Copping with Climate change and Human Development: An exploration on Bihar, India

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Vulnerability and Poverty Linkage

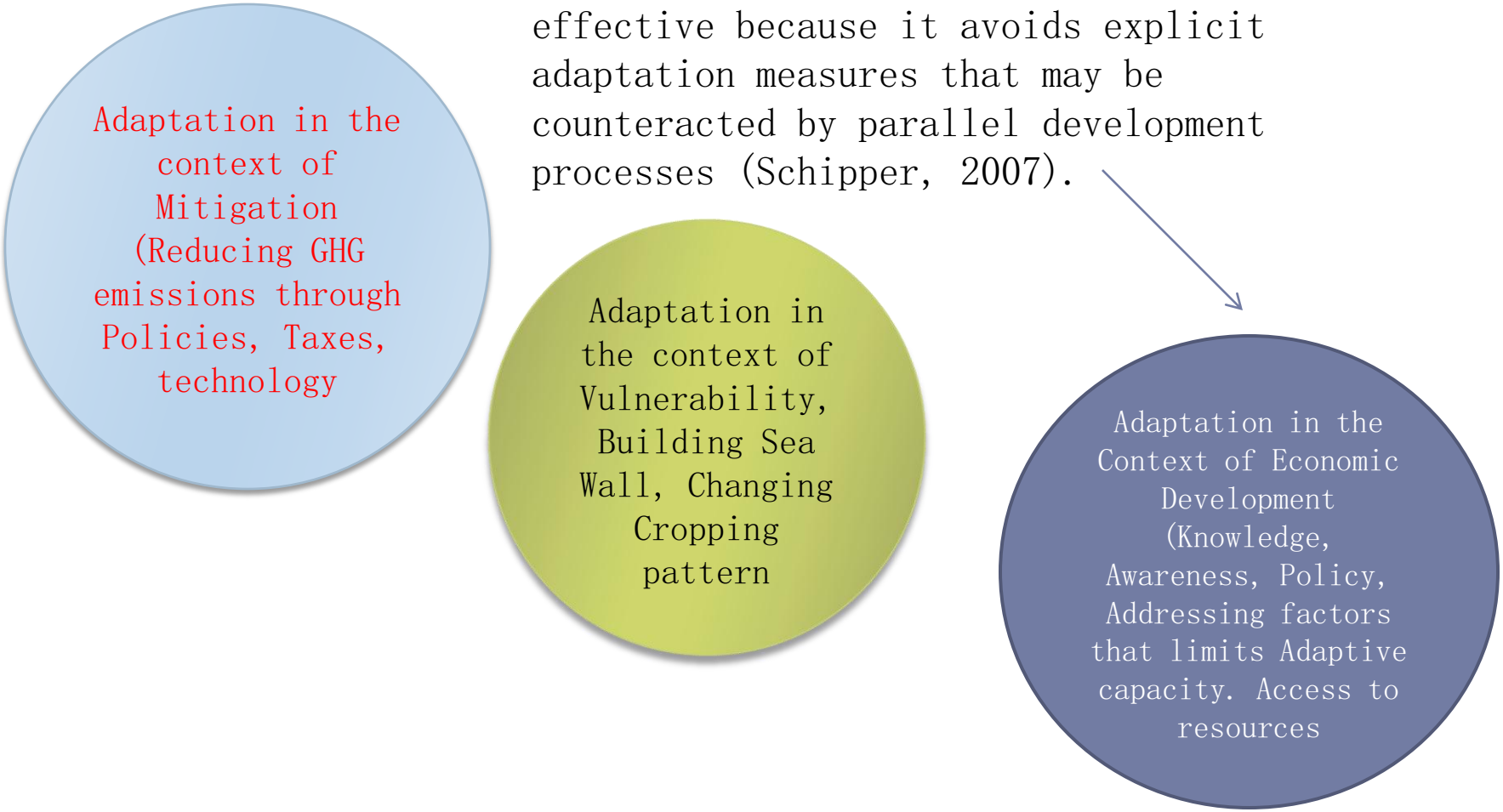
- Vulnerability and poverty are sometimes used in the same context especially in the economics literature.

- Erikson and O′ Brein (2007)-Poverty contributes to vulnerability, and vulnerability to climate change often leads to outcomes that perpetuate poverty.

- In a country like India, climate change is an additional burden and it needs to be addressed carefully along with other issues like high poverty, poor infrastructure, hunger, poor health condition etc (Stern, 2007).

Common framework to address climate change vulnerability and poverty (Tol *et al.*, 2004)

- Vulnerability reduction approach in this context appears to be more effective because it avoids explicit adaptation measures that may be counteracted by parallel development processes (Schipper, 2007).




BIHAR
LOCATION MAP
N
AFGHANISTAN
PAKISTAN
CHINA
New Delhi
NEPAL
BHUTAN
BIHAR
Patna
BANGLADESH
MYANMAR
ARABIAN SEA
INDIAN OCEAN
SRI LANKA
LEGEND
International
State Boundary
Country Capital
State Capital
Map not to Scale
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This map is updated as on


Pashchim Champaran
Purba Champaran
Sitamarhi
Sheohar
Gopalganj
Madhubani
Supaul
Araria
Kishanganj
Siwan
Muzaffarpur
Darbhanga
Madhepura
Saran
Samastipur
Saharsa
Purnia
Vaishali
Khagaria
Katihar
Begusarai
Buxar
Bhojpur
Patna
Bhagalpur
Nalanda
Lakhisarai
Munger
Jehanabad
Sheikhpura
Rohtas
Kaimur
Aurangabad
Gaya
Nawada
Jamui
Banka
GANDAKI R
GHAGHARA R
GANGA RIVER
BURHI GANDAK R
KOSHI R
MAHANANDA R
KANKAI R
BALASON R

Human Development

- Majority of population (more than 80%) in Bihar depend on agriculture for their livelihood.

- About 54.4 percent of the population in Bihar lives in below the poverty line, which is much higher than the national average of 37.2 percent.

- The incidence of high poverty in Bihar can mainly attributed to low per capita land holding, very low industrialization and limited presence of the service sector.

- The state has a high under-five mortality rate of 84.8 percent among Indian states.

- For these reasons, the state has a very low HDI value.

CHART 2

Ranking of Indian states in the world according to 2015 Human Development Report

INDIAN STATES			COMPARABLE COUNTRIES	
States	Constructed HDI score	Hypothetical HDI ranks	Countries	HDI score
Kerala	0.7117	104	Maldives	0.706
Himachal Pradesh	0.6701	116	Uzbekistan	0.675
Tamil Nadu	0.6663	118	Philippines	0.668
Maharashtra	0.6659	119	South Africa	0.666
Punjab	0.6614	124	Bolivia	0.662
Haryana	0.6613	125	Kyrgyzstan	0.655
Jammu and Kashmir	0.6489	128	Iraq	0.654
Karnataka	0.6176	137	Tajikistan	0.624
Andhra Pradesh	0.6165	138	Tajikistan	0.624
Gujarat	0.6164	139	Honduras	0.606
ALL INDIA	0.6087			
West Bengal	0.6042	142	Bhutan	0.605
Rajasthan	0.5768	151	Ghana	0.579
Odisha	0.5567	154	Bangladesh	0.57
Madhya Pradesh	0.5567	155	Bangladesh	0.57
Assam	0.5555	156	Cambodia	0.555
Uttar Pradesh	0.5415	161	Pakistan	0.538
Bihar	0.5361	163	Myanmar	0.536

Sources: UNDP 2015 Human Development Report; RBI (for state per capita income); Desai, Sonalde, and Reeve Vanneman. India Human Development Survey-II, 2011-12 (for education indicators); SRS Based Life Tables 2009-13 and Mint calculations

Climate Change and Projections

Floods and droughts are two major climate change related problems for the state

Year	Area affected (m.ha)	Population affected (million)	Damage to crops		Damage to houses		Cattle lost Nos.	Human life lost Nos.	Damage to public utilities (rs. crore)	Total Damage (rs. crore)
			Area (m.ha)	Value (rs. crore)	Nos.	Value (rs. crore)				
2001	1.20	9.09	0.7	267.2	222008	173.58	565	231	183.54	624.34
2002	1.97	16.02	0.9	511.5	41914	526.22	1450	489	408.92	1446.63
2003	1.51	8.80	0.6	62.7	45262	20.32	106	251	1035.16	1118.14
2004	**2.70**	**29.99**	**1.3**	**522.1**	**929773**	**758.10**	**3272**	**885**	**1030.50**	**2310.65**
2005	0.46	2.64	0.1	11.6	5538	3.83	4	58	30350.00	18.52
2006	0.18	1.09	0.1	7.1	18637	12.26	31	36	84.56	103.88
2007	**1.88**	**2.78**	**1.1**	**768.4**	**784326**	**831.45**	**2423**	**1287**	**642.42**	**2242.24**
2008	0.88	6.21	0.4	34.2	297916	84.51	878	252	97.71	216.42
2009	1.11	2.34	0.0	21.8	7674	5.28	2	97	5.30	32.41
2010	0.20	1.08	0.0	3.1	15170	7.05	0	100	1.59	11.76
2011	0.00	0.58	0.2	59.9	34906	17792.00	39	143	25.79	103.45

- The frequency of extreme temperature events is increasing in Bihar

- A study by Sinha (2011) on climate change impacts on the wetlands of North Bihar claimed that the temperature for the region has a rising trend and the rainfall is declining.

- It is also expected that even minor variations in existing climate extremes can exacerbate the challenges for the state, affecting different sectors and people.

- Shift in climatic region in many parts of the Bihar (Raju et al., 2013). In 2011, Patna city experienced very heavy rainfall which is more above normal rainfall in the month of May

- In a recent study Giri (2015) analyses 30 years of rainfall data, the result shows that the frequency of extreme temperature events is increasing in Bihar except Bhagalpur and Gaya where an increase in extreme rainfall is significant as well as the study also derives change in rainfall pattern across Bihar.

Table - Showing decadal multi-disaster number of deaths in Bihar (2001-2011)

Year	Cold wave	Cyclone	Earthquake	Flood	Heat Wave	Land slide
2001	27	14	0	36	47	6
2002	55	4	2	126	22	1
2003	176	8	1	63	70	11
2004	72	9	0	204	32	10
2005	27	11	1	26	68	8
2006	81	4	3	16	52	2
2007	97	14	5	477	58	18
2008	103	4	0	408	28	0
2009	98	0	1	99	46	7
2010	156	26	0	94	95	9
2011	174	22	6	186	86	15

Government Action

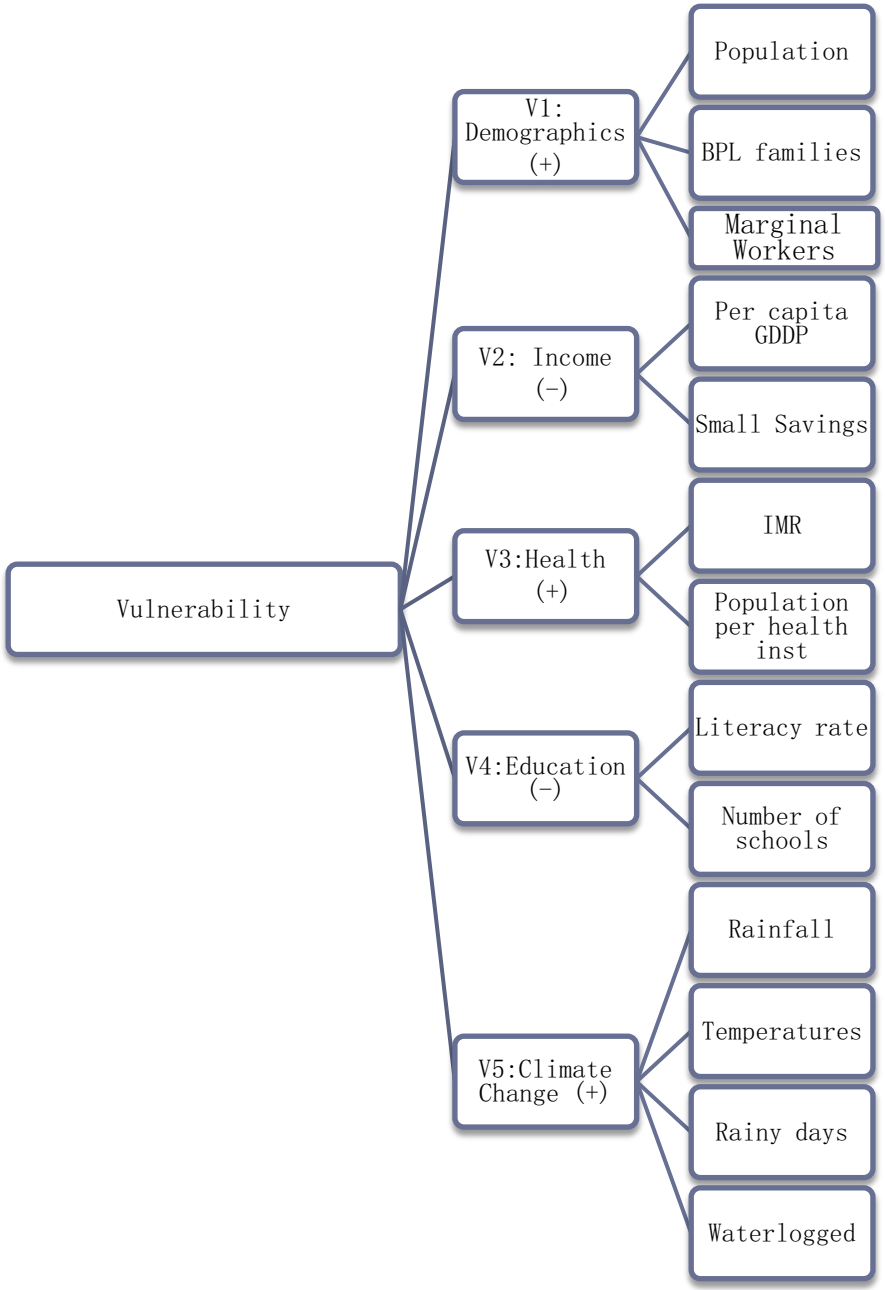
- The Bihar Action Plan on Climate Change (BAPCC) focuses on 'Building Resilience through Development'

- Bihar government has taken several initiatives for the development of local and vulnerable people like;

- Bihar rural livelihood project (SHG).

- BAPCC focuses on transforming agriculture and its allied sectors into climate resilient and vibrant production system, while developing their full potential and ensuring sustained food and nutritional security in the State.

- There is need to establish a link between the existing government effort to enhance livelihood of poor as well as individual effort and climate change adaptation.

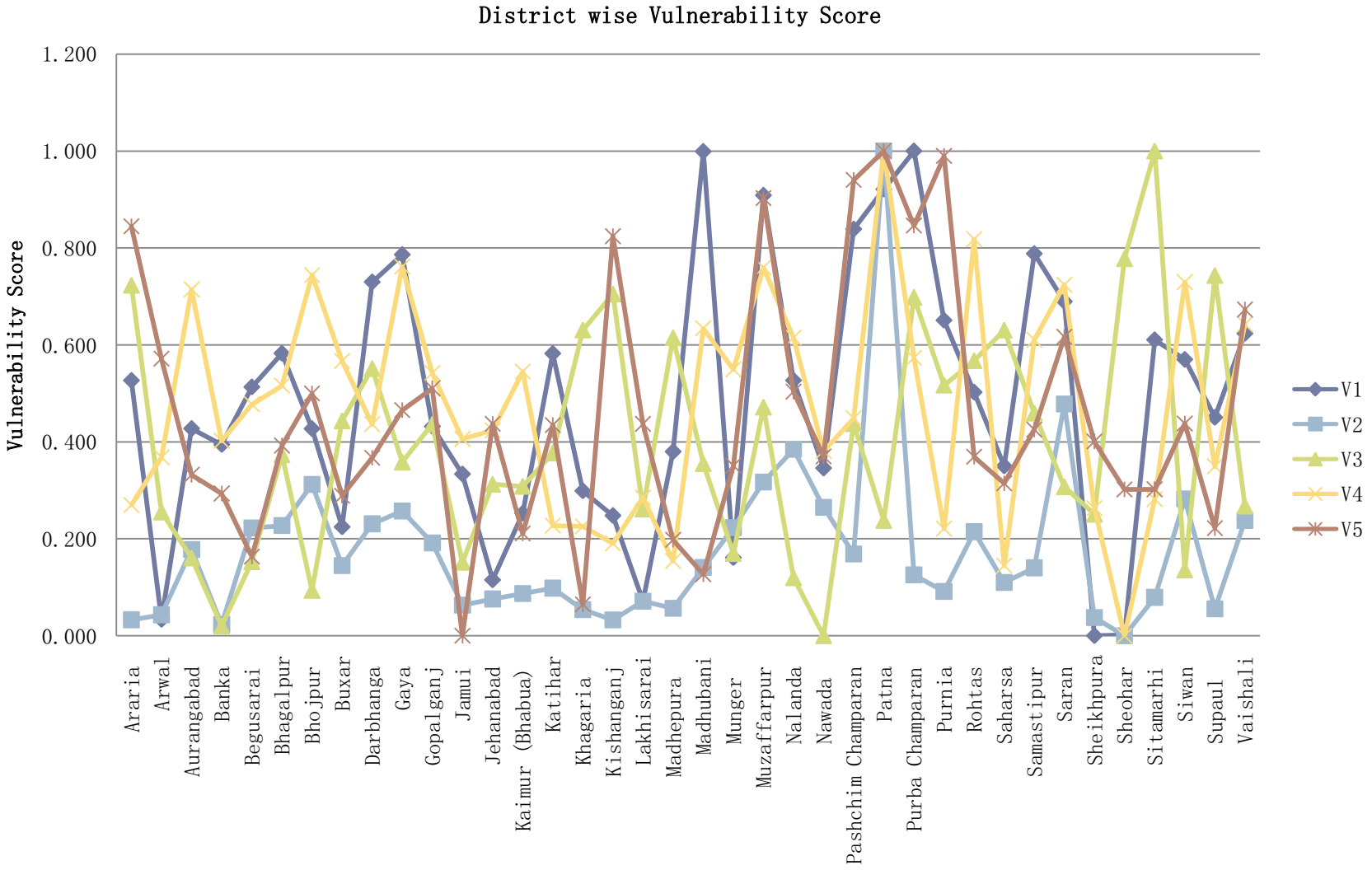


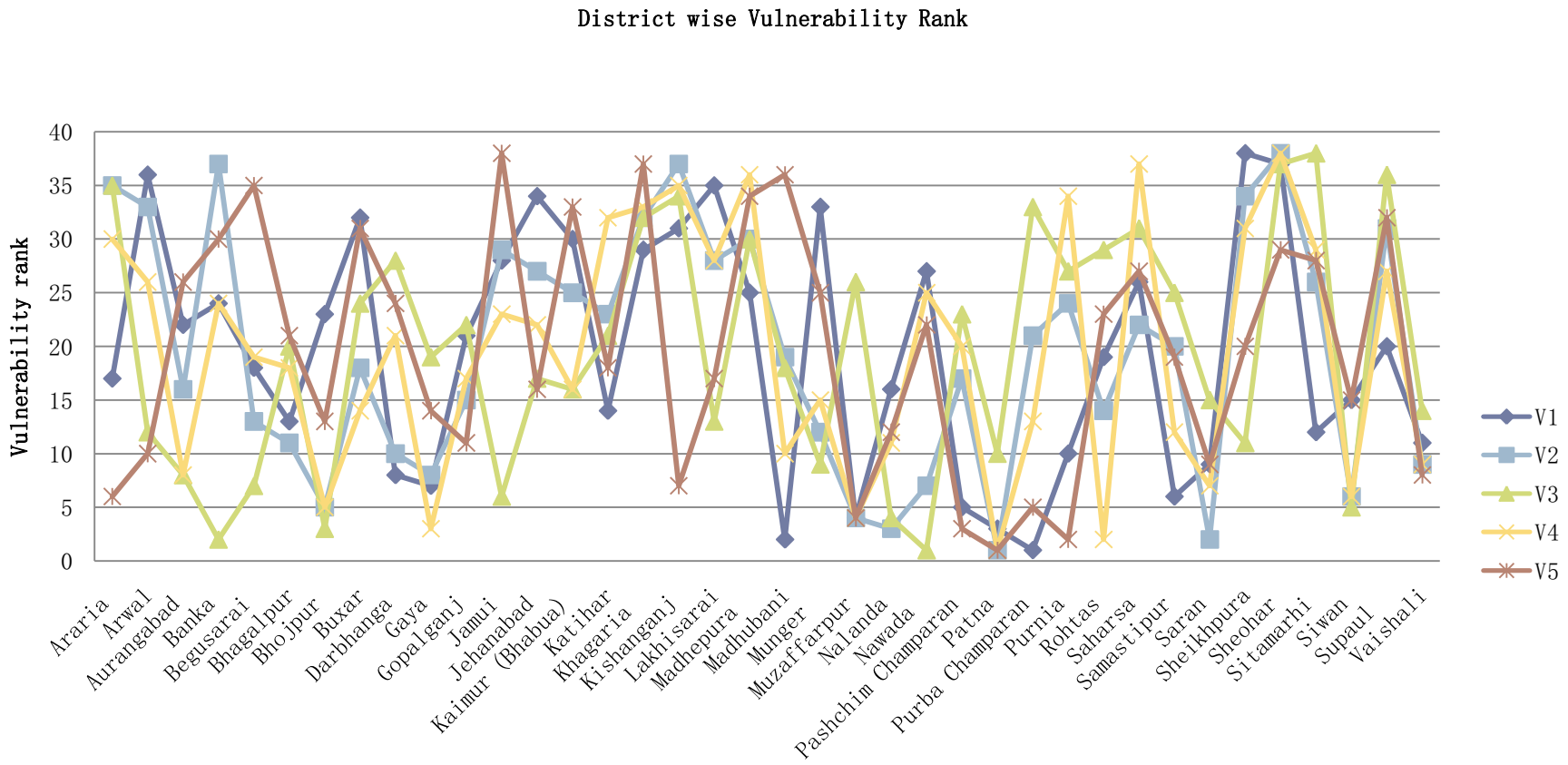
This study intend to develop **district wise indicators** relating both human development as well as climate change and to rank 38 districts according to their indicator score, and further to analyze their vulnerability.

- After selecting appropriate variables for each indicator, in the next step index or indices are calculated

- Principal Component Analysis (PCA) is used to provide weights to the indicators.

- On the basis of aggregate values, the districts are ranked in order to identify the most vulnerable regions/districts


District wise Vulnerability Score
Vulnerability Score
1.200
1.000
0.800
0.600
0.400
0.200
0.000
Araria
Arwal
Aurangabad
Banka
Begusarai
Bhagalpur
Bhojpur
Buxar
Darbhanga
Gaya
Gopalganj
Jamui
Jehanabad
Kaimur (Bhabua)
Katihar
Khagaria
Kishanganj
Lakhisarai
Madhepura
Madhubani
Munger
Muzaffarpur
Nalanda
Nawada
Pashchim Champaran
Patna
Purba Champaran
Purnia
Rohtas
Saharsa
Samastipur
Saran
Sheikhpura
Sheohar
Sitamarhi
Siwan
Supaul
Vaishali
V1
V2
V3
V4
V5


District wise Vulnerability Rank
Vulnerability rank
40
35
30
25
20
15
10
5
0
Araria
Arwal
Aurangabad
Banka
Begusarai
Bhagalpur
Bhojpur
Buxar
Darbhanga
Gaya
Gopalganj
Jamui
Jehanabad
Kaimur (Bhabua)
Katihar
Khagaria
Kishanganj
Lakhisarai
Madhepura
Madhubani
Munger
Muzaffarpur
Nalanda
Nawada
Pashchim Champaran
Patna
Purba Champaran
Purnia
Rohtas
Saharsa
Samastipur
Saran
Sheikhpura
Sheohar
Sitamarhi
Siwan
Supaul
Vaishali
V1
V2
V3
V4
V5

Discussions

- There is significant variability in income and other indices.

- In terms of demography indicators (V1), Purvi Champaran ranks 1 among 38 districts and SheikhPura having the lowest score ranked 38.

- In case of economic/income indicators (V2) Patna district is having highest index score and Sheohar is having lowest score, therefore in Sheohar economic vulnerability is the highest.

- One of the interesting results noticed during the analysis is that Patna district (capital of Bihar and urban) has the Per-capita GDP of Rs. 63063 and in Munger district it is Rs. 22051 which is 34 percent of the Per-capita GDP of Patna district and ranked second in the list.

- The lowest Percapita GDP is for Sheohar district which is Rs. 7092, this shows huge disparity in Income among districts.

- In case of health Nawada is having lowest indicator score this is due to the assumption that Infant Mortality Rate (IMR) and populations per health institution is lowest in Nawada district, hence in case of health index the vulnerability is negatively related with indicator values.

- In case of health indicator second rank is for Banka district and Patna ranks number 10. The lowest rank is for Sitamarhi district.

- In case of education after Patna, Rohtas ranked second and Sheohar score is the lowest.

- In case of V5 which indicates the climate change variable scores, Patna is having the rank one, this shows Patna is facing issues pertaining to rainfall, water logging and temperature. The lowest rank is for the Jamui district. Most of the districts from North Bihar being drought prone areas ranked lowest where as districts from southern Bihar are generally affected by heavy rainfall.

Conclusion

- The vulnerability indicator scores for the districts varies from demographic to climate change,

- Few districts constantly getting lowest rank in all the indicators, for example Sheohar, Kisanganj, and Arwal

- Districts like Patna (urban), Nalanda, and Vaishali are getting constantly high score,

- This analysis indicates the government of Bihar or other policy makers to deal with the issues of human development and climate change effectively.

- Improved planning for rainwater management, urban planning, better health facilities, education and the scheme to improve income of the poor will definitely reduce the vulnerability of poor living in Bihar.

Bihar Vikash Mission

seven resolves

Strengthening the youth,

35 per cent reservation for women in government jobs,

Electricity connection to every household,

Piped water supply to every household,

Pucca lanes and drains in all villages and towns,

Toilets in every house and

Better higher education.

Thank You