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Farmers' Livelihood Security through Sheep Farming in Bareilly District of Uttar Pradesh

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HIGHLIGHTS

- A composite Livelihood Security Index (LSI) was developed and validated using experts' consultation and content validity methods, covering five critical dimensions.
- The overall value of composite index value of 0.617 reflects a moderate level of livelihood security.
- Income, education, flock size, extension contact, and knowledge were found to be significant positive contributors to livelihood security, while credit access showed a negative correlation.

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Keywords: Sheep farming, Livelihood security index, Socio-economic factors, Correlation analysis, Resource use efficiency.

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ABSTRACT

The study was conducted in 2024 to assess the livelihood security of sheep-owning farmers in Bareilly district, Uttar Pradesh. A Livelihood Security Index (LSI) was developed based on five key dimensions: food and nutritional security, economic and marketing security, infrastructural security, social security, and resource use efficiency. Content validity and relevance were tested using scoring methods. Data were collected from farmers using a structured interview schedule, and LSI was computed through standardized scoring and weighted aggregation. Correlation analysis using SPSS (SPSS 26.0) identified the relationship between livelihood security and selected socio-economic variables. Results revealed that most farmers had a moderate level of livelihood security (composite index = 0.617), with resource use efficiency and economic security being the strongest areas. Income, education, flock size, extension contact, and knowledge had significant positive correlations with livelihood security, while credit access showed a negative correlation. The study concluded that targeted interventions in infrastructure, financial literacy, and behavioural capacity-building are essential to enhance the livelihood resilience of smallholder sheep farmers.

INTRODUCTION

Livelihood security encompasses the means and approaches individuals and families adopt to meet fundamental needs. For rural communities, particularly small-scale farmers, securing a stable livelihood is crucial (Chambers & Conway, 1992). Previous studies (Scoones, 1998; DFID, 1999) have emphasized the importance of sustainable livelihoods, linking them to resource availability, market access, and infrastructure development. According to Alinovi et al., (2010), livelihood outcomes represent the objectives that individuals strive to achieve through their livelihood strategies. These outcomes typically include higher income levels, enhanced well-being, improved food security, reduced vulnerability, and more sustainable management of natural resources. Integrating various farm enterprises can enhance livelihoods by boosting food production, raising net income, increasing overall productivity, and minimizing income disparities between rural agricultural workers and urban industrial labourers. The National Commission on Farmers (2006) also suggests that adopting suitable farming systems is a key strategy for promoting agricultural growth and improving livelihoods. In rural

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areas, there are 76.31 per cent of households earn their livelihood from agricultural activities, which includes 29.03 per cent of households who are working as agricultural labourers in the rural area of the state" (NSS, 2005). Sheep farming has emerged as an important livelihood strategy in many parts of India, including Bareilly district of Uttar Pradesh. According to Ellis (2000), livelihood diversification is key to sustaining rural economies, and sheep farming provides an alternative source of income and resilience against economic fluctuations. Despite the government's periodic implementation of various poverty alleviation programs, these initiatives have largely provided temporary relief rather than creating long-term opportunities for sustainable livelihood generation. The Farmer FIRST Programme (FFP), launched by the Indian Council of Agricultural Research (ICAR), focuses on improving agricultural productivity, sustainability, and livelihood security by integrating farmers' knowledge with scientific advancements. Through this programme, ICAR-IVRI distributed improved germplasm of Muzaffarnagari ram to resource-poor sheep farmers in the study area, aiming to enhance the genetic merit and growth performance of sheep within the community, foster improved breeding practices, and ensure a sustainable boost in the overall livelihood of the sheep farming community. Apart from that, hands-on training programmes on scientific sheep husbandry were given to farmers. Farmers also visited organized farms to gain a better understanding of scientific sheep farming. This study empirically examines the status of interventions and the effectiveness of sheep farming in securing livelihoods by developing a Livelihood Security Index (LSI) based on five key dimensions. The five dimensions of food and nutritional security, economic and market security, infrastructural security, social security, and resource use efficiency were considered for developing the composite livelihood security index. It also aimed to assess the relationship between various socio-economic, psychological, and communication variables and livelihood security among farmers. Using bivariate correlation analysis in SPSS, key factors such as income, flock size, knowledge, and risk orientation were found to be significantly associated with livelihood outcomes, highlighting critical drivers of rural resilience and well-being.

METHODOLOGY

The study employed a structured approach to develop and validate the LSI. Five major indicators i.e. food and nutritional security, economic and market security, infrastructural security, social security, and resource use efficiency, were identified through literature review and expert consultations. The indicators for each dimension of the LSI were identified in consultation with researchers, farmers, extension professionals, and through review of the literature. The selected indicators were then refined based on the 14 informal criteria proposed by Edwards (1957), leading to the exclusion of some items.

Item analysis is the most important step while developing a valid and reliable index. Not all of the indicators gathered are probably equally significant in assessing farmers' livelihood security. As a result, these indicators were scrutinised and then screened for inclusion in the final index. Initially, 50 judges were asked to rate the relevance of each indicator on a three-point continuum- Most Relevant, Relevant, and Least Relevant-with scores of 3, 2, and 1, respectively, as used by Singh et al., (2018) & Verma et al., (2025). After obtaining the responses from 34 experts, the Relevancy Weightage (RW) and Mean Relevancy Score (MRS) for each selected indicator were calculated separately using the given formula.

$$\text{Relevancy weightage} = \frac{(\text{Most relevant} \times 3) + (\text{Relevant} \times 2) + (\text{Least relevant} \times 1)}{\text{Maximum possible score}}$$

$$\text{Mean Relevancy score} = \frac{(\text{Most relevant} \times 3) + (\text{Relevant} \times 2) + (\text{Least relevant} \times 1)}{\text{Number of judges responded}}$$

To assess the livelihood security of the 60 selected respondents, a "*Livelihood Security Index*" was constructed following the framework proposed by Guilford (1954). Different indicators of livelihood security were assigned weights based on rankings provided by a panel of experts and social science professionals. The conversion of ranks into weight values was carried out using the approach outlined by Alfares & Duffuaa (2008). Subsequently, the average value of these weights was computed and used as the final weight for each indicator. A similar approach has been adopted in earlier studies, including those by Girish et al., (2020); Dadabhau & Gopal (2014).

To finalize the statements corresponding to specific livelihood security indicators, expert opinions were sought by circulating the proposed statements among selected judges. Based on the feedback and suggestions received, the final set of statements for each indicator was determined.

$$\text{Z indj} = \frac{\text{Indicator j-Min j}}{\text{Max j - Min j}}$$

Where, Zindj= Standard indicator j, Max j and Min j = Maximum and minimum value of indicator j

Subsequently, the 'Livelihood Security Index' for each indicator across all households was computed using the following formula:

$$\text{LSi} = \frac{\Sigma \text{Zindj}}{\text{N}}$$

Where, LSi = Livelihood Security for one indicator, ΣZindj = Summated standardized score of all respondents for one indicator, N= Number of households covered in the study

After computing the Livelihood Security Index for individual indicators, an overall composite "Livelihood Security (LS) Index" was derived using the formula provided below:

$$\text{LSi} = \frac{\Sigma \text{WiHLSi}}{\Sigma \text{Wi}}$$

Where, LSi = Livelihood Security, HLSi = Household Livelihood Security, ΣWi = Summated value of weightage of all indicators

To standardize the index, validity was assessed to ensure that it accurately measured what it was intended to measure, thereby confirming the authenticity of the results. An index is considered valid if it supports logical reasoning and effectively reflects the construct it aims to capture. In this study, content validity was used to evaluate the index. This was determined using the expert judgment method, which involved consulting subject matter experts to evaluate the appropriateness and comprehensiveness of the indicators. A similar method was used by Shruti et al., (2019) & Verma et al., (2024). Only those indicators that received at least 80 per cent approval from experts were retained, indicating strong content validity.

To examine the relationship between the selected independent variables and the dependent variable, bivariate correlation analysis was conducted using SPSS version 26.0. The correlation coefficients (r) were calculated and evaluated for statistical significance. The dependent variable, Livelihood Security, was denoted as Y_1. The independent variables included: Age (X_1), Education (X_2), Family Type (X_3), Family Size (X_4), Flock Size (X_5), Annual Income (X_6), Landholding (X_7), Farming Experience (X_8), Extension Contact (X_9), Mass Media Exposure (X_{10}), Knowledge Level (X_{11}), Attitude Level (X_{12}), Adopted Practices (X_{13}), Innovativeness (X_{14}), Risk Orientation (X_{15}), Economic Motivation (X_{16}), and Credit Orientation (X_{17}).

RESULTS

Indicators having a Relevancy Weightage (RW) greater than 0.80 and a Mean Relevancy Score (MRS) exceeding 2.40 were retained. Through this process, the final set of indicators for each LSI dimension was selected, refined, and revised based on expert feedback. The finalized dimensions of the LSI, along with their respective indicators, RW, and MRS values, are presented in Table 1.

Livelihood Security Index values of different dimensions

Livelihood Security Index values (Table 2) highlight the different aspects of livelihood security among respondents. The composite index value of 0.617 reflects an overall moderate level of livelihood security among the respondents, reinforcing the need for balanced and targeted strategies to address specific areas of improvement (Pradhan et al., 2020). The highest index value was observed in resource use efficiency (0.664), indicating that respondents generally manage their resources effectively. Similar findings had been reported where medium to high levels of efficiency were

Table 1. Selected Livelihood Security Indicators with respective Relevancy Weightage and Mean Relevancy Score

Items	RW	MRS
Food and nutritional security		
Sheep farming assists farmers in meeting their daily needs consistently throughout the year.	0.89	2.67
A nutritious meal for family members is affordable if the farmer practices sheep farming.	0.83	2.50
Products obtained from sheep farming contribute to attaining nutritional stability for the family.	0.83	2.50
There is a need to increase expenditure on food to enhance living standards.	0.88	2.64
The resilience of sheep farming households during food insecurity shocks, such as droughts or market fluctuations for food and nutritional security.	0.90	2.70
Economic and marketing security		
Sheep farming gives more net profit per unit as compared to others.	0.91	2.73
Sheep farming reduces reliance on a single enterprise, thereby lowering the dependency ratio.	0.82	2.46
Sheep farming produces consistent income throughout the year	0.84	2.52
There will be greater utilization of the marketing network for promoting sheep and their meat.	0.91	2.75
Sheep farmers who have insurance policies for their animals ensure financial security.	0.89	2.67
Infrastructural security		
Sheep farming enhances both farm and household infrastructure as a result of increased income and social consciousness.	0.85	2.55
Sheep farming promotes utilization of private infrastructure such as credit facility, input sale facilities, medical dispensary etc.	0.85	2.55
Sheep farming enhances farmers' access to and utilization of modern information and communication technology (ICT) tools.	0.86	2.58
Sheep farming creates opportunities for farmers to access and adopt a range of technologies that can contribute to the success and sustainability of their sheep farming operations.	0.89	2.67
Government support programs or initiatives benefited you as a sheep farmer.	0.91	2.73
Social security	0.85	2.55
Sheep farming improves the social status of the family due to the additional income generated.	0.83	2.50
Social participation as an office bearer or member in either cooperative societies or any SHG will ensure the social security for the family.	0.82	2.47
Sheep farming helps indirectly in improving the education status of the children's and family due to increase income level	0.82	2.47
Sheep farming has the potential to decrease gender discrimination as women can participate in raising and managing sheep.	0.81	2.44
Awareness about one's right to utilize or access public resources in sheep farming to support their farming activities.	0.82	2.47
Resource use efficiency		
Sheep farming facilitates in effective utilization of the resources, as sheep eat more different type of plants than any other kind of livestock.	0.88	2.64
Utilization of manure and left-over materials in sheep farming is done effectively via agriculture.	0.89	2.67
Sheep helps to clean grains lost at harvest time and thus convert waste feed into profitable products.	0.85	2.55
Sheep farming is cost-effective because of their close grazing nature and ability to utilize very low-set vegetation that no other animal can utilize.	0.89	2.67
Sheep can be profitable occupation for a farmer and can fit well into mixed farming.	0.85	2.55

RW= Relative Weightage, MRS= Mean Relevancy Score prevalent among farmers using integrated approaches (Chandana et al., 2023). Economic and marketing security (0.649) also ranks high, suggesting stable economic conditions for many respondents, which aligns with evidence that diversified livelihoods and improved market participation enhance economic resilience (Mishra et al., 2023). In contrast, food and nutritional security (0.556) and infrastructural security (0.589) have lower index values, indicating areas where respondents might face more challenges. These gaps are frequently observed in rural regions, especially where agricultural diversification or infrastructure investment is limited (Gautam & Jha, 2023). These insights can guide future interventions to focus on improving food and nutritional security and infrastructure to enhance overall livelihood security.

The Figure 1 plots the distribution of index values in descending order with a cumulative line on a secondary axis as a percentage of the total.

From Table 3, it was revealed that the 48.33 per cent of the sheep farmers belonged to the medium level of food and nutritional

Table 2. Livelihood Security Index values of different dimensions

Indicators	Index value
Food and nutritional security	0.556
Economic and marketing security	0.649
Infrastructural security	0.589
Social security	0.632
Resource use efficiency	0.664
Composite index value	0.617

Table 3. Distribution of sheep farmers according to different dimensions

Dimensions	Percentage
Food and nutritional security	
Low (0.30-0.48)	33.33
Medium (0.49-0.66)	48.33
High (0.67-0.86)	18.33
Economic and marketing security	
Low (0.35-0.53)	30.00
Medium (0.54-0.72)	55.00
High (0.73-0.90)	15.00
Infrastructural security	
Low (0.30-0.48)	35.00
Medium (0.49-0.67)	51.67
High (0.68-0.85)	11.67
Social security	
Low (0.36-0.51)	33.33
Medium (0.52-0.67)	56.67
High (0.68-0.80)	10.00
Resource use efficiency	
Low (0.32-0.50)	25.00
Medium (0.51-0.69)	58.33
High (0.70-0.88)	16.67
Over all LSI	
Low (0.30-0.50)	31.67
Medium (0.51-0.70)	55.00
High (0.71-0.90)	13.33

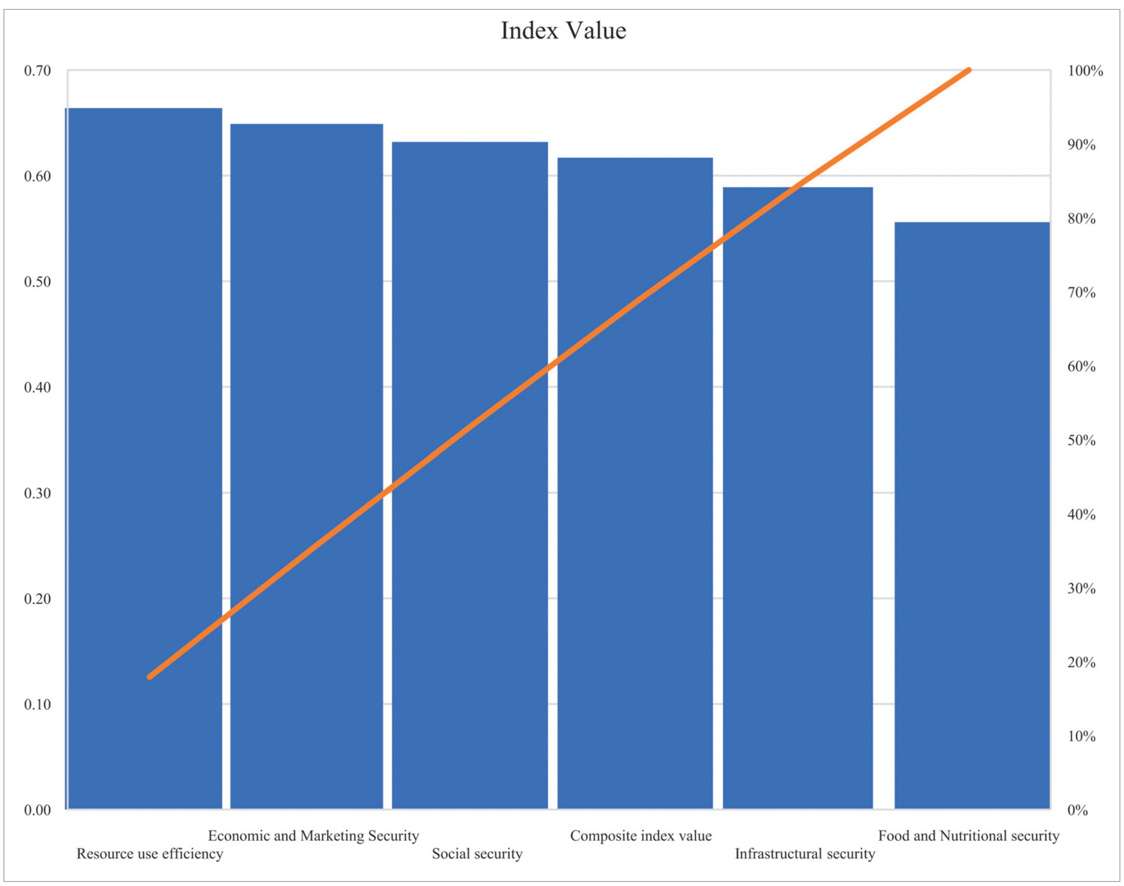

Figure 1. Distribution of index value in descending order

security, followed by 33.33 per cent who belonged to the low level, and 18.33 per cent who belonged to the high level. This indicates that while sheep farming does contribute to the food and nutritional security of farmers, there is a noticeable variation in the levels of security among these farmers. Similar patterns have been observed in other contexts, where a majority of small farmers fell into medium livelihood security levels (Pradhan et al., 2020); (Gautam & Jha, 2023). For economic and marketing security, the majority (55.00%) of the sheep farmers belonged to the medium level, followed by 30 per cent at the low level, and 15 per cent at the high level. The majority of farmers falling into the medium security level could be due to factors such as variable market prices, fluctuating demand for sheep products, and limited market access, which are common determinants affecting livelihood security (Mishra et al., 2023; Chaudhari et al., 2023). The data also indicates that the majority (51.67%) of the sheep farmers belonged to the medium level of infrastructural security, followed by 35 per cent at the low level, and 11.67 per cent at the high level. This predominance suggests that most farmers have basic infrastructure such as shelter and water supply but lack advanced facilities, a finding echoed in research on infrastructure-related livelihood components (Chandana et al., 2023). The distribution of respondents according to their level of social security reveals that a majority (56.67%) fall within the medium category. This suggests a moderate level of access to social resources, which aligns with similar findings in studies across smallholder contexts (Pradhan et al., 2021; Mohammad et al., 2023). Regarding resource use efficiency, the data revealed that 58.33 per cent of the respondents belonged to the medium level, 25 per cent to the low, and 16.67 per cent to the high. This likely reflects a balanced approach to resource management, consistent with observations in livelihood system analyses of small farmers (Gautam & Jha, 2023); (Chandegara et al., 2024). For overall livelihood security, the majority (55.00%) belonged to the medium level, followed by 31.67 per cent at the low and 13.33 per cent at the high level. The large medium group reflects a pattern commonly found in rural household studies (Mishra et al., 2023). The low-security group, representing nearly a third, signals a need for targeted intervention to enhance access to services and income opportunities, as stressed by Meshram et al., 2024. The small high-security group (13.33%) can provide valuable insights and models of effective livelihood strategies, as highlighted in integrated farming studies (Chandana et al., 2023).

Table 4. Correlation analysis of selected variables of farmers with livelihood security

Independent variables	Livelihood security 'r'
Age	0.151^{NS}
Education	.317*
Family type	0.010 ^{NS}
Family size	-0.049 ^{NS}
Flock size	.540**
Annual Income	.607**
Land holding	0.011 ^{NS}
Experience	0.135
Extension agency contact	.500**
Mass media exposure	.351**
Knowledge level	.506**
Attitude level	.412**
Adopted practice	.522**
Innovative proneness	.489**
Risk orientation	.573**
Economic motivation	.344**
Credit orientation	-.259*

** Significant at 0.01 level of probability, * Significant at 0.05 level of probability, NS = Non-Significant

Table 4 presents the correlation analysis between selected socio-economic and psychological variables of farmers and their livelihood security. It highlights the nature and strength of relationships, showing both significant and non-significant associations.

DISCUSSION

Among the variables studied, education exhibited a positive and significant correlation with livelihood security, suggesting that higher education enables farmers to better understand and apply improved farming practices, enhancing their economic resilience and adaptive capacity. Similar observations were reported by Kumar et al., (2019) & Kademani et al., (2020), who emphasized the role of education in increasing farmers' technical competence and decision-making ability. The strongest positive correlation with livelihood security was found for income, implying that better income improves household well-being, access to resources, and adoption of innovations, thereby enhancing livelihood outcomes. This is in agreement with the findings of Sunanda et al., (2014) & Ramya et al., (2017). Flock size also showed a strong and significant positive correlation with livelihood security. A larger flock increases household income and acts as a buffer in times of crisis, particularly in small ruminant production systems. This is corroborated by Kumar et al., (2017), who highlighted that flock size is directly related to profitability in farming. Extension contacts were found to be significantly associated with livelihood security. Regular interaction with extension agents improves access to information, technical guidance, and veterinary care, leading to improved flock management. Kaur & Talukdar (2007) demonstrated that extension services positively influenced productivity outcomes. Knowledge had a significant positive correlation with livelihood security, emphasizing that informed farmers are more likely to adopt good practices, recognize disease symptoms early, and manage resources efficiently. According to Pal et al., (2017), knowledge enhances the decision-making capacity of farmers and increases their readiness to adopt scientific methods in livestock rearing. Attitude and practice were also positively and significantly related to livelihood security. A favorable attitude towards scientific sheep farming enhances willingness to learn and implement new practices, which in turn improves productivity. This aligns with the findings of Kumar et al., (2019), who observed that farmers with positive attitudes and habitual application of improved methods realized higher returns. Risk orientation and innovative proneness also showed strong positive correlation with livelihood security. Farmers with higher risk orientation are more willing to experiment with alternative income-generating strategies and adopt new technologies, thereby enhancing their resilience to uncertainties. Chigadolli et al., (2020) found that risk-tolerant and innovation-driven farmers were more likely to invest in productivity-enhancing interventions. Mass media exposure and economic motivation contributed significantly to livelihood security. Access to mass media plays a vital role in updating farmers with timely and relevant information, which can influence decision-making and farm planning. These findings are consistent with those of Pal et al., (2017) & Ramya et al., (2017). On the other hand, credit access showed a negative but significant relationship with livelihood security. This might be due to improper use of loans, debt burdens, or lack of financial literacy among farmers, leading to increased economic vulnerability. This observation resonates with the conclusions drawn by Mahadik & Sawant (2012). Variables like age, family type, family size, landholding, and farming experience were found to be non-significant, indicating that these demographic characteristics might not have a direct or strong influence on livelihood security. This could be because livelihood security depends more on dynamic behavioral traits and access to services and resources than on static personal or structural factors. Similar interpretations were reported by Mishra et al., (2020).

CONCLUSION

The livelihood security of sheep farmers was found to be predominantly moderate across various dimensions. Resource use efficiency and economic security indicated good capacity in resource management and income generation, while food, nutritional, and infrastructural security highlighted the need for targeted interventions. The composite index and distribution analysis confirmed that most respondents fell into the medium category, with only a few experiencing high or low levels. Correlation analysis revealed income, flock size, extension contact, knowledge, and risk orientation as strong positive contributors, while education, attitude, practice, and innovative proneness also played significant roles. Conversely, credit access showed a negative correlation, suggesting issues of financial mismanagement. The findings underscore the importance of strengthening knowledge systems, infrastructure, market access, and behavioral competencies to elevate livelihood security.

DECLARATIONS

Ethics approval and informed consent: Informed consent was sought from the respondents of the study and their organizations during the course of the research.

Conflict of interest: The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

The authors declare that during the preparation of this work, thoroughly reviewed, revised, and edited the content as needed. The authors take full responsibility for the final content of this publication.

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