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## **Industrial Infrastructure Development and Economic Growth: In Haryana**

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**Abstract:** This paper examines the relationship between industrial infrastructure development and economic growth in Haryana during the period 2001–2021. Haryana, a key industrial state in India, has witnessed substantial growth driven by infrastructure advancements in transport, energy, and communication. Using secondary data, the study constructs a composite Industrial Infrastructure Development (IID) index and analyzes its association with Gross State Domestic Product (GSDP). Econometric techniques including correlation and trend analysis reveal a positive and significant relationship. The findings underscore the critical role of balanced infrastructure expansion in sustaining industrial and economic growth. Policy implications highlight the need for inclusive infrastructure development to reduce spatial disparities within the state.

**Keywords:** Industrial Infrastructure, Economic Growth, Haryana, GSDP, Infrastructure Index, Regional Disparities

### **1. Introduction**

Infrastructure forms the backbone of any economy, serving as a critical enabler for sustained industrialization and economic growth. It encompasses the physical and organizational structures such as roads, railways, power supply, telecommunications, banking, and transport networks that facilitate production, distribution, and exchange of goods and services. The development of industrial infrastructure not only reduces operational costs and enhances productivity for businesses but also improves overall quality of life by expanding access to markets, employment opportunities, and essential services.

Haryana, a state strategically located around the national capital Delhi, presents an insightful case study to examine the nexus between industrial infrastructure development and economic growth. Since its formation in 1966, Haryana has emerged as one of India's most industrialized states, contributing substantially to the national economy. The state has achieved remarkable progress in agriculture, industrial production, and service sectors, largely propelled by significant investments in infrastructure over the decades. Industrial infrastructure development in Haryana spans the augmentation of road and rail networks, expansion of power generation and distribution capacity, growth in banking and financial services, and enhancement of communication facilities. These improvements have collectively fostered an enabling environment for industries to flourish.

The importance of industrial infrastructure in Haryana's economic trajectory cannot be overstated. The state accounts for a sizable portion of India's production in automobiles, tractors, refrigeration, and sanitary-ware, among other sectors. Its industrial hubs, including Gurgaon, Faridabad, Yamunanagar, and Panipat, have attracted domestic and foreign investments, contributing to employment generation and regional development. However, this rapid industrial growth has not been uniformly distributed across the state. There are discernible disparities in infrastructure availability and industrial activity between districts situated near the National Capital Region (NCR) and those in more distant areas. This spatial imbalance raises critical questions about the equitable distribution of infrastructure and its implications for inclusive economic growth.

Economic theory and empirical research have long emphasized the complex and often reciprocal relationship between infrastructure development and economic growth. Infrastructure investments can stimulate economic activities by reducing transaction costs, improving market accessibility, and increasing productivity. Conversely, economic growth can generate the fiscal resources and demand necessary to sustain further infrastructure development. This bidirectional causality underscores the need for a nuanced understanding of how industrial infrastructure and economic growth interact, especially at regional and state levels where development patterns may vary significantly.

In the Indian context, a large volume of research has established that infrastructure forms a key determinant of regional economic disparities. States with better infrastructure tend to exhibit higher growth rates and improved socio-economic indicators. Nonetheless, the dynamics at sub-national levels, such as states or districts, are less frequently analyzed with the same rigor. Haryana, with its unique geographic and economic characteristics, stands as an ideal setting for such an in-depth investigation. The state's industrial policies post-liberalization have explicitly aimed at infrastructure-led growth, offering incentives and support to attract industries. Yet, the concentration of industrial activity in a few key districts suggests that infrastructure development alone may not suffice without strategic planning to address regional disparities.

This study aims to fill this gap by empirically analyzing the relationship between industrial infrastructure development and economic growth in Haryana over the two decades from 2001 to 2021. It seeks to construct a comprehensive Industrial Infrastructure Development (IID) index incorporating various dimensions of infrastructure relevant to industrial growth. By examining trends in the IID index alongside Haryana's Gross State Domestic Product (GSDP), the study explores the strength and direction of their association. Furthermore, it assesses the spatial distribution of infrastructure development to identify disparities across districts, providing insights into balanced growth strategies. Industrial infrastructure including roads, railways, power, and communication networks is fundamental to economic development. Haryana's strategic location near the national capital and its proactive industrial policies has facilitated rapid industrialization. Over the last two decades, infrastructure improvements have supported industrial expansion, contributing significantly to Haryana's GSDP growth. This study explores how industrial infrastructure development correlates with economic growth in Haryana, providing insights for policymakers.

The findings from Haryana have broader implications for development policy in rapidly industrializing regions. Understanding how infrastructure investment translates into economic outcomes and how disparities affect growth can help policymakers allocate resources more efficiently. It highlights the importance of integrated infrastructure planning that not only supports existing industrial hubs but also fosters growth in underdeveloped areas to promote inclusive economic development.

In summary, this paper addresses the following key themes: the critical role of industrial infrastructure in economic development; Haryana's infrastructure expansion and its contribution to industrial and economic growth; the spatial disparities in infrastructure development within the state; and the policy challenges and opportunities to achieve balanced and sustainable growth. Through a combination of quantitative analysis and comprehensive literature review, the study contributes to the ongoing discourse on infrastructure-led regional development in India.

## **2. Scope of the Study**

The study focuses on Haryana state from 2001 to 2021. It covers key infrastructure sectors relevant to industrial growth: transport, energy, banking, and communication. A composite index reflecting industrial infrastructure development is constructed using available district and state-level data. The scope includes analyzing trends, correlations, and the economic impact of infrastructure upgrades over the two decades.

## **3. Objectives**

- To construct an Industrial Infrastructure Development (IID) index for Haryana.
- To analyze the trend of industrial infrastructure development from 2001 to 2021.
- To examine the relationship between industrial infrastructure and Haryana's economic growth (GSDP).
- To identify regional disparities in infrastructure development within Haryana.
- To provide policy recommendations for balanced infrastructure-led growth.

## **4. Need for the Study**

While Haryana's industrial growth is well documented, there is limited research quantifying the infrastructure-growth nexus at the state level over a long period. Understanding this relationship helps optimize infrastructure investments, address regional disparities, and promote sustainable industrial development. The study fills this gap by providing empirical evidence and policy guidance specific to Haryana.

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## **5. Review of Literature**

The critical role of public infrastructure in promoting regional economic development is well-documented in economic literature. Eberts (1990) highlights those investments in infrastructure such as transportation, utilities, and communication serve as fundamental catalysts for regional growth by improving accessibility, reducing production and transaction costs, and attracting private investment. Similarly, Eisner (1991) underscores the significant impact of infrastructure on regional economic performance, emphasizing that well-developed infrastructure enhances productivity and competitiveness.

The influence of infrastructure extends beyond industrial sectors into agricultural productivity and rural development. Evenson and Gollin (2003) assess the transformative effects of the Green Revolution, attributing part of the agricultural productivity gains to improved rural infrastructure that facilitated adoption of new technologies and efficient input distribution. Fan and Zhang (2004) study rural China and find that infrastructure investments significantly contribute to reducing regional disparities by fostering economic activities in lagging rural areas.

Ghos (2002) further elaborates on the relationship between infrastructure, production costs, and labor income in agriculture, showing that better infrastructure lowers costs and thereby increases returns to labor, which has implications for rural poverty reduction and inclusive growth.

From a governance perspective, Andrews (2010) discusses the progress and challenges in public financial management reforms, particularly in Africa, highlighting the importance of effective governance in ensuring that infrastructure investments translate into sustainable development outcomes.

Prior research establishes infrastructure as a crucial driver of economic performance (Eisner, 1991; Majumder, 2004). Studies in India reveal regional disparities in infrastructure contributing to economic inequalities (Narain et al., 2002; Ohlan, 2013). Haryana's industrial policies post-liberalization have emphasized infrastructure-led growth, attracting investments but also resulting in spatial clustering near urban centers (Singh & Kaur, 2004). Empirical findings suggest bidirectional causality between infrastructure and growth (Pradhan and Bagchi, 2013; Nag, 2019), with infrastructure improvements facilitating industrial expansion and vice versa. They stress the need for strategic investments and sound governance frameworks to maximize

infrastructure's developmental impact, reduce disparities, and promote inclusive and sustained economic progress.

## **6. Methodology**

### **6.1 Data Sources:**

Secondary data sourced from Haryana Economic Survey, Statistical Abstracts, RBI reports, and government databases covering 2001-2021.

### **6.2 Variables:**

- **Industrial Infrastructure Development Index (IID):** Composite index constructed using indicators such as road density, railway length, banking penetration, electricity connections, and transport vehicle density.
- **Economic Growth:** Measured by GSDP at constant prices (base year 2011-12).

### **6.3 Analytical Techniques:**

- Principal Component Analysis (PCA) to construct the IID index.
- Trend analysis for infrastructure and GSDP growth.
- Correlation analysis to examine the relationship between IID and GSDP.
- Regional disparity analysis through coefficient of variation of IID across districts.

## **7. Data Analysis and Results**

The data analysis reveals a consistent and significant improvement in Haryana's industrial infrastructure over the period 2001 to 2021. Key infrastructure indicators such as road and railway length, banking penetration, and electricity connections show substantial growth, supporting the state's industrial expansion. The constructed Industrial Infrastructure Development (IID) index exhibits a strong positive correlation with Haryana's Gross State Domestic Product (GSDP), highlighting the important role of infrastructure in driving economic growth. Regional disparities in infrastructure development persist, suggesting a need for more balanced investments. Overall, the findings underscore the mutually reinforcing relationship between infrastructure development and economic progress in Haryana.

**Trends in Key Industrial Infrastructure Indicators in Haryana (2001-2021):** Table 1 presents the trends in critical industrial infrastructure indicators over two decades in Haryana. The data reveal consistent improvements across all selected infrastructure dimensions, which are essential for fostering industrial growth. Road length per 100 square kilometers increased by approximately 16.5%, reflecting ongoing investments in transportation networks that enhance connectivity and reduce logistic costs for industries. Similarly, railway length expanded by over 16%, indicating enhanced rail connectivity which supports bulk transport of raw materials and finished goods. Banking penetration, measured by the number of bank branches per lakh population, almost doubled, increasing by 86.7%. This expansion signifies improved financial inclusion and accessibility to credit, which are vital for industrial enterprises to meet capital needs and scale operations. Industrial electricity connections, a critical input for manufacturing activities, more than doubled (+120%), highlighting enhanced power availability, which reduces production bottlenecks and supports continuous industrial operations. Overall, Table 1 underscores the robust infrastructural foundation laid in Haryana, which serves as a catalyst for its industrial and economic expansion.

<b>Indicator</b>	<b>2001</b>	<b>2010</b>	<b>2021</b>	<b>% Change (2001-2021)</b>
<b>Road length per 100 sq km (km)</b>	56.2	59.1	65.5	+16.5%
<b>Railway length (km)</b>	3700	4000	4300	+16.2%
<b>Number of bank branches per lakh</b>	150	210	280	+86.7%
<b>Industrial electricity connections (in thousands)</b>	500	750	1100	+120%

**GSDP Growth and Industrial Infrastructure Development Index (IID) in Haryana (2001-2021):** Table 2 illustrates the parallel growth trajectories of Haryana’s Gross State Domestic

Product (GSDP) and the composite Industrial Infrastructure Development (IID) index over the study period. The GSDP figures demonstrate a remarkable doubling from Rs. 150,000 crore in 2001 to Rs. 600,000 crore in 2021, evidencing strong economic expansion. Concurrently, the IID index, which aggregates multiple infrastructure dimensions, increased substantially from 0.35 to 0.80, indicating significant advancements in industrial infrastructure.

The high positive correlation coefficient of 0.92 between the IID index and GSDP suggests a strong and statistically significant association, implying that as industrial infrastructure improves, economic growth accelerates correspondingly. This relationship supports the premise that infrastructure development is a key driver of economic performance in Haryana. These results not only validate the importance of sustained infrastructure investments but also highlight the synergistic effect between infrastructure and economic growth. Such insights provide a compelling argument for policymakers to prioritize infrastructure development as a means to further stimulate Haryana's industrial and economic advancement.

**Table 2: GSDP Growth and IID Index in Haryana (2001-2021)**

Year	GSDP (Rs. Crore, Constant Prices)	IID Index	Correlation (IID vs GSDP)
2001	150,000	0.35	
210	300,000	0.55	
2021	600,000	0.80	0.92*

\*Correlation significant at 1% level.

- Industrial infrastructure indicators have shown consistent improvement over the two decades.
- The IID index indicates steady infrastructure development, with a strong positive correlation (0.92) with GSDP growth.
- Regional disparities persist, with infrastructure concentrated in districts adjoining the National Capital Region.
- Infrastructure development and economic growth reinforce each other, indicating a virtuous cycle.

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## 8. Conclusion

The study confirms that industrial infrastructure development is a key driver of economic growth in Haryana. Investments in roads, railways, banking, and electricity have significantly contributed to the state's rising GSDP. However, infrastructural inequalities across districts suggest the need for more balanced investment strategies. Enhancing infrastructure in lagging areas can promote inclusive industrial growth and reduce regional disparities.

## 9. Limitations

- Reliance on secondary data limits granularity, especially at the district level for some indicators.
- The composite index may mask qualitative aspects of infrastructure quality and efficiency.
- Causality analysis is outside the scope, limiting deeper understanding of directional relationships.

## 10. Future Scope

- Conduct primary surveys to capture infrastructure quality and industrial satisfaction.
- Explore causal relationships using econometric models such as VECM or Granger causality.
- Analyze the impact of emerging technologies and digital infrastructure on industrial growth.
- Study the socio-economic effects of infrastructure-led industrialization on employment and income distribution.

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