



# Dairying is an effective instrument for livelihood security in Rural-Urban interface of Karnataka

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Received:2022.1.25 | Accepted:2022.7.16 | Published:2022.8.22

## Abstract

**Objective:** To study the livelihood security of dairy and non-dairy farmers in rural-urban interface of Bangalore.

**Method:** The study was conducted in rural area and surrounding of Bangalore urban in India. Data of 240 dairy samples, 120 non-dairy samples were drawn from different layers of South and North transects during 2016-17. Thus, the total sample size was 360. By considering (HLS) index which accounted different indicators they were grouped in to six domains. Standardize value followed by taking the weights of the indicator by using principal component analysis and index was constructed taking the grand weights of the indicators. According to overall income generated from dairying was more than the non-dairy farmers. Similar study was carried by in Karnataka, showed extension personnel working at grass root level have actively involved in providing opportunities to the sericulture based dairy farmers in Karnataka state.

**Findings:** The livelihood index value was higher among dairy sample households (0.99) than the non-dairy sample households (0.70). Among the dairy farmers, a higher livelihood security index was observed in transition (3.18 & 5.47) layers than rural (2.47 & 2.25) and urban (2.28 & 2.18) layers in North and South transects, respectively. Further the distribution of income in the case of dairy sample households was found equal in transition layer of north transect (0.43) and urban layer of south transect (0.32). In respect of non-dairy sample households, income distribution was more unfair in transition layer urban layer and better income distribution was observed in rural layers, total income from dairy was Rs.2, 10,781/year as compare to Rs. 70,497 /year of non-dairy income.

**Novelty:** Our study reiterates that dairying is one of the important sources of livelihood activity of the rural urban interface of Bengaluru; apart from this, it acts as secondary source of income and uplifts the farmers from subsistence farming and poverty.

**Keywords:** Livelihood index, Gini Coefficient, rural-urban, dairy and Non-dairy, Bangalore

**Cite as:** Shivagangavva PD. Dairying is an effective instrument for livelihood security in Rural-Urban interface of Karnataka. Indian J.Econ.Dev.[Internet].2022 [cited 22 Aug.2022];2022 (Article ID: IJED22254): pages 14. Doi: 10.17485/IJED/v.22.254. Available from: <http://www.ijed.org>

## 1. Introduction

Dairy has been an important part of agriculture scenario. India is predominantly depended on agriculture and as 70 per cent of its population living in villages, the livestock play a vital role for their livelihood. In the last four decades, India's dairy sector has not only grown but also has undergone a structural transformation towards sustainable agricultural activity, especially in rural India, by providing an excellent opportunity for self-employment to small or marginal farmers and agricultural labourers throughout the year and a profitable business to all. Livestock provide high-quality foods such as milk, cheese, butter, ghee, etc. India is not only one of the top producers of milk in the world, but also the largest consumer of milk and milk products. Milk production increased from around 17-22 million tons in the 1960s to over 198.4 million tons in 2019-20. And per capita per day availability of milk from 200 grams (1996-97) to 406 grams/day (2019-20), which is more than the world average of 294 grams/day.

Livelihood has been defined as an adequate flow of resources (both cash and kind) to meet the basic needs of the people, access to social institutions relating to kinship, family and neighborhood, village and gender bias free property rights required to support and sustain a given standard of living, livelihood security has been understood to encompass ownership of access to resources and assets to offset risks, ease out shocks and meet contingencies [9]. The outcomes of livelihood security include economic security, food security, educational security, health security, habitat security and social network security. With rising population, declining land-man ratio and increasing mechanization in farm operations, agriculture alone is not able to provide adequate income and employment to households in India. Similarly, [8] measured livelihood security in sampled urban areas in Bangladesh using five livelihood security indices for measuring outcomes of food, economic, education, health and shelter indices. A livelihood analysis of smallholders in tribal areas of Maharashtra revealed that 35.84% of the smallholders had high (0.74-0.76) level of livelihood security followed by medium (0.70-0.73) level of livelihood security (40.41%). There was wide variation in livelihood dimensions especially in food security, economic security and health security of smallholders. The smallholder farmers who integrated livestock enterprises with crop had better economic security and their livelihood was found to be significantly improving.

## 2. Methodology

### 2.1. Sampling method

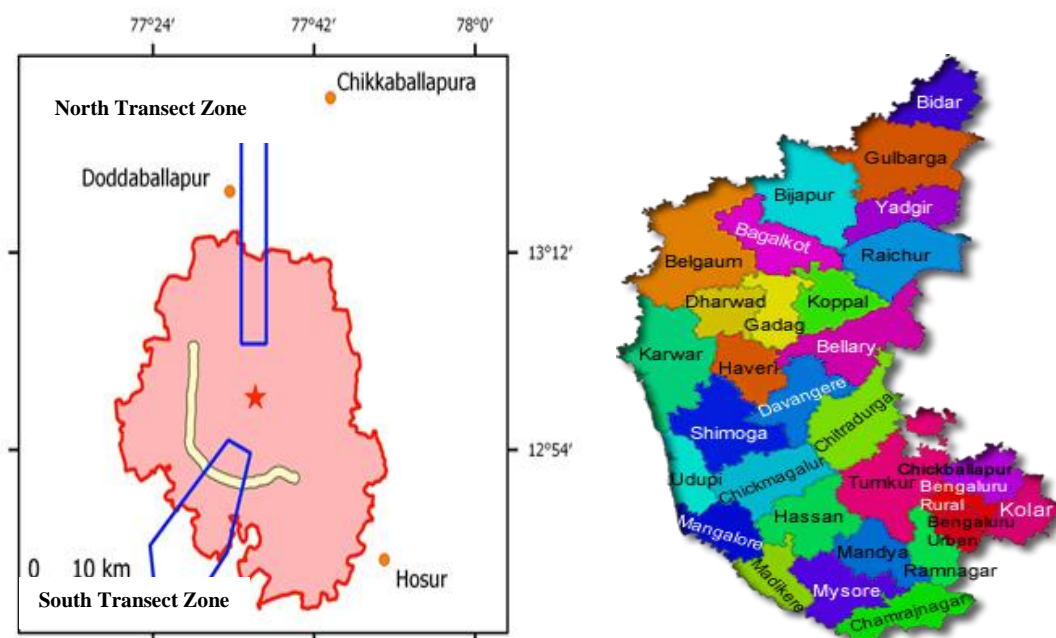


Fig.1: Map of Karnataka, Bengaluru and its rural urban interface

Bangalore the capital of Karnataka is one of the fastest growing mega cities in South India. In the context of this study which investigates social–ecological transition processes in the rural–urban interface of Bangalore was conducted in the North and South transects of Bangalore in 2016-2017. The North transect is a rectangular stripe of five km width and 50 km length, as shown in Figure-1. The lower parts of this transect cuts into urban Bangalore, and the upper part contains rural villages. The South transect is a polygon covering a total area of 300 km<sup>2</sup> following the methodology adopted by project. “Effects of urbanization on value chains and livelihoods of farmers and other stakeholders”, which considered the per cent of build-up area and distance from the city centre using GIS analysis of satellite images, and combining basic measures of building density and distance. The correlation of the two parameters and discontinuities in the frequency distribution of the combined index indicate highly dynamic stages of transformation, spatially clustered in the rural–urban interface [4].

Sampling frame consist of dairy farmers from the two transects, north and south Bangalore representing three layers viz., rural, transition and urban. A sample size of 50 households of dairy farmers from transition and rural layer and 20 from urban was selected randomly from the two transects to constitute a total sample of 240 household. In addition, 20 non-dairy farmers from each layer from both the transects were selected. Thus, the total sample size was 360 (Table

1) and sample farmers were interviewed personally using a well-structured pre-tested questionnaire. The red colour area corresponds to the districts under Bangalore administrative authorities. The outer ring road is shown in yellow. The blue contours indicate the Northern and Southern research transects the star mark indicate the reference point the Vidhana Soudha in the city centre.

### 2.2. Stratification and Village Sampling

The Northern and Southern transect were treated as separate populations when calculating the SSI (Survey Stratification Index) and allocating them to the six arbitrary strata for random sampling. In North transect 21 villages and in South transect 22 villages were selected as detailed in Table 2.

### 2.3. Nature and sources of data

In order to address the objectives of the study, data were obtained from the selected farmers using a pre-tested schedule developed for the study through personal interview. The information elicited from the respondent farmers pertained to cropping pattern, land holdings, socio-economic status, livestock status, cost and returns from the dairy animals. Further the data on sources of income, consumption and non-consumption expenditure, women involvement in dairy activity were also collected from the dairy and non-dairy farmers. Data collected pertained to the crop year 2016-17.

### 2.4. Analytical tools and techniques

The House hold Livelihood Security Index (HLS) uses a balanced weighted average approach with a large number of indicators, where each indicator contributes equally to the overall index. The indicators are grouped into different domains representing security areas such as economic, education, food security, health, habitat, and socio-network security.

This framework allows investigating a diverse range of indicators of Livelihood Security (LS). In this study 15 security indicators have been identified from the data set and broadly grouped them under six security domains: economic security, educational security food security, health security, habitant security, and socio-network security as used by [6]. Household level HLS indices are then constructed following [5].

Indicators are identified and it is assumed that each indicator has different weight to the overall LS index. The indicators are then standardized following the procedure adopted in measuring Life Expectancy in Human Development Reports (also adopted by [5]). For example, a standardized indicator  $j$  of a household is given by:

$$zind_j = \frac{\text{Indicator}_j - \text{Min}_j}{\text{Max}_j - \text{Min}_j} \quad (1)$$

Where minimum and maximum values of the indicators are from the same community to which the household belongs. After each indicator representing a particular livelihood security domain is standardized, then multiplying particular livelihood security domain with their respective weights. These weights are obtained using principal component analysis. The factor loadings and Eigen values for the principal components are obtained that explained per cent variation in the data set. For construction of livelihood indices, weights of individual indicators have been assigned on the basis of principal component analysis. To obtain weights, the extracted factor loadings are multiplied by the Eigen values, i.e., the 1<sup>st</sup> Eigen value is multiplied with the extracted factor loadings and 2<sup>nd</sup> Eigen value is multiplied with second extracted factor loadings, considering only absolute values.

Table 1: Sampling frame of dairy and non-dairy farmers for the study

Particulars	North Transect (n=180)				South Transect(n=180)			
	Urban	Transition	Rural	Subtotal	Urban	Transition	Rural	Subtotal
Dairy Farmers	20	50	50	120	20	50	50	120
Non-dairy farmers	20	20	20	60	20	20	20	60
Total	40	70	70	180	40	70	70	180

Table 2: Village stratification and sampling frame for the study

Stratum	SSI Boundaries	North transect		South transect	
		Villages per Stratum		Villages per Stratum	
		Total	Randomly Selected	Total	Randomly Selected
1 (Urban)	<0.167	5	2	14	3
2	0.333	9	2	10	2
3	0.5	9	3	13	4
4	0.667	18	5	26	5
5	0.833	30	4	23	6
6 (rural)	>0.833	22	5	12	2
Total		93	21	98	22

The values thus obtained across all principal components considered for the analysis are added in case of each indicator to get the weights for that particular indicator. Similarly, weights are obtained for other indicators, too. By summing all the weights, we get the grand total weight.

For construction of livelihood security, sum the entire indicators in each domain that is considered as HLS and grand total weights are also considered to workout composite livelihood security. Weights vary between households because of household level variation in the number of indicators.

$$LSi = \frac{\sum_{i=0}^n wiHLS}{\sum_{i=0}^n wi} \quad (2)$$

2.5. Conceptual framework of livelihood security

**Economic security** - Includes adequate and sustainable access to dairy, farm and off farm income, value of equipment, value of livestock, loan and saving that enable households to meet their basic needs.

**Educational security** – It includes expenditure on year of schooling such as school fees, books, tuition fees & uniforms etc.

**Food security** - Sustainable availability and access of a quantitative and qualitative (across seasonal and years) food basket that is culturally acceptable to the members of the household.

**Habitat security** - Adequate access to shelter, quality of housing, related habitat resources such as Kaccha or Pacca house.

**Health security** – Includes aspects of availability and accessibility to health services, expenditure towards health, quality of sanitation facility and drinking water.

**Social network security** – Includes organizational participation and expenditure to mass media.

2.6. Gini coefficient Co-efficient analysis

The Gini coefficient is a measure of inequality of income distribution. It is explained based on the Lorenz curve and it is the ratio of area between Lorenz curve of the distribution and the uniform distribution line, to area under uniform distribution line (45 degree) is the diagonal which divides the graph at 45 degrees line into half. The Gini coefficient ranges from 0 to 1, where 0 corresponds to perfect income equality and 1 corresponds to perfect inequality. The perfect equality in the distribution is obtained when the curve lies along the 45 degrees. The deviation from 45 degrees indicates the inequality and it is calculated by using the formula

$$G = 1 + \frac{1}{n} - \frac{1}{n^2Y} [y_1 + 2y_2 + 3y_3 + \dots + n y_n]$$

where,

G = Gini coefficient

n = Sample size

Y= Average Net farm income of farm household

$Y_1, Y_2, Y_3 \dots Y_n$  are net farm income of each sample farmer arranged in the ascending order of magnitude of  $y_i$ . The farmer who is having the lowest net farm income is first, and then next and so on.

### 3. Results and Discussion

#### 3.1. Livestock possession of sample farmers

It was observed/ found that households had propensity to keep livestock mainly for benefits realized, such as cash income, food, manure, draft power and hauling services, savings and insurance and social status and social capital. However, herd size of livestock was not uniform as among the dairy and non-dairy sampled households. Table 3 sheds light on the details of livestock possessed by the sample farmers. In the case of dairy sample households in rural layers, among the different livestock possession, the proportion of dairy cows (91.30% and 93.72%) was more followed by goats (4.89% and 4.35%) and sheep (1.91% and 1.93%) in north and south transects, respectively. In the transition layer, the proportion of dairy cows (94.27% and 93.59%) was more followed goat (3.82% and 3.21%) and sheep (1.91% and 3.21%) in both transects, respectively. Similarly, in urban layer also the proportion of dairy cows was the highest followed by goat and sheep.

Table 3: Livestock possession of sample farmers in study area

(Numbers)

Particular	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect (n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Milching cows	88 (98.88)	247 (94.27)	336 (91.30)	56 (100)	146 (93.59)	194 (93.72)	1067 (93.76)	-	-	-	-	8 (30.77)		8 (7.69)
Goat	-	10 (3.82)	18 (4.89)	-	5 (3.21)	9 (4.35)	42 (3.69)	-	7 (53.85)	19 (44.19)	2 (100)	5 (19.23)	11 (57.89)	44 (42.31)
Sheep	1 (1.12)	5 (1.91)	14 (3.80)	-	5 (3.21)	4 (1.93)	29 (2.55)	1(100)	6 (46.15)	24 (55.81)	-	13 (50)	8 (42.11)	52 (50.00)
Total	89 (100)	262 (100)	368 (100)	56 (100)	156 (100)	207 (100)	1138 (100)	1 (100)	13 (100)	43 (100)	2 (100)	26 (100)	19 (100)	104 (100)

Majority of farmers (98.88%) had dairy cows in north transect whereas all the farmers of south transect had only dairy cows. The non-dairy sample households in rural layers did not possess any dairy cows but had both goats (44.19% and 57.89%) and sheep (55.81% and 42.11%) in north and south transect, respectively. In transition layer, dairy cows accounted for 30.77 per cent in south transect, while goat (53.85% and 19.33%) and sheep (46.15% and 50%) found in both north and south transects, respectively. In urban layer of north transect only sheep was reared, while it was only goat in southern transect. Thus, in the overall study area, dairy cow constituted for the highest proportion of livestock than goat and sheep in the case of both the layers. Also, the livestock remained a major source of income for the farmers in rural layers. It was also observed that due to presence of dairy cooperatives and milk vendors, payments to the farmers were made regularly on weekly or fortnight. These findings are comparable with similar findings reported [1] in Mayani and Linthipe Extension Planning Areas (EPAs) in Dedza District.

#### 3.2. Magnitude of annual income of farmers

It is evident from Table 4 that among the sample households, annual income was higher in the case of dairy sample households (₹2,93,402) than non-dairy sample households (₹1,35,110). The layer-wise situation reveals that among dairy sample households, rural layer of North and South transects (₹2,42,024 and ₹2,25,637) dairy sample households' income was more than their counterparts in transition layer of North and South transects (₹ 2,19,831 and ₹1,95,594) and urban layer of North and South transects (₹ 1,63,296 and ₹1,75,310). Accordingly the income from agriculture also showed the same pattern with higher income levels in the case of rural layer of both North and South transect (₹1,16,875 and ₹77,288) income followed by transition (₹1,08,612 and ₹54,252) and urban (₹42,125 and ₹30,657) in north and south transects, respectively. Among non-dairy sample households, income was more in the case of urban layer (₹ 53,638) than their counterparts in transition layer (₹ 26,170 and ₹ 35,450) and rural (₹ 32,400 and ₹ 23,484) layers in North and South transects, respectively. Further the income from other activity was noticed only in urban layers of North and South transect (₹ 32,571 and 37,926) from casual labours and (₹ 70,497) from business only in south transect. It was observed in the study region that farmers depended not only on agriculture and dairy for their livelihood, but also on business, wage income, salary and remittances. The major reason to this could be a location of the region lies in the

urban fringes' agriculture was commercialized with a ease of access to nearby markets. As small agricultural holdings cannot compete with on-going changes, they have diversified themselves into different activities for earning livelihood.

Table 4: Average income sample respondents from different source of income generating activity in study area(₹)/household/ Year)

Particulars	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Agriculture	42,125	1,08,612	1,16,875	30,657	54,252	77,288	84,509	53,638	26,170	32,400		35,450	23,484	31,328
Dairying	1,63,296	2,19,831	2,42,024	1,75,310	1,95,594	2,25,637	2,10,781							
Casual labours								32,571				37,926		33,285
Business												70,497		70,497
Total	2,05,421	3,28,443	3,58,899	2,05,967	2,49,846	3,02,925	2,95,291	86,210	26,170	32,400	1,08,423	35,450	23,484	1,35,110

These findings are comparable with similar findings reported by in India [2].

### 3.3. Livelihood Security

Six different livelihood outcomes based on the various relevant features of the sample households of North and South transect, Bengaluru district have been assessed and results are presented in Table 5 to Table 13. The results presented in table gives information on average income, food quantity, food expenditure, health expenditure, education expenditure and mass media expenditure and comparative livelihood index scores for these various security indices for dairy and non-dairy sample households in the study region.

Table 5: Economic status across different economic security indicators in the study area (₹/Year)₹/Year)

Particulars	Dairy sample respondents						Pooled	Non-Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Income	2,05,421	3,28,443	3,58,899	2,05,967	2,49,846	3,02,925	2,95,291	86,210	26,170	32,400	1,08,423	35,450	23,484	1,35,110
Equipment	10,581	35,541	22,874	21,702	15,062	51,272	26,172	84,313	17,068	87,216	81,684	5,578	12,322	48,030
Loan	1,73,762	54,914	59,582	58,708	26,821	44,059	69,641	30,145	37,422	51,298	33,683	33,910	40,527	37,831
Livestock	10,8,883	1,22,299	3,12,349	1,25,065	1,54,288	2,92,607	1,85,915	5,525	8,532	10,326	4,536	6,329	7,563	7,563
Saving	28,708	80,767	55,117	1,25,359	86,657	72,696	74,884	12,358	18,035	48,268	44,280	34,855	62,099	36,649

Table 6: Consumption level of different food items in the study area (Quantity/Month)

Particulars	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transiti	Rural	Urba	Transitio	Rural	
Cereals (Kg.)	15.54	16.32	18.0	16.32	15.54	18.0	16.62	14.33	18.50	26.30	18.10	25.35	26.20	21.46
Pulses (Kg.)	5.58	5.87	6.45	4.38	5.87	5.58	5.62	5.31	4.66	5.98	3.38	5.23	3.45	4.67
Vegetables (Kg.)	21.15	17.26	14.7	21.10	17.26	14.7	17.72	17.90	14.80	15.95	33.30	26.65	15.10	20.62
Fruits (Kg.)	5.83	5.67	5.86	5.73	5.67	5.86	5.77	10.01	5.82	6.39	4.60	2.63	2.90	5.39
Oil(lt.)	5.25	5.10	4.45	5.20	5.10	4.45	4.93	4.13	6.25	4.85	3.82	3.13	3.00	4.20
Meat (Kg.)	3.74	3.07	2.26	3.96	3.47	3.53	3.34	7.85	2.96	3.62	4.11	3.42	3.56	4.25
Milk (lt.)	13.66	12.28	9.52	13.66	12.28	9.72	11.85	10.78	9.40	6.39	8.13	6.55	6.23	7.91
Sugar, species and nuts (Kg.)	7.02	5.20	4.35	4.57	5.20	4.34	5.11	6.44	9.49	18.65	7.17	7.11	5.04	8.98



Table 7: Item wise average expenditure on food and their share in total consumption expenditure in the study area (₹/Month)

Particulars	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=120)			South transect(n=120)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Cereals	491.52 (12.88)	504.80 (15.09)	654.85 (18.44)	545.94 (14.76)	427.90 (12.17)	650.40 (19.60)	545.90 (15.42)	541.85 (13.16)	651.40 (17.97)	1353.30 (31.93)	363.35 (11.56)	830.90 (23.23)	991.35 (35.56)	788.69 (22.02)
Pulses	616.82 (16.17)	602.50 (18.01)	702.55 (19.78)	484.30 (13.10)	661.14 (18.81)	600.57 (18.10)	611.31 (17.27)	618.45 (15.02)	402.18 (11.10)	728.43 (17.19)	388.25 (12.35)	450.97 (12.61)	453.93 (16.28)	507.03 (14.16)
Vegetables	657.65 (17.24)	639.30 (19.11)	551.40 (15.52)	784.25 (21.21)	552.78 (15.72)	401.66 (12.10)	597.84 (16.88)	557.75 (13.54)	470.20 (12.97)	454.35 (10.72)	882.55 (28.07)	740.85 (20.71)	452.95 (16.25)	593.11 (16.56)
Fruits	351.88 (9.22)	282.81 (8.46)	362.50 (10.21)	360.88 (9.76)	326.02 (9.27)	318.66 (9.60)	333.79 (9.43)	535.33 (13.00)	382.85 (10.56)	329.43 (7.77)	236.25 (7.51)	173.61 (4.85)	167.50 (6.01)	304.16 (8.49)
Oil	469.55 (12.31)	473.41 (14.15)	452.44 (12.74)	463.45 (12.53)	511.91 (14.56)	452.15 (13.62)	470.49 (13.29)	341.65 (8.30)	581.05 (16.03)	503.75 (11.89)	311.71 (9.92)	295.43 (8.26)	265.83 (9.54)	383.23 (10.70)
Meat	385.3 (9.22)	244.92 (7.32)	351.75 (10.85)	408.75 (11.05)	349.69 (9.95)	387.08 (11.66)	354.58 (10.01)	307.80 (10.02)	403.75 (11.14)	412.65 (7.26)	270.58 (7.56)	281.45 (7.87)	230.18 (8.26)	317.73 (8.87)
Milk	281.00 (10.10)	317.00 (7.32)	441.00 (9.90)	312.00 (11.05)	402.00 (9.95)	409.00 (11.66)	360.00 (10.01)	114.00 (7.47)	285.00 (11.14)	189.00 (9.74)	193.00 (8.61)	246.00 (7.87)	193.00 (8.26)	203.00 (8.87)
Sugar, species and nuts	346.69 (9.09)	280.02 (8.37)	250.64 (7.06)	234.08 (6.33)	284.26 (8.09)	203.89 (6.14)	266.60 (7.53)	997.10 (24.21)	447.87 (12.36)	371.77 (8.77)	345.39 (10.99)	416.40 (11.64)	326.87 (11.73)	484.23 (13.52)
Total	3815.68 (100)	3344.55 (100)	3552.07 (100)	3697.61 (100)	3515.53 (100)	3318.61 (100)	3540.67 (100)	4118.74 (100)	3624.70 (100)	4238.26 (100)	3143.82 (100)	3576.90 (100)	2787.58 (100)	3581.67 (100)

Note: Figures in parentheses indicates the percentage to the column respective total

Table 8: Expenditure on education by sample household across different layers and transect of study area(₹/Year)

Particulars	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Education	11,679	10,340	10,194	8,126	7,900	5,541	8,963	19,202	11,569	8,896	15,198	10,660	8,441	12,328

Table 9: Status of different health security indicators in the study area

Particulars	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Health Expenditure (Rs/Year.)	9491	6301	5546	5004	4176	3753	5712	4603	3933	2847	2578	2456	1410	2654
Drinking water Expenditure (₹/Year)	651	571	407	686	625	517	576	677	352	499	456	452	422	498
Insurance (Yes=1)	7 (35)	16 (32)	14 (28)	2 (10)	7 (14)	19 (38)	65 (27)	12 (60)	6 (30)	12 (60)	7 (35)	11 (55)	13 (65)	61 (51)
Insurance (No=0)	13 (65)	34 (68)	36 (72)	18 (90)	43 (86)	31 (62)	175 (73)	8 (40)	14 (70)	8 (40)	13 (65)	9 (45)	7 (35)	59 (49)
Latrine (Yes=1)	19 (95)	46 (92)	44 (88)	18 (90)	43 (86)	33 (66)	203 (85)	19 (95)	18 (90)	19 (95)	19 (95)	19 (95)	18 (90)	111 (92)
Latrine (No=0)	1 (5)	4 (8)	6 (12)	2 (10)	7 (14)	17 (34)	37 (15)	1 (5)	2 (10)	1 (5)	1 (5)	1 (5)	2 (10)	9 (8)

Note: Figures in parenthesis is the percentage to the column total

Table 10: Habitant security indicators in the study area(Numbers)

Particulars	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Habitant (Yes=1)	19 (95)	48 (96)	46 (92)	18 (90)	46 (92)	45 (90)	222 (92)	19 (95)	19 (95)	18 (90)	1 (5)	19 (95)	18 (90)	94 (78)
Habitant (No=0)	1 (5)	2 (4)	4 (8)	2 (10)	4 (8)	5 (10)	18 (8)	1 (5)	1 (5)	2 (10)	19 (95)	1 (5)	2 (10)	26 (22)

Note: Figures in parenthesis is the percentage to the column total

Table 11: Status of different social-network security indicators in the study area

Particulars	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Participation in organization (Yes=1)	5 (25)	30 (60)	38 (76)	9 (45)	27 (54)	37 (74)	146 (61)	15 (75)	16 (80)	9 (45)	11 (55)	14 (70)	13 (65)	78 (65)
Participation in organization (Yes=0)	15 (75)	20 (40)	22 (24)	11 (55)	18 (46)	8 (26)	94 (39)	5 (25)	4 (20)	11 (55)	9 (45)	6 (30)	7 (35)	42 (35)
Mass media expenditure (₹/Year)	3552	2947	2700	3409	3134	2801	3064	4729	4069	2118	2450	2336	2060	2960

Note: Figures in parenthesis is the percentage to the column total

Table 12: Livelihood security indices of dairy and non-dairy farmers in the study area

Particulars	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Low	0.23	0.39	0.35	0.45	0.68	0.52	0.44	0.58	0.49	0.45	0.35	0.27	0.21	0.39
Medium	0.72	1.13	0.70	0.68	1.92	0.63	0.96	0.61	0.98	0.98	0.80	0.65	0.40	0.74
High	1.33	1.66	1.42	1.05	2.87	1.10	1.57	1.24	0.85	0.86	1.33	1.00	0.62	0.98
Total	2.28	3.18	2.47	2.18	5.47	2.25	2.97	2.43	2.32	2.29	2.48	1.92	1.23	2.11

Table 13: Distribution of sample respondents across the livelihood security index level in the study area

Particulars	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Low	7 (35)	17 (34)	19 (38)	5 (25)	15 (30)	14 (28)	77 (32)	5 (25)	6 (30)	6 (30)	5 (25)	8 (40)	9 (45)	39 (33)
Medium	8 (40)	16 (32)	19 (38)	10 (50)	16 (32)	24 (48)	93 (39)	11 (55)	6 (30)	7 (35)	11 (55)	4 (20)	5 (25)	44 (37)
High	5 (25)	17 (34)	12 (24)	5 (25)	19 (38)	12 (24)	70 (29)	4 (20)	8 (40)	7 (35)	4 (20)	8 (40)	6 (30)	37 (31)
Total	20 (10)	50 (100)	50 (100)	20 (100)	50 (100)	50 (100)	240 (100)	20 (100)	20 (100)	20 (100)	20 (100)	20 (100)	20 (100)	120 (100)

Note: Figures in parenthesis is the percentage to the column total and analysis was done only for the available data



Table 14: Estimates of Gini coefficients for income inequality of sample respondents in study area

Particulars	Dairy sample respondents						Pooled	Non- Dairy sample respondents						Pooled
	North transect(n=120)			South transect(n=120)				North transect(n=60)			South transect(n=60)			
	Urban	Transition	Rural	Urban	Transition	Rural		Urban	Transition	Rural	Urban	Transition	Rural	
Gini Coefficient	0.23	0.43	0.37	0.32	0.26	0.27	0.31	0.51	0.63	0.47	0.54	0.47	0.39	0.50

### 3.4. Economic Security

It is evident from Table 5 that for the sample households, average annual income earned was more than double in the case of dairy sample (₹2,93,402) respondent than non-dairy sample households (₹1,35,110). In dairy sample households, economic value of Livestock (₹1, 85,915), loan (₹69,614) and saving (₹74,884) was more than the non-dairy sample households except for equipment's. Among dairy sample households, rural (₹2,42,024 and ₹2,25,637) dairy sample households' income was more than transition (₹2,19,831 and ₹1,95,594) and urban (₹1,63,296 and ₹1,75,310) in north and south transects, respectively. With respect to other economic indicators such as equipment and savings were found to be high in transition layer, while, urban layer showed more loan and rural layer showed more value of livestock asset in North transect. Similarly, south transect the equipment and livestock was more in rural layer while loan and savings value uses are more in urban layer. On the other hand, in the case of non-dairy sample households, the average income per household in non-farm activity was ₹1,35,110. Layer-wise, analysis revealed that the average income was more in urban (₹86,210) followed by rural (₹32,400) and transition (₹26,170) in North transect while in South transect income was more in urban (₹1,08,423) followed by transition (₹35,450) and rural (₹23,484) from the business, casual labour and agriculture. With respect to other economic indicators such as equipment, livestock, loan and savings were high in rural layer in North transect than counterpart. In South transect, equipment's value was more in urban layer, while livestock, loan and saving were higher in rural layer.

Agriculture was the only income generating source in transition (₹26,170 and ₹35,450) and rural (₹32,400 and ₹23,484) layers of north and south transects. In the study region farmers depended not only on agriculture and dairy for their livelihood, but also on equipment, livestock, loan and savings. Urban sample farmers were also practicing agriculture and dairying. This was because as the region lies in the urban fringes, agriculture was commercialized with good access to market. Small agricultural holdings cannot compete with on-going changes thus they had diversified themselves into different activities for earning livelihood. During off season they earned income from rented equipment for their livelihood security along with that they give their equipment for rent. One study mentioned in their study that farmers were secured due to outputs generated through sericulture and dairy enterprises throughout the year made them economically secured [3].

### 3.5. Food security

The standards of living of rural households were easily measured by household consumer expenditure, income and productive assets, their indebtedness, farming practices and preferences, resource availability, their awareness of technological developments and access to modern technology. The household consumption expenditure is one of the indicators of food security.

#### Consumption pattern of food by farm households

Monthly consumption of cereals, pulses, vegetables, etc. in terms of physical quantity was analysed and the results are presented in Table 6. The monthly consumption of pulses (5.78 Kg.), fruits (5.77Kg.), oil (4.85lt.) and milk (11.40 lt.) in case of dairy sample household was more than in the case of non-dairy sample households while, the consumption of cereals (21.46Kg.), vegetable (20.62Kg.), meat (4.25Kg.) and sugar, spices and nuts (8.92Kg.) was more in non-dairy sample households. Among the dairy sample households, cereals was more in rural layer followed by transition (18.00 and 16.32 Kg.), while vegetable (21.15 Kg and 17.26Kg.) and oil (5.25lt and 5.10 lt.) consumption was more in urban layer followed by transition in north transects, while in south transect cereals was more in rural followed by urban (18.00 and 16.32 Kg.), vegetable (21.10 Kg and 17.26 Kg.) and oil (5.20 lt and 5.10 lt.) consumption were more urban followed by transition. pulses, fruits, meat and sugar showed mixed trend across the regions.

In non-dairy households also cereal consumption was more in rural layer followed by transition and urban, pulse (5.98Kg.) consumption was also more in rural layer followed by urban and transition, while consumption of vegetables (17.90Kg.), milk (10.78lt.), meat (7.85Kg.) and fruits (10.01Kg.) were consumed more in urban layers than in rural and transition. The consumption of oil (6.25Kg.) was more in transition, while sugar, spices and nuts (18.65Kg.) consumption was more in rural layer than in other layer in North transect. While in South transect, the consumption of vegetable (33.30Kg.), fruits (4.60Kg.), oil (3.82lt.), meat (4.11Kg.), milk (8.13lt.) and sugar (7.17Kg.) etc. was more in urban layer than in the other layer, while quantity of pulses (5.23Kg.) consumed was more in transition and that of cereals (26.20Kg) consumed was more in rural layer.

The consumption pattern is one of the important economic variables influenced by urbanization attributed to demonstration effect. Table 6 clearly identify the difference in the pattern of consumption expenditure on food items among the three layers of North and South transect of dairy households. However, it was observed that milk consumption was comparatively less in non-dairy sample household; in contrast, non-dairy families consumed more of cereals, vegetables and meat. Similar study reported that sericulture based dairy farming could be great option to provide food security and nutritional security for farmers [3].

### **Monthly consumption expenditure on food items by farm households**

The Table 7 depicts the share of different food item in the household monthly expenditure. The total expenditure on food items was more in the case of non-dairy sample households (₹3526/month) compared to dairy households (₹3581/month).

In the monthly expenditure of dairy households on food items, the highest proportion was spent on pulses (17.76 %) followed by vegetables (16.08 %), cereals (15.65 %), oils (13.37 %), meat (9.75 %), milk (10.67 %) etc. Similarly, in case of non-dairy sample households, as high as about (22.02 %) of the total expenditure was spent on cereals followed by (16.56%) on vegetables (14.16%) on pulses (10.70%) on oils (8.87%) on meat, (8.87%) on milk, etc.

Among the dairy sample households, urban households were spending higher amount both in the north (₹3,816) and south transects (₹3,698). Similarly, rural households (₹3,552) were spending comparatively more than their counterpart in transition (₹3,344) in North transect, while it was reverse in the case of South transect. In case of non-dairy sample households, rural households (₹4,238) spent more on consumption followed by urban (₹4,119), transition (₹3625) in north transect, while in south transect, the food expenditure was more in transition (₹3,577) followed by urban (₹3,144) and rural (₹2,788) layer. The variation in the monthly consumption expenditure over different dairy and non-dairy sample households may be due to differences in their income level and health conscious. These findings are comparable with similar findings reported in district of Kolar and Chikkaballapur, Karnataka [3].

### **3.5. Education security**

The educational security has been captured by indicators like expenditure on education (years of schooling) and presented in Table 8. Generally, the literacy level of dairy and non-dairy sample respondent is associated with income. The amount of expenditure on education by non-dairy sample households (₹12,328) was comparatively higher than dairy sample households (₹8,729). Among the dairy sample households, spending on education was more in urban layer (₹11,679 and ₹8,126), followed by transition (₹10,340 and ₹7,900) and rural (₹10,194 and ₹5541) layer both in North and South transects, respectively. The similar pattern spending was found in the case of non-dairy sample households, that is the education expenditure was more urban layer (₹19,202 and ₹15,198) followed by transition (₹11,569 and ₹10,660) and rural (₹8896 and ₹8,441) layer in north transect and south transect, respectively. The above findings revealed that, irrespective of transect, the average monthly education expenditure was found to be the highest in urban layer followed by transitional and rural layer. Further, there was significant difference in spending on education between

north and south transect across different layer. Education expenditure was relatively more in non-dairy sample households than dairy sample households, which indicates that non-dairy sample households had more awareness about education for than the dairy sample households. These may be attributed to the combined effects of factors such as in rural layer most of the children were studying in government schools and in dairy sample households engage their children's in various dairy related activities such as feeding, washing, watering etc. Similar study revealed that in their study dairy farmers of had significantly higher educational security than the other blocks of Nadia district [7].

### 3.6. Health Security

The health security of sample households was measured by the level of their spending on health, quality of drinking water, access to health services and the quality of sanitation facilities. Expenditure of sample households on health and drinking water were used to assess health security index (Table 9). Results revealed that, expenditure on health by dairy sample households (₹5,327) was double the expenditure done by non-dairy sample households (₹2,971).

Among dairy sample households, across different layers, the health expenditure was relatively more in urban layer both in north (₹9,491) and south (₹5,004) transect compare to the households in rural layer both north (₹5,546) and south (₹3,753) transects. In case of non-dairy sample households, the health expenditure was relatively more in urban (₹4,603) followed by transition (₹3,933) and rural layer (₹2,847) in north transects, Similar pattern was observed in south transect with higher health expenditure in urban (₹2,578) followed by transition (₹2,456) and rural (₹1,410). Further, dairy sample households (₹553) spending more on drinking water than non-dairy sample households (₹476). Among the three layers, urban sample households were spending more on drinking water than households in transition and rural layer in both dairy and non-dairy sample households. As high as 51 per cent of non-dairy sample households were having health insurance as against only 27 per cent in case of dairy sample household respondents.

Among dairy sample households, there was significant difference between North and South transects in terms of health insurance coverage in urban (35 % and 10 %) and transition layer (32 % and 14 %). In contrast, about 28 per cent and 38 per cent of the households were health insured in rural layer correspondingly in north and south transects. Similarly, in non-dairy sample households, there was significant difference between north and south transects in terms of proportion of respondent were health insured in urban (60% and 35%) and transition layer (30% and 55%). In contrast, in rural layer, more proportion of households were health insured in north (60 %) and south (65 %), transect. Good number of farmers had latrine facility in non-dairy (92 %) than dairy sample households (85%). Among the three layers, irrespective of transects, higher proportion of sample farmers had latrine facility in urban layer followed by transition and rural layer both in dairy and non-dairy sample households. Health expenditure was more among dairy sample households than non-dairy farmer, which indicates that dairy sample households are more conscious about health than the non-dairy sample households. Another study showed that health security among the dairy farmers of Chakdah block were significantly higher [7].

### 3.7. Habitant Security

Possessing a house to live (to some extent) determine the level of households' habitant security and also plays an important role in determining the livelihood security of the households. Hence, status of house possession of the sample households was analysed and the results are presented in Table 10. The majority of households had pacca house in case of both dairy (92 %) and non-dairy sample households (78 %). Among the three layers, irrespective of transect, more number of households in urban layer were having pacca house followed in transition and rural except in non-dairy sample households of south transect in urban layer sample households are more conscious about health than the non-dairy sample households. Similar findings showed respondents had some good infrastructure facilities at household level i.e. house for leaving, animal and sericulture rearing etc [3].

### 3.8. Social-network security

Social network security is defined as the capacity of individuals to maintain and participate in social networks that reduce risks and help them to overcome deprivation, expenditure on mass media such as television and newspapers etc. It is important to know the social-network participation of the sample households in the study layer. Hence, social-network security indicators of sample households were computed and compared between dairy and non-dairy sample households. The Table 11 reveals that, as compared to dairy sample households (61 %), relatively higher proportion of

non-dairy sample households (65%) was having membership in one or the other organization. Among dairy sample households, higher proportion of farmers having membership in one or the other organization in rural layer (76% and 74 %) than in transition (60% and 54%) and urban layer (25% and 45%) in both north and south transect.

Similarly, in non-dairy sample households, more proportion of households in transition layer (80%) had more membership followed by urban (75%) and rural (45%) in north transect, whereas in south transect it was in transition layer followed by rural and urban layer. Most of the sample households of dairy sample households were members in rural than transition and urban layer due to the reason that in rural layer farmer have more opportunity than in transition and urban layer. Comparatively non-dairy sample households had high degree of membership than dairy sample households this was due to fact that the non-dairy sample households have more opportunity than the dairy sample households.

Further, mass media expenditure was more or less same between dairy sample households (₹2,993) than non-dairy sample households (₹2,960). Among the three layers, farmers in urban layer were spending more on mass media followed by transition and rural layer in both transect of dairy and non-dairy sample households. The social network implies the level of participation by the households in organizations like Panchayat, Co-operatives, Self Help Organizations and other organizations. In addition, access to social network elements like phone and television is another factor which determines social network status of households. Similar findings revealed that also mentioned higher social status in the society. Sericulture based dairy farming indirectly provides education to the children in the family. It also reduces the gender discrimination as the women were involved in the most of the sericulture and dairy farming activities [4].

#### **Over all livelihood security**

Based upon the indicators of the different aspects of livelihood security, the overall livelihood security outcomes are categorized into three ranges, viz., and low, moderate and high on the basis of attained livelihood security scores. The details regarding the basis of stratification into low, moderate and high have been presented in Table 12 Livelihood security index was developed by using Income Security, Food Security, Education Security, Health Security, Habitat Security and Social- Network Security. Based on the classification procedure, the computed livelihood security indices were divided into three categories such low, medium and high; and the results of the same are presented in Table 12. The analysis of the data indicates that, the livelihood index value was higher among dairy sample households (0.99) than the non-dairy sample households (0.70).

Among dairy sample households, the average livelihood index of low, medium and high category was 0.44, 0.96 and 1.57, respectively. Among the three layers, in North transect, the average livelihood index was higher in transition layer (1.06) followed in rural (0.82) and urban layer (0.76). The similar pattern of distribution was noticed in South transect that is livelihood index was higher in transition layer (1.82) followed in rural (0.75) and urban layer (0.73). These results reveal that the household belongs to transition were more secured than rural and urban layer in both North and South transects. In case of non-dairy sample households, the average livelihood index of low, medium and high category was 0.39, 0.74 and 0.98, respectively. Across three layers, the average livelihood index was higher in urban layer (0.81 and 0.83) followed by transition layer (0.77 and 0.64) and rural (0.76 and 0.41) in both North and South transect. This implied that the household belongs to urban layer were more secured than transition and rural layer.

In dairy sample households, the rural and transition layer showed more secured in terms livelihood than the urban layer indicating dairy farming helps to fulfil the basic needs of dairy sample households, helps to up lift the farmers from poverty and also help in increased the standard of living. On the contrary, in non-dairy sample households, the transition and urban layers appeared to be more secured than the rural layer because transition and urban layer had more non-farm activities than rural so that they were getting assured income. These findings are comparable with similar findings reported by 46.11 per cent of the respondents had high level of livelihood security through sericulture based dairy farming followed by very high level of livelihood security (22.22%). The majority of respondents had high to very high level of livelihood security [3].

## Distribution of sample households based on livelihood security index level

The results on livelihood security index wise distribution of households Table 13 revealed that the highest proportion of households were belong to medium livelihood security level (39 % and 37 %) in both dairy and non-dairy sample households, while the least proportion were belonged to high livelihood security level (29 % and 31 %) in both dairy and non-dairy sample households. There was difference between urban, transition and rural layer across the different levels of livelihood security index in both dairy and non-dairy sample households.

In North transect dairy sample households, among the three layers, the highest proportion of farmers belonged to medium level of livelihood security in urban layer (40%), to low and high level of livelihood security in transition layer (34%) and to low and high level of livelihood security in rural layer (38%). While in south transect, the major of proportion of farmers belong to medium (50%), high (38%) and low (24%) and high (24%) level of livelihood security index in urban, transition and rural layer, respectively. With respect to the non-dairy sample households, in north transect, the highest proportion of farmers belonged to medium level of livelihood security in urban (55%), high level of livelihood security index in transition layer (40%) and medium and high level of livelihood security index in rural layer (35%). While, in south transect, the major proportion of farmers belonged to medium, low and high; and low level of livelihood security index in urban, transition and rural layer, respectively.

### 3.9. Impact of dairying on equity

The impact of urbanization on dairy and non-dairy was analyzed in terms of equity and results are presented in Table 14. The Gini coefficient used to assess the income equity as influenced by dairying and non-dairying across urban, transition and rural layers showed higher degree of equality in the distribution of income across urban, transition and rural farmers as indicated by Gini coefficients. The Gini coefficient value of dairy sample households was lower (0.31) than in case of non-dairy sample households (0.50). This indicated the income is fairly distributed among dairy sample households compared to the non-dairy sample households.

Further, in dairy sample households, higher degree of unequal distribution income with Gini co-efficient of 0.43 was found in transition layer of north transect and in urban layer of south transect it was 0.32 indicating fairly distributed income. In respect of non-dairy sample households, income distribution was very unfairly distributed in transition layers (0.63) of north transect and in urban layer (0.54) of south transect while distribution was relatively fair in rural layer of both north (0.47) and south transect (0.39). These results showed that among non-dairy sample households' income was relatively more unequally distributed than among the dairy sample households. This was due to wide range of non-dairy activities within the farm households like agriculture wage earners, salaried member etc.

## 4. Conclusion

The results showed that dairy activity was economically more feasible as indicated by livelihood index (0.99) than non-dairy activity (0.70). Among the dairy farmers, rural dairy farmers were more secured in terms of livelihood and income than farmers in transition and urban layers. As this might be due to their assured high income from dairying Irrespective of regional differences in opportunities, people in urban squatters appear almost equally insecure. This does not mean that the same intervention strategy is equally applicable everywhere. There are geographical differences in the component indicators, access to resources which available to them, their employment and capital endowment should be taken into consideration to design livelihood security index.

### Scope of the study

Rapid urbanization of rural area surrounding Bengaluru urban conglomerate is effecting changes in the structure of dairy enterprise. This study will address the changes in livelihoods of different stakeholders associated with dairy enterprise. Hence, findings of the study would help in formulating suitable policy framework pertaining to dairy sector in the state.

### Limitations of study

The present study has mainly relied on the data collected through interviews using a pre-tested schedule. Therefore, some amount of recall bias is bound to be associated with the collected data since the respondents did not maintain any record about the cost/expenses/ expenditure and returns for crops, subsidiary enterprises, pattern of food



consumption, education and health. However, efforts were made to minimize them through crosschecks at the time of data collection. However, the degree of discrepancy if any would be negligible as the estimates presented are in averages.

## Acknowledgment

The authors thanks DBT for providing Junior Research fellowship to her under Indo-German Collaborative Project that leads to Ph.D. degree programme.

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