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Core-Periphery Model In The Upper Subarnarekha Basin: A Study Of Spatial Development

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Abstract

The Core-Periphery Model is a theoretical framework used to describe the uneven distribution of economic activities and development within a region. This model highlights how core areas become centers of economic growth and industrial activity, while peripheral areas remain less developed and dependent on the core for resources and opportunities. In the context of the Upper Subarnarekha Basin, located in Jharkhand, the model is useful for analysing how economic activities are concentrated in urban and industrial hubs, while surrounding rural and tribal areas experience slower development. This study examines the core-periphery dynamics in the Upper Subarnarekha Basin by analysing the spatial distribution of resources, infrastructure, and economic activities between urban centers (core) and rural areas (periphery). The objective is to understand how these dynamics contribute to socio-economic disparities and environmental changes in the region.

Key-words: Core-Periphery Model, Development, Resource, Opportunities, Economic growth.

Introduction

The core-periphery model also drew significant attention from John Friedmann, who expanded on this concept in 1966 by emphasizing the role of spatial distance from the core. His interpretation has often been connected with growth pole theory, initially introduced by François Perroux in 1955**,** which highlights the importance of input-output linkages. Friedmann's ideas are also aligned with the work of Albert O. Hirschman (1958), who explored the concept of unbalanced development and introduced the **"**trickle-down effect**"** as part of this theory. Additionally, Friedmann's approach integrates aspects of Douglass C. North's (1955) export-based model and components of Gunnar Myrdal's (1957) theory of cumulative and circular causation. Myrdal's theory introduced concepts such as the "spread effect", where economic development diffuses from the city

to surrounding suburbs and adjacent areas, and the "backwash effect", which explains how the concentration of development in core cities can drain resources and labour from peripheral areas, potentially leading to the degradation of these outlying regions.

Study Area:

The study was carried out in upper part of Subarnarekha basin of Jharkhand state of India given in the figure1. It is situated in the northeast part of our country, India with a total area of 29,196sq km. The Subarnarekha River which covers an area of 12831.12 km^2 flows through the state of Jharkhand. The Subarnarekha basin covers the states of Jharkhand, Odisha and the parts of West Bengal. The watershed for the analysis falls in the districts of Ranchi, Ramgarh, Khunti, Seraiekela Kharsawan of Jharkhand and Pureliya district of West Bengal lying between latitudes 22° 47' 59" N to 23° 33' 01" N and longitudes 85° 8' 51" E to 86° 14' 34" E. (Figure 1).

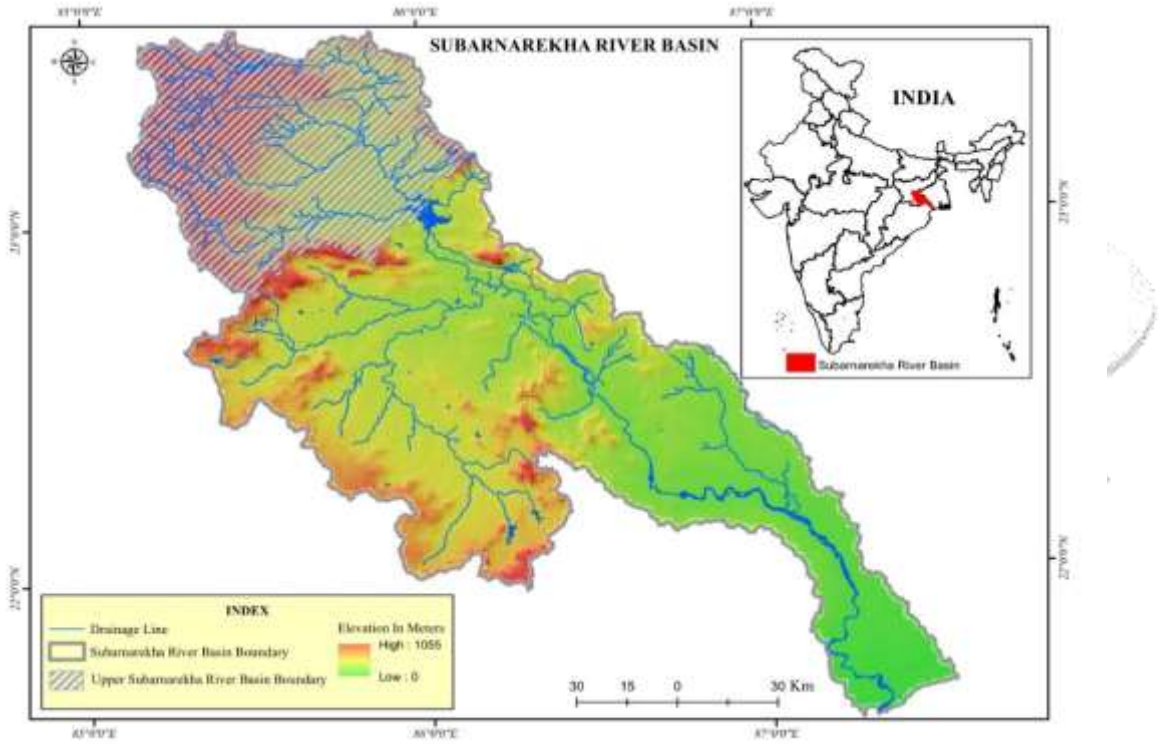

Figure 1: Location Map of Upper Subarnarekha Basin

Source: Survey of India (https://onlinemaps.SurveyofIndia.gov.in/Home.aspx) and Relif and Drainage Layer Prepared from ASTER DEM.

The Subarnarekha basin is surrounded by the Chota Nagpur plateau in the north and the west, by Baitarani basin in the south, in the south east by the Bay of Bengal and the Kasai valley of Kangsabati river on the east (Kumar and Joshi, 2016). The starting point of it is near Piskanagri village in Ranchi district, Jharkhand. It traverses a distance of 395 Km before falling into Bay of Bengal. The principal tributaries joining from right are Kanchi, Karkari, Kharkai Raru and Garru,left tributary is Dulang. (www.india-wris.nrsc.gov.in).

The Upper Subarnarekha Basin, located primarily in Jharkhand, is a region of significant ecological, economic, and social importance. The basin, through which the Subarnarekha River flows, encompasses areas rich in forests, minerals, and agricultural land, making it a critical region for resource use and development. However, over the past few decades, rapid industrialization, urbanization, and population growth have triggered significant changes in land use and land cover in this region. This article explores the dynamics of these changes, focusing on the causes, trends, and implications for the environment and local communities.

Objectives

The main objectives of this study are:

1. To identify and map the core and peripheral areas within the Upper Subarnarekha Basin using economic, infrastructural, and demographic data.
2. To assess the socio-economic disparities between core and peripheral regions, focusing on differences in income, employment, infrastructure, and living standards.
3. To evaluate the environmental impact of the core-periphery dynamics, including issues such as deforestation, land degradation, and resource depletion.
4. To suggest strategies for achieving balanced regional development, reducing the inequalities between core and peripheral areas in the Upper Subarnarekha Basin.

Methodology

The study utilizes a combination of quantitative and qualitative research methods to analyse the core-periphery dynamics in the Upper Subarnarekha Basin. The research process includes the following steps:

Data Collection

Primary Data:

Field surveys were conducted in selected urban centers (such as Ranchi, Jamshedpur, and Chakradharpur) and rural villages in the basin. These surveys collected data on employment, income, access to services, and quality of life in both core and peripheral areas. Interviews were conducted with local authorities, tribal leaders, and NGO representatives to gain insight into the challenges faced by communities and their views on development policies.

Secondary Data:

Socio-economic data, including population, employment, and infrastructure, were obtained from sources such as the Census of India and government reports. These data help in analysing the economic activities and living conditions in different regions. Satellite imagery and GIS data were used to map land use patterns, urban expansion, and infrastructure development in the basin. Published reports and studies were reviewed to understand the environmental impacts of economic activities such as mining and agriculture.

GIS Mapping and Spatial Analysis

GIS software was used to create maps that visualize the distribution of economic activities, infrastructure, and environmental changes in the Upper Subarnarekha Basin. GIS techniques were applied to identify core areas with concentrated urbanization and industrialization. Map peripheral areas that rely on agriculture, forest resources, and other traditional livelihoods. Analyse land use changes, deforestation, and environmental degradation.

Socio-Economic Analysis

Socio-economic disparities between core and peripheral areas were analysed based on several indicators are Income Comparison of median household income between urban (core) and rural (periphery) areas. Employment Analysis of job availability in industrial sectors in the core and agricultural or forest-based livelihoods in the periphery. Access to services: Evaluation of healthcare, education, transportation, and other essential services in both core and peripheral areas. Migration Examination of migration patterns from rural to urban areas due to limited economic opportunities in the periphery.

Environmental Impact Assessment

The study assesses the environmental consequences of core-periphery dynamics by analysing deforestation, land degradation, and water pollution:

Deforestation The impact of mining and industrial activities in the core areas on forest cover. Soil erosion the effects of agricultural expansion and unsustainable farming practices in the periphery. Water pollution and Contamination of water bodies due to industrial waste and resource extraction in core areas, affecting both urban and rural populations.

Spatial Expansion of Ranchi City in Upper Subarnarekha Basin

Significant urban growth was observed on the northern side of Ranchi city. This expansion surpassed the growth patterns seen in 1985, as evidenced by maps from that period. The city has developed outward from its core into the northeast, northwest, west, and southern regions. A notable concentration of this growth aligns with major transportation routes, specifically national highways NH-23, NH-33, and NH-75. Despite this development, the expansion has often been haphazard, lacking coherent planning (Kumar et al., 2011). Records indicate that over the past 83 years, the township has expanded more than sixfold (Pandey et al., 2012).

Initially, the built-up areas were centred around the city core, including places like Ranchi Lake and northern localities such as Kanke. However, post-1976, there was a sudden surge in development to the north, east, and west of the city centre. For instance, Pandra Mandi, a wholesale vegetable market located 8 kilometres from the city centre along NH-75, has become a pivotal hub for local farmers to sell their produce. This market is equipped with modern facilities for storing agricultural goods. Significant institutions like the

Indian Institute of Coal Management (established in 1994) in Kanke, the Reliance Mega Mart, and the Faculty of Forestry at Birsa Agricultural University (established in 1980) have also contributed to the area's growth.

New developments have emerged along Kanke Dam in the northern part of the city, with localities such as Morabadi, Jawahar Nagar, and Gandhinagar experiencing growth. Previously undeveloped areas like Pundag, Nijam Nagar, and Bhitha Basti have transformed into burgeoning colonies. The northeastern route of NH-23 leads to Mesra, which has evolved into an educational hub featuring various new technical and educational institutions.

Following Ranchi's designation as a state capital, the southern part of the city witnessed significant expansion of the Ranchi Airport, extending into the Doranda locality and attracting residential settlements. In the western region, areas near the Harmu River that were once open fields have been replaced by residential and commercial properties. The outskirts of Ranchi, including places like Baryatu, Tatisilwai, and Namkum, have seen the establishment of engineering and medical colleges. Additionally, the Khelgaon sports complex was established in Hotwar along NH-23 in 2007 in preparation for the National Games.

Future development is anticipated in and around areas such as Kanke, Bariyatu, Ratu, Buti, Namkum, Tatisilwai, and Hatia. This urban expansion has often come at the expense of agricultural lands and open fields. Lower elevation zones have experienced more intense development due to the availability of groundwater (Pandey et al., 2012). However, the increasing demand for water over time poses a threat to the city's water bodies within the urban area. In This Figure.2 The core periphery model of Upper Subarnarekha Basin Jharkhand is shown. In this figure, Ranchi city is shown as inner core zone, Ring Road is shown as outer core zone and semi periphery zone is taken up to 10 km radius rom ring road and remaining area is shown as peripheral zone.

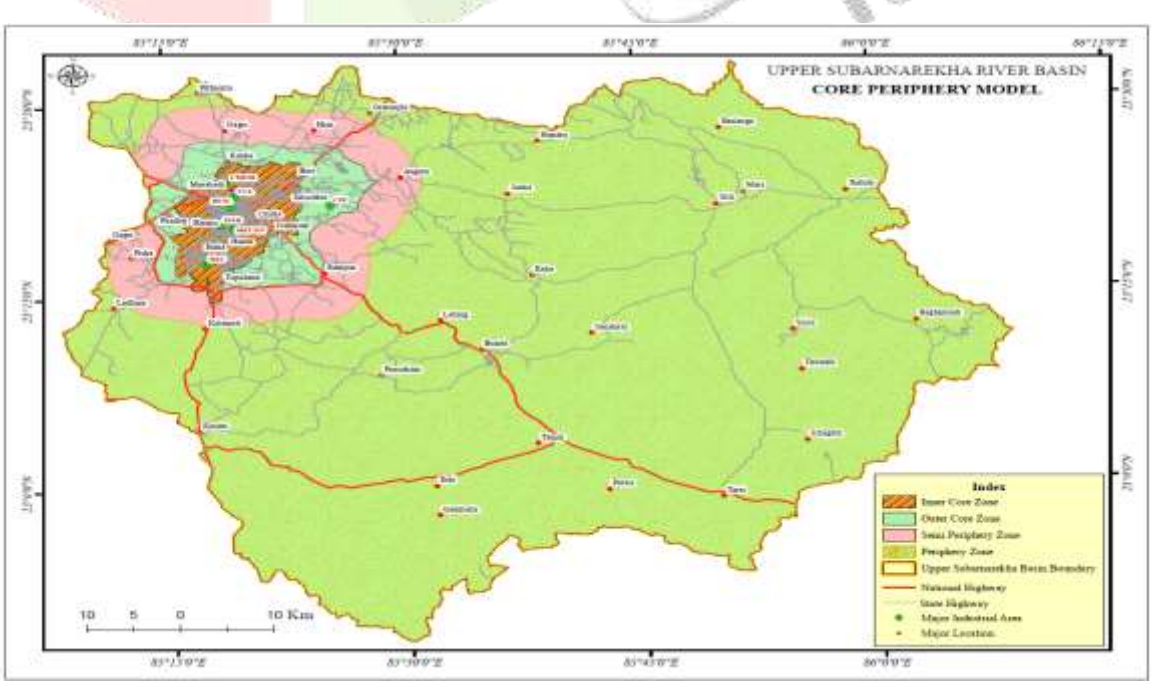

Figure 2: Core Periphery Model, Upper Subarnarekha Basin

Source: Ranchi Municipal Boundary and Ring Road Boundary information collected from Ranchi Municipal Corporation and further Road Network, Major Location, Watershed Boundary Layer Prepared from 1:50,000 scale Survey of India.

Results and Discussion

Identification of Core and Peripheral Areas

The core areas identified in the Upper Subarnarekha Basin include Jamshedpur, Ranchi, and Chakradharpur, characterized by Industrial growth. Jamshedpur, with major industries like Tata Steel, serves as an economic hub, attracting labour and investment. Urbanization Ranchi, as the state capital, plays a central role in administration, education, and commerce, making it a key urban centre. Infrastructure development These core areas have well-developed infrastructure, including transportation networks, healthcare, and educational institutions.

The peripheral areas are largely rural, with a dependence on agriculture and forest-based livelihoods. These areas include villages in West Singhbhum, Khunti, and Seraikela-Kharsawan districts. Key characteristics of the periphery include. Subsistence agriculture Farming is the primary livelihood in these regions, but productivity is often low due to poor irrigation and limited access to markets. Resource dependence Tribal communities rely on forest products, such as lac and medicinal plants, for both income and sustenance.

Socio-Economic Disparities

The socio-economic analysis revealed significant disparities between core and peripheral areas:

Income inequality and Income levels in the core (particularly in Jamshedpur and Ranchi) are 2-3 times higher than in rural peripheries. Employment opportunities Core areas offer more industrial and service-sector jobs, while peripheral areas remain dependent on low-productivity agricultural and forest-based work. Access to services Urban centers have better access to healthcare, education, and public services compared to rural villages, where facilities are often lacking or inadequate.

Environmental Impact

The study identified significant environmental challenges associated with the core-periphery dynamics:

Deforestation Industrial activities, especially mining in Jamshedpur, have led to large-scale deforestation, threatening biodiversity and the livelihoods of tribal communities. Soil degradation Unsustainable farming practices in the periphery, coupled with deforestation, have contributed to soil erosion and declining agricultural productivity. Water pollution and Industrial waste from core areas has contaminated rivers and water bodies, affecting both urban and rural populations.

Migration and Socio-Cultural Impacts

The lack of employment opportunities in the periphery has led to increased migration to urban centers. The migration of rural labour to cities has resulted in a decline in agricultural productivity and disruption of traditional social structures in rural areas. Cultural erosion Tribal communities migrating to urban centers face the loss of their cultural heritage and traditional practices as they adapt to urban lifestyles.

Conclusion

The Core-Periphery Model effectively explains the spatial disparities within the Upper Subarnarekha Basin. Urban centers like Jamshedpur, Ranchi, and Chakradharpur have developed into core areas due to industrialization and infrastructure development, while rural and tribal areas remain peripheral, struggling with poverty, limited access to services, and environmental degradation.

To reduce these disparities and promote balanced development, the following strategies are recommended:

Strengthening rural infrastructure and Improved access to transportation, healthcare, and education in rural areas will help bridge the gap between core and peripheral regions. Promoting sustainable livelihoods Encouraging eco-friendly farming, forest conservation, and small-scale industries can boost economic opportunities in peripheral areas. Environmental conservation and implementing stricter regulations on industrial pollution and deforestation will protect natural resources and support long-term sustainability in both core and peripheral areas.

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