

# CROSSCOUNTRYANALYSISOFHUMANDEVELOPMENT LEVELS IN THE DEVELOPING COUNTRIES

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*In this knowledge era the value of human capital has taken the prime slot. A country may have plenty of natural and physical resources but if it does not have the efficient and able human capital to exploit the available resources than the whole process of development becomes fruitless. The concept of development can be viewed as a multidimensional process which involves the reorganization and reorientation of the whole economic and social system. It is much more than the increase in income and output. It not only involves the radical changes in institutional, social administrative structure, popular attitudes, but also in customs and beliefs. The country's potential to grow is not only dependent on physical resources but also on human resources. In this context during 1970's the concept of economic development was redefined in terms of reduction of poverty, inequality and unemployment in a growing economy (Todaro, 1977). In this paper an attempt has been made to measure and compare level of human capital in developing countries based on the selected socio-economic indicators. Composite index based on these indicators has also been developed in order to rank the countries.*

## INTRODUCTION

There are number of factors which contributes to economic growth and development, such as availability of capital, raw materials, power, market, machinery and equipment, entrepreneurial ability and technical and skilled manpower. The three categories under which these could be placed are: human, physical, and financial. However in the final analysis human resource factor appears to be, the most strategic and critical. A country may have plenty of natural and physical resources and the necessary machinery and capital equipment, but if it has not got the efficient, skilled and able manpower which utilize these resources to the optimum level, these resources will be fruitless. This is now universally accepted phenomena that 'human capital formation' is as important a precondition of economic growth as the rapid rate of 'physical capital formation' (Mehta, 1976).

The broad objectives of the study are:

1. To measure human capital level of different developing countries;
2. To construct the composite index on the basis of large band of socio-economic and demographic factors representing human capital formation and economic development.

To fulfill the above objectives, the present study has been divided into three sections. Section I studies the role and importance of human capital particularly for the developing countries. Section II deals with the methodology used in the paper. In Section III composite indices have been worked out using the factor analysis. Section IV concludes the findings of the study.

## METHODOLOGY

Some of the variables selected for the construction of Composite index are input and output variables. These variables technically associated with particular phenomenon are highly correlated amongst themselves. This causes the problem of multicollinearity and the consequences of this

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**Table 1**  
**Results of Factor Analysis of Developing Countries: 1985**

S. No.	Variable	Component			Communalities $h^2 = a^2_{ij}$	Weights	Wt in %	Wt in %
		F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>				
1	GNP Per Capita	0.7810	-0.0122	-0.3300	-0.0487	0.7600	0.402816	7.560587
2	Gross Domestic Saving	0.1530	0.0272	0.1460	-0.7990	0.6840	0.078913	1.481139
3	Adult Literacy Rate	0.8400	0.0134	0.0537	0.1670	0.8600	0.433247	8.131745
4	Adult Female Literacy Rate	0.8260	-0.0271	0.0870	0.0600	0.8290	0.426026	7.996216
5	Primary Enrollment Ratio	0.8030	-0.2170	0.3160	0.0073	0.7930	0.414163	7.773561
6	Secondary Enrollment Ratio	0.8660	-0.1040	0.0384	-0.0859	0.7860	0.446657	8.383442
7	Life Expectancy at Birth	0.9540	-0.0570	0.0920	0.0238	0.9430	0.492045	9.235339
8	Birth attended by health staff	0.7210	0.2300	-0.1620	0.1980	0.6390	0.37187	6.979748
9	Number of Physicians	0.7740	0.2550	-0.2270	-0.0945	0.7970	0.399206	7.492823
10	Population with access to safe water	0.7630	-0.0388	-0.0715	0.2170	0.7490	0.393533	7.386335
11	Population with access to sanitation	0.6650	0.0068	-0.4140	0.1610	0.6620	0.342987	6.437632
12	Immunization against measles	0.6410	-0.0592	0.4860	0.1420	0.8020	0.330609	6.205296
13	Urban Population	0.7910	-0.2540	-0.2740	-0.0747	0.8090	0.407974	7.657394
14	Maternal Mortality Rate	-0.7040	0.1570	-0.2090	-0.3140	0.6640	0.013188	0.24753
15	Crude Death Rate	-0.8360	0.2930	-0.1490	-0.0494	0.8820	0.024612	0.46195
16	Number of Hospital Beds	0.5040	0.6070	-0.2250	-0.0068	0.6930	0.050988	0.95701
17	Labour Force	-0.3680	0.7340	-0.0129	0.2920	0.7740	0.061656	1.157241
18	Female Labour Force	-0.5300	0.6880	-0.0108	0.1070	0.7760	0.057792	1.084716
19	Teacher Pupil Ratio	-0.6860	-0.0017	0.1190	0.0593	0.4920	0.00883	0.165729
20	Low Birth Weight Babies	-0.5410	0.0190	0.5560	-0.0566	0.6060	0.041255	0.774332
21	Under Weight Children	-0.5720	0.0524	0.5320	0.0457	0.6160	0.039474	0.740907
22	Immunization against DPT	0.4800	0.2040	0.5170	0.3380	0.7630	0.038361	0.720017
23	Crude Birth Rate	-0.8640	-0.3060	-0.2000	0.2180	0.9310	0.011611	0.217925
24	Total Fertility Rate	-0.8400	-0.3020	-0.1990	0.2590	0.9140	0.013794	0.25891
25	Dependency Ratio	-0.7100	-0.4610	-0.1930	0.3400	0.8700	0.018108	0.339882
26	Infant Mortality Rate	-0.8720	-0.0180	-0.0730	-0.0780	0.8160	0.00813	0.152591
	EIGEN Value	13.4100	2.1840	1.9290	1.3850		5.327845	100
	% Variance explained	51.5770	8.4000	7.4200	5.3260			
	CUM% AGE Variance explained	51.5770	59.9770	67.3970	72.7230			

Source: Author's calculations

problem are inaccurate and unreliable results. The statistical technique that can be more usefully applied in such a situation is 'Factor Analysis'. Factor Analysis attempts to estimate the value for the coefficients of regression where the variables are regressed upon the factors (Harman, 1967).

In Factor Analysis, a given set of  $n$  variables grouped into  $p$  number of groups called 'Factors' which are less in number than the set of original variables. The variables within a group (Factor) are of the same nature or are complementary with respect to the phenomenon under study but between two groups (Factors) variables are independent. Thus factors  $F_i$  and  $F_j$  are orthogonal.

The Factor Analysis used in the present study is given as under:

$$X = LF + U \quad \begin{array}{l} \text{where } X \text{ is vector of all the original variables.} \\ F \text{ is vector of 'Factors' derived} \\ \text{and } U \text{ is vector of error terms.} \end{array}$$

$$\begin{aligned} X' &= [X_1, X_2, X_3, \dots, X_n] \\ F' &= [F_1, F_2, F_3, \dots, F_p] \\ U' &= [E_1, E_2, E_3, \dots, E_n] \end{aligned}$$

$L$  is matrix of Factor Loading (Loading Coefficient Matrix)

$$L = \begin{bmatrix} a_{11} & a_{12} & a_{13} & \dots & a_{1p} \\ a_{21} & a_{22} & a_{23} & \dots & a_{2p} \\ a_{31} & a_{32} & a_{33} & \dots & a_{3p} \\ \cdot & \cdot & \cdot & & \cdot \\ a_{n1} & a_{n2} & a_{n3} & \dots & a_{np} \end{bmatrix}$$

The coefficient (Factor loading)  $a_{ij}$  belongs to  $i^{\text{th}}$  variable and  $j^{\text{th}}$  Factor which is similar to simple correlation coefficient and shows the extent to which variable  $X_i$  is related to  $F_j$  Factor. "A salient loading is one which is sufficiently high to assume that a relationship exists between the variable and the factor. In addition, it usually means that relationship is high enough so that the variable can aid in interpreting the factor and vice-verse" (Gorsuch, 1974).

The sum of the square of factor loadings of  $X_i$  original variables under the derived  $p$  Factors is called the communalities for  $X_i$  variables.

$$(a_{i1})^2 + (a_{i2})^2 + (a_{i3})^2 + \dots + (a_{ip})^2 = (C_i)^2$$

Communality in Factor Analysis is some thing like  $\bar{R}^2$  in the Regression Analysis and it shows the extent to which the derived factors explain the  $i^{\text{th}}$  variables. Derived Communality value generally should be larger (more than 70 percent) to be sure that each variable has been explained well. By definition, the communality of a variable is that proportion of its variance which can be accounted for by the common factors (Linderman, 1980).

The Principal Component Analysis (Factor Analysis) produces components (Factors) in lower order of their significance and factor loadings which explain the proportional prominence of various variables in describing variance in the phenomenon. Most of the studies using 'Factor Analysis' adopted 'First Principal Component' as guiding principle for determining individual indicator

**Table 2**  
**Composite Indices of Developing Countries: 1985**

Rank 1985				
Country	Composite Index	Rank	Country	Composite Index
Bulgaria	0.7693	1	Bolivia	0.4230
Hungary	0.7307	2	Zambia	0.4068
Chile	0.7169	3	Myanmar	0.3981
Uruguay	0.7154	4	Congo Rep	0.3887
Korea Republic	0.6946	5	India	0.3759
Costa-Rica	0.6604	6	Cameroon	0.3687
Venezuela	0.6588	7	Morocco	0.3625
Argentina	0.6515	8	Kenya	0.3544
Panama	0.6436	9	Ghana	0.3515
Mexico	0.6314	10	Madagascar	0.3429
Colombia	0.5957	11	Guatemala	0.3419
Malaysia	0.5904	12	Togo	0.3149
Brazil	0.5795	13	Sanegal	0.3029
Ecuador	0.5586	14	Benin	0.2955
Jordan	0.5579	15	Nigeria	0.2909
Sri Lanka	0.5562	16	Malawi	0.2872
Peru	0.5472	17	Papua New Guinea	0.2840
Philippines	0.5416	18	Rwanda	0.2790
Turkey	0.5379	19	Bangladesh	0.2670
Iran	0.5335	20	Tanzania	0.2630
Dominican Republic	0.5312	21	Cot D'Ivoire	0.2504
China	0.5257	22	Pakistan	0.2475
Syrian Arab Republic	0.5161	23	Ethiopia	0.2466
Vietnam	0.5110	24	Haiti	0.2245
Tunisia	0.4826	25	Nepal	0.2125
Paraguay	0.4767	26	Burundi	0.2040
Thailand	0.4717	27	Mozambique	0.1938
Nicaragua	0.4645	28	Niger	0.1921
El Salvador	0.4635	29	Uganda	0.1887
Indonesia	0.4573	30	Sierra Leone	0.1739
Egypt	0.4570	31	Guinea	0.1484
Algeria	0.4562	32	Burkin-Faso	0.1476
Honduras	0.4486	33	Mali	0.1174
Zimbabwe	0.4425	34		

Source: Same as in Table 1

weights. In the present study, all the 'Principal Components' (Factor derived) are considered to assess relative weights of chosen variables so as to reflect maximum possible variations in the human development status. The method for determining the relative weights for the variables is explained below:

$$W_i = F_{ik} \lambda_k$$

$W_i$ : is weight of  $i^{\text{th}}$  variable.  
 $F_{ik}$ : is factor loading of  $i^{\text{th}}$  variable and  $k^{\text{th}}$  Factor which reflects the highest correlation between variable ( $X_i$ ) and factor ( $F_k$ );  
 $\lambda_k$ : is variation explained by  $k^{\text{th}}$  factor.

The selected variables are first standardized by equalizing their variance as under:

$$Z_{ij} = \frac{X_{ij}}{\sigma_i}$$

$Z_{ij}$ : is standardized value of  $i^{\text{th}}$  variable for  $j^{\text{th}}$  country;  
 $X_{ij}$ : is original value of  $i^{\text{th}}$  variable for  $j^{\text{th}}$  country;  
 $\sigma_i$ : is standard deviation for  $X_i$  variable.

The weights for the variable determined by applying above mentioned technique are in accordance with the contribution made by the variable in inter-country variations. More weights are given to those variables, which contribute more towards inter-country variations and vice-versa.

Composite Index is calculated as under:

$$I_{jt} = \frac{\sum_{i=1}^n W_i Z_{ij}}{\sum_{i=1}^n W_i}$$

$I_{jt}$ : is composite Index of  $j^{\text{th}}$  country for  $t$  period of time;  
 $Z_{ij}$ : is standardized value of  $i^{\text{th}}$  variable for  $j^{\text{th}}$  country;  
 $\sum W_i$ : is sum of the weights.

Composite indices have been constructed for developing countries at three points of time i.e. 1985, 1995 and 2005 using the following indicators:

GNP per capita (GNP), Gross domestic saving as percentage of GDP (GDS), Adult Literacy Rate (ALR), Adult Female Literacy Rate (AFLR), Net Primary Enrollment Ratio (PER), Net Secondary Enrollment Ratio (SER), Primary Teacher Pupil Ratio (TPR), Life Expectancy at birth (LEB), Infant Mortality Rate per thousand live births (IMR), Maternal Mortality Rate (MMR), Crude Birth Rate per thousand population (CBR), Crude Death Rate per thousand population (CDR), Total Fertility Rate (TFR), Dependence Ratio [Dependents as proportion of working age population] (DR), Percentage of Births attended by Health Staff (BHS), Number of Physicians per thousand people (PHY), Number of Hospital Beds per thousand people (HB), Percentage of Population with Access to Safe Water (PSW), Percentage of Population with Access to Sanitation (PS), Percentage of Low Birth Weight Babies (LBWB), Percentage of Under Weight Children Under Five (UWC), Percentage of Children Immunized Against DPT (CIDPT), Percentage of Children Immunized against Measles (CIM), Urban population as percentage of total population (UP), Labor Force as percentage of Total Population (LFP), Percentage of Female Labor Force (FLF).

## COMPOSIT INDEX FOR DEVELOPING COUNTRIES

In this section the composite index for developing countries has been computed. The analysis includes 67 countries for the year 1985, 72 countries for the year 1995 and 84 countries for the year 2005.

**Table 3**  
**Results of Factor Analysis of Developing Countries: 1995**

S. No.	Variables	Component				Communalities $h^2_{ij} = \sum a^2_{ij}$	Weights	Wt in %
		F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	F <sub>4</sub>			
1	GNP Per Capita	<b>0.7700</b>	-0.0251	-0.2240	0.0337	0.6450	0.37268	7.18614
2	Adult Literacy Rate	<b>0.8330</b>	0.0408	0.0108	0.2550	0.7610	0.403172	7.774097
3	Primary Enrollment Ratio	<b>0.8080</b>	-0.0042	0.2430	0.0032	0.7120	0.391072	7.540781
4	Secondary Enrollment Ratio	<b>0.7990</b>	0.2060	0.1840	-0.0761	0.7210	0.386716	7.456787
5	Life Expectancy at Birth	<b>0.9230</b>	-0.2240	0.0383	-0.0297	0.9050	0.446732	8.614035
6	Births attended by health staff	<b>0.6790</b>	0.2460	-0.1710	0.1590	0.5760	0.328636	6.336869
7	Number of Physicians	<b>0.7620</b>	0.4380	-0.1740	-0.1710	0.8310	0.368808	7.111479
8	Population with access to safe water	<b>0.6920</b>	-0.1260	0.1170	-0.2340	0.5630	0.334928	6.458193
9	Population with access to sanitation	<b>0.7010</b>	-0.1060	-0.1440	0.0330	0.5250	0.339284	6.542187
10	Immunization against DPT	<b>0.7030</b>	-0.1170	0.4130	-0.0119	0.6780	0.340252	6.560853
11	Immunization against measles	<b>0.6940</b>	-0.0507	0.3960	-0.1170	0.6550	0.335896	6.476859
12	Urban Population	<b>0.7270</b>	0.0392	-0.4310	0.0203	0.7160	0.351868	6.784836
13	Adult Female Literacy Rate	-0.3620	<b>0.5790</b>	0.0210	-0.5010	0.7170	0.055578	1.071678
14	Infant Mortality Rate	-0.9170	<b>0.1110</b>	-0.0279	0.0041	0.8540	0.010655	0.205451
15	Crude Death Rate	-0.7040	<b>0.5760</b>	-0.1160	-0.0483	0.8430	0.05529	1.066125
16	Number of Hospital Beds	0.5860	<b>0.6880</b>	-0.0986	-0.1280	0.8420	0.066041	1.273427
17	Labour Force	-0.3440	<b>0.4770</b>	0.3170	0.3240	0.5510	0.045787	0.882885
18	Female Labour Force	-0.3660	<b>0.7280</b>	0.2200	0.3150	0.8110	0.069881	1.347463
19	Gross Domestic Saving	0.4010	-0.1670	<b>0.4560</b>	0.1370	0.4160	0.035928	0.69278
20	Teacher Pupil Ratio	-0.7510	0.0627	<b>0.1570</b>	0.0441	0.5950	0.01237	0.238523
21	Low Birth Weight Babies	-0.4830	-0.0998	<b>0.6570</b>	-0.1650	0.7020	0.051765	0.998151
22	Under Weight Children	-0.7040	-0.0847	<b>0.5260</b>	-0.0728	0.7840	0.041444	0.799128
23	Maternal Mortality Rate	-0.1980	-0.0351	-0.0711	<b>0.6260</b>	0.4370	0.027237	0.525198
24	Crude Birth Rate	-0.8970	-0.2240	-0.1730	<b>0.0133</b>	0.8850	0.306596	5.91189
25	Total Fertility Rate	-0.8830	-0.1530	-0.1900	<b>0.0619</b>	0.8440	0.002692	0.051899
26	Dependency Ratio	-0.7040	-0.2680	-0.3340	<b>0.1100</b>	0.6910	0.004786	0.000248
	EIGEN Value	12.5840	2.4960	2.0490	1.1310		5.186094	100
	% Variance explained	48.4000	9.5990	7.8790	4.3510			
	CUM%AGE Variance explained	48.4000	57.9990	65.8780	70.2290			

Source: Same as in Table 1

### Composite Index: 1985

The results of Factor Analysis for the selected variables for developing countries for the year 1985 are presented in the table 1. The table shows that the factor five factors derived from 26 indicators under consideration explains 76% inter country variations. The communalities for all factors varied between 49.2 and 94.3 percent, these five factors are sufficient to account for the most of variations in the selected indicators.

The first factor (F<sub>1</sub>) explains 51.5% variations in the variable set. The most important indicators in the first factor are life expectancy, net secondary enrollment ratio followed by Adult Literacy rate, Adult Female Literacy rate, Primary Enrollment ratio. The other indicators included in this set are urban population, GNP per capita, number of physicians per thousand people, number of births attended by health staff, percentage of population with access to safe water, percentage of population with access to sanitation, number of children immunized against measles. The table further shows that life expectancy at birth has the highest weight where as Infant Mortality rate has the lowest weight. The second factor (F<sub>2</sub>) which explains 8.4 percent of variations includes indicators like labour force as a percentage of total population, female labour force followed by number of hospital beds per thousand population, crude death rate, and maternal mortality rate. Low birth weight babies, under weight children, number of children immunized against DPT and teacher pupil ratio constitutes the third factor (F<sub>3</sub>) which explains 7.4 percent variations in the variable set. The fourth factor (F<sub>4</sub>) based on three indicators viz. dependency ratio, total fertility rate, crude birth rate explains 5.3% variations in the variable set. The fifth factor (F<sub>5</sub>) explains 3.8 percent variations with only one indicator of Infant Mortality rate.

Composite Index for 67 countries for the year 1985 has been developed and the resulting ranks of countries are presented in table 2. The table shows that the value of index varies within the range of 0.1174 and 0.7693. Bulgaria was at the top with highest value of composite index (0.7693) among 67 countries in 1985 followed by Hungary (0.7307), Chile (0.7169), Uruguay (0.7154), Korea Republic (0.6946), Costa Rica (0.6604), Venezuela (0.6588), Argentina (0.6515), Panama (0.6436) and Mexico (0.6314). The other countries whose index varies between 0.3 and 0.4 are Tunisia (0.4826), Paraguay (0.4767), Thailand (0.4717), Nicaragua (0.4645), El-Salvador (0.4635), Indonesia (0.4573), Egypt (0.4570), Algeria (0.4562), Honduras (0.4486), Zimbabwe (0.4425), Bolivia (0.4230) and Zambia (0.4068). India with composite index of (0.3759) ranks at 39 place.

The table further shows that Mali has the lowest composite index (0.1174). The countries whose index are better than Mali are Burkina Faso (0.1476), Guinea (0.1484), Sierra Leone (0.1739), Uganda (0.1887), Niger (0.1921) and Mozambique (0.1938).

### Composite Index: 1995

The results of factor analysis for the year 1995 are presented in table-3. The table shows that the four factors taken together explain 70% of variations in the variable set. The communalities for all indicators varied between 41.6 percent and 90.5 percent. The first factor (F<sub>1</sub>) based on variables Life expectancy, Adult literacy rate, Primary Enrollment Ratio, Secondary Enrollment Ratio, GNP per capita, number of physicians per thousand people, urban population, immunization against DPT, percentage of population with access to sanitation, percentage of population with access to safe water and percentage of births attended by health staff explains 48.4 percent variations.

**Table 4**  
**Composite Indices of Developing Countries: 1995**

Country	Rank 1995			Rank	Country	Composite Index	Rank
	Composite Index						
Hungary	0.7354			1	Guatemala	0.4721	37
Bulgaria	0.7322			2	India	0.4637	38
Czech-Republic	0.7311			3	Malawi	0.4470	39
Uruguay	0.6842			4	Bangladesh	0.4444	40
Jordan	0.6666			5	Morocco	0.4434	41
Mexico	0.6586			6	Kenya	0.4380	42
Panama	0.6430			7	Ghana	0.4243	43
Costa-Rica	0.6321			8	Zambia	0.4233	44
Malaysia	0.6194			9	Togo	0.4087	45
Romania	0.6178			10	Tanzania	0.3937	46
Dominican Republic	0.6105			11	Cameroon	0.3914	47
Colombia	0.6083			12	Sanegal	0.3911	48
Chile	0.6008			13	Congo Republic	0.3888	49
Venezuela	0.5978			14	Benin	0.3790	50
Philippines	0.5931			15	Rwanda	0.3743	51
China	0.5913			16	Pakistan	0.3675	52
Turky	0.5909			17	Madagascar	0.3592	53
Syrian Arab Republic	0.5904			18	Nepal	0.3562	54
Tunisia	0.5862			19	Cot D' Ivoire	0.3547	55
Peru	0.5817			20	Mozambique	0.3499	56
Oman	0.5774			21	Nigeria	0.3455	57
Thailand	0.5681			22	Mauritania	0.3432	58
Sri Lanka	0.5670			23	Uganda	0.3430	59
South Africa	0.5586			24	Central Africa	0.3251	60
Algeria	0.5553			25	Guinea	0.3208	61
Ecuador	0.5469			26	Papua New Guinea	0.3135	62
Honduras	0.5464			27	Burundi	0.2954	63
Egypt	0.5319			28	Ethiopia	0.2923	64
Brazil	0.5257			29	Burkin-Faso	0.2888	65
Bolivia	0.5217			30	Yemen Republic	0.2848	66
Vietnam	0.5102			31	Mali	0.2676	67
El Salvador	0.5085			32	Sierra Leone	0.2398	68
Zimbabwe	0.4969			33	Chad	0.2275	69
Nicaragua	0.4950			34	Haiti	0.2175	70
Indonesia	0.4948			35	Niger	0.1810	71
Paraguay	0.4850			36			

Source: Same as in Table 1



Female labour force, number of hospital beds per thousand people, crude death rate, labour force as a percentage of total population, and infant mortality rate constitutes the second factor which explains 9.5 percent variations in the variable set.

The third factor ( $F_3$ ) based on low birth weight babies, under weight children, gross domestic saving and teacher pupil ratio explains 7.8% of variations in the variable set.

The fourth factor ( $F_4$ ) consisting of maternal mortality rate, total fertility rate, dependency ratio and crude birth rate explains 4.3% variations in the variable set.

Composite index based on the weights dried from the factor analysis and the resulting ranks of 72 countries are presented in the table 4. The table shows that Hungary (0.7354) was at the top position followed by Bulgaria (0.7322), Czech-Republic (0.7311) and Russia (0.7198). The table further shows that Niger (0.1810) was at the bottom while Haiti (0.2175), Chad (0.2275) and Sierra Le One (0.2398) slightly better placed. Twenty nine countries lie in the range of 0.5 and 0.7 while thirty countries lie in the range between 0.5 and 0.3. India (0.4367) remains at 38<sup>th</sup> position.

### **Composite Index: 2005**

The table 5 shows the result of factor analysis for the year 2005 for developing countries. The table shows that the four factors under consideration explains 55.8% variations in the variable data. The communalities for all factors varied between 56.3 and 93 percent variations in the variable set.

The first factor ( $F_1$ ) explains 55.8 percent variations in the variable set. The most important indicators in this factor are life expectancy followed by secondary enrollment ratio and percentage of population with access to sanitation.

The second factor ( $F_2$ ) explains 8.3% variations in the variable set. The most important indicators in the set are female labour force, crude death rate, number of hospital beds. The other indicators included in this set are labour force as a percent of total population, maternal mortality rate, infant mortality rate, teacher pupil ratio and total fertility rate.

The third factor ( $F_3$ ) explains 5.95% variations in the variable set. The indicators included in this set are dependency ratio, crude birth rate and low weight babies.

The fourth factor ( $F_4$ ) explains 5.06% variations in the variable set. The only important indicator in this set is under weight children.

Composite index has been developed on the basis of 26 indicators by using weights calculated from 'Principal Component' analysis for 84 countries. The composite index and the resulting rank of countries are presented in the table 6.

The table shows that the index varies between 0.1301 to 0.8353. Israel occupies the top position with highest value (0.8353) followed by Czech-Republic (0.8144) and Uruguay (.8106). Thirty eight countries lie in the range of 0.6 and 0.8 while 25 countries lie in the range of 0.5 and 0.6. Chad with index value (0.1301) lies at the bottom with Niger (0.1747), Ethiopia (0.2185) and Central Africa (0.2525) slightly better placed. India falls to fifty sixth place from 38<sup>th</sup> as in 1995 with the value of index 0.4359.

**Table 5**  
**Results of Factor Analysis of Developing Countries: 2005**

S. No.	Variable	Component				Communalities $h^2 = \sum a^2_{ij}$	Weights	Wt in %
		F <sub>1</sub>	F <sub>2</sub>	F <sub>3</sub>	F <sub>4</sub>			
1	GNP Per Capita	<b>0.6590</b>	0.2290	0.2570	-0.3640	0.6930	0.367953	6.010622
2	Gross Domestic Saving	<b>0.2650</b>	-0.3950	-0.5540	-0.0786	0.5630	0.147963	2.417018
3	Adult Literacy Rate	<b>0.8080</b>	0.2530	-0.1000	0.0798	0.7340	0.451147	7.369625
4	Adult Female Literacy Rate	<b>0.8440</b>	0.1820	-0.0704	0.0984	0.7600	0.471247	7.697974
5	Primary Enrollment Ratio	<b>0.7490</b>	-0.0373	-0.1710	0.3170	0.6920	0.418204	6.831496
6	Secondary Enrollment Ratio	<b>0.8830</b>	0.0714	-0.0380	-0.1220	0.8370	0.493023	8.053686
7	Life Expectancy at Birth	<b>0.8860</b>	-0.2260	-0.1580	-0.1360	0.8940	0.494698	8.081049
8	Births attendant by health staff	<b>0.7490</b>	0.0553	0.0892	0.0634	0.5780	0.418204	6.831496
9	Number of Physicians	<b>0.7330</b>	0.2760	0.1800	-0.3030	0.7380	0.409271	6.685563
10	Population with access to safe water	<b>0.8090</b>	-0.1810	0.1500	0.1150	0.7230	0.451705	7.378746
11	Population with access to sanitation	<b>0.8740</b>	-0.0170	0.1170	0.1240	0.7940	0.487998	7.971599
12	Immunization against DPT	<b>0.6730</b>	-0.0669	0.2090	0.5870	0.8790	0.37577	6.138314
13	Immunization against measles	<b>0.7260</b>	-0.0662	0.2220	0.5450	0.8920	0.405362	6.621717
14	Urban Population	<b>0.7700</b>	-0.0199	0.2570	-0.1880	0.7950	0.42993	7.023033
15	Infant Mortality Rate	-0.9530	<b>0.1270</b>	0.0675	0.0203	0.9290	0.010554	0.172398
16	Maternal Mortality Rate	-0.8800	<b>0.1280</b>	0.0662	-0.0282	0.7960	0.010637	0.173755
17	Crude Death Rate	-0.6340	<b>0.5660</b>	0.2820	0.0110	0.8410	0.047035	0.768325
18	Number of Hospital Beds	0.5440	<b>0.5650</b>	0.2320	-0.1940	0.8240	0.046952	0.766968
19	Labour Force	0.1920	<b>0.5230</b>	-0.6600	0.1090	0.7690	0.043461	0.709954
20	Female Labour Force	-0.2310	<b>0.8080</b>	-0.3280	0.2120	0.8590	0.067145	1.096831
21	Total Fertility Rate	-0.9170	<b>0.0246</b>	0.1640	0.1250	0.9070	0.009768	0.159561
22	Teacher Pupil Ratio	-0.8880	<b>0.0871</b>	0.0573	0.1870	0.8360	0.009464	0.154599
23	Crude Birth Rate	-0.9240	-0.0423	<b>0.1500</b>	0.1540	0.9300	0.007794	0.127316
24	Crude Death Rate	-0.8160	-0.0004	<b>0.1600</b>	0.1750	0.7450	0.008857	0.144678
25	Under Weight Children	-0.4740	-0.2070	<b>0.0940</b>	-0.1300	0.7690	0.027729	0.452967
26	Low birth weight babies	-0.7690	-0.1570	-0.3100	<b>0.0917</b>	0.8590	0.009838	0.160709
	EIGEN Value	14.5170	2.1610	1.5490	1.3160		6.121707	100
	% Variance explained	55.8350	8.3100	5.9560	5.0610			
	CUM%AGE Variance explained	55.8350	64.1450	70.1010	75.1620			

Source: Same as in Table 1

## Convergence-Divergence

In order to have an idea about the nature of change in the degree of inequalities in various indicators, coefficient of variation as measure of convergence as suggested by Barro and Sala-i-Martin (1992, 1995) has been applied. This was done to examine as to what extent the selected indicators are converging or diverging across countries over time.

## Coefficient of Variation

In order to get a clear idea about the nature of change in the degree of inequality in various indicators, coefficient of variation (C.V.) as measure of convergence/divergences suggested by Barro and Sala-i-Martin (1992, 1995) has been computed. It is also used to find out, up to what extent the selected indicators as well as the index is converging or diverging across the countries over time.

$$\text{Coefficient of Variation (C.V.)} = \frac{\sigma}{X} \cdot 100$$

where  $\sigma$  and  $X$  represents mean and standard deviation, respectively of given variable.

Thus coefficient of variation has been used to find out whether the gap is bridging between the countries in respect of human development status or not.

Coefficient of variation of indicators were worked out across the countries and are presented in the table 7 at three point of time 1985, 1995 and 2005.

The value of co-efficient of variation in case of GNP per capita, gross domestic saving, adult literacy rate, adult female literacy rate, primary teacher-pupil ratio, infant mortality rate, maternal mortality rate, crude birth rate, total fertility rate, number of hospital beds, urban population, labour force, female labour force has increased over time 1985 to 1995. This increase has been the maximum for maternal mortality rate and is minimum for labour force and female labour force. Thus the gap among the developing countries in respect of these indicators is widening. Therefore poor countries need to undertake more programmes of social economic upliftment particularly in the education and health sectors to enable these countries to catch-up with the leaders among the developed countries. The table further shows that the coefficient of variation for other indicators like primary enrollment ratio, secondary enrollment ratio, life expectancy at birth, dependence ratio, births attended by health staff, number of physicians, population with access to safe water, population with access to sanitation, low birth weight babies, under weight children, immunization against DPT, immunization against measles is decreasing over a period from 1985 to 1995 thereby indicating that the gap is bridging among the developing countries in respect of these indicators.

Further more it is clear from the table that coefficient of variation for indicators like primary enrollment ratio, secondary enrollment ratio, life expectancy at birth, births attended by health staff, number of physicians, population with access to safe water, immunization against DPT, immunization against measles and urban population has declined from 1985 to 1995 and again from 1995 to 2005, showing tendencies of convergence over long period between the developing countries in respect of these indicators. The table further shows that coefficient of variation in case of GNP per capita, gross domestic saving, primary teacher pupil ratio, infant mortality rate, crude birth rate, total fertility rate, has increased consistently from 1985 to 1995 and further from 1995 to 2005 thereby indicating that gap between the developing countries for these indicators is constantly increasing. Thus there is need for initiating certain measures to improve these indicators so that the gap is bridged.

**Table 6**  
**Composite Indices of Developing Countries: 2005**

<b>Country</b>	<b>Composite Index</b>	<b>Rank</b>	<b>Country</b>	<b>Composite Index</b>	<b>Rank</b>
Israel	0.8353	1	Honduras	0.5833	43
Czech-Republic	0.8144	2	Morocco	0.5805	44
Uruguay	0.8106	3	Indonesia	0.5791	45
Argentina	0.7902	4	Nicaragua	0.5756	46
Greece	0.7761	5	Guatemala	0.5683	47
Hungary	0.7749	6	Myanmar	0.5623	48
Poland	0.7724	7	Zimbabwe	0.5227	49
Korea Republic	0.7659	8	Cameroon	0.4677	50
Bulgaria	0.7656	9	Malawi	0.4554	51
Portugal	0.7607	10	Congo Rep	0.4543	52
Chile	0.7575	11	Zambia	0.4434	53
Jordan	0.7521	12	Tanzania	0.4422	54
Cuba	0.7415	13	Pakistan	0.4372	55
Malaysia	0.7341	14	India	0.4359	56
Brazil	0.7334	15	Rwanda	0.4323	57
Mexico	0.7325	16	Ghana	0.4321	58
Panama	0.7176	17	Benin	0.4319	59
Costa-Rica	0.7161	18	Kenya	0.4295	60
Thailand	0.7142	19	Bangladesh	0.4240	61
Iran	0.7124	20	Sanegal	0.4228	62
Ecuador	0.7088	21	Togo	0.4161	63
Colombia	0.7074	22	Nepal	0.4149	64
Turky	0.6991	23	Madagascar	0.4105	65
China	0.6863	24	Yemen Republic	0.4075	66
Sri Lanka	0.6795	25	Sudan	0.3983	67
Venezuela	0.6767	26	Cot D'Ivoire	0.3855	68
Romania	0.6759	27	Mauritania	0.3822	69
Algeria	0.6735	28	Papua New Guinea	0.3639	70
Saudi Arabia	0.6717	29	Nigeria	0.3612	71
Dominican Republic	0.6700	30	Uganda	0.3503	72
Peru	0.6696	31	Burundi	0.3473	73
Oman	0.6672	32	Mali	0.3260	74
Tunisia	0.6664	33	Guinea	0.3081	75
Philippines	0.6600	34	Mozambique	0.3047	76
Syrian Arab Republic	0.6551	35	Haiti	0.2962	77
El Salvador	0.6494	36	Sierra Leone	0.2806	78
Vietnam	0.6465	37	Burkin-Faso	0.2781	79
Paraguay	0.6302	38	Central Africa	0.2525	80
Libya	0.6173	39	Ethopia	0.2185	81
Bolivia	0.6092	40	Niger	0.1747	82
South Africa	0.6037	41	Chad	0.1301	83
Egypt	0.5972	42			

Source: Same as in Table 1

**Table 7**  
**Convergence/Divergence in various indicators**

S. No.	Variables	1985			1995			2005		
		Mean	S.D.	C.V. (%)	Mean	S.D.	C.V. (%)	Mean	S.D.	C.V. (%)
1.	GNP per capita	0.0407	0.0430	105.6	0.0302	0.0329	108.9	0.0495	0.0702	141.8
2.	Gross Domestic Saving	0.3231	0.9302	34.7	0.2116	0.7835	370.3	0.3723	0.1905	51.2
3.	Adult Literacy Rate	0.5930	0.2653	44.7	0.6102	0.2864	46.9	0.7111	0.2491	35
4.	Adult Female Literacy Rate	0.5173	0.2958	57.2	0.4468	0.2901	64.9	0.6250	0.2941	47
5.	Primary Enrollment Ratio	0.6454	0.2814	43.6	0.7140	0.2545	35.6	0.7612	0.2434	31.9
6.	Secondary Enrollment Ratio	0.3519	0.2357	149.3	0.3623	0.2517	69.47	0.4764	0.2799	58.7
7.	Primary Teacher Pupil Ratio	0.4399	0.2154	48.9	0.4413	0.2331	52.3	0.3964	0.2651	66.8
8.	Life Expectancy at birth	0.4757	0.2359	49.6	0.5142	0.2435	47.3	0.5695	0.2678	47
9.	Infant Mortality Rate	0.4766	0.2436	51.1	0.3188	0.2083	65.3	0.2969	0.2468	83.1
10.	Maternal Mortality Rate	0.1790	0.2105	117.6	0.0596	0.1203	201.8	0.2068	0.2228	107.7
11.	Crude Birth Rate	0.6367	0.2343	36.8	0.5660	0.2709	47.8	0.4559	0.2712	59.4
12.	Crude Death Rate	0.3994	0.2395	59.9	0.3270	0.2089	63.8	0.4053	0.2237	55.2
13.	Total Fertility Rate	0.5742	0.2372	41.3	0.4886	0.2743	56.1	0.3991	0.2719	68.1
14.	Dependency Ratio	0.5503	0.1997	36.3	0.7392	0.2095	28.34	0.3226	0.0986	30.5
15.	Births attended by Health Staff	0.4794	0.2788	58.1	0.5637	0.2838	50.3	0.6624	0.3048	46
16.	Number of Physicians	0.1119	0.1482	132.4	0.1659	0.2153	129.7	0.1249	0.1542	123.4
17.	Number of Hospital Beds	0.0416	0.0459	110.3	0.1158	0.1410	121.7	0.1385	0.1456	105.1
18.	Population with access to safe water	0.4527	0.2682	59.2	0.5442	0.2802	51.5	0.7244	0.2326	32.1
19.	Population with access to sanitation	0.4543	0.2599	57.2	0.5402	0.2652	49.1	0.5803	0.2860	49.3
20.	Low Birth Weight Babies	0.3731	0.2274	60.9	0.2540	0.1418	55.8	0.2031	0.1463	72
21.	Under Weight Children	0.3198	0.2222	69.5	0.3123	0.2090	66.9	0.3517	0.2761	78.5
22.	Immunization against DPT	0.5289	0.3039	57.4	0.6921	0.2584	37.3	0.8240	0.1943	23.6
23.	Immunization against Measles	0.6097	0.2817	46.2	0.6771	0.2635	38.9	0.8117	0.2063	25.4
24.	Urban Population	0.3736	0.2165	57.9	0.3934	0.2290	58.2	0.4571	0.2499	54.6
25.	Labor Force	0.5900	0.1662	28.2	0.5828	0.1669	28.6	0.6511	0.1258	19.3
26.	Female Labour Force	0.6830	0.2126	31.1	0.6663	0.2120	31.8	0.6456	0.2091	32.4

Source: Same as in Table 1

**Table 8**  
**Convergence/Divergence in Composite Indices**

Years	1985			1995			2005		
	Mean	S.D.	C.V. (%)	Mean	S.D.	C.V. (%)	Mean	S.D.	C.V. (%)
Developing Countries	0.4242	0.1677	39.53	0.4755	0.1393662	29.3	0.5564	0.176255	31.67

Source: Same as in Table 1

### Convergence/Divergence in Composite Index

The extent of convergence or divergence in respect of composite index was worked out for developing countries and results are presented in the table 4.15 for the period between 1985-1995 and 1995-2005. Further the table shows that coefficient of variation of composite index for developing countries has decreased from 1985 to 1995 but it has increased slightly from 1995 to 2005. Thus for developing countries there has been converging tendencies from 1985 to 1995 however slightly diverging tendencies from 1995 to 2005. Thus there is need for policy measures on the part of poor countries to improve the composite index of human development.

### References

- Baro and Sala-I-Martin, X. (1995), *Economic Growth*. New York: McGraw-Hill.
- Gorsuch, R.L. (1974), *Factor Analysis*, W.B. Saunders Company, Philadelphia
- Harmon, H.H. (1967), *Modern Factor Analysis*, University Press, Chicagos
- Mehta, M.M. (1976), *Human Resources Development Planning*, The Macmillan Company of India Limited.
- Todaro, M.P. (1977), *Economic Development in Third World, An Introduction to Problems and Policies in a Global Perspective*, London, Longman