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Enhancing indigenous livestock production towards improving livelihoods among small-scale farmers in KwaZulu-Natal Province, South Africa

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Income security is a global concern threatening the livelihood of farmers. To ensure that the livelihoods of farmers are maintained, small-scale indigenous livestock farming serves as a solution to this issue. To investigate the income contribution of producing indigenous livestock towards small-scale farming households in uMhlathuze Municipality, this study was conducted. It randomly collected primary data from 60 small-scale indigenous livestock farmers, following a cross-sectional design with a quantitative approach. Findings from this study reveal that most small-scale indigenous livestock farmers in this area are predominantly middle-aged to older individuals, who are mostly single, male, and unemployed with no educational background. Indigenous livestock farmed include chicken, goats, cattle, and sheep. However, these farmers lack services such as extension, credit, infrastructure, markets, and veterinary services, which significantly impact production. Moreover, factors including age, education, household size, employment status, number of households employed, access to veterinary and extension services, theft, and diseases were found to be significant towards the households' income security. This study, therefore, encourages the adoption of indigenous livestock farming to sustain household income and preserve indigenous knowledge. Also, services such as extension, credit, infrastructure, markets, and veterinary services should be enhanced to improve farmer production and participation in markets.

KEYWORDS

animal husbandry, food security, resilience, rural development, value chain

1 Introduction

Income security is a global concern for individuals and households, particularly relevant in low-and-middle income countries (Collishaw et al., 2023; Miladinov, 2023). It refers to the capability of individuals and households to maintain a stable and sufficient income, essential for sustainable economic development and alleviating poverty. The issue of income insecurity is highly influenced by the persistent inequality, labour market volatility (Grimshaw, 2025), rapid technological advancements and increasing impacts posed by climate change (Salvati and Tridico, 2024; Peter, 2025). The global workforce operating within the informal economy accounts for more than 60%, often burdened by zero income protections (Dada et al., 2025). On the other hand, automation and digitalisation keeps threatening the stability of low-skilled jobs, especially in manufacturing sectors. Furthermore, the impact of climate change continues

to pose pressure on rural communities which rely heavily on agriculture for livelihood (Khumalo et al., 2024b). This worsens the income instability and deepens existing disparities both within and between countries. In Africa, these issues stem from structural constraints including high dependency on primary sectors, limited industrialisation, fragile social protection systems and widespread informal employment (David et al., 2023; Schneider et al., 2024; Zahonogo, 2025). Gender disparities are still relevant in this scale as women face systemic barriers to accessing land, credit, and secure employment which further embed on the strain of income insecurity.

Regionally, in Sub-Saharan Africa, these issues still prevail as poverty is concentrated in rural areas among small-scale farmers. These farmers reported to face low productivity, climate vulnerability, and a lack of diversified income sources within the household (Giller et al., 2021; Woodhill et al., 2022; Qange et al., 2024). While remittances provide some support, they are unreliable sources to most marginalised populations as they are often unpredictable and inaccessible. Conflicts and displacement in regions such as Sahel increase economic vulnerability as limited access to credit and insurance restricts household's capacity to withstand shocks (Naz and Saleem, 2024). Under this region, the country of South Africa continues to face high unemployment particularly among youth, despite its middle-income status and relatively developed social protection mechanisms (Khalid et al., 2021; Yanta, 2022). Within the KwaZulu-Natal Province, municipalities such as uMhlathuze, subsistence farming and social grants remain vital, yet land tenure insecurity and environmental degradation negatively impact the livelihood of these households (Dlamini, 2021; Sowman et al., 2023; Maziya et al., 2024). The prevalence of these challenges reveal that action is necessary as livelihood of underprivileged households is threatened.

Small-scale farming holds immense potential across multiple dimensions including economic, nutritional, environmental and social dimensions. However, this practice remains undervalued in policy discussions despite its role towards sustaining livelihoods for farming households (Ikhsan et al., 2025). Economically, small-scale farming provides direct income from crop and livestock sales, creates jobs for community and stimulates local economies through supporting markets and related enterprises (Mayekiso, 2024; Nontu et al., 2024; Qutu, 2024). Nutritionally, they enhance food security through the provision of diverse, nutrient-rich crops primarily for household consumption, reducing reliance on volatile markets (Mkhize et al., 2023; Glatzel et al., 2025). Environmentally, these farmers employ sustainable, low input practices that promote soil conservation and climate resilience (Mayekiso, 2021; Khumalo et al., 2024a; Mdoda et al., 2025). Socially, small-scale farming empowers women and youth, preserves indigenous knowledge and strengthens community stability through the reduction of rural-urban migration.

Despite the prevalence of insecure land tenure and inadequate infrastructure, small-scale farming remains a solution to achieve livelihood. With improved access to resources, infrastructure and policies, small-scale farming can contribute significantly towards poverty alleviation, food security and sustainable rural development. However, indigenous livestock farming by small-scale farming households hold significant promise towards enhancing income security in rural and semi-rural areas of uMhlathuze Municipality. This practice involves rearing of local breeds such as Nguni cattle,

goats, or sheep which are well-adapted to the local environment and climate, often managed through traditional knowledge systems (Nxumalo et al., 2024; Bashiru and Oseni, 2025). These breeds are resilient to drought, disease, and harsh terrain, significantly reducing input costs and production risks, which in turn provides a more stable and predictable income for farmers (Mathew and Mathew, 2023; Pankaj et al., 2024).

Products obtained from livestock such as meat, milk and manure create diversified income streams (Jalaj et al., 2025), while the actual livestock serve as living assets which can be sold during moments of economic need. Beyond these benefits, indigenous livestock farming supports cultural identity and community resilience, with women and youth increasingly participating in herding, processing and marketing activities. Though challenges such as limited market access, inadequate veterinary services and insecure land tenure persist, focused support of indigenous livestock systems for sustainable development could offer a pathway for rural income and food security. This support includes improved animal health, infrastructure, and market integration which could further enhance the potential of this practice. Therefore, this study aimed to investigate the perceived contribution of small-scale indigenous livestock production towards income security.

2 Study frameworks

2.1 Theoretical framework

This study integrates the Theory of Planned Behaviour (TPB) with Classical Economic Growth Theory (CEGT). Using these theories in conjunction empowers the inceptions and link between the behaviours, resources and practices towards achieving sustainable income.

The TPB, founded by Icek Azjen in 1985 have proven to be resourceful when it comes to predicting and explaining behaviour in different behavioural domains (Ajzen, 1985; Naskar and Lindahl, 2025). This theory asserts that behaviour is influenced by a person's intent to pursue the behaviour and through the power the person believes to have control over this behaviour. Behavioural intent itself is motivated by three constructs including the attitude towards the behaviour, subjective norms, as well as the perceived behavioural control (Hurst et al., 2024). In this study, the small-scale farmers have proven to be passionate and consistent to indigenous livestock farming as they have been practising it for a long time. This is because indigenous livestock farming has always been a norm for people residing in KwaZulu-Natal (Mseleku, 2023; Nhlozi, 2023), leading to everyone participating in it willingly. The number of livestock a household have usually disclose the economic status of the household. However, small-scale farmers practicing indigenous livestock farming do not normally sell their livestock, unless there is a necessity to (Msipa et al., 2025). These necessities include the money to sustain income within the household or to purchase other necessary utilities.

Classical Economic Growth Theory on the other hand, deals with evaluating how economies expand over time, growth limiting factors and how wealth is generated and distributed (Chatzarakis et al., 2024). This theory, developed by Smith (1776), Malthus (1798) and David Ricardo in the early 19th century was based on comprehending the dynamics between population growth, resource constraint and capital accumulation (Faloye, 2024). This theory asserts that growth is driven

by accumulation of capital such as land and labour, where diminishing returns to land, a fixed resource, sets natural limit on growth which slows as resources become scarce, and profits decline to a stationary state. It further states that population growth tends to create pressure on resources (Angulo Bustinza, 2024). Livestock production depends heavily on natural resources especially land, pasture and water. As asserted by the theory that the effect of growth population is inversely proportional to the availability of resources (Yuan and Zhang, 2024), for small-scale indigenous livestock farmers this means their practice might face the diminishing effect. This constrains income growth derived from livestock production. This shows that investment in capital such as technology and disease management is required improve productivity, which could increase the income for small-scale farmers.

The TPB shows the behaviour the farmers have towards the adoption of this farming practice while CEGT illustrates the challenges and counterstrategies for this practice towards achieving income security. These theories form the groundwork for farmers to achieve sustainable livelihoods as livestock farming does not only accounts for the income generation of a household but increases the availability of food within a household. This is further enhanced using the conceptual framework as depicted in Figure 1.

2.2 Conceptual framework

A conceptual framework enhances the flow and relation of concepts to each other (Yao, 2024). This study aligns with the SLF (Sustainable Livelihood Framework) which asserts that each practice

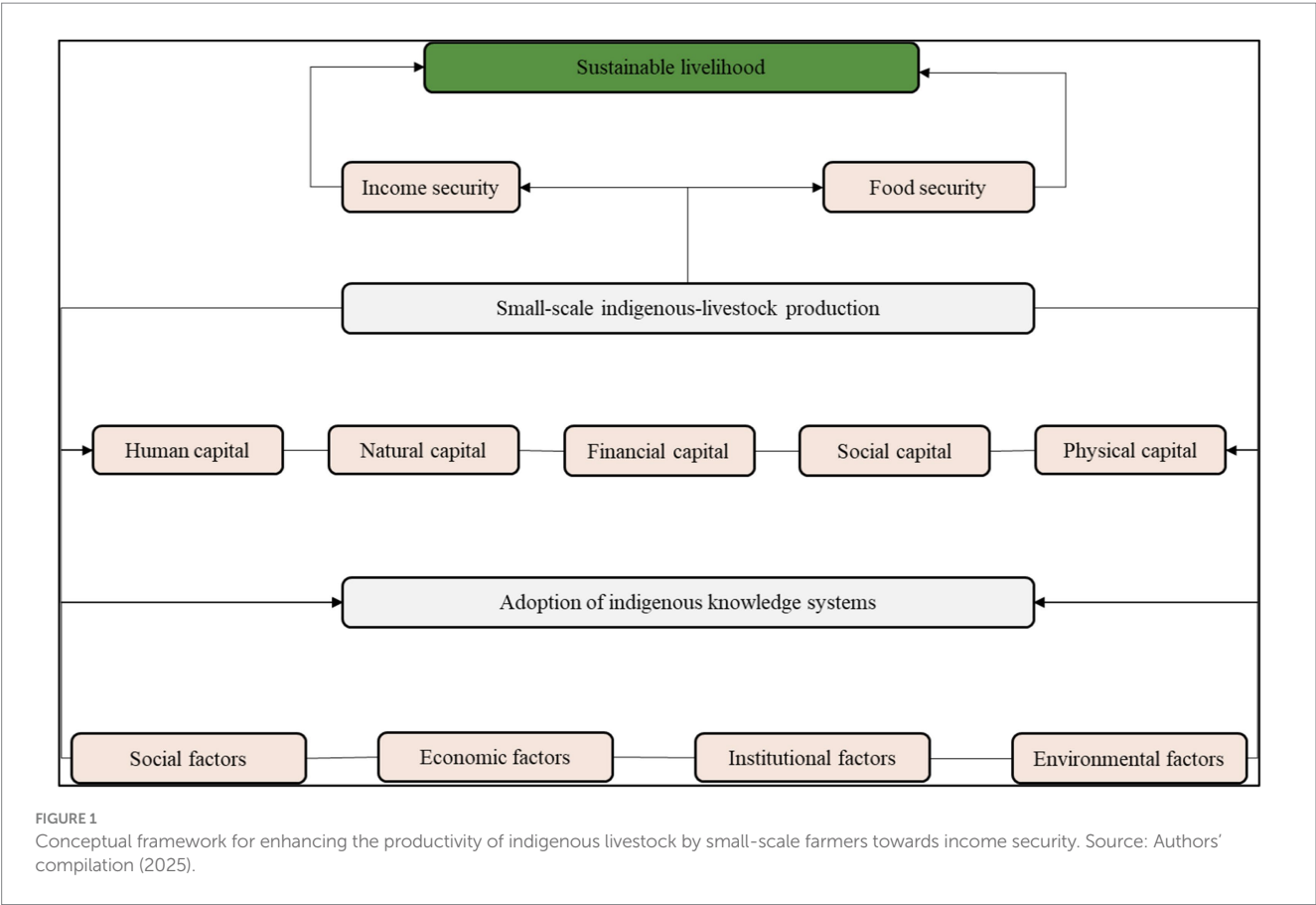
is conducted with the overall aim of achieving sustainability. The framework is shown in Figure 1.

The adoption of indigenous knowledge systems is influenced by several factors and capital assets. These factors include (1) social factors (perceptions, cultures, beliefs); (2) economic factors (income, market access, employment); (3) institutional factors (credit access, agricultural education); and (4) environmental factors (soil fertility, rainfall). These factors influence the farmer’s decision to either adopt indigenous knowledge systems or not. If the cultivation of a certain produce is linked to the culture of the household, increases income in the household, allow for more learning and the soil is fertile, then the farmer is likely to adopt. The prevalence of these factors is further associated with the five capital assets namely, human, natural, financial, social and physical.

Human capital: represents the skills, knowledge, ability to labour and good health that together enable people to pursue different livelihood strategies and achieve their livelihood objectives (Xie et al., 2025). In this scenario, the skills and knowledge the farmer has determines the ability to engage in indigenous livestock farming.

Natural capital: used for the natural resource stocks from which resource flows and services (such as land, water, forests, air quality, erosion protection, biodiversity) useful for livelihoods are derived (Meybeck et al., 2024). These resources are crucial for the production to take place as it accounts for all the biological inputs required to produce and maintain growth of the livestock.

Financial capital: denotes the financial resources that people use to achieve their livelihood objectives, and it comprises the important availability of cash or equivalent, that enables people to adopt different livelihood strategies (Ma et al., 2024). Among the five categories of



assets, financial capital is probably the most versatile as it can be converted into other types of capital or it can be used for direct achievement of livelihood outcomes (for instance, purchasing of food to reduce food insecurity; [Mkandawire, 2024](#)). However, it tends to be the asset that is least available for small-scale farmers, making other capitals important as substitutes.

Social capital: the social resources upon which people draw in seeking for their livelihood outcomes, such as networks and connectedness ([Owuor et al., 2024](#)). These resources increase people's trust and ability to cooperate or form membership in more formalised groups and their systems of rules, norms and sanctions. This type of capital is important through its direct impact on other capitals, improving the efficiency of economic relations through the mutual trust and obligations it poses onto the community ([Zhang and Zhao, 2024](#)). For small-scale indigenous livestock farmers, social capital often represents a place of refuge in mitigating the effects of shocks or lacks in other capitals through informal networks.

Physical capital: comprises the basic infrastructure and producer goods needed to support livelihoods, such as affordable transport, secure shelter and buildings, adequate water supply and sanitation, clean, affordable energy and access to information and technology ([Toruta, 2025](#)). Its influence on the sustainability of a livelihood system is best fit for representation through the notion of opportunity costs or 'trade-offs', as a poor infrastructure can preclude education, access to health services and income generation ([Ma et al., 2024](#)). Small-scale farmers usually face the challenge of inadequate infrastructure, thus reducing opportunities for generating income.

These assets then influence small-scale farmers' decision to engage in indigenous livestock production. The production made can then be consumed to ensure food security or sold to gain income which caters for their income security. Food security illustrates the ability of an individual or household to have adequate access to food that meets their specific dietary requirements. It consists of four dimensions namely food availability, accessibility, utilisation and stability. (1) Availability deals with ensuring the consistent production and supply of sufficient food quantities ([Ogwu et al., 2024](#)); (2) Access to food looks at the ability to obtain appropriate foods ([Agunyai and Ojajorotu, 2024](#)). (3) Utilisation refers to the proper use of food, incorporating it to a certain diet ([Phan, 2024](#)); and (4) Stability dealing with the consistent presence of the previous dimensions over time without risks of sudden shocks or seasonal shortages ([Niazi et al., 2025](#)). On the other hand, income security refers to the assurance or guarantee that individuals or households have a stable, sufficient flow of income over time to meet their basic needs and wants ([Peck and Theodore, 2025](#)). Its key characteristics include stability (consistent and reliable), adequacy (sufficient to cover necessities), protection (such as insurance and savings) and sustainable (durable over time). This allows people to plan successfully for the future, supporting social well-being, social stability, simultaneously alleviating poverty and vulnerability. This leads to the farmers achieving sustainable livelihood.

3 Materials and methods

3.1 Study area description

The study was conducted within the uMhlathuze Local Municipality, situated along the Northeastern coast of the

KwaZulu-Natal Province, at coordinates 28.8047°S and 31.9473°E, illustrated in [Figure 2](#). KwaZulu-Natal ranks as the second most heavily populated province in the country, with an estimated population of 12.3 million ([Statistics South Africa, 2024](#)).

Within this province, uMhlathuze ranks as the third largest municipality after eThekweni Metropolitan and Msunduzi Local Municipality ([Sibiya and Moyo, 2024](#)). This municipality has a population of approximately 410 465 people ([Umhlathuze Municipality, 2018](#)), constituting nearly half of the total population of the King Cetshwayo District, estimated at 971 135, experiencing a steady annual growth rate of 1.45% ([King Cetshwayo District Municipality, 2023](#)). UMhlathuze Municipality derives its name from the uMhlathuze River and covers an area of roughly 123 359 hectares, consisting of both rural and urban areas governed by Traditional Councils. Average daily temperatures range from 23°C to 29°C, with summer reaching more than 40°C. The average annual rainfall is documented to be 1228mm with 80% falling between spring and summer ([Mokoma and Tilahun, 2022](#)).

Economically, uMhlathuze is the most developed municipality within the King Cetshwayo District and serves as the district's primary economic hub, contributing 48% to its Gross Domestic Product (GDP; [City of Umhlathuze, 2024](#)). The municipality's economy is supported by key sectors including agriculture, mining, manufacturing and tourism. Particularly, uMhlathuze is well suited for livestock production due to its favourable grazing conditions and is recognised as the leading producer of sugarcane in KwaZulu-Natal, with approximately 18 500 hectares used for sugarcane production.

3.2 Research design and approach

This study employed a cross-sectional research design following a quantitative approach. A cross-sectional research design refers to the collection of data at a single point in time to provide a snapshot of a population, phenomenon or set of variables ([Hunziker and Blankenagel, 2024](#)). It is commonly used to assess the prevalence of conditions or characteristics and to explore the association between variables ([Ye et al., 2023](#)). The overall advantage of this research design lies on it being time and cost effective, allowing the generation of meaningful insights from a broad sample without the need for a long-term follow-up. On the other hand, quantitative research approach focuses on the collection and analysis of numerical data to objectively measure variables, test hypotheses and identify patterns or relationships within a dataset ([Ghanad, 2023](#)). This approach ensures that the data obtained is grounded in objectivity and statistical rigour ([Mrabti and Alaoui, 2024](#)). The use of this design and approach allows for the collection of generalisable results in a specific point in time, making it easy for analysis.

3.3 Sampling procedure and sample size

A stratified random sampling technique was adopted to select respondents for this study. This sampling technique is a probability sampling method whereby the overall population is divided into strata (sub-groups) based on shared characteristics ([Makwana et al., 2023](#)). Firstly, the list of active farmers was obtained from the KwaZulu-Natal Department of Rural Development and Agrarian Reform with the help

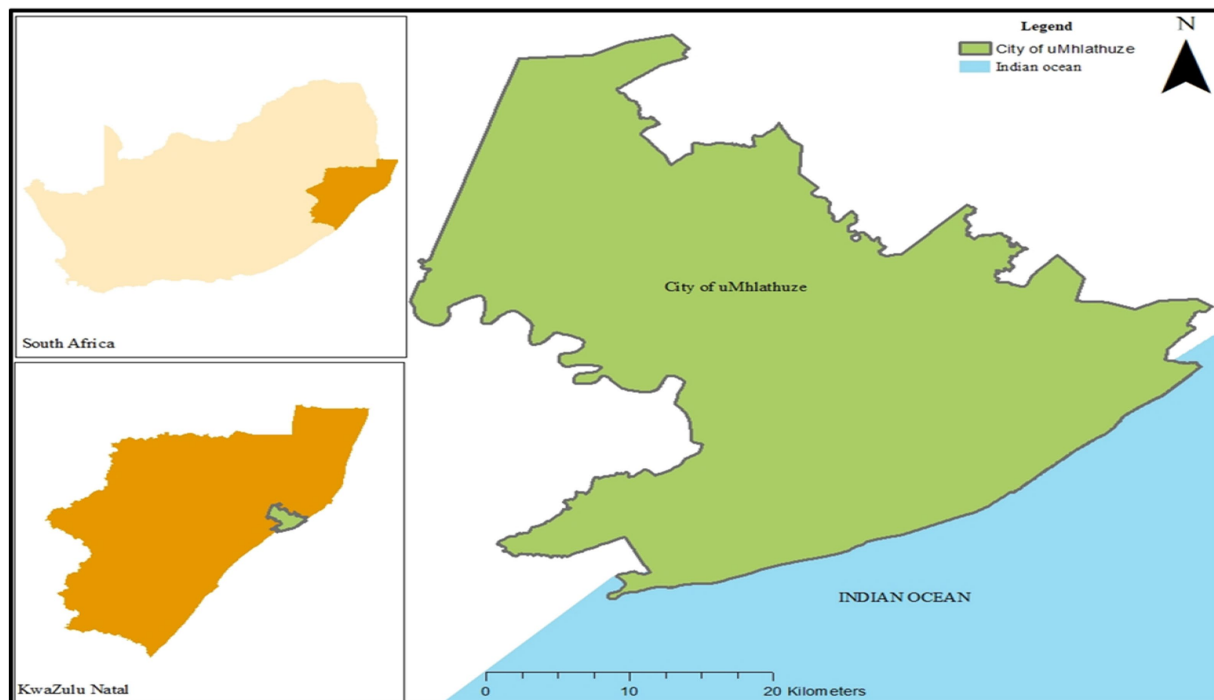


FIGURE 2

Map showing the uMhlathuze Local municipality. Source: Adopted from Sibiya and Moyo (2024).

of extension officers. A total of 71 active indigenous livestock farmers were identified in the selected municipalities. The farmers were selected based on their active involvement in livestock production, ensuring relevant and reliable data for the study.

From the 71 farmers, random sampling was employed to ensure accurate collection of data, reducing bias. To determine the appropriate sample size, Taro's (1967) formula was applied, which is widely used in studies with small finite populations to minimize sampling error. The formula is expressed as shown in Equation (1). The substitution of values into Equation (1) yields Equation (2), which gives a required sample size of 60 farmers at a 5% margin of error and 95% confidence level.

$$n = \frac{71}{1 + 71(0.05^2)} \quad (1)$$

Where:

n = required sample size

N = population size (71 farmers)

e = precision level (0.05, representing a 5% margin of error at 95% confidence level)

$$n = \frac{71}{1 + 71(0.0025)} \quad (2)$$

$$n = 60$$

Thus, the minimum required sample was 60 respondents. This sample is statistically sufficient to ensure representativeness of the population, while also being practical and cost-effective for field work.

From the population list, 60 farmers were randomly selected using stratified random sampling to reduce bias and to ensure that active participants in livestock production were included.

3.4 Data collection

Prior data collection, ethical clearance was obtained from study authorities and consent was acquired before the study conduction. In this study, primary data was collected directly from participants through face-to-face survey using a semi-structured questionnaire. The questionnaire consisted of both open-ended and closed-ended questions. The closed-ended questions provided a quantifiable response, while the open-ended questions allowed participants to elaborate on their experiences and insights. To ensure clarity and inclusivity, the questionnaire was translated into the native language which is isiZulu. This approach improved participant cooperation and understanding of the questions. Pilot testing was conducted to ensure the reliability and validity of the questionnaire towards the overall aim of the study. The type of data collected include socio-economic demographics, challenges, income sources, factors influencing livestock farming and the perceived contribution of producing livestock towards income security.

3.5 Data analysis

After data collection, all survey responses were coded and captured in Microsoft Excel for initial cleaning and organisation. The cleaned dataset was then imported into the Statistical Package for the Social Sciences (SPSS), version 28 for comprehensive analysis. The

study employed descriptive statistics and linear regression analysis to summarise and interpret the data.

3.6 Statistical analysis

Descriptive statistics (means, frequencies, and percentages) were employed to summarise household characteristics and production challenges. These were primarily presented in tables to provide a concise overview of the sample. Descriptive statistics is a branch of statistics that involves summarising and organising data to describe the main features of a dataset, often through measures like mean, median, mode, standard deviation, and frequency distributions (Alabi and Bukola, 2023). The use of descriptive statistics dates to early developments in the field of statistics, evolving from foundational work by statisticians such as Karl Pearson and Francis Galton in the late 19th and early 20th centuries (Kennedy-Shaffer, 2024). Its overall advantage lies in providing a clear, concise overview of large volumes of data, making complex information easier to understand and interpret. This makes it highly compatible with this study to understand patterns and variability in variables such as income levels, livestock numbers, or quantifying the prevalence of challenges in livestock production. Descriptive statistics will be used to represent findings through tables, charts, and summary measures that highlight key trends and distributions within the data.

Linear regression analysis was then applied to examine the relationship between household income (dependent variable) and the set of independent variables. This method is suitable for quantifying the effect of predictors on income while controlling for multiple factors. Model parameters were estimated using Ordinary Least Squares (OLS). The regression results are reported using beta coefficients and p-values to indicate the magnitude and statistical significance of each predictor's effect on household income. Linear regression analysis is a statistical method used to model and examine the relationship between a dependent variable (outcome) and one or more independent variables (predictors; Roustaei, 2024). It assumes a linear relationship and estimates how much the dependent variable changes when the independent variables change. Linear regression was developed by Sir Francis Galton and later formalised by Karl Pearson in the late 1900s (Widianto et al., 2024). The main advantage of linear regression is the ability to quantify and predict relationships between variables while controlling for multiple factors. It provides a simple, interpretable model that helps understand how different factors impact the outcome, making it ideal for testing hypotheses and informing decisions (Jones et al., 2025). In this study, linear regression helps to determine how indigenous livestock produced, market access, and other factors predict household income security as well as identifying statistically significant predictors and quantify their effect sizes. The statistical representation of this model is shown in Equation 3.

$$Y = \beta_0 + \beta_1 x + \varepsilon \quad (3)$$

Where: Y – the dependent variable (household income); x – the independent variable/ predictor; β_0 – the intercept (value when the predictor is 0); β_1 – the slope (change in Y for every unit) change in x ; and ε showing the error term. Table 1 is the representation of each

variable to be assessed along with its description, measurement and expected outcomes.

3.7 Dependent variable

The dependent variable for this study is household income, which was used as a proxy for income security. Household income was measured as the total annual income (in South African Rand, ZAR) reported by respondents. This measure includes both farm income (earnings from indigenous livestock sales and related products) and non-farm income (wages, remittances, pensions, and other activities). To reduce seasonal variation, respondents were asked: “What is the approximate total income earned by your household in the past 12

TABLE 1 Variables, measurements and expected outcomes.

Variable	Predictor	Measurement	Expected outcome
Dependent (Y)	Household income	Continuous	+
Independent (x)	Gender	Dummy (1 = male; female = 2)	+/-
	Age (sex at birth)	Continuous	+/-
	Marital status	Categorical (1 = single; 2 = married; 3 = divorced; 4 = widowed)	+/-
	Level of education	Categorical	+
	Household size	Continuous	+/-
	Employment status	Categorical	+
	Number of households employed	Continuous	+
	Access to markets	Dummy (1 = yes; otherwise, 2)	+
	Access to infrastructure	Dummy (1 = yes; otherwise, 2)	+
	Access to veterinary services	Dummy (1 = yes; otherwise, 2)	+
	Access to extension services	Dummy (1 = yes; otherwise, 2)	+
	Access to credit	Dummy (1 = yes; otherwise, 2)	+
	Theft	Dummy (1 = faced theft; otherwise, 2)	-
	Diseases	Dummy (1 = loss due to health condition; otherwise, 2)	-

Source: Authors' compilation (2025).

months from livestock production and other sources?" This formulation allowed us to capture a comprehensive and comparable measure of household economic well-being, consistent with prior studies on rural livelihoods (Marchal and Marx, 2024).

3.8 Independent variables

The explanatory variables were selected based on both empirical literature and contextual relevance. These include socio-demographic factors (gender, age, marital status, household size, education, employment), and institutional/production-related factors (market access, infrastructure access, veterinary services, extension services, credit access, theft, and livestock diseases). Each variable was carefully coded as shown in Table 1. For example, gender was coded as a dummy (1 = male, 2 = female), household size was measured as a continuous variable (number of household members), and market access was measured as a dummy (1 = access, 2 = no access). *Gender (sex at birth)*: of the household head is a dummy variable denoted as either male or female. Disparities in sex severely affect income levels and income opportunities, thus influencing access to resources, employment and income. Literature reveals that women-headed households usually face more challenges securing stable income due to discrimination of the unavailability of opportunities (Sohaimi et al., 2025). This variable is included to capture the gendered nature of agricultural livelihoods, which has been widely documented in rural development studies.

Age: This is a continuous variable measured in years reflecting the life stage, experience and working capacity of the household head. This variable is expected to have varying results as youth participation is increasing, and older people tend to spend most of their retirement or pension time practicing farming (Susanto et al., 2024). This variable is included because both young and older farmers face distinct opportunities and constraints that can shape household income.

Marital status: is a categorical variable which shows whether an individual is single, married, divorced or widowed, expected to have varying results. This is because the marital status affects the households' composition as well as availability and distribution of resources. However, married households may pool resources for greater income stability. Dyanty et al. (2025) illustrated that married households usually more engaged in agricultural activities in contrast to single, divorced or widowed households. This variable is justified as family structure often influences resource pooling and livelihood diversification.

Level of education: the highest educational attainment of household heads which enhances the individual's skills and employability. This variable is measured in categories including no education, primary, secondary and tertiary education. Higher education correlates with higher income and job security. More educated individuals have been found to have better, more stable income opportunities (Fitrianingsih and Mardiana, 2025). Education is included because it is a proxy for human capital, which is strongly linked to productivity and capacity to adopt improved livestock practices.

Household size: a continuous variable expected to strain income security as it increases, refers to the number of people living in the household. This is because more households mean more dependents but potentially more earners. This variable can either increase

vulnerability or provision of labour resources for income generation. It is therefore included to reflect both consumption pressure and labour contribution affects.

Employment status: a categorical variable based on labour participation with categories including unemployed, employed, or self-employed. This variable is expected to have a positive impact towards income security as employment provides better and regular income. Employment is critical for ensuring consistent flow of income. This variable is included because off-farm employment can complement livestock income and reduce livestock risk.

Number of households employed: continuous predictor, closely related to household income since the increase in number of individuals employed in the household signals an increase in total household income. This variable refers to the total number of household members engaged in income generating activities. This diversifies income sources, simultaneously increasing resilience to shocks. It was chosen to complement employment status, as it captures household-level labour engagement rather than individual status only.

Access to markets: the ability to buy or sell goods and services, a dummy variable expected to increase income security through enabling farmers to generate income and well as to consume. Better access to markets increases productivity and sales (Ma et al., 2024), thus contributing to income security. This is one of the important factors in farming as it determines the price you can get the good for or sell at. Although related to infrastructure, it is treated as a distinct variable because market access depends not only on physical infrastructure but also on distance, transaction costs, and institutional arrangements.

Access to infrastructure: a dummy variable referring to the availability of roads, electricity, water, communication and other types of infrastructures required for ensuring the production and sales for achieving income security. Having access to infrastructure reduces costs, increase productivity, enhancing the capability to produce and sell which leads to obtaining a stable income (Touch et al., 2024). This variable is included separately from the market access to capture the enabling environment that supports production and sales, beyond just reaching markets.

Access to veterinary services: the availability of animal health care services to maintain livestock health and productivity. This dummy variable is expected to have a positive influence towards household income as healthy livestock means more production and fewer losses. This reduces the risk of losing income from animal diseases. It was included as livestock health is a key determinant of productivity in indigenous livestock systems.

Access to extension services: being able to obtain agricultural advisory and training services equips farmers with knowledge on best practices as measured as a dummy variable. This variable is anticipated to promote income security through increased productivity and farm management obtained through information on better, sustainable farming practices (Mungai et al., 2024). This is included because extension is a major source of technology transfer and knowledge dissemination.

Access to credit: a dummy variable looking at the availability of credit being given to small-scale indigenous livestock farmers, enabling investment and risk management. Access to this service facilitates farm improvements and buffer shocks, critical for managing income variability and investments. It was chosen because liquidity

constraints are a major barrier to scaling up production among small-scale farmers.

Theft: a dummy variable looking at the experience of a loss of livestock through stealing or robbery, reducing available resources. This negatively affects income instability and ability to maintain livelihood. It was included because livestock theft is a well-documented constraint in South Africa and directly reduces income security.

Diseases: the prevalence of illness affecting the livestock, therefore reducing the overall productivity. This dummy variable leads to livestock output reduction, which increases expenses and lessens income security. It was included because disease outbreaks are among the leading causes of income losses in small-scale livestock systems.

Findings will be presented in beta coefficients, measuring the magnitude of each predictor effect and P-values to test the statistical significance of these effects of income security explained by the model. For a clear display of findings, a table will be used.

4 Results and discussion

4.1 Participants' socio-demographic information

Table 2 shows the socio-demographic profile of small-scale farmers in the study area. The table shows that the mean age of farmers was 54, with the majority (35%) falling within the 50–59 years category. This suggests that indigenous livestock production is largely practiced by older farmers, while youth participation remains limited (15% aged 30–39). Household sizes were generally large, averaging 9 members, with more than half (52%) containing between 6 and 20 persons. Regarding livelihoods, household heads were predominantly unemployed (45%), while only 30% had formal employment. On average, households had 2 members, indicating a relatively weak formal income base. Gender distribution was fairly balanced, 52% male versus 48% female. Educational attainment varied, with 32% having no formal education and just 13% completing tertiary studies. The findings underscore structural barriers that may constrain productivity and uptake of improved livestock practices.

4.1.1 Source of income

Farmers rely on different sources to obtain the income necessary for their livelihoods. These sources can be classified into categories, as some are living grants and the other come from one's hard labour. The different sources of income available to small-scale farming households are illustrated in Table 3.

Study results reveal that employment is the most significant contributor to household income, with an average monthly income of R3 043.33. However, the high standard deviation of R6 319.28 and the maximum, valued at R25 000.00, indicates a wide disparity in earnings among households. This further reveals that while some households are formally employed or occupy well-paying jobs, others either earn very little or do not receive any income from employment. This is supported by the minimum value when it comes to income households obtained from employment, valued at R0.00.

Social grants are another vital source of income for small-scale farming households, averaging R766.67 per household. The standard deviation of R778.24 reflects some variation which are likely due to

TABLE 2 Socio-demographic characteristics of small-scale farmers in the study area.

Variable	Category	Frequency	Percentage (%)
Age group (years)	30–39	9	15.0
	40–49	16	26.7
	50–59	21	35.0
	60–69	12	20.0
	≥70	2	3.3
Gender	Male	31	51.7
	Female	29	48.3
Marital status	Single	27	45.0
	Married	24	40.0
	Divorced	7	11.7
	Widowed	2	3.3
Education level	No education	19	31.7
	Primary	15	25.0
	Secondary	18	30.0
	Tertiary	8	13.3
Household size (persons)	0–5	8	13.3
	6–10	31	51.7
	11–15	21	35.0
Employment status of household head	Unemployed	27	45.0
	Employed	18	30.0
	Self-employed	15	25.0
Number of household members employed	0	5	8.3
	1	14	23.3
	2	21	35.0
	3	16	26.7
	4	2	3.3
	>4	2	3.3

Source: Field data (2025).

differences in the type of grant or number of grant holders in each household. The maximum income is valued at R2 500.00 and the overall total for all households was found to be R46 000.00. These figures show the importance of social assistance programmes in supporting vulnerable households, especially those with limited access to employment opportunities.

Remittances, (money sent by relatives) averaged R493.33 with a standard deviation of R616.13. The maximum remittance recorded was R2 500.00 and the total obtained across all households summed up to R29 600.00. Although this source is not dominant, it plays a crucial role in supplementing household income.

The sale of livestock appears to be a huge source of income for many households in the study area with an average income of R1 005.83 and a substantial standard deviation of R2 277.05. The maximum income retrieved from livestock sales reached R15 000.00, whereas the cumulative total stood at R60 350.00. The high variation suggests that some households operate livestock farming for income generation while others engage for consumption only. This shows that

TABLE 3 Different sources of income for small-scale indigenous livestock farming households.

Source of income	Average	Standard deviation	Maximum	Sum (all households)
Employment	R3 043,33	R6 319,28	R25 000,00	R182 600,00
Social grant	R766,67	R778,24	R2 500,00	R46 000,00
Remittance	R493,33	R616,13	R2 500,00	R29 600,00
Livestock sales	R1 005,83	R2 227,05	R15 000,00	R60 350,00
Crop sales	R235,83	R773,43	R3 800,00	R14 150,00
Pension (non-governmental)	R800,00	R988,06	R2 000,00	R48 000,00
Wages	R133,83	R294,16	R1 000,00	R8 030,00
Other	R35,00	R147,38	R900,00	R2 100,00
Total Household Income	R6 513,83	R6 766,88	R33 230,00	R390 830,00

Source: Field data (2025).

livestock holds economic potential, especially when supported with adequate infrastructure and market access.

Crop sales, in contrast, obtained an average income of R235.83 per household with a maximum value of R3 800.00 and a standard deviation of R773.43. These findings indicate that only few households earn a significant amount of income from selling crops, while the rest earn very little or nothing. The total income derived from crop sales amounted to R14 150.00. This may be due to seasonal limitations, insufficient access to fertile land or poor access to markets.

Non-governmental pension shows a stable contribution to household income, averaging R800.00, with a standard deviation of R988.06. The maximum income from this source was R2 000.00 and the cumulative amount obtained by all households amounts to R48 000.00. These figures suggest that non-governmental pensions offer a steady and predictable source of income for elderly members, contributing to household stability.

Wages, often derived from casual labour or informal sector activities, contributed an average of R133.83, standard deviation of R294.16, with the highest income at R1 000.00. The total income accumulated by all households from wages added up to R8 030.00. These low values illustrate limited opportunities for wage-based employment within the study area.

Other sources (gifts or once-off payments) accounted for the least significant, averaging only R35.00 per household. With a standard deviation of R147.38 and a maximum of R900.00, the total income from this source was only R2 100.00. This demonstrates that such income streams are neither common nor reliable across households.

Moreover, the total household income across all sources of income averaged R6 513.83 per household, with a standard deviation of R6 766.88. The maximum income recorded was R33 230.00 and the total for all households combined reached R390 830.00. The significant variation in total household income shows substantial disparities in access to economic opportunities. It also shows the importance of income diversification strategies, particularly in rural areas where reliance on a single source may result in the household facing greater vulnerability (Habib et al., 2023).

4.1.2 Access to services

Several services are essential in ensuring the maintenance and enhancement of livestock production. These services include infrastructure, credit, veterinary, extension, and market access. Findings from the study population are illustrated in Figure 3.

Findings reflect a severe lack of services within small-scale indigenous livestock farmers with a lack of veterinary services affecting 80%, market access at 61.67%, lack of infrastructure with 60%, extension services reported by 53.33%, and credit affecting half of the study population (50%). Each of these services are necessary towards the overall production. Farmers with adequate access to veterinary services have the capability to maintain animal health, thus reducing livestock mortality rates and improving productivity (Sennuga et al., 2022; Nuvey et al., 2023). Market access determines the ease of buying or selling livestock, inputs and its related products at fair prices, promoting the income security of the household (Usman and Callo-Concha, 2021; Duong et al., 2024). Inadequate infrastructure such as roads or proper storage handling reduces the farmers' participation in markets, increasing post-harvest losses and reducing the shelf-life of the livestock produced (Bappah and Adejoh, 2024; Urugo et al., 2024). Extension services deal with the transfer of knowledge and skills, assisting farmers adopt sustainable agricultural practices in animal husbandry and disease control (Arowosege et al., 2024; Prabex et al., 2024). Furthermore, access to credit allows farmers to gain quality inputs and resources, at the same time enabling them to meet the requirements for market participation (Mdoda et al., 2024; Ullah et al., 2024). Lacking this service means farmers have fewer chances to participate in markets or obtain quality resources to improve their production. The lack of access to these services hinders the growth and sustainability of livestock production.

4.2 Indigenous livestock produced

Indigenous livestock refers to animal breeds that have naturally adapted to specific local environments over time, usually influenced by local conditions. The different types of livestock are illustrated in Figure 4.

Data on indigenous livestock production shows notable distinctions when it comes to the types of livestock produced by farmers showing different preferences, adaptability and resource availability. From the data retrieved, it was discovered that chicken and goats are the most produced type of livestock, accounting for 70% and 68.33% respondents respectively. This may be due to that these animals have low-resource requirements, reproduce quickly (Lingala et al., 2024; Sahu, 2024), making them an ideal choice for small-scale farmers to preserve food security and income generation. Cattle is the

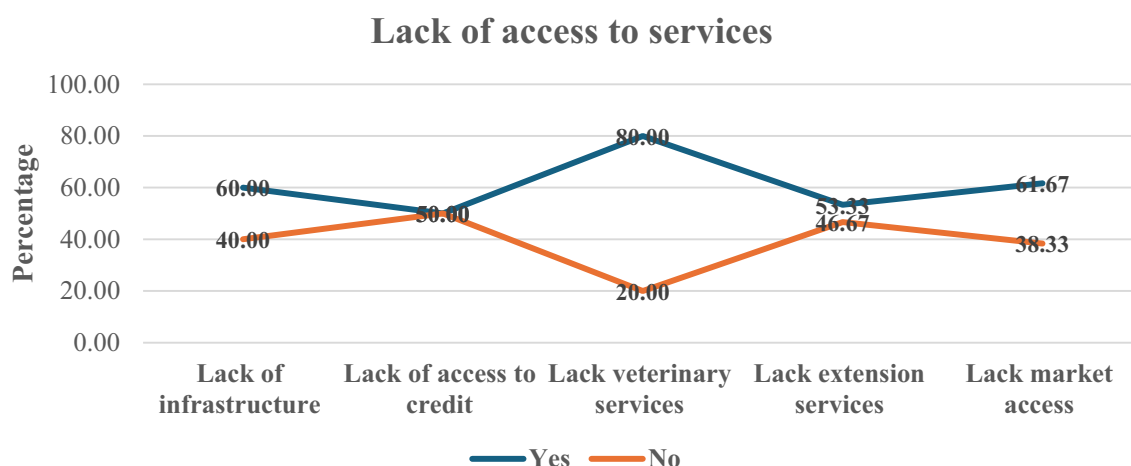


FIGURE 3
Access to services. Source: Field data (2025).

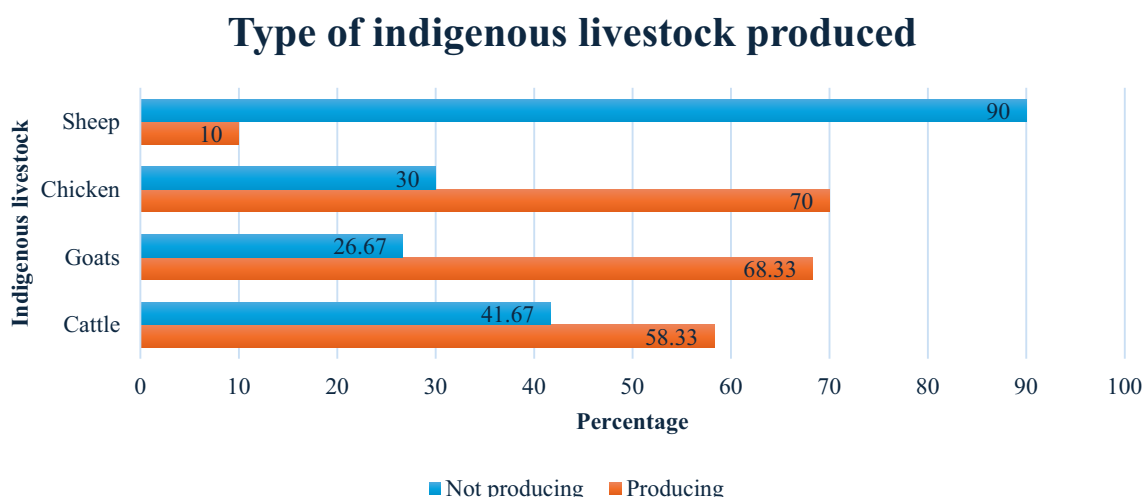


FIGURE 4
Type of indigenous livestock produced. Source: Field data (2025).

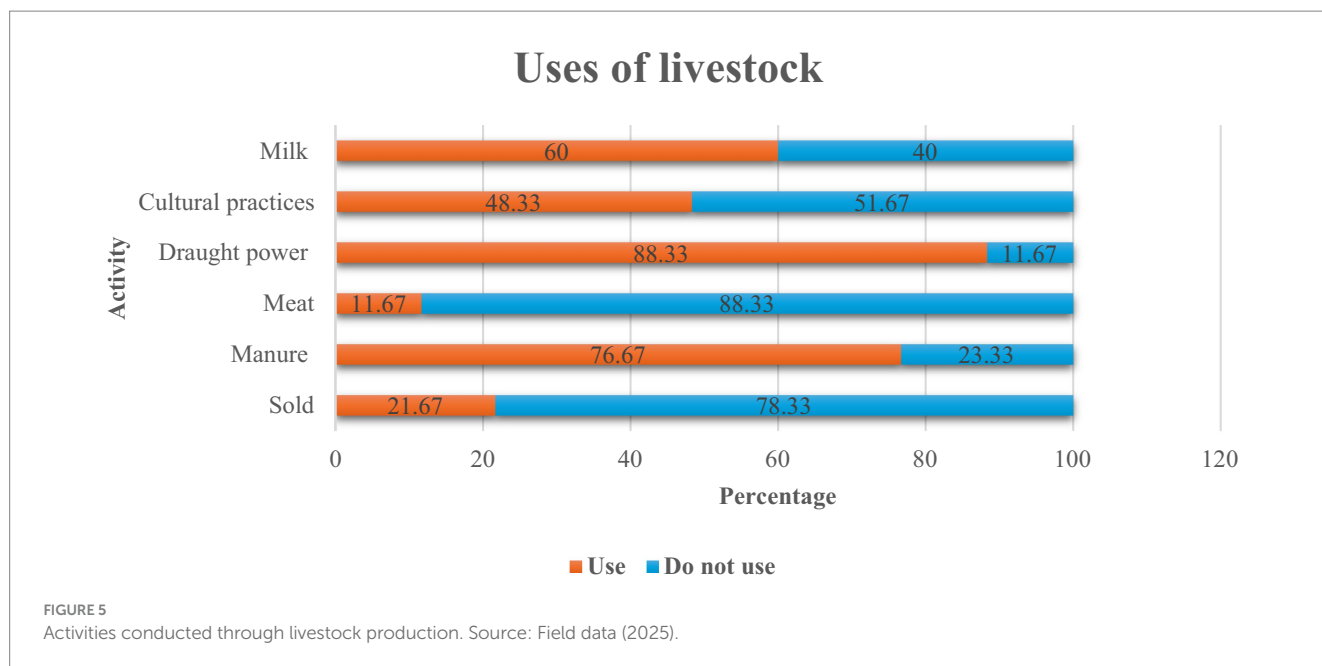
third most produced type of livestock, produced by 58.33% of farmers. This is largely due to their cultural value, contribution to draught power and higher market value in contrast to other types of livestock (Asteraye et al., 2024). Unlike chicken and goats, its production may be limited by resource requirements such as grazing land and water. The least produced livestock in the area is sheep, produced by only 10% of farmers. This illustrates that sheep is either less suited to local conditions or carry less cultural or economic value in the area. These patterns show strong reliance on goats and chickens for food and income while cattle and sheep are produced by fewer households, likely due to high input requirements or production constraints.

4.3 Uses of indigenous livestock

Indigenous livestock is not always used as a source of food only but cater for different purposes which contribute to our overall

livelihood. A breakdown of these activities that are conducted using this livestock is illustrated in Figure 5.

Findings in the figure reveals the varied yet uneven ways in which indigenous livestock is being utilised by farming households. A majority of 88.33% small-scale farmers use livestock for draught power, showing the continued importance of animals in supporting farming operations and transport especially in rural settings. Similarly, 76.67% of the respondents asserted to use livestock as a source of manure, highlighting its value as an organic fertiliser for improving soil fertility, thus contributing to sustainable agricultural practices. Milk production is also common in this area as 60% notes to make use of it, contributing to nutrition and income within the household. On the other hand, only 21.67% participate in selling livestock. This shows that most farmers keep livestock primarily for subsistence or cultural reasons rather than financial gain. This is further supported by the low use of livestock for meat, accounting for 11.67%, possibly due to cultural preferences and high value placed on living animals. Nearly



half (48.33%) use livestock for cultural practices, reflecting the significant role played by livestock in society and upholding of ceremonies. This trend of use shows that while indigenous livestock serve multiple functions including nutrition, food, financial and cultural functions, their use is largely non-financial, rather rooted in subsistence use.

4.4 Factors influencing livestock production

Livestock production is influenced by several factors which can be classified as social, technological, economical or even natural. The significance of these factors is outlined in Table 4 and the discussion of each factor below with the total household income being the dependent variable.

Gender: found to be non-significant mainly due to the nearly balanced inclusion of both genders in livestock management.

Age: a statistically significant predictor of income security with a p-value of 0.015, indicating that the increase in age means greater access to inputs, resources and experience necessary to improve livestock production. These results are supported by Tang et al. (2024) who contend that if older rural populations are supported with production inputs, they can maintain or even improve commercialisation of agricultural produce.

Marital status: a non-significant factor mainly due to the low relevance of divorced and widowed households which means there is decision sharing available either with spouse or family members.

Education: proven to improve income with a statistical significance of 0.021. These results imply that higher education levels are linked to improved farm management, decision making and access to off-farm employment. The World Bank (2024) also reports that the attainment of education contributes directly to increased household income and economic resilience in rural areas.

Household size: an increase in household size was associated with a higher income with a p-value of 0.028 and beta coefficient of 115.57.

This is likely due to that an increase in the household size means more labour available for farming and other income-generating activities. Findings from a study conducted in Somalia discovered that large households often engage in diversified income activities, increasing their resilience and earning potential (UNICEF, 2023).

Employment status: significant booster for household income with a p-value of 0.005, illustrating that an employment of the household head elevates the status of income the household obtains. According to the World Bank (2023), increased employment access and household diversification into wage labour have a great impact towards poverty alleviation.

Number of households employed: a complementary factor of employment status, found to be very significant with a p-value of less than 0.001 and a beta value of 2737.65, illustrating that an increase in the number of household members employed positively influences the income of a household. Bening et al. (2025) highlight that multi-earner households in Ghana had significantly better economic opportunities.

Access to markets: a factor found to be not statistically significant, mainly due to that these households practice livestock farming primarily for subsistence purposes, with only a few practicing for commercial gains.

Access to infrastructure: discovered to be non-significant mainly because it is always associated with markets, both in this case not contributing much to the income generation of the household. Izdori et al. (2025) note that market access without supporting infrastructure including roads, transport and storage facilities tend to fail when it comes to improving income.

Access to veterinary services: with a significant positive impact ($\beta = 3478.92$; $p = 0.007$), illustrating improved health and productivity for the livestock. This further supports an argument made by Moiane (2024) that access to animal health reduces mortality rate and improves income generated by livestock farmers in East Africa.

Access to extension services: predictor found to have a statistically negative impact towards household income, with β being -1080.55 and a p-value of 0.013. This negative impact may be due to

TABLE 4 Significance of factors influencing livestock production.

Variables	Coefficient (β)	Std error	t-stat	p-value	95% confidence intervals	
					Lower bound	Upper bound
Intercept	18695.94	3652.59	5.12	<0.001	11339.25	26052.63
Gender	259.71	744.01	0.35	0.729	−1238.80	1758.22
Age	186.95	74.01	2.53	0.015	37.89	336.01
Marital status	−707.44	531.64	−1.33	0.190	−1778.22	363.34
Level of education	864.75	375.54	2.30	0.021	128.68	1600.82
Household size	115.57	52.53	2.20	0.028	12.61	218.53
Employment status	5,780.84	1969.28	2.94	0.005	1814.51	9747.16
No. of households employed	2,737.65	621.38	4.41	<0.001	1486.13	3989.18
Access to markets	393.57	2049.86	0.19	0.849	−3735.07	4522.21
Access to infrastructure	1,298.11	1,064.29	1.22	0.229	−845.47	3441.69
Access to veterinary services	3478.92	1223.77	2.84	0.007	1014.12	5943.72
Access to extension services	−1080.55	432.22	−2.50	0.013	−1936.88	−224.21
Access to credit	1798.08	1136.11	1.58	0.121	−490.16	4086.32
Theft	−9687.73	1268.39	−7.64	<0.001	−12242.40	−7133.06
Diseases	−3672.46	1318.02	−2.79	0.008	−6327.09	−1017.82

Source: Field data (2025).

inefficiencies in extension service delivery or poor service quality. Mapiye and Dzama (2024) also discovered that the low-impact extension services are due to lack of contextual relevance, leading to poor adoption and counterproductive outcomes.

Access to credit: a variable with a positive but insignificant impact ($\beta = 1798.08$; $p = 0.121$). While access to credit can contribute investment, without financial literacy and proper loan management, it may not translate to meaningful income gains (Das, 2024).

Theft: highly significant with a negative impact ($\beta = -9687.73$; $p < 0.001$) meaning that the higher the prevalence of theft, signals the reduction in total household income. According to Gea and Sinaga (2025), livestock theft causes substantial financial losses, eroded trust within the rural economies and reduced future production potential.

Diseases: with a significant, yet negative impact with β totalling -3672.46 and p being 0.008 . This is because the outbreak of a certain disease in the livestock produced, results in a reduction of production and strains the household income as medication is required (Countryman et al., 2024). These results are further supported by Rashid et al. (2025), noting that animal and human health challenges directly restrict income-generating ability, either through lost labour or veterinary costs.

5 Conclusion and recommendations

This study aimed to investigate the perceived income contribution of producing indigenous livestock towards small-scale farming households in uMhlathuze Municipality under KwaZulu Natal Province. It followed a cress-sectional research design with a quantitative approach to randomly collect primary

data from a sample of 60 small-scale indigenous livestock farmers. This data was collected via face-to-face interviews, using a questionnaire as a data collection tool, translated to IsiZulu language to counter language barriers. Findings from this study revealed a dominance of old-and-middle-aged farmers (30+ years) showing the balance between experience and energy. This reveals that youth participation is restricted, which could pose a threat of extinction of indigenous knowledge and promotion of indigenous livestock for financial gains. However, gender disparities still prevail with males being the dominant gender, denoting inequality. Looking at the marital status of households, about half of the population manage their farming activities without a spouse, which could limit the advantage of shared labour and financial decision making within households. This means that these households might have to rely on hired labour for sustaining their production. Educational background of farmers in the study population noted a high prevalence of no education, meaning that these farmers rely more on traditional farming activities. On the other hand, the presence of those who attended shows the likelihood of adoption of sustainable farming practices and market integration. Most of these farming households have a large household size with a maximum of 15 households illustrating the resource requirement of the household and the potential of family labour, reducing the need for hired labour. Almost half (45%) of the household heads are unemployed with the counterpart employed or self-employed, showing the availability of additional income streams. In most of the farming households, working household members are present with about 2 members employed. The availability of working household members show potential for investment in farming and reduction in exposure to agricultural

risk, though on the other side it limits time and labour available within a household. These farmers have different sources of income necessary to maintain livelihood. These sources include employment, social grant, remittance, livestock sales, crop sales, pension (non-governmental), wages and other sources such as gifts or once-off payments. Despite this, these farmers lack crucial services such as veterinary services, market access, infrastructure, extension services, and credit. Each of these services are necessary towards the enhancement of the whole production. The lack of access to these services hinders the growth and sustainability of livestock production. These indigenous livestock farmers produce livestock such as chicken, goats, cattle and sheep, respectively in order of descending quantities. This may be due to that chicken and goats have low-resource requirements and reproduce quickly, whereas cattle have high production costs and sheep carry less significance or not specifically adapting to the environment. These livestock serve different purposes as they are used for draught power, manure, milk production, sales, meat and cultural practices. This reflects the significant role played by livestock including nutrition, food, financial and cultural functions, although their use in this area is largely subsistence. Furthermore, factors including age, education, household size, employment status, number of households employed, access to veterinary services, access to extension services, theft, and diseases were found to be statistically significant towards the household's income. Therefore, this study recommends that the youth and females should be also included in agricultural activities. Also, services such as extension, credit, infrastructure, markets, safety, and veterinary should be enhanced to improve farmer participation in markets at the same time enhancing their farm productivity.

Data availability statement

The original contributions presented in the study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

The studies involving humans were approved by the university of Zululand Research Ethics Committee (UZREC). The studies were conducted in accordance with the local legislation and institutional requirements. The participants provided their written informed consent to participate in this study. Written informed consent was obtained from the individual(s) for the publication of any potentially identifiable images or data included in this article.

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Author contributions

YN: Conceptualization, Supervision, Writing – original draft, Writing – review & editing. NN: Formal analysis, Methodology, Writing – original draft, Writing – review & editing. BD: Conceptualization, Methodology, Validation, Writing – original draft, Writing – review & editing. ZM: Formal analysis, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing. SD: Formal analysis, Investigation, Methodology, Software, Writing – original draft, Writing – review & editing.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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