Regional Disparity Revisited: The Case of Karnataka

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1. Introduction

A recent article that appeared in Economic and Political Weekly by N.J. Kurian (2000) on regional disparity has once again reopened the issue of regional disparity in the context of economic development, be with economic reforms or without. To quote him:

"Considerable level of regional disparities remained at the end of the 1970's. The accelerated economic growth since the early 1980's appears to have aggravated regional disparities. The ongoing economic reforms since 1991 with stabilization and deregulation policies as their central themes seem to have further widened the regional disparities. The seriousness of the emerging acute regional imbalances has not yet received the public attention it deserves".

Kurian (2000); p.538

I am equally inspired by another article that appeared in the Indian Journal of Regional Science by R.V. Dadibhavi (1998), who addressed to the issue of north-south disparity in Karnataka, mainly looking from the angle of income and plan outlays at the district levels. I want to take up this issue at bit more analytical level. Disparities are to be viewed from various angles. The major ones that come to my mind are quality of life, and two major resource endowments namely, human and natural capital. That is why I have chosen to analyse the district level disparities from these angles, and not just the usual income or levels of investment etc. Furthermore, the question I am raising in this article is about the linkage between regional disparities and their causalities at the district levels. The main question posed in this paper is whether the social, sectoral and infrastructural disparities are linked in any systematic way? In a

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sense, I am attempting to link these issues within the framework of Sustainable Human Development (Chopra and Kadekodi, 1999). Conceptually, as I will argue and also for policy purposes, it is logical to link them and analyse the regional disparities.

Before, I take up the districts of Karnataka in detail, as far as the state of regional disparity is concerned, it may be useful to compare Karnataka with another state such as Bihar as two distinct situations. Table 1 shows some salient features of these along with the all India status.

Table 1: Some comparative status of Karnataka, Bihar and All India

INDICATOR	UNIT	KARNATAKA	BIHAR	ALL INDIA
Income per capita	Rs. per year	27372	22459	25653
Gini ratio of per cap. Income	Fraction	0.49	0.39	0.43
Sen Poverty Index	Ratio	0.18	0.21	0.18
Poverty ratio: Head count ratio	Ratio	33	42	39
Literacy rate	%	47.7	33.8	44.7
Enrolment Rate (6-14 years)	%	65.5	38.3	57.8
Crude birth rate	No. per 1000	28	31	30
Infant mortality	No. per 1000	55	67	84
Contraceptive prevalence (all methods)	%	47.7	19.8	36.9
Transportation: connected with *pucca* road	%	25.9	19	36.8
Recorded Forest /Geographical area.	%	20.19	16.81	20.00
Wasteland/Geographical area	%	10.87	12.08	20.17

Sources: Shariff (1999), Wastelands Atlas of India (2000), State of Forest Report (1997)

Some comments can be offered on the basis of this state level data and information. Firstly, on the whole, one gets the impression that Karnataka is at par with the all India performance. In fact its performance is slightly better than the All India levels in respect of Infant mortality, Crude birth rate, Family welfare and planning, Literacy, School enrolment rate, Per capita income, Head Count Ratio, Forest area, and Extent of wastelands. Bihar is better only in terms of Gini measure of income inequality, which may be a fact of doubt. But from this, it should not be construed that in all respect, the districts within Karnataka are better placed. Secondly, it should be noted that, using such state level indicators and information, one cannot

draw any useful policy directives for development in a sub-regional context (Mishra and Joshi, 1985; Kurian, 2000)[1].

Considerable attention was given in the past to analyse regional disparities in India at the state levels, and also to devise state level plan allocations (Mishra and Joshi, 1985; Kurian, 2000; Gulati, 1977). Much less however is done at district or sub-regional levels, though the Planning Commission (1984) has long back emphasized district level planning (Aziz, 1993). In fact, today this issue of inter-regional variations in development is being discussed much more seriously in Karnataka. Specific mention is being made about the north south disparity within the state. The on-going debate has led to the setting up of a 'High Power Committee to Study Imbalance in the State of Karnataka' in the month of April 2000. Karnataka is also known for its rich endowments in natural and environmental resources. Therefore, a detailed analysis of regional development and disparity and their causes is timely.

This paper is addressed to this question of regional disparity, the causes and remedial measures for Karnataka. In doing this, Section 2 goes into some selected indicators of development at the district level. This is followed by a model of linking environmental and social developmental status of the state at district levels. Section 4 goes into regionalisation of the districts of Karnataka as hierarchical clusters. Finally, some plausible remedial policy suggestions are offered.

2. Sustainable Development Indicators at District Level.

It is now very much understood that more than income, the quality of life or human development related indicators are better for analyzing development and disparity paradigms (Haq, 1996). As of today, at the Indian state level, no official estimates of Human Development Index (HDI) are available. Even the *India: Human Development Report* of NCAER (1999) did not have these either. Fortunately, Karnataka is one such state for which lot more details of HDI and its correlates are available (Government of Karnataka, 1999; Vyasulu and Vani, 1997). But HDIs tell only a partial story of regional disparity (Vyasulu and Vani, 1997).

[1] The recent spurt for creating newer states in states like Madhya Pradesh, Uttar Pradesh and Bihar is in fact telling the story of intolerable state of disparities at sub-regional or state levels.

It is emphasised again and again that, rather than treating *Per capita income* and its growth rate, or *GDP per capita* and its growth rate, other alternative indicators are necessary to understand the level of development and also to design policy interventions (Sen, 1989; World Bank, 1992, World Bank, 1993). The notable major additional indicators of development are: *Human Development Index (HDI), Percentage of population below poverty line, Extent of income inequality, social sectoral inequalities* (*educational and health care deliveries*), *Index of human dignity,* and *Extent of environmental degradation.* Human Development Index itself is a weighted index based on distinct concepts of development, namely, development of human capability and ability to attain welfare. The specific indicators used in constructing HDI are, *Life expectancy, Literacy, and Per capita income*. Following Sen (1976), a modification of HDI is defined to account additionally for income inequality (as measured by Gini coefficient). Gini measure of income inequality is one of the traditionally used indicators of disparity of income distribution (Sen, 1992). An alternative to HDI is the Gender weighted Human Development Index (GHI). It is a weighted average of male and female population in respect of life expectancy, infant mortality and education. Moreover, it does not include income as one of the component attributes. In that sense, it is a purely a social indicator of welfare, in some sense far better than HDI.

Looking for development policy, *Percentage of population below poverty line* is a measure of deprivation and the target group to be addressed. Poverty line itself is defined either based on desirable nutritional levels or a mix of desirable food and non-food consumption level (Minhas et al., 1989; Sukhatme, 1977; Dandekar 1994; Dandekar and Rath, 1970; Planning Commission, 1993). Most difficult is to define any index of human dignity, including freedom and justice (Scruggs, 1998).

As much as the levels of education, health care infrastructure and income are important ingredients of HDI. The gaps and disparities in them are also to be looked in to. Being more of qualitative in nature, these attributes are however, very difficult to measure. These can be captured indirectly in terms of indices such as *School dropouts, Percentage of eligible children attending primary education, and Infant and Child mortality.* Finally, given the complexity of diversity, it is equally difficult to define any unique measure of environmental quality and

quantity (Opschoor, 1989 and 1992; Chopra and Kadekodi, 1999). Two alternative indicators are considered in this paper. They are Indicators of *Forest degradation* and *Extent of wastelands*.

Table 2 shows some of these socio-economic and environmental indicators at the district levels for Karnataka. Since complete data had to be compiled for as many indicators as possible, rather than the present 28 districts, the twenty districts that existed in 1991-95 period have been considered. Looking back for the data base, it is also meant that, we had to rely on only two-three major sources of data, so that they are compatible for understanding the developmental process at the district levels.

Table 2A: Environment and Development related Data at District level

	1	2	3	4	5	6	7	8	9	10	11
District	.% Population below poverty line (1993-94)*	HDI based on SWI in 1991*	Life expectancy Index 1991*	Education Index 1991*	Infant Mortality Rate Index 1991*	GHI 1991*	Gini co-efficient Rural*	Gini co-efficient Urban*	Per capita income in 1997(Rs.)*	GDP per capita in 1991 (Rs.)*	Growth of per capita income (91-95) (%)*
Bangalore (U)	31.420	0.565	0.680	0.770	0.640	0.696	0.314	0.299	4712	9242	4.090
Bangalore (Rural)	38.170	0.457	0.695	0.549	0.641	0.619	0.271	0.194	2381	4788	4.220
Belgum	29.860	0.454	0.668	0.560	0.632	0.610	0.253	0.305	2363	5088	4.630
Bellary	44.500	0.410	0.589	0.516	0.391	0.484	0.279	0.293	2143	4995	1.630
Bidar	56.060	0.402	0.646	0.489	0.469	0.523	0.266	0.281	2002	3555	3.270
Bijapur	28.980	0.430	0.629	0.552	0.426	0.523	0.232	0.287	2130	4181	9.320
Chikmagalure	15.610	0.503	0.660	0.636	0.594	0.626	0.313	0.259	2787	7348	4.640
Chitradurga	39.000	0.447	0.615	0.619	0.628	0.613	0.404	0.407	2136	4534	4.100
Dakshina Kannada	8.910	0.565	0.730	0.808	0.851	0.807	0.330	0.301	2632	6384	0.440
Dharwar	49.750	0.444	0.630	0.601	0.432	0.546	0.249	0.332	2163	4158	6.800
Gulbarga	45.540	0.387	0.650	0.421	0.564	0.530	0.230	0.314	2431	4592	5.600
Hassan	14.440	0.460	0.673	0.594	0.541	0.596	0.232	0.313	1999	4288	6.910
Kodagu	20.730	0.584	0.717	0.738	0.705	0.718	0.288	0.378	3770	11270	-0.820
Kolar	48.450	0.430	0.631	0.564	0.594	0.588	0.256	0.296	1588	3787	3.570
Mandya	30.160	0.428	0.650	0.530	0.479	0.545	0.286	0.335	2308	4309	7.990
Mysore	28.940	0.426	0.638	0.510	0.577	0.569	0.225	0.258	2785	4805	10.440
Raichur	25.110	0.372	0.676	0.383	0.597	0.536	0.208	0.233	1933	3918	3.350
Shimoga	25.560	0.467	0.618	0.648	0.407	0.553	0.313	0.259	2759	4993	6.170
Tumkur	40.640	0.440	0.594	0.602	0.528	0.567	0.298	0.290	2047	4091	2.630
Uttara Kannada	24.970	0.513	0.699	0.699	0.645	0.677	0.263	0.316	2199	5480	2.520

Table 2B: Environment and Development related Data at District level

12	13	14	15	16	17	18
Population Density Per sq.km. In 1991*	Pop. growth in % (1981-1991)*	%change in forest cover (1989 to 97)**	Degraded notified forest land in % (1999)***	Total wasteland in 1988-89 (%)****	Total wasteland in 1999 (%).***	%change in wasteland area (89 to 99)
2210	38.440	-8.480	7.996	0.143	0.19	33.660
288	15.230	-8.480	7.996	0.140	0.19	33.660
267	20.240	-40.270	5.180	0.074	0.11	46.280
191	26.920	-43.320	11.102	0.084	0.17	97.140
231	26.120	-60.100	0.944	0.057	0.07	30.940
172	21.910	-95.360	0.321	0.169	0.13	-24.770
141	11.570	13.850	4.857	0.092	0.12	25.870
201	22.670	-59.410	7.910	0.117	0.18	53.680
319	13.360	65.080	1.109	0.077	0.10	29.440
255	18.930	-31.760	2.869	0.053	0.09	71.360
159	24.100	-61.090	1.818	0.121	0.04	-64.980
230	15.670	84.440	3.050	0.082	0.08	1.700
119	5.750	112.390	7.679	0.025	0.08	228.940
270	16.340	-42.330	7.850	0.061	0.12	91.510
331	15.960	11.030	4.291	0.092	0.09	1.960
265	21.920	1.010	0.844	0.064	0.06	-1.680
165	29.490	-100.000	2.672	0.116	0.07	-41.860
181	15.270	-8.610	2.833	0.091	0.07	-27.150
218	16.580	-46.360	4.654	0.145	0.26	80.470
119	13.830	-4.880	5.172	0.039	0.07	88.620

Table 2C: Environment and Development related Data at District level

19	20	21	22	23	24	25
Children under five Mortality rate 1991*	No. of healthcare subcentres per lack rural pop. (1996-97)*	PHC/10000 pop. 1993-94	% of 'Students dropout (std.1-7th)1997-98*	% of children enrolled in the school 1993-94	Children enrolled / school 1993-94	No. of schools/ 1000 enrolled (1993-94)
67	37	0.054	33.800	73.964	325.824	3.069
67	9	0.367	38.240	71.203	121.343	8.241
69	20	0.312	51.770	72.477	229.358	4.360
119	16	0.286	48.750	67.549	241.830	4.135
85	20	0.282	67.230	89.682	310.710	3.218
88	18	0.299	54.990	70.359	223.724	4.470
75	37	0.409	57.280	79.516	159.628	6.265
104	26	0.336	39.650	68.980	159.574	6.267
46	35	0.425	7.750	94.863	313.450	3.190
95	23	0.247	45.990	72.176	278.510	3.591
86	23	0.334	59.860	65.102	203.973	4.903
78	33	0.421	45.290	78.406	117.868	8.484
66	39	0.564	13.700	79.516	182.870	5.468
100	20	0.310	37.600	81.465	141.247	7.080
84	25	0.343	41.170	72.555	144.989	6.897
89	28	0.375	48.420	66.439	180.582	5.538
80	18	0.296	59.620	53.624	122.261	8.179
88	25	0.331	46.000	76.080	141.453	7.069
102	20	0.356	36.800	73.355	125.325	7.979
69	31	0.442	52.910	75.485	126.367	7.913

Notes:

- Gini co-efficient for Chikmagalore district is taken from its adjoining district (Kodagu)
- SWI: Sen's Welfare Index (Sen's welfare index in lieu of the income index, weighted additionally by Gini income disparity index
- GHI = (l1+l2+l3)/3 * 100, l1,l2,l3 are the equally distributed indices of life expectancy, infant mortality and education;
- Child under five mortality rate = No. of child die per 1000 under five years age;
- Life expectancy index = Actual value-25/85-25;
- Education Index = [2* adult literacy rate index+l*combined enrolment ratio index]/3;
- % of children enrolled in the school (1993-94) = (Children enrolled in the primary school 1993-94/Projected eligible child population)*100
- Formula used for Population projection $Pt=P_0e^{rt}$

Sources for data:

* Human Development in Karnataka 1999, Planning Dept., Govt. of Karnataka
** State of Forest Report 1997, Forest Survey of India, Dehradun
*** Wastelands ATLAS of India, Ministry of Rural Development, Dept. of Land Resources, 2000, Government of India, New Delhi & NRSA Hyderabad;
**** Report on area statistics of landuse/land cover generated using remote sensing techniques prepared by landuse, cartography and map printing group, NRSA, Dept. of Space, Government of India, Hyderabad
***** Karnataka at a Glance 1994-95
Min. of Environment and Forest Website: www.envfor/nic.in and
www.envfor/nic.in/naeb/sch.wsl/wsl-ka.htm

How do the data reflect on the state of regional development in Karnataka? Going by HDI (corrected for income inequality), the quality of life is quite high in the districts of Bangalore, Dakshina Kannada, Kodagu, and Uttara Kannada. The districts falling in the lowest categories of quality of life are Bidar, Gulbarga, and Raichur. But if one looks at the measures of rural income inequality only, districts such as Bangalore (urban), Chitradurga, Dakshina Kannada, and Shimoga are worse than the state level inequality. The better districts are Bangalore (rural), Belgaum, Bellary, Bidar, Bijapur, Dharwad, Gulbarga, Hassan, Mysore and Raichur.

More than HDI, the GHI is appropriate as measures of social development. The highest levels of GHI are found in Dakshina Kannada and Kodagu. These are followed by Bangalore (U), Bangalore (R), Belgaum, Chikamagalore, Chitradurga, and Uttara Kannada. The least level of GHI are found in Bellary. On the contrary, based on GDP per capita or Income per capita, the districts such as Bangalore and Kodagu have highest income levels. This is followed by Chikamaglore and Dakshina Kannada. The lowest in this category are Bidar, and Kolar. Now consider the extent of poverty. Districts like Dakshina Kannada, Chikmagalore and Hassan have very low intensity of poverty population. The highest poverty rates are found in Bellary, Bidar, Chitradurga, Dharwad, Gulburga, Kolar, and Tumkur districts.

The environmental status be examined now. Between 1989 and 1997, the worst affected districts in terms of decline in forest cover are Belgaum, Bellary, Bidar, Bijapur, Chitradurga, Gulbarga, Tumkur, Raichur and Kolar. The districts that have registered significant improvements in forest cover are Dakshina Kannada, Hassan, and Kodagu. As far as the extent of wastelands is concerned, in a number of districts, it has increased between 1988 and 1999. The notable ones are, Bangalore, Belgaum, Bellary, Bidar, Chitradurga, Dharwad, Kodagu, Kolar, Tumkur and Uttara Kannada. In 1999, the districts of Bangalore (U), Bangalore (R), Chitradurga and Tumkur have the highest wastelands (as a percentage of geographical area). The better off districts in this respect are Uttara Kannada, Raichur, Shimoga and Gulbarga.

When it comes to development, the social dimensions are far more appropriate than the income related attributes. As far as the educational status is concerned, of the many presented in Table 2, two major indicators are Percentage of eligible children (i.e., between age group 6 to 14) that attend the primary school, and the Percentage of school dropout rates. The enrolment rates

are highest in Bidar, Chikmagalore, Dakshina Kannada, Dharwad, Hasan, Shimoga, Tumkur and Uttara Kannada, Mandya, Kolar, and Kodagu. Raichur district has the least enrolment rate. As against these, the school dropout rates are highest in Bidar. It is the least in Dakshina Kannada district, followed by Kodagu. As far as health delivery system is concerned, Child morality rate and PHC's serving the population are important indicators (in addition to the usual indicators such as Life Expectancy and Infant mortality). The PHC facilities are highest in Kodagu, least in Bellary, Bidar, Bijapur, and Dharwad.

One gets the impression from the data, on the face of them that, districts which are well endowed with natural resources and social infrastructure are much better off in terms of quality of life. But this fact needs to be tested with a rigorous model, which is attempted in the next Section.

3. Can we link the environment-development nexus at the district levels?

This is a difficult question indeed. The simplest answer to this is that, given the set of information, and possible linkages between different factors and indicators, one may formulate a notional causality driven model of linkages between the major development indicators and also to explain them by several other factors and indicators. We consider the following eight indicators to be very pertinent to say some thing about the state of development at the district levels. They are:

- ***Extent poverty**: measured by Percentage of population below poverty line (POPBPL),*
- ***Income inequality**: measured by Gini measure of income inequality,*
- ***Quality of life**: measured by HDI and/ or GHI,*
- ***Level of environmental status**: measured by (1) degradation of forests and (2) extent of wastelands*
- ***Status of Education**: measured by (1) Percentage of eligible children going to school, (2) Percentage of school drop out rates*
- ***Health status**: measured by (1) Life expectancy, (2) Child mortality*

These stand out as the most relevant indicators representing economic, social and environmental status. In this paper, we have considered six factors as the possible explanatory variables of social development. They are:

- ***Population density,***
- ***Rate of population growth,***
- ***GDP or Income per capita,***
- ***Rate of growth of income per capita,***

- ***Number of PHC's per 10000 population, and***
- ***Number of schools per 1000 children enrolled***

Population changes are driven by many factors, only some of which are directly responsible to development. They are mainly the income growth and public expenditures on family welfare etc., by way of promoting and creating awareness about the problems of population growth. Other factors can be culture, habit, caste, religion, social stratification and so on. Similarly, income levels as well as its growth are due to investment patterns, degree of industrialization, extent of natural and agricultural resources and so on. The health and educational (or to be more correct, the basic human capital formation) infrastructural facilities are represented by the last two indicators. The links between these factors are shown in Figure 1.

Tables 3 and 4 present estimates of econometric models of these linkages. The data as shown in Table 2 at district levels are used here. They are regression estimates based on ordinary least squares method. Since most of the estimated coefficients are significant, we may proceed to interpret the outcomes of the models.

As far as the Well being index HDI at the district level is concerned, it is being explained by four factors, namely *GDP at the district level (positively), Percentage of people below poverty line (negatively), Population growth (negatively), extent of income inequality (negatively).* In other words, for increases in GDP at the district level, the HDI as a measure of well-being will go up; the same will go down for increases in poverty level, population and income inequality.

Now consider the environmental status of the districts. *Population growth* affects it adversely; so also is *income inequality* , but improvement in well-being will improve the environmental quality. District level poverty is explained well by the *state of environment (negatively), population growth (positively), and GDP growth (also positively).* Finally improvements in environment will reduce the *income inequality,* but improvement in *GDP growth* does the reverse. As against the HDI, linking the GHI with other social indicators is more useful. As can be seen from Table, 4, the Gender Weighted Index is better explained. It is explained or affected by the *change in forest cover* positively (an indicator of environmental change), positively by by the *number of PHC's* (an indicator of health status), and positively by the *number of children enrolled per school* (an indicator of educational status). Can one explain child mortality (i.e.,

below age 5) in Karnataka? As expected, child mortality is negatively related to *life expectancy*, and positively by *Gini measure of income inequality*. It is also lower at higher and higher levels of education (as revealed from the positive coefficient of *Education Index*. It seems to be influenced positively by the *rate of population growth*. On similar lines, the Life Expectancy is explained by *GDP per capita* (positively), *Number of PHC's per 1000 population* (positively), and negatively by *Gini measure of income inequality*.

The level of education itself is measured by the Education Index. Our regression estimates show that it can be very well explained by *Population below poverty line* (negatively), *GDP per capita* (positively), *Percentage of eligible children enrolled* (positively), *Number of children enrolled per school* (positively), and *Child mortality* (negatively). Another indicator of educational status is Percentage of eligible children enrolled in schools. This is explained by, as expected, *GDP per capita* ((positively), and negatively by the *Percentage of people below poverty line*. One final indicator of educational status is Percentage of children drop-out from schools. This is explained in our model by *Percentage of population below poverty line* (positively), *GDP per capita* (negatively), and *Number of schools per 1000 enrolled* (negatively).

Thus, the district level analysis of environmental and developmental nexus in Karnataka reveals several important features. Before drawing any policy implications, it may be mentioned that it is not intended here to test any of the much talked hypotheses such as the Environmental Kuznets curve or Kuznets hypothesis itself, or any other on the linkage between social infrastructural development and quality of life[2]. Broadly, we have five major factors that are taken to influence the status of social quality of life in Karnataka and the regional disparities in them. They are population, income, income inequality (including poverty level), educational infrastructure and health facility. The econometric models clearly suggest that all of them seem to have nearly equal influence on the developmental status at the district levels. In particular, population pressure and adverse income distribution at the district levels can make the levels of quality of life, levels of human capital (i.e., both education and health status) and environmental resources very poor. Both population growth and income disparity are considered to be two major factors requiring policy interventions to reduce the pressure on environmental resources and to raise social and human status of life at district levels.

[2] One will require more of time series data for analyzing such phenomena.

Table 3: Regression Models of Development – Environment Linkages

Expl. Variables	HDI(WSI)	Gini(R)	PopBpl	ΔWland	Total Wland 1997	Deg. Forest 1999	Δ Forest
Constant	0.389 (10.3*)	0.221 (4.6*)	70.337 (1.9*)	82.495 (2.1*)	-8.923E-2(-2.2*)	-1.079 (-0.4)	-96.323 (-0.8*)
HDI(WSI)			-110.891 (-1.1*)				323.03 (1.2*)
Popl. Bpl	-5.979E-4(-0.9*)						-0.953 (-1.2*)
Gini (R)				-236.722 (-1.7*)	0.208(1.4)		
GDP per cap	1.939E-5(4.1*)	5.204E-06(1.0*)	9.491E-4(0.4)	1.716E-2(4.5*)			5.094E-3(0.7*)
GDP per cap Income		-2.721E-03(-0.7*)					2.374(0.7*)
Δ Forest	2.353E-4(1.1*)		-6.247E-2 (-0.7*)	-0.384 (-2.3*)			
Δ W.land					5.129E-4(3.2*)	4.058E-2(3.7*)	
Tot. Wland in		0.344	48.443	956.012			
1997		(2.0*)	(1.0*)	(7.2*)			
Tot Wland in 1998				-1516.000 (-7.2*)	1.243 (5.8*)	24.455 (1.4*)	-387.074 (-1.7*)
Degr Forest 1999					2.823E-3(1.0*)		
Popl. Growth	-4.592E-4(-0.4)		6.824E-2(0.1)	-2.393 (-2.4*)		8.877E-2(0.8*)	-2.024 (-1.6*)
Popl Density						3.812E-3(0.3)	
R^2	0.796	0.333	0.456	0.913	0.810	0.531	0.762
Adj R^2	0.741	0.207	0.262	0.872	0.759	0.405	0.652
σ	2.997E-02	4.05E-2	10.910	22.943	2.738E-2	2.341	32.540
d.f.	15	16	14	13	15	15	13

Notes: R^2 =square of correlation coefficient; Adj R^2 =Adjusted R-square; σ = standard error; d.f.= degrees of freedom

Table 4: Development and Social Sectoral Linkages

Expl. Variables	Development Variables							
	Gender weighted Index	**Gini: Inequality**	**Child mortality**	**Child Mortality**	**Education Index**	**Life Expectancy** Index	**Student Dropout** Rate	**% Children Enrolled**
Constant	0.523 (4.33*)	0.389 (2.01*)	59.078 (2.50)*	321.921 (9.03*)	0.127 (0.88)	0.810 (27.11*)	58.035 (2.46*)	88.027 (4.58*)
POPBPL	-1.997E-3 (-1.48*)		0.673 (2.32*)	0.153 (1.08*)	-2.261E-3 (-1.51*)		0.181 (0.64)	-0.234 (-1.01*)
GDP per cap.	1.288E-5 (1.40*)	-7.291E-7 (-0.12)	-2.725E-3 (-1.47)*		1.887E-5 (1.92*)	2.382E-6 (1.24*)	-3.648E-3 (-1.94*)	6.338E-4 (0.41)
Gini Inequality			57.001 (0.80*)	2.746 (0.07)	0.862 (2.31*)	-8.537E-2 (-1.21*)		
ΔForest Cover	3.148E-4 (0.8)							
PHC/10,000 popl.	7.24E-2 (-0.37)					4.786E-2 (1.52*)		
No. of Schools/ 1000 enrolled							-4.50E-2 (-0.03)	-1.479 (-1.02*)
Education Index		0.270 (2.47*)		-12.225 (-0.6)				
Life Expectancy		-0.411 (-1.39*)		-363.056 (-7.37*)				
Gr. Per cap. Income		-3.421E-3 (-0.98*)						
Tot. Waste-Lands 1997		0.138 (0.77*)						
Popl gr. %			3.74E-02 (0.08)					
% Eligible children enrolled					2.048E-3 (1.21*)			
Children enrolled per School	2.59E-4 (1.10*)				2.283E-4 (0.91)			
Child Mortality					-1.942E-3 (-9.03*)			
R^2	0.624	0.549	0.494	0.897	0.724	0.909	0.332	0.173
Σ	5.62E-2	3.56E-2	13.36	6.03	6.62E-2	1.30E-4	12.94	10.51
d.f.	14	14	15	15	14	14	16	16

4. Regionalisation based on environment-education-health- development nexus

As much as environment is not measurable by any single index, state of education, health, and development are not. Therefore a basic question is how to regionalize the districts as per the status of development or social infrastructure (i.e., health and education), or environment? There is a problem of aggregation, which is difficult to resolve[3]. An alternative approach is to formulate a cluster model. Among the various indicators of development, and social and environmental status (as shown in Table 2), four broad groupings can be made. They are: developmental indicators, health indicators, educational indicators and finally environmental indicators. For each of them, only some selected specific indicators are used for further analysis based on Cluster Models. The specific indicators used here are shown in Table 5.

Table 5: Indicators Grouped under Development Paradigms

GROUPED INDICATOR	SPECIFIC INDICATORS USED
DEVELOPMENT	• HDI or GHI • Population density • Population below poverty line
EDUCATION	• Percentage of eligible children enrolled • Percentage of students drop-out.
HEALTH	• Life expectancy • Percentage of child mortality
ENVIRONMENT	• Change in forest cover (1988-97) • Total wastelands in 1997

Separate cluster models are estimated for each of these group of variables, and also for two groups of variables taken together, three groups of variables taken together and finally taking all the four groups together. Appendix Tables 1-7 show the regional (clustering) patterns of the districts formed under these grouped variables. A summary analysis of the regionalisation and hence the status of disparity are presented below.

[3] Unless one has a large data base (say at household or village levels) it is not easy to arrive at any meaningful weights or indicators for aggregation.

***4.1: Development* and *Development with Environmental status* contrasted.**

Firstly, six districts (namely, Raichur, Bellary, Bijapur, Gulburga, Chitradurga and Shimoga) which are in the lowest category of development (cluster 6) are also lowest when environmental degradation status is considered. Secondly, Kodagu, which is quite high up in developmental status (cluster 3), is quite low when environmental degradation is added (switching to 5). As compared to developmental status, South Kanara and Mandya districts are better when environmental status is added (switching from cluster 4 to 2). Finally, Dharwad district, which is very low in developmental status (cluster 5) is better when environmental status is also considered (cluster 2).

***4.2:Development* and *Development with Health* status contrasted**

As can be seen from Appendix Table 2, South Kanara and Mandya districts are quite low in health status. Next comes a group of three districts consisting of Bidar, Tumkur and Hassan, which are quite low in both development and health levels. Bijapur, Shimoga, Raichur, Gulbarga and Chitradurga districts are slightly better in health status, though in terms of development they are the lowest.

The better off districts in both development and health status are Bangalore, Dharwad, Belgaum, Kolar and Mysore.

***4.3: Development* and *Development with Educational status* contrasted**

When education is added, districts like North Kanara and Chitradurga go to the bottm of the list. Kodagu district is only marginally better. Once again, Bangalore, Belgaum, Dharwad, Kolar and Mysore districts are better in terms of both development and educational status.

***4.4: Development* and *Development with Educational and Health status* contrasted**

Under this category, the worst districts are Bellary, Raichur, Shimoga, Gulbarga, Chitradurga and Bijapur. In health and educational status, Dharwad districts seems to go down very much. Districts such as Bidar, Hassan and Tumkur are quite low in terms of both development, education and health status.

***4.5: Development* and *Development with Educational and Environmental status* contrasted**

If one considers development, education and environmental status together, the districts of Bidar, Tumkur, Bellary, Raichur, Gulbarga, Chitradurga and Bijapur are the least developed ones. Chikamagalore and North Kanara are moderately developed. The better off are the districts of Bagalore, Dharwad, Belgaum, Kolar and Mysore.

***4.6:Developmental a*nd *Development with Health and Environmental status* contrasted**

The developmental pattern under these categories are exactly the same as under education and environment taken together with development.

***4.7:Development* and *Development with Education, health and Environmental status* contrasted**

The regionalisation pattern here is exactly the same as under health and environment, education and environment, or environment alone taken together with development.

Therefore, there is a clear message from the Cluster pattern analysis of regionalisation of the districts. Only the developmental and environmental status seem to divide the districts fairly well in term of levels of development and disparity. The regionalisation on the basis of these two also coincide with the regional patterns with health and educational status.

5. Some broad Conclusions

The developmental strategies in Karnataka require two distinct approaches. Firstly, as revealed by the findings of Section 3, social development and environmental conservation are to be dealt simultaneously. This is because, as found from the econometric models and shown in Figure 1, there is a strong two way positive linkage between social development and environmental conservation. Measures to reduce inequality and environmental conservation and preservation should also be treated as one problem. This is because of their two way negative linkages, namely, improvements in environmental status will reduce income inequality and vice-versa. Improvements in literacy, health care deliveries and thrust on income generation have their direct and feedback impacts in reducing the extent of poverty. Therefore, the summary package of development across the districts can be literacy, health care, employment and income

generation, and environmental preservation. They will in turn reduce both income inequality and the extent of poverty, and also contain the population problem.

The second approach is to address at the district level problems, specifically based on the method of regionalisation. The cluster analysis suggests specific policy measures for the six districts, which are quite low in the scale in both the state of social development and environmental status. They are Raichur, Bellary, Bijapur, Gulbarga, Chitradurga and Shimoga. These districts do require interventions on social, developmental and environmental fronts simultaneously. Also falling in line for special attention are Bidar and Tumkur districts, and to some extent Hasan district. Kodagu district requires specific measures to reverse its forest degradation and high rate of wastelands. Though their environmental status is quite better, districts of Dharwad, S. Kannada and Mandya require focus on development, to sustain their environmental status.

In conclusion, this paper raises some specific issues relating to the state of development in Karnataka. It is clear from the analysis that environment and social development are to be taken together in reversing the regional disparity and raising the quality of life in the state. More than the measures such as poverty eradication programmes, population control measures, attempts to reduce the pressures on forests, improving wastelands, water quantity and quality improved health care and schooling systems etc., can bring about major shifts in the development status of the districts in Karnataka.

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Appendix Table 1: District Level Cluster Patterns by Development and Development with Environment

DEVELOPMENT ONLY	Development + Environment						
		1	2	3	4	5	6
	1	Bangalore (U)					
	2		Bangalore (R) Belgaum, Dharwar, Kolar, Mysore				
	3			Chikmagalore, North Kanara		Kodagu	
	4		South Kanara, Mandya				
	5				Hassan		Tunkur, Bidar
	6			Shimoga			Bellary, Raichur, Gulbarga, Chitraduraga, Bijapur

Notes:

By 'Development', it is meant that the clusters are based on HDI, POP BPL and Population density.
By 'Health', its is meant that the clusters are based on two health-related variables namely, Life Expectancy and percentage under 5 child mortality.
By 'Environment', it is meant that the clusters are based on two environment-related indicators namely, Change in Forest Cover between 1989 and 1997, and Total Wasteland in 1997.
By 'Education', it is meant that the clusters are based on two education-related indicators namely; percentage of Eligible children in age 5-14 enrolled in schools, and percentage student dropouts from schools.

Appendix Table 2: District Level Cluster Patterns by Development and Development with Health Care

DEVELOPMENT ONLY	Development + Health						
		Label1 1	**2**	**3**	**4**	**5**	**6**
	1	Bangalore (U)					
	2		Bangalore (R), Dharwad, Belgaum, Kolar, Mysore				
	3			Chikmagalore, Kodagu, North Kanara			
	4						South Kanara, Mandya
	5					Bidar, Tumkur, Hassan	
	6			Bellary	Bijapur, Shimoga, Raichur, Gulbarga, Chitradurga		

Note: As in Appendix Table 1.

Appendix Table 3: District Level Cluster Patterns by Development and Development with Education

DEVELOPMENT ONLY	Development + Education						
		1	**2**	**3**	**4**	**5**	**6**
	1	Bangalore(U)					
	2			Bangalore(R), Belgaum, Dharwar, Kolar, Mysore			
	3					Kodagu	North Kanara, Chikmagalore
	4		South Kanara, Mandya				
	5			Bidar, Hassan	Tumkur		
	6				Bellary, Raichur, Shimoga, Gulbarga, Bijapur, Chitradurga		

Note: As in Appendix Table 1.

Appendix Table 4: District Level Cluster Patterns by Development and Development with Education and Health Status

DEVELOPMENT ONLY		Development + Education + Health Status					
		1	2	3	4	5	6
	1	Bangalore (U)					
	2		Bangalore (R), Belgaum, Kolar, Mysore			Dharwad	
	3			Chikmagalore, Kodagu, North Kanara			
	4		Mandya		South Kanara		
	5					Bidar, Hassan, Tumkur	
	6						Bellary, Raichur, Shimoga, Gulbarga, Chitradurga, Bijapur

Note: As in Appendix Table 1.

Appendix Table 5: District Level Cluster Patterns by Development and Development with Education and Environment

DEVELOPMENT ONLY		Development + Education + Environment					
		1	2	3	4	5	6
	1	Bangalore (U)					
	2		Bangalore (R), Dharwad Belgaum, Kolar, Mysore				
	3			Chikmagalore, North Kanara		Kodagu	
	4		South Kanara, Mandya				
	5				Hassan		Bidar, Tumkur
	6			Shimoga			Bellary, Raichur, Gulbarga, Chitradurga, Bijapur

Note: As in Appendix Table 1.

Appendix Table 6: District Level Cluster Patterns by Development and Development with Environment and Health status

		Development + Environment + Health Status					
		1	2	3	4	5	6
DEVELOPMENT ONLY	1	Bangalore(U)					
	2		Bangalore (R), Kolar, Belgaum, Dharwar, Mysore				
	3			Chikmagalore, North Kanara		Kodagu	
	4		South Kanara, Mandya				
	5				Hassan		Bidar, Tumkur
	6			Shimoga			Bellary, Raichur, Gulbarga, Chitradurga, Bijapur

Note : As in Appendix Table 1

Appendix Table 7 : District Level Cluster Patterns by Development and Development with Education, Health status and Environment

		Development + Education +Environment+Health					
		1	2	3	4	5	6
DEVELOPMENT ONLY	1	Bangalore (U)					
	2		Bangalore (R), Dharwad Belgaum, Kolar, Mysore				
	3			Chikmagalore, North Kanara		Kodagu	
	4		South Kanara, Mandya				
	5				Hassan		Bidar, Tumkur
	6			Shimoga			Bellary, Raichur, Gulbarga, Chitradurga, Bijapur

Note: As in Appendix Table 1