ISSN No:-2456-2165

Ranking of the Districts of Madhya Pradesh using Artificial Neural Network – Maternal and Child Health Care and Welfare Perspectives

B S Kambo,
Former Deputy Director (Statistics)
Ministry of Labour & Employment
Government of India, New Delhi

Dr.Kulwinder Kaur,
Assistant Professor,Hindu College
University of Delhi110007
Delhi, India

Gurinder Singh,
M.S (IT) Student,
American Public University
Charles Town WV25414, USA

Abstract:- An analysis has been made to classify all district of the Madhya Pradesh according to maternal and childcare and welfare perspectives. Districts have been classified into four level of development depending upon the values of the principal component as well as Neural Network from 32 indicators considered in the study. Ranking of the district of Madhya Pradesh shows that Indore district has the highest development index whereas Tikamgar having lowest. It has been observed beyond doubt that 12 out of 45 districts have come under the category of backward, 10 in the category of underdeveloped ,11developing and 12 in the developed category, showing thereby that large regional disparity exist with respects to Maternal and child Health care in the level of development in the state.

Keywords*:-** *AHS, Principal Component, ANN, MLP, Activation Function, Classification.**

I. INTRODUCTION

Socio-economic development is an integrated process which requires simultaneous progress on a number of fronts to improves the quality of life of people. Development of social sector along with technology absorption in agriculture, industry and services which are the principal sectors of our economy, could be considered as the primary objective of any economic developmental efforts. Economic backwardness and economic development always have their meaningful co-existence. It is observed that some of the countries develop more rapidly in their socio economic conditions compared to others. Similar is the situation for different regions within the same country or State. The health, education and income are three essential aspects of human development. A well designed public policy and programme can advance human development even without high level of income or economic growth (UNDP, 2004)[1] .An indicator system understands the linkages between economic strength and better quality of life. By deconstructing the components of district growth into discrete measurements, we can coherent the main drivers of economic progress, which in turn, disclose the necessary preconditions for a rising standard of living. The indicator system also serves as a tool for decision makers in government and social sectors like Health, Education, etc. It identifies both problems and opportunities for policymakers and business leaders, and indicates possible initiatives for improvement. Used consistently over time, indicators can help track changes and trends in economic performance, thereby revealing where policy might best be employed to spur ongoing improvements in districts' quality of life. The 73rd and 74th amendments of constitution ushered the decentralization of planning and as such the district of the state become the focus point of planning and implementation.Decentralized district-based health planning is essential in India because of large inter-district variations. In the absence of vital data at district level, the state level estimates are being used for formulating district level plans as well as setting the milestones thereof. In the process, the hotpots (districts requiring special attention) very often gets disguised by the State average. This statistical fallacy compounds the problems of the districts acutely. The state level figures of index has its own limitation in the policy formulation, especially for Madhya Pradesh where socio- cultural, demographic and economic milieus are diversified. To minimize such limitation one needs to adopt the measures that capture disparities in respect of human well-being where appropriate policy action are very much essential at the district level to identify of strategies to handle the backwardness existing in health and education .

The proposed change in the system and the process warrants availability of data and information at district level to facilitate job of district functionaries and elected representatives.Keeping this in view, the present study deals with the study of disparities among districts of Madhya Pradesh regarding certain indicators relating to fertility, mortality, maternal and child health care and welfare perspectives. The present study has the following objectives:

- To study the disparities among district of Madhya Pradesh regarding certain indicators relating to maternal and child care and welfare perspectives
- To study the spatial distribution of development in Madhya Pradesh at district level
- To classify the district according to different levels of development by computing an index using Principal Component analysis and Neural Net Work
- We hypothesis that vital indicators must shows down ward trend as we move from backward districts to developed districts where as the socio economic indicators must shows upward trend as we move from backward district to forward districts provided the districts are correctly classified by the index.

ISSN No:-2456-2165

II. REVIEW OF LITERATURE

Number of authors like Dasgupta[2] (1971) Rao[3] (1973), Rao[4] (1977), and Narian[5] et.el (1991) attempted to identify the backward states and districts by the factor analysis approach. Gulati[6] (1991) Iyengar and Sudarshan[7] (1982) attempt to classify regions using multivariate data relating to the major development basing on composite index method and using Beta distribution. During 1984-85 to 1986—87. Iyengar-Sudarshan methods was attempted to measure the overall level of district along with its development at the sectoral level in Orissa.Swain[8] (2010) has pointed has the following drawbacks in the Iyengar-Sudarshan method

- The method fails when the indicators of development are correlated. In that situation the weights need to be modified.
- The method uses weights, which are inversely proportional to standard deviations which seem to be arbitrary, because the best linear combination of independent variable uses weights which are inversely proportional to variances.
- Further, the assumption that the linear combination of variables which vary between 0 and 1 follows a theoretical Beat distribution has no justification, unless theoretically or empirically proved, although in a developing region large regional disparities give rise to relatively more sub-regions at a lower stage of development. As the development process moves ahead, large disparities tend to diminish and as such the skewness in the distribution.

These observation on Iyengar-Sudarshan method suggest that one might search for an alternative methods to classify the sub-regions according to stages of development Mohanti[9] and Ram (2001), Ram[10] and Chander Sekhar (2006), have developed different ranking techniques including Multivariate ones to rank the districts / states of the country. Prem[11] et. el (2007) have developed composite indices of developments for Statistical Evaluation of Socio-economic Development of different States in India. Swain et.al (2010) had used the principal component analysis approach (based on 13 indicators which are almost subset of indicators used in this study) and classified the districts of Orissa according to the differential level of development by computing an index of simple average of the principal components .Kambo et.al (2011) has done the Statistical Evaluation of disparities in districts of Madhya Pradesh using base line data of Annual Health Survey , District Level Household and Facility Survey and census (2011) (DLHS-3) -2007-08 Madhya Pradesh. Artificial Neural Net work and Principal component analysis approach have been used in this study to identify the disparity in the districts of Madhya Pradesh.

III. SOURCE OF DATA

The study is based on secondary data collected from publication namely "Annual Health Survey Factsheet (2012-13) and Annual Health Survey (AHS) Second Updation Bulletin 2012-13 Madhya Pradesh, Office of the Registrar General & Census Commissioner[12], India New Delhi. This data is available in the public domain.

Annual Health Survey (AHS): This survey was conceived at the behest of National Commission on Population, Prime Minister Office and Planning Commission to provide bench mark basic vital and health indicators such as Crude Birth rate (CBR), Crude death rate (CDR), Infant Mortality rate (IMR) , Total fertility rate (TFR) , Maternal Mortality Ratio , Sex Ratio at birth and hosts other indicators on Maternal & Child care , family planning practices etc. and to map change therein on year to year basis at district level in all the 284 districts of Empowered Action Group (EAG) of eight states viz. Bihar, Jharkhand, Madhya Pradesh, Chhattisgarh, Orissa ,Rajasthan, Uttar Pradesh and Uttrakhand including Assam (called AHS States).As per Annual health Survey second updation (2012-13) these nine AHS states constitute 50 % of country's population, 60% of birth, 71% of Infant death and 72% of mortality under five and 62 % of maternal death . AHS in Madhya Pradesh surveyed 2557 sample units (villages in Rural area and block in the urban areas) comprises of 2.284 millions sample population and on an average 456800 number of households.

IV. METHODOLOGY & MODELING

Selection of indicators for the present study

A. In the Present Study Seven Broad Sector of Human Well Being have been Taken into Account as Suggested by Ram and Chander Sekhara (2006) and Swain Et.El (2010)

- Fertility reduction
- Health status of women and children
- Educational status of women
- Hygiene and sanitation
- Electrification
- Maternal and childcare status
- Family welfare

Based on these broad sectors, 32 important indicators (Table 1) have been selected for the study

In this study, Principal Component Analysis (PCA) has been applied initially to classify the districts into four level of development viz. Developed, Developing Underdeveloped and Backward. These classified districts were confirmed by using Multilayer Preceptron (MLP) Neural Network.

B. Artificial Neural Networks

(ANNs) are extremely easy mathematical models of biological neural networks having the talent to learn and provide meaningful solutions to the problems with high-level complexity. The ANNs are non – linear data driven self adaptive approach and is faster compared to its usual techniques, robust in noisy environments, and can answer a wide range of problems They are powerful tools for modeling specially when underlying data relationship is unknown. They can identify and learn correlated pattern between input data set and corresponding target values. After training ANNs can be used to predict out come of the independent input data unit. The processing elements in each layer are called neurons or nodes. The information flow and processing in the network is from the input layer to the hidden layer and from the hidden layer to the output layer. The number of neurons and hidden layers in the network is problem dependent and is determined by the trial and error method. A synaptic weight is assigned to each link to represent the relative connection strength of two nodes at both ends in predicting the input output relationship. The neural networks used in this study being three layered having input layer, where the input is fed to the network, hidden layer where the data is processed, and output layer where the output will be presented (Figure 1).

Mathematically Multi Layer Perceptrons is a real function consisting of composition of weighted sum of the function corresponding to the neuron

The output, Y_j of any neuron j, is given as

$$Y_j = f(\sum W_i X_i + b_j)$$

where *Xi* is the input received at neuron *j*, Wi is the input connection pathway weight, *m* is the total number inputs to node *j*, and *bj* is the node threshold. Function *f* is called an Activation Function which determines the response of a node to the total input signal that is received. The commonly used Activation function is sigmoid (logistic or hyperbolic tangent) function.

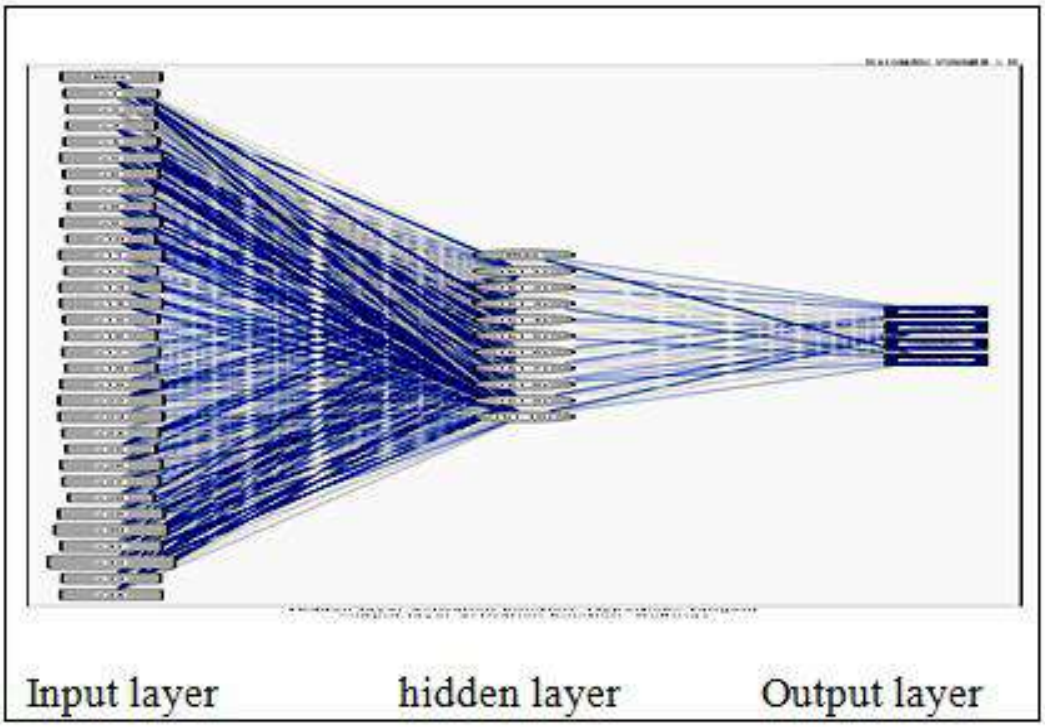

Fig 1:- Three-Layered Feed-Forward Artificial Neural Network Configuration.

In our study net work information is given in (Table1).

Table 1 : Network Information

Input Layer	Covariates	1	Birth Rate
		2	Death Rate
		3	Maternal Mortality Rate
		4	Neo Natal Mortality Rate
		5	Post Neo Mortality Rate
		6	Infant Mortality Rate
		7	Under Five Mortality Rate (U5MR)
		8	Maternal Mortality Ratio
		9	SexRatio at Birth
		10	Sexratio (0-4)
		11	Efective Female Literacy
		12	Effective literacy
		13	House hold with Electricity (%)
		14	Household Hold with safe drinking
		15	Household Hold with toilet
		16	Household Hold using LPG (%)
		17	Household Hold living in Pacca houses (%)
		18	Household Hold having Computer/orLaptop with or without connectivity(%)
		19	Household Hold having Telephone/Moble with or without connectivity(%)
		20	Women Received any Anti Natal Check Up (%)
		21	Mothers who did not receive any Post Natal Chck up (%)
		22	Mothers received atleat one TT inj (%)
		23	Mothers who had fully Anti Natal Checkup (%)
		24	Mothers received IFA 100 days (%)
		25	Women having Children 3 plus (%)
		26	Children Fully immunised (%)
		27	Children age 12-23 months BCG (%)
		28	Children age 12-23 months three doses Polio (%)
		29	Children age12-23 months Three doses DPT(%)
		30	Children age 12-23 months measles (%)
		31	Children age 6 -35 months VitA(%)
		32	Children age 6-35 months IFA(%)
	Number of Units[a]		32
	Rescaling		Standardized
Hidden Layer(s)	Number of		1
	Number of Units		10
	Activation Function		Hyperbolic tangent
Output Layer	Dependent Variables	1	classifier_component
	Number of Units		4
	Activation		Softmax
	Error Function		Cross-entropy

a. Excluding the bias unit

ISSN No:-2456-2165

It has 32 units in the input layer .One hidden layer having 10 units. Activation function is Hyperbolic Tangent. Four no. of units in the output layer corresponding to the possibility that a district can be developed, developing, underdeveloped and backward. Activation function for the output layer is Softmax and Error Function is Cross-entropy.Initial classification of the districts was done using Principal Component analysis (PCA).

The PCA is a multivariate statistical technique to find a few uncorrelated linear combination of original variables which can be used to summarize the data, loosing as little information as possible. In mathematical terms, from an initial set of n correlated variables, PCA creates uncorrelated indices or components, where each component is a linear weighted combination of the initial variables. For example, from a set of variables X1 through to Xn,

$PC_1 = a_{11}X_1 + a_{12}X_2 + \text{----------}+a_{1n}X_n$

$PC_m = a_{m1}X_1 + am_2X_2 +\text{----------}+a_{mn}X_n$

where a_{mn} represents the weight for the mth principle component and the nth variable. The uncorrelated property of the components is highlighted by the fact they are orthogonal , i.e. at right angles to each other, which mean the weights for each principal component are given by the eigenvectors of the correlation matrix, or if the original data were standardized, the co-variance matrix. The variance λ for each principal component is given by the eigen value of the corresponding eigenvector. The components are ordered so that the first component (PC_1) explains the largest possible amount of variation in the original data, subject to the constraint that the sum of the squared weights ($a^2_{11} + a^2_{12} +\text{--------}+ a^2_{1n}$ is equal to unity). As the sum of the eigen values equals the number of variables in the initial data set, the proportion of the total variation in the original data set accounted by each principal component is given by λ_i / n. The second component (PC_2) is completely uncorrelated with the first component, and explains additional but less variation than the first component, subject to the same constraint. Subsequent components are uncorrelated with previous components; therefore, each component captures an additional dimension in the data, while explaining smaller and smaller proportions of the variation of the original variables. Thus , it is a technique to transform the original data set of variables into smaller set of independent linear combination so that most of the variation in the original data is explained by those linear combination. The linear combinations so selected are called Principal Components. The objective of this analysis is to reduce the number of variables into a few ones that can explain most of the variance of the original data set. We have verified that our data satisfies all the criterions needed for applying principal component analysis.

V. ANALYSIS AND RESULTS

The data was analyzed using Statistical Package for Social Science version18 (SPSS) [19]. It has been found that that there is wide variation in the selected indicators across 45 districts of Madhya Pradesh .For few instances, Infant mortality Rate (IMR) ranges between 37 in Indore to 85 in Panna - a variability almost 2.3 time. IMR for 71percent of districts lies between 60-74 and 75-89. Crude death rate (CDR) varies between 5.2 in Indore to 11.3 in West Nimar & Panna. 42 percent of the districts have CDR between 6-7 and 29 percent of districts have CDR between 8-9. Neo – Natal mortality rate (NNMR) was lowest in Indore (24) and highest in Panna (61) – a variability almost 2.5times. NNMR for 49 percent of districts lies between 40-49. and only 7 percent of the district have NNMR between 20-29 and 60-69.. Under five Mortality (U5MR) ranges between 46 in Indore to 127 in Panna – variability almost 3 times. U5MR lies between 81 to 100 & 61 to 80.for 71 percent of the districts. Crude birth rate ranges between 16.3 (Gwalior) and (29.2) Panna. Sex ratio at birth ranges between 804(Gwalior) to 1003 (Dindori). The percent of women (15-49) who received fully anti natal check up was lowest 3.7% in Morena and highest of 30.6 in Indore. The percent of women (15-49) who receives at least one injection of Tetanus toxoid was lowest 78.4 % in Umaria and highest of 97.4% in Balaghat. Percent of children between age 12-23 months who had received full immunization varies between 31.5 % in Tikkamgarh to 85.5 % Indore.

The Eigen values and the percentage of variance explained by the principal components derived from the correlation matrix are presented in (Table 2)

ISSN No:-2456-2165

Table 2 : Eigen value and

Comp-onent	Initial Eigenvalues		
	Total	% of Variance	Cumulative %
1	**13.84**	**43.25**	**43.25**
2	**4.65**	**14.52**	**57.77**
3	**3.11**	**9.71**	**67.49**
4	**1.79**	**5.59**	**73.08**
5	**1.54**	**4.81**	**77.89**
6	**1.24**	**3.86**	**81.75**
7	1.00	3.11	84.86
8	.82	2.57	87.43
9	.63	1.96	89.39
10	.61	1.91	91.30
11	.46	1.43	92.73
12	.41	1.28	94.00
13	.34	1.08	95.08
14	.28	.89	95.97
15	.23	.72	96.69
16	.18	.57	97.25
17	.17	.52	97.77
18	.14	.43	98.20
19	.12	.37	98.58
20	.12	.36	98.94
21	.08	.24	99.18
22	.06	.20	99.38
23	.06	.18	99.56
24	.05	.16	99.72
25	.04	.11	99.84
26	.02	.06	99.90
27	.01	.04	99.94
28	.01	.03	99.96
29	.00	.01	99.98
30	.00	.01	99.99
31	.00	.01	100.00
32	.00	.00	100.00

Extraction Method: Principal Component Analysis.

The reasons for computing first six principal components corresponding to the eigen value greater than or equal to 1, is due to the fact that they together explains 81.7 percent of variation in the data. The first , second , third , fourth fifth and sixth components respectively explains 43.3 %, 14.5 %, 9.7 % .5.6 % ,4.8 % and 3.9 % of the total variation in the data.

The values of Principal components for 45 districts are shown in the (Table 3).

Table 3: Value of Principal components for 45 districts of Madhya Pradesh

Sl No	DISTRICTS	d1	d2	d3	d4	d5	d6	mean of d	Normal Index
1	TIKAMGAR	-20.98	-2.45	-8.58	-0.65	-0.76	0.82	-5.43	0.0
2	SIDHI	-19.61	-2.23	-2.74	-1.14	-1.76	-1.46	-4.82	5.5
3	SHEOPUR	-13.73	-8.72	1.19	-1.97	-1.52	-0.16	-4.15	11.5
4	UMARIA	-21.85	4.66	-5.68	-1.66	1.80	-0.13	-3.81	14.6
5	JHABUA	-12.68	-6.30	-0.15	-6.19	2.48	0.81	-3.67	15.8
6	SHAHDOL	-17.07	2.72	-3.40	-0.94	-0.64	-0.63	-3.33	18.9
7	PANNA	-27.79	2.73	-0.03	2.24	1.94	1.53	-3.23	19.8
8	DATIA	-0.03	-8.74	-3.41	1.08	0.53	-3.07	-2.27	28.4
9	DAMOH	-17.98	4.07	-1.82	2.25	-0.78	1.36	-2.15	29.5
10	CHHATARPUR	-11.46	1.90	-3.98	0.56	-0.42	1.44	-1.99	30.9
11	MANDLA	-13.30	4.77	0.79	-2.16	-1.32	-0.60	-1.97	31.1
12	DINDORI	-14.87	5.29	4.18	0.31	-5.19	-0.87	-1.86	32.1
13	SATNA	-14.04	-1.08	0.44	3.67	1.74	-0.44	-1.62	34.3
14	BHIND	4.15	-6.23	-1.96	-0.03	-1.88	-1.59	-1.26	37.5
15	BARWANI	-9.29	-3.73	4.86	-1.38	1.03	1.66	-1.14	38.6
16	SHIVPURI	-5.87	-5.21	1.88	1.90	0.82	-0.31	-1.13	38.6
17	SAGAR	-9.34	3.68	-2.97	2.93	-1.33	1.28	-0.96	40.2
18	REWA	-6.73	1.44	1.73	0.35	-0.20	-0.05	-0.58	43.6
19	MORENA	6.46	-8.25	-0.05	2.48	-1.95	-1.85	-0.52	44.1
20	GUNA	-1.82	-5.90	1.78	1.56	2.35	-0.89	-0.49	44.4
21	RAJGARH	-0.15	-3.06	2.56	-0.99	-0.96	0.56	-0.34	45.8
22	EAST NIMAR	-0.59	-3.34	1.00	-0.26	0.96	0.26	-0.33	45.9
23	RAISEN	-3.72	0.20	1.76	0.87	0.69	-0.34	-0.09	48.0
24	DHAR	7.45	-3.72	2.47	-2.07	-0.71	1.67	0.85	56.5
25	SEHORE	4.40	-2.55	1.96	0.60	0.53	0.91	0.97	57.6
26	HARDA	3.58	1.81	-0.07	-0.24	1.33	-0.01	1.07	58.4
27	MANDSAUR	7.43	2.41	0.15	-3.07	0.81	-0.75	1.16	59.3
28	UJJAIN	11.39	-4.71	1.85	-0.17	-1.82	1.05	1.27	60.2
29	CHHINDWARA	2.87	6.10	0.52	-1.22	1.68	-2.31	1.27	60.3
30	SHAJAPUR	7.37	-3.10	3.72	0.68	-1.09	0.56	1.36	61.1
31	KATNI	-0.64	3.75	3.40	1.66	-1.42	1.57	1.39	61.3
32	SEONI	-0.35	6.36	3.21	0.03	-0.11	-0.63	1.42	61.6
33	DEWAS	12.15	-3.36	0.65	-1.17	-0.39	1.20	1.51	62.4
34	VIDISHA	0.12	3.00	1.16	2.27	2.63	1.10	1.71	64.2
35	WEST NIMAR	6.45	-2.14	3.55	1.09	0.96	0.67	1.77	64.7
36	NEEMUCH	12.65	1.29	-0.11	-2.18	-0.04	0.84	2.08	67.5
37	NARSIMHA	7.74	5.23	1.28	-0.26	0.55	-1.50	2.17	68.4
38	RATLAM	12.31	-2.71	3.32	1.37	1.40	-0.52	2.53	71.6
39	BETUL	8.85	7.45	0.47	-0.47	2.33	-2.18	2.74	73.5
40	HOSHANGABAD	10.39	4.30	0.68	0.23	0.87	0.09	2.76	73.6
41	JABALPUR	20.57	2.57	-5.32	0.38	-0.93	-0.26	2.83	74.3
42	BALAGHAT	7.70	10.38	4.18	-1.48	-1.60	-1.27	2.98	75.7
43	GWALIOR	25.61	-2.80	-5.00	1.60	0.15	-1.13	3.07	76.5
44	BHOPAL	27.31	2.52	-4.96	0.23	0.05	2.18	4.56	89.8
45	INDORE	36.97	1.76	-4.55	-0.64	-0.80	1.40	5.69	100.0

ISSN No:-2456-2165

As d_1 d_2, d_3, d4, d_5 and d_6 are uncorrelated and are shown to be normally distributed by Kolmogorov test (Table 4) .We use mean values of these six principal components, which is also normally distributed, to classify the district of Madhya Pradesh (Table 5).

The percentile of normal distribution are used to classify the districts. The values of have been categorized by the following:

- Less than ($\bar{d}$ - 0.6745 X σ): [-5.43 to less than -1.71] = Backward**.**
- ($\bar{d}$ -0.6745 X σ) to $\bar{d}$): [-1.71 to 0.0] = **Underdeveloped.**
- ($\bar{d}$ to ($\bar{d}$ + 0.6745 X σ): [0.0 to 1.71) = **Developing.**

More than ($\bar{d}$ + 0.6745 X σ): [more than 1.71] = **Developed.**

Table 4: Normality(One-Sample Kolmogorov-Smirnov Test)

		d1	d2	d3	d4	d5	d6	mean of d
Sample size		45	45	45	45	45	45	45
Normal Parameter	Mean	.00	.00	.00	.00	.00	.00	.00
	Std.	13.84	4.65	3.11	1.79	1.54	1.24	2.53
Kolmogorov-Smirnov Z		.61	.81	1.29	.45	.54	.66	.81
Asymp. Sig. (2-tailed)		.84	.52	.07	.99	.93	.77	.53

Ranking of districts: Since some of the mean values of d's are negative, it will be proper to compute indices from the mean value of d by using transformation which makes them to lie between 0 and 100. That is, the index I_i for the it district is given by

I_i = $[d_{(i)}$ - Min $\bar{d}_{(i)})]/ [Max\ \bar{d}_{(i)}$ - Min $(\bar{d}_{(i)})]*100$ i = 1.2.3. ----------, 45

Table 5 :Classification of the districts of Madhya Pradesh based on PCA and ANNs

Developed	Developing	Underdeveloped	Backward
BALAGHAT	CHHINDWARA	BARWANI	CHHATARPUR
BETUL	DEWAS	BHIND	DAMOH
BHOPAL	DHAR	EAST NIMAR	DATIA
GWALIOR	HARDA	GUNA	DINDORI
HOSHANGABAD	KATNI	MORENA	JHABUA
INDORE	MANDSAUR	RAJGARH	MANDLA
JABALPUR	RAISEN	REWA	PANNA
NARSIMHAPUR	SEHORE	SAGAR	SHAHDOL
NEEMUCH	SEONI	SATNA	SHEOPUR
RATLAM	SHAJAPUR	SHIVPURI	SIDHI
VIDISHA	UJJAIN		TIKAMGAR
WEST NIMAR			UMARIA

The Multilayer Perceptrons (MLP) Neural Network run on the data has predicted 100 % correct classification of districts in the training and testing sample (Table 6).

Table 6 : Observed and Predicted Classification of districts in training and testing

Sample	Observed	Predicted				
		Developed	Developing	Underdeveloped	Backward	Percent Correct
Training	Developed	10	0	0	0	100.0%
	Developing	0	9	0	0	100.0%
	Underdevel	0	0	9	0	100.0%
	Backward	0	0	0	6	100.0%
	Overall	29.4%	26.5%	26.5%	17.6%	100.0%
Testing	Developed	2	0	0	0	100.0%
	Developing	0	2	0	0	100.0%
	Underdevel	0	0	1	0	100.0%
	Backward	0	0	0	6	100.0%
	Overall	18.2%	18.2%	9.1%	54.5%	100.0%

VI. RESULTS AND DISCUSSIONS

An analysis has been made to classify all district of the state according to maternal and childcare and welfare perspectives. Further, districts have been classified into four level of development depending upon the values of the principal component as well as Neural Network from 32 indicators considered in the study. This analysis shows an overview of how many districts need to be considered to formulate the revised policy and programmes to improve those indicators which contribute to low level development. The Ranking of the district of Madhya Pradesh (Table 7) made using principal component analysis and Artificial Neural Network (MLP) shows that Indore has the highest development index whereas Tikamgar having lowest.

It has been observed (Table 5) beyond doubt that 12 out of 45 districts have come under the category of backward districts, 10 in the category of underdeveloped, 11 developing and 12 in the developed category, showing thereby that large regional disparity exist with respects to Maternal and child Health care in the level of development in the state as revealed by principal components of various dimensions and Neural Net work.

The hypothesis that vital indicators must shows down ward trend as we move from backward districts to developed districts where as the socio economic indicators must shows upward trend as we move from backward district to forward districts provided the districts are correctly classified by the index, has been confirmed by the neural net work and graphs, shown in the appendix on pages 8.

India's health outcome indicators continue to be weaker than they should be, at our level of development and noted that the total public expenditure on health in India by Centre and the States was less than 1 (0.93) percent of GDP in 2007–08. It has increased to about 1.2 per cent during 2017-18. Even though the mortality is

ISSN No:-2456-2165

coming down at all India level, but infant and child mortality rates are still very high particularly in the EAG states and is 2nd highest in MP. This enforces the couples the need to have large families. Massive efforts to enhance child survival through programme like Universal immunization, oral rehydration therapy, oral polio etc. are already making head way. The present need therefore should be to induce confidence among couples about increased survival probability/ chance of their children, To ensure this the specific action needed are:

- Compulsory immunization of all children under five (more specifically infant) should be accelerated particularly in the backward and under developed districts of State in order to achieve Millennium Development Goals (MDG-4 (U5MR less than equal to 42) and MDG-4 (IMR less than equal to 28). None of the districts so far have achieved Millennium Development Goals

Table7 : Ranking of 45 districts of Madhya Pradesh

Sl No	Districts	mean of d	Ranking Index
1	TIKAMGAR	-5.433	0.0
2	SIDHI	-4.825	5.5
3	SHEOPUR	-4.152	11.5
4	UMARIA	-3.812	14.6
5	JHABUA	-3.674	15.8
6	SHAHDOL	-3.326	18.9
7	PANNA	-3.230	19.8
8	DATIA	-2.273	28.4
9	DAMOH	-2.151	29.5
10	CHHATARPUR	-1.993	30.9
11	MANDLA	-1.971	31.1
12	DINDORI	-1.858	32.1
13	SATNA	-1.619	34.3
14	BHIND	-1.257	37.5
15	BARWANI	-1.143	38.6
16	SHIVPURI	-1.134	38.6
17	SAGAR	-0.959	40.2
18	REWA	-0.577	43.6
19	MORENA	-0.525	44.1
20	GUNA	-0.488	44.4
21	RAJGARH	-0.340	45.8
22	EAST NIMAR	-0.329	45.9
23	RAISEN	-0.091	48.0
24	DHAR	0.849	56.5
25	SEHORE	0.975	57.6
26	HARDA	1.066	58.4
27	MANDSAUR	1.164	59.3
28	UJJAIN	1.266	60.2
29	CHHINDWARA	1.272	60.3
30	SHAJAPUR	1.359	61.1
31	KATNI	1.387	61.3
32	SEONI	1.419	61.6
33	DEWAS	1.510	62.4
34	VIDISHA	1.713	64.2
35	WEST NIMAR	1.765	64.7
36	NEEMUCH	2.075	67.5
37	NARSIMHA	2.174	68.4
38	RATLAM	2.529	71.6
39	BETUL	2.741	73.5
40	HOSHANGABAD	2.756	73.6
41	JABALPUR	2.834	74.3
42	BALAGHAT	2.984	75.7
43	GWALIOR	3.073	76.5
44	BHOPAL	4.555	89.8
45	INDORE	5.691	100.0

- Comprehensive health Scheme such as “The Integrated Child Development Services, “Total Sanitation Campaign (TSC)”;" National Nutrition Policy"," National Charter for children "needs to be intensively monitored and accelerated on a continuous and permanent basis for prevention and early detection of sickness among rural children .
- It has been found that the sex ratio at birth in the developed districts is 886. In order to improve the sex

ratio, Pre-Conception and Pre-Natal Diagnostic Techniques (Prohibition of Sex Selection) Act, the PC & PNDT Act, should be strictly implemented.

- The Health Management Information System (HIMS) of the Ministry of Health and Family Welfare has been playing a vital role in mentoring of various health programme but the issues relating to quality of data that flows from levels needs to be addressed by imparting training to all personnels engaged in HIMS, this will help to take timely decision and state interventions. This would in turn ensure to achieve the goals set for NRHM viz. Reduction in Infant Mortality Rate (IMR), Maternal Mortality Ratio (MMR), Universal access to public health services such as Women's health, child health, water, sanitation & hygiene, immunization, and Nutrition, Prevention and control of communicable and non-communicable diseases, including locally endemic diseases, access to integrated comprehensive primary healthcare ,Population stabilization, gender and demographic balance; Revitalize of local health traditions and mainstream AYUSH, Promotion of healthy life styles.
- Shortage of health professionals at all levels has become a serious impediment to achieving an expansion in the public provision of health services. There has been inadequate attention to improving our education and training capacities in this area. There are also problems of accountability of personnel even when these are recruited. These lacunae needs to be rectified and Twelfth Plan must give a special emphasis to solve this problem.

There is need of strong coordination at the grass-root level i.e at village level between various schemes run by the Ministry of Women and Child Development and Ministry of Health and Family Welfare.

REFERENCES

[1]. UNDP., (2004), Human Development Report, 2004
[2]. Dasgupta B, (1971), Socio Classification of districts. A Statistical approach. Economic and Political Weekly Vi(33) 1763-74
[3]. Rao, S. K., (1973), A Note on measuring economic distance between Regions in India. Economic and Political weekly, 8(17): 703-710.
[4]. Rao, Hamlata, (1977) Identification of backward regions and the trends in regional disparities in India. Artha Vijnana, XIX (2); 93-112.
[5]. Narain, P., Rai, S.C. and Sarup, Shanti, (1991), Statistical evaluation of development on socio-economic front.J. Ind. Soc. Agril. Statist., 43: 329-345.
[6]. Gulati, S.C. (1991) Population growth and development: district level analysis. Demography India 20(2): 199-208
[7]. Iyengar, N.S and Sudarshan, P (1982). A method of classifying regions from multivariate data. Economic and political Weekly, Special Article: 2047-52.
[8]. Swain A.K.P.C and Mohanty Bigyanananda (2010) Socio-demographic Disparities in Orissa-Maternal and Child Health and Welfare Perspectives Demography India,Vol.39, No. 1, pp.129-139.
[9]. Kambo .b.s (2011) Statistical Evaluation of Socio-Demographic disparities in Madhya Pradesh – Maternal and Child Health Care and Welfare Perspectives.Political Economy, journal of India, Vol 22, No1 pp 46 -65
[10]. Mohanty, S. K. and Ram, F., (2001), District at a Glance: India. Mimeograph, IIPS, Mumbai-400088.
[11]. Ram, F. and Chander Shekhar, (2006), Ranking and Mapping of Districts based on Socio-Economic and Demographic Indicators. International Institute for Population Sciences (IIPS), Mumbai-400088.
[12]. Narian P (2007): Statistical Evaluation of Socio-economic Development of different States in India.J..Ind. Soc. Agril. Statist. 6/ (3), 2007: 328-335
[13]. Office of the Registrar General & Census Commissioner , India New Delhi. Annual Health Survey 2012-13 Fact Sheet, Madhya Pradesh. **Website : www.censusindia.gov.in**
[14]. Annual Health Survey (AHS) Second Updation Bulletin 2012-13 **,** Registrar General & Census Commissioner, India .04th March, 2014
[15]. Bhuyan, K.C (2010), Multivariate Analysis and its applications. New Central Book agency(P) Ltd , Kolkata -700009
[16]. Johnson, R.A. and Wichern, D. W., (2003), Applied Multivariate Statistical Analysis (3rd edit). Prentice Hall of India Private Limited, New Delhi.
[17]. Statistical Package for Social Science (SPSS version 18)
[18]. Field A (2000) Discovering Statistics using SPSS for windows. London – Thounds Oaks- New Delhi: sage publication.
[19]. Statistical Package for Social Science (SPSS version 18) IBM.

APPENDIX

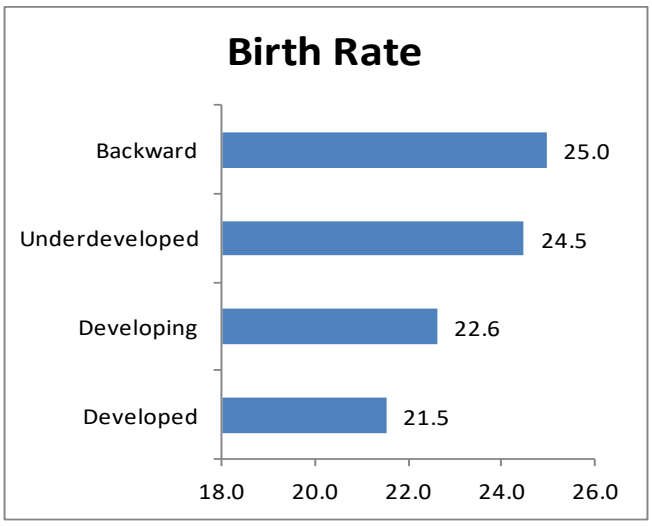

Fig 2

ISSN No:-2456-2165

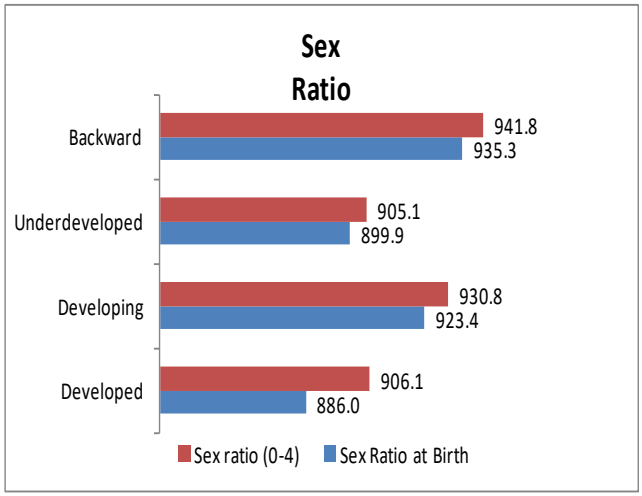

Fig 3

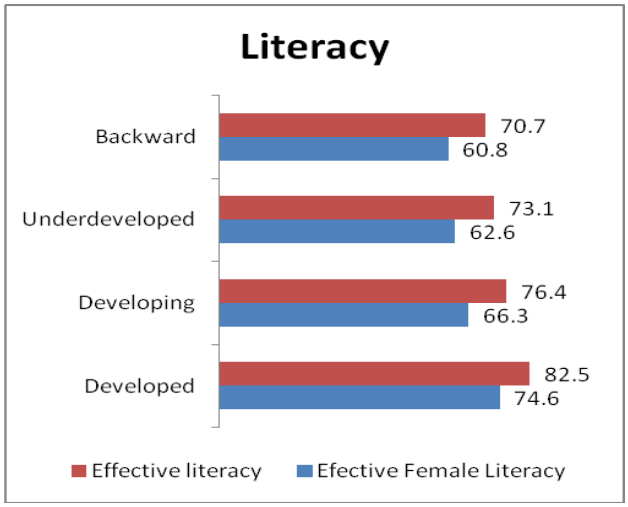

Fig 4

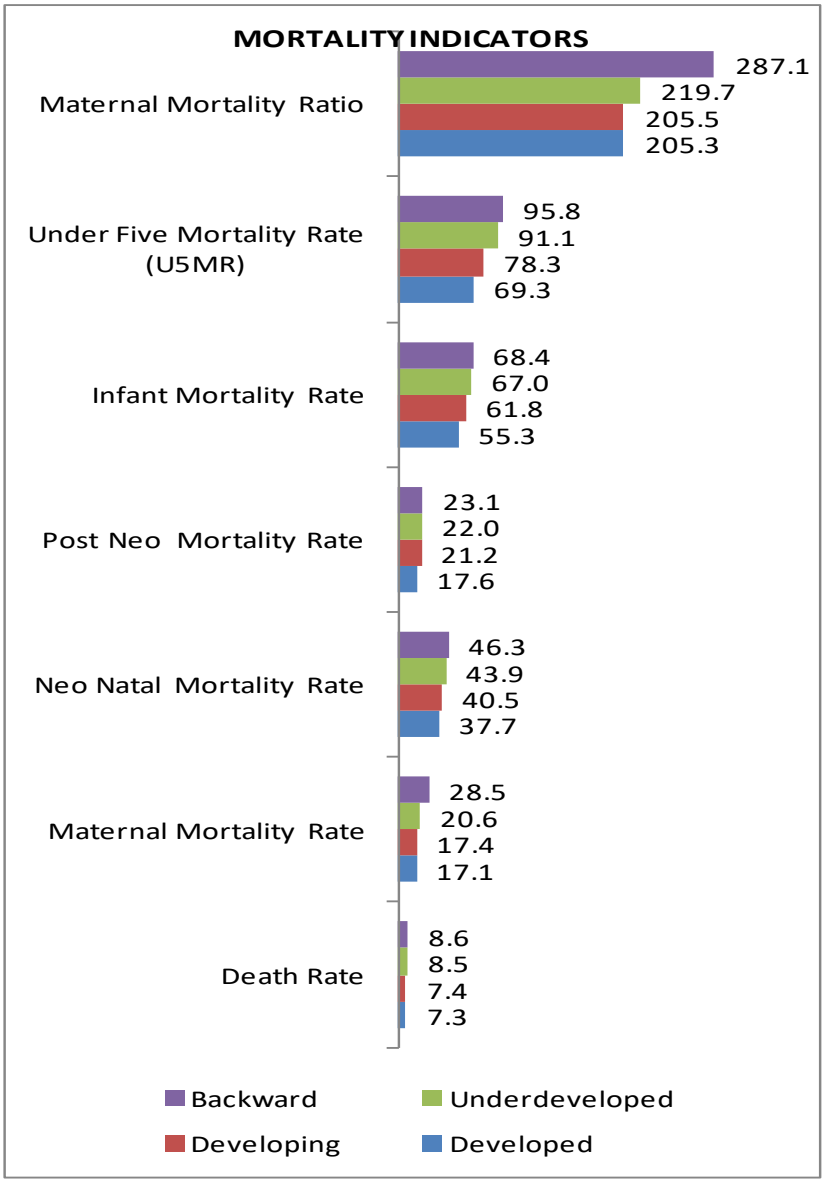

Fig 5

ISSN No:-2456-2165

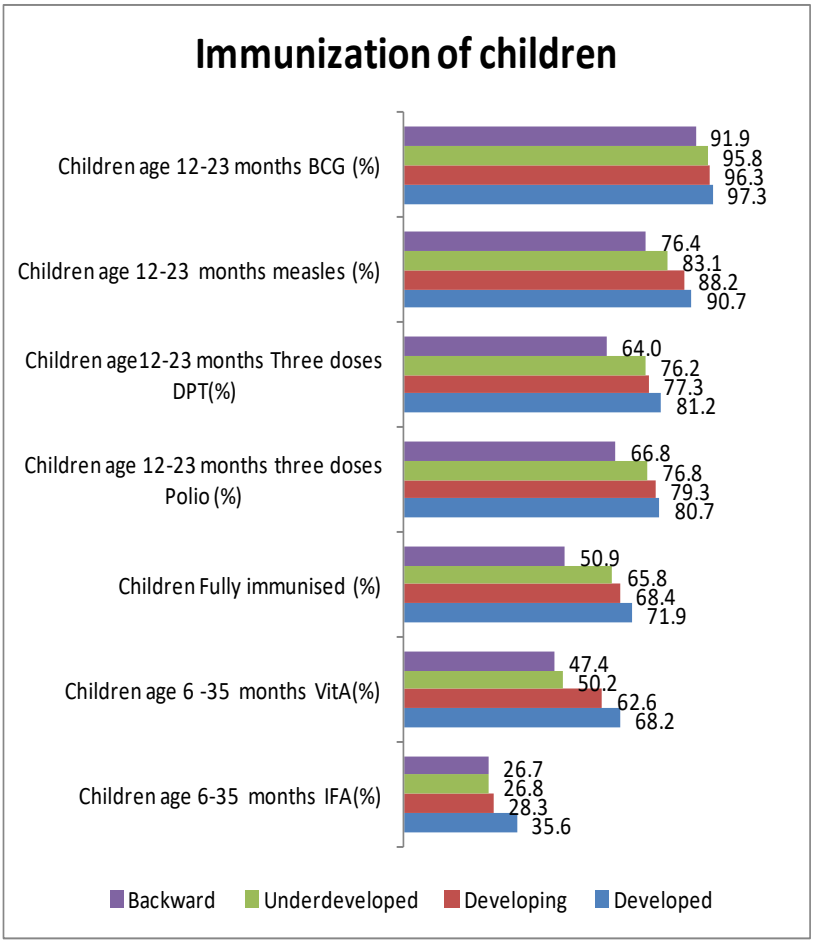

Fig 6

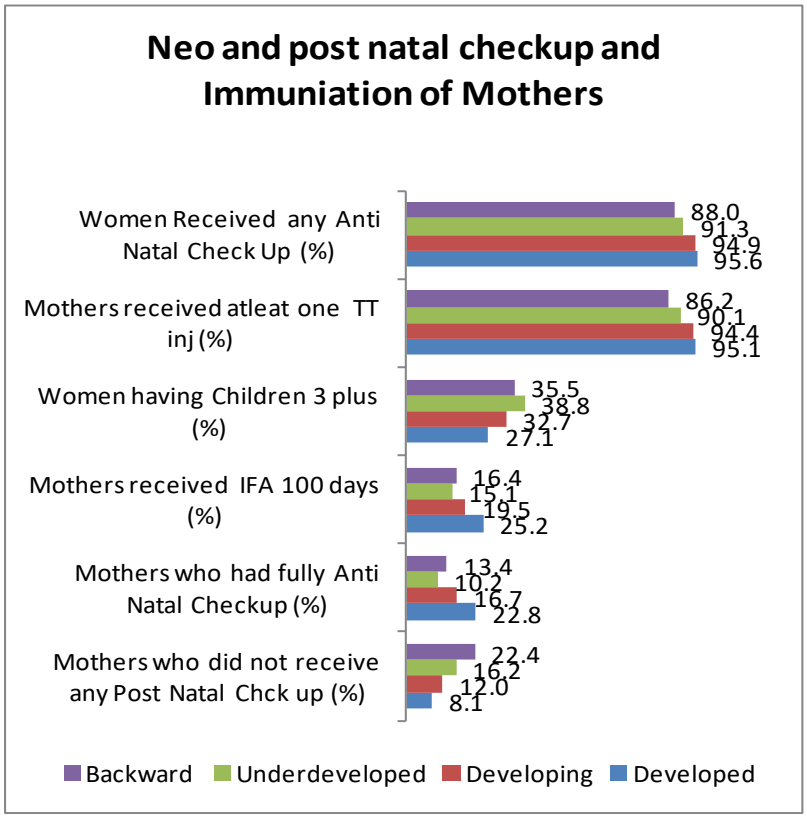

Fig 7

ISSN No:-2456-2165

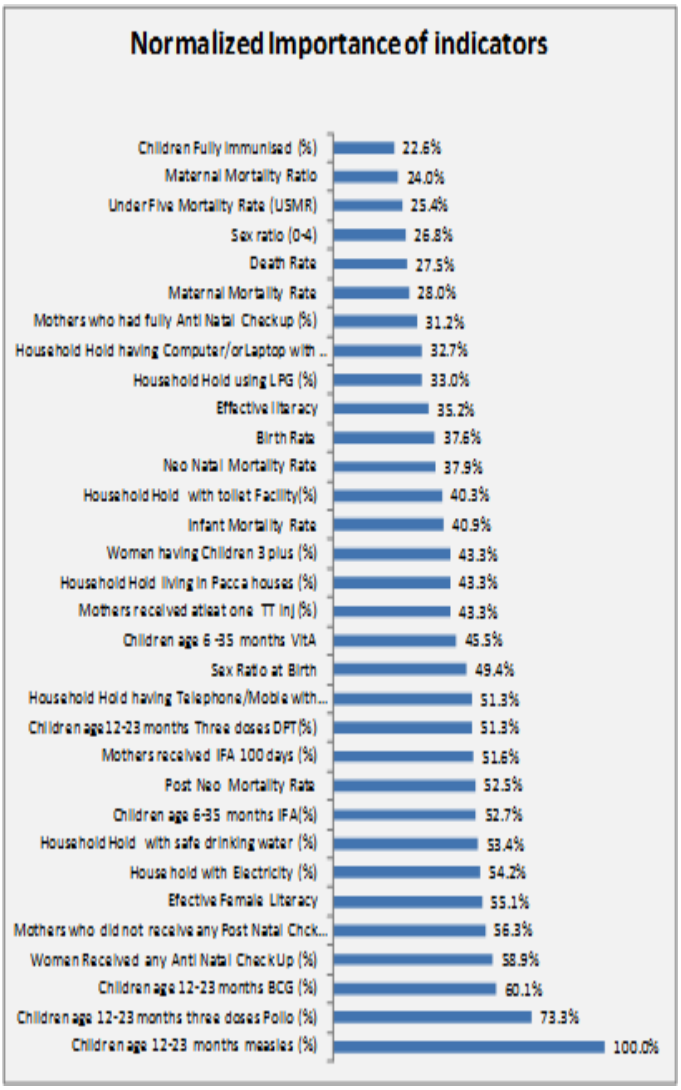

Fig 8