# Latent Class Model on Socio-Religious Data

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**Abstract:** We believe that in last two decades perception regarding socio-religious values had been changed in our society. Survey has been carried out on "changes in social values and their acceptance" in year 2011. Respondents have asked 74 questions (marked on Likert-scale) regarding educational system, political and religious affiliations and their impact on social values. Among these we have selected only those questions related to socio-religious issues (based on of individual and collective perceptions about the prevailing standard of the society in comparison with Islamic standards). Similar surveys using the same questionnaire had had conducted in year 1994 and 2001. Respondents, at each time of survey, were young students (youth acquiring education) from different colleges (Karachi region) and Karachi University. Perception can be explained more appropriately through latent class model (LCM). Through LCM we can explore structures in the data in term of different opinion groups. The modeling is done on the selected set of similar questions from each year. Conditional probabilities for year 2011, 2001 and 1994 are then compared in search of presence of any difference of opinion between the respondents. It is observed that by the passage of time, due to the influence of the electronic media there is a change in the opinion about the values of the society among the youth. Although, there is a reduction in the proportion of "Dissatisfied group" within the society but negative perception is penetrating among our young generation specifically about Ulmah and Imam's role and women's due rights toward society.

**Keywords:** Chi-square test, Latent Variable, Parsimony Measures, Structural Modeling etc.

## 1. INTRODUCTION

In this paper LCM is used to explain the changes occur by the passage of time in the perception of social values among youth in contrast to religious norms. Surveys conducted in this regard include respondent's perceptions on Islam and local urban society, while other responses are based on their perception on their own rights and duties on educational and political system. In this paper we have encountered only those questions related to socio-religious values (specific and collective perception on the prevailing standard in the society). Analyses are carried out on the survey conducted at three different time (that are; 1994, 2001 and 2011) using the same questionnaire and same age group (15-22 years of age). Respondents were students of, colleges (in Karachi Region) and, University of Karachi. A total of 324, 235 and 240 individuals participated in surveys conducted in year 1994, 2001 and 2011 respectively.

LCM, in our opinion, will serve the purpose as we think that the respondents may form different opinion groups. We will assess, among three different time periods, the variation in the opinion groups by comparing the class proportions $(\lambda_j)$ and class conditional probabilities $(\omega_{ij})$. There is no prior knowledge of the number of groups and it itself is an estimable quantity along with other parameters of the model.

Strategy for analysis will be focusing on the following steps.

1. Create models which could categorize the individuals into various "thought" groups according to their opinion.
2. On the basis of the fitted models and its parameters $(\lambda_j, \omega_{ij})$, label and distinguish different thought groups.

Latent Structure Model or LCM was initially developed by Lazersfeld and Henry [1] and then further by Goodman [2], Clogg [3] and others. There are numerous scientists who have used the approach of LCM to define groups or clusters within the populations under study. It is a technique suitable for many areas of study, such as, education, social sciences, behavioral sciences, psychiatry, medical research and marketing research but not limited to these fields as mentioned here. Many researchers wrote well known papers on education data see [4, 5, 6]. Keel *et al*. [7] used LCA for eating disorders phenotypes. Number of researches has been carried out in the field of general psychiatry using LC modeling; See [8-16]. Use of LCM in marketing research and medical diagnosis can be seen in [17, 18]. It is also considered for measurement errors in numerical variables [19] and to compare classification error rate in categorical administrative and survey variable [20, 21].

### 1.1. Latent Structure Modeling

Latent Structure Model is a method through which we can measure unobservable variables from the set of

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manifest variables. Manifest variables can be directly observed and considered as the basic measurement of an empirical study. In such kind of analysis, we are interested in the concept that cannot be directly observed or measured and thus need other responses that can serve as an indicator of the concepts under consideration. Then try to ascertain whether the relationship between set of manifest variables can be used as predictable as being measures of unobserved variables called latent (hidden) variables [22]. For example, intelligence can be a variable but it cannot be directly observed or measured. In most of the social surveys, questionnaires have been designed to find the hidden factors which are difficult to observe or cannot be directly questioned. These factors can then be identified through the number of directly observable variables or manifest variables. LCA is a method which assumes existence of latent variable in such a manner that given the latent variable, all manifest variables are locally independent [23]. This assumption is called conditional independence or local independence, which is the base of LCM and is the key to differentiate between mixture model and Latent Class Model. Goodman [24] provided a suitable version for Latent Class Model. When local independence is of substantive scientific importance an alternative method is to consider it as additional discrete latent variable see [25].

Manifest variables can be dichotomous, polytomous, ordered-category, likert-scale or nominal level of measurement. We consider only a single categorical variable with K levels, each level representing a latent class in LCM and evidently within each latent class the set of manifest variables should become independent of one another. The model is shown in Equation 1. The parameter of LC model and estimation method is given in the next section. The process of estimating the class proportions and within class probabilities requires persistent iterative algorithm.

### 1.2. The Model

Let the response of n individuals are taken on p manifest variables (p items), say, $(x_1, x_2, x_3, \ldots, x_p) = X'$, the individual response in $x_i$ is labeled as either 1 (positive response; Agree) or 0 (otherwise; don't Agree). It is assumed that y a single categorical latent variable with k labels (each label represent a latent class), that is, y = 1, 2,…, j, … k; causes mutual independence among the $X'$ variables. Y is also a random variable since by definition it varies from one individual to another [26]. The probability that a respondent is categorized as member of the class of y (Y = j) can be written as;

$$P(Y = j) = g(y) = \lambda_j; \quad j = 1, 2, \ldots, k$$

With a restriction, that the sum of all $\lambda_j's$ are equal to one. Under the assumption that the manifest variables become independent when they are observed in a class, thus the distribution function of x can be written in the form of mixture Bernoulli distribution;

$$\varphi(x|y) = \sum_{j=1}^{k} \lambda_j \prod_{i=1}^{p} \omega_{ij}^{X_{ih}} (1 - \omega_{ij})^{1-X_{ih}} \tag{1}$$

Where $P(x_i = i / y = j) = \omega_{ij}$, be the probability of a positive response on variable (question) i for a person in category j (i = 1,2,…,p; j = 1, 2, …, k). The log-likelihood for n random respondents is:

$$L = \sum_{h=1}^{n} \log \left\{ \sum_{j=1}^{k} \lambda_j \prod_{i=1}^{p} \omega_{ij}^{X_{ih}} (1 - \omega_{ij})^{1-X_{ih}} \right\} \tag{2}$$

To find the maximum likelihood estimates for $\lambda_j's$ and $\omega_{ij}'s$ the log likelihood function (L) should be maximized with a constraint that sum of all $\lambda_j$ should be equals to 1. The classical way to find the maximum likelihood estimates is to differentiate L with respect to the parameter, and equate it to zero. The problem with the function is that it has several local maxima and to find the best maximum likelihood solution one need to find the global maxima. There are many methods through which one can estimate the model's parameters such as EM algorithm, Newton-Raphson, fisher Scoring, Generalized EM algorithm etc (for more details see [27]). We will use the classical approach for estimating the model parameters using EM algorithm. It is a general approach to estimate the maximum likelihood estimates and was first introduced by Hartley [28] for the case of a discrete distribution. It was then discussed by Dempster, Laird and Rubin [29] supplemented by Wu [30]. The equations of parameters to be estimated are given in equation 3-5, that are, $\lambda_j$ (class proportion), $\omega_{ij}$ (class probabilities) and $g(j / x_h)$ class assigning probabilities, respectively.

$$\lambda_j = \frac{1}{n} \sum_{h=1}^{n} g(j / x_h) \tag{3}$$

$$\omega_{ij} = \frac{1}{\lambda_j n} \left( \sum_{h=1}^{n} x_{ih} g(j / x_h) \right) \tag{4}$$

$$g(j/x_h)=\frac{\lambda_j\prod_{i=1}^{p}\omega_{ij}^{X_{ih}}(1-\omega_{ij})^{1-X_{ih}}}{\sum_{j=1}^{k}\lambda_j\prod_{i=1}^{p}\omega_{ij}^{X_{ih}}(1-\omega_{ij})^{1-X_{ih}}} \quad (5)$$

In order to obtain maximum likelihood estimates for Grouped data [31] for a single latent variable having two classes (j = 1, 2) with four dichotomous manifest variables $x_1, x_2, x_3, x_4$. there will be 24 = 16 fold table for the total response pattern. The log-likelihood function for p dichotomous manifest variables yielding $2^p$-fold table and k latent classes can be represented as given in Equation 6 and the formula's for estimating parameters are presented in equation 7, 8 and 9.

$$L=\sum_{t=1}^{2^P} f_t \log\left\{\sum_{j=1}^{k}\lambda_j\prod_{i=1}^{p}\omega_{ij}^{X_{it}}(1-\omega_{ij})^{1-X_{it}}\right\} \quad (6)$$

$$\lambda_j=\frac{1}{\sum f}\sum_{t=1}^{2^P} f_t g(j/x_t) \quad (7)$$

$$\omega_{ij}=\frac{1}{\lambda_j\sum f}\left(\sum_{t=1}^{2^P} f_t x_{it} g(j/x_t)\right) \quad (8)$$

$$g(j/x_t)=\frac{\lambda_j\prod_{i=1}^{p}\omega_{ij}^{X_{it}}(1-\omega_{ij})^{1-X_{it}}}{\sum_{j=1}^{k}\lambda_j\prod_{i=1}^{p}\omega_{ij}^{X_{it}}(1-\omega_{ij})^{1-X_{it}}} \quad (9)$$

## 2. MATERIAL AND METHOD

LCM is applied on six questions (given below) from questionnaire related to the individual's perception on the social values in light of Islamic guiding principles. We believe that in an Islamic society the prevailing rules governing the social system should be in line with those provided by the religion. The objective behind selecting these questions is to find how much people understand the norms of living provided by Islam and how they act in the society. The questions are statement to which responses are on 5-level scale, 1 to 5. The responses are coded as 1 ="strongly agree", 2= "agree", 3 = "don't know", 4 = "disagree" and 5 = "strongly disagree". For this analysis, we considered whether a respondent agree or do not agree to the statement and for that reason we simplified the scale as "1" being (agree, strongly agree) and "0" being (any other response).

CS: Our society is completely civilized society.

UI: Ulmah and Imams of Masajids are playing positive role in promoting mutual understanding and unity among the members of the society.

FP: I believe in using family planning methods.

WR: In our society women are given their due rights.

WM: Men and women are equal in all aspects.

BAN: Telecasting by foreign channels through cables/dish antenna should be banned.

These questions/statements are related to respondent perception about the society, role of religious teaching, freedom of media and family planning (which were previously thought to be un-Islamic), people were against family planning but now different point of view expected to emerge. In our opinion norms and teaching of Islam have a significant impact on the upbringing of children. We think that the rules provided by Islam and those society following should not have contradictions, if we call it an Islamic society. Therefore, we expect positive response from highly religious people (Islamic values followers) on every statement except telecasting foreign channels through cable/dish antenna. Such group might be regarded as a religious and fully satisfied group.

## 3. RESULTS

"poLCA", a software package implemented in R statistical computing environment [32] is used to obtain LCM. We have also performed analyses after adding gender as the 7th manifest variable to explore, if it can be helpful in classification of different opinion groups. A detailed discussion will be provided on the model fitted for each year (for both analyses; gender inclusive/ exclusive) separately followed by an overall comparison as well. Akaike Information criteria (AIC), Bayesian Information criteria (BIC), deviance statistics $(G^2)$, chi-square $(\chi^2)$, number of estimated parameters (r) and maximum log-likelihood (ML) of the respective model are presented in Table **1** (analysis output using 6 manifest variables) and Table **4** (analysis output using 7 manifest variables; gender inclusive). Tables **3** and **6** presents cross classification tables of latent class assignment against gender for socio-religious surveys of years 1994, 2001 and 2011 using 6 and 7 variables, respectively. Whereas, Tables **2** and **5**, presents estimated class conditional probabilities and class proportions. These solutions are obtained based on global maxima. Outputs obtained for the fitted model for each year are discussed separately along with comparisons of different models.

The model with minimum value of summary statistics (AIC, BIC, $G^2, \chi^2$ and Maximum log-likelihood

**Table 1: Results of LC Models Fitting to Socio-Religious Data for Using 6-Variables**

| | No. of classes | AIC | BIC | $G^2$ (Likelihood ratio/deviance statistic) | $\chi^2$ (Chi-square goodness of fit) | Number of estimated parameters (r) | Maximum log-likelihood (ML) |
|---|---|---|---|---|---|---|---|
| 1994 (N =324) | 1 | 2153.6 | 2176.28 | 115.2 | 236.03 | 6 | -1070.8 |
| | 2 | 2111.1 | 2160.33 | 58.78 | 59.56 | 13 | -1042.5 |
| | 3 | 2115.1 | 2190.8 | 48.8 | 46.14 | 20 | -1037 |
| | 4 | 2120.6 | 2222.7 | 40.27 | 40 | 27 | -1033.3 |
| 2001 (N=235) | 1 | 1613.5 | 1634.2 | 108.01 | 121.85 | 6 | -800.7 |
| | 2 | 1591.3 | 1636.33 | 71.8655 | 71.4938 | 13 | -782.68 |
| | 3 | 1581.2 | 1650.4 | 47.75 | 46.48 | 20 | -770.6 |
| | 4 | 1580.9 | 1674.4 | 33.5 | 27.61 | 27 | -763.4 |
| 2011 (N=240) | 1 | 1623.2 | 1644.1 | 107.45 | 118.53 | 6 | -805.6 |
| | 2 | 1610.1 | 1655.3 | 80.32 | 73.81 | 13 | -792 |
| | 3 | 1604.7 | 1674.3 | 60.94 | 56.18 | 20 | -782.3 |
| | 4 | 1599.4 | 1693.4 | 41.61 | 38.3 | 27 | -772.7 |

**Table 2: Estimated $\lambda_j's$ and $\omega_{ij}'s$ (with Standard Errors of Estimates) for LC Models Using 6-Variables (Probabilities for Positive (Agreement) Response to each Statement is Shown)**

| | 1994 (2-class model) | | 2001 (2-class model) | | 2011(2-class model) | |
|---|---|---|---|---|---|---|
| | Class 1 | Class 2 | Class 1 | Class 2 | Class 1 | Class 2 |
| | 0.8855 | 0.1145 | 0.7648 | 0.2352 | 0.7778 | 0.2222 |
| | [0.04082] | [0.0408] | [0.1007] | [0.1007 | [0.1262] | [0.1262] |
| CS | 0.1105 | 0.8976 | 0.0318 | 0.8012 | 0.1401 | 0.5411 |
| | [0.0285] | [0.1748] | [0.0677] | [0.1804] | [0.0480] | [0.1573] |
| UI | 0.1337 | 0.5023 | 0.0972 | 0.3171 | 0.0604 | 0.7635 |
| | [0.0226] | [0.1143] | [0.0279] | [0.1091] | [0.0682] | [0.2673] |
| FP | 0.5441 | 0.9404 | 0.5755 | 0.5891 | 0.6179 | 0.631 |
| | [0.0326] | [0.0995] | [0.0407] | [0.0792] | [0.0406] | [0.0894] |
| WR | 0.0846 | 0.5583 | 0.0733 | 0.3767 | 0.0747 | 0.1699 |
| | [0.0226] | [0.1183] | [0.0273] | [0.1167] | [0.0246] | [0.0683] |
| WM | 0.4827 | 0.7415 | 0.4418 | 0.7344 | 0.3163 | 0.5806 |
| | [0.0311] | [0.0980] | [0.0441] | [0.1079] | [0.0447] | [0.1187] |
| BAN | 0.7624 | 0.6274 | 0.5501 | 0.6536 | 0.6628 | 0.5488 |
| | [0.0265] | [0.1002] | [0.0419] | [0.0890] | [0.0407] | [0.0951] |

of the model) are preferred but $G^2, \chi^2$ always decrease for higher models due to excessive number of model parameters. Another way of selecting the model is through obtaining the absolute differences between the two consecutive models if the difference are “0-2”, “2-6”, “6-10” or “>10” it would be interpretated as “Week”, “Positive”, “Strong” or “Very Strong” respectively [33].

## 4. DISCUSSION

### 4.1. Year 1994

A Model should be fitted keeping in mind that selection of higher class model may lead to estimate excessive number of parameters. It is apparent from Table **1** that in year 1994 there is evidence of grouping

**Table 3: Cross Classification Tables of LC Membership against Gender (Using 6 Variables)**

**(a) 1994 socio-religious survey**

| | "DS" Class 1 | "IVF" Class 2 | Total |
|---|---|---|---|
| Male | 168 | 29 | 197 |
| Female | 123 | 4 | 127 |
| Total | 291 | 33 | 324 |

**(b) 2001 socio-religious survey**

| | "DS" | "Confused" | |
|---|---|---|---|
| | Class 1 | Class 2 | Total |
| Male | 92 | 22 | 114 |
| Female | 90 | 31 | 121 |
| Total | 182 | 53 | 235 |

**(c) 2011 socio-religious survey**

| | "DS" Class 1 | "PIVF" Class 2 | Total |
|---|---|---|---|
| Male | 68 | 30 | 98 |
| Female | 128 | 14 | 142 |
| Total | 196 | 44 | 240 |

in the data, as there is a difference of 42.418 and 15.93 in the values of AIC and BIC for no class and 2-class model, respectively. As well as, the difference in the value of $G^2$ is 56.41823. Although, $G^2$ and $\chi^2$ decreases with an increase in the number of classes. We prefer 2-latent class model since both the parsimony measures AIC and BIC are at their minimum as compared to higher class models.

The class proportion for class 1 is 88.55% of the total respondents (see Table **2**). This class indicates that our society is a civilized society, Ulmah and Imams have no contribution in promoting mutual harmony and unity in the community (with 86.63% probability) and our society is not giving due rights to women (with 91.54% probability). Moreover, individuals respond positively regarding the equality of men and women with a quite low probability of 48.27% (see Table **2**). We marked class 1 as "Dissatisfied with the society (DS)" group, which is alarming that majority of the respondents, belong to a highly dissatisfied class, having negative perception about the values of the society. Class 2 can be described as completely satisfied with the society and represents only 11.45% of the sample. Majority of them show agreement in almost all statements except free use of cable/dish antenna. We mark this group as Islamic value follower (IVF) group. Class conditional probabilities indicate that respondents are not in favor of international telecasting through cable and dish antenna, with 76.24% and 62.74% probability in class 1 and 2, respectively. Opinion about adopting family planning procedure is another statement which surprisingly not have marked negative by both the groups. Except these two statements both the groups show completely different opinions (see Table **2**).

**Table 4: Results of Fitting LC Models when Gender is Added in the Model**

| | No. of Classes | AIC | BIC | $G^2$ (Likelihood ratio/deviance statistic) | $\chi^2$ (Chi-square goodness of fit) | Number of estimated parameters (r) | Maximum log-likelihood (ML) |
|---|---|---|---|---|---|---|---|
| 1994 (N = 324) | 1 | 2589.5 | 2615.9 | 198.5 | 360.78 | 7 | -1287.7 |
| | 2 | 2533.5 | 2590.2 | 126.6 | 143.414 | 15 | -1251.76 |
| | 3 | 2522.7 | 2609.7 | 99.86 | 123 | 23 | -1238.4 |
| | 4 | 2529.9 | 2647.2 | 91.07 | 100 | 31 | -1234 |
| 2001 (N = 235) | 1 | 1941 | 1965.2 | 165.19 | 212.36 | 7 | -963.5 |
| | 2 | 1920.44 | 1972.3 | 128.5601 | 136.1351 | 15 | -945.223 |
| | 3 | 1910.8 | 1990.4 | 102.9 | 120.1 | 23 | -932.4 |
| | 4 | 1911.6 | 2018.8 | 87.72 | 99.72 | 31 | -924.8 |
| 2011 (N = 240) | 1 | 1949.8 | 1974.2 | 180.9 | 241.3 | 7 | -967.9 |
| | 2 | 1919.4 | 1971.6 | 134.57 | 140.38 | 15 | -944.7 |
| | 3 | 1918 | 1999 | 118.05 | 126.5 | 23 | -936.4 |
| | 4 | 1913 | 2020.9 | 96.1 | 95.56 | 31 | -925.5 |

**Table 5: Estimated $\lambda_j's$ and $\omega_{ij}'s$ [with Standard Errors of Estimates] for LC Models when Gender is Added in the Model (Probabilities for Positive Response to each Statement is Shown)**

| | 1994(3- class model) | | | 2001 (2-class model) | | 2011(2-class model) | |
|---|---|---|---|---|---|---|---|
| | Class 1 | Class 2 | Class 3 | Class 1 | Class 2 | Class 1 | Class 2 |
| | 0.6543 | 0.1348 | 0.2109 | 0.7624 | 0.2376 | 0.7106 | 0.2894 |
| | [0.0843] | [0.0303] | [0.0742] | [0.1015] | [0.1015] | [0.0912] | [0.0912] |
| Sex (Male) | 0.4346 | 0.9537 | 0.925 | 0.4997 | 0.5636 | 0.2732 | 0.74 |
| | [0.0480] | [0.0492] | [0.1498] | [0.0406] | [0.0829] | [0.0517] | [0.1001] |
| CS | 0.1042 | 0.7366 | 0.1572 | 0.0257 | 0.8131 | 0.1 | 0.5463 |
| | [0.0278] | [0.1134] | [0.0540] | [0.0734] | [0.1737] | [0.0403] | [0.1071] |
| UI | 0.0786 | 0.4909 | 0.2767 | 0.098 | 0.3124 | 0.0802 | 0.5518 |
| | [0.0258] | 0.0993 | [0.0749] | [0.0276] | [0.1081] | [0.0378] | [0.1200] |
| FP | 0.695 | 1 | 0 | 0.5757 | 0.5884 | 0.6303 | 0.5976 |
| | [0.0796] | [0] | [0] | [0.0406] | [0.0778] | [0.0436] | [0.0799] |
| WR | 0.0655 | 0.5773 | 0.0865 | 0.0746 | 0.3694 | 0.0531 | 0.2007 |
| | [0.0244] | [0.1029] | [0.0417] | [0.0269] | [0.1164] | [0.0248] | [0.0644] |
| WM | 0.5079 | 0.7261 | 0.3896 | 0.4424 | 0.7297 | 0.3146 | 0.5233 |
| | [0.0396] | [0.0840] | [0.0787] | [0.0436] | [0.1135] | [0.0433] | [0.0869] |
| BAN | 0.7498 | 0.6304 | 0.8125 | 0.5501 | 0.6526 | 0.6965 | 0.4926 |
| | [0.0352] | [0.0894] | [0.0638] | [0.0419] | [0.0870] | [0.0438] | [0.0876] |

**Table 6: Cross Classification Tables of LC Membership against Gender Including Gender Variable in the Model**

**(a) 1994 socio-religious survey**

| | "FD-DS" Class 1 | "PIVF" Class 2 | "MDS" Class 3 | Total |
|---|---|---|---|---|
| Male | 73 | 40 | 84 | 197 |
| Female | 126 | 1 | 0 | 127 |
| Total | 199 | 41 | 84 | 324 |

**(b) 2001 socio-religious survey**

| | "DS" | "Confused" | Total |
|---|---|---|---|
| | Class 1 | Class 2 | |
| Male | 92 | 22 | 114 |
| Female | 90 | 31 | 121 |
| Total | 182 | 53 | 235 |

**(c) 2011 socio-religious survey**

| | "DS" Class 1 | "PIVF" Class 2 | Total |
|---|---|---|---|
| Male | 44 | 54 | 98 |
| Female | 130 | 12 | 142 |
| Total | 174 | 66 | 240 |

When gender is added to the model as a manifest variable AIC, ML and $\chi^2$ suggest 3-class model to have best fit, as the difference between 2-class and 3-class model is 10.747 (see Table **4**). Only, BIC suggests 2-class model, since it increases in 3-class model, from 2590.2 to 2609.7. Clearly, 3-class model is just the extension of 2-class model (see Table **5**) therefore we suggest 3-class model when gender is added in the analysis as it help in elaborating the structure of the model. Class 1, marked as "Female dominating DS (FD-DS)" group, constitutes majority of females with 56.53% probability (all females of the total sampled belong to this class; 126 out of 127 females; see Table **6a**) who think men and women are equal in all aspects but the society is not civilized and not giving due rights to women. These females believe that Ulmah and Imams are not playing constructive role in the society with the opinion of ban on international telecasting and believe in using family planning methods. Cross classification table is constructed for the class membership and gender (see Table **6a**), which indicate that approximately 40 out of 41 individuals constituting class 2 are males, that is, 95.36% proportion (see Table **5**). These males are satisfied with the norm of the society except some do not believe that Ulmah and Imams are playing

constructive role (with 50.9% probability). We might consider it as religious group or IVF group and name this class as "Partial IVF (PIVF)" group. Class 3 shows disagreement in all statement with very high probabilities, named as "Male DS (M-DS)" group as all 84 individuals are males in this class (see Table **6a**).

### 4.2. Year 2001

AIC, $G^2$ and $\chi^2$ suggest that 2-class model when using 6 variables in the analysis (see Table **1**). BIC is at its minimum in 1-class model. Such sensitivity of BIC might be due to small sample size. Respondents of class 1, (with 76.48% class proportion), have negative perception about the society, relatively larger people believed in using family planning methods as well as around 45% believe in equality of men and women. 55% of the approx 76% of the total sampled respondents shows disagreement in free use of cable and dish antenna. Generally, Class 1 represents those individuals who are dissatisfied with the society but they are not having conservative believes about family planning, we marked it as "DS" group. Whereas, class 2 (with 23.52% class proportion) believe that our society is a civilized society but Ulmah and Imam's are not playing constructive role. They consider men and women equal in all aspect but perceive that the society is not giving due rights to women. Moreover, they show agreement on banning international telecasting through cable and use of family planning methods. On one hand individuals in class 1 understand the norms of the society but are not satisfied with the society in terms of giving rights to women and Ulmah role, we marked this class as "Confused" group.

When gender is added in the model, significant decrease in the value of AIC from 1-class to 2-class can be seen, while the value of BIC from lower to higher class show a little increase (that is, 7.04 and 19.08 in case of difference between 1 Vs 2-class and 2 Vs 3 class, respectively). $G^2$,$\chi^2$ and ML also points towards the suitability of 2-class model (see Table **4**). The groups formed are similar to those obtained earlier. Therefore, inclusion of "gender" in the model does not make any difference.

### 4.3. Year 2011

When model is fitted using 6 variables, BIC has minimum value in 1-class model (see Table **1**). The value of AIC and deviance statistics decreased sufficiently from 1-class model to 2-class model. The value, of AIC keeps on decreasing and of BIC keeps on increasing with an increase in the number of classes. Such controversial scenario leads us to search the highest difference between the fitness statistics and therefore we suggest 2-class model. See Table **2**, in which Class 1 (with 77.78% class proportion) is in disagreement with all statements except use of family planning methods (class 1 marked as "DS" group). Respondents in class 2 (with 22.22% class proportion) on the other hand show agreement to all statements except they believe that our society is not giving due rights to women and favor ban on international telecasting, we marked it as "Partial Islamic Value follower (PIVF)" group.

2-class model is also fitted when 7 variables are used (see Table **4**). The results are similar to previously fitted model (gender exclusive; see Tables **2** and **5**). Class 1 is a female dominating "DS" group, the proportion of respondents, after inclusion of gender, reduces from 77.78% to 71.06%. Respondents disagree with all statements except they believe in use of family planning method. The other group formed is "PIVF", with 28.9% probability, of those males (with 74% probability) who agree with all statements except they favor no ban on international telecasting and believe that our society is not giving due rights to women.

### 4.4. Overall Comparison between Years 1994, 2001 and 2011

For 1994 data inclusion of gender as a variable in the model gives more clear understanding of the results. As the distribution of individuals in three different classes clarifies that approximately all females belong to "DS" group and the other two classes are solely of male respondents. There is a reduction of approximately 12% proportion of "DS" people from year 1994 to 2001 (see Table **2**), which further reduces by approximately 5% from year 2001 to 2011 (see Table **5**), which is quite a good sign.

In 2001survey, none of the groups (model classes) show confidence in the role of Ulmah and Imams in promoting understanding in the society. In 1994 and 2011 survey majority of the respondent's perception about Ulmah and Imams role is negative. Although, this percentage has decreased slightly in 2011 for PIVF group (see Tables **2** and **5**), which is an indication that the persistent negativity is now eliminating but with a very slow pace.

In almost all analyses of three years data (see Table **2**), respondents believed in using family planning method as well as favor ban on cable and dish

antenna. In 2011 when gender is added to the model, class 2 is now opposing the ban. Moreover, in all three eras, respondents strongly believe that due rights are not given to women in the society. Female dominating groups believe that men and women are not equal in all aspects. In 1994 approximately 5% and 7% of the total sampled individuals in minority groups (with 11.5% (IVF in Table **3a**) and 13.5% (PIVF in Table: **6a**) of class proportion) agree with equality of men and women and these individuals are male. Almost all respondents in all three surveys show dissatisfaction regarding women due rights. Only 1 (gender inclusive) and 4 (gender exclusive) females in 1994 survey are satisfied with the society regarding their rights. We think this change of opinion might be due to promotion of certain secular values through cable TV networks and electronic media. Promoting other cultures and showing several opportunities for females in various fields and presenting TV characters as having better lives than those in our societies. The respondents are urban youth and they have facilities of watching foreign TV's and/or foreign programs. Male dominating groups in year 2011 are mostly in favor of international telecasting and many of them believe that men and women are equal in all aspects and this influences the changes in the thinking of both sex to believe that our society is not giving due rights to women.

There is a group of individuals who perceive that our society is civilized, the class proportion increased from approx 11% ("IVF" group; see Table **2**) in 1994 to approx 23% and 22 % in year 2001 and 2011, respectively. In 1994 approximately 9% of the total respondents believe in that our society is civilized which got doubled in 2001 (i.e 18% of the total sampled). Whereas, for 2011 data, this percentage again decreased to 9% (see Table **2**). In the analysis of 1994 data, almost all females are in "DS" group (with approx. 88% and 65% class proportion; see Tables **2** and **5**), that is 123 and 126 females out of 127 belong to DS group. Similar pattern is observed in later year analyses.

Group which we are searching is of Islamic Value followers found in the 1994 survey analysis, with a very small proportion of approx 11% (see Table **2**), similar classes obtained in 2001 and 2011 data analysis but there is a major contradictory opinion on statements of the women's rights and to some extent free use of cables and dish antenna. As mentioned earlier that such opinion could be due to fascinating and attracting charm of being so called successful women portrayed on media.

## 5. CONCLUSION

Considering all analyses we found that at most three class models were applied. Overall, two extreme classes found were "group of people highly satisfied with society's values" and "not very highly satisfied". Generally we came to the conclusion that by the passage of time, due to electronic media the opinion towards the society values is changing.

Keep in mind that these surveys were conducted on the youth of that time and they are supposed to be the nation builder in the future. The norms of practical living hood in contrast with the norms provided by Islam are changing with the passage of time. Although, analysis of the data sets show reduction in the proportion of Dissatisfied group with the society but negative perception particularly about Ulmah and Imam's role and women's due rights toward society is penetrating among our young generation.

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