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'To farm or not to farm?': Determinants of farmer's dairy farming decisions in India: Empirical evidence from regions with different levels of dairy development

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ABSTRACT

Dairy is a supplementary enterprise and a major source of income for marginal and landless farmers. The factors underlying the farmers' decision on dairying in India have been examined. The study was undertaken in three states viz., Haryana, Maharashtra and Odisha representing varying level of dairy development. This study employs the sustainable livelihoods approach and binary logit model to explain the determinants of dairying. A significant difference in farmers' decision to exit dairy farms across states was noticed. The findings revealed that various dimensions of human, social, economic, natural, and physical assets influence decisions on livelihood transition of dairy farmers. The economic assets such as higher share of dairy to total income prevented farmers from quitting dairy farming while higher off-farm income promoted farmers to quit milk production. Literate farmers from Haryana had more inclination to quit dairy farms as the opportunities in the off farm employment increases with increase in education. Family size, an important human capital discouraged the livelihood transition from farming to non-farm activities in Haryana and Odisha. Social participation of farmers in Haryana and Maharashtra found to be effective in retaining farmers in dairy farming, while extension contact in Haryana favored towards retention. Mass media contact in Maharashtra diverts farmers towards off-farm activities. Trainings related to dairy farming and women participation encourage farmers to continue dairying in Odisha.

Key Words: *Dairy farming, Farmer's decision, Farm exit, Sustainable livelihood assets*

INTRODUCTION

Indian dairy sector has achieved rapid strides and transformed itself from milk deficient to surplus producer owing to the operational flood programme. India is the global leader in milk production. With rapid urbanization, increasing per capita income, changing consumption pattern and burgeoning population, future milk demand has been increasing at a faster pace than the growth in production. Unless the milk production increases at required pace, there is a possibility of widening gap in supply of milk, which could lead to a dependence on imports. At the same time, some milk producers are not finding milk production to be remunerative and switch over to alternate livelihood sources (NDDB, 2011) especially with the small holders despite their significant share to total production. Indian dairy sector is witnessing a structural transformation since many divert towards off-farm livelihood sources. Latest census 2011 reported that during 2001 and 2011a drop in the number of farmers in the country was found by 9 million, therefore, there would be lesser hands to produce and more mouths to feed. On the other hand pressures emanate from natural resource constraints, increasing fragmentation of holdings, frequent climatic variations, rising input costs and post-harvest losses pose an enormous challenge to agricultural growth. Therefore, this investigation was undertaken to study the factors determining farmers' decision to quit dairy farming.

Literature on decision of farm exits in developed countries focused on policy guidelines to retain them as the small portion of the population engaged in farm production, registered and large scale of farm (Kimhi and Bollman, 1999; Goetz and Debertin,

2001; Stiglbauer and Weiss, 2000; Pietola et al., 2002; Bragg and Dalton, 2004; Foltz, 2004; Vare and Heshmati, 2004; Glauben et al., 2006). Many of these studies focused on socio-economic forces influencing farm exit such as off-farm employment, government payments, land and livestock ownership, land size, returns from off-farm employment opportunities, types of farm enterprises, and. Some studies also examined the influence of demographic factors such as gender, family size, farm operators' age, marital status, and number of children (Kimhi and Bollman, 1999; Stiglbauer and Weiss, 2000; Pietola et al., 2002; Vare and Heshmati, 2004; Glauben et al., 2006).

Studies of farm exit or livelihood transition are very scanty in developing countries (Bhandari, 2013) including India. To have a better understanding of why some farmers make the strategic choice to quit the milk production while others choose to continue their businesses, the present study employed the sustainable livelihoods approach, to get deeper understanding of the livelihoods of milk producers. An attempt has been made to empirically examine the influence of various livelihood assets on farmer's decision to quit dairy farming as a source of livelihood in India. It is also necessary to understand the reasons that trigger the behavior of farmers' for effective policy formulation (Pietola and Lansink, 2001). Keeping in view the spatial, agro-ecological diversity of the country and regional disparity in dairy development across the states (Raut, 2002, Jha 2004, Saikia and Kakaty, 2007, Gupta and Purohit, 2010, Kumar et al., 2013, Dadhich, 2015, Kale et al 2016) the present study was undertaken in three Indian states with different level of dairy development.

METHODOLOGY

2.1 Sampling Plan

Keeping in view the regional disparity in dairy development across India(Raut, 2002, Jha 2004, Saikia and Kakaty, 2007, Gupta and Purohit, 2010, Kumar et al., 2013, Dadhich, 2015), the states were classified into three categories of development viz. high, moderate and less based on the Dairy Progressiveness Index (Kale et al 2016). The present study was undertaken in three randomly selected Indian states with different level of dairy development namely; Haryana, Maharashtra and Odisha respectively from high, moderate and less developed states. All the districts from each selected state were grouped into three categories i.e. high, medium and low based on the per day milk productivity per bovine milch animal . One district from each category was selected randomly, thus a total of nine districts (3 districts from each state) were chosen for the study. Further, one block from each district was selected randomly and hence, a total of nine blocks were selected. After selection of the blocks, a list of villages having dairy animals from each block was prepared in consultation with block level veterinary officer. Subsequently, a total of eighteen villages were selected randomly for the study by selecting two villages from each block. From each village, 50 dairy farmers having at least one milch animal were selected to gather information. Altogether, 900 dairy farmers comprise the sample size for the present study. The selected dairy farmers were interviewed with the help of structured interview schedule by face to face interview.

2.2 Data analysis

In order to understand the factors determining the future decision of respondents to quit dairy farming as an occupation in near future, Binary logit model was run. The explanatory or independent variables were selected based on the extensive review of literature and expert consultation. The planning and decision making capacity of the farmers are largely influenced by the combined effect of different livelihood assets, viz. physical, human, natural, financial and social. Therefore, 15 variables/indicators were collated from literature review and in consultation with experts (Table 1).

To find out the highly significant explanatory variables, binary logit model was run using stepwise regression (forward wald approach). In the forward stepwise procedure, one explanatory variable is

added in the model at a time based on the highest Wald or the likelihood ratio statistics with the entry criterion (p=0.05). As each new variable is added to the model, all of the existing explanatory variables in the model are evaluated and variables are removed using removal criterion (p=0.10) based on the Wald or likelihood-ratio test variables. When no more variables meet the entry or the removal criteria, the algorithm of selecting significant variables stops. For all the three states namely, Haryana, Maharashtra and Odisha, the initial variables entered in the logistic regression equation were age, sex, family size, education level, training undergone, share of income from dairy to total income, off-farm income, institutional loan availed (categorical variable), land holding, herd size, social participation, mass media exposure, extension contact, organised milk market and area under fodder.

The Mathematical notation of binary logit model is

$$\text{Logit (p)}=\log \frac{Pi}{1-Pi}$$

$$\log \frac{Pi}{1-Pi} = \beta_0 + \beta_1 X1 + B_2X_2 + \ldots + B_{15}X_{15}$$

Where; Pi = Probability of the decision to quit. βo = Constant term. β = Coefficients. X = Independent variables.

Before regression analysis, it is imperative to determine whether there is a similarity between the independent variables in a model. Similarities between the independent variables will result in a very strong correlation. Therefore, muti-collinearity test was done based on variance inflation factor (VIF) value using SPSS. If the VIF value lies between 1-10, then there is no multicollinearity (Kutner et al., 2004). The results of the test showed that VIF values were found in the range of 1 to 4 indicating the absence of muti-collinearity among the selected variables.

Table 1
Sustainable Livelihood Asset Framework

Human Asset	**Economical asset**
Age	Share of income from dairy to total income
Gender	Annual off-farm income
Education of the respondent	Institutional loan availability
Family size	Organized milk marketing
Training undergone	Area under fodder
Social asset	**Natural and Physical asset**
Social participation	Herd size
Mass media exposure	Land holding
Extension contact	

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RESULTS AND DISCUSSION

3.1 Descriptive statistics:

Descriptive statistics presented in Table 2 shows the status of livelihood assets possessed by the livestock rearers in Haryana, Maharashtra and Odisha states.

Table 2
Descriptive statistics for livelihood assets of sample farmers

Livelihood Assets	**Haryana (n=300)**		**Maharashtra (n=300)**		**Odisha (n=300)**	
Age (Years) (M ± SE)	44.82 ±0.77		42.75 ±0.71		46.43 ±0.72	
Family size (M ± SE)	7.58±0.21		5.80±0.17		7.25±0.24	
Social Participation (M± SE)	1.60±0.07		1.88±0.72		1.39±0.67	
Mass Media Contact (M ± SE)	7.28±0.21		7.31±0.22		4.82±0.16	
Extension Contact (M± SE)	11.88±0.22		11.76±0.22		9.36±0.16	
Herd Size (M± SE)	7.84±0.38		8.23±0.51		5.42±0.30	
Land Holding (Ha.) (M± SE)	1.60±0.11		1.77±0.11		0.52±0.04	
Annual Off-farm income (Rs.) (M ± SE)	93537 ±7777.10		55967 ±4332.52		75854 ±3455.36	
Share of Dairy to Total Income (M ± SE)	29.64±1.20		26.61±1.18		24.63±1.15	
Sex	**F**	**%**	**F**	**%**	**F**	**%**
• Male	269	89.67	266	88.67	229	76.33
• Female	31	10.33	34	11.33	71	23.67
Education						
Illiterate	62	20.67	29	9.67	81	27
Literate	238	79.33	271	90.33	219	73
Training undergone						
No	273	91.00	298	99.33	264	88.00
Yes	27	9.00	2	0.67	36	12.00
Fodder from own field	258	86	118	39.33	11	3.66
Institutional credit availed	22	07.33	32	10.67	8	2.67
Organised marketing	148	49.33	188	62.67	81	27

F-Frequency, %- Percentage, M-Mean, SE-Standard Error

The average age of the sample respondents was found to be lowest in Maharashtra (42.75) followed by Haryana (44.82) and Odisha (46.43). The average family size was highest in Haryana (7.58), followed by Odisha (7.25) and Maharashtra (5.80). Social participation was more in Maharashtra (1.89), followed by Haryana (1.60) and Odisha (1.40). Average score of mass media contact (7.31) was highest in Maharashtra, followed by Haryana (7.28) and Odisha (4.82). Average score of extension contact was more in Haryana (11.88), followed by Maharashtra (11.76) and Odisha (9.36). The average herd size per household was more in Maharashtra (8.23) than Haryana (7.84), whereas in Odisha it was found to be low (5.42). The average land holding was more in Maharashtra (1.77 ha), followed by Haryana (1.60 ha) and Odisha (0.52 ha). The average annual off-farm income was more (Rs. 93536) in Haryana, followed by Odisha (Rs. 75854) and Maharashtra (Rs. 55967). Share of dairy to total income was more in Haryana (29.64), followed by Maharashtra (26.61) and Odisha (24.63). As the most of the farmers are small and marginal farmers, they were found engaged in labour Self-employnment, Shopkeeping, milk vending, Animal trading Commission Services vegetable vendor, brick kiln owner or worker etc., Sample respondents were predominantly males with the female comprising only 10.33 per cent in Haryana, 11.33 per cent in Maharashtra and 23.67 per cent in Odisha. Male members in Odisha were

mostly involved in non-farm activities including their out-migration to cities and town and hence a quarter of respondents in Odisha were found to be females. Literate farmers were more in Maharashtra (90.33 %), followed by Haryana (79.33 %) and Odisha (73 %). Only nine per cent respondents in Haryana followed by Odisha (7.22%) and Maharashtra (0.67%) had undergone training related to dairying. Around 86 per cent of the respondents cultivated fodder crops in Haryana, followed by Maharashtra (39.33%) and in Odisha only 3.66 per cent. Most of the households were depend on the non-institutional sources or without credit as only a few respondents availed institutional credit in Odisha (2.67%), Haryana (7.33%) and Maharashtra (10.67%). Most of the sampled households in Maharashtra (62.67%) sold the milk to the organised marketing agencies such as cooperative societies and private dairies. While in Haryana, flow of milk to unorganized milk marketing agencies (50.67%) was slightly more than organized sector (49.33%). The dominance of unorganized agencies in milk marketing (73%) was seen in Odisha.

3.2 Future decision of the dairy farmers

Table 3
State-wise distribution of dairy farmers based on future decision to quit dairy farming as an occupation

Future decision	Haryana (n=300)		Maharashtra (n=300)		Odisha (n=300)	
	Frequency	Percentage	Frequency	Percentage	Frequency	Percentage
Quit dairy farming	90	30	72	24	62	20.67

4.3 Determinant of future decision to quit dairy farming in Haryana (Highly dairy progressive state)

Dependent variable

0= Decision to continue dairy farming

1 = Decision to quit dairy farming

Table 4
Determinant of future decision to quit dairy farming in Haryana (Highly dairy progressive state) (n = 300)

Explanatory Significant Variables (X_i)	**Estimates (β)**	**S.E.**	**Wald**	**Exp(β) or Odds Ratio**
Constant	6.553***	1.147	32.627	701.332
Family size	-0.291***	0.089	10.797	0.747
Educational level 0: Illiterate and 1: Literate	1.599***	0.545	8.601	4.948
Share of income from dairy to total income	-0.086***	0.020	19.080	0.918
Off-farm income	0.000***	0.000	22.253	1.000
Social participation	-1.036***	0.229	20.389	0.355
Extension contact	-0.259***	0.060	18.372	0.772
Organized market	-1.277***	0.428	8.901	0.279
Chi-square (7df):218.191 Nagelkerke R Square:0.517	Log likelihood: 148.328 Cox & Snell R Square:0.733			

Note: *** indicate the significance at 1per cent level of probability.

In the case of Haryana, estimates of the binary logit model following stepwise regression (forward wald approach) indicated that the fitted model is valid based on the significant Chi-square statistic (218.19). Post stepwise regression, only seven variables turned as significant (Table 4). The 'beta' coefficient (β) for family size turned negative indicating that as the size of the farm family

increases by one unit (holding other regressors constant), the estimated log of the odds or logit in favour of quitting the dairy farming goes down by 0.29 units indicating a negative relationship between the family size and decision to quit dairy farming. When the family size increases, the decision favouring quitting the dairy farming decreases as the responsible persons are not available in small family to look after dairy farming with due care. As most of the milk producers are small holders they mainly depend on the family labour for performing farm activities, therefore family size is important in decision to continue or quit (Karan and Ishii, 1996; Filmer and Pritchett, 1997;Bhandari, 2006).

Odds ratio or Exp (β) shall be interpreted in terms of percentage as well. As the family size of the respondents increases by one unit, the odds in favor of quitting the dairy farming goes up by 0.747 or 25.30 per cent (0.747 – 1 = -0.253). The Share of income from dairy to total income, social participation, extension contact and organized milk market were negatively significant at one per cent level of probability. It indicates one unit increase in the Share of income from dairy to total income, social participation, extension contact and organized milk market, the estimated log of the odds or logit in favor of quitting the dairy farming goes down by 0.918, 0.355, 0.772, and 0.279 units, respectively. Hansson and Ferguson (2011) noticed that farmers who are more active in their networks, and located in a network that has a positive attitude towards milk production had less chance to quit. Rantamäki-Lahtinen (2009) found that sharing information and processing it with peers in the network influenced farmers decision to continue good performance in farming. Off-farm income of the respondents found to be positively significant at one per cent level of probability indicating that as the size of the farm family increases by one unit (holding other regressors constant), the estimated log of the odds or logit in favour of quitting the dairy farming goes up by 1 unit. Similarly, the odds ratio shows literate respondents were more than 4 times likely to quit dairy farming, ceteris paribus, in comparison to the illiterate respondents. An increase in the level of education improves the skill and opportunity for employment outside agriculture (Bhandari, 2013). Therefore, educated individuals have a tendency to leave traditional agriculture and join the modern off-farm sector.

3.4 Determinant of future decision to quit dairy farming in Maharashtra (Moderate dairy progressive state)

Table 4
Determinant of future decision to quit dairy farming in Maharashtra (Moderate dairy progressive state) (n = 300)

Explanatory Significant Variables (X_i)	Estimates (β)	S.E.	Wald	Exp(β) or Odds Ratio
Constant	0.562	0.465	1.462	1.755
Share of income from dairy to total income	-0.116***	0.021	29.257	0.890
Off farm income	0.000***	0.000	16.053	1.000
Social participation	-0.894***	0.225	15.830	0.409
Mass Media contact	0.130**	0.066	3.831	1.139
Chi-square (4df): 150.535 Nagelkerke R Square: 0.591	-2 Log likelihood: 180.113 Cox & Snell R Square: 0.395			

Note: ***& ** indicate the significance at 1 and 5 per cent level of probability.

In the case of Maharashtra, significant Chi-square statistic (150.53) indicated that the fitted binary logit model following stepwise regression (forward wald approach) is valid. After stepwise regression, only four variables turned to be significant (Table 4). The 'beta' coefficient (β) for share of income from dairy to total income and social participation turned negative indicating that as the share of income from

dairy to total income and social participation increases by one unit (holding other regressors constant), the estimated log of the odds or logit in favor of quitting the dairy farming goes down by 0.890 and 0.409 units, respectively. It indicates the share of income from dairy to total income and social participation had a negative relationship with decision to quit dairy farming. Large share of income from dairy indicate its higher dependency for livelihood and therefore the chance to quit is less. Social participation may also bring many opportunities to do work in new areas because of more exposure to new information. Therefore, it might be the reason to quit on account of higher social participation. Whereas, off-farm income and mass media contact were found to be positively significant at one and five per cent level of probability. As the off-farm income and mass media contact increases by one unit (holding other regressors constant), the estimated log of the odds or logit in favour of quitting the dairy farming goes up by 0.890 and 0.409 units, respectively.

3.5 Determinant of future decision to quit dairy farming in Odisha (Least dairy progressive state)

Table 4.
Determinant of future decision to quit dairy farming in Odisha (Least dairy progressive state) (n = 300)

Explanatory Significant Variables (Xi)	Estimates (β)	S.E.	Wald	Exp(β) or Odds Ratio
Constant	5.746***	1.890	9.238	312.933
Sex(1) 0:Male 1:Female	-2.726***	.811	11.304	0.066
Family size	-.151***	.056	7.271	0.859
Training undergone	-4.134***	1.531	7.288	0.016
Share of income from dairy to total income	-.292***	.052	31.430	0.747
Off farm income	.000***	.000	13.274	1.000
Chi-square (5):174.195 Nagelkerke R Square:0.689	Log likelihood: 131.509 Cox & Snell R Square:0.440			

Note: *** indicate the significance at 1 per cent level of probability.

The estimates of binary logit model for Odisha with stepwise regression (forward wald approach) indicate that fitted model is valid based on the significant Chi-square statistic (174.195) and the analysis showed that only five variables turned as significant (Table 4). The 'beta' coefficient (β) for family size and share of income from dairy to total income turned negative indicating that as the share of income from dairy to total income and social participation increases by one unit (holding other regressors constant), the estimated log of the odds or logit in favour of quitting the dairy farming goes down by 0.859 and 0.747 units, respectively. It indicates the family size and share of income from dairy to total income had negative relationship with decision to quit dairy farming. Due to small scale production, it is difficult to employ the hired labour, and hence the availability of family labour which depends on family size may have important implications to quit dairy farming. In the case of categorical variables, on an average, ceteris paribus, farmers' decision to quit dairy farming decreases by 0.016 when they were imparted training related to dairy farming. Similarly, decision to quit dairy farming decreases by 0.016, ceteris paribus, when the respondent is a female. The analysis also indicated that the off-farm income was found to be positively significant at one per cent level of probability. As the off-farm income increases by one unit (holding other regressors constant), the estimated log of the odds or logit in favour of quitting the dairy farming goes up by 1 unit.

CONCLUSION

Farm households in India have been exhibiting livelihood transition by shifting their farming occupation to non-farm activities. In response to changes in livelihood of dairy farmers in India, this paper aimed at investigating the factors determining farmer's decision to quit dairy farming as a source of livelihood occupation. Using the sustainable livelihood framework, the study contributes to the literature by providing a detailed analysis of why some households quit dairy farming and why others continue it by examining the access to various assets which influence livelihood transition under three regions of different level of dairy development. The findings revealed that various aspects of human, social, economic, natural, and physical assets influence decisions on livelihood transition in dairy farmers of India.

The economic assets such as share of dairy to total income and off-farm income showed uniform effect on farm exit decision of dairy farmers in all the three states with different level of dairy development. Therefore, these are most crucial determinants of farmer's decision to quit. Governmental policies toward development of smart cities, urbanization and modernization in terms of housing for all may provide off-farm employment opportunities to individuals and likely encourage households to quit dairy farming. However, this is a plausible interpretation and need validation with study on employment and status of respondents who left dairy farming. Higher the share of dairy to total income, there is a less chance to quit dairy farming. It implies that there is a need to increase the profitability of dairy farms to be competitive with non-farm sector. Mobilizing farmers for secondary agriculture along with production can sustain the interest of farmers in dairy enterprise. Similarly, literate farmers from Haryana had more inclination to quit dairy farms as the opportunities in the off-farm employment increases with increase in education.

The family members are found to be important human capital that discouraged livelihood transition from farming to non-farm activities. Social participation and extension contact of farmers found to be effective in retaining farmers in dairy farming. Therefore, mobilizing farmers to participate in the cooperatives, farmers' interest group, Self Help Groups, strengthening of extension services will be highly helpful for sustaining the interest of farmers in dairy farming. Interestingly mass media contact in Maharashtra contributes positively in diverting farmers towards off-farm activities. It might be due to exposure of farmers to other avenues of employment in other non-farm sectors. Training related to dairy farming and women participation in dairy farming encourage farmers to continue dairy farming. Therefore, skill oriented training and capacity building in the dairy management must be provided. The study calls for further investigation on the scope for employment generation and its sustainability for farmers who quit farming. Further, the options in the non-farm sector preferred by the farmers and the extent of satisfaction who left the dairy farming has to be probed.

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