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RESEARCH ARTICLE

Performance assessment of the dairy co-operatives in the mainland and Saurashtra-Kutch regions of the Gujarat, India

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Abstract: Dairy co-operatives in Gujarat (India) is a perfect case of local institution driving economic development. However, the discrepancies in its growth still exist across regions due to factors like social rigidity, bureaucratic procedures, inadequate local involvement, and management issues. The co-operative model completely failed once in the Saurashtra-Kutch region of the state and was re-established during 2007-09. Hence, the present study measures the performance of village-level dairy co-operatives societies (DCS) in the Mainland portion and Saurashtra-Kutch region of Gujarat over two periods (2011-14 & 2015-19) and proposes strategies to improve the performance. A total sample of 120 DSCs was taken from four milk unions, two from each region, and Iyengar and Sudarshan's approach was used for calculating the composite performance index which assigns weights inversely varying with variation in the indicator. The inverse variance-based co-operative performance index analysis of 120 DCSs across two regions suggests that the Mainland region (0.269) DCSs perform better than the Saurashtra-Kutch region (0.194) and over a period, the performance has improved to 0.354 and 0.271, respectively. Further, logistic regression-based marginal effects indicated that the probability of having high financial performance is 0.278 times greater for DCS with high physical performance than the counterpart. This suggests that poor performers should diversify and intensify input and other services delivery which will raise member participation rate, increase animal productivity, and lead to intensified dairying and higher milk procurement.

Keywords: Dairy co-operatives, Mainland, Saurashtra-Kutch, Performance, Logistic regression

Introduction

Indian dairy development has its roots in a massive dairy development program, popularly known as Operational Flood (OF) which led to the "white revolution" in India during 1970's. The OF program enabled a great transformation in the Indian dairy sector from scarcity to plenty and made the nation the world's top milk producer. The OF program was initiated in a situation when there was a dairy commodity surplus in Europe (1970), which threatened the milk deficit nascent Indian dairy industry. The menace of cheap imports from Europe, adversely affecting Indian dairying was converted into an opportunity for building a robust dairy sector (Gautam et al. 2009). The three-tier dairy co-operative structure (DCS at village level, Milk Union at district level & Milk Federation at state) initiated from the "AMUL (Anand Milk Union Limited)", was the base for this programme. Subsequently, National Dairy Development Board (NDDB) was established in 1965 with the mission to replicate the "AMUL pattern" that originated in Anand town of Gujarat all over India through the OF program. However, social rigidities coupled with several other factors have rendered the AMUL pattern less efficient in a few states, especially in Northern and Eastern India. Whereas it led to great success in Western and Southern India on account of local initiatives and state support. According to Christie (2020), the dominance of elite communities in the milk co-operatives and political arena was found to impede the involvement and leadership of the weaker section. The Planning Commission (2003) also reported misconduct and inadequate accountability of DCS employees. Further reasons reported for the non-functionality of co-operatives were the quality of animals, the cost of milk production, and the difference between the market price and price received by the farmers from DCS (Planning Commission, 2003).

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Among all the states, Gujarat is the only state where the co-operatives procure more than half (57%) of the state's total milk production (NDDB, 2023). Gujarat contributes 7.5 percent to the country's milk production by producing 17.28 million tonnes of milk annually out of a total of 230.58 million tonnes. (NDDB, 2023) The state has 22 district-level milk unions with a network of 19,853 village DCSs. Although, even within Gujarat, evident discrepancies exist in the concentration and success of dairy co-operatives across the Mainland and Saurashtra-Kutch region of the state. The Mainland region includes the Northern, Southern, and middle parts of Gujarat, while the Saurashtra-Kutch region includes all the districts present in the peninsular area of the state (NDDB, 2019). In the Mainland region, co-operatives procure around 73% of the regional milk production, while it takes only 25% of milk produced in the Saurashtra-Kutch region (AHDS, 2019). The Gujarat government has put efforts into the past to promote co-operatives-based dairying in the Saurashtra - Kutch region through the establishment of the Gujarat Dairy Development Corporation (GDDC) in the year 1975 because the Gujarat Co-operative Milk Marketing Federation (GCMMF) was not effective enough to move in this region. Hence, left the dairying potential of the Saurashtra-Kutch region untapped. In the region of Saurashtra-Kutch, the milk cooperatives failed due to insufficient milk collection, which resulted in heavy losses to GDDC on account of unpaid loans from dairies. On the order of the Board of Industrial Finance and Reconstruction (BIFR), all the assets of Dairies financed by the GDDC were handed over to NDDB (in 2005) to recover the advances made by NDDB to GDDC for the dairy co-operative's promotion in the Saurashtra-Kutch region. Later with the joint efforts of GCMMF, NDDB, and the state government, within the short span of two years (2007 to 2009), around 1600 new DCSs were created in the Saurashtra-Kutch region, procuring over one million liters of milk per day. The farmers were paid the highest ever remunerative prices that they ever received in the past and were equal to other developed milk sheds in Gujarat (Syed, 2009). However, by the entry of *Maahi*, a producer company since 2012, co-operatives are facing cut-throat competition, especially in the Saurashtra-Kutch region. Hence, assessment of the performance of these dairy co-operatives in the current competitive dairy environment is important. Also, co-operatives are the major player in milk procurement and marketing in the state and hence, their effective functioning can be translated to substantial benefits to the dairy farmers. Therefore, this study endeavored to measure the performance of DCSs over time as well across regions in terms of coverage and financial aspects.

This study analysed the physical and financial performance of DCSs falling under the Mainland and Saurashtra-Kutch region of Gujarat and classified them into three categories i.e., Good, Average and Poor based on their composite performance index value.

Data and methodology

The study is based on the secondary data collected from the village level dairy co-operative societies (DCSs) for the period from 2011-12 to 2018-19. Two milk unions (MUs) with the highest average membership per DCS were selected from the Mainland and Saurashtra-Kutch regions of Gujarat each. Khaira and Mahesana MUs from Mainland and Surendranagar (Sur'nagar) and Junagadh MUs from the Saurashtra-Kutch region were selected for the study. To avoid the over or under-representation of DCSs in the sample, a total of 120 registered DCSs working for the last ten or more years were randomly selected from all four MUs using the Probability Proportion to Size (PPS) approach (Appendix I). The selected sample of 120 DCSs entails 46, 48, 23, and 3 DCSs from Khaira, Mehsana, Sur'nagar, and Junagadh MU, respectively.

The relative performance of the DCSs was measured through a composite performance index (CPI) of 120 DCSs for two-time periods i.e. first quadrennial ending in 2014-15 and the second quadrennial ending in 2018-19. The index is based on two types of performance indicators, i.e., physical indicators and financial indicators, comprising 18 variables having a close association with the overall performance of DCSs. The physical indicators used to measure co-operatives coverage were:

The number of members per household of the village[1], The quantity of milk procured per milk pourer (including members and non-members), Annual sale (kg) of cattle feed per animal of the village, Animals treated per 100 animal population,

Artificial insemination (AI) done per 100 animal population and Score for other services provided by DCS.

The other services by DSCs include five services that are vaccination, animal insurance assistance, sale of fodder seeds, milk products, and other items (implements, edible oil, sugar, etc). Giving equal weight to all five services, the maximum score was set equal to five.

The financial indicators included:

Net income of DCS per liter of milk procured (Rs. /lit), Reserved fund of DCS per liter of milk procured (Rs. /lit), Share capital and dividend per member (Rs. per member), Total turnover per liter of milk procured (Rs./lit), Ratio of the value of milk sold to the union to value of milk procured, Ratio of local milk sale to the value of milk procured, Depreciation per liter of milk procured (Rs./lit), Salaries and incentives paid to DCS staff per liter of milk procured (Rs./lit.), Share of annual bonus to the total value of milk procured (%), Operational cost per liter of milk procured (Rs./lit), Procurement price paid per liter of milk (Rs./lit.) and Ratio of the value of milk procured in the total value of turnover.

The absolute values of financial indicators were first deflated using state GDP deflator to remove the inflation effect and to measure the progress in real terms. To draw reliable conclusions,

the indicators for index calculation were first converted at per unit level. The need for this conversion arises because generally, DCSs with a larger operational area (a village) tend to have higher absolute values of the parameters which give biased results. The index calculation used the approach of Iyengar and Sudarshan (1982) which is the generalization of the *core relative approach* of the UNDP-Human Development Index (1990). Ease in use and freedom from the restrictive assumption of linearity in the relationship of variables makes it advantageous over other methods.

The methods comprise of two steps:

Step-1: Index (Y_{id}) for each indicator and d^{th} DCS

If the variable is assumed to be positively associated with the performance

$$Y_{id} = \frac{(X_{id} - Min\ X_{id})}{(Max\ X_{id} - Min\ X_{id})}$$ where, i= 1,2,3….n & d= 1,2,3…..m

If the variable is assumed to be negatively associated with the performance

$$Y_{id} = \frac{(Max\ X_{id} - X_{id})}{(Max\ X_{id} - Min\ X_{id})}$$ where, i= 1,2,3….n & d= 1,2,3…..m

Where X_{is} represents the four-year average value of i^{th} performance variable of d^{th} DCS.

The numerator in the equation measures the extent by which the d^{th} DCS is better in the i^{th} variable as compared to the worst-performing DCS. The denominator is the range, which measures the total variation present in the variable across DCSs. All the variables except operational cost per liter and the ratio of the value of milk procured in the total value of turnover were assumed to be positively associated with the performance.

Step- 2: The physical, financial, and lastly, composite performance indices for each DCS. The weights reflecting the relative importance of variables were used.

$$W_i = \frac{k}{\sqrt{Var\ (Y_i)}}$$

Where, $k = \left[\frac{1}{\sum_{i=1}^{n} \frac{1}{\sqrt{Var}(Y_i)}}\right]$

$0 < W_i < 1$ and $W_1 + W_2 + \cdots + W_n = 1$

The weights were calculated assuming that they vary inversely as the variation in the respective performance indicators. This manner of weights assignment prevents undue dominance of any one variable having large variation, to the contribution of the rest of the indicators and hence, the distortion of inter-society comparisons. The weights used for the calculation of the index are given in Appendix II.

Physical index

$$Y_d^p = W_1 Y_{1d} + W_2 Y_{2d} + \cdots + W_6 Y_{6d}$$

Financial index $Y_d^f = W_7 Y_{7d} + W_8 Y_{8d} + \cdots + W_{18d} Y_{18d}$

Composite index

$$Y_d^c = Y_d^p + Y_d^f = W_1 Y_{1d} + W_2 Y_{2d} + \cdots + W_{18} Y_{18d}$$

The composite index Y^C_d varies from zero to one.

To validate the positive association between physical and financial performance of DCSs, we used logistic regression using Stata 12. Two categorical variables were generated by grouping the DCSs into two groups *viz*, Better performer (1) and Poor performer (0) based on both PPI and FPI using above and below average criteria. In our study, the PPI-based categorical variable was predicator while the FPI based categorical variable was taken as an unexplained variable. The logistic regression model is used when the outcome variable is dichotomous, it typically takes value 0 or 1.

The simple logistic model has the form

$$Logit\ (Y) = Natural\ \log(odds) = ln\left[\frac{\pi}{1-\pi}\right] = (\alpha + \beta X)$$ ——————————————————(1)

Taking the antilog of Equation 1 on both sides, one derives an equation to predict the probability of the occurrence of the outcome of interest as follows:

$$\pi = P\ (Y = outcome\ of\ interest, X = X_i\ , a\ specific\ value\ of\ X) = \frac{e^{\alpha+\beta_i X_i}}{1+e^{\alpha+\beta_i X_i}}$$ ——————————————————(2)

Where, π is a conditional probability of the form P (Y=1| X_1,...,X_s), such as the high performance of DCS. That is, it is assumed that "success" is more or less likely depending on the combinations of values of the predictor variables. The log-odds is also known as the logit transformation of π.

α and βs are the regression coefficients, Xs are a set of predictor variables, and e = 2.71828 is the base of the system of natural logarithms. α and βs are typically estimated by the maximum likelihood (ML) method which is designed to maximize the likelihood of reproducing the data given the parameter estimates.

Results and Discussion

This section discusses the extent of progress shown by the DSCs of both regions on various measures of physical and financial performance and hence, the composite performance index value over time and also how the physical and financial performance of DCSs is related to each other. The comparison of the quadrennial average of absolute values of physical parameters for two-time intervals along with percent change over time is presented in Appendix III. The DCSs of the Saurashtra-Kutch region have progressed well on the all-physical parameters compared to the Mainland region, indicating a increasing role of dairy co-operatives as an alternative channel of milk disposal for producers in the area, especially in the Sur'nagar MU. The provision of services at remunerative prices enables them to increase milk yields, reduces the cost of milk production, and encourages farmers to practice dairy farming on a commercial level with the adoption of modern package of practices. Gupta and Murthy (1985) had also concluded that the largely scattered small milk producers cannot be served better by merely procuring their milk for urban society, but the co-operatives should also integrate the production and distribution of inputs and services. However, a big difference was seen in the input services offered by the DCSs of both regions. No input services were offered by DCSs of the Saurashtra-Kutch region except the sale of cattle feed, which too was the initiative of a few DCSs on their own and was irregular. Among all the other services, the sale of milk products was the most common among the DCSs of both regions. In the Mainland region, DCSs of Khaira MU showed a greater increase in membership, milk procured quantity, and cattle feed sale than DCSs of Mahesana MU, while the latter progressed more on providing veterinary and other services than the former.

Among the MUs of Mainland, the average absolute values of financial indicators (Appendix IV) for Mahesana MU are less than that of Khaira MU, which is due to a greater share of small and medium-size DCSs in Mahesana MU. It is important to understand the method and government rules governing the finance calculation of DCSs to reach valid conclusions. Before calculating the profit-loss statement, generally, the DCSs deduct the amount of price difference paid by MU to DCS and also the price difference to be paid by DCS to farmers from the income from other sources (income from sample milk sold to MU, local milk sale, profit from the sale of cattle feed, milk products, and other items). Generally, the whole amount of price difference paid by MUs to DCS is passed on to the farmers. Dairy co-operatives pay the producer on a volume (liter) basis while MUs pay the DCSs on a weight (kilogram) basis which generates positive-sum for the same quantity of milk. The MUs also pay DCSs a commission (around 3%) on the value of milk sent to it. These both also form income to the DCSs. The management board of respective DCSs decides on what amount to be passed on to the farmers as the DCS's price difference. Then the profit-loss statement is calculated and the net income that arrived is distributed among different funds as per criterion laid under by-laws of co-operatives. This fund includes reserves, share dividend, education, member's welfare, member bonus, religious, animal breed improvement, staff bonus, and co-operatives promotional funds. Hence, after allocating the required finance for these funds and working capital for society, the rest is passed on to the farmers as price difference paid by DCS. Therefore, the average absolute value of net income, reserve funds, and share dividend of DCSs are lower in the mainland region. But, in the Saurashtra-Kutch region, the quantity of milk procured by recently formed DCSs is less, and also the income from other sources like the sale of inputs or other items is almost nil. Therefore, they were hardly able to distribute the DCS's price difference to the farmers from their income and the left net income is relatively higher. These DCSs lack controlling of financial flows between the payments to the farmers and the different government funds due to meagre values of incomes. The other major reason could be illiteracy and lack of knowledge about maintaining financial records and analysing the financial statements among the management board of the societies of the Saurashtra-Kutch region. All the DSCs in the sample from the Saurashtra-Kutch region were dependent on professional accountants to prepare their financial statements. The substantial increase in the quantity of milk procured by the DCSs in the Saurashtra-Kutch region is also reflected in the increase in the absolute values of milk procured and milk sold to the MUs. However, the average value of locally sold milk has reduced in DCSs of the Saurashtra-Kutch region entirely accounted to the DSCs of Sur'nagar MU. The values of depreciation indirectly represent the magnitude of physical assets owned by DCSs. The increasing average absolute values of depreciation in DCSs of all the MUs suggest improving the financial conditions of DCSs, especially in Khaira and Sur'nagar MUs.

The perusal from table 1 indicates that on a facet of physical performance, the DCSs under Khaira MU were the best followed by Mahesana MU of Mainland region, Sur'nagar MU, and Junagadh MU from Saurashtra-Kutch region, respectively. The DCSs of the Mainland are older and more experienced than those of the Saurashtra-Kutch region, hence the co-operative coverage gap is explainable. Besides, the MUs of the Mainland region have their well-established infrastructure for the production of cattle feed and veterinary services and well-managed supply chain through DSCs, while the newly formed MUs of Saurashtra-Kutch regions lack this infrastructure and hence struggle to pass on the inputs and services to the farmers regularly through DCSs at remunerative prices. Also, on the demand side, the poor adoption of new technologies like crossbred cattle, artificial insemination results in inadequate development of the market for these inputs and services. Therefore, the producers should be educated and made aware of the new methods of production and local leaders should be given a major role in bringing change in the attitude of the producers.

Likewise, financial and composite (overall) performance index values of DCSs followed the same order as physical performance. The physical performance indices (PPI) values are smaller than financial performance indices (FPI) because the set of physical indicators is smaller than financial indicators. Over time, the performance of DCSs has improved as indicated by the increased performance index values from the period 2011-15 to 2015-19. The difference between the average PPI of two-time intervals showed that maximum progress in physical performance was made by DCSs of Mahesana MU (0.020) followed by Khaira MU (0.017), Sur'nagar MU (0.017), and Junagadh MU (0.009), respectively. While, in the case of financial performance (FPI), DCSs under Khaira MU (0.077) have progressed maximum followed by Mahesana MU (0.066), Sur'nagar MU (0.057), and Junagadh MU (0.016), respectively. The maximum progress in overall performance was seen among DCSs of Khaira MU (0.094) followed by Mahesana MU (0.077), Sur'nagar MU (0.077), and Junagadh MU (0.022), respectively. The relatively better improvement in the performance of co-operatives under the Mainland region can be accounted to the easy availability and reasonable costs of inputs and services such as cattle feed, mineral mixtures, breeding (AI), and veterinary services. The efficient and effective extension support, assured milk prices, and economic benefits such as annual bonus by the milk union are the other economically incentivizing factors. These findings are supported by earlier studies namely, Wani et al. (2015), and Bhaviskar (1998). A study by Sutar et al. (2022) also reports that governance and management support offered to members and support received from milk unions plays a significant role in the performance of the dairy co-operatives. The variation in the overall performance across DCSs measured through the coefficient of variation indicates that there is a relatively high variation in overall performance among DCSs of Khaira MU, followed by DCSs of Mahesana MU, Sur'nagar MU, and Junagadh MU. Although, this variation has reduced over the period among the DCSs of Khaira MU and Junagadh MU, while it has increased in the Sur'nagar MU and remained almost unchanged in the Mahesana MU.

Figure 1 gives a graphical presentation of CPI value-based classification of DCSs and percentage share of DCSs in the different performance categories across regions and MUs. The categorization of DCSs into good, average, and poor performance categories was done using the cumulative square root frequency approach. The increased frequency of DCSs in the higher performance category for time interval 2015-19 shows improvement in the performance of DCSs in the region or MU over time. The greater frequency of DCSs in the higher performance category indicates better performance of DCSs in the region or MU. In the time interval of 2011-15, the DCSs of the Mainland region performed better than that of the Saurashtra-Kutch region. In the Mainland region over a period around 36 % of total DCSs have shifted toward higher performance category while in the Saurashtra-Kutch region only 23% of DCSs have shifted toward higher performance category and there has not been a single DCS in the good performance category which implies that the DCSs in the Mainland region are improving at a relatively faster pace than that of Saurashtra-Kutch region.

Table 1: Average region-wise performance score DCSs

Particular	Mainland			Saurashtra-Kutch			Gujarat
	Khiara	Mahesana	Overall	Sur'nagar	Junagadh	Overall	
				2011-2015			
PPI	0.081	0.054	0.067	0.022	0.014	0.021	0.057
FPI	0.202	0.202	0.202	0.176	0.148	0.173	0.195
CPI	0.283	0.256	0.269	0.198	0.162	0.194	0.253
MAX CPI	0.556	0.372	0.556	0.245	0.193	0.245	0.556
MIN CPI	0.214	0.190	0.190	0.159	0.154	0.154	0.154
CV CPI (%)	18.93	14.12	17.54	9.85	5.97	11.31	20.99
				2015-2019			
PPI	0.098	0.074	0.085	0.039	0.023	0.037	0.075
FPI	0.279	0.259	0.269	0.242	0.164	0.233	0.261
CPI	0.377	0.333	0.354	0.282	0.186	0.271	0.336
MAX CPI	0.468	0.448	0.468	0.348	0.193	0.348	0.468
MIN CPI	0.291	0.233	0.233	0.217	0.180	0.180	0.180
CV CPI (%)	10.39	14.02	13.63	11.83	3.52	16.31	17.43

PPI is physical performance index value*; FPI* is financial performance index value; *CPI* is composite performance index value*; MAX* is maximum*; MIN* is minimum and *CV* is coefficient of variation (%)

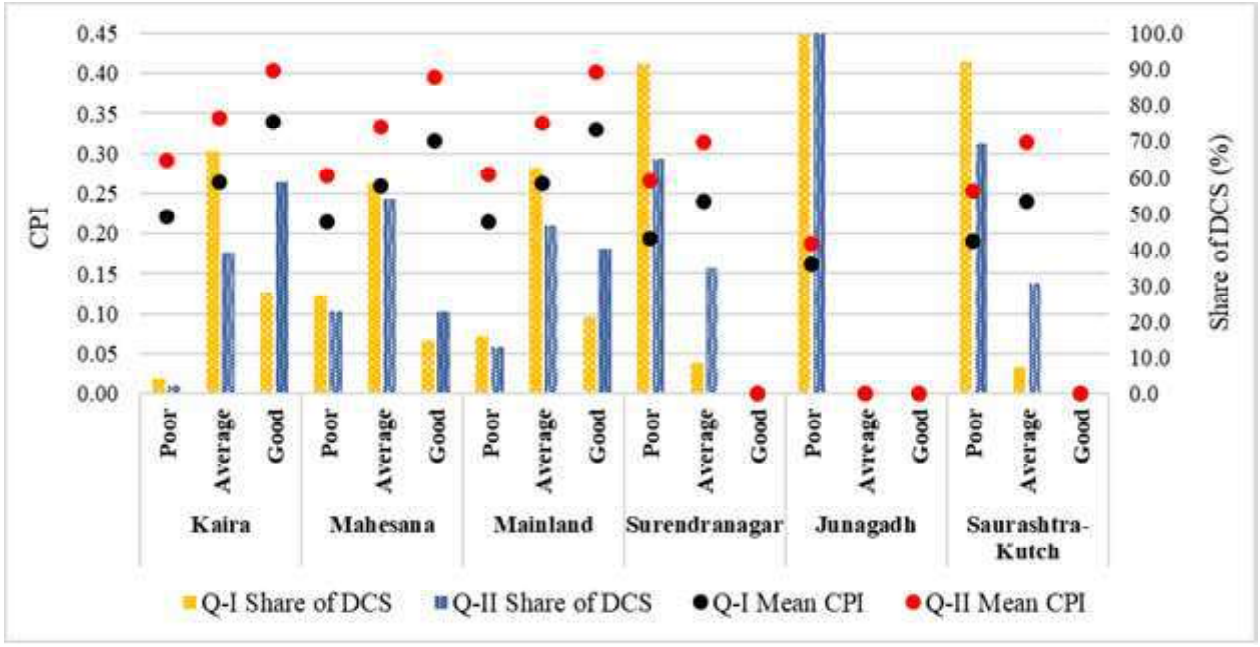

Fig 1. Classification of DCSs according to composite index value across regions

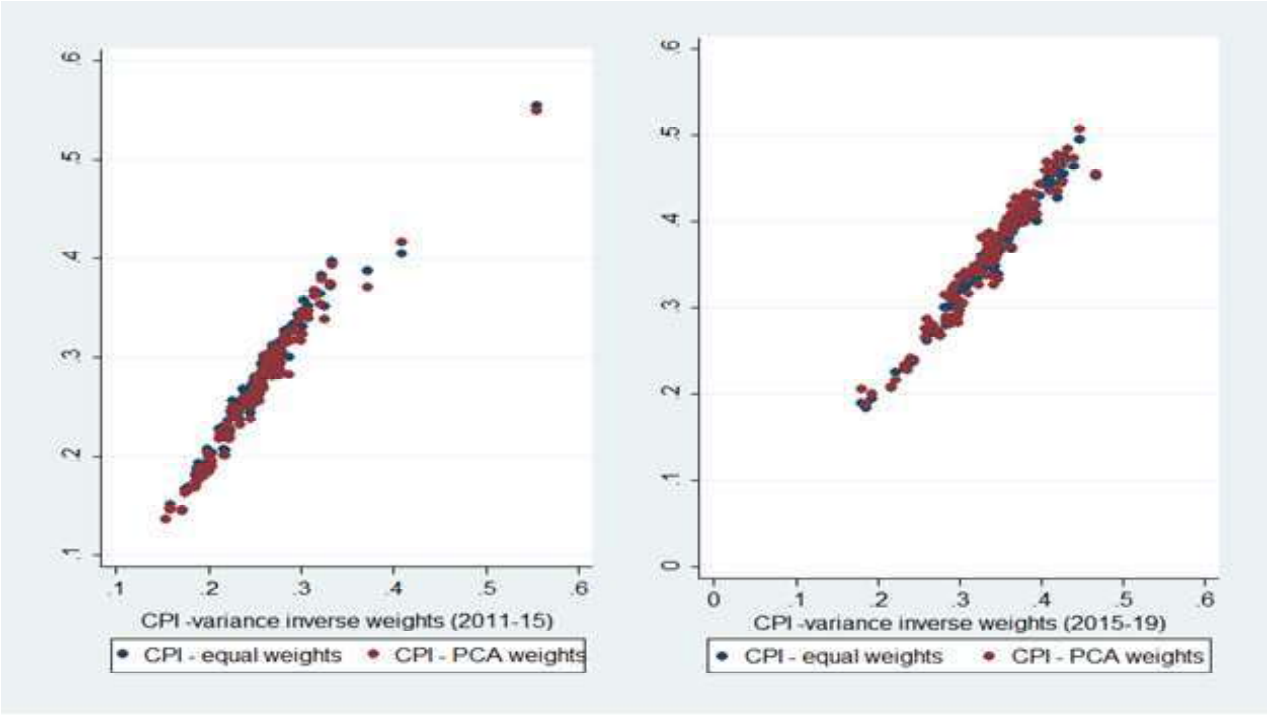

Fig 2. Robustness of CPI to different weighting schemes

Correlation coefficients: CPI- variance inverse weights and CPI-equal weights =0.9720 for 2011-15 and 0.9889 for 2015-19; CPI-variance inverse weights and CPI- PCA weights = 0.9720 for 2011-15 and 0.9754 for 2015-19

Table 2 shows the association between physical and financial performance measured through logistic regression-based Odds ratio for both time intervals. The value of the Odds ratio for the period 2011-15 indicates that for the DCS's with high physical performance, the odds of being in the high financial performance category is 1.698 times higher than DCS's having lower physical performance. The values of marginal effect indicate that the predicted probability of falling in the high financial performance group for the DCS with high physical performance is 0.128 times

Table 2: Association between the physical and financial performance of DCSs

Y (Physical performance) (0 if low & 1 if high)	2011-2015		2015-19	
	Odds ratio	ME (dy/dx) #	Odds ratio	ME (dy/dx) #
X = Financial performance (Dummy, 0 if low & 1, if high)	1.698	0.128	3.221*	0.278**
	(0.638)	(0.903)	(1.251)	(0.087)
Constant	0.545*	-	0.757	-
	(0.138)		(0.190)	

ME is marginal effects; # is for discrete change of the dummy variable from 0 to 1; * is significance level at ($p<0.05$) and ** is significance at ($p<0.01$); values in parenthesis indicates standard errores

greater than the low physical performing DCS. Similarly, for the period 2015-19, the probability of a DCS with high physical performance to fall in the high financial performance group is 0.278 times (statistically significant) higher than the counterpart. It implies that the higher physical performance of DCS leads to higher performance on the financial front. Therefore, the DCSs must focus more on the physical aspects of increasing membership, milk procurement, and provision of various technical and physical inputs and services to the members. These results are in confirmation with the study carried out in Jammu and Kashmir by Rather et al. 2016.

The robustness of CPI calculated using variance inverse weights to other weight allotment approaches like equal weights and Principal Component Analysis (PCA) based weights, was checked through correlation analysis as presented in Figure 2. The correlation coefficient values indicate that these results are unaffected by the selection of the weighting scheme.

Conclusion

The co-operatives have played a crucial role in the dairy development of the Gujarat state, although it shows a disparity in its growth across regions in the state. The results brought out the vast performance gap among the DCSs of both Mainland (0.354) and Saurashtra-Kutch (0.271) regions of the state. Despite the rejuvenation efforts made by the NDDB and the state government for a decade, the progress in the performance of DCSs in the Saurashtra-Kutch region has been slow and unsatisfactory. Further, the study reported that better physical services enhance the probability (0.278) of DCSs to have high financial performance. However, in the Saurashtra-Kutch region, farmers hardly get extension support, inputs, and animal health care services from co-operatives, and thus, a substantial market share goes to the private dairy or vendors in the local milk market. Hence, the MUs of the region should coordinate with the Directorate of Animal Husbandry Department of the state and other non-government agencies to play the role in the provision of key input services like breeding, feeding, health care, and extension services for member producers. Studies show that illiteracy and lack of democratic functioning of cooperatives limit member participation, hence the awareness activities and mandatory representation from different social groups in the management of co-operatives should be considered to improve participation. Other factors such as agricultural conditions, water availability, the adoption of new technologies, non-farm income sources, co-operatives management at the ground level, market conditions, etc. may influence the farmer's participation and co-operatives growth.

The bulk milk cooler installation at the DCS level should be done to increase the milk shelf-life so that society gets a better price from MU and reduce the double transportation cost incurred by the MUs. An intensive membership drive, with a prime focus on progressive and young farmers, will help in increasing contact with other milk producers in the future. Giving a key role to DCSs in providing subsidies for the purchase of animals as well as implements like chaff cutters, fogging systems, etc. to the producers, will also help strengthen the region's co-operatives. The development of dairying in general and dairy co-operatives, in particular, requires well-coordinated joint efforts of the animal husbandry department of the state, all the MUs of the region, and other dairy development agencies like NDDB, GCMMF.

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Supplementary files

Appendix I-IV

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