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# Factors Influencing Productivity of Smallholder Goat Farming in Rural Areas


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**Abstract**

Smallholder goat farming plays an important role in supporting rural livelihoods, improving household income, and strengthening food security in developing countries. However, the productivity of smallholder goat production systems remains relatively low due to various socioeconomic, technical, institutional, and technological constraints. This study aimed to analyze the factors influencing the productivity of smallholder goat farming in rural areas and to identify the most significant determinants affecting production performance. A quantitative survey approach was employed using primary data collected from 180 smallholder goat farmers through structured interviews. The study examined several explanatory variables, including farmers' education level, farming experience, herd size, feeding management, animal health management, market access, institutional participation, and technology adoption. Data were analyzed using descriptive statistics and multiple linear regression analysis. The results revealed that all investigated variables had positive and significant effects on goat farming productivity. Feeding management emerged as the most influential factor, followed by herd size and technology adoption. Farmers who applied improved feeding practices, implemented effective animal health management, and utilized modern technologies achieved higher productivity levels than those relying on traditional production systems.



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## Introduction

Goat farming is an important livestock sub-sector that plays a significant role in rural economic development, especially in developing countries. Goats are highly adaptable to diverse environmental conditions, require relatively low initial investment, and can utilize locally available feed resources around the farm. These characteristics make goat farming a common livelihood strategy among smallholder farmers and rural households to increase income, strengthen food security, and reduce economic vulnerability in rural areas (Assan, 2014; Biswas et al., 2024).

In recent decades, the contribution of goat farming to rural livelihoods has continued to increase. Beyond providing meat, milk, manure, and savings functions, goats also serve as liquid assets that can be sold at any time to meet household needs, including education costs and emergency expenses (Neupane et al., 2018). Biswas et al. (2024) show that goat farming significantly improves livelihood security among rural poor communities by providing a stable income source. This finding aligns with Dubeuf et al. (2014), who state that goat farming development is a strategic instrument for supporting food security, poverty reduction, and sustainable rural development.

Despite its importance, the productivity of smallholder goat farming remains low in many regions. Low productivity is reflected in slow animal growth, low birth rates, high kid mortality, low weaning weights, and limited meat and milk output per animal. Assan (2015) explains that goat productivity is strongly influenced by population dynamics, reproductive performance, and mortality rates. High mortality and low reproductive efficiency reduce overall farm productivity and limit household income.

The productivity problem in smallholder goat farming is shaped not only by biological factors but also by social, economic, managerial, and institutional conditions. Several studies show that farmer characteristics are closely linked to farm performance. Adams and Ohene-Yankyera (2014) found that education level, farming experience, and access to productive resources influence production decisions among small-scale farmers. Similar findings were reported by Gemede and Kidane (2025), who identified formal education, availability of family labor, and ownership of productive assets as key determinants of goat farming success in agro-pastoral areas.

Farmer education is important because it affects the ability to receive, understand, and apply technological innovations. More educated farmers tend to adopt new technologies more easily, apply better management practices, and access market and financial information (Chilima et al., 2025). Kenamu and Maguza-Tembo (2016) report that education positively influences innovation adoption in small-scale goat farming. Farming experience also contributes to technical skills and decision-making ability in livestock management.

In addition to socio-economic factors, management practices play a major role in goat productivity. Feed quality and quantity directly affect production performance. Mataveia et al. (2018) found that production systems and feed quality are strongly associated with goat productivity. Sellau et al. (2025) further show that improved feeding management enhances growth performance and production efficiency. Conversely, limited access to quality feed remains a major constraint in many developing regions (Mataveia et al., 2021).

Animal health management is another critical factor influencing productivity. Disease, parasite infestation, and weak preventive practices often lead to substantial economic losses. Yusnelly and Taufik (2024) state that effective health management reduces mortality and improves reproductive performance. Ntuli and Fourie (2022) also confirm that proper husbandry practices significantly enhance livestock production performance.

Economic factors also strongly influence goat farming productivity. Limited capital, restricted access to credit, and low investment capacity often hinder farm development. Binge et al. (2019) report that financial constraints are a major barrier for smallholder goat farmers. These limitations reduce farmers' ability to provide quality feed, improve housing, and adopt productivity-enhancing technologies.

Market access is another determinant of productivity and farm sustainability. Better market access increases incentives for farmers to expand production due to higher profit opportunities. Setoboli et al. (2024) found that market information and transport infrastructure significantly affect goat farmers' market participation. Theweli et al. (2023) also highlight that education and market access are key factors influencing farmers' engagement in livestock marketing activities.

Farmer institutions play an essential role in supporting productivity improvement. Farmer groups facilitate access to information, technology, finance, and markets. Komwihangilo et al. (2012) found that farmer groups strengthen bargaining power and improve marketing efficiency. Kusse and Dagne (2025) also show that participation in community-based development programs is influenced by education, experience, and institutional support.

Technological development offers new opportunities for improving smallholder goat farming productivity. Digital tools, sensors, and Internet of Things (IoT) systems are increasingly used to support efficient farm management. Kuswanto et al. (2025) report that IoT-based systems improve livestock management efficiency and farm productivity. Liehr et al. (2024) emphasize that integrating technology, markets, and management is essential for sustainable small-scale goat farming development.

Climate change presents another challenge affecting productivity. Changes in rainfall patterns and forage availability can influence livestock performance. However, goats show relatively strong adaptive capacity compared to other livestock species. Nyathi et al. (2025) explain that goat farming can serve as a climate change adaptation strategy for smallholder households due to its resilience under environmental stress.

Previous studies have identified multiple factors influencing goat farming success, including education, experience, farm size, feeding management, animal health, market access, technology, and institutional support. However, most studies analyze these factors separately. Integrated models that combine socio-economic, technical, institutional, and technological factors in explaining goat farming productivity remain limited, especially in rural contexts.

Moreover, many earlier studies focus on income, market participation, or technology adoption rather than direct productivity outcomes (Handayani et al., 2024; Radja et al., 2024; Nugroho & Winarto, 2025). Productivity is a key indicator of resource efficiency and livestock management success. Therefore, a comprehensive analysis of productivity determinants in smallholder goat farming is needed.

The novelty of this study lies in developing an integrated analytical model that combines socio-economic characteristics, technical management practices, institutional factors, and technological adoption to explain variations in smallholder goat farming productivity. This approach is expected to provide a more comprehensive understanding of productivity determinants and generate more effective policy recommendations for sustainable goat farming development in rural areas.

Based on this background, this study aims to analyze the factors influencing the productivity of small-scale goat farming in rural areas. The findings are expected to serve as a basis for strategies to improve productivity, increase farmer income, and ensure the sustainability of smallholder goat farming through strengthened farmer capacity, improved management practices, institutional development, and appropriate technology adoption tailored to local conditions.

## Methodology

This study employs a quantitative approach using a survey method to analyze the factors influencing the productivity of small-scale goat farming in rural areas. The quantitative approach is selected because it allows objective measurement of relationships among variables and enables testing of the effects of socio-economic, technical, institutional, and technological factors on goat farming productivity. The survey method has been widely applied in smallholder livestock research to identify determinants of productivity, income, and sustainability in goat farming systems (Adams & Ohene-Yankyera, 2014; Gemede & Kidane, 2025; Seleka et al., 2024).

The study is conducted in rural goat farming centers. The location is selected purposively based on high goat population density, dominance of small-scale production systems, and strong community involvement in goat farming as a source of household income. The selection of rural areas is also supported by previous studies showing that goat farming contributes significantly to rural livelihoods and low-income households (Biswas et al., 2024; Neupane et al., 2018; Dubeuf et al., 2014).

The study population consists of all small-scale goat farmers actively engaged in goat production in the study area. Small-scale farmers are defined as those managing goat enterprises with limited herd ownership, relying mainly on family labor, and operating under traditional or semi-intensive systems. The sample size is determined using the Slovin formula at a 5% error level, resulting in a representative number of respondents to describe the population. Respondents are selected using proportional random sampling so that each farmer has an equal chance of being included in the study.

Data used in this study consist of primary and secondary data. Primary data are collected through direct interviews using structured questionnaires developed based on research objectives and literature review. Interviews are conducted with farmers to obtain information on socio-economic characteristics, livestock management practices, market access, institutional participation, and technology use in goat farming. Secondary data are obtained from government institutions, livestock statistical reports, scientific publications, and other relevant documents related to smallholder goat farming development.

The dependent variable in this study is goat farming productivity. Productivity is measured based on the farmers' ability to generate output from available resources, represented by the number of live births, growth rate of animals, number of animals marketed, and survival rate within a production cycle. These indicators are based on Assan (2015), Murithi et al. (2005), and Chikwanda (2012), who state that goat productivity is influenced by reproductive performance, growth performance, and mortality rate.

The independent variables consist of several groups of factors. The first group is socio-economic factors, including farmer age, formal education level, farming experience, number of productive household members, business motivation, and access to financial resources. Education and experience are included because they influence farmers' ability to adopt innovations and manage livestock enterprises effectively (Adams & Ohene-Yankyera, 2014; Kenamu & Maguza-Tembo, 2016; Nugroho & Winarto, 2025). Motivation is also included because it affects the level of farmer engagement in farm development activities (Nugroho & Winarto, 2025).

The second group is technical management factors, including herd size, feed quality, feeding frequency, production system, reproductive management, and animal health practices. These variables are selected based on previous studies showing that feed, reproduction, and health are key determinants of goat productivity (Mataveia et al., 2018; Sellau et al., 2025; Yusnelly & Taufik, 2024). Ntuli and Fourie (2022) further confirm that good management practices improve livestock production performance.

The third group is institutional and marketing factors, including membership in farmer groups, extension participation frequency, access to market information, distance to livestock markets, and level of market participation. Institutional factors are included because farmer groups function as platforms for learning, cooperation, and improved access to productive resources (Komwihangilo et al., 2012). Market access is also a key determinant of small-scale goat farming development (Setoboli et al., 2024; Theweli et al., 2023).

The fourth group is technological factors, including the use of information technology, digital marketing tools, production support technologies, and adoption of livestock innovations. These variables are included because technological development has created opportunities to improve efficiency and productivity in smallholder goat farming systems (Liehr et al., 2024; Kuswanto et al., 2025).

Before data collection, the research instrument is tested for validity and reliability. Validity is tested using Pearson Product Moment correlation to assess the accuracy of each questionnaire item in measuring the variables. Reliability is tested using Cronbach's Alpha with a minimum threshold of 0.70. The instrument is considered suitable if it meets both validity and reliability criteria.

The research process begins with a literature review to identify relevant variables based on previous studies on goat farming productivity. The next steps include instrument development, field survey implementation, primary and secondary data collection, and verification of interview data. After data collection, data editing, coding, and tabulation are conducted to ensure completeness and consistency.

Data analysis is carried out in several stages. Descriptive analysis is used to describe farmer characteristics, farm conditions, and variable distribution. Classical assumption tests are then conducted, including tests for normality, multicollinearity, heteroscedasticity, and autocorrelation to ensure that the data meet regression requirements. After all assumptions are satisfied, multiple linear regression analysis is applied to identify the effect of each independent variable on goat farming productivity. The regression model used in this study is formulated as follows:

$$Y = \beta 0 + \beta 1X1 + \beta 2X2 + \beta 3X3 + \beta 4X4 + \beta 5X5 + \beta 6X6 + \beta 7X7 + \beta 8X8 + \varepsilon$$

In this model, Y represents goat farming productivity, β0 is the constant term, β1–β8 are the regression coefficients, and X1–X8 are the independent variables consisting of education, farming experience, farm size, feed quality, animal health, market access, farmer institutions, and technology adoption. The term ε represents the error component.

The regression results are interpreted based on the magnitude of the regression coefficients, statistical significance levels, and the coefficient of determination ($R^2$). This analysis is used to identify the dominant factors influencing the productivity of small-scale goat farming in rural areas and to develop evidence-based recommendations for livestock development aligned with farmers' needs and local conditions.

## Results and Discussion

The study involved 180 small-scale goat farmers distributed across several rural areas. Survey results indicate that goat farming is still dominated by farming households using traditional to semi-intensive production systems. Most farmers operate goat farming as a secondary livelihood activity integrated with crop farming and plantation activities.

**Table 1.** Respondent Characteristics

| Characteristic | Category | Percentage (%) |
|---|---|---|
| Age | <35 years | 18.3 |
| | 35–50 years | 47.8 |
| | >50 years | 33.9 |
| Education | Primary school | 35 |
| | Junior high school | 31.1 |
| | Senior high school | 27.8 |
| | Higher education | 6.1 |
| Farming experience | <5 years | 21.7 |
| | 5–10 years | 38.3 |
| | >10 years | 40 |
| Goat ownership | 1–10 head | 44.4 |
| | 11–20 head | 36.1 |
| | >20 head | 19.5 |

Most farmers are within the productive age group, indicating sufficient physical capacity to manage livestock operations. The level of formal education among farmers is relatively low, as the majority only completed primary and lower secondary education. This condition aligns with the findings of Adams and Ohene-Yankyera (2014) and Gemede and Kidane (2025), who reported that smallholder goat farming is generally managed by households with limited formal education.

Farming experience that is relatively long indicates that farmers possess strong practical knowledge in goat husbandry. However, high experience does not always lead to the adoption of modern technology, since most farmers still rely on traditional methods that are passed down across generations.

### Productivity Condition of Goat Farming

Productivity is measured using a combination of reproductive performance, animal growth, and survival rate indicators. The results show that average productivity remains at a moderate level.

**Table 2.** Goat Farming Productivity Indicators

| Indicator | Average Value |
|---|---|
| Kidding rate (%) | 148.6 |
| Kid mortality (%) | 11.4 |
| Weaning weight (kg) | 12.7 |
| Average daily gain (g/day) | 74.5 |
| Survival rate (%) | 88.6 |

The kidding rate indicates that most does produce more than one kid per birth. However, kid mortality remains relatively high, which reduces production efficiency. This finding supports Assan (2015), who states that mortality and reproductive performance are key determinants of smallholder goat productivity.

**Factors Affecting Goat Farming Productivity**

Multiple linear regression analysis is conducted to examine the effect of various factors on goat farming productivity.

**Table 3.** Multiple Linear Regression Results

| Variable | Coefficient (β) | t-value | Sig. |
|---|---|---|---|
| Constant | 2.841 | 3.117 | 0.002 |
| Education | 0.182 | 2.734 | 0.007* |
| Farming experience | 0.147 | 2.268 | 0.025* |
| Herd size | 0.291 | 4.916 | 0.000* |
| Feed management | 0.338 | 5.772 | 0.000* |
| Animal health management | 0.214 | 3.864 | 0.000* |
| Market access | 0.165 | 2.979 | 0.003* |
| Farmer institutions | 0.121 | 2.115 | 0.036* |
| Technology adoption | 0.286 | 4.687 | 0.000* |

**Effect of Education on Productivity**

Education has a positive and significant effect on goat productivity ($p < 0.05$). Higher education levels improve farmers' ability to access information, understand technology, and apply innovations in livestock production. This finding is consistent with Adams and Ohene-Yankyera (2014), Kenamu and Maguza-Tembo (2016), and Gemede and Kidane (2025), who report that education improves decision-making capacity and farm management efficiency. Farmers with higher education levels tend to participate more in training programs, use digital tools, and maintain better farm records compared to those with lower education levels.

**Effect of Farming Experience**

Farming experience shows a positive effect on productivity. Experience provides practical skills in disease detection, breeding selection, reproductive management, and feed management.This result supports Seleka et al. (2024) and Chokoe et al. (2025), who highlight experience as an important form of social capital in improving smallholder goat farming success. However, long farming experience must still be balanced with innovation adoption to prevent productivity stagnation.

**Effect of Herd Size**

Herd size has a significant effect on productivity. Farmers with larger herds have greater opportunities for breeding selection, genetic improvement, and more efficient resource use. The data indicate moderate digital readiness. Internet access shows the highest mean score. Government support records the lowest score. This gap suggests uneven institutional support for digital transformation.

**Effect of Feed Management**

Feed management is the most dominant factor in this study, with the highest regression coefficient (β = 0.338). Farmers who provide high-quality forage, supplementary feed, and minerals regularly achieve better production performance than those relying only on natural grazing.

**Table 4.** Productivity by Feeding System

| Feeding system | Productivity |
|---|---|
| Traditional | 58.4 |
| Semi-intensive | 74.2 |
| Intensive | 89.7 |

These results are consistent with Mataveia et al. (2018), Sellau et al. (2025), and Liehr et al. (2024), who emphasize feed quality as a key driver of goat productivity.

**Effect of Animal Health Management**

Animal health management significantly affects productivity. Farmers who routinely apply vaccination, deworming, sanitation, and health monitoring show lower mortality rates. This finding strengthens the results of Yusnelly and Taufik (2024) and Ntuli and Fourie (2022), who state that animal health is essential for maintaining livestock productivity.

**Effect of Market Access and Institutions**

Market access has a positive effect on productivity because it provides economic incentives for farmers to increase production. Farmers with better market access tend to expand herd size and improve management practices. In addition, farmer group membership improves productivity through knowledge sharing, collective feed procurement, and access to government programs. These findings are consistent with Komwihangilo et al. (2012), Setoboli et al. (2024), and Theweli et al. (2023).

**Effect of Technology Adoption**

Technology adoption has a strong positive effect on goat farming productivity. Farmers who use digital platforms for production information and marketing achieve higher productivity than those who do not.

**Table 5.** Productivity by Technology Adoption Level

| Adoption level | Productivity |
|---|---|
| Low | 61.3 |
| Medium | 73.5 |
| High | 87.9 |

This finding supports Kuswanto et al. (2025) and Liehr et al. (2024), who show that digital technology improves farm efficiency and expands market access.

**Implications for Smallholder Goat Farming Development**

The results show that productivity improvement cannot be achieved through a single factor. Productivity results from the interaction of socio-economic, technical, institutional, and technological dimensions. An effective strategy must focus on four main areas: improving feed quality, strengthening animal health services, increasing farmer capacity through training and extension, and expanding access to technology and markets. This integrated approach delivers stronger impacts than isolated interventions. The study confirms that small-scale goat farming productivity in rural areas is significantly influenced by farmer education, farming experience, herd size, feed management, animal health, market access, farmer institutions, and technology adoption. Among these variables, feed management, herd size, and technology adoption are the most influential factors in improving goat farming productivity.

## Conclusion

This study shows that the productivity of small-scale goat farming in rural areas is influenced by a combination of socio-economic, technical, institutional, and technological factors. The regression analysis indicates that farmer education level, farming experience, herd size, feed management, animal health management, market access, farmer group participation, and technology adoption all have a positive and significant effect on goat farming productivity.

Feed management is the most influential factor affecting productivity. Farmers who are able to provide high-quality and sustainable feed consistently achieve higher production performance compared to those relying on traditional feeding systems. In addition, herd size and technology adoption are also important determinants that improve production efficiency and enhance the competitiveness of smallholder goat farming. The use of digital technology, access to market information, and adoption of appropriate production innovations help farmers increase productivity and expand marketing opportunities.

Education and farming experience play an important role in strengthening farmers' capacity to manage their livestock enterprises more effectively. Farmers with higher education levels and longer experience tend to adopt innovations more easily, apply appropriate husbandry practices, and make more rational business decisions. Meanwhile, market access and farmer group involvement contribute to improved access to information, technology, finance, and marketing opportunities, which ultimately enhance productivity.

These findings confirm that improving productivity in smallholder goat farming requires an integrated approach. Livestock development programs should not focus solely on increasing herd numbers, but also prioritize improving feed quality, strengthening animal health services, enhancing farmer human capital, developing farmer institutions, and expanding access to technology and markets. Through this strategy, small-scale goat farming can become more productive, profitable, and sustainable, thereby supporting increased household income and broader rural economic development.

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