

RESEARCH ARTICLE

Impact of Dairying on Livelihood Security of Farmers in Aspirational Districts of Karnataka

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Abstract: This study examines the socio-economic impact of dairying on the livelihood security of farmers in the Aspirational districts of Karnataka, viz., Raichur and Yadgir districts. Dairying is a vital component of rural economies, contributing significantly to food security and poverty alleviation. Livelihood Security Index (LSI) was constructed to assess the differences between dairy and non-dairy farmers across seven dimensions; food and nutritional security, economic security, health security, educational security, social security, institutional security, and infrastructural security. Findings indicate that dairy farmers enjoy higher LSI compared to their non-dairy counterparts, attributed to consistent income generation and better integration into support systems. The study also highlights essential management practices adopted by dairy farmers, including housing, feeding, health care, breeding, and milking techniques. These practices were crucial for enhancing productivity and profitability in the dairy sector. The research underscores the importance of promoting dairying as a sustainable livelihood strategy to improve rural livelihoods of the farmers especially in Aspirational districts of our country.

Keywords: Socio-economic impact, Livelihood Security, Dairying, Aspirational District

Introduction

As an agrarian nation, India relies heavily on agriculture and allied sectors, with the livestock sector contributing significantly to the national economy (Singh et al. 2020). The dairy industry alone accounts for 4.11% of the national GDP and 25.60% of the agricultural GDP (Chadda et al. 2022). Karnataka ranks 8th in milk production, contributing 5.56% to the nation's total milk output (DAH&D, 2023). With a bovine population of 114.4 lakh, the state's dairy sector is primarily supported by small-scale farmers who manage less than two hectares of land and own one to four dairy animals (DAH&D, 2019). This sector not only ensures food security for millions of rural households but also acts as a buffer against poverty and economic instability (Rodríguez et al. 2016).

The concept of livelihood encompasses a range of activities and resources that individuals or households utilize to secure their basic needs (Frankenberger, 1996). Livelihood security is defined as having adequate and sustainable access to income and resources to meet these needs while managing risks associated with various uncertainties (Chambers and Conway, 1992). In rural areas, particularly in aspirational districts where the agricultural landscape is fraught with challenges such as fluctuating market prices, depleting natural resources, and climate variability, dairying emerges as a viable alternative for enhancing livelihood security (Lazard and Youngs, 2021). The Government of India's Aspirational Districts Programme (ADP), launched in 2018, aims to uplift underdeveloped regions by improving living standards through integrated development initiatives across various sectors, including agriculture.

The present study investigates the impact of dairying on the socio-economic profile of dairy farmers in Karnataka's aspirational districts. It aims to document the current status of dairy farming, to analyse its role in enhancing livelihood security, and to identify the challenges faced by dairy farmers. By focusing on both dairy and non-dairy farmers in Raichur and Yadgir, the research seeks to provide insights into their socio-economic conditions and how dairying contributes to their livelihoods. The findings will be instrumental for policymakers and stakeholders in formulating effective strategies that promote sustainable dairy farming

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practices and improve the overall economic stability of rural households.

This study delves into seven key indicators of livelihood security namely income stability, food security, health access, education opportunities, asset ownership, social capital, and risk management capabilities. By exploring these dimensions, the research aims to highlight how dairying not only serves as a source of income but also enhances overall quality of life for farmers and their families. Overall, this paper underscores the importance of dairying in securing livelihoods for farmers in Karnataka's aspirational districts. It emphasizes that enhancing support for this sector can lead to significant improvements in socio-economic conditions for rural households. Through targeted interventions and policy support, dairying can play a pivotal role in alleviating poverty and fostering sustainable development in these aspirational districts regions.

Materials and methods

Sampling plan: The present study was conducted during the year 2022 in the Aspirational districts of Karnataka state viz., Raichur and Yadgir Districts. The districts were chosen purposively based on the Government of India's Aspirational Districts Programme (ADP) by NITI Aayog. Two blocks from each district were selected randomly, i.e. Raichur and Sindhanur blocks of Raichur; Surpur and Shahapur blocks of Yadgir. A Cluster of five villages from each block were randomly selected. Thus, a total of 20 villages were selected for the study. Respondents for this study are dairy farmers who had at least one dairy animal at the time of investigation and non-dairy farmers who are not active in dairy farming. A total of, 50 respondents from each block were selected randomly, among those 25 respondents are dairy farmers and remaining 25 are non-dairy farmers. Thus, a total of 200 respondents from two aspirational districts were selected for the study.

Measuring dairy management practices: For measuring the management practices of dairy farming, adopted by the respondents, a list of practices regarding housing, feeding, health care, breeding, milking and general management practices was prepared by referring the published literatures and by consulting the experts in the field. The respondents were categorized based on the frequency and percentage.

Construction of LSI: The Livelihood Security Index (LSI) was developed in the present study to evaluate the impact of dairy farming on the livelihoods of respondents. By comparing dairy farmers with non-dairy farmers, the study aimed to assess the significance of dairy farming in securing livelihoods within the research area. Through a review of various studies on the Livelihood Security Index (LSI), a comprehensive framework was developed consisting of seven key components: food and nutritional security, economic security, health security,

educational security, social security, institutional security, and infrastructural security.

The construction of a Livelihood Security Index (LSI) hinges on assigning weights (scale values) to the seven key components of LSI. These weights reflect the perceived importance of each component in determining a Livelihood Security of respondents. The Normalized Rank Order Method, developed by Guilford (1954), provides a structured approach for this weighting process. The 90 judges were asked to rank the seven components based on their perceived importance in assessing the livelihood security of respondents. Out of the initial 90 judges selected for the study, 38 responded. After a thorough evaluation, 6 responses were excluded due to inconsistencies or incomplete data. The remaining 32 responses were used for further analysis. Below formula was used to calculate proportions (p-values) for each rank assigned by the judges. This formula considers the assigned rank and the total number of components being ranked (7). Finally, for each dimension, a 'scale value' was obtained by multiplying the frequency of each rank by its corresponding C-value and then summing these products. The sum was then divided by the total number of judges (32). This process resulted in a unique scale value for each livelihood security component, reflecting its relative importance in the overall LSI, which is presented in Table 1.

$$p = [(R_i - 0.5) * 100] / n$$

Where, R_i = stands for the rank value of the dimension i in the reverse order as 7 to 1, n indicates the number of dimensions ranked by the judges.

Ensuring the validity and reliability of the vulnerability index is crucial. To achieve this, a critical step called item analysis and relevance test was conducted. The judges were asked to evaluate the relevance of each indicator using a three-point scale: 'Most Relevant' (3 points), 'Relevant' (2 points), and 'Least Relevant' (1 point). This process helped to assess the importance of each indicator in the context of the index. Two key metrics were calculated for each indicator: Relevancy Weightage (RW) and Mean Relevancy Score (MRS). These metrics helped to determine which indicators should be included in the final index.

Each dimension of LSI consists of various number of indicators and therefore, their range of total scores were different. Hence, total score of each dimension was converted into unit score by using simple range and variance as given below.

$$U_{ij} = (Y_{ij} - \text{Min } Y_{ij}) / (\text{Max } Y_{ij} - \text{Min } Y_{ij})$$

Where, U_{ij} = Unit score of the i th respondents on j th dimension, Y_{ij} = Value of the i th respondent on the j th dimension, $\text{Max } Y_j$ = Maximum score on the j th dimension, $\text{Min } Y_j$ = Minimum score on the j th dimension

Thus, the score of each dimension will be ranging from 0 to 1 i.e. when Y_{ij} is minimum, the score is 0 and when Y_{ij} is maximum the score is 1. Then, the unit scores of every respondent will be multiplied by respective scale value of each dimension and summed up. Thus, the score obtained was divided by the sum of scale values in order to get the LSI for each respondent.

$$LSI_i = \frac{U_{ij} \cdot S_j}{\text{Sum of scale values}}$$

Where, LSI_i = Livelihood Security Index of i th respondent, U_{ij} = Unit score of the i th respondent on j th component, S_j = Scale value of the j th component

Propensity Score Matching (PSM) technique: Propensity score matching technique (Rosenbaum and Rubin 1983) was employed for comparing dairy farmers and non-dairy farmers with respect to overall livelihood security. This technique and its application to the present study are explained below.

Estimation of Propensity Score (PS) value: The PS for each dairy farmer was calculated using a logistic regression model. This model predicts the probability that a farmer is a dairy farmer, given their specific characteristics (X_i). The PS is calculated as $P(X_i) = \Pr(D_i = 1 | X_i)$, where D_i indicates whether the individual is a dairy farmer ($D_i=1$) or not ($D_i=0$). To calculate the PS, both dairy farmers and non-dairy farmers were included in the analysis. The factors (X_i) that influence the livelihood security of both groups were used as covariates in the logistic regression model.

Matching of PS: To ensure that the dairy farmers and non-dairy farmers have similar characteristics, they were matched based on their PS. This means that dairy farmers were paired with non-dairy farmers who had similar probabilities of being dairy farmers. The kernel-based matching method was used to find the best matches between the two groups.

Assessment of matching quality: The balance requirement will be evaluated to determine if there are any statistically significant differences between the two groups after resampling the data. This is done to ensure that the matching procedures successfully balanced the data and created a randomized experimental design like effect.

Calculation of average treatment effect (ATT): The ATT and implication of dairy farming on the control and treated groups after matching will be compared.

$$ATT = E[Y_{1i} - Y_{0i} | D_i = 1] = E\{E[Y_{1i} - Y_{0i} | D_i = 1, p(X_i)]\} = E\{E[Y_{1i} | D_i = 1, p(X_i)] - E[Y_{0i} | D_i = 0, p(X_i)] | D_i = 1\}$$

Here, Y_{1i} and Y_{0i} represent overall livelihood security of the sample dairy farmers in the treated group and non-dairy farmers in the control group, respectively.

Index gap analysis with respect to different groups: Index gap analysis (% ΔIg) was made for comparing the overall livelihood security index value of dairy and non-dairy farmers of the study area.

$$\text{Index gap (\% } \Delta Ig) = (\text{Index value of dairy farmers} - \text{Index value of non-dairy farmers}) / (\text{Index value of dairy farmers}) \times 100$$

Results and Discussion

Socio-economic profile: The study from Table 2 found that 72 per cent of dairy farmers belonging to middle to old age compared to 79 per cent of non-dairy farmers. While most dairy farmers were male (73.00%), non-dairy farmers had a slightly higher proportion of males (79.00%). Both groups had similar average family sizes, with dairy farmers reporting 6.31 members per household and non-dairy farmers reporting 6.60. The majority of farmers in both categories had completed secondary education,

Table 1: Seven Dimensions of Livelihood Security Index (LSI)

r_i	R_i									Σf	p	C
1	7	12	6	4	2	1	3	4		32	92.85	8
2	6	9	6	3	5	2	2	5		32	78.57	7
3	5	2	10	7	2	2	1	8		32	64.28	6
4	4	5	3	8	10	0	3	3		32	50.00	6
5	3	3	1	4	8	9	1	6		32	35.71	5
6	2	1	2	4	4	2	14	5		32	21.42	5
7	1	0	4	2	1	16	8	1		32	7.14	4
Σf		32	32	32	32	32	32	32		32	350	41
Σf_c		221	199	191	187	153	169	192		1280		
Sc		6.90	6.21	5.96	5.84	4.78	5.28	6.00		$M=4.57$		
										$\sigma=0.67$		
										$SE=0.11$		

r_i = Correct rank order, R_i = Reverse rank order, Σ = Sum, p = Proportion, C = C values of respective ranks, Sc = Scale value, M = mean value, σ = Standard Deviation, Standard Error = $\sigma/\sqrt{N}$

and dairy farmers reported a higher average annual income (0.91) compared to non-dairy farmers (0.78). Both groups demonstrated moderate levels of social participation, but dairy farmers had slightly higher levels of mass media exposure and extension contact.

Status of the dairying in the Aspirational Districts: The data from Table 3 suggests that dairy farming experience, livestock possession, and milk production are closely related factors that influence the success of dairy farmers. Experienced farmers with a medium number of livestock tend to have higher milk production, indicating the importance of knowledge and resources in optimizing dairy operations. However, the data also revealed that most farmers consume a significant portion of their milk

production, potentially limiting their income from sales. To enhance profitability, dairy farmers may benefit from exploring ways to increase milk sales while maintaining sustainable production levels.

Dairy Management practices adopted: The data from Table 4 highlights the various management practices adopted by dairy farmers, including housing, feeding, health, breeding, milking, and general management. It suggests that most farmers use semi-kutchha sheds attached to their houses, with a focus on ventilation. Feeding practices involve a combination of grazing and stall feeding, with a majority providing roughages and concentrates. Health management emphasizes deworming and vaccination, while breeding was predominantly through artificial insemination.

Table 2: Socio-economic profile of the dairy farm households

Variables	% of Dairy farmer	% of Non-dairy farmers
<i>Age</i>		
Young (Up to 35)	28.00	21.00
Middle age (36-50)	38.00	46.00
Old (More than 50)	34.00	33.00
<i>Gender</i>		
Male	73.00	79.00
Female	27.00	21.00
<i>Family size</i>		
Small (Up to 5)	47.00	43.00
Medium (6-8)	37.00	33.00
Large (More than 8)	16.00	24.00
<i>Family type</i>		
Nuclear family	54.00	57.00
Joint family	46.00	43.00
<i>Education</i>		
Illiterate	12.00	15.00
Read and write	16.00	19.00
Primary level	12.00	19.00
Middle school	16.00	13.00
Secondary education	33.00	25.00
Graduate and above	11.00	09.00
<i>Annual income</i>		
Low (Up to 0.79 lakh)	28.00	50.00
Medium (0.80-1.20 lakh)	47.00	44.00
High (More than 1.21 lakh)	25.00	6.00
<i>Social participation</i>		
Low (Up to 16.50)	37.00	46.00
Medium (16.51-20.91)	40.00	38.00
High (More than 20.92)	23.00	16.00
<i>Mass media exposure</i>		
Low (Up to 12.35)	22.00	26.00
Medium (12.36-15.46)	43.00	55.00
High (More than 15.47)	35.00	19.00
<i>Extension contacts</i>		
Low (Up to 16.59)	29.00	49.00
Medium (16.60-20.15)	50.00	42.00
High (More than 20.16)	21.00	9.00

Milking practices prioritize udder washing, and most farmers rely on tap water and have their animals insured. However, record-keeping remains an area for improvement. Adopting best practices in these areas can enhance dairy productivity and profitability.

Livelihood security of dairy and non-dairy farmers: The analysis of the seven dimensions of livelihood security from Table 5 reveals significant differences between dairy and non-dairy farmers. Dairy farmers generally exhibit higher levels of food, economic, health, educational, social, institutional, and infrastructural security compared to their non-dairy counterparts. This advantage could be attributed to the consistent income generated from dairy farming, which enhances food and nutritional security throughout the year. In contrast, non-dairy farmers face greater vulnerabilities due to reliance on unpredictable agricultural conditions, leading to lower economic stability.

Social and institutional security levels also indicate that dairy farmers are better integrated into support systems, although both groups showed a need for improved participation in cooperative organizations and access to training programs. Furthermore, infrastructural security is notably higher among dairy farmers, likely due to better access to essential services and facilities. Overall, the livelihood security index reflects that dairy farming provides a more robust foundation for economic and social well-

Table 3: Status of the dairying in the Aspirational Districts

Variables	% of Dairy farmer
Experience in dairy farming	
Low (Up to 11 years)	26.00
Medium (12-19 years)	41.00
High (More than 20 years)	33.00
Livestock Possession	
Low (<3)	26.00
Medium (4-6)	57.00
High (>7)	17.00
Milk Production	
Low (Up to 7 litres per day)	37.00
Medium (8-12 litres per day)	46.00
High (More than 13 litres per day)	17.00
Milk Consumption (litres/day)	
Low (Up to 1.00 litres per day)	10.00
Medium (1.01-2.00 litres per day)	80.00
High (More than 2.01 litres per day)	10.00
Milk sale (litres/day)	
Low (Up to 5 litres per day)	38.00
Medium (6-11 litres per day)	43.00
High (More than 12 litres per day)	19.00

being. This underscores the importance of promoting dairy

Table 4: Dairy Management practices adopted by the respondents

Practices		Percentage
i. Housing management		
Type of shed	Pucca	37.00
	Semi kutcha	63.00
Sheds proximity to farmers house	Away	18.00
	Attached	82.00
Ventilation of the shed	Ventilated	72.00
	Non-ventilated	28.00
ii. Feeding management		
Feeding method	Grazing	23.00
	Stall feeding	12.00
	Both	65.00
Type of feed	Roughages only	21.00
	Roughages+concentrates	79.00
Feeding of pregnant animals with an extra ration during the advanced stage of pregnancy		65.00
iii. Health management		
Deworming practices	Yes	83
	No	17
Vaccination carried out	At Farm	40.00
	At Veterinary centre	60.00
Sick animals' management	Separately	26.00
	With others	74.00
iv. Breeding management		
Breeding method	Natural	41.00
	A. I	59.00
A.I available from	State department	100.00
	Private	0.00
A.I availed at	Door step	37.00
	Veterinary centre	63.00

v. Milking management		
Washing of udder prior to milking	Yes	100.00
	No	0.00
Concentrate feeding at milking time	Yes	39.00
	No	61.00
Frequency of milking	Twice	100.00
	Thrice	0.00
vi. General management		
Record keeping	Yes	14.00
	No	86.00
Source of water for animal	Village pond	19.00
	Bore well	26.00
	Tap water	55.00
Animal insurance	Yes	68.00
	No	32.00

Table 5. Distribution of respondents according to different livelihood security index dimensions

Dimensions	% of dairy farmers	% of non-dairy farmers
i. Food and nutritional security		
Low (Up to 0.67)	12.00	30.00
Medium (0.68-0.85)	28.00	33.00
High (More than 0.86)	60.00	37.00
ii. Economic security		
Low (Up to 0.41)	38.00	54.00
Medium (0.41-0.63)	43.00	36.00
High (More than 0.63)	19.00	10.00
iii. Health security		
Low (Up to 0.74)	22.00	30.00
Medium (0.74-0.85)	30.00	42.00
High (More than 0.85)	48.00	28.00
iv. Educational security		
Low (Up to 0.60)	16.00	40.00
Medium (0.60-0.75)	45.00	36.00
High (More than 0.75)	39.00	24.00
v. Social security		
Low (Up to 0.33)	40.00	45.00
Medium (0.33-0.73)	36.00	38.00
High (More than 0.73)	24.00	17.00
vi. Institutional security		
Low (Up to 0.52)	34.00	57.00
Medium (0.52-0.72)	37.00	23.00
High (More than 0.72)	29.00	20.00
vii. Infrastructural security		
Low (Up to 0.58)	11.00	46.00
Medium (0.58-0.79)	64.00	41.00
High (More than 0.79)	25.00	13.00
viii. Overall livelihood Security		
Low (Up to 0.59)	9.00	47.00
Medium (0.60-0.70)	52.00	41.00
High (More than 0.71)	39.00	12.00

farming as a viable livelihood option to enhance the overall quality of life in rural communities of aspirational districts.

Comparison of characteristics between dairy and non-dairy farmers using propensity score matching: “Propensity Score Matching (PSM) was employed to statistically compare the livelihoods of dairy and non-dairy farmers. Figure 1 illustrates

that the background characteristics of both groups overlap significantly, suggesting that their livelihoods can be meaningfully compared based on these characteristics.”

By calculating the index gap analysis i.e., the percentage difference between the overall livelihood security index value of dairy and non-dairy farmers. It can be observed from the Table 6

Fig. 1 Common support showing the frequency distribution of propensity score of dairy and non-dairy farmers

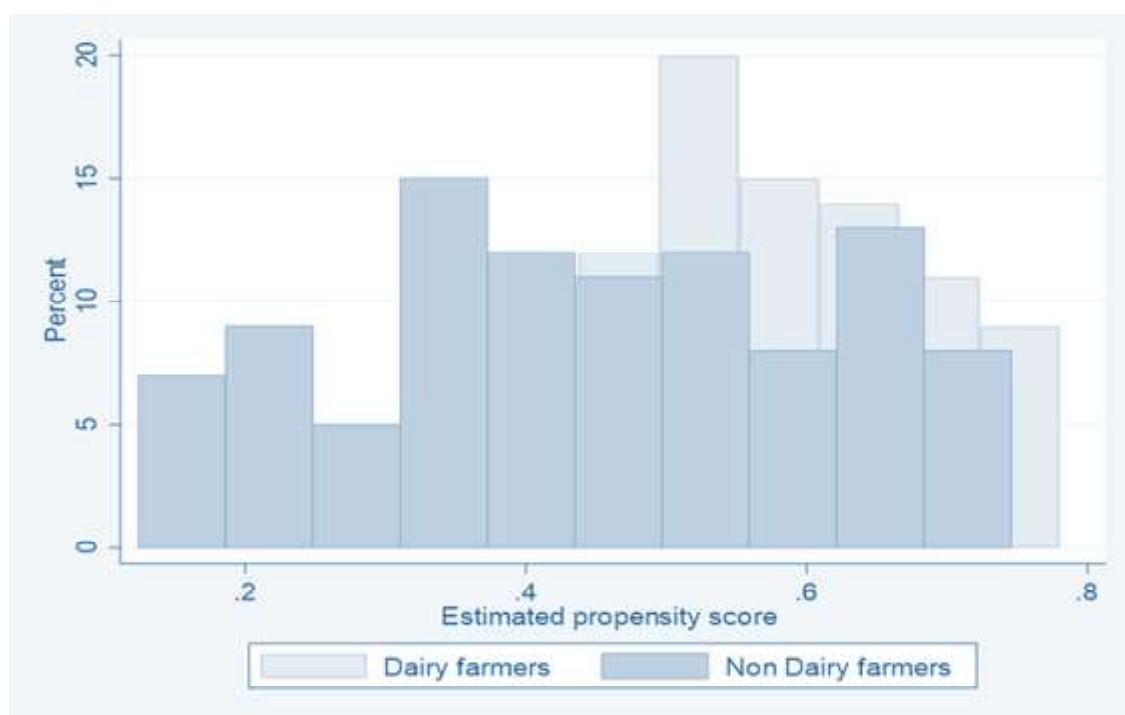


Table 6: Average difference and gap analysis after propensity score matching of dairy and non-dairy farmers

Number of matches	Dairy	%Gap
m=1	0.0958*** (.01482)	14.08
m=3	0.0959*** (0.013)	14.10
m=5	0.0952 *** (0.013)	14
Observations	200	

that livelihood security of dairy farmers had significantly higher than that of non-dairy farmers by 14.10 per cent. Therefore, farmers who were practising dairying had more secured livelihood than the non-dairy farmers.

Conclusions

The findings of this study reveal that dairying significantly enhances livelihood security among farmers in Karnataka's aspirational districts. By employing a comprehensive Livelihood Security Index (LSI), it is evident that dairy farmers experience superior food, economic, health, educational, social, institutional, and infrastructural security compared to non-dairy farmers. The management practices identified, ranging from housing and feeding to health care and milking, play a critical role in ensuring the success of dairy operations. The 14.10% advantage in

livelihood security underscores the need for targeted interventions to support dairy farming as a viable livelihood option in across the Aspirational Districts of our country. Hence, strengthening dairy based developmental programmes can be one of the important policy interventions for securing the livelihood of farmers in Aspirational districts of our country. Strengthening management practices and providing access to training programs can further enhance productivity and profitability in this sector. Ultimately, promoting dairying not only contributes to individual farmer resilience but also fosters sustainable development and poverty alleviation in rural communities across aspirational districts.

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