

Impact and determinants of membership in dairy cooperative society: The case of smallholder dairy farmers in Barpeta District of Assam

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Abstract: Dairy cooperatives are associated with creating opportunities for attaining higher level of market integration having implications for significant improvement in income of the dairy farmers. Given the positive impact of DCS membership from the analysis of multivariate regression the study further looks for factors that determine the decision to become membership of DCS. The analysis of the determinants based on logistic regression shows that milch animal holding, credit accessibility, availability of other services from DCS have positive relation with the membership decision, while dairy farming experience, distance to the cooperative collection centre and price of milk are negatively and significantly associated with cooperative membership. The study suggests that facilitating access to credit through dairy cooperatives to meet the financial viability, offering services to dairy farmers like fodder seed, subsidized concentrate feed, veterinary services, and establishment of more collection centre and improving market infrastructure can be instrumental in stimulating farmers' membership decision to join cooperatives. Overall, to increase farmer's membership the study recommends policies to take up more awareness programmes and trainings from time to time among the younger farmers on the beneficial effects of participating in cooperative system of dairying. The study concludes that cooperatives can be efficient in fostering wellbeing of the farmers with relatively higher income, employment and nutritional status.

Keywords: Dairy cooperative membership, Impact, determinants, Logit model, Barpeta, Assam

Introduction

Among various livestock activities, the dairy sub sector occupies an important position in the agricultural economy of India (Sujatha et al. 2015). India ranks the largest milk producer in the global sphere with 176.3 million tons of production during the year 2017-18 sharing 20% of the World's total milk production. The legacy of recent growth in the dairy sector has been largely attributable to the efforts made under the Operation Flood programme launched in 1970. The large scale development of milk marketing under Cooperative framework paved the way for development of the dairy sector with the launch of this programme. Studies point out that expansion of the dairy cooperatives creates opportunities for attaining higher level of market integration which could bring significant improvement in income of the farmers. Dairy cooperatives, apart from providing market opportunities for the milk produced to the members, also provide the technical inputs like provision of artificial insemination, health services and feed inputs (Meena and Jain, 2012). They have a tendency to fuel the uptake of membership in DCS on the one hand and increasing production and productivity of the farmers in the other. However, the performance and impact of cooperatives have not been uniform across regions of the country (Bardhan and Sharma, 2012). Unlike in other parts of India where cooperative farming has revolutionized livestock sector, Assam has remained largely unsuccessful in cooperative model of dairy developed undertaken as per various schemes of dairy development (Barbaruah, 2012). Given the evidence of successful process of dairy development enabled by cooperative movement in states like Gujarat, Punjab, Haryana etc., Assam has failed in its effort to yield a desired progress in the same. This can be pointed out to the factors influencing the membership of DCS. In the same way, there are limited studies demonstrating the impact of DCS membership on gains in parameters like income and nutrition. Given the gap, the present study makes an effort to find what are the various socio economic factors that drive the undertaking of membership in DCS and impact on income, employment and per-capita consumption of self-produced milk of member producers vis-à-vis their non-member counterpart.

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Marketing of dairy output is a serious constraint in the development of this sector. Poor marketing facilities in the rural areas and lack of facilities for organized dairy processing have led to the proliferation of production clusters mainly in the peri-urban parts of the state (Sirohi et al. 2009). Although many of the dairy cooperative societies were formed under erstwhile schemes, such as Assam Rural Infrastructure and Agricultural Services Project, Rastriya Krishi Vikash Yojana, Assam Agricultural Competitiveness Project, many of these projects are practically lying defunct or the volume of milk procurement has significantly declined. As per official records, there are 374 numbers of dairy cooperative societies with membership of around 20 thousand milk producers in Assam, whereas only about 51 thousand litres of liquid milk are marketed by these dairy cooperative societies (NDDDB, 2017-18). The government has been advocating for rural milk producers to join dairy cooperatives in order to improve the income of the farmers. Despite of all the efforts put in by the Dairy Development in Assam, the status of dairy cooperatives has not improved as most of the schemes are standing alone with meagre funding pattern and poor flexibility (Kakaty and Das, 2017). For cooperative network not being improved sufficiently even after several rounds of attempts at state level through funding from international agencies like World Bank and Govt. of India, producers have to sell their milk to the milk vendors/at milk market at a very low fixed price. Milk producers in the state need to be assured of a secure market for their highly perishable produce. Given that cooperatives provide marketing opportunities to smallholder farmer, it may have impact on augmenting farm income, employment and stimulating consumption of self-produced milk among farmers giving partly a food security at household level. Therefore the present study is undertaken to register the wellbeing prospect of dairying in dairy cooperative framework in the state of Assam.

Materials and methods

Data and Sampling Design

The survey is carried out in Barpeta district of Assam. Barpeta district is selected considering several factors such as concentration of dairy cooperatives, crossbred cattle population etc. including that of Barpeta district has been considered to have significant dairy activities and a major source of liquid milk supply to the processors as well as to the urban consumers in the state (Jafor, 2019). Due to the vibrancy in dairy activities in the district, clusters such as Bajali development block received special policy attention from the Govt. of Assam through initiation of Swarna Dhenu scheme in 2002. The Assam State Animal Husbandry and Veterinary (AH & V) Department has launched an ambitious project called Swarna Dhenu Scheme (Golden Cow Concept) with a view to upgrading the state's local and the implications of the scheme were manifold where farmers were benefitted with increased milk production. Another important reason for selection of the district is because it is based on high

concentration of commercial dairy producers and with surplus milk production, one of the potential districts listed by NDDDB in Assam (Kakaty and Das, 2017). The district has been selected purposively based on the share of dairy cooperative societies among the districts in Assam (20.19 percent share of total DCS available in Assam) (Directorate of Dairy Development, Assam). However, after making complete enumeration of the listed DCSs available in the district some of these dairy cooperatives are found to be functional. Six cooperatives (30 percent share in active DCS) have randomly been selected from the total active DCS operating in the Bajali development block. The selection of these DCS are such that they are non-contiguous to one another. A total of 150 registered members have been chosen randomly from the active dairy cooperatives. Similarly, another 150 non-members are selected from the same area to that of the members with consideration that they held at-least one in-milk cattle in the farm and carry almost similar socio-economic characteristics. In case where villages which do not have a single household which is not a member of the cooperatives, some non-members are retained from the nearby villages. Thus, the members and non-members together constitute a total of 300 milk producers. A range of information is collected in the enumeration that includes demographic, social, production and marketing related information. All the households are categorized into three categories, viz. small (1-3 milch animals), medium (3.1-6 milch animals) and large (6.1 and above) based on SAU¹ (Kumbhare et al. 1983). The survey is carried out during January 2019 to December 2019.

Empirical Models (Liner Regression Model: Impact of DCS on the wellbeing of sampled households and Binary Logit Model: Factors influencing the membership decisions)

Impact of DCS on the wellbeing of sampled households: Linear Regression

To assess the impacts of cooperative membership on certain indicators of household wellbeing of smallholder dairy farmers such as dairy income, per capita consumption of self-produced milk and labour hour spent in dairying (as potential for employment), regression models of the following form are estimated.

$$Y_i = \alpha + \beta D_i + \varphi X_i + \delta_i, \quad i = 1, 2, \dots, N \quad (1)$$

Where the dependent variable Y_i , is a measure of the indicators of households wellbeing in terms of dairy income (log specified), consumption of self-produced milk and employment expressed in the form of labour hour spent in dairying. The first indicator, i.e., dairy income is continuous variable transformed to logarithmic value due to reduce the impact of potential outlier observations while also being able to interpret coefficients in percentage terms. The other indicators are not log transformed due to scaling and the potential for occurrences of zeroes in them. The variable of our prime concern is D_i , which is a treatment variable for membership in registered dairy cooperative society

of the study location. For any household defining =1 for a cooperative member and =0 otherwise of the households. A rich set of control variables are included to control for heterogeneity between households of the study site. Includes various socio-economic characteristics that influence the dependent variables but not the treatment variable.

Factors influencing the membership decisions: Binary Logit Model

Binary logistic model is used to identify the factors that influence the households’ membership in DCS. Two methods- *t*-test and chi-square test analysis are employed to investigate the differences between cooperative members and non-members. The dependent variable is a binary variable depending on whether a farmer has dairy cooperative membership or not. The explanatory variables taken are either continuous or binary. The binary logistic model (Gujarati, 2011) can be expressed as,

$$L_i = \ln\left[\frac{P_i}{1-P_i}\right] = Z_i = \beta_i X_i + U_i, \quad i = 1, 2, \dots, N \quad (2)$$

Where,

$\ln\left[\frac{P_i}{1-P_i}\right]$ = Logit for taking cooperative membership

P_i = Probability of being a member of dairy cooperative societies

$1 - P_i$ = Probability that a farmer is not a member of dairy cooperative societies

β_i = Parameters to be estimated

X_i = Independent Variables

U_i = Random error term

The model on DCS membership decision takes the following form-

$$Z = \beta_0 + \beta_1 GENDER + \beta_2 HHSIZE + \beta_3 FARMEXP + \beta_4 LANDH + \beta_5 MILCH + \beta_6 DISTCOOP + \beta_7 PRICE + \beta_8 EDUC + \beta_9 CREDIT + \beta_{10} OFF - FARMY + \beta_{11} OTHERSERV + \mu$$

Where, β_0 =Constant

$\beta_1 - \beta_{11}$ =Co-efficient of the independent variables

μ = Error term

Description of the socio economic variables influencing the membership decisions of farmers in dairy cooperative societies

The study has considered several socio-economic variables to see the influence on their membership decision in dairy cooperative societies. These explanatory variables indicate farmers’ socio-economic and demographic characteristics. The selection of these variables is guided by various theoretical and

empirical studies conducted in various parts of India and elsewhere-Ahmed and Mesfin (2017); Awotide et al. (2015); Balghah (2019); Bardhan and Sharma (2012); Chagwaza et al. (2016); Debeb and Haile (2016); Fikadu et al. (2019); Njiru et al. (2015); Nugusse et al. (2012). One of the important variables such as ‘education of the household head’ is hypothesized to affect membership of DCS positively. Studies point out that education of the household head helps in right decision making to utilize household resources productively because of their ability to process information (Nugusse et al. 2012). Prior studies confirm that male headed households are more likely to take membership of DCS vis-à-vis their non-member counterpart for their increased role in milk marketing and relationship with various selling sources (Ahmed and Mesfin, 2017; Fikadu et al. 2019). Households with higher family size tend to have more labour supply inducing adoption of commercial dairying along with their increased propensity to participate in cooperatives model of milk marketing (Chagwaza et al. 2016; Awotide et al. 2015). However, empirical results also indicate that as household size increases, domestic consumption also shoots up implying reduced marketable milk surplus and discouraging the household to take the membership of DCS (Tefera and Wold, 2015). Cooperative membership is also influenced by the number of years a farmer is engaged in farming (Balgah, 2019). Availability of off-farm income sources may influence the membership decision both positively and negatively. According to Tefera and Wold (2015), having extra income from non-farm activities facilitates to invest more in dairy farming leading to rise in the intensity of farming operations and farm output and finally influence the farmers to choose assured sources of milk sale such as DCS through adopting membership. However, Bagher (2011) finds that with involvement in other off-farm sources of income interests to intensify dairying leads to not becoming the member of DCS.

Certain variables relating to farmers’ asset ownership viz. size of land holding and milch animal holding are generally tend to have a positive relationship with cooperative membership (Awotide et al. 2015; Njiru et al. 2015). Chagwiza et al. (2016) have indicated that distance to the cooperative collection centre has a negative and significant relationship with farmers’ membership to dairy cooperatives. The lesser the distance to collection point, producers’ transportation hindrances are reduced and likely to incentivize the farmers to adopt membership. The other independent variables assumed to have positive relationship with membership in dairy cooperative societies are access to credit (Gashaw and Kibert, 2018), price of milk, and availability of other services (e.g. fodder seed, subsidized concentrate feed, training, veterinary services etc.) from DCS (Tefera and Wold, 2015).

Results and Discussion

Descriptive statistics of explanatory variables of the model

Table 2 and 3 present the descriptive statistics of the continuous and dummy variables derived from *t*-test and chi square test to compare the differences in the characteristics explaining the DCS membership status. The descriptive statistics display that among the factors the mean income from dairying, per capita consumption of milk, farming experience, milch animal holding, distance to DCS collection centre are found to be statistically different between members and non-members of DCS. Co-operative members have higher income, per capita consumption and employment, large household size and land holding, and more milch cow on average as compared to non-members. According to the results in Table 2, the average annual income of the member group is significantly ($p < 0.01$) higher (INR 259780.7) than the non-member group (INR 152189.3). This is because cooperative members have larger milch animal than non-members, leading to higher milk production and income. Meena and Jain (2012) also recorded a higher significant income for members than non-members households. The per day per capita consumption of milk has been found to be 270.59 grams and 162.03 grams respectively for member against non-member group with $p < 0.01$ significant level. Higher per capita consumption of milk for member farmers shows attainment of higher nutritional

status of household members than their counterparts. The mean dairy farming experience of non-members is significantly higher compared to the members. It indicates that some dairy farmers establishing dairy farm newly may prefer to join DCS compared to some experienced farmers with intentions to remain as non-member to source their milk sale in channels other than DCS. There is statistically significant difference ($p < 0.01$) between members and non-members with members having an average of 4.22 milch animals against 3.01 of non-members. In a similar comparison made by Kumar et al. (2013) and Njiru et al. (2015), cooperative farmers have relatively bigger size of herd than the counterparts. It is observed from Table 2 that the mean distance to the DCS collection centre from the non-member households over the members are significantly higher by 0.37 km which is consistent with the findings of Fikadu et al. (2019). The price paid to the DCS members are based on FAT and SNF percent and farmers in the study location always try to maintain milk quality fetching price of INR 38.38/litre, slightly lower than the price fetched by non-members equivalent to INR of 39.04. The statistical difference between members and non-members of the dummy explanatory variables are based on Chi square test and presented in Table 3. Except level of education (for the primary, secondary

Table 1 Description of variables and their expected sign with cooperative membership

Variables	Definition	Measurement	Variable type	Expected sign
Dependent Variable				
MEMBER	Whether the farmer is a member of DCS	1= Member, 0= Otherwise	Dummy	
Independent variables				
GENDR	Gender of the respondent	1= Male, 0= Otherwise	Dummy	+
EDUC	Education level of the respondent	0= Illiterate, 1= Primary, 2= Secondary, 3= HS, 4= Graduate & above	Categorical	+
HHSIZE	No. of family members in a household	No. of family members	Continuous	+/-
FARMEXP	Experience in dairy farming	No. of years	Continuous	+/-
LANDH	Size of landholding of household	Hectare	Continuous	+
MILCH	No of milch animal owned by the household	No. of milch cows measured as SAU	Continuous	+
CREDIT	Whether the respondent has access to credit during five years preceding	1= Yes, 0= No	Dummy	+
OFF-FARMY	Whether household has any off-farm (non-farm) sources of income	1= Yes, 0= No	Dummy	+/-
DISTCOOP	Distance of the cooperative milk collection centre from the farmer house	Kilometers	Continuous	-
PRICE	Price for milk	Rs/kg	Continuous	+
OTHERSERV	Access to other services	1= Yes, 0= No	Dummy	+

and graduate & above group) and access to off-farm income, the other explanatory variables exhibit statistically significant difference in their proportion between the members and non-members. It could also be implied from the previous significant chi square studies (Gashaw and Kibret, 2018) that farmers join cooperatives because of the need to access to institutional and financial services coming from cooperatives.

Impact of Dairy Cooperatives on the wellbeing of sampled households

Cooperatives are conceived as an important vehicle for augmenting production of milk leading to growth in income of the farmers, consumption of self-produced milk and increased use of labour (as potential for growth in employment). In the context of the present study these outcome variables are estimated using multivariate regressions. The main variable of interest is a dummy for whether the household has participated

in the cooperatives or not and coefficient estimates are summarized in Table 4. Explanatory variables are checked for multicollinearity and found with absence of any multicollinearity problem (mean VIF 1.14). VIF is a measure of the amount of multicollinearity among the independent variables in a multiple regression model. Detecting multicollinearity is important to measure the correlation between one or more independent variables or inputs and to test certainly how much the combination of independent variables affects the dependent variable within the model. Moreover, results presented in Table 4 show that the F statistic in all the three regression models is statistically significant at 1 percent. Thus the models estimation can be considered as a good fit for the data used in the study. It is seen from the table that controlling for some socio-economic factors such as age and gender of household head, household size, land ownership, access to credit and herd size, the membership of DCS influence positively and significantly the dairy income (by 12.10 percent), consumption of self-produced

Table 2 Descriptive analysis of explanatory variables (continuous) of dairy farmers

Characteristics	Member Mean (Std. Error)	Non-member Mean (Std. Error)	Difference (Std. Error)	t-value
Income/year (in Rs.)	259780.7(17762.16)	152189.3(14382.5)	107591.4*** (22854.99)	4.7076
Per Capita Consumption (grams/day)	270.592(11.7736)	162.0305(8.6949)	108.5615*** (14.6363)	7.4173
Employment (Labour hour/milch SAU/day)	3.0986(0.1827)	3.0826(0.1299)	0.0161(0.2242)	0.0716
Household size (No.)	5.7667(0.2654)	5.42(0.2423)	0.3467(0.3594)	0.9645
Farming experience (Years)	12.4367(0.7750)	15.67(1.0533)	-3.2333** (1.3077)	-2.4725
Land holding (Hectare)	1.0738(0.09486)	0.9099(0.09613)	0.1640(0.1351)	1.2138
Milch animal holding (SAU)	4.22(0.2160)	3.0133(0.1643)	1.2067*** (0.2714)	4.4462
Distance to DCS collection centre (km)	2.098(0.1167)	2.4687(0.1437)	-0.3707** (0.1851)	-2.0027
Price of milk (in Rs.)	38.38(0.2607)	39.04(0.3264)	-0.66(0.4177)	-1.5801

Source: Author’s estimation based on field survey data;
 , * indicate significance level of 5% and 1% respectively

Table 3 Distribution of households by explanatory variables (categorical)

Variables	Character	Member N=150	Non-member N=150	Total N=300	Pearson chi2 test
Gender	Male	137 (91.33)	147 (98)	284	6.6021***
	Female	13 (8.67)	3 (2)	16	
Education Illiterate (Base category)	Primary	22 (14.67)	32 (21.33)	54	2.2584
	Secondary	48 (32)	49 (32.67)	97	0.0152
	Higher Secondary	47 (31.33)	33 (22)	80	3.3409*
	Graduate & Above	31 (20.67)	30 (20)	61	0.0206
Access to credit	Yes	56 (37.33)	8 (5.33)	64	45.7627***
	No	94 (62.67)	142 (94.67)	236	
Access to off-farm income	Yes	49 (32.67)	58 (38.67)	107	1.1767
	No	101 (67.33)	92 (61.33)	193	
Availability of services	Yes	49 (32.67)	16 (10.67)	65	21.3879***
	No	101 (67.33)	134 (89.33)	235	

Source: Author’s estimation based on field survey data; Notes: Figures in parentheses indicate percentage to the total.
 *, *** are significant at 10 % and 1 % percent level respectively

milk and use of labour on the farming. This finding is in line with the study done by Kumari and Malhotra (2016) where the authors found that the cooperatives have a positive impact on gross

income of women dairy farmers. This indicates that taking membership in dairy farming has potential for better livelihood

Table 4 Impact of DCS on the wellbeing of the farmers

Variables	Income	Per capita consumption of milk	Labour hours spent
	Co-efficient(Std. Error)	Co-efficient(Std. Error)	Co-efficient(Std. Error)
Membership of DCS	0.1210***(0.0341)	75.9636***(13.3038)	0.4852**(0.2328)
Age of the HH head	-0.0026*(0.0013)	-0.5337(0.4751)	0.0078(0.0085)
Gender of the HH head	-0.1142(0.0818)	-31.7632(38.1937)	-0.6025(0.3971)
Household size	0.0009(0.0048)	-11.5020*** (2.1538)	0.0309(0.0365)
Land owned by the farmer	0.0141(0.0130)	-7.8950(4.8033)	0.0374(0.0771)
Access to credit	0.1633***(0.0365)	47.6752**(19.6054)	-0.0502(0.2513)
Herd size (milch animal equivalent)	0.1104***(0.0101)	15.8885*** (3.3741)	-0.4051*** (0.0575)
Constant	4.8368***(0.1144)	237.6345*** (47.7498)	4.3243*** (0.5990)
	R ² =0.5980	R ² =0.3247	R ² =0.2507
	F(7, 292)= 39.21***	F(7, 292)= 14.40***	F(7, 292)= 9.59***
	No of obs. = 300	No of obs. = 300	No of obs. = 300

Source: Author’s estimation based on field survey data;

*, **, *** indicate significance level of 10%, 5% and 1% respectively

Table 5 Factors determining dairy cooperative membership

Variables	Co-efficient (Std. Error)	p-value	Marginal effect
Gender	-0.6870 (0.7405)	0.353	-0.1627
Education level			
Illiterate(base category)			
Primary	-0.0378 (1.0327)	0.971	-0.0094
Secondary	0.6499 (1.039)	0.522	0.1589
HS	0.9110 (1.0247)	0.374	0.2181
Graduate & above	0.4725 (1.0490)	0.652	0.1156
Household size	0.0137 (0.0485)	0.778	0.0034
Farming experience	-0.0289 (0.0132)	0.028**	-0.0072
Land holding	0.0341 (0.1347)	0.800	0.0085
Milch animal holding	0.1877 (0.0709)	0.008***	0.0467
Access to credit	2.2477 (0.4182)	0.000***	0.4573
Access to off-farm income	-0.1751 (0.3103)	0.573	-0.0436
Distance to DCS collection centre	-0.3271 (0.1055)	0.002***	-0.0815
Price of milk	-0.1047 (0.0430)	0.015**	-0.0261
Availability of services	1.1765 (0.3687)	0.001***	0.2728
Constant	3.9740 (2.0049)	0.047**	
Pseudo R square	0.2376		
Wald Chi square	72.22***		
Log pseudo likelihood	-158.53229		

Source: Author’s estimation based on field survey data;

, * indicate significance level of 5% and 1% respectively

and nutritional support among the member farmers compared to the farmers without membership of DCS.

Factors determining membership of DCS

Table 5 presents the logistic regression results for the factors that influence farmers' membership in dairy cooperatives. It can be observed from the table that the model is statistically significant and model is a good fit as explained by Wald chi square value of 72.22 ($p < 0.01$) and Pseudo R square of 0.2376 indicating that 23.76 percent of the variations in probabilities of taking cooperative membership was explained by the covariates defined in the logistic model. Out of the explanatory variables included in the model, six variables were found to be statistically significant to influence farmers' membership in dairy cooperatives. Among these variables; milch animal holding, access to credit and availability of other services rendered by DCS positively influence the membership decision. On the other hand, dairy farming experience, distance to the DCS collection centre and price of milk negatively influence the decision of the farmers to join cooperative societies.

Farmers' experience in dairy farming, also considered as a proxy for age of the farmers influence negatively the DCS membership. It indicates that farmers starting dairy business newly show more interests to join DCS compared to the farmers who are involved in dairying for a longer time. The value of marginal effect implies that when experience increases by one more year, the probability of membership in dairy cooperatives decreases by 0.72 percent. Farmers with relatively higher herd sizes are more likely to join DCS as explained by milch animal holding having positive and statistically significant ($p < 0.01$) effect on DCS membership. This indicates that addition of one more SAU of milch cow to the farmers' herd increases the probability of a farmer becoming DCS member by 4.67 percent. The finding is supported by other studies such as Bardhan and Sharma (2012). The positive and significant ($p < 0.01$) relation between the access to credit and cooperative membership indicates that having access to credit leads to 45.73 percent higher probability of becoming member. This result coincides with the findings of Nirju et al. (2015). There are instances of accessing small credits from DCS which also attract the farmers towards joining DCS. Gashaw and Kibret (2018) shows that this source of credit is a reliable one compared to that of formal lending institutions and traders associated with collateral agreements. It is evident from Table 5 that larger the distance from the farmers' house to cooperative collection centre, the lower the probability of becoming member of DCS. This is explained by the fact that farmers who are close to the cooperative office will also have more knowledge about the cooperative benefits and will also have lower transaction costs. The result is in line with the findings of Fikadu et al. (2019), Chagwiza et al. (2016) and Ahmed and Mesfin (2017). The association between price fetched by selling milk and probability of becoming members of DCS indicates that increase in the milk price by INR 1.00 would decrease

the likelihood of farmers' membership to DCS by 2.61 percent. In a study carried out in the context of Assam, Bayan (2018) showed that the price received by cooperative members are already low, for which farmers may not be inclined to join DCS leading to negative relationship between membership and price received for the milk sold. In addition to this, farmers are also discouraged by the duration of payment as explained by them that they have to wait several days for getting paid, but they are in urgent cash needs for maintaining day to day expenses of cattle feed. Availability of other services (e.g., access to concentrate feed at subsidized rate, fodder seed, veterinary services, training etc.) from DCS positively and significantly ($P < 0.01$) relates to farmers' membership. This result is in line with some other studies such as Debeb and Haile (2016), Tefera and Wold (2015).

Conclusions

The study has shown a greater role of DCS on increasing dairy income, higher consumption of self-produced milk and rise in employment through higher use of labour. This indicates the need for emphasis on the diffusion of cooperative forms of dairying in many districts of Assam due to its livelihood and nutritional impact on the smallholder farmer's economy. The study suggests generating certain instrumental factors such as access to credit through dairy cooperatives to meet the financial viability, establishing more collection centre and improving market infrastructure to enable members to meet their needs. Moreover, if cooperatives are continued to be adopted as medium of offering services to dairy farmers like fodder seed, subsidized concentrate feed, veterinary services etc., this will motivate farmers to take its membership. Access to these extension services will ensure improved dairying which will scale up milk production and income of the farmers. Given the importance of urgent cash needs for daily transactions, it is strongly recommended that cooperatives pay more attention to it in case of expediting membership. Overall, to increase farmer's membership the study recommends policies to take up more awareness programmes and trainings from time to time among the younger farmers on the beneficial effects of participating in cooperative system of dairying. A proper policy review should be necessary action with all limitations and functional trade-offs to ensure enough incentives which would favour membership growth and livelihood of farmers beyond this study.

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(Footnotes)

¹ SAU (standard animal unit): 1 Crossbred= 1.40 SAU; 1 Indigenus= 1.00 SAU