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Household livelihood security and diversification of smallholder farmers in central Kerala: A mixed farming perspective

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Abstract

Livelihood security is essential for sustainable rural development, particularly for smallholder farmers who rely on varied agricultural systems for their existence. The study investigates the livelihood security of smallholder farmers engaged in mixed farming in Central Kerala, particularly in the Thrissur and Palakkad districts. To account for the multiple and interconnected aspects of livelihoods, a composite Livelihood Security Index (CLSI) was developed. The method includes the identification and weighting of crucial indicators through expert evaluation, ensuring that the final set accurately depicts the realities of smallholder farming. Data were collected from respondents through a structured interview schedule addressing four key dimensions of livelihood security - economic, food and feed, ecological, and social. The index was developed through standardization and compilation of field data. The findings indicated that economic security (0.71) contributed the most to improving the overall livelihood security of farmers, as mixed farming provides additional income to the farmers; on the other hand, ecological security (0.47) contributed the least to improving the livelihood security, as climate change is significantly affecting mixed farming, and farmers fail to adopt measures to tackle it. Overall, the livelihood security was moderate, suggesting both opportunities and vulnerabilities within the existing mixed farming systems. The study suggests the necessity of policies that encourage sustainable and varied agricultural methods and increase ecological resilience to improve the lives of Kerala's smallholder farmers.

Keywords: Mixed farming, livelihood security, composite index, central Kerala

Introduction

In developing countries like India, the crop-livestock system serves as the backbone of smallholder agriculture, which provides an integrated approach to food accessibility, economic stability, and resource utilization (Innazent *et al.*, 2022) ^[1]. Livestock significantly enhances livelihood security by supplying income, nutrition, energy, manure, labour, and acts as a liquid asset for the majority of rural families (Herrero *et al.*, 2013) ^[2]. The dairy sector of Kerala, a southern state of India, not only offered self-employment opportunities but also encouraged the economic advancement of the population, particularly in the rural areas of the state. In Kerala, milk production was primarily carried out by smallholder farmers and was a broadly practiced activity that relied heavily on purchased feed (Thayyil, 2007) ^[3]. Most dairy households utilize integrated crop-livestock systems, generating income from both dairy products and crops, which leads to enhanced economic development (Khan *et al.*, 2010) ^[5]. The danger of household livelihood failure increases the degree of vulnerability of a household to income, food, health, and nutritional instability. Unfortunately, not all households are

equal in their ability to manage stress and shocks. Livelihood security is described as sufficient and sustainable access to income and other resources to enable households to fulfill their essential needs (Frankenberger, 1996) ^[4]. In this study, various dimensions of livelihood are taken into account, and a composite livelihood security index (CLSI) was developed to recognize which aspect of security is stronger and which poses challenges; thus, the weaker component can be enhanced.

Methodology

The study was conducted in Central Kerala. Central Kerala includes – Palakkad, Thrissur, Ernakulam, and Idukki districts. The cattle population in Central Kerala, based on the 2019 livestock census (DAHD, 2019) ^[6], is shown in Table 1. Among these, Thrissur and Palakkad districts were purposively selected based on the cattle population. The study utilizes primary data from 200 mixed farmers with land sizes up to 2 ha and 2-3 milch cows, collected through a well-structured questionnaire. To ensure the reliability of the questionnaire and to identify the cropping patterns in the area, a pilot study was conducted. The major cropping

systems of the region include coconut, arecanut, rice, banana, homestead vegetables, and green fodder, with coconut as the major crop. Primary data on various parameters, including food and feed availability, financial capacity, infrastructural security, social security, and ecological security, were collected from respondents.

Table 1: Livestock population in Central Kerala based on the 2019 livestock census

SI. No.	Districts	Cattle population
1	Palakkad	1,66,952
2	Thrissur	1,11,932
3	Ernakulam	1,08,061
4	Idukki	97,395

The data collected were analyzed using both descriptive and inferential statistical methods to draw meaningful insights and understand underlying patterns. A Composite Livelihood Security Index (CLSI) was developed to assess the livelihood security status of farm households. The index was constructed following a systematic approach designed to develop composite measures. It represents a weighted index that brings together multiple indicators from various dimensions of livelihood security into a single comprehensive measure. To construct CLSI, the livelihood security was classified into four categories, which were further classified into respective components. A set of 73 indicators representing the four dimensions of livelihood security was used. The indicators were identified through a literature review (Eqbal, M.D., 2015; Jena, T., 2021; and Sreekumar, S., 2023) [7, 8, 9], and to validate and refine the selection, expert consultation was carried out. Food and feed security highlights the adequacy of nutrition for both farm families and their livestock. Economic security signifies the financial stability and capability of farm households to uphold livelihoods and preserve a decent quality of life. Social security indicates the general welfare and social stability of agricultural households, including health, education, institutional aid, and access to markets. Ecological security signifies the sustainability of natural resources and the resilience of agricultural systems to environmental changes.

As not all indicators have the same impact on livelihood outcomes, weighing ensures that the most important factors are given appropriate significance in the final index. The weighing process was conducted using the Delphi technique, which depends on expert agreement obtained through multiple iterative rounds. A Likert scale was designed for each indicator, and experts were asked to assign scores. The scores were transformed into weightage by following the methodology followed by Alfares (2006) [10]. Mean scores of each indicator were calculated to assess the level of consensus among experts.

The mean scores, along with the indicators, are then sent to the experts for their review and agreement. The indicators are finalised after this. Based on the responses from farmers, the indicators are ranked from 1 to 3, where 1 = least secure, 3 = highly secure. The responses are standardized between 0 and 1 to make it easier for interpretation and to compare the livelihood security levels across households through a procedure adopted by Hahn *et al.* (2009) [11].

$$Z \text{ indj} = \frac{\text{indicator j} - \text{min j}}{\text{Max j} - \text{min j}}$$

Where,

Z indj = standardized indicator j

Max j and Min j = the maximum and minimum value of indicatorj, respectively.

Then, for each household, livelihood security was carried out using the formula:

$$\text{HLSI} = \frac{\sum Z \text{ indj}}{N}$$

Where,

HLSI = Household Livelihood Security for one indicator

$\sum Z \text{ indj}$ = the summated standardized score of all households of an indicator

N = Number of households

To compute the Composite Livelihood Security Index (CLSI), the following formula is used:

$$\text{CLSI} = \frac{\sum W_i \text{ HLSI}}{\sum W_i}$$

Where,

CLSI = Composite Livelihood Security Index

HLSI = Household Livelihood Security Index

$\sum W_i$ = Summated value of the weightage of indicators

The component indices of livelihood security were calculated separately to determine the stronger index and the weaker one. A security index was determined for each component of livelihood security for every farmer. According to these values, farmers were classified into low, medium, and high categories based on the mean and standard deviation, where mean + SD represents the higher level of classification for each component of livelihood security, while mean – SD represents the lower level.

Garrett ranking technique was used to identify the constraints faced by the respondents in the study area (Garrett and Woodworth, 1969) [12]. The formula used is given below:

$$\text{Percent position} = 100(R_{ij} - 0.5)/N_j$$

Where,

R_{ij} = Rank provided for the *i*th variable by the *j*th respondent;

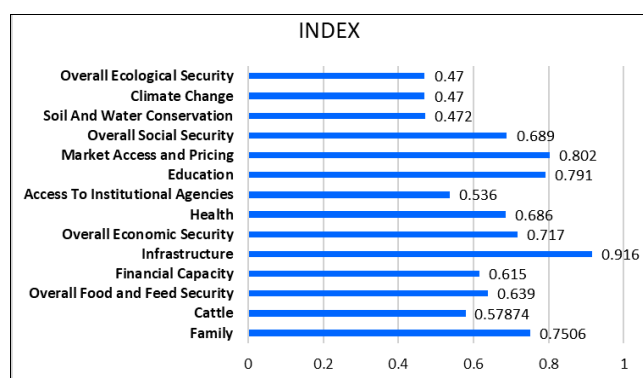
N_j = the number of variables ranked by the *j*th respondent.

Results and discussion

In this study, the overall livelihood security is classified under broader dimensions: food and feed, economic, social, and ecological. The overall livelihood security index and its component indices are shown in Table 2. It clearly depicts that the respondents have comparatively high economic security (0.71), while the ecological security is the lowest (0.47). Overall, the livelihood security of the respondents is medium (0.62).

Table 2: Livelihood security index and its component indices

Component	Sub component	Index
Food and feed security	Family	0.7506
	Cattle	0.57874
	Overall Food and Feed Security	0.639
Economic security	Financial Capacity	0.615
	Infrastructure	0.916
	Overall Economic Security	0.717
Social security	Health	0.686
	Access To Institutional Agencies	0.536
	Education	0.791
	Market Access and Pricing	0.802
	Overall Social Security	0.689
Ecological security	Soil And Water Conservation	0.472
	Climate Change	0.47
	Overall Ecological Security	0.470
Livelihood Security Index		0.629

**Fig 1:** Livelihood security index and its component indices

The extent and allocation of respondents across each livelihood security indicator in the study area are outlined under the subsequent sub-headings:

Food and Feed Security

Food security analyses the availability of food and its proper utilisation, including the capacity of the household to produce sufficient food that meets the nutritional needs of its members. Feed security considers the year-round availability and affordability of quality fodder and feed necessary for maintaining livestock productivity. Table 3 shows that the majority of respondents in the study area had a medium level of security. 10.5 per cent of the respondents had a low level of food and feed security, while only 16.5 per cent had a high level. This indicates that most households can meet their daily food and feed requirements, but this is not fully ensured throughout the year. This may be due to the periodic shortage of green fodder or fluctuation in milk yield, or high cost of feed. The cost of the raw materials used for cattle feed production has risen, which significantly increases the cost of the feed, affecting the farmers with low-income security (Jayadevan and Franco, 2022)^[13]

Table 3: Distribution of respondents based on food and feed security

Food and Feed Security	Frequency	Percentage	Mean
Low (<0.52)	21	10.5	0.64
Medium (0.52-0.75)	146	73	
High (>0.75)	33	16.5	

Economic Security

Economic security represents the financial stability and self-sufficiency of farming households, ensuring their ability to sustain livelihoods and maintain a reasonable standard of living. The average Monthly Per Capita Consumption Expenditure (MPCE) in the study area is Rs. 10932, which is higher than the state average of Rs. 6611 (GOI, 2025)^[14]. The higher mean value does not imply that all households have a uniform level of security, but only a section of households may have better economic conditions. While a considerable proportion still face livelihood constraints, with their consumption expenditure remaining close to or below the standard MPCE. Table 4 shows the classification of livelihoods based on economic security. Most respondents report medium economic security (71.5%), as mixed farming provides them with additional income. Low income security has been experienced by 13% of the respondents. The sample respondents were so selected that they have at least 1-3 milch cows, and in the case of households with only one milch cow, they may not have had a year-round production cycle, which would have adversely affected their income. Other reasons could be the fluctuations in milk prices and the high production cost. Only 15% of the respondents reported high income security.

Table 4: Distribution of respondents based on economic security

Economic Security	Frequency	Percentage	Mean
Low (<0.62)	26	13	0.72
Medium (0.62-0.81)	143	71.5	
High (>0.81)	31	15.5	

Social Security

The ability to access social services and institutional networks that contribute to a secure livelihood represents the social security index. Table 5 shows the classification of livelihoods based on social security. About 75% of the respondents have medium social security, while 12% of the respondents have low social security. This implies that numerous farmers have restricted access to community networks, social institutions, and support systems that can offer stability in periods of stress. In many instances, farmers reported low engagement in cooperatives, self-help groups, and farmer associations, often due to insufficient awareness. To address these issues, it is crucial to strengthen farmer organizations and promote increased community involvement through cooperatives, producer associations, and self-help groups.

Table 5: Distribution of respondents based on social security

Social Security	Frequency	Percentage	Mean
Low (<0.64)	24	12	0.69
Medium (0.64-0.74)	150	75	
High (>0.74)	26	13	

Ecological Security

Ecological security represents the sustainability of natural resources and the ability of farmers to adopt adaptive measures against climate change. Table 6 shows the classification of livelihoods based on ecological security. About 22% of the respondents have high ecological security. While majority of the farmers have medium security and 10.5% of the respondents have low ecological

security. Most farmers are unaware of the climate-resilient practices, the environmental impact of greenhouse gas emissions from cattle, and the water and soil conservation practices. To improve the ecological security of farmers, awareness should be provided to farmers to adopt climate-resilient practices and water-saving irrigation methods like drip irrigation, sprinkler irrigation, etc.

Table 6: Distribution of respondents based on ecological security

Social Security	Frequency	Percentage	Mean
Low (<0.64)	24	12	0.69
Medium (0.64-0.74)	150	75	
High (>0.74)	26	13	
Ecological Security	Frequency	Percentage	Mean
Low (<0.35)	21	10.5	0.46
Medium (0.35-0.57)	135	67.5	
High (>0.57)	44	22	

Livelihood Security

A sustainable livelihood can withstand and bounce back from shocks and strains, preserve or improve its capabilities and assets, offer sustainable livelihood opportunities for future generations, and provide net benefits to other livelihoods both locally and globally in the long and short term (Uddin *et al.*, 2015) ^[15]. Overall livelihood security of farmers was calculated to analyze the extent of security of the farmers and their ability to cope with the constraints. Table 7 shows the livelihood security of the respondents. The livelihood security of majority of the farmers in this

area is medium (64.5%), while 17.5% of the respondents have low livelihood security. The farmers have relatively stable income sources or access to basic needs, but limited ecological sustainability. This suggests that the existing livelihood strategies are sufficient to meet the daily requirements but not enough to ensure long-term resilience.

Table 7: Livelihood security of farmers in the study area

Livelihood Security	Frequency	Percentage	Mean
Low (<0.57)	35	17.5	0.62
Medium (0.57-0.68)	129	64.5	
High (>0.68)	36	18	

Challenges faced by mixed farmers

Crop-livestock systems involve interaction between crop and livestock production that are exploited simultaneously across time and space, which impose numerous challenges (de Moraes *et al.*, 2014) ^[16]. A constraint analysis was done using the Garrett ranking technique, which showed that the major constraint faced by the farmers is the high cost of the feed. Even though sufficient subsidy was provided, the farmers couldn't meet the daily feed requirements of their cattle. Another major constraint faced by the farmers is the low price of milk. The price they receive from the milk society is comparatively lower than the price they receive from the sale of milk to their nearby houses. The ranking of the constraints along with their average score is shown in Table 8.

Table 8: Constraints faced by farmers

Rank	Constraints	Average score
1	High Cost of Feed	79.42
2	Low Price of Milk	70.58
3	High Labour Cost and Seasonal Labour Shortage	56.06
4	Pest Attack and Disease in Crops	52.9
5	Outbreak of Disease in Cows	51.54
6	Price Volatility of Crops	44.28
7	Delay in Payment from Agents	42.6
8	Wild Animal Attack	36.06
9	Problem Due to Wind and Irregular Monsoon	35.72
10	High Cost of Veterinary Medicine	28.81

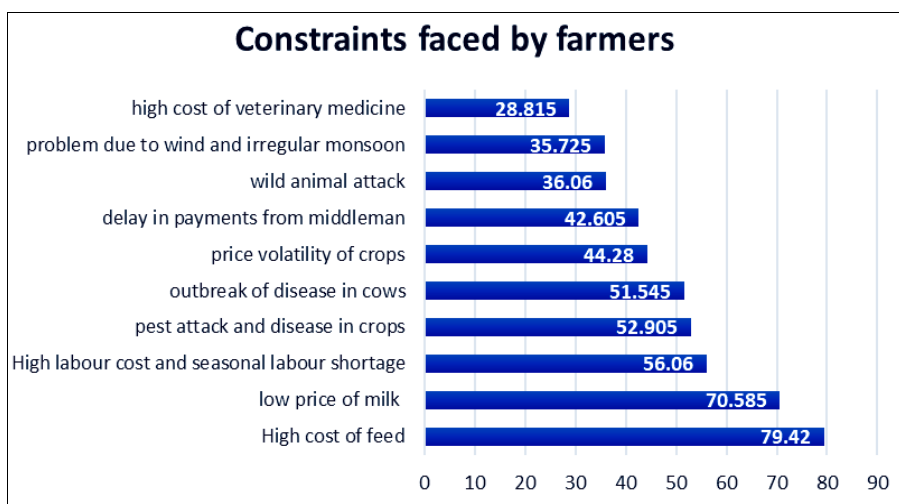


Fig 2: Mean Garrett scores of constraints faced by mixed farmers

Conclusion

The study assessed the livelihood security index of smallholder farmers in Central Kerala by developing a composite livelihood security index (CLSI). Among the four components of livelihood security, the economic security index showed the maximum, indicating that mixed farming can provide them with an extra source of income apart from their regular source of income. However, the low level of ecological security can be resolved by the adoption of climate-resilient practices and by organizing training sessions for creating awareness among farmers about various soil and water conservation practices that can be adopted to ensure sustainability. Food and feed security, along with social security, showed a medium level of security. The overall livelihood status of the smallholder mixed farmers turned out to be medium, indicating that they can meet their daily requirements but are vulnerable to external shocks. Institutional support, including community fodder banks, timely awareness on various schemes and subsidies, and exposure to climate-resilient practices in farming can help smallholder mixed farmers to improve their livelihood status.

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