

CASE STUDY

PM Gati Shakti National Mission Plan (NMP)

By: Dr. Venkateswarlu Kandimalla and Mr. Devsheesh Saxena, NeGD





Introduction

The National e-Governance Division (NeGD), under the Ministry of Electronics & Information Technology (MeitY), is at the forefront of driving the Digital India vision. A critical pillar of this mission is Capacity Building (CB), aimed at equipping government officials and stakeholders with the knowledge and skills required to implement and sustain transformative digital initiatives. This case study on the "Digitally Skilling India: The SIDH Implementation Journey" is a part of NeGD's ongoing effort to document, analyze, and disseminate best practices in e-Governance. Developed by our internal experts at the Technical Advisory Unit (TAU), this study provides a comprehensive examination of a pioneering project that leverages technology to streamline digital skilling, a significant administrative challenge. Our case studies are developed through a rigorous methodology that involves in-depth research, detailed analysis of project documents, and, most importantly, interviews with the key protagonists and stakeholders who were instrumental in the project's journey from conception to implementation. This ensures that the narratives are not only accurate but also rich with practical insights and firsthand experiences. The objective of this repository is to create a valuable knowledge asset for policymakers, project leaders, and implementers across all levels of government, facilitating learning and enabling the replication of successful models under the broader Digital India umbrella.

Acknowledgment

The Capacity Building Division, NeGD, extends its sincere gratitude to **Dr. Venkateswarlu Kandimalla** from the Technical Advisory Unit (TAU)/CB for authoring this insightful and detailed case study.

We are deeply thankful to the officials of the Ministry of Commerce and Industry, the nodal ministry through its Department for Promotion of Industry and Internal Trade (DPIIT), and to BISAG-N, which plays a critical role in the PM Gati Shakti National Master Plan (NMP) by serving as the technical developer and data integrator for the platform, providing end-to-end geospatial and IT solutions.

The insights were helpful in capturing the journey of the PM Gati Shakti National Master Plan (NMP).

Furthermore, we extend our thanks to the internal experts at NeGD who meticulously reviewed this document, ensuring its alignment with our pedagogical standards and its value as a tool for capacity building.

Disclaimer

This case study has been developed by the National e-Governance Division (NeGD) under its Capacity Building mandate for the purpose of knowledge sharing and academic reference. The information presented herein has been compiled from official government sources, project documents, and interviews with relevant stakeholders involved.

While every effort has been made to ensure the accuracy and reliability of the information, this document is intended for educational and illustrative purposes only. It should not be interpreted as an official policy statement or a guideline for implementation. The views and conclusions expressed are those of the author and contributors based on their analysis and do not necessarily reflect the official position of the Ministry of Electronics & Information Technology (MeitY) or the National e-Governance Division (NeGD).

The commercial use of this material is strictly prohibited. This case study is meant to be used as a learning tool for government officials, trainees, and individuals interested in e-Governance and public policy.

Any reproduction or use of this material must include proper attribution to 'National e-Governance Division (NeGD).' All intellectual property rights remain with NeGD unless otherwise specified.

Leveraging Technology for Infrastructure Development: A Case Study of PM GatiShakti

Executive Summary

The PM Gati Shakti National Master Plan (NMP), launched on October 13, 2021, by the Prime Minister of India, is a transformative initiative designed to revolutionize India's infrastructure development. This ambitious plan addresses longstanding challenges such as fragmented planning, lack of inter-agency coordination, project delays, and high logistics costs, which account for approximately 13–14% of India's GDP. By fostering integrated, multimodal, and digitally enabled planning, the initiative aims to enhance India's global competitiveness and support its journey toward becoming a \$5 trillion economy. The plan breaks down bureaucratic silos by uniting Central Ministries, State Governments, and implementing agencies on a unified digital platform, ensuring seamless coordination for infrastructure planning, development, and execution.

At its core, PM Gati Shakti NMP comprises two key components: a digital platform and an institutional framework. The digital platform, a Geographic Information System (GIS)-based tool hosted by BISAG-N, integrates over 1,400 data layers from more than 44 Ministries and Departments, covering critical infrastructure such as roads, railways, ports, airports, power lines, telecom towers, and land use. This platform enables real-time data sharing, advanced route planning, terrain analysis, faster land acquisition, and identification of infrastructure gaps and redundancies. The institutional framework supports effective implementation through a three-tier governance structure: the Empowered Group of Secretaries (EGOS) provides policy direction, the Network Planning Group (NPG) evaluates projects based on GatiShakti principles, and the Technical Support Unit (TSU) offers analytical and technical expertise.

The initiative focuses on achieving key objectives to transform India's infrastructure landscape. It seeks to enhance multimodal and last-mile connectivity for infrastructure and industrial nodes, synchronize projects across Ministries and States, and expedite approvals through transparency. Additionally, it supports the development of economic zones, logistics parks, and urban-rural integration while aligning with the National Infrastructure Pipeline (NIP) and National Logistics Policy (NLP). The plan covers critical sectors, including highways, railways, airports, ports, waterways, oil and gas pipelines, telecommunications, urban infrastructure, and energy transmission, ensuring a holistic approach to infrastructure development.

PM Gati Shakti NMP delivers significant benefits and outcomes that align with India's long-term economic goals. It aims to reduce logistics costs to global standards (approximately 8% of GDP), accelerate project implementation through integrated approvals, and avoid duplication in infrastructure creation. The initiative enhances the efficiency of cargo and passenger movement, boosts global competitiveness, and supports flagship programs such as Make in India, Atmanirbhar Bharat, and India@2047. Furthermore, it empowers States and Union Territories to make evidence-based policy decisions by leveraging the digital platform

for district-level infrastructure planning. By positioning infrastructure as a driver of economic growth, PM Gati Shakti NMP ensures greater efficiency, accountability, and transparency in public investment, paving the way for India's emergence as a global economic powerhouse.

Background

India's rapid economic growth and urbanization over the past two decades have significantly increased the demand for robust infrastructure. However, systemic challenges have consistently impeded progress. Fragmented planning has been a major hurdle, with Ministries and Departments operating in silos, often overlooking the need for multimodal connectivity. This lack of coordination has resulted in misaligned project timelines, duplicated infrastructure efforts, and inefficient resource utilization, leading to substantial wastage of public funds. Infrastructure projects frequently face delays and cost overruns due to prolonged approval processes, complex land acquisition procedures, and regulatory bottlenecks. Additionally, India's logistics costs, ranging from 13–14% of GDP, far exceed global benchmarks of 8–9%, driven by inefficiencies in transportation, warehousing, and connectivity. The absence of digital tools for real-time data sharing and spatial analysis has further slowed decision-making, highlighting the urgent need for a transformative, technology-driven approach to infrastructure planning and execution.

In response, the Government of India launched the PM Gati Shakti NMP to align infrastructure development with national priorities such as the National Infrastructure Pipeline (NIP), Make in India, and Atmanirbhar Bharat. A key challenge was the lack of a unified platform to facilitate cross-sectoral coordination, as Ministries operated without integrated data-sharing mechanisms. PM GatiShakti NMP was envisioned to address this as a whole-of-government initiative, shifting from isolated, project-based planning to a cohesive, network-level approach. The Bhaskaracharya National Institute for Space Applications and Geo-informatics (BISAG-N) was tasked with developing a state-of-the-art GIS platform, integrating data from over 44 Ministries to enable spatial and temporal planning.

Drawing inspiration from global best practices, such as the integrated digital frameworks used in countries like China and Germany, PM GatiShakti NMP adapts these models to India's federal structure and economic goals. PM GatiShakti creates a networked ecosystem that supports industrial growth, rural-urban connectivity, export competitiveness, and sustainable development, positioning India for long-term economic success.

Problem Statement

India's infrastructure development has long been constrained by systemic inefficiencies that undermine economic growth and global competitiveness. A fragmented approach to planning and implementation has led to persistent challenges, including poor coordination, redundant investments, project delays, and underutilized assets. These issues have driven up logistics costs, limited connectivity, and weakened the efficiency of goods and services delivery, both domestically and internationally. The lack of integrated planning has resulted in Ministries and Departments operating in isolation, creating disconnected infrastructure networks. This siloed approach has caused significant gaps in connectivity, inefficiencies in logistics, and suboptimal service delivery across sectors.

The absence of a centralized digital platform for real-time data sharing and project coordination has further compounded these problems, leading to delays in approvals, redundant efforts, and planning mismatches. High logistics costs, ranging from 13–14% of India’s GDP compared to the global benchmark of 8–9%, have eroded the competitiveness of Indian exports and increased domestic costs. Infrastructure projects also frequently face delays due to challenges in land acquisition, regulatory bottlenecks, and inadequate inter-agency alignment. Moreover, poor multimodal integration has resulted in underutilized assets, such as ports lacking efficient road or rail connectivity and airports with limited cargo access. Limited last-mile and rural connectivity further exacerbate these challenges, leaving economic zones, industrial clusters, and remote areas inadequately linked to broader infrastructure networks. This has hindered regional development and inclusive growth, particularly in underserved regions.

These systemic barriers underscore the critical need for a unified, data-driven, and collaborative approach to infrastructure development precisely what the PM Gati Shakti National Master Plan aims to deliver.

The major issues facing in infra projects has been given in below figure.



Fig. Major problems facing infrastructure sector

Objectives Of PM Gatishakti NMP

The PM Gati Shakti National Master Plan (NMP), launched to transform India’s infrastructure landscape, aims to create a cohesive, technology-driven, and integrated framework for infrastructure development. By addressing inefficiencies and fostering collaboration, it seeks to enhance economic growth, connectivity, and sustainability. The objectives outlined below reflect the initiative’s core goals, while the future plans highlight its vision for long-term impact and scalability.

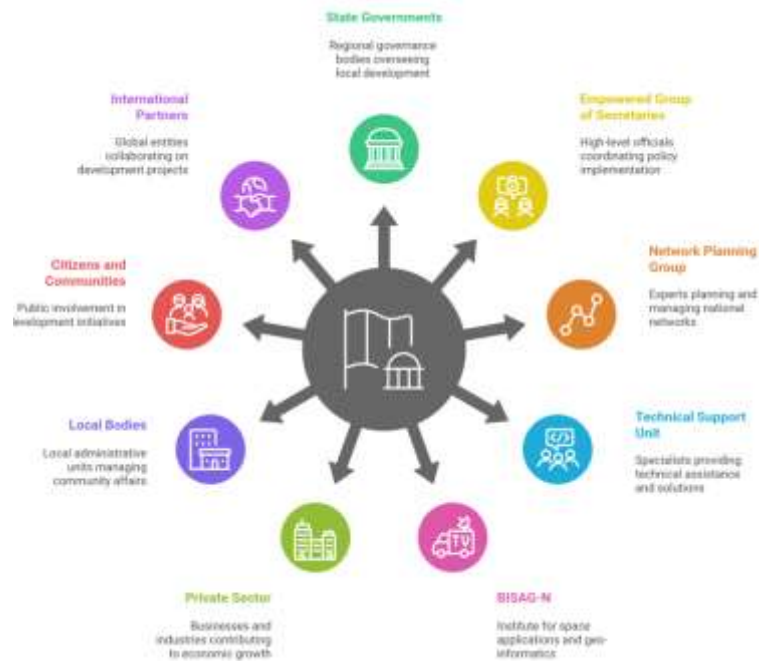
- a) The initiative prioritizes enhancing multimodal connectivity by integrating transportation modes such as roads, railways, airways, waterways, and pipelines to ensure seamless movement of goods and people. A key focus is improving last-mile connectivity to economic zones, industrial parks, ports, and logistics hubs, strengthening supply chains and supporting industrial growth.
- b) Breaking departmental silos is another critical objective, achieved through a "Whole-of-Government" approach that synchronizes planning and execution across ministries and departments. The unified digital platform facilitates collaborative decision-making, ensuring alignment and minimizing inefficiencies in infrastructure projects.
- c) Reducing logistics costs and improving efficiency is a cornerstone of the initiative, targeting a reduction from approximately 14% of GDP to the global benchmark of around 8%. This involves streamlining cargo movement, minimizing transportation time, and eliminating bottlenecks to enhance India's global competitiveness.
- d) Accelerating infrastructure project implementation is a key goal, addressing delays caused by coordination gaps, land acquisition challenges, and regulatory hurdles. The GatiShakti digital platform enables real-time monitoring and faster approvals, ensuring timely project delivery.
- e) Optimizing infrastructure investments is central to the plan, focusing on identifying critical gaps and eliminating duplicative efforts. By leveraging data-driven insights, the initiative ensures efficient resource allocation and maximizes the impact of public investments through complementary project planning.
- f) The initiative drives industrial and economic growth by enhancing connectivity to industrial corridors, manufacturing clusters, and logistics hubs. By supporting initiatives like Make in India and improving ease of doing business, it fosters a conducive environment for economic expansion and global competitiveness.
- g) Promoting inclusive and sustainable development is a priority, ensuring infrastructure reaches underserved regions, including tribal and hilly areas. The plan emphasizes environmentally sustainable practices, balancing development with ecological considerations through informed planning.
- h) Leveraging advanced technology for smart governance is a key objective, utilizing GIS-based mapping, satellite data, and analytics for real-time decision-making. A dynamic digital dashboard provides transparency into project status and interlinkages, enhancing accountability and efficiency.
- i) As stated before, the initiative enables evidence-based, data-driven planning by providing Ministries, States, and local bodies with comprehensive data layers on terrain, land use, population, and economic zones. This supports transparent and scientific decision-making for infrastructure development.
- j) Institutionalizing coordinated governance is achieved through robust structures like the Empowered Group of Secretaries (EGOS), Network Planning Group (NPG), and State Monitoring Committees. These ensure continuous collaboration across administrative levels, driving effective implementation.
- k) Looking ahead, the future for PM GatiShakti NMP include expanding the digital platform's capabilities by integrating advanced technologies like artificial intelligence and machine learning to enhance predictive planning and optimize resource allocation. The initiative aims to deepen State and District-level adoption, enabling localized infrastructure planning to address regional needs. It will focus on developing new multimodal corridors, smart logistics parks, and green infrastructure to align with

India's sustainability goals. Additionally, the plan seeks to strengthen public-private partnerships to attract investment and accelerate project execution.

Stake Holders and Responsibilities

The PM Gati Shakti National Master Plan (NMP) involves a diverse set of stakeholders collaborating to achieve integrated infrastructure development in India. Each stakeholder plays a critical role in ensuring data-driven planning, seamless coordination, and efficient execution, aligning with the initiative's vision of transforming India's infrastructure landscape to support economic growth, inclusivity, and global competitiveness. The list of stakeholders has been given below figure some are directly responsible some are indirectly responsible.

- Central Government Ministries
- State Governments and Union Territories
- Empowered Group of Secretaries (EGOS)
- Network Planning Group (NPG)
- Technical Support Unit (TSU)
- Bhaskar Acharya National Institute for Space Applications and Geo-informatics (BISAG-N)
- Private Sector and Industry
- Local Bodies and District Administrations
- Citizens and Communities
- International Partners and Financial Institutions



- Central Government Ministries are Primary planners and implementers of infrastructure projects. Over 44 Ministries align projects with PM Gati Shakti principles. The main responsibilities are providing data layers (e.g., roads, railways,

power lines, telecom networks) for the GIS-based digital platform, synchronize project planning and execution to ensure multimodal connectivity, participate in joint planning through the Network Planning Group (NPG) for project evaluation and ensure timely approvals and clearances to minimize delays. The responsibilities have been given in below figure.



Fig. Responsibilities of Central Government Ministries and Departments

- b) State Governments are key partners in implementing infrastructure projects at the regional and local levels, ensuring alignment with national goals. The responsibilities are utilizing the PM Gati Shakti digital platform for State and District-level infrastructure planning, Identify and address connectivity gaps in economic zones, industrial clusters, and rural areas, contribute state-specific data (e.g., land use, local infrastructure) to the GIS platform and establish State Monitoring Committees to oversee project implementation and coordination with the Central Government. The State Government responsibilities have been given in below figure.



Fig. Responsibilities of State Government and Union Territories

- c) Empowered group of secretaries provides strategic oversight and policy direction for the PM Gati Shakti NM. The primary responsibilities are formulating policies to support integrated infrastructure development, resolve inter-ministerial conflicts and ensure alignment with national priorities, oversee the implementation of recommendations from the Network Planning Group and Monitor progress and ensure adherence to the initiative's objectives. The EGOS responsibilities have been given in below figure.



Fig. Responsibilities of Empowered Group of Secretaries.

- d) Network Planning Group acts as the technical and planning backbone, evaluating projects for alignment with PM Gati Shakti principles. The primary responsibilities in Implementation of PM Gati Shakti NMP comprises of planners from various infrastructure Ministries to assess project proposals, ensure projects promote multimodal connectivity and optimize resource utilization, identify gaps, redundancies, and opportunities for infrastructure synergy and provide recommendations to EGOS for policy and project approvals. The NPG responsibilities have been given in below figure.



Fig. Responsibilities of Network Planning Group

- e) Technical Support unit provides analytical and technical expertise to support project planning and execution. The responsibilities of technical support group are conduct advanced analytics, including GIS-based spatial analysis and route optimization, assist Ministries and States in leveraging the digital platform for data-driven planning, support the identification of critical infrastructure gaps and solutions and provide technical guidance for seamless project implementation. The TSU responsibilities have been given in below figure.

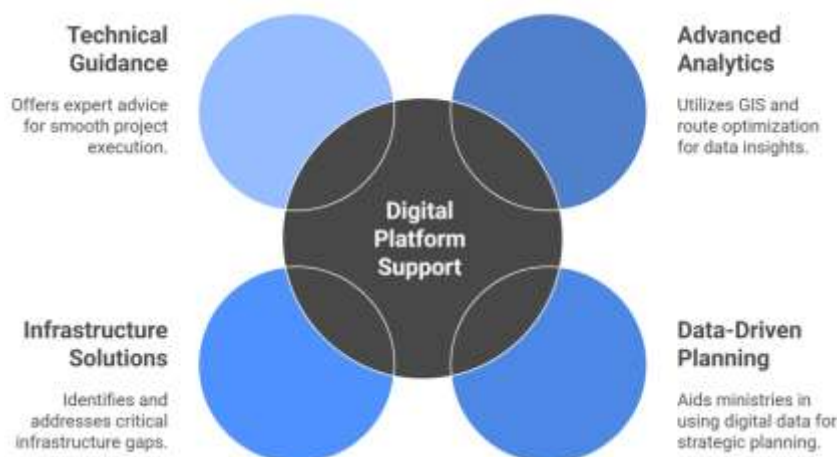


Fig. Responsibilities of Technical Support Unit

- f) BISAG-N is nodal agency and technology partner responsible for developing and maintaining the Gati Shakti GIS based digital platform. It provides geospatial data layers, analytical tools, and real-time project visualization to all users and develops and maintains the GIS-based digital platform of PM Gati Shakti NMP portal. The Primary responsibilities are integrated over 1,400 data layers from ministries and states into the

digital platform, ensure real-time data availability for planning, monitoring, and decision-making, provide technical support for geospatial mapping, satellite data integration, and analytics and enable user-friendly access to the platform for stakeholders across administrative levels. The BISAG-N responsibilities have been given in below figure.

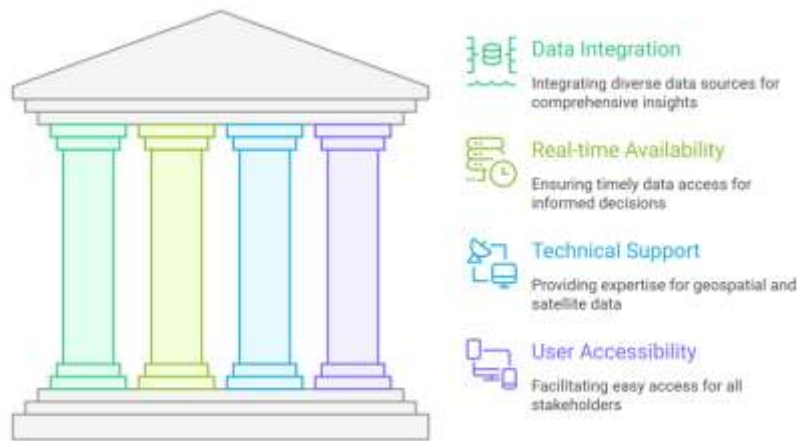


Fig. Responsibilities of BISAG-N

- g) Private sector and industry are partners in infrastructure development, particularly through public-private partnerships (PPPs) and investments in economic zones and logistics hubs. The responsibilities are collaborated with the Government to develop industrial corridors, logistics parks, and smart cities. Provide inputs on industry-specific infrastructure needs (e.g., manufacturing, logistics), invest in and execute projects aligned with PM Gati Shakti's connectivity goals and leverage the digital platform for site selection and project planning. The private sector and industry responsibilities have been given in below figure.



Fig. Responsibilities of Private Sector and Industry

- h) Local bodies and District administrations are supporting last-mile connectivity and localized infrastructure planning. The major responsibilities are implementing District-level infrastructure projects in alignment with state and national plans, provide granular data on local infrastructure, land use, and connectivity needs, facilitate land acquisition and local clearances for infrastructure projects and ensure rural and underserved areas

are integrated into the broader infrastructure network. The local bodies and district administrations responsibilities have been given in below figure.



Fig: Responsibilities of District Administrations and Local Bodies

- i) Citizens and communities are indirect stakeholders who benefit from improved infrastructure and connectivity. The responsibilities are providing feedback on infrastructure needs, particularly in rural and underserved areas, benefit from enhanced access to economic opportunities, services, and connectivity and participate in public consultations for projects impacting local communities. The citizens and communities' responsibilities have been given in below figure.



Fig: Responsibilities of Citizens and Communities

- j) International partners and financial institutions are supporting the initiative through funding, technical expertise, and global best practices. The responsibilities are providing financial support for large-scale infrastructure projects (e.g., through multilateral agencies like the World Bank or Asian Development Bank), share expertise in integrated planning and multimodal connectivity based on global models and facilitate technology transfers and capacity building for sustainable infrastructure

development. International partners and financial institutions responsibilities have been given in below figure.

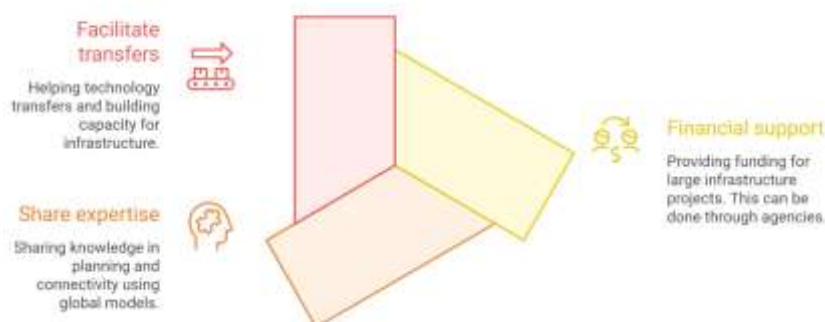


Fig: Responsibilities of International partners and financial institutions

Approach And Methodology

The PM Gati Shakti National Master Plan (NMP) adopts a structured, technology-driven, and collaborative approach to execute infrastructure projects in India. Its methodology is designed to address systemic challenges such as fragmented planning, high logistics costs, and project delays by fostering integration, efficiency, and data-driven decision-making. Below is a detailed outline of the principles and guiding pillars for the execution of PM Gati Shakti. The six principles of PM Gati Shakti are the guiding philosophies that underpin the approach to planning and implementing the initiative. These principles focus on the methodology and strategic framework for achieving integrated infrastructure development. The principles are Integrated development, Multimodal Infra structure, Last mile connectivity, Reduced Ecological Impact, Expedited Land Acquisition and Minimized Clearances etc. These principles guide how the PM Gati Shakti plan is conceptualized and executed, emphasizing a systematic, integrated, and technology-driven approach. The Six Principles has been given in below figure.

- a) **Integrated Development:** Promoting a unified approach to infrastructure planning by converging efforts across ministries, states, and sectors to ensure seamless connectivity.
- b) **Multi-Modal Infrastructure:** Developing interconnected infrastructure across road, rail, air, and waterways to create a robust multimodal transport network.
- c) **Last-Mile Connectivity:** Ensuring connectivity to the farthest and most remote areas to integrate them into the economic mainstream, particularly for industrial and economic zones.
- d) **Reduced Ecological Impact:** Incorporating sustainability by minimizing environmental disruptions through efficient planning and execution of infrastructure projects.
- e) **Expedited Land Acquisition:** Streamlining processes for acquiring land for infrastructure projects to reduce delays and ensure timely implementation.
- f) **Minimized Clearances:** Simplifying and fast-tracking regulatory and environmental clearances to accelerate project execution while maintaining compliance.

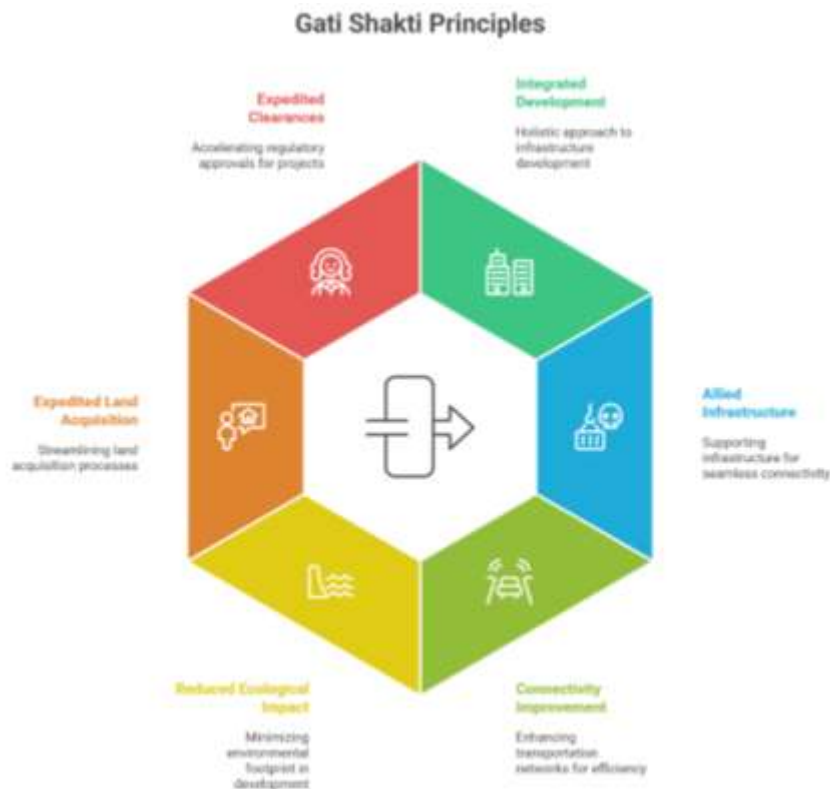


Fig. Guiding Principles of PM Gati Shakti NMP

The six pillars of PM Gati Shakti refer to the key focus areas or objectives that the initiative aims to achieve. These are the core outcomes or components of the plan; these pillars represent the tangible goals and focus areas that PM Gati Shakti targets to transform India's infrastructure landscape and boost economic growth. The Six Pillars has been given in below figure.

- a) **Comprehensiveness:** This principle focuses on integrating all existing and planned initiatives of various Ministries and Departments into a centralized digital platform. It ensures that every department has visibility into each other's activities, providing critical data for planning and executing projects in a holistic manner. This breaks the silos of departmentalism by mapping economic zones and infrastructure on a single portal.
- b) **Prioritization:** By enabling cross-sectoral interactions, this principle allows different departments to prioritize their projects effectively. It ensures that projects are aligned based on their importance and interdependencies, reducing delays and optimizing resource allocation.
- c) **Optimization:** The National Master Plan assists in identifying critical infrastructure gaps and selecting the most efficient routes for transporting goods and services, minimizing time and cost. This principle emphasizes creating an efficient logistics network to enhance competitiveness.
- d) **Synchronization:** This principle addresses the issue of ministries and departments working in silos, which often leads to delays. PM GatiShakti ensures synchronized planning and implementation across departments and governance levels, fostering coordination to expedite project execution.

- e) **Analytical:** The plan leverages GIS-based spatial planning and analytical tools with over 200 data layers to provide comprehensive data in one place. This enables executing agencies to make data-driven decisions, improving transparency and efficiency in project planning and monitoring.

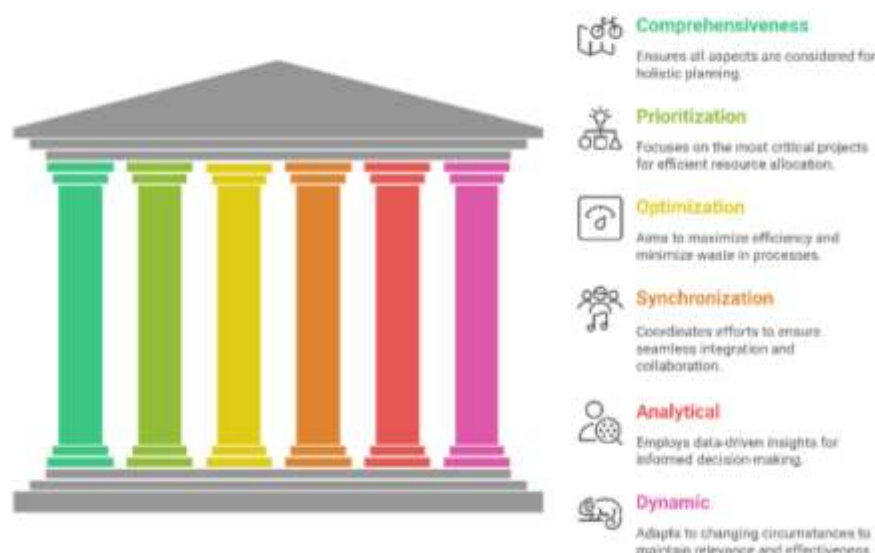


Fig. Guiding Pillars of PM Gati Shakti NMP

The methodology of PM Gati Shakti NMP is structured around four components 1) a digital platform for planning and monitoring 2) Institutional Framework for coordination 3) cross sector and multimodal integration and 4) tools and technologies for effective execution. The Broad methodology is outlined as follows:

- 1) **Digital Platform for Planning and Monitoring:** It is a GIS-Based Platform hosted by the BISAG-N. The key functions are Consolidates real-time data to provide a comprehensive view of existing and planned infrastructure. Uses geospatial analysis to identify optimal routes for roads, railways, and pipelines, minimizing costs and environmental impact. Detects connectivity gaps (e.g., missing links to industrial clusters) and proposes targeted solutions. Provides dynamic dashboards to track project progress, identify bottlenecks, and ensure timely interventions. Streamlines approvals by integrating data on land acquisition, environmental clearances, and regulatory requirements. The execution process is for Stakeholders access the platform to visualize interdependencies and plan projects collaboratively. Data-driven insights guide site selection, project prioritization, and resource allocation and Continuous updates ensure the platform reflects current infrastructure status and needs.
- 2) **Institutional Framework for Coordination:** EGOS sets policy guidelines and approves major projects based on NPG recommendations assesses project proposals, ensuring they address connectivity gaps and optimize resources. TSU provides

technical inputs, such as route optimization and gap analysis, to support project execution and State committees coordinate with local bodies to implement district-level projects and facilitate land acquisition and clearances.

- 3) **Cross-Sectoral and Multimodal Integration:** Projects are planned to ensure synergy across sectors (e.g., aligning highway development with railway corridors and port connectivity). Focus on multimodal hubs, such as integrated logistics parks, to streamline cargo and passenger movement and Last-mile connectivity is prioritized to link economic zones, industrial clusters, and rural areas to broader networks. The execution process for use the GIS platform to map interdependencies between sectors (e.g., ensuring power lines support new industrial hubs). Coordinate timelines across ministries to avoid delays (e.g., synchronizing road and rail projects and Implement projects in phases, prioritizing high-impact areas like industrial corridors and economic zones.
- 4) **Tools and Technology Used:** BISAG-N employs a robust suite of tools and platforms, including GIS software, satellite imagery, remote sensing, GNSS, AI, and open-source technologies, to develop the PM GatiShakti NMP portal and facilitate data collection, by integrating geospatial and information science systems, BISAG-N ensures the portal is a comprehensive, scalable, and cost-effective solution for infrastructure planning. The combination of satellite-based data, stakeholder inputs, and advanced analytics enables the platform to support integrated, data-driven decision-making, driving the success of PM Gati Shakti's vision for a connected and competitive India. The core of the PM GatiShakti portal is a GIS-based platform that integrates spatial and non-spatial data for infrastructure planning. GIS Software, Remote Sensing and Photogrammetry, Global Navigation Satellite System (GNSS), Satellite Communication and Imagery, Satellite Data Processing Tools and SATCOM Network geospatial technologies have been used in PM Gati shakti NMP portal development and execution.

To manage and integrate large-scale datasets, BISAG-N employs Management Information Systems (MIS), Enterprise Resource Planning (ERP) and Web Technologies information science tools for efficient data handling and system integration. BISAG-N emphasizes cost efficiency by leveraging open-source solutions such as Open-Source GIS Platforms, Database Management Systems, Artificial Intelligence (AI) and Machine Learning (ML) and Custom Software Development for portal development. BISAG-N employs advanced front-end technologies to provide user-friendly interfaces for the PM GatiShakti portal, enabling stakeholders to visualize and interact with geospatial data effectively. Facilitates map-based decision-making for over 1,400+ GIS data layers, allowing ministries, states, and districts to view infrastructure alignments (e.g., highways, railways, pipelines) technologies used are JavaScript frameworks like Leaflet.js or Open Layers for interactive map rendering, integrated with HTML5 and CSS3 for responsive design for Real-time data visualization layered geospatial mapping, and user-friendly dashboards for monitoring project progress.

The Custom Web Portals developed using Modern JavaScript libraries for dynamic, single-page applications, to ensuring seamless user experiences across devices and to supports stakeholder access to the NMP portal, including State Master Plan (SMP) and District Master Plan (DMP) portals. BISAG-N's back-end

infrastructure supports the processing, storage, and integration of vast geospatial datasets, ensuring scalability and real-time GIS database management, server-side processing and API integration. GIS data management technologies used PostgreSQL with PostGIS extension for geospatial data storage and querying, or similar robust database systems for supporting spatial queries, data conversion, and integration of multi-source data (e.g., ISRO satellite imagery, ministry inputs). The server-side processing Programming languages like Python (with libraries like GDAL or GeoPandas) or Java for server-side logic, integrated with GIS servers like GeoServer or ArcGIS Server have been used for handles data migration, format translation, and real-time analytics for infrastructure planning.

For API integration RESTful APIs or GraphQL, built with frameworks like Node.js, Django, or Spring Boot technologies used for facilitates interoperability among ministries and state agencies, supporting real-time data updates. BISAG-N leverages cloud infrastructure to ensure scalability, accessibility, and security for the PM Gati Shakti platform's geospatial data and applications. The technologies Microsoft Azure, AWS, or NIC Cloud (under MeitY) has been used for scalable storage for large-scale geospatial data, high-performance computing for real-time analytics, and secure access controls. For data storage and processing cloud-based storage solutions (e.g., Amazon S3, Azure Blob Storage) and big data tools like Apache Hadoop or Spark has been used for processing large-scale geospatial data to supports data versioning, backup, and real-time integration with state and ministry databases. AI and ML integration Cloud-based AI/ML frameworks like TensorFlow or PyTorch hosted on scalable cloud environments for enables advanced analytics, such as terrain modeling and risk assessment, integrated with GIS data.

PM Gatishakti Portal Overview

It is a Geospatial Information System (GIS)-based decision support system that integrates data from various ministries and departments to enable coordinated infrastructure planning and execution across India. The portal has been developed BISAG-N under the guidance of the Ministry of Commerce and Industry, particularly the Logistics Division. The Access is role-based and permission-controlled, ministries, departments, and state governments are provided login-based access and training is provided through BISAG-N and the capacity building commission for effective usage. The platform is integrated with LOGI SAGAR, ULIP, and other logistics/transport data platforms. Key Functions and Portal Users shown below table 1 and 2

TABLE.1 KEY FUNCTIONS OF THE PM GATISHAKTI PORTAL

S. No	Function	Details
1	Integrated Planning	Brings together data from over 30 central ministries/departments and states on a single platform for holistic infrastructure planning.

2	GIS-Based Mapping	Offers multi-layered geospatial data (railways, roads, waterways, power lines, forests, etc.) to support evidence-based decision-making.
3	Project Coordination	Facilitates synchronized planning between different agencies to avoid duplication, reduce costs, and optimize resource allocation.
4	Infrastructure Gap Identification	Helps identify missing infrastructure and bottlenecks for improving connectivity to economic and social nodes.
5	Real-Time Data Access	Allows dynamic monitoring of project status and field data by integrating various dashboards and MIS systems.
6	Location Intelligence	Provides analytical tools to assess terrain, environmental sensitivity, existing connectivity, etc., before project finalization.
7	Logistics Efficiency Improvement	Aims to improve multimodal logistics and reduce India's logistics cost by ensuring last-mile and first-mile connectivity.

TABLE 2.PM GATISHAKTI PORTAL USERS

S.NO	User Group	Role in Using the Portal
1	Central Ministries & Departments	Use the platform to plan, align, and track infrastructure projects like roads, railways, ports, pipelines, etc.
2	State Governments	Align state-level infrastructure planning with national priorities using real-time data and avoid duplication.
3	Nodal Ministries (e.g., Railways, MoRTH, MoPNG)	Key actors in infrastructure creation and inter-ministerial coordination for multimodal connectivity.
4	Infrastructure Project Developers (Public Sector)	Use geospatial layers for route alignment, feasibility studies, and inter-agency clearances.
5	Planning & Monitoring Agencies (NITI Aayog, MoSPI)	Use data for strategic planning, performance tracking, and infrastructure gap studies.
6	Private Sector (Limited Access)	May have conditional access for logistics planning, connectivity proposals, or PPP projects.
7	Policy Makers & Analysts	Use insights and visualizations from the portal for policy design and impact evaluation.

Challenges Faced

The below challenges focus the need for enhanced coordination, capacity building, and policy reforms to ensure effective implementation of PM GatiShakti.

- a) Seamless coordination among Ministries is hindered by legacy workflows, differing mandates, and overlapping responsibilities. Example: Delays in aligning railway project timelines with highway expansions due to conflicting priorities.
- b) State and District officials often lack training in GIS and digital tools, limiting effective use of the GatiShakti portal. Example: Rural states struggle with geospatial platform adoption due to limited exposure.
- c) Incomplete or outdated data layers and lack of real-time integration with state databases lead to poor planning. Example: Inconsistent forest land or utility line data disrupts project alignment.
- d) Delays in land acquisition and environmental approvals, outside the platform's scope, impede progress. Example: Highway projects stall due to pending forest clearances despite portal alignment.
- e) Confidentiality concerns, especially in defence and telecom, restrict data sharing, limiting planning depth. Example: Restricted access to high-resolution datasets hampers state-level planning.
- f) Institutional inertia and reluctance to adopt digital tools slow cultural shifts. Example: Lack of incentives for departments to embrace GatiShakti processes.
- g) Absence of standardized outcome-based KPIs (e.g., reduced travel time) limits impact assessment. Example: Monitoring focuses on completion status rather than tangible benefits.
- h) Policy hurdles and lack of awareness deter private investment in logistics infrastructure. Example: Limited private engagement in multimodal logistics parks despite ULIP benefits.
- i) Confusion over project ownership and misaligned priorities cause delays. Example: Resource competition between urban bodies and state departments.
- j) Focus on national corridors overshadows rural and Gram Panchayat-level integration, limiting last-mile connectivity. Example: Slow progress in incorporating rural infrastructure into the plan.

Learnings & Outcomes in Implementation of NMP

The key learnings underscore the importance of integration, technology, and stakeholder engagement for successful infrastructure planning and execution under PM GatiShakti.

- a) Collaborative planning across departments reduces duplication and enhances project synergy. Example: Coordinated highways, rail, and logistics hubs near industrial parks cut costs and optimize alignment.
- b) GIS-based platforms and real-time data enable evidence-based planning, allowing dynamic adjustments. Example: Early detection of alignment conflicts using geospatial data saves time and resources.
- c) Seamless integration of transport modes (road, rail, air, waterways) reduces logistics costs and delays. Example: Enhanced rail-road connectivity to ports has lowered container dwell time and boosted throughput.
- d) Structures like EGOS, NPG, and State Monitoring Committees ensure alignment and resolve conflicts. Example: NPG scrutiny for projects above ₹500 crore aligns them with national priorities.
- e) Tools like ULIP and Logistics Data Bank enhance cargo tracking and supply chain transparency, supporting monitoring and citizen engagement.

- f) Training State and District officials in geospatial tools and planning maximizes platform use. Example: State-level technical support units have improved adoption.
- g) Involving private sector, states, and local bodies ensures practical plans. Example: Early input from end-users enhances project design.
- h) Early integration of clearances and utility shifts prevents delays. Example: Synchronized timelines across ministries avoid interdependency issues.
- i) Customizing national plans with local data (e.g., rural roads) enhances regional relevance and accuracy.
- j) Dashboards and KPIs ensure transparency and enable timely corrections by tracking bottlenecks.

The Key Outcomes of PM Gatishakti NMP

- a) PM GatiShakti has integrated infrastructure schemes like Bharatmala (highways), Sagar Mala (ports), UDAN (aviation), and inland waterways, improving seamless movement of goods and people. This has reduced logistics costs and enhanced efficiency. Example: Improved rail-road connectivity to ports has reduced container dwell time and increased throughput, boosting trade efficiency.
- b) The platform has brought together 44 Central Ministries and 36 States/UTs, synchronizing planning and execution with over 1,600 GIS-based data layers. This has minimized delays caused by siloed operations. Over 200 big-ticket infrastructure projects have been evaluated by the Network Planning Group (NPG), ensuring alignment with national priorities like last-mile connectivity and multimodal infrastructure.
- c) Aligned with the National Logistics Policy, PM GatiShakti has contributed to India's improved ranking in the World Bank's Logistics Performance Index, moving from 44th in 2018 to 38th in 2023, reflecting better logistics efficiency. Example: Streamlined planning for logistics hubs has reduced transportation bottlenecks, lowering costs for businesses.
- d) All 36 States/UTs have developed State Master Plan (SMP) portals aligned with the NMP, mapping over 533 state-level projects. This has enhanced regional infrastructure development. The platform has expanded to 27 aspirational districts, with plans to cover 750 districts, improving local-level planning and last-mile connectivity.
- e) The initiative has extended to social sector ministries, addressing gaps in schools, hospitals, and Anganwadi's through GIS-based planning. This ensures infrastructure development reaches underserved areas. Example: Enhanced planning for primary healthcare and education facilities in remote regions.
- f) The GIS platform, powered by ISRO imagery and BiSAG-N tools, provides over 200 data layers for real-time project monitoring and decision-making. This has reduced cost overruns and delays by enabling dynamic adjustments. Example: Early identification of alignment conflicts using geospatial data has saved time and resources.
- g) PM GatiShakti has improved connectivity to economic zones like textile clusters, pharmaceutical hubs, and defence corridors, enhancing India's global competitiveness. Example: Integrated planning for industrial corridors has attracted investments and boosted manufacturing.
- h) Over five regional workshops have facilitated knowledge sharing and best practices across States/UTs, strengthening local adoption. Training programs by DPIIT have equipped officials with skills to use the GIS platform effectively.

- i) The GatiShakti model has been showcased to 30 countries at forums like UNESCAP and the Asia Pacific Business Forum, highlighting its innovative approach to infrastructure planning.
- j) The platform promotes green infrastructure and sustainable logistics, aligning with India's Net Zero by 2070 goals. GIS tools help identify degraded lands for redevelopment, reducing environmental impact.

Successfully Completed Projects

Some of the successfully completed projects using PM Gati shakti NMP has been given below.

- a) **Pushkar-Merta Railway Line (Rajasthan):** It is a broad-gauge railway line connecting Pushkar and Merta, aimed at providing direct connectivity between Central India, the western border, and Northern India. The project, valued at ₹799.64 crore, was evaluated by the Network Planning Group (NPG) under PM Gati Shakti. It has eased congestion, reduced highway traffic, and improved regional connectivity. The GIS-based platform ensured synchronized planning with other infrastructure, such as highways, to avoid alignment conflicts and expedite execution. The project's completion was supported by streamlined approvals and data-driven planning.
- b) **Merta City-Ras Railway Line (Rajasthan):** It is another broad-gauge railway project in Rajasthan, connecting Merta City and Ras, valued at ₹947 crore. Enhanced the flow of goods and promoted industrial and regional development in Pali and Nagaur districts. The NPG utilized PM GatiShakti's geospatial tools to align the railway line with regional infrastructure needs, ensuring faster project execution and integration with economic zones.
- c) **Delhi-Meerut Expressway (Partial Completion):** It is a major highway project under the Bharatmala scheme, aimed at reducing travel time between Delhi and Meerut. While the expressway faced an 11-month delay due to a pending railway overbridge (ROB) approval, PM GatiShakti's intervention helped streamline subsequent coordination, ensuring parts of the project were completed efficiently. The platform's real-time GIS data and inter-ministerial coordination resolved alignment issues and expedited approvals for remaining segments.
- d) **Multimodal Logistics Hubs:** Several logistics hubs and terminals have been developed to enhance freight movement, integrated with rail, road, and port connectivity. Reduced container dwell time at ports and improved throughput, contributing to India's improved Logistics Performance Index ranking (38th in 2023, up from 44th in 2018). The Unified Logistics Interface Platform (ULIP) and GIS tools facilitated planning and monitoring, ensuring seamless multimodal connectivity. Specific hubs, such as those near industrial corridors, were completed with synchronized infrastructure alignment.
- e) **Social Infrastructure Projects (Schools, Hospitals, Anganwadis):** PM GatiShakti extended its framework to social sector ministries, enabling data-driven planning for schools, hospitals, and Anganwadi's, particularly in underserved areas. Improved access to essential services in remote regions through targeted infrastructure development. GIS-based tools identified social infrastructure gaps, enabling precise planning and execution. Several projects in aspirational districts were completed, with 27 districts already integrated into the platform.
- f) **Project Evaluations:** Over 200 big-ticket infrastructure projects have been evaluated by the NPG, ensuring alignment with PM GatiShakti's principles of multimodal connectivity and last-mile integration. While not all are fully completed, many have reached significant milestones.

- g) **State-Level Projects:** Over 533 state projects have been mapped on State Master Plan (SMP) portals, with some completed in states like Gujarat and Uttar Pradesh, leveraging PM GatiShakti's geospatial planning for roads, railways, and industrial connectivity.
- h) **Economic Zones Connectivity:** Enhanced connectivity to textile clusters, pharmaceutical hubs, and defence corridors has been achieved, with several projects completed to support industrial growth.

Quantifiable Achievements and Future Plans

- a) The plan targets expanding national highways to 2 lakh km, railway cargo capacity to 1,600 tons by FY25, renewable energy capacity to 225 GW by FY25, and 17,000 km of gas pipelines.
- b) Over 200 major projects reviewed by NPG, ensuring integrated planning.
- c) 533+ state projects mapped on the portal, enhancing regional development.
- d) India's logistics performance ranking improved by six places (World Bank, 2023).
- e) While challenges like land acquisition delays, limited state-level capacity, and data integration gaps persist (as noted in the user's previous input), PM GatiShakti has mitigated some through:
- f) Satellite imagery and GIS tools improve project tracking, though irregular updates in some rural areas remain a hurdle.
- g) These have enhanced coordination, though full synchronization across all ministries is ongoing.
- h) Training initiatives are addressing skill gaps, but states like Uttar Pradesh and Gujarat are ahead in adoption compared to others.

Some projects, especially rural roads, suffer from irregular updates, slowing progress. Delays in approvals, like for railway overbridges, continue to cause setbacks. While the platform aims to involve private players, policy hurdles limit full participation. Opening non-sensitive data to private companies is under consideration.

The plans focus on expanding its scope, enhancing technological integration, and deepening its impact on infrastructure and economic development. These future plans aim to address existing challenges (e.g., land acquisition delays, data sharing limitations) while scaling the initiative's impact across economic, social, and environmental dimensions, ensuring holistic and sustainable infrastructure growth. Below is a concise outline of the key future initiatives based on available information:

- a) Develop District Master Plan (DMP) portals for collaborative planning at the district level, covering all 750 districts, with 27 aspirational districts already in progress. This aims to enhance last-mile connectivity and integrate rural infrastructure. *Example:* Goa's use of NMP for a disaster management plan along the Amona River will be scaled to other regions.
- b) Implement three major railway corridors announced in the Interim Budget 2024-25 to boost multimodal connectivity and freight efficiency. These corridors will align with GatiShakti's principles of integrated infrastructure development.
- c) Open non-sensitive data layers to private companies to boost investment in infrastructure projects, particularly under the ₹6 trillion National Monetisation Pipeline (NMP). This aims to address limited private sector participation and enhance logistics efficiency.
- d) Leverage advanced geospatial intelligence, AI, and real-time satellite imagery (via ISRO and BiSAG-N) for smarter planning and monitoring. The Unified Logistics Interface Platform (ULIP) will be further enhanced for supply chain transparency.

- e) Align with India's Net Zero by 2070 goals by promoting green infrastructure, such as renewable energy projects and sustainable logistics hubs. GIS tools will identify degraded lands for eco-friendly redevelopment.
- f) Expand the use of PM GatiShakti for social infrastructure planning, targeting gaps in schools, hospitals, and anganwadis, especially in underserved areas, to ensure inclusive development.
- g) Scale up training programs through DPIIT and BiSAG-N, integrating PM GatiShakti modules into all Central Training Institutes (CTIs) and Administrative Training Institutes (ATIs). Over 20,000 officials have already been trained, with plans to reach more state and district-level personnel.
- h) Simplify bureaucratic procedures for land acquisition and environmental clearances to reduce project delays. Task forces will focus on addressing legal and structural challenges outside the platform's current scope.
- i) Promote the GatiShakti model internationally, building on its recognition at forums like UNESCAP. The plan includes sharing best practices with other countries to establish it as a global benchmark for infrastructure planning.
- j) Develop outcome-based Key Performance Indicators (KPIs) to measure impacts like reduced travel time and logistics costs, enhancing accountability and enabling mid-course corrections through real-time dashboards.

Conclusion

PM GatiShakti has significantly advanced India's infrastructure by fostering integrated planning, reducing logistics costs, and improving connectivity across economic and social sectors. Its data-driven approach, supported by GIS tools and inter-ministerial coordination, has streamlined project execution and boosted economic competitiveness. However, challenges like land acquisition, data accuracy, and private sector integration require continued focus to maximize impact. The initiative's global recognition and alignment with sustainability goals position it as a transformative model for infrastructure development.

References

1. Bhaskaracharya National Institute for Space Applications and Geo-informatics (BISAG-N). (n.d.). About BISAG-N and role in PM GatiShakti portal development. <https://bisag-n.gov.in>
2. Department for Promotion of Industry and Internal Trade (DPIIT). (n.d.). PM GatiShakti National Master Plan: About and NMP pages. PM GatiShakti Official Portal. <https://pmgatiashakti.gov.in>
3. Department for Promotion of Industry and Internal Trade (DPIIT). (n.d.). PM GatiShakti portal: District/State FAQs and resources. PM GatiShakti Official Portal. <https://pmgatiashakti.gov.in>
4. Government of India. (n.d.). National Logistics Policy (NLP): Overview and objectives. Ministry of Commerce and Industry. <https://www.india.gov.in>
5. Government of India. (n.d.). PM GatiShakti National Master Plan: Multi-modal connectivity. <https://www.india.gov.in/spotlight/pm-gati-shakti-national-master-plan-multi-modal-connectivity>
6. Ministry of Road Transport and Highways (MoRTH). (n.d.). Standard Operating Procedure (SOP) for submitting proposals to the Network Planning Group (NPG). <https://morth.nic.in>
7. Unified Logistics Interface Platform (ULIP). (n.d.). ULIP official portal and documentation. <https://goulip.in>

8. Invest India. (n.d.). PM GatiShakti and Network Planning Group: Sectoral promotion. <https://www.investindia.gov.in>
9. Press Information Bureau (PIB). (2021, October). PM GatiShakti: National Master Plan – Official launch note. Government of India. <https://pib.gov.in>
10. Press Information Bureau (PIB). (2024). PM GatiShakti: 3-year progress and milestones. Government of India. <https://pib.gov.in>
11. Press Information Bureau (PIB). (2022–2024). PM GatiShakti extended briefs and adoption examples. Government of India. <https://pib.gov.in>
12. Press Information Bureau (PIB). (2024, August 9). Cabinet decision: Eight new line projects across Indian Railways. Government of India. <https://static.pib.gov.in/WriteReadData/specificdocs/documents/2023/apr/doc2023427188001.pdf>
13. Press Information Bureau (PIB). (n.d.). Network Planning Group (NPG): Project lists and decisions. Government of India. <https://pib.gov.in>
14. Press Information Bureau (PIB). (n.d.). Unified Logistics Interface Platform (ULIP) and Logistics Data Bank (LDB): Progress and transaction figures. Government of India. <https://pib.gov.in>
15. Press Information Bureau (PIB). (n.d.). PM GatiShakti initiatives. Government of India. <https://www.pib.gov.in/PressReleasePage.aspx?PRID=1825332>
16. Press Information Bureau (PIB). (n.d.). PM GatiShakti updates. Government of India. <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2036104>
17. Press Information Bureau (PIB). (n.d.). PM GatiShakti progress. Government of India. <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2043972>
18. Press Information Bureau (PIB). (n.d.). PM GatiShakti overview. Government of India. <https://pib.gov.in/PressNoteDetails.aspx?NoteId=152010&ModuleId=3>
19. Bhaskaracharya National Institute for Space Applications and Geo-informatics (BISAG-N). (n.d.). PM GatiShakti compendium and program brochures. PM GatiShakti Portal Downloads. <https://pmgatishakti.gov.in>
20. World Bank. (2023). Logistics Performance Index (LPI) 2023: India ranking and data. <https://lpi.worldbank.org>
21. The Economic Times. (n.d.). PM GatiShakti: State-level adoption and specific projects. <https://economictimes.indiatimes.com>
22. The Times of India. (n.d.). PM GatiShakti: Capacity building and state implementation examples. <https://timesofindia.indiatimes.com>
23. The Print. (n.d.). PM GatiShakti: State adoption and local project examples. <https://theprint.in>
24. ResearchGate. (n.d.). Research and commentary on National Logistics Policy and ULIP. <https://www.researchgate.net>

END OF THE DOCUMENT