Abstract The study was conducted in Kamrup district of Assam to evaluate the sustainability of dairy farms of the Self Help Group members in three dimensions of sustainability i.e. economic, social and environmental and data were collected from 200 respondents (100 group members and 100 non-members) through a pretested interview schedule. Sustainability of the dairy farms was measured by using the index specially developed for the study. The mean economic sustainability (0.71), social sustainability (1.73) and environmental sustainability (1.98) of the dairy farms of members were higher as compared to that of the dairy farms of non-member. The Sustainable Dairy Farming Index of the SHG members' dairy farms was significantly higher than that of the dairy farms of non-members. The group activities had positive impact in the performance of dairy farming in the district. "Sustainable Dairy Farming Index" developed in this study would be useful in evaluating the sustainability of other Agricultural/livestock farming practices and the sustainability indicators can be used as checklist for assessing sustainability of the dairy farms.

Keywords: Self help group, sustainability, dairy farming, indicators, Assam, India

Introduction

Self Help Group (SHG) is an informal homogeneous democratic group of 10-20 people joining together voluntarily to deal with common problems with an underlying philosophy of mutual help and collective wisdom. They collect voluntary savings on a regular basis and use the pooled resources to make small interest bearing loans to their members. In India, SHG model and Micro Finance Institute model started in the 1990s. SHGs, which are instrumental in empowering rural poor, are adopting dairy farming is one of the important activities and significantly contributing in empowering the group members socially and economically. In Assam, the idea of Self-Help Group flourished in the nineties at a time when formation of non-government organization has become a trend with the objective of improving the socio-economic conditions of both the urban and the rural poor (Das et al., 2001). There were 73, 17,551 numbers of SHGs in the country and 2, 17,072 numbers of SHGs in Assam (NABARD, 2012-13). In the state of Assam, many rural and agricultural development schemes sponsored by government are mandated with formation and capacity building of dairy-based SHGs. The dairy farms of these group members are small in size (2-3 numbers of cows) and unorganized. Sustainability of dairy farms of these groups relies on the performance of the farms in three broad areas, namely, economic, social and environmental aspects. Earlier studies in different parts of the worlds identified various indicators for evaluation of sustainability of dairy farms. Bylin et al., (2004) developed ten indicators, namely, Animal Welfare; Biodiversity; Community Health; Energy; Farm Financials; Nutrient Management; Organic; Pest Management; Soil Health Management; and Water Management. Few parameters were selected from each indicator category to develop assessment questions. Premchand (2008) worked out the composite Sustainable Dairy Farming Index (SDFI) taking economic, social and ecological indicators. Parent et al, 2010, developed a holistic method, named DELTA, to assess sustainability for three aspects: environmental, technical-economic and social. Little is known about sustainability of the small scale unorganized dairy enterprises undertaken by these SHG groups. If the indicators and factors that influence the dairy farming activities of the groups are available, the concerned organizations involved in the development of dairy sector vis-
à-vis SHGs can manipulate to improve the performance of the dairy sector. Hence, the present investigation is undertaken to assess and compare the sustainability of dairy farms of SHG members' and non-members.

Research methodology

The present study was conducted in Kamrup district of Assam state. The state was selected for the study considering that it was having highest number of SHGs (218,352 SHGs, NABARD, 2009-10) amongst the Northeastern states of India. The Kamrup district was selected as the numbers of dairy SHGs were highest in the district in comparison to other districts of the state at the time of study. There were 123 dairy SHGs out of total 6,370 SHGs covering 1,440 members in the district (P&RD, 2008-09). A total of 20 (twenty) SHGs were selected from the district based on the criteria that the groups must have been functional at least for the last three consecutive years. From each selected group, 5 members i.e. 100 members and another 100 non-members from the adjacent villages with similar socio-economic background were selected randomly to collect data on dairy farming. So, the total sample size for the present study was 200. Data were collected through a pretested interview schedule during 2010. To measure the sustainability of dairy farms, Sustainable Dairy Farming Index (SDFI) was developed by incorporating 14 indicators under three dimensions of the sustainability, i.e., economic, social, and environmental, after taking opinion of a panel of 40 experts. Under economic dimensions of sustainability, 6 (six) indicators were included: production efficiency, net profit, market, lactation length, dry period, and calving interval. Community relations, farmers' knowledge on dairy farming, adoption of improved dairy farming practices (IDFPs) and access to resources and support services were the indicators under the social dimensions. Four indicators, namely, animal welfare, use of dung as manure over fuel, water management, and preparedness for flood, were selected under the environmental dimensions for the study. For making the indicators scale free, following methods were applied:

\[
\frac{X_{ij} \text{- Min} X_{ij}}{\text{Max } X_{ij} \text{- Min } X_{ij}} (1)
\]

\[
\frac{\text{Min } X_{ij} \text{- } X_{ij}}{\text{Max } X_{ij} \text{- Min } X_{ij}} (2)
\]

Where

\(i = 1,2,3, \ldots \text{n indicators}\)

\(j = 1,2,3 \text{ dimensions of sustainability}\)

\(X_{ij} = \text{Value of } i^{th} \text{ indicator of } j^{th} \text{ dimension}\)

Equation (1) was applicable for indicators having positive implications on sustainability.

Equation (2) was applicable for indicators having negative implications on sustainability.

The composite SDFI of the farms was calculated by taking the weighted mean of three dimensions i.e.

\[
\text{SDFI} = \frac{W_1 \times \text{ESI} + W_2 \times \text{SSI} + W_3 \times \text{EnSI}}{3}
\]

Where

\(W_1, W_2, W_3 = \text{Weight assigned to respective dimensions}\)

\(\text{ESI} = \text{Economic Sustainability Index}\)

\(\text{SSI} = \text{Social Sustainability Index}\)

\(\text{EnSI} = \text{Environmental Sustainability Index}\)

First, the inverse of the proportional contributions of ESI, SSI and EnSI to SDFI was obtained. Then, the weights assigned to each dimension were the ratio of its inverse contribution to the sum of all the three inverse proportions.

Results and Discussion

Economic Sustainability

The mean production efficiency and mean lactation length of the dairy farms of SHG members were significantly higher than that of the non-members while the mean dry period of the animals (6.18 months) of members and that of non-members (7.29 months) were found to be differed significantly and negatively at 1 per cent level of probability. The dairy animals of SHG members were found to have short calving interval (14.96 months) as compared to that of dairy animals (15.88 months) of non-members (Table-1). The SHGs were more than five years old and all were banked linked. These groups received financial assistance and loan from the government agencies, non-government organizations and banks. Group approach helped the SHG members' access to internal and external credit facilities that were useful in procurement of farm inputs like good quality animals, balanced feeds, and other resources. With financial supports from different agencies, the members of SHGs created farm assets. Good quality animals in the farms coupled with better feeding and management practices resulted in better productive and reproductive performance of the animals. Verma (1993) reported that the milk productivity of the animal reared by members of cooperative societies was significantly higher than that of the non-members.

The members of the SHGs earned more profit (Rs.8,184) from the dairy farming than that of the non-members (Rs.4,862). The better reproductive and productive performance of the animals resulted in more milk production in the farms of the
The better management of the farms and judicious use of resources by the members also reduced the cost of milk production, thereby, generated more profit from their enterprise.

It is interesting to note that dairy farmers, irrespective of members and non-members sold milk in informal market i.e. to middleman/vendors, sweet makers, tea stall and consumers directly. Only few of them marketed milk through both formal and informal markets. The infrastructure for transport and communication was poor, and therefore costs associated with transfer and transport of milk and milk products were high. The largest city of the entire North-East India, Guwahati, is situated in the studied district i.e. Kamrup, where large numbers of sweet makers/shop and urban consumers are excited. The middleman with an intricate network dominated the milk market in the city. Another reason was that milk cooperatives or societies were non-existent in the district that compelled the farmers to sale milk in informal markets.

Social Sustainability

The SHG members maintained a good community relationship than that of the non-members. Informal relationship amongst its members is the underlying principle of SHGs functioning. These groups developed social capital through social and economic support, sharing information and mutual trust amongst the members. Group action influenced members’ involvement in informal/formal organizations. Social relationship promoted mutual help amongst the SHG members and also provided mental and emotional support during the time of crisis.

The knowledge and adoption level of IDFPs of the SHG members were found to be better than that of the non-members (Table 1). The SHG members assembled regularly to discuss various issues including the primary activities. This facilitated the members to share their experiences and problems faced in performing day to day activities in the farms. The process of sharing information helped them in gaining knowledge and encouraged them to adopt feasible and viable practices in their farms. Capacity building programmes and frequent visits to the farms by various agencies involved in dairy husbandry enhanced the knowledge and skills of the SHG members. The group members maintained links with various stakeholder of dairy sector that also supported them in empowering with latest information. The internal dynamics of the groups, interaction with other groups, capacity building of the members and contacts with the change agents

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Indicators</th>
<th>Members</th>
<th>Non-members</th>
<th>Members vs Non-members (z-stat)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Economic</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Production efficiency</td>
<td>3.17</td>
<td>2.21</td>
<td>6.84**</td>
</tr>
<tr>
<td>2</td>
<td>Lactation length</td>
<td>257.83</td>
<td>243.97</td>
<td>19.76**</td>
</tr>
<tr>
<td>3</td>
<td>Dry period</td>
<td>6.18</td>
<td>7.29</td>
<td>-2.93**</td>
</tr>
<tr>
<td>4</td>
<td>Intercalving period</td>
<td>14.96</td>
<td>15.88</td>
<td>-5.07**</td>
</tr>
<tr>
<td>5</td>
<td>Net Profit</td>
<td>8184</td>
<td>4862</td>
<td>380.23**</td>
</tr>
<tr>
<td>6</td>
<td>Marketing of milk</td>
<td>1.14</td>
<td>1.08</td>
<td>0.76</td>
</tr>
<tr>
<td></td>
<td>Social</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Community Relationship</td>
<td>1.57</td>
<td>0.58</td>
<td>6.75**</td>
</tr>
<tr>
<td>2</td>
<td>Knowledge level on IDFPs</td>
<td>52.32</td>
<td>41.22</td>
<td>26.16**</td>
</tr>
<tr>
<td>3</td>
<td>Adoption level on IDFPs</td>
<td>50.22</td>
<td>38.03</td>
<td>29.43**</td>
</tr>
<tr>
<td>4</td>
<td>Access to Resources and Support Services</td>
<td>2.50</td>
<td>2.31</td>
<td>1.51</td>
</tr>
<tr>
<td></td>
<td>Environmental</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>Animal Welfare</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>a</td>
<td>Animal with disease condition</td>
<td>0.19</td>
<td>0.26</td>
<td>-1.52</td>
</tr>
<tr>
<td>b</td>
<td>Housing Condition</td>
<td>1.67</td>
<td>0.86</td>
<td>4.41**</td>
</tr>
<tr>
<td>c</td>
<td>Calf rearing Condition</td>
<td>2.13</td>
<td>1.93</td>
<td>2.46*</td>
</tr>
<tr>
<td>2</td>
<td>Utilization of Dung</td>
<td>1.73</td>
<td>1.49</td>
<td>2.46*</td>
</tr>
<tr>
<td>3</td>
<td>Water management in the farms</td>
<td>1.89</td>
<td>1.33</td>
<td>5.51**</td>
</tr>
<tr>
<td>4</td>
<td>Preparedness to flood</td>
<td>1.74</td>
<td>1.59</td>
<td>1.34</td>
</tr>
</tbody>
</table>

**Significant at 1 per cent level of probability  *Significant at 5 per cent level of probability
positively contributed in knowledge gain and adoption level of IDFPs in the farms of the SHG members. Findings of various researchers, viz., Prakash (2009), Ganguly (2005), Singh (2003), and Nishi (1996) also are also in similar line.

There was no significant difference between the mean score of access to resources and support services of members and non-members (Table 1). During the study, the farmers revealed that they could not inseminate their cows in time that led to frequent failure of conception. It was also found that farmers had less access to the veterinary facilities, portable water, insurance, extension services, etc. The findings has received support from the findings of International Livestock Research Institute, (ILRI), 2007, which reported that access to livestock services emerged as a major constraint to dairy producers in Assam.

Environmental Sustainability

The animal welfare in a dairy farm was assessed through overall health condition of the animals, housing condition and calf rearing condition in the farms of the respondents. Prophylaxis measures like vaccination, deworming etc. were not done periodically though it is important as the temperate and humid environment of the state is conducive for growth and multiplication of various disease causing organisms.

The housing condition in the farms of members was satisfactory than that of non-members. Various capacity building programmes sensitized the group members about the animal welfare and its relation to production. Frequent extension contact, more knowledge on dairy farming, higher level of adoption and higher income helped the members to make the housing condition more comfortable to the animals.

A glance of the Table 1 indicates that the calf rearing condition in the farms of both members and non-members were found to be unsatisfactory. Adequate attention was not given in bringing up of the calves especially male calves. This might be due to the high cost of feeds and fodder and less manpower in the farms.

Dung was mostly used for manuring the agricultural field and sometimes used it for both the purposes i.e. as manure and fuel. Dung utilization pattern amongst dairy farmers was quite eco-friendly as not a single respondent used the dung completely as fuel (Table 1). The finding is similar with the finding of Premchand, 2008, who also reported that it was mostly used for manure and only 27.00 per cent was used for fuel.

Water management in the farms of SHG members was satisfactory though rain water harvesting facility was almost absent. There was absence of proper drainage system to drain off the farm sewage in the vicinity of the farms. These non-productive aspects of dairy farming were not given proper attention that might be due to the extra investment required.

A perusal of Table 1 reveals that SHG members as well as non-members were not prepared for flood. Flood is a common problem for the whole area and there was little community or institutional efforts to make long lasting provisions like raised platform to keep the animals during flood, stoking of feeds and fodder, pre and post flood mass vaccination of animals, deworming etc. in the study area.

Composite Sustainability of Dairy Farms

The SDFI was worked out by taking into all the three-dimensions of sustainability, viz. economic, social and environmental dimensions. The relevant findings are presented in Table 2. Economic sustainability reflects the financial stability, viability, and profitability of dairy farms. The average ESI for dairy farms of members ranged from -0.78 to 3.78 and that for the non-members’ dairy farms varied between -0.1.02 to 2.80. Mean ESI for dairy farms of members (0.71) was higher as compared to that of the dairy farms of non-member (0.12). The dairy farms of the SHG members exhibited high production efficiencies, longer lactation length, higher net profit from the enterprise, and shorter dry and intercalving periods of the animals. The farms maintained by the members were economically viable than that of the non-members.

The SSI measures the extent of social compatibility of a farming system. The SSI of the dairy farms of members ranged from 0 to 4.00 while that for the non-members varied in between 0 to 3.68. The mean SSI of members (1.73) had a significance difference at 0.01 per cent of probability with that of the non-members (1.24). The farms of members exhibited higher social sustainability due to higher knowledge and adoption level of IDFPs in the farms, better credit access, involvement in the community matters and vice versa and more extension contacts with change agents.

The EnSI for members' dairy farms ranged from 0.11 to 4.5 while that for the non-members varied in between 0 to 3.02. The mean EnSI score for members' dairy farm (1.98) was higher than that of non-members (1.66). Comfortable housing conditions, better utilization of dung, good water management condition in farms were the reasons for higher EnSI of dairy farms of the members.

The SDFI for the dairy farms of members ranged from 0.04 to 1.21 while that for the dairy farms of non-members varied in between -0.10 to 1.03. Difference at one per cent level of probability was found between the mean SDFI of members' dairy farms and that of the non-members dairy farms. Mean SDFI for the members' dairy farms (0.59) was higher as...
compared to that of the non-members (0.36). A higher sustainability of dairy farms of SHG members was due to group action that facilitated SHG members' having better accessibility to institutional credit, more extension contacts with the change agents, more trainings, higher knowledge and adoption of technologies, greater informal relation with fellow farmers, comfortable housing for animals, and proper water management approach in the farms.

**Conclusions**

In light of the above analysis, it may be inferred that dairy farms of the SHG members were performing well in comparison to the non-members in most of the sustainability indicators included in the study. Micro-credit groups like SHGs would be effective and viable means for promoting dairy sector in the state like Assam where good infrastructure and effective support services and institutions required for sustainable dairy development are lacking. Following factors are crucial for better sustainability of dairy farms of SHGs:

1. Micro-credit facilities offered by the SHGs to its members helped the farmers to take small loans to invest in the farming activity which acted as the driving forces for better performance of the farms of the members.
2. The information empowerment of SHG members through group activities like meetings, trainings, contacts with change agents, and informal discussion with fellow members helped the members in adopting improved farming practices in their farms.
3. Mutual help and cooperation amongst the members, the essence of SHG, are unique and providing basis for the better sustainability of the farms of the members than the non-members.
4. Bank-linkage of SHGs facilitated the groups in getting loans from the financial institutions which are otherwise not interested in providing loan to resource-poor dairy farmers. It encouraged the members in investing more in the farms.
5. A positive and healthy competition of the members of SHGs led to continuous improvement of the performance of the farms.

Strengthening of dairy -based SHGs, financially and organisationally, will contribute to the sustainability of dairy sector in the state.

**References**


NABARD (2009-10) Status of Microfinance in India. Microcredit Innovation Department, National Bank for Agricultural and Rural Development, Mumbai

NABARD (2012-13) Status of Microfinance in India. Microcredit Innovation Department, National Bank for Agricultural and Rural Development, Mumbai


P&RD (2009) Panchayat and Rural Development Department, Govt. of Assam. www.prd.nic.in


---

**Table 2** Sustainability Index of Dairy Farms of SHG Members and Non-members

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Dimensions</th>
<th>Members</th>
<th>Non-members</th>
<th>Members vs Non-members (z-stat)</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Economic Sustainability</td>
<td>0.71</td>
<td>0.12</td>
<td>4.01**</td>
</tr>
<tr>
<td>2</td>
<td>Social Sustainability</td>
<td>1.73</td>
<td>1.24</td>
<td>3.26**</td>
</tr>
<tr>
<td>3</td>
<td>Environmental Sustainability</td>
<td>1.98</td>
<td>1.66</td>
<td>2.82**</td>
</tr>
<tr>
<td>4</td>
<td>Sustainable Dairy Farming Index (SDFI)</td>
<td>0.59</td>
<td>0.36</td>
<td>2.78**</td>
</tr>
</tbody>
</table>

**Significant at 1 per cent level of probability**