DISCRIMINANT FUNCTION ANALYSIS FOR SELF-HELP GROUPS:
A CASE STUDY OF GUJARAT, INDIA

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ABSTRACT
Study was undertaken in Panchmahal district of Gujarat to analyse the progress and performance of the Self-Help Groups (SHGs) and to identify the factors discriminating women and men SHGs. Linear discriminant function analysis was used to find the variables discriminating between beneficiaries of female and male groups. There was a considerable growth in factors like number of loans, amount of loan disbursed and recovery performance between 2002 and 2006. Average number of loans disbursed was 5.82 per year per group whereas the average amount advanced was Rs. 9210. Overall recovery percentage was 93.36. The progress and performance of female SHGs was better than that of male SHGs. Main variables discriminating between beneficiaries of female and male groups were education, land holding, loan amount, institutional participation, extension contact and their respective contribution in discriminating the two groups were 48.36, 16.02, 17.00, 6.42 and 12.18 per cent respectively.

Key words: Discriminant function, Gujarat, SHG.

INTRODUCTION
The microfinance (mF) movement in India is more than a decade old now. The Pilot Project on ‘Linking Self-Help Groups (SHGs) with Banks’ of the National Bank for Agriculture and Rural Development (NABARD) was mainstreamed as a normal lending activity of banks in 1996. Since then, the mF movement through self-help groups (SHGs) has made unprecedented progress in India (Nair, 2005). India has adopted Bangladesh’s model of micro-finance in a modified form. The mF has emerged as a powerful instrument in new economy to alleviate the poverty and to empower the women. SHGs and credit management groups have also started in India with availability of mF and thus the movement of SHG has spread out in India.

Women managed SHGs have shown remarkable growth during the last decade in India. SHGs have proved to be very versatile and their members have successfully taken up both economic and community related interventions. They provide an opportunity to poor women to take decisions involving themselves, their groups and their lives. Savings and credit is normally used as an entry point for formation of SHGs since it gives the members a chance to participate in decision-making and satisfies their short-term credit needs. Realising that they can be a promising tool in capacity building of rural poor especially women, central and state governments have vigorously supported the SHG-centric models of development in India.

Generally a SHG consists of 10 to 20 members who save some amount (Rs. 10 to 200 per month) that they can afford. A monthly meeting is organised, where formal and informal discussions are held on disbursement and repayment of loans. The members also share their experiences and discuss on many social issues of the groups at the meeting.

SHG is a small voluntary association of poor people, preferably from the same socio-economic background. They come together for addressing their common problems. They are encouraged to make voluntary thrift on a regular basis. They use this pooled resource to make small interest bearing loans to their members. The process helps them imbibe the essentials of financial management including
prioritisation of needs, setting terms and conditions as well as accounts keeping. This gradually builds financial discipline amongst them. They also learn to handle resource of a size that is much beyond individual capacity of any of them. SHG members begin to appreciate the resource which is limited and have a cost. Once the group shows this mature financial behavior, banks are encouraged to prefer loans to the SHG in certain multiples of its accumulated. The bank loans are given without any collateral and at market interest rates. The group continues to decide the terms of loans to their own members and since they own accumulated savings, they are part and parcel of the aggregate loans preferred by the group, hence peer pressure ensures timely repayments (Anonymous, 2006).

The foregoing discussion indicates SHGs are emerging as an alternative and an effective micro-credit system. Therefore, the SHGs in micro finance have received much attention from the policy makers and others for their perceived ability to contribute significantly to the economic growth and poverty alleviation. The financial institution and policy makers need to evaluate the present status of SHGs and microfinance. The present study was planned in Panchmahal district to analyse the progress and performance of the SHGs and to identify the factors discriminating women and men SHGs with this background.

**MATERIALS AND METHODS**

**Data and sampling**

Panchmahal district was selected for the study. Panchmahal district has 11 talukas and 3764 SHGs are functioning here. Lunavada and Ghoghamba taluka were selected on the basis of higher number of SHGs. Four SHGs i.e. two female and two male groups were randomly selected from each selected talukas. Thus, total eight SHGs were selected for the study. 8 members were randomly chosen from each selected SHG for the selection of beneficiaries. Thus, 64 beneficiaries in all were selected from eight SHGs (32 female and 32 male). The required primary data from 2002 to 2006 were collected through personal interview method with help of pre-tested comprehensive interview schedule during the months of July-August 2007.

**Method of analysis**

The progress and performance of SHGs was studied through the variables such as loan disbursement, recovery, overdue, savings and working capital. The data were tabulated and percentage and simple average were computed to draw meaningful conclusions.

Further, Linear Discriminant Function Analysis was used to find the variables discriminating between beneficiaries of female and male. The variables selected for discriminant analysis are:

- \( X_1 \) = age of the SHG member in years.
- \( X_2 \) = Education score of family head in an ascending order for the number of year of schooling.
- \( X_3 \) = Total land holding of the beneficiary in hectares.
- \( X_4 \) = Loan amount taken from SHG in Rupees.
- \( X_5 \) = Loan amount repaid was taken by giving a score ‘ 0’ for full repayment and ‘ 1’ for partial repayment.
- \( X_6 \) = Institutional participation: During the course of data collection, respondents were asked about their association with various organizations within and outside their villages. Those who participated in Village Panchayat, Milk Producers’ Cooperative Society and Taluka Panchayat etc. were assigned score ‘ 1’ and ‘ 0’ otherwise.
- \( X_7 \) = Extension contact: Those who contact Gram Sevak, Extension Officer, TDO etc. were given score ‘ 1’ and ‘ 0’ otherwise.
- \( X_8 \) = Extension participation: The respondent participated in NGO Training, Agricultural Exhibition etc. were assigned a score ‘ 1’ and ‘ 0’ otherwise.
- \( X_9 \) = Mass media participation: The type of mass media participation was Radio news, News papers, TV shows and Magazines. Score “1” was assigned for those who had exposure to mass media participation and ‘ 0’ otherwise.
- \( X_{10} \) = The net income from loan utilization in Rupees.

**Procedure for Linear Discriminant Function Analysis**

The discriminant function was used to know the relative importance of different variables in terms of their power to discriminant between the
beneficiaries of two groups; Female and Male groups. The discriminant function of the following form was used:

\[ Z = L_1 X_1 + L_2 X_2 + L_3 X_3 + L_4 X_4 + L_5 X_5 + L_6 X_6 + L_7 X_7 + L_8 X_8 + L_9 X_9 + L_{10} X_{10} \]

Where,

\[ Z = \text{Composite discriminant scores for the two groups.} \]
\[ X_i's = \text{Variables selected to discriminate the groups.} \]
\[ L_i's = \text{Discriminant coefficients.} \]

Two groups are expected to be roughly of equal size for the application of discriminant function. Thus, the sample comprised of 32 female and 32 male members each in the present study. The function was constructed by choosing values of linear discriminant coefficients in such a way that the following ratio was maximized.

\[
\frac{(\text{Variation of 'Z' between the two groups})}{(\text{Variation of 'Z' within the two groups})}
\]

The calculation of discriminant function involved the solution of the following equations in the matrix notations.

\[ SL = D \]

Where,

\[
S_1 S_2 \ldots S_k \quad L_1 \quad d_1 \\
S_2 S_2 \ldots S_k \quad L_2 \quad \text{and} \quad D = d_2 \\
\vdots \quad \vdots \quad \vdots \\
S_k S_k \ldots S_k \quad L_k \\
\]

Where,

\[ k = \text{Number of Variables} \]
\[ L_k = \text{Vector of coefficient of discriminant function} \]
\[ S = \text{Pooled dispersion matrix, and} \]
\[ D = \text{Vector of difference between the mean values of different characteristics for the two groups.} \]

The discriminant function was tested for the significance to know whether the variables considered together were significantly discriminating the two groups or not. The Mahalanobis \(D^2\) statistic was used to measure of distance between the groups (Kumar S, 1999).

The product of coefficient of discriminant function and the differences between the mean values of different characteristics for the two groups were multiplied by 100 and the value of \(D^2\) ultimately gave the per cent contribution of individual characteristics to the total distance measured.

**RESULTS AND DISCUSSION**

**PROGRESS AND PERFORMANCE OF SHGs**

Number and amount of loans, recovery, overdue, savings and working capital were considered important parameters to assess the progress and performance of SHGs for a period of five years (2002 to 2006).

**Progress of Loan Disbursement, Recovery and Overdue in SHGs**

It was be observed that the average number of loans disbursed per SHG increased over the years for both male and female groups (Table 1) and reached to 7.63 in 2006 from 3.37 during 2002. Highest increase (48.15 per cent) in number of loans disbursed was observed during 2002 & 2003. Number of loans disbursed was found higher for female SHGs (6.30) than that of male SHGs (5.35).

The loan amount disbursed per SHG also increased from Rs 3887.50 in 2002 to Rs 13,887.50 in 2006 for both male and female SHGs. It was also observed that loan amount disbursed per SHG was higher in female group (Rs 10, 510) than that of male group (Rs 7910). The progress of SHGs in terms of number and amount of loan disbursed was found to be satisfactory in the entire sample SHGs.

Though the sample SHGs indicated satisfactory performance in terms of number and quantum of loans disbursed, it is important to assess the recovery and overdue status as they determine the performance of any financial institution. It was interesting to note that overall recovery percentage was 93.36 per cent during five year period for sample as a whole. The recovery of loan ranged from 91.67 per cent to 93.94 per cent for the sample as a whole. It was also observed that the recovery percentage of female SHGs (94.68 per cent) was higher than that of male SHGs (91.60 per cent). As the recovery is essential for recycling of fund for productive purpose, it can be inferred from the above results that SHGs performance was good in Panchmahal district.
The study of overdue is also required to evaluate the performance of SHGs as overdue is past due which is not paid at the scheduled or expected time limit. Overdue amount per group was only Rs 258.53 (2.81 per cent to total advances) for the sample as a whole. The amount overdue was slightly more for the male SHG (Rs 299.10 per group) than that of female SHG (Rs 217.95 per group). Thus the overdue was very low and it was found because of the failure of crops and low prices of agricultural produce.

The other important indicator considered to assess the performance of SHGs is their savings. Adequate savings is a pre-requisite to get linked to a financial institution and therefore, all SHGs

<table>
<thead>
<tr>
<th>Year</th>
<th>Male</th>
<th>Female</th>
<th>Aggregate</th>
<th>Male</th>
<th>Female</th>
<th>Aggregate</th>
</tr>
</thead>
<tbody>
<tr>
<td>2002</td>
<td>448.14</td>
<td>379.92</td>
<td>414.03</td>
<td>4817.50</td>
<td>5793.75</td>
<td>5305.63</td>
</tr>
<tr>
<td>2003</td>
<td>487.09</td>
<td>413.44</td>
<td>450.27</td>
<td>5236.25</td>
<td>6305.00</td>
<td>5770.63</td>
</tr>
<tr>
<td>2004</td>
<td>563.14</td>
<td>471.80</td>
<td>517.47</td>
<td>6053.75</td>
<td>7195.00</td>
<td>6624.38</td>
</tr>
<tr>
<td>2005</td>
<td>615.12</td>
<td>515.37</td>
<td>565.35</td>
<td>6612.50</td>
<td>7862.50</td>
<td>7237.50</td>
</tr>
<tr>
<td>2006</td>
<td>657.79</td>
<td>573.52</td>
<td>615.66</td>
<td>7071.25</td>
<td>8746.25</td>
<td>7908.75</td>
</tr>
<tr>
<td>Pooled</td>
<td>554.26</td>
<td>470.85</td>
<td>512.56</td>
<td>5958.25</td>
<td>7180.50</td>
<td>6569.38</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses indicate increase over previous year.
It can be observed from Table 3 that the working capital available per SHG was about Rs 58,761.60 for the sample as whole. The working amount was higher in female SHG (Rs 61, 915.70 per group) as compared to male SHG (Rs 55,607.50 per group) during the study period. The working capital also showed increasing trend over years.

**Variables discriminating between the Beneficiaries**

In order to examine the relative importance of different factors in discriminating between the beneficiaries of female and male groups, the discriminant function analysis was carried out. The coefficients of the discriminant function measure the net effect of an individual variable. The values of mean and the mean difference in characteristics of beneficiaries are presented in Table 4.

The t-values were found non-significant for the variables viz.; age, loan repayment, extension participation, mass media contact and income from loan utilization. Therefore, these variables were dropped from the discriminant function analysis.

The discriminant function fitted for the significant variables (Table 5) for beneficiaries is as follows:

\[ Z = 0.2360X_2 + 1.0752X_3 - 0.0003X_4 + 0.5170X_6 + 0.7129 X_7 \]

The results indicated that the main variables discriminating between beneficiaries of female and male groups were education (0.2360), land holding (1.0752) and loan amount (-0.0003), institutional participation (0.5170) and extension contact (0.7129).

**Working capital**

Savings form a major portion of working capital which is available for lending. Therefore, it is important to know the working capital availability in the groups. The working capital of the SHG comprises of savings, interest on savings, fine, interest on loans and grant/loan from sponsoring organization/bank.

**TABLE 3: Working Capital of SHG.**

<table>
<thead>
<tr>
<th>Year</th>
<th>Working capital per Group (Amount in Rs per group)</th>
<th>Aggregate (Amount in Rs per group)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male</td>
<td>Female</td>
</tr>
<tr>
<td>2002</td>
<td>41125.50</td>
<td>47132.50</td>
</tr>
<tr>
<td>2003</td>
<td>51094.50</td>
<td>53996.50</td>
</tr>
<tr>
<td>2004</td>
<td>55472.75</td>
<td>61383.50</td>
</tr>
<tr>
<td>2005</td>
<td>61419.50</td>
<td>68813.50</td>
</tr>
<tr>
<td>2006</td>
<td>68925.75</td>
<td>78252.50</td>
</tr>
<tr>
<td>Pool</td>
<td>55607.50</td>
<td>61915.70</td>
</tr>
</tbody>
</table>

Note: Figures in parentheses indicate increase over previous year.

prescribed a minimum monthly savings to its members. The data regarding savings per member and per SHG is presented in Table 2. The saving was Rs 512.56 per member and Rs 6569.38 per group for the sample as whole during the study period. Saving per member is lower (Rs 470.85) in the female SHG than that of the male SHG (Rs 554.26) since per member saving was Rs 30 per month in female SHG while in case of male SHG it was Rs 30 for two selected groups and Rs 50 for other two selected group.

**Working capital**

Savings form a major portion of working capital which is available for lending. Therefore, it is important to know the working capital availability in the groups. The working capital of the SHG comprises of savings, interest on savings, fine, interest on loans and grant/loan from sponsoring organization/bank.

**TABLE 4: Means and the mean differences in characteristics of male and female groups.**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>Mean value</th>
<th>Mean difference (ΔX)</th>
<th>t-values for (ΔX)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Male group</td>
<td>Female group</td>
<td></td>
</tr>
<tr>
<td>Age (X₁)</td>
<td>36.28</td>
<td>35.78</td>
<td>0.50</td>
</tr>
<tr>
<td>Education (X₂)</td>
<td>7.34</td>
<td>3.22</td>
<td>4.12</td>
</tr>
<tr>
<td>Land holding (X₃)</td>
<td>1.18</td>
<td>0.88</td>
<td>0.30</td>
</tr>
<tr>
<td>Loan amount (X₄)</td>
<td>4896.88</td>
<td>6178.12</td>
<td>-1281.25</td>
</tr>
<tr>
<td>Loan repayment (X₅)</td>
<td>0.28</td>
<td>0.28</td>
<td>0</td>
</tr>
<tr>
<td>Institution participation (X₆)</td>
<td>0.66</td>
<td>0.41</td>
<td>0.25</td>
</tr>
<tr>
<td>Extension contact (X₇)</td>
<td>0.81</td>
<td>0.47</td>
<td>0.34</td>
</tr>
<tr>
<td>Extension participation (X₈)</td>
<td>0.56</td>
<td>0.69</td>
<td>-0.12</td>
</tr>
<tr>
<td>Mass media contact (X₉)</td>
<td>0.62</td>
<td>0.69</td>
<td>-0.06</td>
</tr>
<tr>
<td>Income from loan utilisation (X₁₀)</td>
<td>1765.78</td>
<td>2012.50</td>
<td>-246.72</td>
</tr>
</tbody>
</table>

**indicates significant at 1 per cent level and * indicates significant at 5 per cent level.**
In order to know the relative importance of each characteristic and its power to discriminate the two groups, the percentage of total distance was computed (Table 5). It could be observed from the table that education, land holding, loan amount, institution participation and extension contact were the major characteristics discriminating the SHGs of the female and male groups and their respective contribution in discriminating the two groups were 48.36, 16.02, 17.00, 6.42 and 12.18 per cent.

**CONCLUSION**

There was a considerable growth in number of loans, amount of loan disbursed and recovery performance between 2002 and 2006. Average number of loans disbursed per groups per year was 5.82 whereas; the average amount advanced per group per year was Rs. 9210. Overall recovery percentage was 93.36. SHGs emphasized monthly savings which enabled the group to get linked to financial institution and also made it sustainable and self reliant. The saving was Rs.512.56 per member and Rs. 6569.38 per group for the sample as a whole during the study period. Working capital which is the main source of funds available with SHG for lending to its members comprised of SHGs savings, interest on savings, fine, interest on loans and grant/loan from sponsoring bank. This fund available per SHG was about Rs. 58,760 for the sample as whole. It was also revealed that the progress and performance of female SHGs was better than that of male SHGs. The main variables discriminating between beneficiaries of female and male groups were education, land holding, loan amount, institution participation and extension contact and their respective contribution in discriminating the two groups were 48.36, 16.02, 17.00, 6.42 and 12.18 per cent.

The study clearly indicates that the women groups are faring well in all the respects of SHG functioning due to strong peer pressure and commitment to the institution. So there is a need for the concerned developmental agencies to identify and form more of such groups as they help for the economic development of the family as a whole.

**REFERENCES**