

Potential Base Areas and Development Strategies for Small Ruminant Livestock in Banyumas Regency, Central Java, Indonesia

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ABSTRACT

Banyumas Regency, located in Central Java Province, Indonesia, has great potential for the development of small ruminant livestock (goats and sheep). The development of small ruminants plays an important role in food security and the rural economy of Banyumas Regency. This study aims to: (1) assess the potential of small ruminant livestock and identify base areas for goat and sheep development in Banyumas Regency; and (2) formulate development strategies for small ruminants. The methods used were surveys and documentation techniques. Surveys were carried out in four selected sub-districts with high goat population. Data were collected through literature studies, field observations, and interviews with farmers and policymakers. The collected data were analyzed using trend analysis, Location Quotient (LQ) analysis, and SWOT analysis. The results show that the goat population tends to decline, with the trend equation $Y = 230786 - 5556.5X$ and $R^2 = 0.4485$. Conversely, the sheep population shows an increasing trend with $Y = 11776 + 627.65X$ and $R^2 = 0.8113$. SWOT-based strategic analysis yielded scores of (0.58; -1.00), placing the coordinates in Quadrant II, indicating that the appropriate strategy for small ruminant development is the ST (Strengths-Threats) Strategy. This strategy utilizes existing strengths to overcome or minimize threats, also known as diversification strategies.

INTRODUCTION

The livestock subsector is an important pillar in national agricultural development, particularly in providing animal protein, increasing household income, and strengthening the rural economy. Among various livestock commodities, small ruminants (goats and sheep) play a strategic role due to their adaptability to tropical agro-ecosystems, relatively low investment needs, and increasing market potential driven by population growth and changing consumption patterns. According to (Sujarwanta et al., 2024), demand for small ruminant meat continues to rise in line with population growth, lifestyle changes, and increased need for animal protein.

Banyumas Regency is one of the regions in Central Java with substantial potential for the development of small ruminant livestock. Biophysical conditions, availability of forage, abundant dryland and home yards, and strong rural livestock-keeping traditions make Banyumas a promising area for sustainable small ruminant development. However, the goat population shows a declining trend despite the favorable potential.

The decrease in the goat population requires immediate solutions through appropriate development strategies. Several challenges remain, including limited access to feed technology, suboptimal seed quality, low reproductive efficiency, limited financing, restricted market access, and outbreaks of strategic infectious diseases such as Foot-and-Mouth Disease (FMD). These issues require adaptive, comprehensive, and locally grounded development strategies. As (Maake et al., 2022) stated, the scattered location and small-scale nature of sheep farming complicate access to facilities, human resources, institutional support, and technical assistance.

On the other hand, the opportunities for developing small ruminant production are becoming increasingly promising. The rising demand for goat and sheep meat, the growth of culinary businesses based on small ruminant products, and the expanding market for sacrificial and *aqiqah* animals serve as driving factors for higher production needs (Sujarwanta et al., 2024). The Sustainable Development Goals (SDGs 2030) also encourage the livestock sector to transform toward environmentally friendly, inclusive production systems that can enhance the welfare of smallholder farmers. In this context, technological and managerial innovations, improvements in human resource quality, and institutional development become essential aspects that need to be strengthened (Magfiroh, 2025).

Given the considerable potential as well as the existing challenges, a scientific study is needed on the basic potential of small ruminant livestock in Banyumas Regency and the most appropriate development strategies to promote the sustainability of smallholder farming systems. An analysis of basic potential, such as through the Location Quotient (LQ) method or spatial analysis, can provide an overview of sub-districts that possess comparative advantages as centers of small ruminant production. Meanwhile, the formulation of development strategies based on internal-external conditions, farmer capacity, and readiness to adopt innovations will offer more targeted policy recommendations. (Silondae et al., 2024) stated that LQ analysis is a statistical

model that uses the characteristics of a sector to determine a region's specialization in a particular sector. It identifies whether a sector in a given region belongs to a basic or non-basic sector.

Based on the basic potential for developing small ruminant livestock, strategic steps for its development are then formulated. The formulation of development strategies for small ruminants employs a SWOT analysis. According to (Bilotto et al., 2024), increasing meat production requires integrated strategies to ensure environmental sustainability and appropriate land use. This must be carried out through policy coordination related to agriculture, land use, and the environment in order to maintain food security.

This study is designed to identify the basic potential of small ruminants, analyze farmers' readiness to adopt innovations, and formulate development strategies that support improvements in productivity, competitiveness, and the sustainability of the small ruminant subsector in Banyumas Regency.

LITERATURE REVIEW

Economic Base Theory and Location Quotient (LQ)

Economic Base Theory explains regional growth through base (export-oriented) activities that bring income into a region and non-base activities that circulate that income locally. In applied regional planning, the Location Quotient (LQ) is widely used to operationalize this idea by indicating whether a sector/commodity is relatively more concentrated in a smaller area than in a benchmark area (e.g., regency vs. province). An LQ value greater than 1 is commonly interpreted as a sign of relative specialization, meaning the sector may function as a "base" activity and deserves policy attention for strengthening competitiveness and spillovers (Pominova et al., 2021).

However, recent methodological evidence emphasizes that LQ should be interpreted carefully—especially in small regions or in contexts with small establishment/production counts. A marginal change (e.g., one additional unit) can produce disproportionately large changes in LQ values, making them unstable and potentially misleading for identifying "true" specialization. Researchers therefore recommend pairing LQ with additional checks such as minimum scale thresholds, alternative indicators, and attention to industry aggregation and data quality (Pominova et al., 2021).

For livestock commodity planning, LQ is often strengthened by adding growth and share/trend measures to avoid "static" specialization and to capture whether the specialized commodity is also dynamically developing. For example, an open-access study on local chicken production used LQ together with growth and share to classify districts into categories (e.g., superior/static/potential) and to guide priority setting for livestock development programs (Silondae et al., 2024).

Previous research supporting H1 (agreement): Evidence from livestock commodity mapping shows that combining LQ with growth/share helps identify priority areas and differentiate between specialized-but-stagnant vs. specialized-and-growing districts (Silondae et al., 2024). Previous research cautioning against H1 (partial rejection/qualification): Methodological studies demonstrate LQ instability in small regions and warn that high LQ values may

reflect very small denominators rather than meaningful specialization; thus, LQ alone may not reliably indicate “base” status (Pominova et al., 2021).

H1: Districts/sub-regions with higher small-ruminant specialization ($LQ > 1$) and positive growth/share trends are more likely to be classified as priority (leading/potential) base areas for small-ruminant development.

Value Chain Perspective and SWOT-Based Strategy Formulation

A value chain perspective views livestock development not only as on-farm production, but as an interconnected system of input supply → production management → marketing → processing → consumption, shaped by governance, infrastructure, services, and actor coordination. This is crucial in small ruminant systems, where performance depends heavily on feed access, animal health services, market intermediation, and producer bargaining power.

A value-chain-focused study in coastal Bangladesh highlights that weak support services, limited farmer knowledge, and poor coordination among chain actors can prevent livestock (including goats) from reaching sustainable performance; the study underscores the need for enabling environments, coordination, and targeted interventions across chain stages (Barua et al., 2021).

For small ruminants specifically, research in Jordan mapped the chain functions and combined the value chain diagnosis with SWOT analysis. It found that “fragility” in the chain was linked to climate stressors (e.g., drought), high feed costs, and lack of institutional support; importantly, the SWOT results separated constraints into external and internal threats, supporting strategy design that is sensitive to both market-policy context and internal production/management weaknesses (Awad et al., 2023).

In this framework, SWOT is not merely descriptive: it becomes a planning tool to match internal conditions (Strengths/Weaknesses) with external conditions (Opportunities/Threats), producing strategic directions such as:

- a. SO (aggressive/growth): use strengths to seize opportunities
- b. WO (turnaround): overcome weaknesses by leveraging opportunities
- c. ST (defensive/competitive): use strengths to counter threats
- d. WT (survival): minimize weaknesses and avoid threats

Previous research supporting H2 (agreement): Small-ruminant value chain research using SWOT shows that strategy directions logically follow the balance of internal capabilities (infrastructure, management, inputs, marketing power) and external pressures (climate shocks, feed prices, policy support, market access) (Awad et al., 2023).

H2: The stronger the internal value-chain capacity (inputs, skills, infrastructure, production and marketing management) and the more favorable the external environment (market opportunities and institutional support), the more likely small-ruminant development will align with SO/WO (growth and upgrading) strategies rather than ST/WT (defensive/survival) strategies.

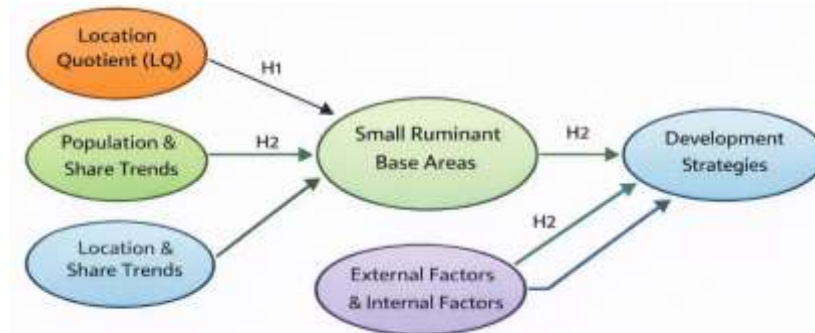


Figure 1. Conceptual Framework

METHODOLOGY

Research Target and Sampling Method

This study was conducted in Banyumas Regency, Central Java Province, using survey and documentary methods. Surveys focused on purposively selected sub-districts with the highest small ruminant population. A total of 131 goat and sheep farmers were selected using simple random sampling. SWOT factor identification was conducted using Focus Group Discussions (FGDs) involving experts from academia, government agencies, and practitioners.

Primary data were collected through structured interviews, field observations, and discussions with extension officers and local authorities. Secondary data for trend and LQ analysis were obtained from: Banyumas Fisheries and Livestock Office, Central Bureau of Statistics (BPS) of Banyumas, Indonesian Livestock Statistics, Scientific literature and institutional reports.

Data Analysis and Trend Analysis

Simple statistical trend analysis was used to examine goat and sheep population changes:

$$Y = a + bX$$

Notes:

Y = Population of goats/sheep; a = Intercept; b = Regression coefficient; and X = i-th year.

Location Quotient (LQ) Analysis

Used to determine base and non-base sectors using (Hidayat, et al., 2021):

$$LQ = \frac{X_{ij} / X_i}{X_{.j} / X_{..}}$$

Notes:

X_{ij} : Population of small ruminant livestock in the sub-district

X_i : Total population of various ruminant livestock in the sub-district

X_j : Population of small ruminant livestock in Banyumas Regency

X : Total population of various ruminant livestock in Banyumas Regency

Interpretation:

LQ > 1 = Base sector

LQ = 1 = Potential sector

LQ < 1 = Non-base sector

SWOT Analysis

Following (Awad et al., 2023) and (Nurzaman et al., 2025), internal (strengths and weaknesses) and external (opportunities and threats) factors were identified to formulate development strategies.

RESEARCH RESULT

Trend Analysis of Goat and Sheep Populations

The trend of the goat population over the past 11 years, from 2014 to 2024, shows an initial increase during the first five years, reaching its peak in 2018. However, in 2019 the population declined sharply, coinciding with the COVID-19 outbreak in Indonesia. This decline is presumed to have occurred because farmers were no longer able to properly manage their livestock, resulting in many animals dying or being slaughtered prematurely due to illness or for household consumption.

In the following years, the population increased again, although not significantly, and then declined once more in the final year of observation. The regression line also indicates a downward trend, expressed as $Y = 230786 - 5556.5X$, with a coefficient of determination (R^2) of 0.4485.

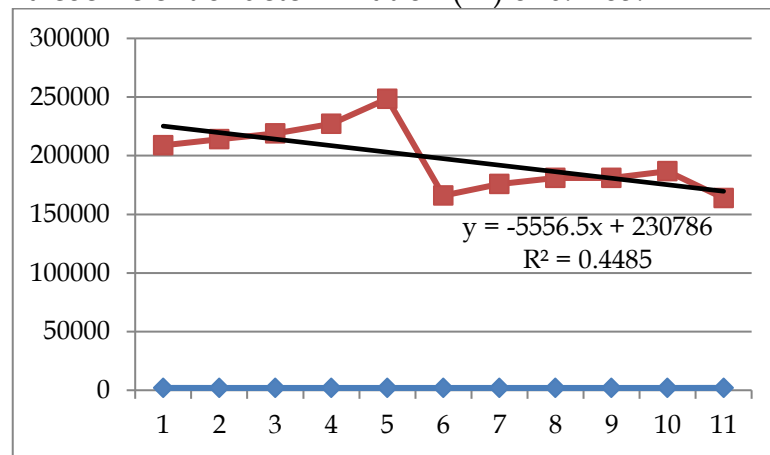


Figure 2. The Regression Line

In contrast, the sheep population demonstrates an increasing trend ($Y = 11776 + 627.65X$; $R^2 = 0.8113$), although the population remains relatively low, indicating strong development potential.

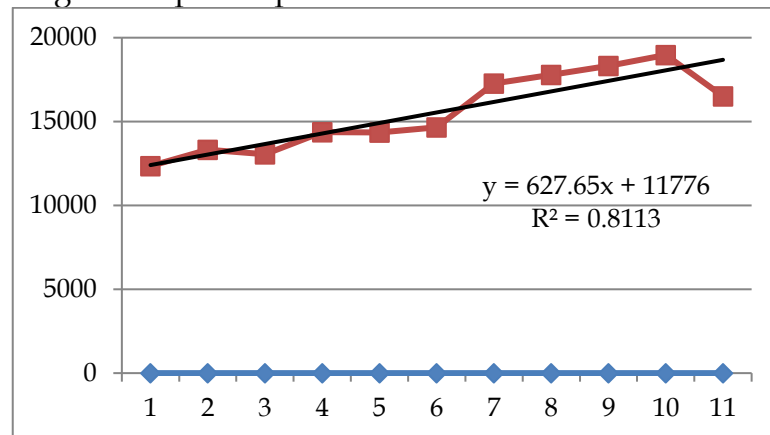


Figure 3. Sheep Population

LQ Analysis

The Location Quotient (LQ) index analysis is used to assess the potential of regional development for small ruminant livestock in Banyumas Regency. According to (Fironika et al., 2023), the development of the livestock subsector can be analyzed using economic theory through the Location Quotient (LQ) method, which is applied to identify leading (basic) and non-basic superior commodities in a region. (Aprylasari & Toyibulah, 2025) states that the development of the livestock subsector in a given area can be influenced by the activity of basic sectors or commodities that have comparative and competitive advantages, regional specialization, and the livestock potential possessed by the region.

LQ results indicate that several sub-districts qualify as base areas for small ruminant development, including Sumpiuh, Kebasen, Gumelar, Kemranjen, Purwokerto Selatan, Rawalo, Somagede, Tambak, Banyumas, Purwojati, Patikraja, Ajibarang, Purwokerto Timur, and Lumbir.

Table 1. LQ Result

Subdistrict	Pop	LQ < 1	Subdistrict	Pop	LQ > 1
Sokaraja	2,619	0.5344	Sumpiuh	8,309	1.4305
Kembaran	4,592	0,4079	Kebasen	10,926	1.3734
Wangon	11,533	0.9881	Gumelar	11,203	1.359
Kalibagor	8,392	0,6107	Kemranjen	9,740	1.3337
Kedungbanteng	3,149	0.6999	Pwt Selatan	603	1.3242
Sumbang	7,244	0.4448	Rawalo	5,420	1.2927
Karanglewas	3,293	0,9185	Somagede	15,370	1.2302
Baturaden	3,033	0.2623	Tambak	6,057	1.223
Jatilawang	4,156	0.9416	Banyumas	9,320	1.2705
Cilongok	5,681	0.7864	Purwojati	3,764	1.1236
Pekuncen	7,802	0.9097	Patikraja	4,564	1.1186
Pwt Barat	139	0.5876	Ajibarang	7,329	1.0838
Pwt Utara	252	0.663	Pwt Timur	233	1.059
			Lumbir	9,077	1.0286

High population does not always correlate with a high LQ score, demonstrating the importance of proportional livestock distribution across regions.

Development Strategy (SWOT Analysis)

SWOT analysis is a method used to formulate strategies based on internal and external factors. Internal factors consist of strengths and weaknesses, while external factors include opportunities and threats (Alam et al., 2024).

Strengths

Table 2. Strengths

No	Strategic Factors	Grade	Rating	Score
1	Adequate livestock-raising experience	3	3	10
2	Breed quality	4	3	13.33
3	Large population	3	2	6.67
4	Availability of labor	3	2	6.67
5	Active participation in farmer groups	2	2	4.44
6	Easy access to breeding stock	3	3	10.00
7	Availability of markets	2	3	6.67
8	High farmer interest	3	3	10.00
9	Economically profitable	4	3	13.33
	Sum	30		81.11

Weaknesses

Table 3. Weaknesses

No	Strategic Factors	Grade	Rating	Score
1	Traditional management practices	5	3	14.21
2	Limited knowledge of feed	3	2	6.32
3	Low livestock ownership	6	3	18.95
4	Waste not yet utilized	3	2	6.32
5	Limited capital	5	3	14.21
6	Livestock raising as a side business	3	2	6.32
7	Lack of market information	3	3	9.47
8	Insufficient feed supply	2	3	4.74
	Quantity	30		80.53

Opportunities

Table 4. Opportunities

No	Strategic Factors	Grade	Rating	Score
1	Available market	5	3	15
2	Increasing demand for livestock	5	2	10
3	Availability of feed/ AI technology	2,5	2	5
4	Stable and reliable prices	2,5	2	5
5	Ease of obtaining permits	1,25	3	3,75
6	Waste-processing technology	1,25	2	2,5
7	Government support/attention	2,5	2	5
8	Livestock farmer groups	3,75	2	7,5
9	Conducive farming environment	3,75	3	11,25
10	Import restrictions	2,5	3	7,5
	Quantity	30		72,5

Threats

Table 5. Threats

No	Strategic Factors	Grade	Rating	Score
1	Presence of substitute products	4,5	3	13,5
2	High feed prices	3	2	6
3	Conversion of agricultural land	3	2	6
4	Difficulty obtaining loan capital	4,5	3	13,5
5	Weak farmer institutions	4,5	3	13,5
6	Scarcity of forages during the dry season	3	2	6
7	Dominant role of middlemen	6	2	12
8	Difficulty in obtaining forage Quantity	1,5	2	3
		30		73,5

SWOT analysis produced scores of:

$$S - W = 0.58$$

$$O - T = -1.00$$

These coordinates place the development strategy in Quadrant II (ST Strategy), meaning farmers must use internal strengths to address external threats. This implies diversification and efficiency-based strategies.

Recommended ST strategies include:

1. Improving Operational Efficiency

Enhancing seed quality, farmer skills, and forage cultivation to reduce feed costs.

2. Product Diversification

Expanding marketable products (packaged carcass meat, processed meat, goat milk, kids for breeding).

3. Strengthening Partnerships

Building collaborations with restaurants, traditional markets, and government programs such as MBG (Free Nutritious Meal Program).

4. Enhancing Marketing and Promotion

Strengthening market networks and reducing dependence on livestock brokers.

The implementation of ST strategies can maintain and even improve small ruminant farming performance despite external challenges.

DISCUSSION

The trend analysis indicates a structural contrast between goat and sheep dynamics in Banyumas Regency. Goat population shows a downward regression ($Y = 230786 - 5556.5X$; $R^2 = 0.4485$), while sheep population shows an upward regression ($Y = 11776 + 627.65X$; $R^2 = 0.8113$).

The moderate explanatory power in the goat model implies that the decline is influenced by fluctuations and shocks, while the stronger sheep fit suggests a more consistent growth trajectory. The documented drop around 2019 is aligned with the proposition that pandemic-era disruptions can affect small-ruminant systems through constraints on routine husbandry, mobility, and farm

operations, which may reduce performance and increase premature off-take (e.g., slaughter due to stressors) (Yiakoulaki et al., 2022). These patterns justify treating goats and sheep as distinct development objects rather than a single aggregated “small ruminant” category, because their vulnerabilities and growth signals differ materially.

From the economic base and regional specialization viewpoint, LQ is used to identify sub-districts with comparative concentration of small ruminants ($LQ > 1$). The results classify Sumpiuh, Kebasen, Gumelar, Kemranjen, Purwokerto Selatan, Rawalo, Somagede, Tambak, Banyumas, Purwojati, Patikraja, Ajibarang, Purwokerto Timur, and Lumbir as base areas for small-ruminant development.

This spatial output supports the logic of place-based livestock planning, where investment prioritization (extension intensity, breeding support, animal health services, and market facilitation) is concentrated in locations with demonstrated specialization rather than being spread evenly. At the same time, the finding that high absolute population does not necessarily correspond to high LQ confirms a core interpretation of LQ: it measures relative concentration, not absolute scale (Saragih et al., 2024).

Consequently, base-area designation should be interpreted as “relative advantage” and should be complemented by dynamic indicators (such as growth/trend) and minimum-scale thresholds for policy targeting.

This methodological caution is strongly supported by recent regional-science evidence. Studies show that LQ can be misleading in small regions and may be unstable when denominators are small; marginal changes can produce disproportionate LQ shifts, which risks over-interpreting specialization and “cluster” status (Pominova et al., 2021). Accordingly, the combination of trend analysis + LQ used in this study constitutes a stronger basis for spatial prioritization than LQ alone, because it links specialization to temporal direction (expansion vs contraction). In other words, base areas should be read through a dual lens: (i) comparative concentration (LQ) and (ii) trajectory (trend).

Strategic diagnosis through SWOT yields coordinates $S-W = 0.58$ and $O-T = -1.00$, placing the system in Quadrant II, where an ST (Strength–Threat) posture is recommended. This is analytically coherent given that internal capability is slightly favorable, yet the external environment is net adverse. The internal profile shows strengths such as livestock-raising experience, breed quality, labor availability, farmer-group participation, market availability, and perceived profitability, while weaknesses include traditional management, limited feed knowledge, low livestock ownership, limited capital, lack of market information, and insufficient feed supply.

Externally, key threats include substitute products, high feed prices, land conversion, loan constraints, weak farmer institutions, dry-season forage scarcity, and middlemen dominance. Within strategic management logic, an ST strategy is appropriate when the policy problem is not primarily “opportunity capture” but rather threat containment through capability leverage (Taufiqurrachman et al., 2023). This reading also aligns with evidence from small-ruminant value chain studies that employ SWOT to identify intervention points under climate and market pressures (Day et al., 2025). For instance, value-chain

assessment in arid Jordan identifies climate stressors and production/marketing constraints as central risks and argues for interventions focused on efficiency and chain coordination – an orientation consistent with ST strategy logic (Awad et al., 2023). Therefore, the Quadrant II position can be interpreted as indicating that Banyumas' small-ruminant sector already has workable internal assets (skills, labor, market presence, farmer interest), but these assets must be mobilized deliberately to counter external stress (feed/forage shocks, market governance, and land-use pressure).

The recommended ST strategy package – (i) improving operational efficiency, (ii) product diversification, (iii) strengthening partnerships, and (iv) enhancing marketing and promotion – is consistent with the observed internal-external structure. First, efficiency improvements through seed quality, farmer skills, and forage cultivation directly target high feed costs and forage scarcity, which are among the most consequential threats. This emphasis reflects wider evidence base that in small-ruminant systems, feed and management constraints are primary determinants of sustainable performance and resilience under environmental variability (Timpanaro & Foti, 2024).

Second, product diversification (processed meat, packaged carcass, goat milk, breeding kids) addresses both market competition (substitutes) and price vulnerability by expanding revenue channels and capturing higher value-added segments. This also reflects value-chain upgrading logic, where differentiation and downstream integration reduce dependence on undifferentiated live-animal sales (Mujahid et al., 2024).

Third, partnership strengthening with restaurants, traditional markets, and government programs provides an institutional mechanism to convert strengths (market availability, farmer interest, farmer groups) into more stable demand and improved governance of transactions. This direction is consistent with value-chain research emphasizing that coordination among chain actors and support services improves efficiency and sustainability, particularly in settings where smallholders face weak bargaining power and fragmented markets (Timpanaro & Foti, 2024). Fourth, improved marketing and promotion coupled with reduced broker dependence directly targets the “middlemen dominance” threat identified in the SWOT profile, while also responding to the weakness of limited market information (Indira, 2023).

In addition, disease risk identified in the background discussion (e.g., FMD) has direct strategic relevance because disease shocks can amplify both population decline and marketing disruptions. Recent evidence confirms FMD detection in Indonesia's 2022 outbreaks (including in cattle and goats) and documents epidemiological risk patterns in Java during 2022–2023 (Susila et al., 2023). Under an ST logic, internal strengths (experience, farmer groups, market access) can be mobilized to operationalize risk mitigation through collective biosecurity practices, vaccination coordination, and strengthened veterinary linkages, thereby preventing external shocks from translating into sustained population losses.

Finally, these findings provide empirical support for a two-step developmental logic: (1) prioritize base areas using LQ combined with trend

signals, and (2) implement ST strategies that emphasize efficiency, chain upgrading, and governance improvements in the prioritized areas. The approach is especially relevant given the sampling and institutional data-collection design that combines farm-level surveys with stakeholder input for SWOT factor identification, allowing strategy formulation to reflect both quantitative spatial signals and practical constraints identified by expert stakeholders.

In sum, the evidence indicates that small-ruminant development in Banyumas is best pursued through targeted, threat-aware upgrading, rather than broad expansion, to stabilize goat dynamics while leveraging the more consistent sheep growth trajectory.

CONCLUSIONS AND RECOMMENDATIONS

The findings indicate contrasting dynamics in small-ruminant development in Banyumas Regency. The goat population shows a declining trend over the observed period, while the sheep population demonstrates a clearer and more consistent increase, suggesting that the two commodities require differentiated policy and program responses. The Location Quotient (LQ) results identify several sub-districts as base areas ($LQ > 1$), implying that small ruminants constitute a relatively specialized activity in those locations and therefore represent priority zones for targeted interventions. The strategic diagnosis using SWOT places the sector in Quadrant II, meaning internal conditions are moderately supportive but external pressures are dominant; consequently, an ST (Strength-Threat) strategic orientation is the most appropriate, emphasizing the use of existing internal strengths to reduce vulnerability to external threats rather than relying on expansion alone.

In practical terms, implementation should prioritize spatial targeting by concentrating development resources—extension, breeding improvement, animal health support, and market facilitation—within the identified base areas to maximize effectiveness and avoid dispersed, low-impact programming. Interventions should be commodity-specific: goat development should emphasize stabilization and recovery through improved reproductive performance, survival rates, and feed management, while sheep development can be positioned for scaling and productivity gains where growth trends are strongest. The recommended ST orientation should be operationalized through efficiency-oriented actions that reduce exposure to feed-price shocks and seasonal forage shortages, including forage cultivation, feed innovation adoption, and systematic capacity building for farmers. In parallel, diversification and value addition should be promoted to reduce dependence on live-animal sales and strengthen resilience against substitute products and market volatility, including pathways such as processed meat, packaged products, milk-based products (where feasible), and breeding stock improvement. Finally, strengthening partnerships with restaurants, traditional markets, and government programs—supported by more effective farmer organizations—can improve market governance, reduce dependence on middlemen, and increase access to institutional support and technical assistance, while a routine monitoring system is required to track population trends, LQ

changes, marketing channels, and key risk indicators to ensure continuous strategy refinement.

ADVANCED RESEARCH

This study is limited by the use of aggregated time-series population data, so the trend results cannot fully explain the causal drivers behind changes in goat and sheep numbers (e.g., reproduction, mortality, off-take, disease shocks, feed-price volatility, and market disturbances). The Location Quotient (LQ) classification is also sensitive to benchmark selection, spatial scale, and small denominators, meaning some “base area” labels may be unstable if populations are small or fluctuate sharply. In addition, SWOT scoring depends on stakeholder perceptions and factor selection, which can introduce subjectivity and may not capture differences across farmer types, production systems, or marketing channels.

Future research should incorporate farm-level data to test determinants of productivity and profitability (feed costs, herd health, breeding, labor, and marketing margins), validate base areas using complementary spatial/dynamic methods (e.g., shift-share or spatial clustering), and extend analysis to value-chain governance and price formation to better target upgrading interventions. Mixed-method studies are also recommended to clarify why goat trends decline while sheep trends increase, including household decision-making and institutional constraints.

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