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Regional Power Inequalities in Rajasthan: A Geographical Analysis

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Abstract

Rajasthan is the largest state in geographical area in the country. It comprises of vast arid land and desert region. Agriculture is the main vocation of the people in the State. State has very little surface water irrigation potential, which has been almost fully exploited. Ground water is main source of irrigation.The power sector in Rajasthan has witnessed substantial improvement over the past decade due to increase in generation capacity and strengthening of network infrastructure leading to an improvement in the overall power supply position of the state. Currently, most connected consumers in the state are being provided with at least 21-22 hours of power supply. However, there are areas in the state which experience unduly long interruptions in power supply due to inadequacies in the distribution infrastructure. Moreover, a large portion of non-agriculture consumers in rural areas are supplied through single phase only. Further, there is a large section of households in the state i.e. about 29 %, which is yet to be electrified.

Keywords: Power, Inequalities, Geographical Analysis

Introduction

Rajasthan is the largest state in geographical area in the country. It comprises of vast arid land and desert region. Agriculture is the main vocation of the people in the State. State has very little surface water irrigation potential, which has been almost fully exploited. Ground water is main source of irrigation.The power sector in Rajasthan has witnessed substantial improvement over the past decade due to increase in generation capacity and strengthening of network infrastructure leading to an improvement in the overall power supply position of the state. Currently, most connected consumers in the state are being provided with at least 21-22 hours of power supply. However, there are areas in the state which experience unduly long interruptions in power supply due to inadequacies in the distribution infrastructure. Moreover, a large portion of non-agriculture consumers in rural areas are supplied through single phase only. Further, there is a large section of households in the state i.e. about 29 %, which is yet to be electrified.

Power sector is one of the basic infrastructure sectors. Energy demand in agriculture, industrial, commercial and household sectors has increased tremendously and placed normous pressure on its resources The depleting resources and increasing pollution of environment due to energy use has necessitated optimum us of its resources; which in turn requires proper energy planning to achieve energy security.

For proper planning to optimize its use, an integrated and updated database of production and consumption of different sources viz. coal, crude petroleum, natural gas and electricity is needed. Good energy statistics will allow monitoring of energy generation from various sources, its use in different sectors, losses and damages done to environment by various processes.

Economic development of a region depends on a number of factors like geography, natural resources, political and social parameters. Rajasthan is the largest state of India with a total geographical area of 3.42 lakh Km2 of which 61 percent is under arid and rest is semi-arid zone. Such areas like west of Aravali hills with low level of precipitation, which is much lower to state average of 58 cm. Rainfall is not only low but also erratic and uncertain resulting in frequent droughts in the state. In fact, State experienced 19 droughts between 1967-68 and 2002-03 and the recent one of 2009-10. The intensity of the drought situation varied in different regions of the state and created setback to development process. Although state is quite rich in mineral resources but not in essential water resources as there is no perennial river system except Mahi and Chambal and they also have to depend on rainfall in their catchment areas. Over and above

these, state has to depend on the neighboring states for its water resources, which is also a cause of concern.

There could be a number of factors or reasons for regional or district inequality in the development like physical and natural barriers, economic barriers, social barriers, administrative barriers, etc. In order to attempt to minimize and bridge the gap between developed and under-developed areas, since last 60 years planned development process has been in place through five year plans.

Objectives of the Study

The present study was undertaken with the following objectives -

1. To examine the level of development in Power across all the districts of Rajasthan.
2. To measuring inter-district inequalities with respect to power indicators of development.
3. To analyzing the respective roles of physical/natural factors vis-a-vis man-made factors in causing (or aggravating) inter-regional inequalities

Hypothesis

1. The regional imbalance is the outcome of both natural and man-made factor.
2. Highly developed districts are receiving very high share in plan outlay in Rajasthan.
3. By increasing plan-outlay in backward area, regional equalities could be reduced.

Methodology

The researcher admitted that identification of appropriate indicators was difficult task. Further, it also agreed that aggregation of a variety of indicators into a single measure generally posed many difficulties. However, for combining the variables into a single index of regional disparities, the paper used three approaches are-

(i) The simple ranking method,
(ii) The indices method; and
(iii) The Principal Component Analysis

Steps Taken

1. At the first stage, for each indicator, districts were ranked from 1 to 33 depending on the value of the indicator concerned.
2. Under the second step, weights were assigned to each rank, within the given sector.
3. The sect oral rank for ith district was computed by taking an arithmetic mean of the weights assigned to different indicators pertaining to the sector concerned.

Source of Data

The Directorate of Economic and Statistics, Government of Rajasthan regularly publishes District outline of the all district 2011. This was a major source of information for the present study. Besides these, there are publications of different power departments of the state government in which data are made available for different districts periodically.

Indicators Selected for Rajasthan's Power

For the purpose of this study, following indicators have been selected.

Table1. Shows the details of weights assigned for each parameter on the basis of ranking done for 33districts.

Table 1: The details of weights assigned for each parameter

Sector	Indicators
Power	1. Power Consumption per Capita
	2. Electricity consumption various sectors. (Domestic, commercial , industries)
	3 Percentage villages electrified

This method is based on assigning unequal weights, as performance of different districts in relation of each parameter is different. The composite ranking of all districts obviously considers indicator-wise ranks culminating into sectoral ranking on the basis of weights assigned. This helps in identifying advancement or backwardness of the given district in relation to all the identified indicators (Table 2).

This method was considered to have an edge over others as described above. It was simple and did not involve subjectivity. Wherever the overall (aggregated) weighted average was found to be above 70, the district was termed as highly developed. Those having an overall weight age average between 50 and 70 were assumed to be medium developed, whereas the overall weight age average (or score) below 50 implied that such districts were backward in respect of all sectors

Table 2: Ranking and weights used for identified indicators

Range of Ranking of Districts	Weights	Normative Rank
1–4	90	A
5–8	80	B
9–12	70	C
13–16	60	D
17–20	50	E
21–24	40	F
25–28	30	G
29–33	20	H

Review of Literature

Dev (2008) examined economic performance of states and explained regional disparities in important economic indicators in the post-reform period. **Ghasal** (2008) examined the level of regional disparities in human development and real per capita income (economic growth) during the liberalization period and took fourteen states for analyzing the disparity level.

In the empirical literature on regional growth in India, most of the existing studies are directed towards the question of convergence or divergence while a few studies have touched upon the spatial dimension. Studies finding convergence include Biswajith Guha (2003)21in his article "Human Development in India –A Study of Interstate Disparities" has deviated from the established Human Development Indices and has taken access to safe drinking water, electricity connections two meals a day throughout the year, permanent houses and availability of beds in public hospitals in 15 major states of India. Quality of life Index for rural and urban population has been worked out. In the Paper entitled

"Human Development in Orissa" An Inter-District Analysis from the perspective of infrastructure the authors, Amar Kumar Mohanty, Narayana Nayak and Banichatterjee27(2004)examine Human Development in Orissa by taking districts as units of study. The study is divided into five sections and the data is secondary. HDI values for the districts are computed for 93-94; 97-98 and 2003-04 along with index values of Index components.

Amitabh, Kundu, abusalah sheriff and P.K.Ghosh32(2007)in their article Index in Human Development India" Indicators, scanning and composition" state that the concept of human development can be traced to oriental societies as Kautilya's Arthasastra and Adamsmith's Wealth of Nations" refer to the good for the common man .

"The Birth of the Human Development Index" authored by Mahbub-Ul-Haq37(2009) States that GNP as a measure of human welfare is incomplete GNP is one dimensional and does not include social, political cultural and other choices people make. HDI has emerged as a new composite index of socio-economic progress. R.L. Bhalla, Geography of Rajasthan (2017) classified the geographical regions are effected regional inquealities.

.**Responsible For Inter-Regional Inequalities**

Factors which generally cause inter regional (or more specifically, inter-district) economic inequalities may be classified into four categories-

1. Physical and Natural Barriers
2. Economic Barriers
3. Social, political and administrative Barriers

Dependence on Nature

India's agriculture is still hostage to the vagaries of nature, with 60% of the sector dependent on rainfall. So when rain fails for two consecutive years like it has, it is a full blown crisis for the country's farmers. The world is experiencing a high climatic variability and has its impact on all ecosystems, regions and sectors, but the nature and extent of vulnerability to climate change differs with adaptive capacity of individual, society and region. The regions which are scarce on resources are among the very vulnerable systems of the earth and most of such regions have existing extreme climatic conditions like deserts and snow covered areas. The vulnerability of arid regions is further accentuated by low levels of socio-economic development, and this is the case with arid regions of India, which leads to fast depletion of resources.

World where a majority of electricity generation is based on nonrenewable sources, it is clear that the utility planning and global demand growth have the potential to increase penetrations of renewable energy on electricity grids worldwide. This will have profound effects on the grid operation and stability, which will in turn affect the operation of renewable resources such as wind and solar energy as well as the operation of other resources and equipment connected to the grid. Presently wind power generation has exceeded 432 GW and by the end of 2020, the installed capacity is expected to be around 1950 GW. Power electronic converters and controllers make it possible to integrate large wind power generation to the grid .The unpredictable nature of wind power prevents the wind power plants to be controlled in the same way as conventional plants.

Table -3 -Indicators and Their Relationship with Level of Development

Sector	Indicator having positive relationship	Indicators having inverse relationship
Power	All indicators	-

Power is a core sector for industrial sector development closely linked with commercial and domestic sectors for development. For this, five parameters like per capita domestic consumption, total domestic consumption, commercial consumption, industrial consumption and percentage of villages electrified were identified. Details of each of the parameter are given in table 4.

Table – 4 Composite Ranks of Districts in Power Sector

S.No.	Districts	Average	Rank
1	Ajmer	88.00	**2**
2	Alwar	76.00	**5**
3	Banswara	34.00	**26**
4	Baran	26.00	**32**
5	Barmer	36.00	**24**
6	Bharatpur	52.00	**18**
7	Bhilwara	72.00	**7**
8	Bikaner	64.00	**13**
9	Bundi	44.00	**20**
10	Chittaurgarh	58.00	**16**
11	Churu	52.00	**18**
12	Dausa	36.00	**24**
13	Dhaulpur	30.00	30
14	Dungarpur	38.00	**23**
15	Ganganagar	72.00	**7**
16	Hanumangarh	60.00	**14**
17	Jaipur	90.00	**1**
18	Jaisalmer	28.00	**31**
19	Jalor	44.00	**20**
20	Jhalawar	34.00	**26**
21	Jhunjhunun	66.00	**12**
22	Jodhpur	84.00	**3**
23	Karauli	22.00	**33**
24	Kota	80.00	**4**
25	Nagaur	60.00	**14**
26	Pali	74.00	**6**
27	Rajsamand	56.00	**17**
28	S. Madhopur	34.00	**26**
29	Sikar	68.00	**10**
30	Sirohi	68.00	**10**
31	Tonk	42.00	**22**
32	Udaipur	72.00	**7**
33	Pratapgarh	42.00	**22**

Composite ranking show that Jaipur ranks No.1 with No.1 rankings in three and No.2 in two indicators. Only in industrial consumption and percentage of villages electrified it is at No.2. In fact for rural electrification, 99.04 per cent villages of Jaipur district are electrified as against 100 per cent in Jhunjhunu district. In composite ranking Jaipur is followed by Ajmer, Jodhpur, Kota, Alwar, Pali,

Ganganagar, Udaipur, Bhilwara. Districts where power position is not satisfactory are Bundi (No.20), Dausa (No.24), Banswara (No.26), Sawai Madhopur (No.26), Dhaulpur (No.29), Jaisalmer (No.31) and Baran (No.32),. This also shows that worst ranking of 33 is for Karauli.

From these analyses, keeping in new composite ranking potential districts with reference to core sector Power have been identified. It is suggested that these sector should be given priorities in the plan allocation to districts. With development in these core sectors, other related development will also take place, directly or indirectly. The potential districts are given in Table 5.

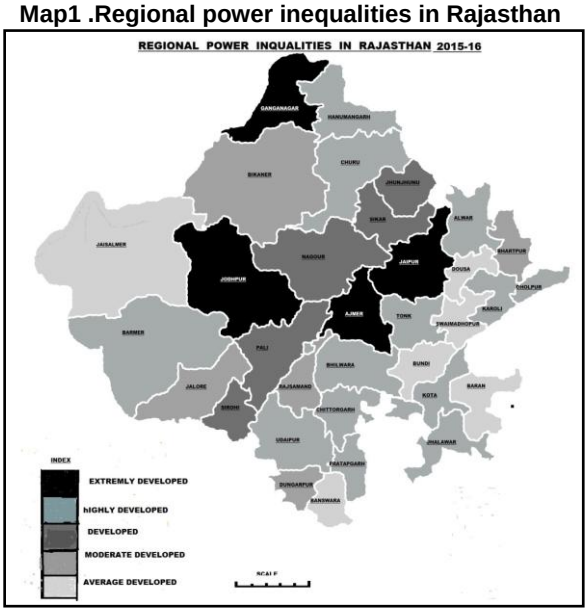
Table –5 Potential Districts of Sector

Sector	Potential Districts
Power	Jaipur ,Ajmer, Jhunjhunu , Sikar ,Alwar,Karauli,Ganganagar, Hanumangarh,Jodhpur,Barmer,Nagaur, Pali,Sirohi.Kota. Jhalawar,Tonk,Udaipur,Bhilwara, Chittorgarh,(19 districts)

Power sector of Rajasthan has witnessed substantial improvement over the past decade due to increasing generation capacity and strengthening of network infrastructure leading to an improvement in the overall power supply position of the state. Currently, most connected consumers in the state are being provided with at least 21-22 hours of power supply. However, there are areas in the state which experience unduly long interruptions in power supply due to inadequacies in the distribution infrastructure. Moreover, a large portion of non-agriculture consumers in rural areas are supplied through single phase only. Further, there is a large section of households in the state i.e. about 29 %, which is yet to be electrified. Electricity is a concurrent subject and distribution of electricity falls under the purview of the respective State Government/State Power Utility. As per Electricity Act 2003, it is the duty of a distribution licensee to develop and maintain an efficient, co-ordinated and economical distribution system in his area of supply and to supply electricity in accordance with the provisions contained in the Act.

To supplement the efforts of State Government, Government of India and Government of Rajasthan have taken a joint initiative to provide 24 X 7 Power in the state to all consumers (except agriculture consumers). Agriculture consumers will be provided 6.5 -7 Hrs. of supply daily. This initiatives aims at ensuring uninterrupted supply of quality power to existing consumers by the end of 12thplan and providing access to electricity to all unconnected consumers in the next five years

Map1 .Regional power inequalities in Rajasthan



Power

Uninterrupted and cost-effective supply of power is regarded as the basic need for agricultural, as well as industrial development. Three indicators were used to ascertain the availability of power in the districts of Rajasthan.

Power Consumption Per Capita

It is not the total consumption, but per capita consumption of power which is widely used to compare the inter-regional disparities. Accordingly, on the basis of available data, all the districts were ranked on the basis of average consumption of power

Electricity consumption in various sectors

Power consumers are generally categorized as domestic, commercial, industrial, agricultural and other users. For all the districts of Rajasthan data on the total electricity *consumption by each category of users* were collected and ranks assigned to districts accordingly.

Percentage of Villages Electrified

Majority of farmers in Rajasthan irrigate their rabi crops from the ground water sources. Even where canal water is used, conjunctive use of water is prevalent. Wells are fitted with electric or diesel pump sets. One indicator of agricultural development across the districts (for which data are available) was the percentage of villages electrified. Power is a core sector for industrial sector development closely linked with commercial and domestic sectors for development. For this, five parameters like per capita domestic consumption, total domestic consumption, commercial consumption, industrial consumption and percentage of villages electrified were identified. Details of each of the parameter are given in Composite ranks of districts are presented in Table2.

Table-6 Energy Requirements on Account of Electrification of Unelectrified Households

Electrification of Un-Electrified Households (25 Lakh @5 L / Year)							
			2014-15	**2015-16**	**2016-17**	**2017-18**	**2017-19**
B *URBAN*							
1 .Electrification of unelectrified Household	500,000	Nos.	100000	100000	100000	100000	100000
2. Cumulative Annual Energy Requirement for unelectrified Urban Household		MUs	201	447	739	1077	1460
RURAL							
3 .Targeted Electrification of unelectrified households	2500000	%	20%	20%	20%	20%	20%
4 .Electrification of unelectrified Household		Nos	500000	500000	500000	500000	500000
5 .Cumulative Annual Energy Requirement for unelectrified Rural Households		MUs	365	821	1369	2008	2738
6 .Total households electrified	B1+B4	Nos	600000	600000	600000	600000	600000
7 .Annual Energy Requirement due to Electrification of unelectrified Household	B2+B5	MUs	566	1268	2108	3084	4198

Table 7 Energy Requirements for Other than Domestic Category Consumers and Total Energy Requirement

	Annual Energy Requirements			**2014-15**	**2015-16**	**2016-17**	**2017-18**	**2018-19**
1	Total Domestic Annual Energy Requirement (Current + Projection		**MUs**	**10892**	**13143**	**15611**	**18298**	**21207**
2	Current Energy Requirement - Other than Domestic	**33676**	**MUs**					
3	Annual Energy Requirement - Other than Domestic Consumers (Growth as per FRP		**MUs**	**36563**	**39721**	**43178**	**46963**	**51108**
4	Total Energy Requirements for sale	**C1+C3**	**MUs**	**47454**	**52864**	**58789**	**65261**	**72316**
5	Distribution losses		**%**	**21.75**	**20.00**	**18.50**	**17.25**	**16.00**
6	Total Energy required at Discom Periphery		**MU**	**60645**	**66080**	**72133**	**78865**	**86090**
7	Transmission losses		**%**	**4**	**4**	**4**	**4**	**4**
8	Total Annual Energy Purchase Requirement		**MU**	**63171**	**68834**	**75138**	**82151**	**89677**
9	Peak Demand (MW) LF=64%		**MW**	**11268**	**12278**	**13402**	**14653**	**15955**

The table also provides the overall energy demand from all categories including the electrified and to be electrified households.

To meet the expected demand of the state, capacity addition of 6145.15 MW is expected in the state by 2018-19 from under construction projects. Out of which about 625 MW is from non-conventional energy sources and 5520.15 MW from conventional sources. As such the total anticipated available capacity by 2018-19 is expected to be 21346.14 MW. (17081 MW–Conventional & 4265 MW–Renewable). Taking into consideration the 70% contribution from conventional installed capacity and 8% from non-conventional installed capacity to meet the peak demand, the capacity available for meeting the peak demand of 16000 MW would be around 12298 MW.

Conclusion

The challenges for Rajasthan's power sector include new project management and execution, ensuring availability of fuel quantities and qualities, lack of initiative to develop large coal and natural gas resources available in Rajasthan, land acquisition, environmental clearances at state and central government level, and training of skilled manpower to prevent talent shortages for operating latest technology plants. Poor coal transport infrastructure has worsened these problems. To expand its coal production capacity, Coal India needs to mine new deposits.

The problems faced by the power sector of the state are many, acute and serious. The implementation of the envisioned action plan will

enable the department to meet the challenges, present in future, and achieve the objective of integrated, efficient, environmentally and financially sustainable development and the management of the power resources of the State and at the same time ensure optimal utilization of every drop of water, through water conservation, increased distribution efficiency and use of power saving devices and practices leading to an efficient, scientific, innovative, transparent and responsive irrigation department. The power sector would then be able to accelerate economic growth of the state.

Even though the mineral wealth of the state has rather less inter-regional concentration, minerals found in the southern and eastern regions of Rajasthan have been exploited optimally and very little or no attempt has been made to fully use the lime stone, lignite, gas and other resources which are available in plenty in the western districts of the state. Only recently some efforts have been made to exploit petroleum from some of the western districts like Barmer.

There could be a number of factors or reasons for regional or district inequality in the development like physical and natural barriers, economic barriers, social barriers, administrative barriers, etc. In order to attempt to 9 minimize and bridge the gap between developed and under-developed areas, since last 60 years planned development process has been in place through five year plans. A number of area specific schemes or programmers have been implemented and are being implemented for over all development of the state to strengthen economic base and improve standard of living of the people.

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