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Forage Availability Strategies for Livestock in East Manggarai Regency, East Nusa Tenggara Province

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Abstract

This study aimed to identify internal and external factors influencing livestock forage availability, analyze strengths, weaknesses, opportunities, and threats, and formulate priority strategies to address forage scarcity during the dry season in East Manggarai Regency. The research was conducted across three sub-districts (Kota Komba, Borong, and Rana Mese) from November 2025 to January 2026, employing a survey method with a mixed-methods approach. The study sample comprised 75 cattle farmers selected through quota sampling, and 15 expert respondents selected through purposive sampling. Data were analyzed using the Internal Factor Evaluation (IFE) matrix, External Factor Evaluation (EFE) matrix, Internal-External (IE) matrix, SWOT analysis, and Quantitative Strategic Planning Matrix (QSPM). The IFE analysis yielded a total score of 2.26 (medium category), and the EFE score was 2.60, positioning livestock farming in the Hold and Maintain cell of the IE matrix. Key strengths identified included extensive grazing land availability and productive farmer age distribution, while primary weaknesses encompassed traditional husbandry systems and low feed processing adoption. Based on QSPM analysis, the top-priority strategies were the establishment of a grass bank, sustainable forage development, and enhanced farmer capacity through extension services and feed processing technology training.

Keywords: Livestock forage; Feed strategy; Cattle farming; IFE-EFE analysis; Grass bank; Feed security

1. Introduction

The national cattle population in 2024 was recorded at 13,268,492 head. East Nusa Tenggara Province (NTT) contributed 609,414 head, accounting for approximately 4.6% of the national total, while East Manggarai Regency contributed 10,320 head, representing 1.7% of the provincial figure (BPS NTT, 2024). This underscores the significant role of the cattle farming sector in supporting the regional economy.

From a climatological perspective, East Manggarai Regency experiences a dry season lasting approximately 6 to 8 months annually. This condition substantially affects the availability of livestock forage. Natural grasses, which constitute the primary feed source, undergo desiccation and nutritional quality degradation during the dry season, directly impairing the health and productivity of cattle. Consequently, the cattle population in East Manggarai Regency has fluctuated markedly, declining from 17,580 head in 2020 to 10,320 head in 2024 (BPS NTT, 2024).

The cattle husbandry system in East Manggarai Regency remains largely traditional, following an extensive pattern dependent on natural grazing. Farmers allow livestock to graze freely without intensive feed management. The primary challenge is the limited year-round forage availability, particularly during the dry season, which adversely affects livestock productivity and health (Nafiu et al., 2020). Although various studies have emphasized the importance of

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alternative feed utilization and forage conservation technologies, comprehensive research formulating forage availability strategies using integrated IFE, EFE, IE, SWOT, and QSPM approaches remains scarce in this region.

The objectives of this study were to: (1) identify the internal and external factors affecting forage scarcity; (2) analyze strengths, weaknesses, opportunities, and threats; and (3) formulate appropriate priority strategies to address livestock forage scarcity during the dry season in East Manggarai Regency.

2. Material and methods

2.1. Research Design and Location

This study employed a survey method with a mixed-methods approach, integrating qualitative and quantitative methodologies. The research was conducted in three sub-districts of East Manggarai Regency, namely Kota Komba, Borong, and Rana Mese, from November 2025 to January 2026. Site selection was based on two primary criteria: (a) coastal climatic conditions rendering the areas susceptible to prolonged dry periods, and (b) comparatively high cattle population densities relative to other sub-districts.

2.2. Population and Sample

The study respondents comprised two groups: (1) 75 farmer respondents selected through quota sampling (25 farmers per sub-district), with a minimum of two years of livestock farming experience as the eligibility criterion; and (2) 15 expert respondents selected through purposive sampling, including 12 livestock supervisors from 12 sub-districts, 2 officials from the East Manggarai Regency Department of Animal Husbandry, 1 academician from St. Paulus Ruteng Catholic University, and 1 livestock practitioner.

2.3. Research Variables

The variables investigated included: (1) farmer characteristics (age, educational level, farming experience, herd size, sex, and number of household dependents); (2) internal factors comprising strengths and weaknesses affecting forage availability; (3) external factors comprising opportunities and threats; and (4) priority alternative strategies to support year-round forage availability.

2.4. Data Collection Techniques

Primary data were collected through: (a) field observations of general forage availability conditions and livestock husbandry management; (b) structured interviews using questionnaires administered to farmer respondents; and (c) in-depth interviews with expert respondents. Secondary data were obtained from the East Manggarai Regency Central Statistics Agency (BPS), the Department of Animal Husbandry, and relevant scientific literature.

2.5. Data Analysis

Data analysis was conducted in three stages: (1) the input stage, utilizing the Internal Factor Evaluation (IFE) Matrix and External Factor Evaluation (EFE) Matrix, with factor weighting determined through the paired comparison method; (2) the matching stage, employing the Internal-External (IE) Matrix and SWOT Matrix; and (3) the decision stage, utilizing the Quantitative Strategic Planning Matrix (QSPM) to determine strategy priorities based on the highest Total Attractiveness Score (TAS).

3. Results and discussion

3.1. Farmer Respondent Characteristics

All 75 farmer respondents (100%) were classified within the productive age category (15–64 years) in accordance with the provisions of Law No. 13 of 2003 on Manpower. This indicates that cattle farmers in East Manggarai Regency possess adequate physical and cognitive capacities to receive and adopt livestock technology innovations. Productive age strongly supports farmers' ability to coordinate decision-making regarding forage availability (Rais et al., 2023).

Formal educational attainment was predominantly at the primary school level (SD), accounting for 46.7% (35 respondents), followed by junior secondary school (SMP) at 26.7% (21 respondents), senior secondary school (SMA) at 21.3% (16 respondents), diploma level at 1.3% (1 respondent), and undergraduate degree at 4.0% (3 respondents). The low level of formal education constrains farmers' capacity to adopt new technologies; however, accumulated

farming experience serves as an important compensatory factor. Akbarrizki et al., (2024) noted that higher levels of education correspond to broader knowledge of the livestock sector and greater receptivity to innovations.

Farming experience varied considerably: 50.7% of respondents had 1–5 years of experience, 29.3% had 6–10 years, 17.3% had 11–15 years, and 2.3% had 16–20 years. Although the majority are relatively inexperienced, practical farming knowledge still contributes significantly to livestock management skills (Andaruisworo, 2022). In terms of herd scale, 38.7% operated small-scale farms (1–5 head), 54.7% medium-scale (6–10 head), and 6.7% large-scale (>10 head). The majority of respondents were male (97.3%), reflecting the predominance of men in livestock farming activities in the region.

3.2. Internal Factor Analysis (IFE Matrix)

The identification process revealed six strength factors and seven weakness factors influencing livestock forage availability in East Manggarai Regency. The results of the IFE matrix analysis are presented in Table 1.

Table 1 Results of the IFE Matrix Analysis of Livestock Forage Availability in East Manggarai Regency

No	Internal Factor	Weight	Rating	Score
Strengths				
1	Extensive grazing land and forage area are still widely available	0.09	3	0.28
2	The majority of farmers are in the productive age group	0.09	4	0.37
3	Private livestock ownership status	0.09	3	0.28
4	Utilization of family labor	0.06	2	0.12
5	Easy access to agricultural by-product feed from rice fields	0.06	2	0.12
6	Accumulated experience in livestock farming	0.06	2	0.12
Weaknesses				
1	Agricultural by-products are not processed as feed	0.09	2	0.19
2	Traditional and extensive husbandry system	0.09	1	0.09
3	Low formal educational attainment among farmers	0.06	2	0.12
4	Prolonged dry season lasting 6–8 months annually	0.09	1	0.09
5	Cattle farming is practiced as a secondary livelihood	0.09	1	0.09
6	Limited role of extension workers in farmer capacity development	0.09	2	0.19
7	Insufficient government attention to the livestock sector	0.09	2	0.19
	Total	1.00		2.26

Source: Primary Data, 2026

The IFE analysis yielded a total score of 2.26, classified in the medium category. The highest-scoring strength factor was the predominance of farmers within the productive age group (score: 0.37), followed by the availability of extensive grazing land and private livestock ownership (each scoring 0.28). Rais et al., (2023)noted that labor productivity increases with age up to a certain threshold, while farmers of productive age tend to be more receptive to innovations and technologies. The forage land potential in NTT is estimated at approximately 832,228 hectares, which supports extensive livestock systems (Hambakodu, 2021). However, natural pasture forage production can be up to three times higher during the rainy season than the dry season, and its nutritional quality is generally poor (Sema et al., 2021). This condition positions land availability as a strength that has yet to be optimally utilized.

The most prominent weakness factors were the non-processing of agricultural by-products as feed, the limited role of extension workers in farmer capacity development, and insufficient government attention to the sector (each scoring 0.19). Extension worker competency is essential in agricultural outreach activities; group-based extension approaches have proven more effective as they facilitate feedback and interaction that enhance innovation adoption (Bachtiar et al.,

2025). The utilization of agricultural by-products as alternative feed holds considerable potential; however, limited farmer knowledge remains a principal barrier (Muzdalifah & Ruqayyah, 2025).

3.3. External Factor Analysis (EFE Matrix)

The results of the EFE matrix analysis are presented in Table 2.

Table 2 Results of the EFE Matrix Analysis of Livestock Forage Availability in East Manggarai Regency

No	External Factor	Weight	Rating	Score
Opportunities				
1	Tourism development potential through the livestock sector, utilizing extensive grazing land	0.16	3	0.47
2	Availability of relatively large and productive land for livestock business development	0.16	4	0.63
3	Availability of natural feed from agricultural land and grazing areas	0.16	3	0.47
4	Local government program support for livestock sector development through Artificial Insemination programs	0.11	3	0.32
Threats				
1	Animal disease outbreaks with the potential to reduce the livestock population and productivity	0.10	2	0.20
2	Climate change and extreme weather are affecting forage availability and animal health	0.13	1	0.13
3	Insufficient livestock forage during the dry season	0.10	2	0.20
4	Limited water availability during the dry season	0.10	1	0.10
	Total	1.00		2.60

Source: Primary Data, 2026

An EFE score of 2.60 indicates that external factors are at a medium level. The greatest opportunity was the availability of relatively extensive and productive land for livestock business development (score: 0.63), followed by tourism development potential through the livestock sector and the availability of natural feed from agricultural land (each scoring 0.47). These results suggest that the external environment remains generally supportive of livestock development. Extensive land availability and natural feed from agricultural land constitute important factors in supporting productivity enhancement and business sustainability. Furthermore, optimal utilization of local potentials can strengthen competitiveness and future development prospects (Sutrisno et al., 2023).

The primary threats requiring anticipation were animal disease outbreaks and dry-season forage shortage (each scoring 0.20), followed by climate change impacts (0.13) and water limitations (0.10). These findings indicate that the sustainability of livestock farming is substantially influenced by year-round forage availability. According to Anggriani et al., (2023), forage availability is a primary determinant in ruminant livestock development; however, its production is frequently subject to fluctuations due to land conditions and seasonal variation. Climate change affecting rainfall patterns further risks reducing forage availability, thereby constraining livestock productivity.

3.4. Strategic Position: IE Matrix

The combination of IFE score (2.26) and EFE score (2.60) places livestock forage availability in East Manggarai Regency in Cell V of the IE Matrix, designated as the Hold and Maintain position. This position indicates that, although both internal and external conditions remain in the medium category, significant development potential exists given the implementation of appropriate strategies. Strategies recommended for this position include intensive approaches such as market penetration, market development, and product development to strengthen competitiveness (Atmaza et al., 2026). This position indicates that external opportunities are sufficiently available, though internal conditions still require strengthening. The strategies required include forage development through land expansion, cultivation of high-yielding grass varieties, improvement of cultivation technologies, and enhanced farmer capacity to maximize internal

potential. These efforts are expected to improve sustainable feed availability and support livestock productivity. Development strategies focusing on internal factor strengthening are necessary to optimize the utilization of available external opportunities (Rofiq & Rohman, 2023).

3.5. Alternative Strategies: SWOT Matrix

Based on the SWOT analysis, eight alternative strategies were formulated and grouped into four quadrants. Strengths-Opportunities (SO) strategies comprised: (1) sustainable forage development leveraging extensive land and natural feed availability; (2) savanna-based livestock agrotourism utilizing private ownership and grazing land potential; and (3) adoption of Artificial Insemination (AI) technology supported by farming experience and farmers' productive age. Weaknesses-Opportunities (WO) strategies focused on leveraging available opportunities to address identified weaknesses, including utilization of government programs for feed quality improvement, technical extension services, and transition from extensive to semi-intensive husbandry systems. Strengths-Threats (ST) strategies employed existing strengths to address dry-season forage scarcity through the establishment of a Grass Bank. Weaknesses-Threats (WT) strategies aimed to simultaneously minimize weaknesses and mitigate threats through enhanced extension worker engagement and the utilization of agricultural by-products as forage reserves.

3.6. Priority Strategies: QSPM

The Quantitative Strategic Planning Matrix (QSPM) is the most suitable tool for establishing strategy priorities based on the Attractiveness Score (AS) of each alternative relative to key factors (Maulana et al., 2023), where AS values are rated as: 1 = not attractive, 2 = somewhat attractive, 3 = attractive, and 4 = highly attractive. The strategy rankings based on Total TAS values are presented in Table 3.

Table 3 Strategy Rankings Based on QSPM Analysis

No	Alternative Strategy	Total TAS	Rank
1	Sustainable development of livestock forage crops	5,917	Priority 1
2	Strengthening the role of extension workers in feed management and animal health education	5,284	Priority 2
3	Establishment of a Grass Bank to address forage scarcity during the dry season	4,939	Priority 3
4	Leveraging farming experience and productive age for forage technology adoption	4,394	Priority 4
5	Transitioning from traditional to semi-intensive systems with government support	4,212	Priority 5
6	Leveraging extensive land and livestock ownership for agrotourism development	3,487	Priority 6

Source: Primary Data, 2026 (processed)

The first-priority strategy was sustainable livestock forage development (TAS: 5.917) through the cultivation of high-yielding grasses and legumes with strong productivity and tolerance to arid environmental conditions. Sustainable development of high-quality forage is necessary to improve feed availability and quality, thereby supporting enhanced productivity of ruminant livestock. The development of superior grass and legume species constitutes one of the key strategies to ensure year-round forage availability, particularly in regions frequently experiencing forage shortages during the dry season (Ardika et al., 2026).

The third-priority (TAS: 5.762) and fourth-priority strategies (TAS: 5.529) focused on human resource capacity development through forage technology adoption and strengthening the role of extension workers, respectively. Improving farmer competency and the effectiveness of extension services play a pivotal role in accelerating innovation adoption and supporting more efficient and sustainable livestock business management. Effective extension program implementation contributes to innovation dissemination and improves farmers' ability to adopt appropriate livestock technologies suited to their operational needs (Ediset et al., 2024).

The fourth priority strategy is the establishment of a Grass Bank (TAS 4,394), which aims to ensure the availability of forage during the dry season. The Grass Bank serves to store surplus forage from the rainy season in the form of hay, silage or fermented forage for use when forage availability declines. The availability of forage reserves is a critical factor in maintaining continuity of production and livestock productivity, particularly in regions susceptible to forage deficits due to seasonal fluctuations (Atmaza, 2026).

The fifth strategy (TAS 4,212) and the sixth strategy (3,487) focus on the development of livestock farming to support the growth of the livestock sector through the development of livestock-based agrotourism utilising grazing land and community-owned livestock, using semi-intensive or intensive rearing systems. East Manggarai Regency is home to the Masui savannah, situated in Kota Komba Sub-district, which has become one of the livestock-based tourist destinations. Under Law No. 9 of 1990, tourism encompasses everything related to travel, including the management of tourist sites and attractions, as well as related businesses in this sector.

4. Conclusion

Based on the research findings, it was concluded that the results of the identification and analysis were as follows: (1) The IFE analysis yielded a score of 2.26, with the dominant strengths being extensive forage land and the productive age of livestock farmers, and the dominant weaknesses being the low level of feed processing and the limited role of extension workers; (2) The EFE analysis yielded a score of 2.52, with the main opportunity being the availability of potential land and the main threat being climate change; (3) The IE position is in the 'Hold and Maintain' quadrant; (4) The QSPM analysis identified the Establishment of a Grass Bank (TAS 6.081) as the priority strategy, followed by the Development of Sustainable Forage (TAS 5.917) as a supporting strategy, both of which are interconnected in strengthening feed security in East Manggarai Regency.

Compliance with ethical standards

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Disclosure of conflict of interest

The authors declare that there are no financial, professional, or personal conflicts of interest that could have influenced the conduct, analysis, or publication of this research.

Statement of informed consent

Written informed consent was obtained from all participants prior to their participation in the study. Participants were informed about the objectives of the research, the voluntary nature of their participation, the confidentiality of the information provided, and their right to withdraw from the study at any stage without any consequences.

References

[1] Akbarrizki, M., Suharti, Shearen, R. S. A., Zulfikar, R., & Andanawari, S. (2024). Persepsi Peternak pada Budidaya Maggot (Larva) Black Soldier Fly Untuk Pakan Itik Petelur di Desa Deyangan Kecamatan Mertoyudan Kabupaten Magelang. *Jurnal Penelitian Peternakan Pertanian*, *21*(1), 126–138.

[2] Anggriani, L., Muwakhid, B., & Sumartono. (2023). Analisis Potensi Pakan Hijauan untuk Pengembangan Ternak Ruminansia di Kabupaten Bima Nusa Tenggara Barat. *Jurnal Nutrisi Ternak Tropis*, *6*(2), 104–112. https://doi.org/10.21776/ub.jnt.2023.006.02.5

[3] Ardika, I. N., Melati, N. P. Y., Warmadewi, D. A., Sumadi, I. K., & Inggriati, N. W. T. (2026). Diseminasi dan pengembangan hijauan pakan ternak unggul untuk memenuhi kebutuhan nutrisi ternak kambing. *Buletin Udayana Mengabdi*, *25*(2), 125–130.

[4] Atmaza, A. F. S., Putri, B. R. T., and Sumardani, N. L. G. 2026. The characteristics of farmers and inseminators towards the success of artificial insemination (AI) in beef cattle in Dompu Regency, Indonesia. GSAR Journal of Agriculture and Veterinary Sciences, 3(2), 17–20.

[5] Atmaza, A. F. S. (2026). The Effect of Price, Product Quality, and Store Atmosphere on Consumer Loyalty of ACK Fried Chicken. Sharia Agribusiness Journal, 6(1), 1-9.

[6] Bachtiar, E. E., Tapi, T., Saputra, H., Budicahyono, M. E., & Konyep, E. (2025). Penyuluhan Pertanian : Pendekatan, Metode dan Dampaknya Terhadap Pembangunan Pertanian Dalam Mendukung Swasembada Pangan. *Journal of Sustainable Agriculture Extension*, *3*(1), 42–52.

[7] BPS NTT. (2024). *Populasi Ternak Sapi Potong*.

[8] Ediset, Jaswandi, Anas, A., & Alianta, A. A. (2024). Implementasi Penyuluhan dalam Diseminasi Inovasi pada Usaha Peternakan Sapi Potong di Kabupaten Dharmasraya Sumatera Barat. *Jurnal Peternakan Indonesia*, *26*(1), 22–31. https://doi.org/10.25077/jpi.26.1.22-31.2024

[9] Hambakodu, M. (2021). Produksi, komposisi botani dan kapasitas tampung padang penggembalaan alam Kecamatan Haharu Kabupaten Sumba Timur. *The 2nd Conference of Applied Animal Science Proceeding Series*, *2*, 112–117.

[10] Muzdalifah, & Ruqayyah, S. (2025). Optimalisasi Limbah Pertanian untuk Produk Olahan Inovatif di Kabupaten Bima sebagai Upaya Peningkatan Nilai Ekonomi. *Journal of Community Service*, *1*(2), 40–44.

[11] Nafiu, L. O., Aku, A. S., Abadi, M., & Zulkarnain, D. (2020). Pemberdayaan Peternak melalui Bimbingan Teknis Seleksi Bibit Sapi Bali pada Kawasan Sentra Bibit Sapi Bali di Kabupaten Konawe Selatan. *Jurnal Pengamas*, *3*(2), 145–156.

[12] Rais, M. A., Mayulu, H., & Rahmatullah, S. N. (2023). Tingkat Pengetahuan Peternak Kambing Terhadap Pakan Komplit di Kecamatan Anggana , Kabupaten Kutai Kartanegara. *Jurnal Ilmu Dan Teknologi Peternakan Indonesia*, *9*(1), 15–26.

[13] Rofiq, A. F. N., & Rohman, F. (2023). Perumusan Strategi Bisnis untuk Meraih Keunggulan Bersaing. *Jurnal Kewirausahaan Dan Inovasi*, *2*(1), 244–264.

[14] Safitri, A. N., Arbainah, S., & Hasanudin, M. (2023). Perumusan strategi usaha menggunakan IFE, EFE, IE, SWOT dan QPSM. *Jurnal Ekobis: Ekonomi, Bisnis Dan Manajemen*, *13*(1), 25–38.

[15] Sema, Nurjaya, & Nurcaya. (2021). Produksi Hijauan , Komposisi Botani dan Kapasitas Tampung di Padang Penggembalaan Alam pada Musim Hujan. *Jurnal Ilmu Dan Industri Pakan*, *7*(2), 124–132.

[16] Sutrisno, ENSD, L. C., & Putra, B. W. P. (2023). Analysis of the Sustainability of Beef Cattle Breeding Business-Intensive Rearing Patterns in , Indramayu Regency , West Java. *Jurnal Ilmu Produksi Dan Teknologi Hasil Peternakan*, *11*(3), 126–132.

[17] Law of the Republic of Indonesia No. 9 of 1990 on Tourism.