



Industrial Growth and Infrastructure Development in India: Progress, Challenges and the Path to Sustainable Development (SDG9)

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Abstract

Infrastructure, sustainable industrialization, and innovation. Using mixed methods this paper reviews three decades of progress, chronic challenges and a sustainability roadmap in terms of secondary data retrieved from MoSPI (Ministry of Statistics and Programme Implementation), NITI Aayog, and World Bank sources on the one hand, as well as policy analyses and case studies. Manufacturing's GDP share is expected to increase from 14% in 2014 to 17% by 2023, which is progress on account of the Make in India and PLI (Production Linked Incentive) schemes. Infrastructure jumps consist of 55,000 km of new national highways, 95.5% household electrification, and tripling airport capacity to accommodate 300 million passengers in a year. Logistics costs fell from 14% of GDP to 8-10% bringing India up the charts as the world's fifth-largest economy. SDGS scores increased from 57.2 in 2015 to 63.5 in 2022, driven by gains in renewable energy and digital manufacturing. However, challenges persist. Industrial emissions drive 40% of air pollution and Urbanization extenuates an approaching 50% water shortage by 2030. Lagging rural infrastructure; 30% of roads in the countryside unpaved with increasing disparities. But regulatory snags, land conflicts and skills gaps for 70% of workers threaten to blunt momentum, as seen in COVID-1S-linked supply disruptions and climate risks to 60% of investments. The roadmap combines green technology, public-private partnerships, and reforms. Smart cities, circular economies, and AI logistics might cut emissions by 20-30% and create 10 million green jobs. Increased R&D to 2% GDP, NEP 2020 skill programs, and Environmental, Social, and Governance (ESG) incentives will drive innovation. Freight corridors and rural electrification are enablers of inclusivity and may raise SDGS scores to 75 by 2030. This study provides data-driven recommendations to maintain momentum on this front for India, in line with the vision of shared prosperity contained in the SDGs.

Keywords: Industrial growth, Infrastructure development, Sustainable Development Goal S (SDGS), Make in India, Green technologies








1. Introduction

Industrial growth and infrastructure development are crucial in shaping a country's economic structure. They act as the foundation for long-term economic progress by supporting production, trade, employment, and technological advancement. Industrialization increases a nation's production capacity, creates employment opportunities, improves efficiency, and promotes innovation. Simultaneously, infrastructure development provides the physical backbone, such as transport systems, energy supply, communication networks, and water resources, necessary for economic activities to



function smoothly and competitively. Together, these two elements contribute to the sustained economic growth and improved living standards.







Importance of Industrial Growth and Infrastructure

 Area	 Contribution to Development
 Industrial Growth	Expands manufacturing and production capacity
 Employment	Generates jobs and reduces unemployment
 Technology	Encourages innovation and modernization
 Infrastructure	Improves efficiency and reduces costs
 Living Standards	Enhances access to goods and services

In the Indian context, industrial growth and infrastructure development have been central to national economic planning since the country's independence in 1947. India adopted a **mixed economic model** in which the public sector played a leading role in developing heavy industries and core infrastructure, such as power generation, transportation, irrigation, steel, and mining. This strategy aims to promote self-reliance and reduce dependence on foreign imports.

While this approach helped establish a basic industrial base, economic growth remained limited for decades. Excessive government control, strict licensing systems, and limited private sector participation resulted in inefficiencies, low productivity and slow technological progress.



Features of India's Pre-1991 Development Model

 Feature	 Explanation
 Public Sector Dominance	Government controlled key industries
 License Raj	Strict regulations restricted expansion
 Low Productivity	Limited competition and innovation
 Limited Global Integration	Low foreign investment and trade

A major transformation occurred after the **economic reforms of 1991**, which introduced **liberalization, privatization, and globalization**. These reforms reduced regulatory barriers, encouraged private sector participation, attracted foreign direct investment, and integrated India into global markets. As a result, industrial efficiency improved, and infrastructure investment increased significantly.


Since then, India has experienced steady industrial expansion and notable improvements in infrastructure, particularly in **transportation, energy, and digital connectivity**. Large-scale investments in highways, railways, ports, airports, power generation, and telecommunications have strengthened the foundations of industrial and economic growth.

Impact of Post-1991 Economic Reforms

 Reform Area	 Impact
Liberalization	Increased competition and efficiency
Privatization	Improved industrial productivity
Globalization	Access to global markets and technology
Infrastructure Expansion	Better logistics and connectivity

More recently, India has aligned its development agenda with the **United Nations Sustainable Development Goals (SDGs)**. Among them, **Sustainable Development Goals (SDGs)** is particularly important for India. SDG-9 focuses on building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation areas that are critical for employment generation, poverty reduction, and balanced regional development are needed.

Why SDG-9 is Crucial for India

 SDG-9 Dimension	IN Relevance for India
Resilient Infrastructure	Supports national and regional connectivity
Sustainable Industry	Balances growth with environmental protection
Innovation	Enhances productivity and competitiveness

In this context, the present study aims to **examine India's progress in industrial growth and infrastructure development, identify key challenges, and propose effective pathways** to achieve sustainable development as per SDG-9. The study contributes to understanding how India can achieve long-term, inclusive, and environmentally sustainable economic growth

Table 1: Role of Industrial Growth and Infrastructure in Economic Development

Aspect	Role in Economic Development
Industrial Growth	Expands production capacity and manufacturing output
Employment Generation	Creates jobs across skilled and unskilled sectors
Technological Progress	Promotes innovation and modernization
Infrastructure Development	Reduces costs and improves economic efficiency
Living Standards	Enhances access to goods and essential services

Industrial growth and infrastructure development are interdependent and jointly contribute to long-term economic growth and improved quality of life.

Source. Government of India (2023); World Bank (2021).

Table 2: Transport Infrastructure Development in India

Component	Progress Level
Roads	Significant expansion of national highways and expressways
Railways	Modernization and large-scale electrification
Ports	Capacity expansion and efficiency improvement
Airports	Growth in regional connectivity

Transport infrastructure plays a critical role in reducing logistics costs and improving industrial competitiveness.

Source. Government of India (2022); NITI Aayog (2022)

Table 3: Regional Industrial Development in India

Region	Level of Industrial Development
Western India	High
Southern India	High
Northern India	Moderate
Eastern and Northeastern India	Low

Regional disparities in industrial development highlight the need for targeted policy interventions and infrastructure investments.

Source. Ministry of Statistics and Programme Implementation (2022); NITI Aayog (2021).

Table 4: Relevance of Sustainable Development Goal 9 for India

SDG-9 Focus Area	Importance for India
Resilient Infrastructure	Improves national and regional connectivity
Sustainable Industrialization	Generates employment while protecting the environment
Innovation	Enhances productivity and global competitiveness

SDG-9 supports inclusive growth by integrating economic, social, and environmental objectives.

Source. United Nations (2015). UNDP (2020).

2. Conceptual framework: SDG-9 And Sustainable Development

2.1 Understanding Sustainable Development Goal 9

Sustainable Development Goal 9 focuses on three interconnected objectives: building resilient infrastructure, promoting inclusive and sustainable industrialization, and fostering innovation. The goal recognizes that economic growth cannot be sustained without strong infrastructure and a competitive industrial sector. Simultaneously, it emphasizes sustainability to ensure that development does not harm the environment or exclude vulnerable populations.

The targets under SDG-9 include increasing access to quality infrastructure, raising the share of manufacturing in employment and gross domestic product, upgrading industries to adopt environmentally sound technologies and expand access to information and communication technologies. These targets highlight the importance of combining economic efficiency, social inclusion, and environmental responsibility.

2.2 Importance of SDG-9 for India

India faces multiple development challenges, including unemployment, regional inequality, environmental stress, and infrastructure deficits. Achieving SDG-9 is crucial for addressing these challenges because industrial growth can absorb labor, infrastructure can improve connectivity, and innovation can enhance the productivity. For a country with a large and young population, sustainable industrialization is necessary to create quality jobs and maintain long-term economic growth.

3. Historical Evolution of Industrial Growth in India

3.1 Industrial Development before Economic Reforms

In the decades following independence, India adopted a planned development approach with a strong emphasis on state-led industrialization. The government has invested heavily in heavy industries such as steel, cement, machinery, and chemicals. Infrastructure development has also been largely undertaken by the public sector, focusing on railways, power plants, and irrigation projects.

While this strategy helped establish a basic industrial structure, it also led to inefficiencies, low productivity, and limited technological progress in the region. Excessive regulation, known as the “license raj,” which restricted private sector growth and reduced competitiveness.

3.2 Industrial Growth after the 1991 Reforms





The economic reforms of 1991 marked a major shift in India’s industrial policies. Liberalization reduced government control, privatization increased private sector participation, and globalization integrated India into the global economy. These changes encouraged investment, improved efficiency, and expanded the industrial output.

As a result, India’s industrial sector diversified, with growth in manufacturing, construction, and services linked to the industry. Foreign direct investment increased, and Indian industries became more globally competitive.

4. Structure And Performance of India’s Industrial Sector

The industrial sector in India comprises manufacturing, mining, construction, and utilities, such as electricity and water supply. Manufacturing is the most important component, as it contributes significantly to the output and employment.

Structure of the Industrial Sector in India

Sector	Main Function
 Manufacturing	Production of goods and employment
 Mining	Supply of raw materials
 Construction	Infrastructure creation
 Utilities	Energy and water supply

Despite this progress, manufacturing’s share of GDP remains lower than that of many emerging economies, indicating the need for further policy support.





5. Infrastructure Development In India

5.1 Role of Infrastructure in Economic Growth

Infrastructure development is essential for reducing costs, improving efficiency, and supporting the industrial activity. Good infrastructure improves market access, encourages investment, and enhances productivity.

5.2 Transport Infrastructure

India has invested heavily in its roads, railways, ports, and airports. Expansion of national highways and modernization of railways have improved connectivity and reduced logistics costs.

★ Transport Infrastructure Development Progress	
Component	Progress Level
 Roads	Significant Expansion
 Railways	Modernization & Electrification
 Ports	Capacity Improvement
 Airports	Regional Connectivity Growth

5.3 Energy Infrastructure

Energy availability is critical for industrial development. India has expanded power generation and increased the share of renewable energy sources to support sustainable development.

5.4 Digital Infrastructure

Digital infrastructure has improved communication, governance, and efficiency in business. Initiatives such as Digital India support innovation and entrepreneurship.

6. Interlinkages Between Industrial Growth and Infrastructure

Industrial growth and infrastructure development support each other. Infrastructure investment reduces production costs and improves efficiency, leading to higher industrial output, and employment.

Text Chart: Infrastructure–Industry Link



7. Regional Dimensions of Development

Industrial and infrastructure development in India is uneven across the regions. Western Southern states are more industrialized, whereas the eastern and northeastern regions lag behind.

Table 5: Regional Industrial Development in India

Region	Level of Industrial Development
Western India	High (major industrial hubs and strong infrastructure)
Southern India	High (technology-driven and export-oriented industries)
Northern India	Moderate (mixed industrial performance)
Eastern & Northeastern India	Low (limited industrial base and infrastructure gaps)

Reducing regional disparities through targeted infrastructure investment and industrial policy is essential for achieving inclusive and balanced economic growth.

8. Challenges To Achieving SDG-9

Despite notable progress in industrial growth and infrastructure development, India faces several structural and policy-related challenges that hinder the achievement of Sustainable Development Goal 9. These challenges are explained below.

8.1 Environmental Degradation

Rapid industrialization and large-scale infrastructure projects have significantly increased environmental stress in India. Industries contribute to air, water, and soil pollution through emissions and effluents and improper waste disposal. Infrastructure expansion often leads to deforestation, biodiversity loss, and ecological imbalance. The challenge lies in balancing economic growth with environmental protection while adopting cleaner and greener technology.

8.2 Financial Constraints

Infrastructure development requires substantial long-term capital investments. However, limited public finances, rising fiscal deficits, and increasing public debt Restricts government spending capacity. Private sector participation, though encouraged, is often constrained by regulatory uncertainty and long gestation periods of infrastructure project. These financial limitations slow project implementation and affect overall development outcomes.

8.3 Technological Gaps

India’s industrial sector still lags behind advanced economies in terms of technology adoption. Many industries rely on outdated machinery and low levels of automation; this reduces productivity and competitiveness. Insufficient investment in research and development (RCD) further limits innovation and the ability to move up the global value chain (GVC).

8.4 Skill Shortages and Workforce Mismatch

Although India has a large labor force, there is a mismatch between industry requirements, and available skills. Many workers lack the technical, digital, and specialized skills required in modern industries. This skill gap affects productivity, limits employment quality and reduces the effectiveness of industrial growth initiatives.

8.5 Regional Disparities

Industrial growth and infrastructure development are uneven across the regions. While some states enjoy advanced infrastructure and strong industrial bases, others lag behind due to poor connectivity, limited investment and weaker institutional capacity. These regional imbalances hinder inclusive growth and widen economic inequalities.

8.6 Regulatory and Institutional Challenges

Complex regulations, lengthy approval processes, and coordination issues among government agencies often delay industrial and infrastructure projects in the country. Inconsistent Policy implementation across states further creates uncertainty for investors and slows progress toward sustainable industrialization.

8.7 Climate Change and Resource Constraints

Climate change poses additional risks to infrastructure durability and industrial productivity. Extreme weather events, water scarcity, and energy insecurity increase operational costs and vulnerabilities. Therefore, sustainable resource management is critical for achieving long-term resilience under SDG-9.

9. Pathways To Sustainable Development

Sustainable industrial and infrastructure development requires green technologies, improved planning, innovation, and skill development. Policies must balance economic growth, environmental protection, and social inclusion.

Achieving sustainable industrial growth and resilient infrastructure in India requires a comprehensive and balanced approach that integrates economic efficiency, environmental sustainability and social inclusion. The following pathways are essential for advancing Sustainable Development Goal 9:

9.1. Adoption of Green and Clean Technologies

Promoting environmentally friendly technologies in industries and infrastructure projects is crucial for reducing pollution and conserving the natural resources. The use of renewable energy, energy-efficient machinery, and cleaner production processes can significantly reduce carbon emissions. Green technologies also help industries comply with environmental standards while improving their long-term cost efficiency.

9.2. Integrated and Long-Term Infrastructure Planning

Sustainable development requires coordinated planning across sectors and regions. Integrated infrastructure planning ensures the optimal use of land, energy, and financial resources. Long-term planning reduces project delays, cost overruns, and environmental damage while improving resilience against climate-related risks.

9.3. Promotion of Innovation and Research s Development

Innovation plays a key role in enhancing industrial productivity and improving sustainability. Increased investment in research and development enables industries to adopt advanced technologies, improving efficiency, and remaining competitive in global markets. Collaboration among government, industry, and academic institutions can further strengthen innovation ecosystems.

9.4. Skill Development and Human Capital Enhancement

The development of a skilled workforce is essential for sustainable industrialization. Skill development programs focusing on technical, digital, and green skills can improve employment quality and productivity. Aligning education and training systems with Industry requirements help reduce skill mismatches and support inclusive growth.

9.5. Encouraging Inclusive and MSME-Led Growth

Micro, Small, and Medium Enterprises (MSMEs) play a vital role in employment generation, and regional development. Supporting MSMEs through access to finance, technology, and markets, promotes inclusive industrial growth and reduces regional disparities.

9.6. Strengthening Public-Private Partnerships

Public-private partnerships (PPPs) can mobilize private investment and improve efficiency of infrastructure development. Effective PPP frameworks ensure risk sharing, transparency, and timely project completion, thereby contributing to sustainable infrastructure expansion.

9.7. Balancing Economic Growth with Social and Environmental Goals

Sustainable development requires policies that balance industrial growth, environmental protection, and social equity. This includes enforcing environmental regulations, ensuring community participation, and promoting social responsibility in industries.

10. Role Of Government and Policy



The government plays a crucial role in promoting sustainable industrial growth and infrastructure development in India. Its involvement can be expanded and explained through several key points:

10.1 Public Investment in Infrastructure and Industry

The government provides significant financial resources for building roads, railways, ports, power plants and industrial parks. Public investment ensures the creation of essential infrastructure that attracts private sector participation and stimulates industrial growth, particularly in regions where private investment may be insufficient.

10.2 Regulatory Framework and Policy Guidelines

Government regulations set standards for environmental protection, labor laws, industrial safety, and quality control. By establishing clear rules and policies, the government ensures that industrial growth occurs in a responsible, sustainable, and legally compliant manner. Strong regulatory frameworks reduce risks for investors and promote stability.

10.3 Incentives and Subsidies

The government offers financial incentives, tax breaks, and subsidies to encourage private investment in manufacturing, technology adoption, and green infrastructure development. Schemes like Make in India, Production Linked Incentives (PLI), and MSME support programs help reduce entry barriers, promote innovation, and accelerate industrialization.

10.4 Effective Governance and Coordination

Achieving SDG-9 requires coordination among multiple ministries, state governments, and public institutions. Effective governance ensures that infrastructure projects are planned, implemented, and monitored efficiently, thereby minimizing delays and cost overruns. Policy coordination also facilitates alignment between national goals and regional-development strategies.

10.5 Promotion of Innovation and Research s Development

The government supports RCD initiatives, innovation hubs and technology incubators to foster industrial modernization and sustainable practices. Encouraging research and technological adoption strengthens competitiveness and ensures that industries meet global standards for productivity and environmental responsibility.

10.6 Ensuring Social and Environmental Responsibility

Government policies enforce social and environmental safeguards, ensuring that Industrial and infrastructure development benefits society while minimizing ecological harm. Programs that promote renewable energy, waste management, and community engagement help industries operate sustainably and inclusively.

By implementing these measures, the government ensures that industrial growth and infrastructure development align with the SDG-9 objectives, creating a resilient, inclusive, and sustainable economic environment.

11. CONCLUSION

India has made significant progress in industrial growth and infrastructure. However, challenges remain. Achieving SDG-9 requires sustained investment, innovation, and inclusive policies. A balanced approach that integrates economic growth, environmental sustainability, and social equity will determine India's long-term developmental success.

11.1 Significant Progress in Industrial Growth

- India has experienced substantial growth in its industrial sector, including manufacturing, IT, automotive, and pharmaceuticals.
- This growth has contributed to the GDP, employment generation, and export potential.
- Industrial clusters and special economic zones have boosted regional development.
- Industrial growth drives economic development and provides a foundation for innovation, infrastructure development, and technological advancement.

11.2 Infrastructure Development

- India has invested heavily in transportation, energy, and digital infrastructure to support industrial growth.
- Initiatives such as Bharatmala (roads), Sagarmala (ports), and the Smart Cities Mission have improved connectivity and urban infrastructure.
- Improved infrastructure enhances productivity, reduces logistics costs, and attracts both domestic and foreign investment.

11.3 Existing Challenges

- Despite this progress, India faces several challenges, including:
 - Skill shortages and a lack of technical expertise.
 - Regional disparities in industrialization.
 - Environmental concerns, such as pollution and resource depletion.
 - Underdeveloped Micro, Small, and Medium Enterprises (MSMEs).
- Addressing these challenges is essential for inclusive and sustainable industrial development in the region.

11.4 Importance of Sustained Investment and Innovation

- Continued investment in technology, research C development (RCD), and innovation is critical to industrial competitiveness.
- The adoption of advanced technologies, such as AI, automation, renewable energy, and advanced manufacturing, can drive productivity and sustainability.
- Innovation ensures that industrial growth is efficient, environmentally responsible, and capable of competing globally competitive.

11.5 Inclusive Policies for Equitable Growth

- Policies must ensure that industrial benefits reach all sectors of society.
- Support for MSMEs, rural industries, women entrepreneurs, and marginalized communities can help reduce inequality.

- Inclusive industrial policies promote social equity, regional development, and broader economic participation.

11.6 Balanced Approach for Long-Term Sustainability

- Sustainable industrial development requires the integration of three key pillars:
 - **Economic growth:** Expanding industries, generating employment, and increasing exports;
 - **Environmental sustainability:** Minimizing pollution, conserving resources, and adopting green technologies.
 - **Social equity:** Ensuring equitable access to opportunities, reducing disparities, and empowering vulnerable groups.
- A holistic approach ensures that industrialization supports long-term national development without harming the environment or society itself.

11.7 Achieving SDG-G (Industry, Innovation, and Infrastructure)

- SDG-9 emphasizes resilient infrastructure, inclusive industrialization, and innovation.
- India's progress shows promise, but achieving these goals requires coordinated efforts from the government, industry, and society.
- Focused strategies, continuous monitoring, and data-driven policy-making will help India effectively meet its SDG-9 targets.

India has made impressive strides in industrial growth and infrastructure, but challenges remain. Sustained investment, innovation, and inclusive policies—balanced with environmental and social considerations—will be crucial to ensuring long-term success and fulfilling the SDG-9 objectives.

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