E-ISSN: 3048-6041 | Volume- 3, Issue- 1 | January 2026

Sustainable Development through Infrastructure, Industrialization, and Innovation: A study of SDG 9 in India

Dr. Pankaj Kumar Mahato
Assistant Professor, Department of Commerce, Gaya College, Gaya Jee
ORCID: 0000-0001-7962-4630

Abstract

This study presents an analysis of India's progress towards Sustainable Development Goal 9, focusing on infrastructure, industrialization, and innovation. It explores the nation's commitment to SDG 9 and the significant progress made through various government initiatives. The study also reveals disparities across states, where some states are lagging due to weak manufacturing bases, uneven innovation capacities, and digital access gaps. It employs a descriptive and analytical methodology on data collected from NITI Aayog. This research identifies critical challenges and proposes actionable pathways. It advocates a crucial shift from mere infrastructure expansion to productive utilization, distributed innovation ecosystems, and outcome-based governance to ensure inclusive and accelerated SDG 9 achievement for a 'Viksit Bharat'.

Keywords: SDG 9, Infrastructure, Industrialization, Innovation, Viksit Bharat

1. Introduction

The global community's commitment to sustainable development is expressed through the United Nations' 2030 Agenda, consisting of seventeen Sustainable Development Goals (SDGs). These goals collectively aim to address the interlinked global challenges of poverty, inequality, climate change, and environmental degradation, thereby promoting an equitable, secure, and enduring global society. Central to this agenda is SDG 9: "Build resilient infrastructure, promote inclusive and sustainable industrialization and foster innovation." Filho et al. (2021) underscore its essential nature for creating societies that can withstand future shocks and adapt to evolving global dynamics.

SDG 9 is versatile, comprising of three core, interdependent aspects: infrastructure, industrialization, and innovation. This includes not only foundational physical structures but also regional and trans-border networks, all designed to support economic development and enhance human well-being. Furthermore, SDG 9 promotes inclusive and sustainable industrialization, aiming to significantly increase industry's share of employment and gross domestic product by 2030. At the same time, it aims at the modernization of industries to achieve enhanced resource efficiency and environmental soundness. NITI Aayog (2021) and

*Corresponding Author Email: pankajmahato.finance@gmail.com
Published: 30 January 2026
DOI: https://doi.org/10.70558/SPIJSH.2026.v3.i1.45505

the Sustainability Reporting Standards Board (2025) emphasize these aspects. The third fundamental aspect of SDG 9 emphasizes the critical need to enhance scientific research, upgrade technological capabilities, and foster a culture of innovation across all sectors. It requires a substantial increase in research and development personnel and expenditure, as outlined by NITI Aayog (2024).

India, as a developing nation endowed with a lively demographic dividend, and a rapidly expanding economy, has demonstrated a steadfast commitment to the 2030 Agenda for Sustainable Development. India has achieved active integration of the SDGs into its national planning and policy frameworks, viewing them as crucial accelerators for achieving its long-term development aspirations, including the ambitious vision of 'Viksit Bharat' by 2047. Mujalde and Bairagi (2019) discuss programs such as 'Make in India,' designed to bolster domestic manufacturing, and the 'Startup India' and 'Atal Innovation Mission,' supposed to cultivate a vibrant innovation ecosystem. While India has demonstrated positive trends in its overall SDG 9 Index score for states and Union Territories between 2018 and 2023-24, the path toward comprehensive and equitable achievement by 2030 remains complex and presents interconnected challenges. This research aims to provide a comprehensive analysis of India's progress, identify critical obstacles, and explore pathways to accelerate the attainment of SDG 9 targets across its three core dimensions: infrastructure, industrialization, and innovation.

1.1 Significance of the Study

The acceleration of SDG 9 in India carries deep significance, extending far beyond its direct targets to influence a broader, more intricate spectrum of sustainable development outcomes. From a fundamental economic perspective, robust, resilient, and accessible infrastructure forms the essential base upon which all productive economic activities are built. Mujalde and Bairagi (2019) note India's rapid and extensive expansion of transportation networks, encompassing roads, railways, and waterways, which directly contributes to economic development by enhancing connectivity. Sustainable industrialization, as highlighted by Prabhakar (2024), is not merely an economic activity but a critical engine for job-centric economic expansion, playing an important role in large-scale employment generation and ensuring the sustained strength of the national economy. Furthermore, developing a robust culture of innovation drives economic diversification, opening new markets and value streams. It also actively facilitates the development of novel products and services that are inherently more resource-efficient, generate less waste, and proactively address pressing environmental challenges.

The intrinsic interlinkages between SDG 9 and other SDGs further underscore its cross-cutting importance. Investments in sustainable infrastructure directly support the achievement of numerous other goals, such as ensuring universal access to clean water and sanitation, providing affordable and clean energy, and facilitating the development of sustainable cities and communities, according to Abiad and Teipelke (2017). Mantlana and Maoela (2019) have analysed these intricate interlinkages, highlighting SDG 9's foundational role in promoting broader social inclusion, ensuring environmental sustainability, and driving holistic economic development. The emphasis on innovation within SDG 9 also translates into transformative advancements that can greatly improve health and well-being and provide quality education

through new technologies and pedagogical approaches. This interconnectedness positions SDG 9 not as an isolated goal, but as a central lever for comprehensive sustainable development. Persistent challenges such as unchecked urban growth, escalating pollution levels, and inadequate resilience measures intensify disaster risks, collectively underscoring persistent and substantial infrastructure deficits, as Mahato (2025) articulates. This indicates a critical need to shift from mere expansion to quality, resilience, and equitable access.

The imperative to thoroughly upgrade infrastructure and retrofit existing industries to enhance resource-use efficiency and adopt cleaner technologies by 2030, as outlined by NITI Aayog (2024), faces significant practical barriers. These barriers are particularly pronounced among small and medium-sized manufacturing units, which often require substantial incentives for machinery upgrades, access to advanced technologies, and comprehensive skills development for their workforce, according to Nikam (2023).

Therefore, this study addresses the critical and widening gap between India's ambition for SDG 9 achievement and the complex, deeply interconnected, and often systemic challenges hampering comprehensive, equitable, and sustainable progress across infrastructure development, inclusive industrialization, and robust innovation fostering. This necessitates a deeper understanding of not just what has been achieved, but also, why certain targets remain elusive and how current strategies can be refined, and effectively implemented for accelerated, inclusive, and long-term sustainable outcomes.

2. Literature Review

2.1 SDG 9 in Developed Countries

Research into SDG 9 within developed nations reveals a dynamic landscape where advanced technological integration and refined policy frameworks are key drivers, yet significant challenges persist. Unlike developing contexts, the focus here often shifts from basic provision to enhancing resilience, sustainability, and the cutting-edge application of technology.

Regarding infrastructure, developed countries frequently grapple with aging foundational structures that require sophisticated rehabilitation and adaptation, rather than initial construction (Chester & Allenby, 2018). Efforts are concentrated on building resilience against adverse shocks and climate change through adequate engineering design and targeted knowledge (Duarte et al., 2023). Furthermore, policy makers and infrastructure companies in these nations are urged to establish clear objectives for resilient infrastructure planning (Evans et al., 2021).

Regarding industrialization, developed economies are increasingly prioritizing green industrial policies and the transition towards zero-emission industries. Nilsson et al. (2021) stress that a new standard is emerging for energy and emissions-intensive sectors, requiring transformative policy strategies rather than merely protective ones. Countries like Denmark, Sweden, and Switzerland are recognized as leaders in Inclusive and Sustainable Industrial Development, demonstrating progress in minimizing environmental footprints while enhancing social inclusiveness (Cheng & Cantore, 2020). The concept of "Industry 4.0" and subsequently "Industry 5.0" promotes the computerization of manufacturing, integrating artificial

intelligence and sustainable technologies, notably aligning with SDG 9 objectives (Davim, 2023).

Innovation ecosystems in developed countries are characterized by robust research and development investments and a strong emphasis on technological advancement. G7 economies, for instance, are reinforcing their leadership in sustainable production systems through high-tech manufacturing and digital transformation, although the equitable impact of technologies like AI remains a concern (Mai et al., 2025). The United States stands out for its extensive contributions to innovation ecosystem research (Meng & Ma, 2018), while European Union countries are actively assessing and advancing digital transformation in their industries and infrastructure (Fura et al., 2024). Nations such as Italy, the UK, and Spain are also noted for their significant research contributions and international collaborations in innovation and circular economy concepts (Alka et al., 2024). Overall, these countries leverage their scientific capabilities to drive sustainable development.

2.2 SDG 9 in Developing Countries

Research on Sustainable Development Goal 9 in developing countries, reveals a complex picture of progress amidst persistent challenges across infrastructure, industrialization, and innovation. While many of these nations are striving to meet the 2030 Agenda, critical gaps remain, often aggravated by unique regional contexts.

In the realm of infrastructure, developing countries face significant barriers. Lozano-Ramírez and Garcia-Lopez (2025) highlight that efficient infrastructure is vital for inclusive growth, yet regions encounter low digitalization rates and limited technology adoption. Specifically, Gulseven et al. (2020) emphasize the critical role of transportation infrastructure—such as roads, railways, ports, and airports—in driving economic growth and regional integration in developing nations. Sinha et al. (2024) outline targets for facilitating resilient infrastructure, particularly in African countries, LDCs, and Small Island Developing States.

Regarding industrialization, an upward trend in manufacturing employment has been observed in many developing Asian and Sub-Saharan African countries since around 2010 (Vries & Erumban, 2021). However, de Vries and Erumban (2021) also note that manufacturing activity in Sub-Saharan Africa lags behind developing Asia, and the marginal productivity of additional workers in modern activities remains low. Ma et al. (2021) indicate that most countries in Latin America and the Caribbean exhibit limited production capacity, with only a few achieving high levels of industrialization. A significant challenge for small-scale industries in developing countries, particularly in Sub-Saharan Africa, is limited access to financial services and credit, impeding their growth and competitiveness.

Innovation ecosystems in developing countries also present specific dynamics. Valls-Pasola and Alvarez (2020) underscore that effective innovation in developing nations like Argentina requires a combination of supply-side and demand-oriented policies, acknowledging the regional basis of innovation ecosystems. Singh and Ru (2023) broadly identify poor awareness, funding issues, and distorted policies as key challenges for achieving SDG 9 targets related to innovation across developing nations. The limited adoption of Fourth Industrial Revolution technologies in Small and Medium-sized Enterprises in developing versus developed countries

is also a focus for researchers like Mosupye-Semenya (2024). Overall, while efforts are underway, a tailored approach addressing specific regional and national contexts is crucial for accelerating SDG 9 in these diverse economies.

3. Research Gap

From our review of how both developed and developing nations approach SDG 9, a crucial gap emerges: we still lack a precise, state-level understanding of India's diverse progress. While developed countries focus on refining sustainable infrastructure and green industries, and other developing nations grapple with foundational gaps and industrial growth, India's sub-national variations remain underexplored. We need to uncover why specific Indian states excel or falter, meticulously examining how national initiatives interact with local contexts to identify precise bottlenecks and craft effective, tailored interventions.

4. Research objectives

This study seeks to grasp India's progress on SDG 9 by:

i. Mapping out how different states and territories are performing, helping us see who's excelling and who needs more support.

ii. Examining how well the Indian government's various initiatives are actually working to push SDG 9 forward.

iii. Figuring out the core reasons why some states are lagging behind.

iv. Crafting practical suggestions to help overcome challenges and speed up SDG 9 achievement across the nation.

5. Methodology

A descriptive and analytical research design has been used in this study. The research primarily relies on secondary data, drawing information from authoritative sources like publications from NITI Aayog. Data related to indicators and performance metrics directly relevant to SDG 9 across India's states and union territories has been collected. To analyse this data, qualitative content analysis has been utilized. Performance of key initiatives/schemes towards SDG 9 by the Government has also been assessed.

6. Results and Discussion

6.1 SDG-9 Target

A summary of SDG 9 targets for India has been provided in Table 1

Table 1: SDG-9 Target in India corresponding to Global SDG Target 2030

Target No.	SDG Target No.	Indicators	Target

1	9.1	Percentage of targeted habitations connected by all-weather roads under Pradhan Mantri Gram Sadak Yojana (PMGSY)	100
2	9.2	Percentage Share of GVA in Manufacturing to total GVA (current prices)	25
3	9.2	Manufacturing employment as a percentage of total employment	19.66
4	9.2	Percentage Share of GVA in Services to total GVA (current prices)	63.26
5	9.2	Services employment as a percentage of total employment	52.98
6	9.5	Innovation score as per the India Innovation Index	100
7	9.c	Percentage of households that own at least one mobile phone	100
8	9.c	Percentage of inhabited villages with 3G/4G mobile internet coverage	100
Source: NITI Aayog SDG Report 2023-24			

India's SDG 9 targets aim for significant progress across infrastructure, industry, and innovation. By 2030, key objectives include 100% connectivity for all via all-weather roads and universal mobile and internet access (3G/4G) in villages and households. Industrial goals focus on a 25% share of Gross Value Added (GVA) from manufacturing and 19.66% manufacturing employment, alongside 63.26% GVA from services and 52.98% services employment. Additionally, the target is to achieve a 100% score on the India Innovation Index.

6.2 Raw data on performance of States & UTs

Table 2 presents raw data on performance of States & UTs on indicators of SDG 9.

Table 2: Raw data on performance of States & UTs on indicators of SDG 9

S. No.	States/UTs	Target 1	Target 2	Target 3	Target 4	Target 5	Target 6	Target 7	Target 8
1	Andhra Pradesh	99.19	12.79	10.51	39.30	32.44	13.32	91.2	87.11
2	Arunachal Pradesh	95.01	1.25	2.18	40.21	28.53	15.46	90.3	47.91
3	Assam	99.97	11.64	4.69	45.25	18.19	11.29	91.9	96.08
4	Bihar	99.59	8.67	5.71	59.98	25.45	11.58	93.4	99.43
5	Chhattisgarh	98.51	16.89	7.58	34.83	17.88	10.97	85.7	92.37
6	Goa	100	35.49	18.42	41.62	54.09	14.93	99.0	86.22

7	Gujarat	100	35.34	23.77	35.28	25.08	12.41	92.4	96.50
8	Haryana	100	19.94	16.09	51.09	39.03	16.35	97.2	99.95
9	Himachal Pradesh	98.60	28.92	6.93	44.08	24.26	14.62	97.9	92.92
10	Jharkhand	100	20.60	8.91	43.89	22.53	13.10	91.5	97.10
11	Karnataka	100	13.06	10.36	65.41	32.34	18.01	92.8	96.86
12	Kerala	99.50	9.51	10.91	64.12	44.24	13.67	97.3	99.86
13	Madhya Pradesh	99.98	7.55	6.27	35.90	20.76	12.74	89.6	95.85
14	Maharashtra	99.55	Null	12.42	Null	32.15	16.06	93.1	92.27
15	Manipur	95.40	Null	14.72	Null	37.79	19.37	95.9	77.14
16	Meghalaya	95.68	9.02	2.63	58.91	30.49	16.00	87.4	83.03
17	Mizoram	99.57	Null	5.43	Null	45.66	13.41	94.4	77.85
18	Nagaland	95.41	0.83	6.17	61.74	37.78	11.00	94.2	76.22
19	Odisha	99.96	24.31	7.95	35.55	25.57	11.42	88.3	89.69
20	Punjab	100	16.82	17.75	45.56	37.95	15.35	96.7	99.82
21	Rajasthan	100.04	11.49	10.09	44.59	20.47	12.88	97.2	95.43
22	Sikkim	100	35.68	3.39	28.58	39.22	13.85	95.7	93.49
23	Tamil Nadu	100	20.43	16.77	53.05	33.98	15.69	92.8	98.00
24	Telangana	100	9.76	10.34	64.18	31.68	17.66	92.5	97.25
25	Tripura	98.70	3.21	3.12	45.15	39.31	11.43	91.5	64.78
26	Uttar Pradesh	99.99	12.08	9.20	46.35	22.59	14.22	94.9	99.70
27	Uttarakhand	98.98	31.91	9.86	43.86	31.11	17.67	96.5	88.87
28	West Bengal	100	14.40	18.75	55.13	31.91	12.98	93.3	99.88
29	Andaman and Nicobar Islands	100	Null	10.03	Null	49.50	17.29	Null	37.39
30	Chandigarh	Null	2.12	10.33	90.10	75.88	27.88	Null	Null
31	Dadra and Nagar Haveli	Null	Null	52.42	Null	22.87	12.09	Null	100

	and Daman and Diu								
32	Delhi	Null	4.94	23.52	85.20	59.52	27.00	97.7	100
33	Jammu and Kashmir	99.49	8.52	8.39	61.26	28.61	12.83	97.2	93.13
34	Ladakh	98.46	Null	1.86	Null	34.34	5.91	Null	81.89
35	Lakshadweep	Null	Null	10.64	Null	50.84	7.86	Null	66.67
36	Puducherry	Null	30.39	18.48	47.12	53.42	15.88	Null	100
	India	99.70	14.34	11.42	54.18	27.75	36.40	93.3	95.08
	Target	100	25	19.66	63.26	52.98	100	100	100
Source: NITI Aayog SDG Report 2023-24									

Analyzing this table reveals a mixed performance across India's States and UTs toward SDG 9 targets. Nationally, India is nearing its 2030 goals for road connectivity (Target 1: 99.70% against 100%) and digital access (Target 7: 93.3% mobile ownership; Target 8: 95.08% 3G/4G coverage, both against 100%). However, significant shortfalls appear in industrial targets, with manufacturing GVA at 14.34% versus a 25% goal, and the Innovation Index at 36.40% against 100%.

Performance varies considerably at the sub-national level. Goa, Gujarat, and Sikkim notably surpass the manufacturing GVA target, while Arunachal Pradesh and Nagaland report minimal progress. Similarly, states like Kerala and Haryana excel in digital access, yet others like Arunachal Pradesh and Tripura lag in 3G/4G coverage. Numerous "Null" values for several States/UTs indicate data gaps or a complete lack of progress on specific indicators, highlighting the uneven developmental trajectory across the country.

6.3 Index score on performance of States & UTs

Table 3 presents index score on performance of States & UTs on indicators of SDG 9.

Table 3: Index score of States & UTs on indicators of SDG 9

S. No.	States/UTs	SDG 9 Index Score	S. No.	States/UTs	SDG 9 Index Score
1	Goa	76	19	Uttar Pradesh	53
2	Haryana	72	20	Nagaland	50
3	Kerala	69	21	Andhra Pradesh	49
4	Punjab	69	22	Odisha	48

5	Tamil Nadu	67	23	Assam	44
6	West Bengal	66	24	Meghalaya	44
7	Karnataka	62	25	Chhattisgarh	39
8	Manipur	62	26	Madhya Pradesh	39
9	Uttarakhand	62	27	Tripura	39
10	Gujarat	61	28	Arunachal Pradesh	28
11	Telangana	60	29	Puducherry	76
12	Himachal Pradesh	59	30	Delhi	75
13	Maharashtra	58	31	Jammu and Kashmir	59
14	Mizoram	55	32	Chandigarh	55
15	Sikkim	55	33	Dadra and Nagar Haveli & Daman and Diu	55
16	Bihar	53	34	Andaman and Nicobar Islands	50
17	Jharkhand	53	35	Lakshadweep	48
18	Rajasthan	53	36	Ladakh	43
	India	61			
	Target	100			

Source: NITI Aayog SDG Report 2023-24

India's overall SDG 9 Index Score is 61, indicating a moderate advancement towards the 2030 target of 100. State-level performance, however, shows significant variation. Goa, Haryana, Kerala, and Punjab lead with scores of 76, 72, 69, 69 respectively closely followed by Tamil Nadu at 67, demonstrating stronger progress in infrastructure, industry, and innovation. Conversely, Arunachal Pradesh lags considerably with a score of 28, alongside Chhattisgarh and Tripura at 39, highlighting persistent developmental gaps.

6.4 Key Government Initiatives towards SDG

A brief overview of the government schemes which has enabled India to achieve overall SDG 9 score of 61 has been presented in Table 4

Table 4: Key Programmes/Initiatives of Government of India	
S. No.	Name
1	Digital India

2	PM GatiShakti - National Master Plan for multi-modal connectivity
3	Industrial Corridor Development Programme
4	National Logistics Policy
5	North East Industrial Development Scheme (NEIDS)
6	Udyami Bharat Scheme
7	Bharatmala Project
8	PM Mega Integrated Textile Region and Apparel (PM MITRA)
9	Border Area Development Programme (BADP) (ACA)
10	Pradhan Mantri Gram Sadak Yojana (PMGSY)
11	Make in India/ Start up India
12	Ease of doing business initiatives
Source: NITI Aayog SDG Report 2023-24	

i) Digital India, launched in July 2015, dramatically increased internet connections from around 25.15 crore in 2014 to around 96.96 crore by 2024. BharatNet has made approx. 2.18 lakh Gram Panchayats service-ready with high-speed internet, and 5G now covers approx. 99.6% of districts (data through 2024–25).

ii) PM GatiShakti has integrated over 40 ministries and 36 States/UTs, utilizing more than 1,600 geospatial data layers, and evaluated over 200 big-ticket projects by 2024.

iii) The Industrial Corridor Development Programme (with origins in 2007) has seen approx. ₹9,899.9 crore sanctioned for projects. Cabinet approved 12 new industrial cities/nodes in August 2024, some with multi-thousand-crore project pipelines and significant employment potential.

iv) The National Logistics Policy established the Logistics Ease Across Different States (LEADS) performance index, the Unified Logistics Interface Platform, and a Logistics Data Bank to integrate digital logistics systems (2022–25).

v) The North East Industrial Development Scheme, notified in 2017, has sanctioned 35 projects worth ₹4,857.11 crore by November 2024.

vi) Udyami Bharat and other MSME support programs like Prime Minister's Employment Generation Programme (PMEGP) facilitated more than 22,050 projects, creating more than 1,76,400 jobs with around ₹900.23 crore in subsidies.

vii) In infrastructure, Bharatmala Pariyojana awarded more than 26,425 km of projects and constructed/under construction 19,826 km by early 2025.

viii) Pradhan Mantri Gram Sadak Yojana (PMGSY) sanctioned more than 8.25 lakh km of rural roads, with around 7.8 lakh km completed through 2024–25.

ix) The Border Area Development Programme has released more than ₹2,975.22 crore in recent fiscal years to bridge critical gaps in social and physical infrastructure in remote areas situated near the international border.

x) Make in India and Startup India initiatives collectively contributed to more than US$667.4 billion in cumulative FDI between April 2014 to March 2024. Startup India recognized more than 1.57 lakh startups, creating more than 16 lakh direct jobs by the end of 2024.

xi) PM MITRA, operationalized in 2023–24, finalized 7 park sites with a approx. ₹4,445 crore outlay, aiming to attract ₹70,000 crore investment and generate more than 20 lakh jobs.

xi) Ease of Doing Business initiatives have improved India's rankings through regulatory simplifications and digital approvals, supporting FDI and manufacturing growth.

6.5 Why some Indian States and UTs are lagging in SDG 9 achievement

Several states, particularly Bihar and those in the North-East, struggle due to a structurally weak manufacturing base. These regions exhibit low manufacturing GVA and employment shares, stemming from historical under-industrialization, limited private investment, and weak industrial clusters. Even with good road connectivity, the absence of industrial ecosystems constrains SDG 9 progress.

Another factor is services-led growth that doesn't productively absorb labour. States like Bihar, Kerala, Assam, and West Bengal have high services GVA, but this often reflects low-productivity informal services rather than high-value sectors, meaning services expansion isn't translating into innovation-driven growth.

Furthermore, innovation capacity is uneven. Most lagging states have very low innovation scores, hampered by weak R&D institutions, poor industry-academia linkages, and minimal private R&D spending, concentrating innovation ecosystems in a few metro areas.

Finally, digital access gaps in remote regions limit internet coverage. This uneven access delays the adoption of digital manufacturing, e-commerce integration, and innovation diffusion to crucial MSMEs.

6.6 Measures to accelerate India's SDG 9 progress

To accelerate India's SDG 9 progress, the policy makers need to emphasize a strategic shift from mere expansion to more purposeful and inclusive development.

One key recommendation is to move from simply building roads to creating "productive connectivity." This means transforming areas connected by roads into "rural production zones" with industrial estates and logistics hubs, linking initiatives like PMGSY and PM GatiShakti, and tying funding to tangible economic outcomes. This will convert infrastructure into a driver of economic growth.

To address low manufacturing in lagging states, a "cluster-first strategy" may be proposed. This involves identifying specific product clusters, providing shared infrastructure and testing facilities, and linking them to anchor firms. This approach aims for faster industrial development without waiting for broader economic transformation.

Innovation needs to be "democratized" beyond major cities. Establishing State Innovation Missions and district-level centres, coupled with R&D tax credits for firms in smaller cities, can foster broader innovation growth.

For services-dominated states, the focus should be on upgrading to "high-productivity, innovation-intensive services" like IT-enabled manufacturing. This involves skill development linked to industry certifications and co-locating services firms within industrial parks, turning services growth into industrial competitiveness.

Finally, closing digital and logistics gaps in remote regions through accelerated 5G/optic fibre coverage, regional logistics hubs, and incentivizing private sector involvement will ensure inclusive progress. Strengthening governance, monitoring, and linking central transfers to SDG 9 outcomes will improve accountability and execution speed.

7 Conclusion

India is steadfastly committed to achieving SDG 9, a goal critical for its aspiration of 'Viksit Bharat' by 2047. Significant strides have been made, particularly in expanding foundational infrastructure and launching impactful national initiatives like Digital India and PM GatiShakti. Still, the journey towards fully inclusive and sustainable industrialization and innovation remains complex.

Persistent challenges, such as a weak manufacturing base in several states, uneven innovation capacities, and digital access disparities in remote regions, underscore the need for a detailed approach. To truly accelerate progress, the emphasis must shift from mere infrastructure expansion to its productive utilization, from metro-centric innovation to distributed ecosystems, and from scheme-based delivery to outcome-based governance. By adopting these strategic shifts, India can ensure that SDG 9 not only drives economic growth but also fosters a more equitable, resilient, and sustainable future for all its citizens.

8 Limitation

A primary limitation of this analysis is its reliance on aggregated national and state-level data, which may obscure the context-specific challenges at the sub-district or community level. While efforts were made to highlight regional disparities, the scope of available data prevents a deeper dive into local factors, policy implementation, and informal sector dynamics that significantly influence SDG 9 outcomes. Future research could benefit from more localized, qualitative investigations to complement these findings.

References

Abiad, A., & Teipelke, R. (2017). Infrastructure provision in developing Asia’s giants: A comparative perspective on China, India, and Indonesia. Journal of Infrastructure Policy and Development, 1(1), 24. https://doi.org/10.24294/jipd.v1i1.7

Alka, T. A., Raman, R., & Suresh, M. (2024). Research trends in innovation ecosystem and circular economy. Discover Sustainability, 5(1). https://doi.org/10.1007/s43621-024-00535-5

Cheng, C. F. C., & Cantore, N. (2020). The Inclusive and Sustainable Development Index: a Data Envelopment Analysis Approach. SSRN Electronic Journal. https://doi.org/10.2139/ssrn.3698652

Chester, M., & Allenby, B. (2018). Toward adaptive infrastructure: flexibility and agility in a non-stationarity age. Sustainable and Resilient Infrastructure, 4(4), 173. https://doi.org/10.1080/23789689.2017.1416846

Davim, J. P. (2023). Sustainable and intelligent manufacturing: Perceptions in line with 2030 agenda of sustainable development. BioResources, 19(1), 4. https://doi.org/10.15376/biores.19.1.4-5

Duarte, S., Cabrita, M. do R., & Machado, V. A. C. (2023). Green Supply Chain Practices: Toward A Sustainable Industry Development. E3S Web of Conferences, 409, 1004. https://doi.org/10.1051/e3sconf/202340901004

Evans, C. B. R., Halimatussadiah, A., Kovarik, J.-B., Sanchez, J. F. M., Palhol, F., Pasquali, F., Riefky, T., Simbolon, Y. S., Starnes, M. A., Syabri, I., Wicaksono, T. Y., & Zen, F. (2021). Maintaining Resilient Infrastructure Systems in: Task Force 7 Infrastructure Investment and Financing, Policy Brief. HAL (Le Centre Pour La Communication Scientifique Directe). https://hal.science/hal-03436315

Fura, B., Karasek, A., & Hysa, B. (2024). Statistical assessment of digital transformation in European Union countries under sustainable development goal 9. Quality & Quantity, 59(1), 937. https://doi.org/10.1007/s11135-024-01972-0

Gulseven, O., Elmi, A., & Bataineh, O. (2020). The Divergence Between Industrial Infrastructure and Research Output\n among the GCC Member States. arXiv (Cornell University). https://doi.org/10.48550/arxiv.2004.11235

Lozano-Ramírez, N. E., & Garcia-Lopez, N. P. (2025). Mapping Construction 4.0 and Sustainability for Innovation in the Construction Industry of Developing Countries. 1(1). https://doi.org/10.7771/3067-4883.1512

Ma, N., Shum, W. Y., Han, T., & Cheong, T. S. (2021). Global Industrial Development: Insights From the Distribution Dynamics Approach for the Post Covid Era. Frontiers in Public Health, 9. https://doi.org/10.3389/fpubh.2021.792947

Mahato, Dr. P. K. (2025). Indian States and UTs Progress Analysis Towards Sustainable Development Goals 2030: SDG 11 Focus. ShodhPatra: International Journal of Science and Humanities, 2(9), 129. https://doi.org/10.70558/spijsh.2025.v2.i9.45356

Mai, S., Qing, L., Mehmood, U., Almulhim, A. A., & Aljughaiman, A. A. (2025). From digital advancement to SDGs disruption: How artificial intelligence without inclusion threatens sustainable development in G7 economies. Journal of Environmental Management, 394, 127411. https://doi.org/10.1016/j.jenvman.2025.127411

Mantlana, K. B., & Maoela, M. A. (2019). Mapping the interlinkages between sustainable development goal 9 and other sustainable development goals: A preliminary

exploration. Business Strategy & Development, 3(3), 344. https://doi.org/10.1002/bsd2.100

Meng, Y., & Ma, Y. (2018). Innovation Ecosystem Analysis 1986-2017: A Citation-Based Literature Survey. American Journal of Industrial and Business Management, 8(11), 2231. https://doi.org/10.4236/ajibm.2018.811149

Mosupye-Semenya, L. (2024). Comparative analysis of national innovation systems: Implications for SMEs' adoption of fourth industrial revolution technologies in developing and developed countries. Journal of Entrepreneurship Management and Innovation, 20(1), 65. https://doi.org/10.7341/20242014

Mujalde, S., & Bairagi, Ms. S. (2019). Analysis of Infrastructure Building Policies in India: Meeting SDG 9. International Journal of Trend in Scientific Research and Development, 12. https://doi.org/10.31142/ijtsrd20327

Nikam, J. (2023). Gaps, challenges and drivers for environmentally sustainable textile and garment manufacturing in India. https://doi.org/10.51414/sei2023.033

Nilsson, L. J., Bauer, F., Åhman, M., Andersson, F., Bataille, C., Can, S. de la R. du, Ericsson, K., Hansen, T., Johansson, B., Lechtenböhmer, S., Sluisveld, M. A. E. van, & Vogl, V. (2021). An industrial policy framework for transforming energy and emissions intensive industries towards zero emissions. Climate Policy, 21(8), 1053. https://doi.org/10.1080/14693062.2021.1957665

NITI Aayog. (2021). SDG INDIA Index & Dashboard 2020-21 [Report]. https://www.niti.gov.in/sites/default/files/2025-04/SDG_India_Index_2020.pdf

NITI Aayog. (2024). SDG india index report 2023-24. Government of India. https://www.niti.gov.in/sites/default/files/2024-07/SDA_INDIA_0.pdf

Prabhakar, A. C. (2024). Driving Economic Prosperity: Fostering Job-Oriented Sustainable and Inclusive Development in India. Open Journal of Business and Management, 12(4), 2854. https://doi.org/10.4236/ojbm.2024.124147

Saha, S., & Shaw, P. (2019). Revisiting Industrialisation and Innovation in India: Roadmap for SDG 9. In South Asia economic and policy studies (p. 41). Springer Nature. https://doi.org/10.1007/978-981-32-9091-4_3

Singh, S., & Ru, J. (2023). Goals of sustainable infrastructure, industry, and innovation: a review and future agenda for research. Environmental Science and Pollution Research, 30(11), 28446. Springer Science+Business Media. https://doi.org/10.1007/s11356-023-25281-5

Sinha, S., Mazwane, S., Makhura, M. N., & Toit, A. D. (2024). Sustainable Development Goal 9: Industry, innovation and infrastructure. In Edward Elgar Publishing eBooks (p. 223). Edward Elgar Publishing. https://doi.org/10.4337/9781839105449.00027

Sustainability Reporting Standards Board. (2025). Background material on sustainability & business responsibility & sustainability reporting (BRSR) (revised edition 2024). The

Institute of Chartered Accountants of India. https://sustainability.icai.org/wp-content/uploads/2025/06/Background-Material-on-Sustainability-Business-Responsibility-Sustainability-Reporting-BRSR-Revised-Edition-2024.pdf#page=88.28

The Sustainable Development Goals Report 2024. (2024). In □The □Sustainable development goals report. United Nations. https://doi.org/10.18356/9789213589755

Valls-Pasola, J., & Alvarez, J. R. (2020). Entrepreneurial and innovation ecosystems: Ibero-American perspective. Journal of Evolutionary Studies in Business-JESB, 5(1), 1. https://doi.org/10.1344/jesb2020.1.j066

Vries, G. J. de, & Erumban, A. A. (2021). Industrialization in developing countries: is it related to poverty reduction? In Working Paper Series. https://doi.org/10.35188/unu-wider/2021/112-9