. However, as most male heads of household are engaged in off-farm occupations, women frequently manage livestock tasks in their absence. The total annual labor cost including imputed family labor is approximately IDR 3,600,000, covering fodder collection, feeding, and enclosure maintenance.

Conversely, the semi-intensive system tends to rely on non-family labor, who are paid on a monthly or annual basis. Some operations also utilize a profit-sharing model. Labor costs vary significantly with the scale of the business: farmers with 1-10 cattle (Category I) incur an annual cost of IDR 15,000,000, while those with 11-20 cattle (Category II) spend IDR 15,076,923, and operations with more than 20 cattle (Category III) reach IDR 20,605,263 per year (Table 6). This clearly indicates that as the scale of the business

Table 6. Labor costs in intensive and semi-intensive farming systems

Category	Annual Labor Cost (IDR)
Semi Intensive	
Category I	15.000.000
Category II	25.076.923
Category III	20.605.263
Intensive	3.600.000

Table 7. Cost analysis of semi-intensive beef cattle breeding businesses in Cikedung, Indramayu

	Cost	Semi Intensive (n=36)			Average (IDR/ year)
		Category 1	Category II	Category III	
		(IDR/year)	(IDR/year)	(IDR/year)	
A	Variable Cost				
	Bran	101.053	-	-	33.684
	Straw	484.211	98.462	-	194.224
	Salt	33.516	12.246	-	15.254
	Electricity	631.579	553.846	500.000	561.808
	Water	726.316	553.846	500.000	593.387
	Dewormer	164.745	43.194	31.927	79.955
	Jamu	176.463	29.538	-	68.667
	Eye drops	8.421	7.692	5.000	7.038
	Sick livestock	915.789	761.538	225.000	634.109
	Manpower	20.605.263	15.076.923	15.000.000	16.894.062
	Transportation	-	-	-	-
	Artificial Insemination	-	-	-	-
	Total Variable Cost	23.847.355	17.137.286	16.261.927	19.082.190
B	Fixed Cost				
	Equipment Depreciation	61.183	56.476	47.611	55.090
	Barn Depreciation	613.684	379.231	265.000	419.305
	Total Fixed Cost	674.867	435.707	312.611	474.395
	Total Cost	24.522.222	17.572.993	16.574.539	19.556.585

Notes : category 1 = 1-10 head, category 2 =11-20 head, category 3 = >20 head

increases, so do the labor requirements and associated costs.

4. **Financial Aspect**

In the semi-intensive rearing system, farmers were classified into three distinct categories based on their livestock holdings, as detailed in Table 7. These categories are defined as follows: Category I: Farmers with 1–10 head of livestock, Category II: Farmers with 11–20 head of livestock, and Category III: Farmers with more than 20 head of livestock.

Interestingly, despite Category III having the largest number of livestock, it shows the lowest average maintenance costs. Variable costs include feed like bran and straw, as well as other necessities such as salt, electricity, water, medicine, and veterinary services. Labor costs are the largest component. Surprisingly, Category I incurs the highest labor cost at at IDR 20,605,263 annually, while Category II and III spend IDR15,076,923 and IDR 15,000,000, respectively. Straw is also a significant expenditure, particularly for Category I.

Meanwhile, fixed costs cover the depreciation of pens and equipment. Category I has the highest pen depreciation at Rp613,684, followed by Category II at Rp379,231 and Category III at Rp265,000. The total annual expenditure is highest for Category I at Rp24,522,222, followed by Category II at Rp17,572,993, and Category III at Rp16,574,539. The overall average maintenance cost for semi-intensive farmers is Rp19,556,585 per year.

The primary sources of revenue for farmers come from the sale of livestock and cow dung. As expected, higher livestock ownership categories generally correlate with greater income (Table 8).

Category I (1–10 head): Annual total revenue is IDR 34,507,500, almost entirely from livestock sales, with a very small contribution from dung sales. This suggests that income is still limited and requires strategies for improvement, both in terms of livestock numbers and marketing.

Category II (11–20 head): Shows an increase in revenue to IDR 49,009,231 per year, with most of it from livestock sales. Revenue from dung sales remains low, indicating unmaximized potential. With better management, this category offers greater income growth opportunities compared to Category I.

Category III (>20 head): Records the highest revenue at IDR 107,532,632 per year, predominantly from livestock sales. Dung sales reached IDR 58,947, indicating a potential for further development. This category demonstrates that a larger business scale can increase profitability, and optimizing by-products like dung can add value to the beef cattle breeding business.

IFE EFE Matrix

Based on the identification of internal factors within the semi-intensive beef cattle breeding business, an Internal

Table 8. Revenue of the semi-intensive beef cattle breeding business in Cikedung Subdistrict, Indramayu

Revenue	Semi intensive (n=36)			Total	Average
	Category III	Category II	Category I		
	(IDR/year)	(IDR/year)	(IDR/year)		
Livestock Sales	107.473.684	49.000.000	34.500.000	190.973.684	63.657.895
Manure Sales	58.947	9.231	7.500	75.678	25.226
Total Revenue	107.532.632	49.009.231	34.507.500	191.049.362	63.683.121

Notes : category 1 = 1-10 head, category 2 =11-20 head, category 3 = >20 head

Table 9. Internal factor evaluation (IFE) matrix

	Internal Key Factors	Weight	Rating	Weighted Score	Notes
Strengths					
1	Available Grazing Land/Grass	0.15	3	0.45	
2	Labor Avaibility	0.12	3.5	0.42	
3	High Interest In Farming	0.09	3	0.27	
4	Livestock products are easy to market	0.09	2.5	0.225	
5	Farming Experience	0.13	4	0.52	
Strengths Total		0.58	16	1.885	72.36%
Weaknesses			0	0	
1	Insufficient Livestock Care	0.06	1	0.06	
2	Underutilized Livestock Waste	0.06	1	0.06	
3	Limited Farmer Knowledge	0.12	2	0.24	
4	Low Farming Skills	0.09	2	0.18	
5	Poor Quality of Produced Cattle Breeds	0.09	2	0.18	
Weaknesses Total		0.42	8	0.72	27.64%
Overall Total		1	24	2.605	100%

Factor Evaluation (IFE) matrix was constructed, identifying five key strengths and five key weaknesses within the internal environment (Table 9).

The beef cattle breeding business in Cikedung District, Indramayu Regency, has an overall internal factor score of 2.605. This falls into the medium category (scores between 2.00–2.99). This result suggests that while the existing internal strengths are positive, they are not yet fully optimized and require further enhancement to mitigate identified weaknesses.

The IFE matrix analysis reveals that the strength score is 1.885, which is higher than the weakness score of 0.72. This indicates that farmers in the area have been relatively successful in leveraging their internal potential and managing existing constraints. Key internal strengths identified include: available labor, sufficient grazing land, high interest in farming, easy access to markets, and adequate farming experience.

The Internal Factor Evaluation (IFE) matrix analysis reveals that farming experience (weighted score: 0.52) and availability of grazing land (weighted score: 0.45) are the primary strengths of the livestock system in Cikedung. These findings are consistent with Budi *et al.* (2020), who identified the availability of forage (global weight: 0.142) and cattle land (global weight: 0.141) as dominant internal strengths in similar Indonesian smallholder contexts. This alignment confirms that physical resource availability remains a foundational asset for local breeders.

However, a critical gap exists between these resource-based strengths and the technical capacity of the farmers. While Agustine *et al.* (2023) emphasize that farmers prioritize reproductive ability (0.34) to fulfill the investment function (0.561) of their cattle, the IFE results in this study highlight significant weaknesses in produced cattle breed quality (rating: 2) and insufficient livestock care (rating: 1). This technical deficit is echoed by Budi *et al.* (2020), who noted that the limited quality of farmers and farmer groups (weight: 0.241) and capital limitations (weight: 0.366) are major constraints.

This discrepancy suggests that although farmers in Cikedung possess high interest (score: 0.27) and long-term experience, the combination of limited knowledge and low farming skills (total weakness score: 0.42) acts as a bottleneck. As noted by both Budi *et al.* (2020) and Agustine *et al.* (2023), without addressing these human resource limitations and improving technical proficiency, the potential of cattle as a 'liquid investment asset' or a reliable 'savings and insurance' tool cannot be fully realized.

External factors reflect conditions outside the business that can present either opportunities or threats. This study employed a macro-environmental approach to external factor analysis, encompassing social, cultural, environmental, technological, economic, political, governmental, and legal aspects. The following section presents the identified external factors based on this macro-environmental approach.

1. **Socio-Cultural and Environmental Factors**

Beef is a traditional animal protein source in Indonesia. Given that the majority of Indonesia's population is Muslim, beef and chicken are the most commonly consumed animal proteins (Khusun *et al.*, 2022). Indonesia's population is projected to grow from 251 million to 274 million by 2020. Average meat consumption is currently 2.72 kg per capita per year and is expected to rise to 3.36 kg per capita per year by 2020. Java Island boasts the highest beef production and consumption due to 56% of Indonesia's population residing there (BPS, 2024). In Indonesia, beef production is primarily concentrated in three provinces on the island of Java. East Java leads with a 20% contribution, followed by West Java at 18%, and Central Java at 17%. The remaining beef production is distributed across other islands, specifically Sumatra and Sulawesi (Kementan 2024).

The environment is an external factor that can pose a threat to livestock farming. Indonesia has a tropical climate with fairly extreme environmental conditions. These conditions are a major cause of environmental stress, making livestock more susceptible to ectoparasites and endoparasites. Furthermore, drastic changes in environmental conditions also impact feed availability, putting livestock at risk of nutritional deficiencies during certain seasons due to high temperatures and excessive humidity. Stress levels in livestock can affect survival, growth, and reproduction, potentially reducing overall animal productivity (Widyas *et al.* 2022).

2. **Technology Factors**

Technology is a critical external factor influencing the development of beef cattle farming, especially for smallholder farmers. The adoption of simple, easily implementable technologies, such as feed innovations (e.g., silage and fermented feed), utilizing agricultural waste to produce organic fertilizer from livestock manure to reduce waste, parasite control, and the use of fermented total mixed ration (TMR) (a fermented mixture of roughage, concentrates, and additives), is key to sustainably improving livestock productivity and performance (Widi, 2015).

3. **Economic Factors**

As a developing country, Indonesia is experiencing rapid population growth and economic advancement, which are the primary drivers of increased demand for animal-derived food, particularly beef. However, there remains a significant gap between supply and demand. Domestic production can only meet about 45% of national needs, while beef prices remain high and tend to increase annually. To cover this deficit, the Indonesian government imports beef, as well as feeder cattle, slaughter cattle, and some breeding cattle. Indonesia's livestock sector exhibits a high dependency on meat and cattle imports from several key countries, including Australia, India, the USA, New Zealand, and Brazil. The volume of these imports is substantial, while the volume of exports remains very small. This significant gap between imports and exports is projected to persist and could even widen in the future (Hadi and Chung 2022).

4. **Political, Governmental, and Legal Factors**

A clear manifestation of political intervention and government policy in the livestock sector is the Beef Self-Sufficiency Program (PSDS). This government program, launched from 2001-2005, aimed to reduce import

dependence and enhance national food security. In 2014, the government relaunched this program to continue previous efforts, despite facing significant challenges in meeting national beef demand (Handayani *et al.* 2016).

Furthermore, in 2016, the government introduced the UPSUS SIWAB program (Special Efforts for Mandatory Pregnant Broodstock Cattle), based on Ministry of Agriculture Regulation No. 48/Permenan/PK.210/10/2016. This is a national strategic policy to increase the cattle population through artificial insemination and natural mating. This program reflects political intervention and the active role of the government in setting the direction for livestock development. Through a top-down approach, the government sets ambitious targets supported by the provision of facilities such as feed, water, medicine, and vaccines (Rusdiana and Soeharsono, 2017).

Based on the identification of external factors for beef cattle breeding businesses with both semi-intensive and intensive rearing patterns, an External Factor Evaluation (EFE) matrix was developed. This matrix identifies four key opportunities and four key threats in the external environment (Table 10).

Based on Table 10, the beef cattle breeding business in Cikedung District, Indramayu Regency, demonstrates a moderate external condition, with an External Strategic Factor score of 2.98. This falls within the medium category (between 2.00–2.99), indicating that the external position of the farming business is neither exceptionally strong nor overly weak.

The total score for opportunity factors (1.68) is higher than the total score for threat factors (1.33). This difference suggests that farmers in the region are quite capable of responding to and leveraging external opportunities, while the impact of various external threats is relatively smaller. Consequently, the available opportunities are more dominant and can serve as a strong foundation for strengthening the development strategies of the beef cattle farming business.

The EFE results identify local government support (0.6) as the most significant opportunity in Cikedung. This aligns with Agustine *et al.* (2023), who link smallholder success to government intervention through extension services, and Budi *et al.* (2020), who highlight the beef self-sufficiency policy (global weight: 0.042) as a key external driver. This opportunity is further bolstered by advancements in technology (0.39), providing the 'information system' infrastructure deemed essential by Agustine *et al.* (2023) and Budi *et al.* (2020) for enhancing human assets.

Conversely, external threats such as beef import policies (0.24) and seasonal changes (0.39) present significant risks. Agustine *et al.* (2023) argue that import volatility undermines the 'investment function' of local cattle by reducing price certainty. Similarly, Budi *et al.* (2020) identify marketing and trading systems (0.075) and land conversion (0.047) as critical threats to livestock sustainability. Therefore, leveraging local government support to improve technical training and extension services is vital to mitigate the market pressures and environmental threats identified across these studies.

The scores and weights from the IFE and EFE matrices were then used to perform an IE matrix analysis, the results of which are illustrated in Figure 1. The analysis of the Internal Factor Evaluation (IFE) and External Factor Evaluation (EFE) matrices, as depicted in Figure 1, indicates that the beef cattle breeding enterprise in Cikedung District, Indramayu Regency, occupies a moderate strategic position. This is evidenced by an EFE weighted score of 2.980 and an IFE weighted score of 2.606.

This specific positioning places the enterprise within Quadrant V of the IE matrix, which corresponds to a "Hold and Maintain" strategic posture. Consequently, the recommended strategic imperatives involve the sustainment and optimization of current operational performance, with a concentrated focus on internal reinforcement and the judicious capitalization on external opportunities. This strategic alignment suggests a need for efficiency improvements and selective growth initiatives rather than aggressive expansion.

Formulating Business Development Strategies

To formulate strategies that are both effective and applicable, the next crucial step involves conducting a

Table 10. Eksternal factor evaluation (EFE) matrix

	External Key Factors	Weight	Rating	Weighted Score	Notes.
Opportunities					
1	Local Government Support	0.15	4	0.6	
2	Limited Competition In Breeding Business	0.13	3	0.39	
3	Future Demand For High Quality Breeding Stock	0.09	3	0.27	
4	Advancements In Technology And Information	0.13	3	0.39	
Opportunities Total		0.5	13	1.65	55.37%
Threats					
1	Loss Of Grazing Land For Semi-Intensive Systems	0.15	3	0.45	
2	Uncontrollable Spread Of Livestock Diseases	0.1	2.5	0.25	
3	Central Government Beef Import Policies	0.12	2	0.24	
4	Unpredictable Seasonal Changes	0.13	3	0.39	
Threats Total		0.5	10.5	1.33	44.63%
Overall Total		1	23.5	2.98	100%

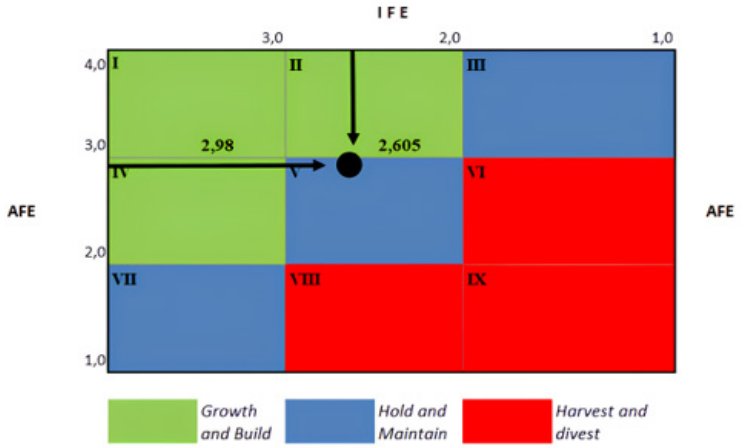

Figure 1 IE Matrix for Beef Cattle Breeding Business in Cikedung District

Table 11. SWOT matrix beef cattle breeding business in Cikedung District

SWOT Matrix	Strengths	Weaknesses
	1. Available grazing land/grass indicates a natural and potentially cost-effective resource for feed	1. Insufficient livestock care could lead to health issues, reduced productivity, and higher mortality rates
	2. The availability of labor ensures adequate workforce capacity, whether family or external, ensures operational capacity	2. Underutilized livestock waste means missing out on potential revenue streams and not optimizing resource use.
	3. High interest in farming reflects a strong community engagement and potential for sustained effort within the sector.	3. Limited farmer knowledge can hinder the adoption of best practices, new technologies, and effective problem-solving
	4. Livestock products are easy to market straightforward market access point reduces sales barriers for farmers.	4. A lack of practical skills can lead to inefficient operations and lower overall productivity
	5. Farmers possess extensive practical experience valuable practical knowledge and resilience	5. Poor quality of produced cattle breeds directly impacts the market value of the livestock and the profitability of the breeding operation.

Opportunities	SO Strategy	WO Strategy
1. Local government support can take many forms, including subsidies, training programs, and access to resources, which can considerably improve the industry		1. Diversification by utilizing livestock manure for organic fertilizer manufacturing (O1, W2) tackles environmental concerns while also producing an alternate revenue source, thereby enhancing the enterprise's overall sustainability
2. Limited competition in the breeding industry means a larger market share for established breeders and possibly better earnings	1. Standardization and enhancement of Feed Quality (O3, S1) is concerned with the methodical standardization and enhancement of beef cattle feed quality	
3. Future demand for high-quality breeding stock: As the population and incomes expand, so does the desire for better quality meat, which begins with superior breeding stock	2. Collaborative cooperation with local governments to improve genetics and secure land tenure (O2, O4, S2, S5) are critical in promoting long-term genetic improvement and operational sustainability	2. Collaborative training and development efforts in conjunction with the government (W1, W3, W4, O1, O2, O3, O4) are meant to strengthen farmers' capacities, enhancing livestock management practices and contributing to better overall enterprise performance
		3. Implementing a complete livestock recording system (W5, O3) promotes more effective selection of breeding stock, which helps the steady increase of herd genetic quality
4. Advancements in technology and information, New technologies in breeding, feed management, and health can improve efficiency and productivity, while information access can help farmers make more informed decisions		

Table 11. SWOT matrix beef cattle breeding business in Cikedung District (continued)

Threats	Strategy ST	Strategy WT
1. Urbanization, industrial expansion, and changes in land use policies can all limit accessible grazing grounds, affecting semi-intensive farmers who rely on them	1. The cultivation and storage of forage (S1, S2, S3, S5, T1, T4) entails farmers establishing pasture areas, either independently or cooperatively, followed by the processing and warehousing of the harvested forage	1. Infrastructure improvements aim to increase health and biosecurity measures by improving environmental control and enabling more effective disease management (T2,T5,W5)
	2. The implementation of rotational grazing (S2, T1) emphasizes the adoption of rotational grazing practices to optimize pasture health and productivity, thereby ensuring the sustainable utilization of available land resources	
2. The uncontrollable development of cattle illnesses can result in large financial losses owing to animal mortality, reduced productivity, and trade restrictions	3. The transition from semi-intensive to intensive rearing systems (S2, S3, S5, T1, T4) advocates shifting from semi-intensive methods to more intensive livestock management practices	
3. Increased beef import policies by the central government can decrease local prices, making it difficult for domestic producers to compete	4. Collaboration with breeding stock parent companies as beef cattle suppliers (T3, S2, S4) to ensure a consistent and reliable supply of beef cattle.	
4. Unpredictable seasonal changes: Unusual weather patterns, such as protracted droughts or heavy rainfall, can have a negative impact on pasture quality and availability, as well as general animal health		

matching analysis through the SWOT Matrix. This matrix is essential for identifying and designing various strategic alternatives by combining internal factors (strengths and weaknesses) with external factors (opportunities and threats). This process helps create a more focused and realistic direction for business development, one that aligns with the real-world conditions of the field (Table 11).

Strategy Priority

The alternative strategies derived from Table 14 are further analyzed to select the best priority strategies for developing the beef cattle breeding business in Cikedung, Indramayu. This is done using the Quantitative Strategic Planning Matrix (QSPM). The QSPM calculation integrates internal and external factors with the formulated strategic alternatives. This process involves re-assigning weights, determining Attractiveness Scores (AS), and calculating Total Attractiveness Scores (TAS).

The weights for internal and external factors are adopted from the previously established IFAS and EFAS matrices. Attractiveness Scores (AS) are numerical values indicating the relative appeal of each strategy within a given alternative. The AS scoring criteria are: 1 = Not attractive, 2 = Somewhat attractive, 3 = Moderately attractive, and 4 = Highly attractive.

The Total Attractiveness Score (TAS) is obtained by multiplying the factor's weight by its Attractiveness Score (AS). The total TAS is then accumulated to get a final score for each strategic alternative. The alternative with the highest total TAS score identifies the most suitable strategy for implementation. It's important to note that the QSPM is primarily used to prioritize strategies within a single set of alternatives (Table 12).

Based on the SWOT and Quantitative Strategic Planning Matrix (QSPM) analyses, ten alternative strategies for developing the beef cattle breeding business in Cikedung District, Indramayu Regency, were identified. These strategies were then prioritized based on their Sum Total Attractiveness Score (STAS). The highest priority strategy (STAS: 7.250) is to increase feed quantity while also enhancing feed quality. This demonstrates that supplying adequate and high-quality feed is the most important factor in the success of the cattle breeding industry. The second priority strategy (STAS: 7.090) is to establish collaboration with important stakeholders in livestock management. This is intended to avoid inbreeding and provide unambiguous contracts for marketing and sourcing beef cow breeds. The third priority strategy (STAS: 6.890) focuses on improving cattle housing and security measures. The goal is to keep animals healthy while reducing the possibility of disease spread.

Prioritizing these techniques is critical as a decision-making tool. It aids in optimizing resource use, increasing operational efficiency, and accelerating the effective and sustainable fulfillment of company objectives. Setting strategic priorities is an important element in business planning and development, including beef cattle breeding. Focusing on the most significant or urgent methods will increase operational efficiency and speed up the achievement of targeted outcomes. Furthermore, prioritization promotes

Table 12 Prioritizing Beef Cattle Breeding Business Development Strategies

Strategy	STAS	Priority
Strategy 1 (SO1)		
Increase quantity and improve quality of feed aims to capitalize on available resources and interest in farming by enhancing feed management	7.250	1
Strategy 2 (SO 2)		
Collaborate with local government on new breeding males and grazing land leases, utilizing the simplicity of marketing and great interest in farming to ensure better breeding techniques and land usage	7.090	2
Strategy 10 (WT)	6.890	3
Expand livestock pens with strong security, add shelters in grazing areas, and include isolation pens for sick cattle to immediately address inadequate livestock care and low farming skills by upgrading infrastructure, thereby decreasing disease spread and environmental stress		
Strategy 4 (WO 2)		
Collaborate with the government to provide training and development in beef cattle breeding to address the lack of knowledge and skills among farmers by utilizing government assistance and farming enthusiasm	6.860	4
Strategy 3 (WO 1)		
Utilize livestock manure for compost as an alternative business venture addresses waste underutilization by transforming it into a new cash stream, leveraging the passion in farming	6.520	5
Strategy 8 (ST 3)		
Transition from semi-intensive to intensive rearing system uses available labor and interest in farming to counter concerns like loss of grazing land and disease transmission by providing more regulated conditions	6.370	6
Strategy 9 (ST 4)		
Collaborate with livestock parent companies as beef cattle providers use easy market access and farming experience to mitigate threats from competition or low breed quality by ensuring a supply of superior genetics	6.010	7
Strategy 5 (WO 3)		
Implementing livestock recording addresses inadequate livestock care and limited information by instituting a systematic approach to animal management	5.700	8
Strategy 6 (ST 1)		
Farmers begin planting pasture/grazing land individually or in groups, which can subsequently be processed and stored in warehouses. They employ existing grazing land and farming experience to address the threat of unpredictable seasonal variations and feed availability	5.500	9
Strategy 7 (ST 2)		
Implement rotational grazing takes advantage of available grazing land and farming experience to solve issues associated to land degradation and feed supply	5.440	10

more focused decision-making, makes better use of limited resources, and reduces risks (Budi *et al.*, 2020). Prioritized strategies also provide clear direction for farmers and all stakeholders to complete their tasks, making cooperation easier and more measurable. Thus, identifying strategic priorities not only helps to achieve short-term goals, but it also increases the business's long-term sustainability.

CONCLUSION

Beef cattle farmers in Cikedung District, Indramayu Regency, are mainly over 50 years old, have low education, and consider cattle farming a secondary source of income, primarily producing Ongole Crossbred (PO) cattle. The recommended strategy approach for these farmers is to "Hold and Maintain" their present business performance, which entails developing internal competencies and taking advantage of external opportunities. The top strategic targets highlighted include increasing the quantity and quality of feed, forming strong partnerships with essential stakeholders to improve livestock management, renovating existing cow pens, and improving security systems. These targeted initiatives seek to create long-term growth by capitalizing on current strengths while addressing areas for improvement within the local beef cattle business.

CONFLICT OF INTEREST

The authors declare that they have no conflicts of interest, whether financial, personal, or affiliative, with individuals or organizations associated with the subject matter discussed in the manuscript.

REFERENCES

Agus, A., & Widi, T. S. M. 2018. Current situation and future prospects for beef cattle production in Indonesia—A review. Asian-Australian Journal of Animal Sciences, 31(7), 976.

Agustine, R., Muzayyanah, M. A. U., Putra, A. R. S., & Baliarti, E. 2023. Utilization of farmer priority on local beef cattle development strategy in Central Java, Indonesia. Biodiversitas Journal of Biological Diversity, 24(1).

Angerer, V., Sabia, E., von Borstel, U. K., & Gauly, M. 2021. Environmental and biodiversity effects of different beef production systems. Journal of Environmental Management, 289, 112523.

BPS (Badan Pusat Statistik). 2024. Statistik Indonesia (Populasi Sapi Potong menurut Provinsi) 2024. Jakarta (ID): Badan Pusat Statistik.

BPS (Badan Pusat Statistik). 2024. Statistik Indonesia (Jumlah Penduduk Menurut Provinsi di Indonesia) 2024. Jakarta (ID): Badan Pusat Statistik.

Budi, S., Eko, PBWH., & Hartuti, P. 2020. The priority of beef cattle farm development strategy in Semarang regency using AHP and SWOT (A'WOT) method. Journal of Sustainability Science and Management, 15(6), 125-136.

Burrow, H. 2019. Strategies for increasing beef cattle production under dryland farming systems. *WARTAZOA*. Indonesian Bulletin of Animal and Veterinary Sciences, 29(4), 161-170.

Dahlanuddin, Z. L., Sutaryono, Y. A., Hermansyah, P. K., McDonald, C., Williams, L. J., Corfield, J. P., & van Wensveen, M. 2016. Scaling out integrated village management systems to improve Bali cattle productivity under small scale production systems in Lombok, Indonesia. Livestock Research for Rural Development, 28(5), 1-13.

David FR, David FR. 2016. Strategic Management: A Competitive Advantage Approach, Concepts, and Cases Sixteenth Edition. England (UK): Pearson Education.

Fadli, N. L. O., & Selamet, A. 2020. Structure and dynamics of Bali cattle population in Poleang Selatan sub-district, Bombana regency. Halu Oleo Journal Animal Husbandry Scientific, 1(2), 119-123.

Hadi, S. N., & Chung, R. H. 2022. Estimation of demand for beef imports in Indonesia: an autoregressive distributed lag (ARDL) approach. Agriculture, 12(8), 1212.

Handayani, S., Fariyanti, A., & Nurmalina, R. 2016. Simulation analysis for prediction of beef meat self-sufficiency in Indonesia. Indonesia. Journal Sosiohumaniora, 18, 61-70.

Kementerian Pertanian. Statistik Peternakan. Jakarta, Indonesia: Kementerian Pertanian Republik Indonesia; 2023.

Khusun, H., Februhartanty, J., Anggraini, R., Mognard, E., Alem, Y., Noor, M. I., ... & Drewnowski, A. 2022. Animal and plant protein food sources in Indonesia differ across socio-demographic groups: socio-cultural research in protein transition in Indonesia and Malaysia. Frontiers in Nutrition, 9, 762459.

Kusuma, S. B., Ngadiyono, N., Sumadi. 2017. Estimasi dinamika populasi dan penampilan reproduksi sapi peranakan ongole di Kabupaten Kebumen Provinsi Jawa Tengah. Buletin Peternakan. 41(3): 230-242.

Makatita, J. 2021. The influence of livestock breeder characteristics on behavior in beef cattle farming in Buru district. Journal Agrokompleks Tolis. 1(2):(51 54).

Muninggar, R. M., Widiati, R., & Widi, T. S. M. 2021. Rearing business analysis of Brahman Cross Breed ex import cattle with a partnership between corporations and smallholder farms. Jurnal Ilmu-Ilmu Peternakan, 31(3), 235-246.

Perwitasari, F. D., Kusumastuti, R. A. R. T. A., & Widiati, R. 2024. Investment and Competitiveness of Cross-breed Beef Cattle Fattening Businesses in Indonesia. International Research Journal of Economics and Management Studies IRJEMS, 3(2).

Rusdiana, S. Soeharsono. 2017. UPSUS SIWAB Program for increasing beef cattle population and economical value of livestock enterprise. In Forum Penelitian Agro Ekonomi (Vol. 35, pp. 125-37).

Said, S. 2020, March). Integrated livestock business and industry in Indonesia. In IOP Conference Series: Earth and Environmental Science (Vol. 465, No. 1, p. 012003). IOP Publishing.

Saputra, Y., Priyanto, R., Putra, B. W., & Cyrilla, L. 2025. Strategy for Development of Cattle Breeding and Reproductive Businesses in the Cikedung People's Livestock Area. Jurnal Ilmu Produksi dan Teknologi Hasil Peternakan, 13(1), 34-41.

Suryani, R. 2015. Outlook Komoditas Pertanian Subsektor Peternakan Daging Sapi. Pusat Data dan Sistem Informasi Pertanian Sekretariat Jenderal Kementerian Pertanian. Jakarta: Kementerian Pertanian.

Widi, T. S. M. 2015. Mapping the impact of crossbreeding in smallholder cattle systems in Indonesia (Doctoral dissertation, Wageningen University and Research).

Widyas, N., Widi, T. S. M., Prastowo, S., Sumantri, I., Hayes, B. J., & Burrow, H. M. 2022. Promoting sustainable utilization and genetic improvement of Indonesian local beef cattle breeds: A review. Agriculture, 12(10), 1566.