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Geopolitical shifts and supply chain realignments have made the India-Middle East-Europe Corridor more vital than ever—a strategic blueprint for global trade resilience.

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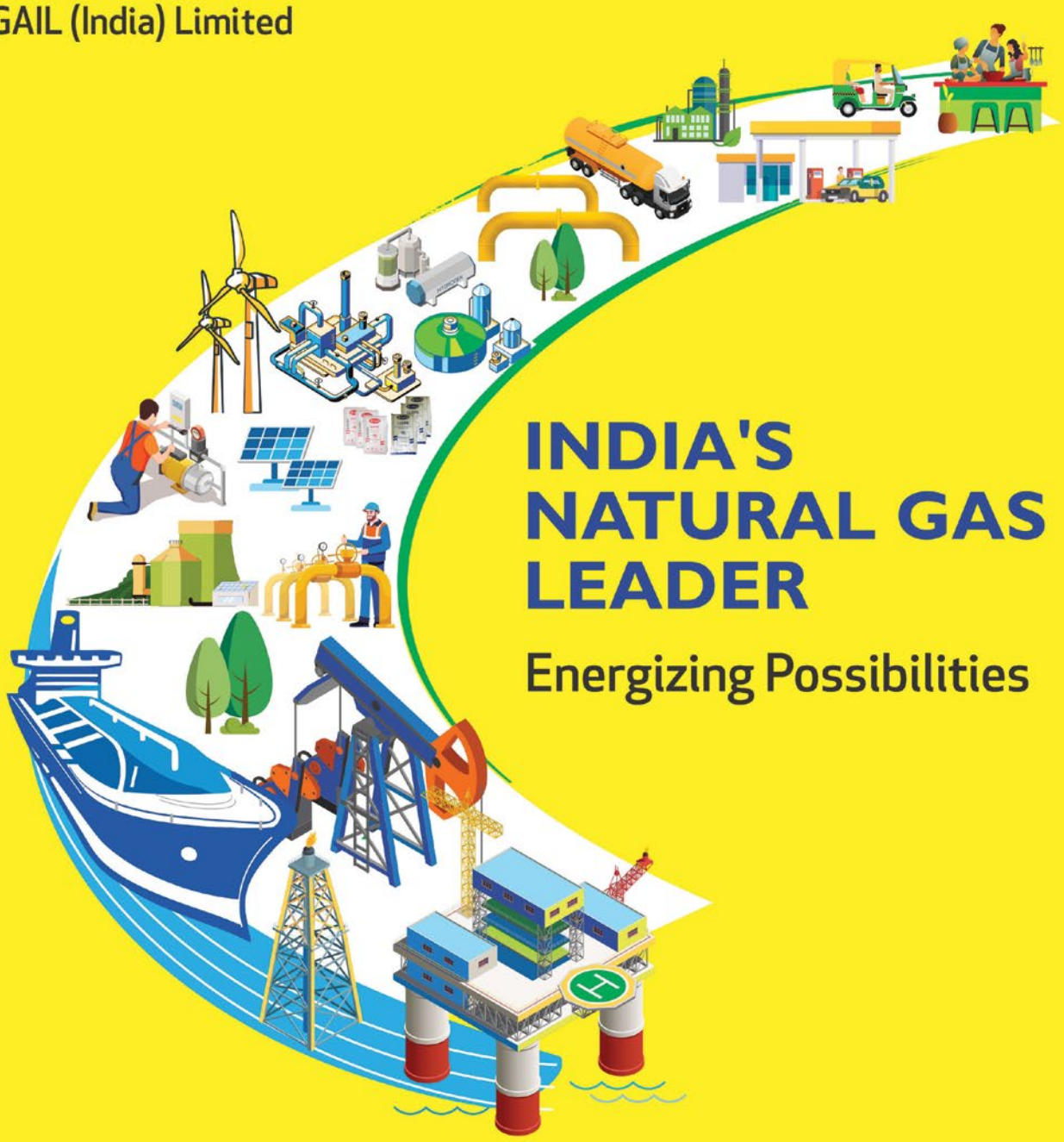

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The Corridor of Opportunity

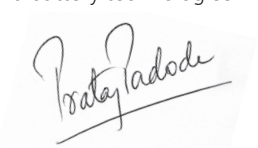
All emerging economic and military powers require secure trade routes. Take, for example, the Suez Canal, a vital gateway for global trade. It attracts about 12-15 per cent of global trade and about 30 per cent of global container traffic, with more than $1 trillion in goods transiting annually. The blockage of the Suez Canal in March 2021 for just six days, caused by the container ship Ever Given running aground, reportedly led to a nearly $89 million loss to Maersk. Therefore, the India-Middle East-Europe Economic Corridor (IMEC) is a pivotal transnational initiative to enhance trade connectivity between Asia, the Middle East, and Europe. First announced at the G20 Summit in New Delhi in September 2023, IMEC includes India, the UAE, Saudi Arabia, and key European nations. According to a recent PwC report, the corridor's strategic location enhances market access by leveraging India's longstanding trade ties with the Gulf Cooperation Council and the EU.

IMEC also facilitates diversified trade, capitalising on India's strengths in IT, pharmaceuticals, and renewable energy, the Middle East's transition towards technology-driven sectors, and Europe's dominance in aerospace, automotive, and green industries. By fostering cross-regional collaboration and strengthening logistics networks, IMEC has the potential to drive sustained economic expansion among participating nations. Our cover story examines the challenges associated with the corridor's development, as well as the benefits it could deliver across multiple economies.

Meanwhile, **Ramanathan Rajamani**, CEO of AISATS—a joint venture between national flag carrier Air India and Singapore's SATS Airport Services—expresses confidence in India's logistics sector. Speaking exclusively to **INFRASTRUCTURE TODAY**, he highlights the company's plans to expand its footprint in India, capitalising on the sector's rapid growth. However, ensuring responsible progress is critical. **Vivek Lohia**, MD of Jupiter Group, proposes a roadmap for India to reduce carbon emissions and position itself as a global leader in sustainable logistics.

The Aatmanirbhar Bharat (Self-Reliant India) programme, launched during the Covid-19-induced lockdown, has driven demonstrable successes across multiple manufacturing verticals. **Shivam Bajaj**, Founder & CEO of Mumbai-based Avener Capital, argues that the initiative should be extended to develop a robust self-reliant infrastructure financing ecosystem. **YR Nagaraja**, MD of Ramky Infrastructure, advocates for a collaborative approach involving industry leaders, government bodies, investors, institutions, and communities to create resilient, inclusive, and sustainable infrastructure.

Against the backdrop of Operation Sindoor and its expected impact on indigenous defence manufacturing, **Pushkar Gokhale**, Head of Security Solutions Business at Godrej Enterprises Group, underscores the importance of safeguarding new infrastructure assets. EY's **Shailesh Agarwal** explains how technology is enabling the flagship Bharatmala Pariyojana for highways, positioning it as a model for future infrastructure projects. Amidst discussions on India's role in the global energy transition, **Devansh Jain**, Executive Director of a 90-year-old chemicals-to-renewables conglomerate, expresses confidence in the sector's growth prospects, citing a $3 billion capital expenditure plan. Jain highlights India's unique potential to scale its manufacturing capabilities across electronics, solar, wind, and battery technologies.



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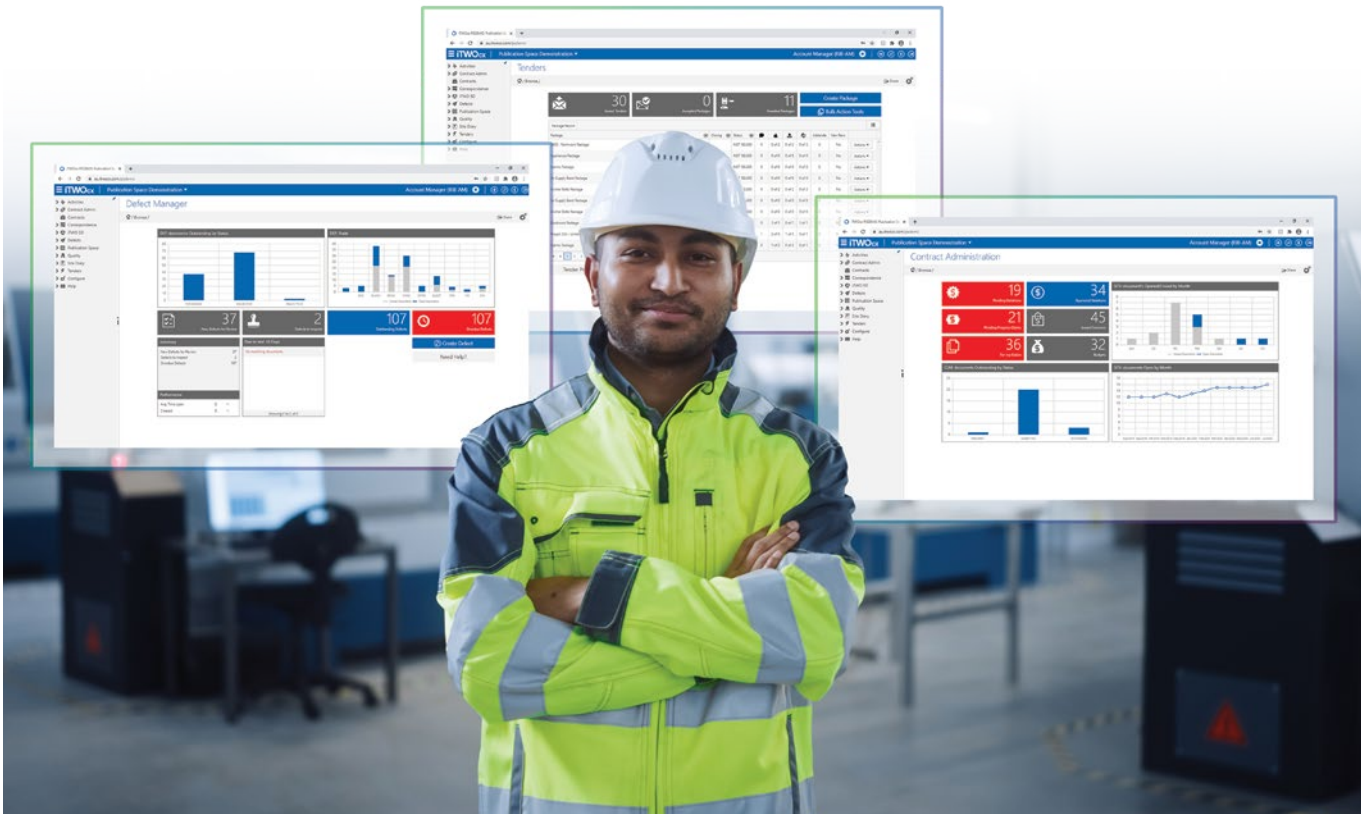

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Extract of the Financial Results for the Quarter and Year ended 31st March 2025

(₹ in Crore)

S. No.	Particulars	Standalone				Consolidated			
		Quarter ended		Year ended		Quarter ended		Year ended	
		31.03.2025	31.03.2024	31.03.2025	31.03.2024	31.03.2025	31.03.2024	31.03.2025	31.03.2024
		(Unaudited)	(Unaudited)	(Audited)	(Audited)	(Unaudited)	(Unaudited)	(Audited)	(Audited)
1	Total Income from Continuing Operations	12,482.39	12,253.72	46,325.32	45,815.37	12,590.80	12,305.39	47,459.38	46,913.12
2	Net Profit before Tax from Continuing Operations [including Regulatory Deferral Account Balances (net of tax)]	5,142.51	5,033.80	18,619.43	18,009.46	5,061.69	5,124.80	19,294.20	18,513.95
3	Net Profit after Tax from Continuing Operations	4,336.17	4,127.77	15,353.57	15,377.48	4,142.87	4,166.33	15,521.44	15,573.16
4	Net Profit after Tax from Discontinued Operations	-	-	-	97.13	-	-	-	-
5	Net Profit after Tax for the period	4,336.17	4,127.77	15,353.57	15,474.61	4,142.87	4,166.33	15,521.44	15,573.16
6	Total Comprehensive Income comprising Net Profit after Tax and Other Comprehensive Income	4,254.45	4,099.98	15,114.24	15,241.72	4,065.38	4,137.21	15,285.16	15,338.55
7	Paid up Equity Share Capital (Face value of share: ₹10/- each)	9,300.60	9,300.60	9,300.60	9,300.60	9,300.60	9,300.60	9,300.60	9,300.60
8	Reserves (excluding Revaluation Reserve) as shown in the Balance sheet	82,915.05	77,566.45	82,915.05	77,566.45	83,362.21	77,844.51	83,362.21	77,844.51
9	Securities Premium Account	5,509.28	5,509.28	5,509.28	5,509.28	5,509.28	5,509.28	5,509.28	5,509.28
10	Net worth	92,215.65	86,867.05	92,215.65	86,867.05	92,662.81	87,145.11	92,662.81	87,145.11
11	Total Borrowings	130,964.96	123,448.62	130,964.96	123,448.62	130,964.96	123,448.62	130,964.96	123,448.62
12	Debt Equity Ratio	1.42	1.42	1.42	1.42	1.41	1.42	1.41	1.42
13	Earnings per equity share from continuing and discontinued operations including movement in Regulatory Deferral Account Balances (Face value of ₹10/- each): Basic and Diluted (in ₹)	4.66	4.44	16.51	16.64	4.46	4.48	16.69	16.74
14	Earnings per equity share from continuing and discontinued operations excluding movement in Regulatory Deferral Account Balances (Face value of ₹10/- each): Basic and Diluted (in ₹)	4.61	4.63	16.21	17.25	4.40	4.67	16.39	17.36
15	Bonds Redemption Reserve	3,193.24	4,064.11	3,193.24	4,064.11	3,193.24	4,064.11	3,193.24	4,064.11
16	Debt Service Coverage Ratio	1.55	2.26	1.48	1.65	1.57	2.33	1.53	1.69
17	Interest Service Coverage Ratio	3.83	4.61	3.94	4.10	4.16	4.88	4.28	4.27

Notes :

1. The above is an extract of the Financial Results filed with the Stock Exchanges under Regulations 33 and 52 of the SEBI (Listing Obligations and Disclosure Requirements) Regulations, 2015. The Complete Financial Results are available on the Investors section of our website **https://www.powergrid.in** and under Corporates Section of BSE Limited & National Stock Exchange of India Limited at **https://www.bseindia.com** and **https://www.nseindia.com** respectively. These can also be accessed by scanning Quick Response Code:
2. Previous periods figures have been rearranged/reclassified wherever considered necessary.

For and on behalf of POWER GRID CORPORATION OF INDIA LTD.
G Ravisankar
Director (Finance)
DIN: 08816101

Place : Gurugram
Date : 19 May 2025

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THE NEW POWER CORRIDOR

The nations involved in the proposed IMEC collectively account for nearly half of global GDP, totalling $47 trillion. Therefore, to fully unlock the benefits of this multilateral initiative of immense geopolitical significance, they must work towards resolving security concerns and harmonising trading regulations, writes Manish Pant.

Experts often refer to the proposed India-Middle East-Europe Economic Corridor (IMEC) as the New Silk Road. However, that name is already associated with China's transnational economic corridor, the Belt and Road Initiative (BRI). A more fitting description would be the New Spice Route—reviving a historic trade artery that once positioned India as a dominant force in global commerce, controlling an estimated 25–33 per cent of global wealth. Despite shifting control to Arab and later European traders, the route remained vital to

international trade until new pathways emerged and colonisation reshaped global commerce. IMEC seeks to revitalise this legacy, positioning India as the central driver of its expansion across the Middle East and Europe.

As the fastest-growing major economy, India aims to leverage IMEC's potential. A 2023 study by ANZ India projects India's GDP to exceed $20 trillion by 2040, achieving developed economy status. Addressing the IMEC Conclave in New Delhi, **Piyush Vedprakash Goyal, Union Minister for Commerce & Industry**, declared, "We will not only be linking trade but also connecting civilisations and cultures, knitting together Southeast Asia, the Middle East, and Central and Eastern Europe. IMEC revitalises the immense potential of nations along its route and can emerge as a defining global axis of the 21st century."

The partner countries have expressed their commitment to the corridor. Speaking to **INFRASTRUCTURE TODAY** on a sweltering May afternoon in New Delhi, **Reuven Azar, Israel's Ambassador to India,** highlighted India's geographic proximity to West Asia and the necessity for robust infrastructure and seamless connectivity to support efficient trade. "IMEC holds immense promise for the Middle East, as India's growing economic role strengthens regional trade flows. While sea transport remains the most cost-effective

"We will not only be linking trade but also connecting civilisations and cultures, knitting together Southeast Asia, the Middle East, and Central and Eastern Europe. IMEC revitalises the immense potential of nations along its route and can emerge as a defining global axis of the 21st century."

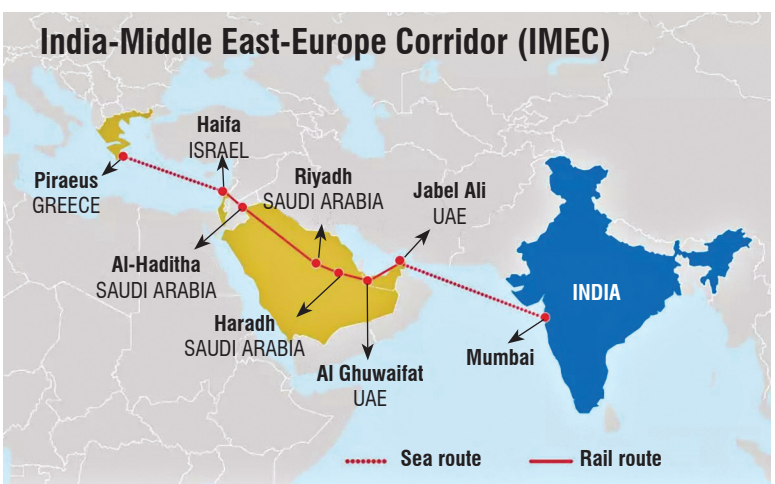
- Piyush Vedprakash Goyal, Union Minister for Commerce & Industry

"IMEC holds immense promise for the Middle East, as India's growing economic role strengthens regional trade flows. While sea transport remains the most cost-effective option, certain goods, such as fresh produce, require faster transit. Additionally, geopolitical disruptions, such as those involving the Houthis [in Yemen], make alternative pathways necessary."

- Reuven Azar, Ambassador of Israel to India

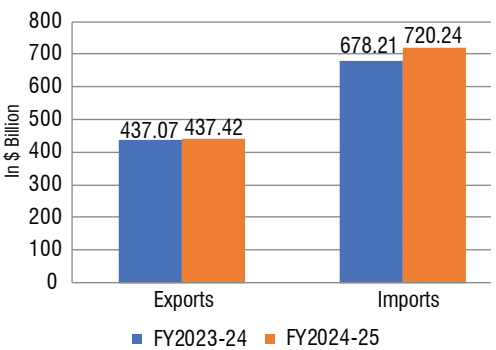
option, certain goods, such as those involving the Houthis [in Yemen], make alternative pathways necessary." Operating through its outfit Ansarallah, the Houthi movement has severely disrupted merchant shipping in the Red Sea and Gulf of Aden. In March this year, the US State Department designated Ansarallah as a Foreign Terrorist Organisation. Against this backdrop, IMEC aims to establish a stable, trade-friendly corridor linking the UAE, Saudi Arabia, Jordan, Israel, and Europe..

IMEC is designed as an integrated transport network, incorporating rail, road, and sea routes to streamline logistics, reduce costs, and foster economic cooperation. It is expected to enhance employment, support infrastructure expansion, and contribute to sustainability by reducing greenhouse gas emissions through optimised transport systems. Calling it a partnership of equals that seeks to bolster synergy, connectivity, and inclusiveness, Goyal states, "This, in a way, is an extension of India's global outreach, our growing relevance among nations. It will bring down logistics costs by up to 30 per cent, reduce transportation time by 40 per cent, and create seamless trade linkages across continents."



Source: IT Research

India Merchandise Trade



Source: Ministry of Commerce & Industry

The DHL white paper *China Plus X: The New Global Supply Chain* highlights the shift toward multi-shoring, encouraging businesses to diversify production beyond China for resilience. **RS Subramanian, Vice President for South Asia, DHL Express**—a division of global logistics conglomerate DHL Group—explains "As companies seek to diversify their manufacturing beyond traditional hubs, India emerges as a strategic alternative. The country's large workforce, improving infrastructure, and government initiatives like Make in India and One District One Product position the country well to capitalise on this shift."

The IMEC project was officially established at the 2023 G20 Summit in New Delhi under the Partnership for Global Infrastructure and Investment, a global initiative focused on meeting infrastructure needs in low- and middle-income countries. Supported by India, the US, Saudi Arabia, UAE, the EU, Italy, France, and Germany, IMEC will feature a multimodal transport network across two corridors. The eastern corridor will link India to the Arabian

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"As companies seek to diversify their manufacturing beyond traditional hubs, India emerges as a strategic alternative. The country's large workforce, improving infrastructure, and government initiatives like Make in India and One District One Product position the country well to capitalise on this shift."

- **RS Subramanian,** Vice President for South Asia at DHL Express

"The corridor is expected to spur large-scale investments in ports, railways, and logistics hubs across regions, particularly in Indian states like Gujarat, Maharashtra, and Andhra Pradesh. It's estimated that over 2 million jobs could be generated by 2030 across logistics, infrastructure, IT, and support services."

- **Ramanathan Rajamani,** CEO, AISATS

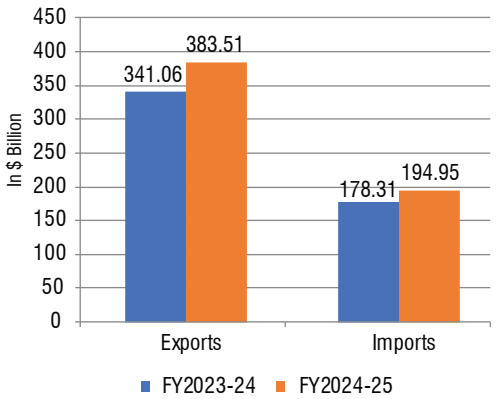
During Prime Minister Narendra Modi's February visit to Washington, DC, he and the US President Donald Trump discussed IMEC's strategic expansion, reinforcing India's leadership role in global trade connectivity and multilateral cooperation.

Peninsula, while the northern corridor will connect the Gulf to Europe. The project also includes an electricity cable, a hydrogen pipeline, and a high-speed data cable, ensuring enhanced trade facilitation, energy efficiency and digital connectivity.

"Equally important is the ripple effect this will create across infrastructure and employment. The corridor is expected to spur large-scale investments in ports, railways, and logistics hubs across regions, particularly in Indian states like Gujarat, Maharashtra, and Andhra Pradesh. It's estimated that over 2 million jobs could be generated by 2030 across logistics, infrastructure, IT, and support services," states **Ramanathan Rajamani, CEO, AISATS,** an Air India and SATS joint venture.

IMEC will integrate major ports across India, the Middle East, and Europe, strengthening intercontinental connectivity. In India, it will link Mundra, Kandla, and Jawaharlal Nehru Port Authority. In the Middle East, key ports such as Fujairah, Jebel Ali, and Abu Dhabi in the UAE, along with Dammam and Ras Al Khair in Saudi Arabia, will be part of the network. A dedicated railway line will connect Fujairah in the UAE to Haifa in Israel via Saudi Arabia and Jordan. In Europe, Piraeus in Greece, Messina in Italy, and Marseille in France will serve as vital trade entry points, ensuring seamless cargo movement and reinforcing supply chain resilience.

India Services Trade



Source: Ministry of Commerce & Industry

Countering BRI

IMEC is widely seen as a strategic counterweight to China's BRI, limiting Beijing's Eurasian influence by reinforcing economic and geopolitical partnerships aligned with US interests. The corridor strengthens global commerce while enabling the US to reaffirm its presence and reassure traditional allies amid shifting power dynamics. **Steven A Altman, Adjunct Assistant Professor, New York University Stern School of Business,** supports this view: "IMEC is a rare example of a project initiated under former President [Joe] Biden that President [Donald] Trump has embraced wholeheartedly. It aligns with US interests in three main areas: geopolitical competition with China, supporting a more integrated and peaceful Middle East—especially ties between Saudi Arabia and Israel—and, of course, stronger US cooperation with India itself." During Prime Minister Narendra Modi's

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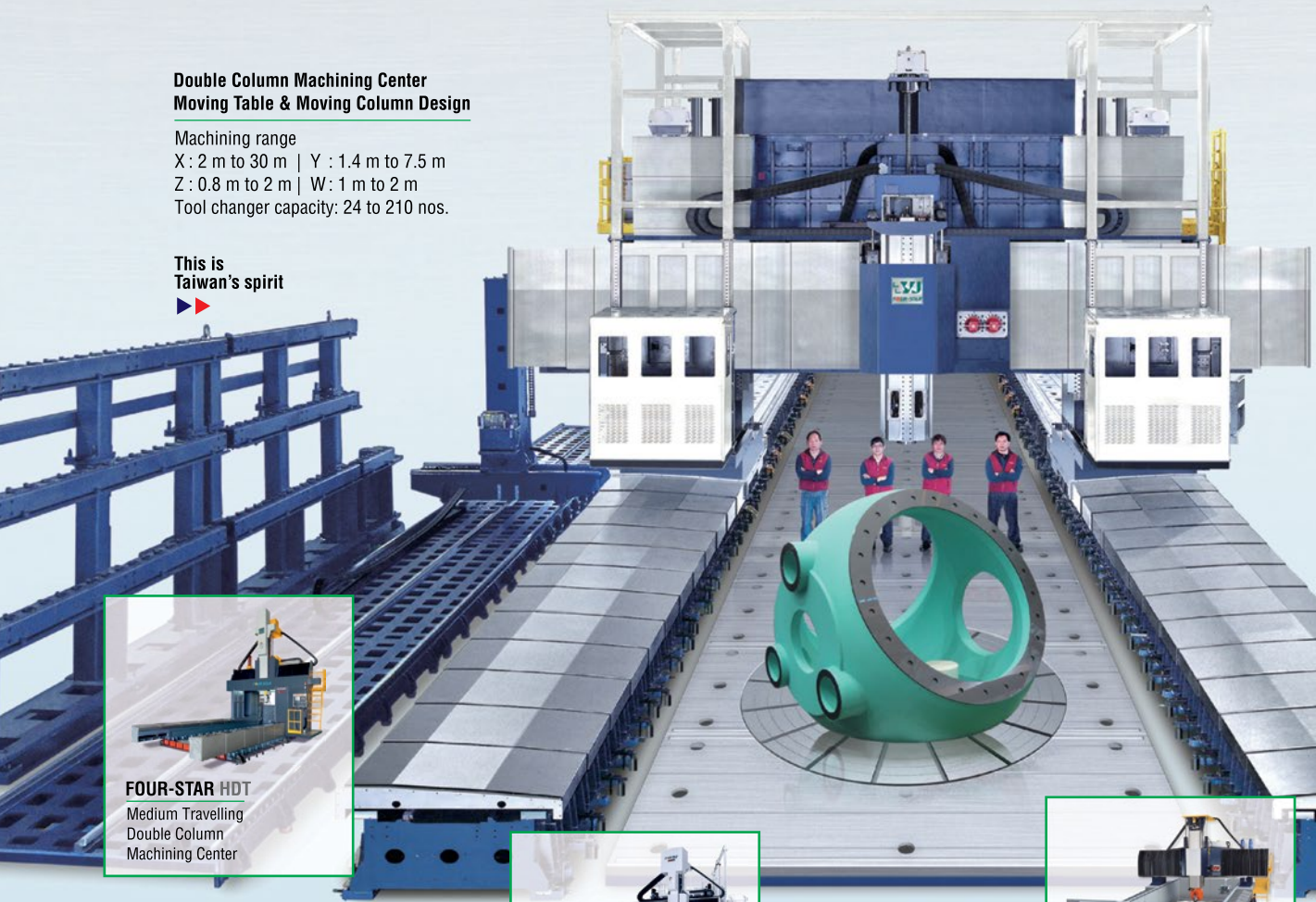

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- Steven A Altman, Adjunct Assistant Professor, New York University Stern School of Business

"IMEC will significantly reduce transit time between India and Europe and diversify supply chains away from chokepoints like the Suez Canal. It creates a viable alternative to China's BRI, anchored in transparency and multi-party governance. For India, it could mean greater export competitiveness, increased FDI in logistics, and deeper trade ties with West Asia and Europe, turning India from a regional to a transcontinental logistics hub."

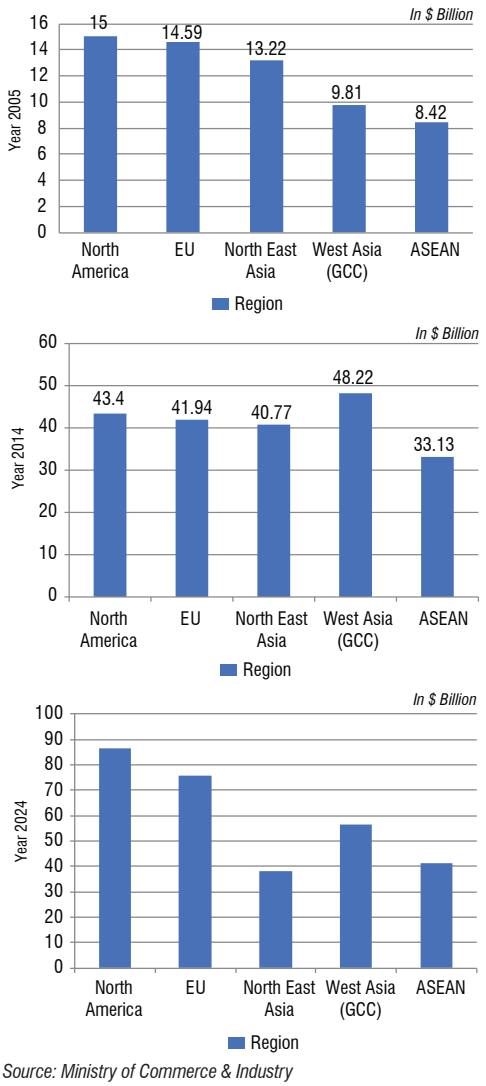
- Sudeep Mehrotra, CEO Asset Management, Welspun One

February visit to the US, he and President Donald Trump reaffirmed their commitment to the project.

Since 2020, a series of geopolitical and economic disruptions—including China's prolonged Covid-induced lockdowns, Russia's military action in Ukraine, and the Israel-Hamas war—have compelled nations to rethink global trade routes. Ambassador Azar emphasises that any major project must rest on solid geopolitical foundations, with security being paramount. "Proposed corridors through Afghanistan, Pakistan, or Iran lack the stability required for reliable international trade, making investing in infrastructure risky. In contrast, IMEC benefits from strong security coordination among participating nations, bolstered by the Abraham Accords and US CENTCOM (Central Command) oversight, ensuring smooth and secure trade operations."

As a rising economic and military power, India must safeguard its commercial interests in the region. The successful military strikes on terrorist launch pads deep inside Pakistani territory under Operation Sindoor not only sent shockwaves across the globe—taking both friends and foes by surprise—but also reinforced India's stature as a military power and a rising leader of the Global South. IMEC dismantles Pakistan's historical veto over India's westward connectivity, unlocking new economic and geopolitical pathways. It deepens India's engagement with the Arabian Peninsula, fostering strategic ties and regional stability. **Sudeep Mehrotra, CEO of Asset Management, Welspun One,** a leading logistics park developer, underscores its significance: "IMEC will significantly reduce transit time between India and Europe and diversify supply chains away from chokepoints like the Suez Canal. It creates a viable alternative to China's BRI, anchored in transparency and multi-party governance. For India, it could mean greater

Top 5 Export Destinations from India



Source: Ministry of Commerce & Industry

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IMEC: A Geopolitical Game-Changer

Revolutionising Trade Routes - IMEC accelerates cargo movement by integrating rail, sea, and road networks, reducing dependency on the congested Suez Canal.

Strengthening Regional Connectivity - India, the Middle East, and Europe gain seamless trade integration, fostering economic growth and geopolitical cooperation.

Counterbalancing China's BRI - A transparent, rule-based alternative, IMEC enhances trade security, mitigating risks associated with debt diplomacy.

Advancing Sustainable Infrastructure - Green hydrogen pipelines, digital trade networks, and renewable energy transport make IMEC a clean logistics powerhouse.

Enhancing Geopolitical Influence - India, the EU, and the Gulf nations bolster their global economic leadership, reshaping strategic alliances.

Source: IT Research

export competitiveness, increased FDI in logistics, and deeper trade ties with West Asia and Europe, turning India from a regional to a transcontinental logistics hub." By promoting intra-regional connectivity and peace, IMEC sets a precedent for infrastructure-led diplomacy, extending its model to Africa for broader development.

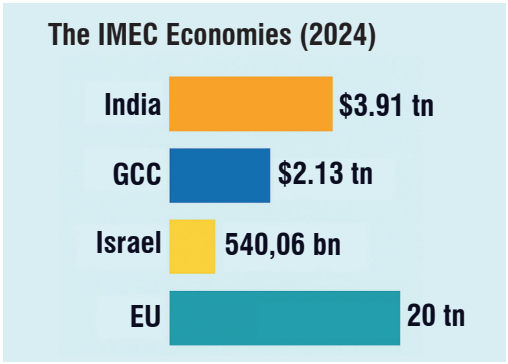
Devansh Jain, Executive Director of INOXGFL Group, is leading a $3 billion expansion at the Noida-headquartered chemicals-to-renewables conglomerate. He views IMEC as a vital opportunity for Indian enterprises amid ongoing global trade realignments. "As a group, our goal is straightforward—to keep building and scaling our businesses. We currently have seven factories under construction, spanning energy storage, solar, wind, and chemicals. Six of these plants are in India, with one located in the Middle East to support regional operations."

India is also reviving its shipbuilding industry through strategic financial initiatives, including the ₹180.9 billion Shipbuilding Financial Assistance Policy and the ₹250 billion Maritime Development Fund. By significantly reducing transit times and opening new trade corridors, IMEC is expected to drive growth in shipbuilding and repairs. **Rear Admiral V K Saxena, CEO, Swan Defence and Heavy Industries,** which owns India's largest shipyard, states, "We are fully aligned with the government's maritime vision. Our state-of-the-art infrastructure positions us to deliver advanced shipbuilding and repair solutions that meet global standards. IMEC not only opens new opportunities for Indian shipyards but also reinforces our shared vision to establish India as a global hub for maritime innovation and excellence."

The micro, small, and medium enterprise (MSME) sector also stands to benefit. As of March 2025, 62 million registered MSMEs employed over 250 million people, fostering entrepreneurship, particularly in semi-urban and rural areas, according to government data. Historically, MSMEs have powered economic transformations in nations such as Japan, Germany, South Korea, and China. DHL's Subramanian reiterates this optimism: "We are optimistic about the IMEC, which will benefit Indian MSMEs. We believe they will be a key contributor to the vision of Viksit Bharat (developed India) in 2047."

With IMEC unlocking new global opportunities, India is well-positioned to ensure local entrepreneurship thrives, securing a stronger foothold in international trade. Altman,

▼ **Hydrogen pipelines from India to West Asia will be among the key pieces of the IMEC project, enabling clean energy trade, bolstering regional security, and advancing India's hydrogen diplomacy.**



Source: World Bank, IMF, GCC Secretariat, Bank of Israel, European Central Bank

who also serves as Director of the DHL Initiative on Globalization at NYU Stern's Center for the Future of Management, substantiates this argument: "The DHL Trade Atlas 2025 report forecasts that India will achieve the third-largest absolute amount of trade growth over the next five years, behind only China and the US. Infrastructure expansion is especially important for growing India's participation in high-end manufacturing, which often requires intricate multi-country value chains that depend on the very efficient movement of goods into and out of a country."

Global Headwinds

Despite its promise, a multilateral initiative of IMEC's scale will inevitably face implementation challenges. Geopolitical instability in the Middle East—marked by the Israel-Hamas conflict, tensions with Iran, and regional rivalries—could disrupt progress. "Geopolitical rivalries—particularly between Saudi Arabia and the UAE on one side, and Iran on the other—along with Turkey's exclusion and competition from China's BRI, pose significant challenges to cooperation. Regulatory fragmentation across nations risks inconsistent tariffs and logistics standards, delaying execution. Security concerns, including Middle East instability and maritime disputes in contested waters, amplify risks," warns **Sonam Chandwani, Managing Partner, KS Legal**, a Mumbai-based law firm. While choosing to remain cautiously optimistic, Altman acknowledges that political and security developments in the Middle East—particularly the Israel-Hamas war—have significantly delayed progress. "In my view, the geopolitical and economic logic favouring IMEC has only become stronger since the project was initially conceived. But substantial risks remain, and it will take sustained high-level commitment across many countries for its potential to ultimately become a reality," he adds.

Funding and coordination are equally critical, as massive capital investment is required for rail, port, and digital infrastructure, while aligning priorities across participating nations adds complexity. Since 2013, China's BRI has reportedly amassed $1.18 trillion in financial investments and contractual cooperation across 150 participating countries.

"As a group, our goal is straightforward—to keep building and scaling our businesses. We currently have seven factories under construction, spanning energy storage, solar, wind, and chemicals. Six of these plants are in India, with one located in the Middle East to support regional operations."

- Devansh Jain, Executive Director, INOXGFL Group

"We are fully aligned with the government's maritime vision. Our state-of-the-art infrastructure positions us to deliver advanced shipbuilding and repair solutions that meet global standards. IMEC not only opens new opportunities for Indian shipyards but also reinforces our shared vision to establish India as a global hub for maritime innovation and excellence."

- Rear Admiral V K Saxena, CEO, Swan Defence and Heavy Industry

Development Pillar 1: Multimodal Transport

Infrastructure Planning - A regional master plan integrating roads, railways, and ports to enhance seamless cargo movement, ensuring efficient trade corridors.

Technological Advancements - Smart logistics, real-time tracking, and automated systems to improve transportation efficiency, reduce turnaround times, and enable precise monitoring of goods.

Integrating Logistics - Coordinated supply chains, optimised storage, and efficient distribution networks to reduce delays and maximise resource utilisation.

Source: PwC India-Vishwamitra Research Foundation

"Geopolitical rivalries—particularly between Saudi Arabia and the UAE on one side, and Iran on the other—along with Turkey's exclusion and competition from China's BRI, pose significant challenges to cooperation. Regulatory fragmentation across nations risks inconsistent tariffs and logistics standards, delaying execution. Security concerns, including Middle East instability and maritime disputes in contested waters, amplify risks."

- Sonam Chandwani, Managing Partner, KS Legal

"Both public and private sector financing is essential for fulfilling the investment needs in such infrastructure projects. Mechanisms need to be established to efficiently attract funding from different sources and allocate it efficiently for maximum benefits and returns. There are several mechanisms available currently which can be used to attract funding for infrastructure development."

- Manish R Sharma, Partner & Leader of Infrastructure, Transport and Logistics at PwC India

Development Pillar 2: Strategies for Institutional Alignment

Collaborative Governance

Intergovernmental committees to ensure cross-border cooperation, enabling stakeholder participation, transparency, and strategic decision-making.

Regulatory Frameworks

Harmonised customs, immigration, and transport policies for streamlining cross-border trade, improving efficiency and reducing bottlenecks.

Capacity Building

Strengthening institutions through targeted training to enhance economic policy management, public administration, and operational efficiency.

Stakeholder Engagement

Involving local communities, private entities, and global organisations to foster trust, transparency, and alignment with regional priorities.

Source: PwC India-Vishwamitra Research Foundation

Regulatory and technical hurdles—such as harmonising customs procedures, transport standards, and legal frameworks—require extensive policy coordination. Chandwani adds, "Financially, the absence of a dedicated funding pool and lack of clarity regarding the private sector's role deter investment. Finally, environmental compliance for green hydrogen pipelines demands rigorous standards, which could clash with local policies. Without robust legal frameworks and diplomatic alignment, these challenges could derail IMEC's transformative potential, undermining its economic promise." Environmental and social risks, including potential degradation and displacement, must be carefully managed through sustainability safeguards and community engagement to ensure long-term viability.

Despite these concerns, stakeholders remain confident that economic cooperation and political alignment will ensure IMEC's viability. Azar affirms that the collective financial strength of stakeholders will help overcome any obstacles. "IMEC connects thriving economies—including the US, India, the UAE, Saudi Arabia, and Israel—fostering diverse economic collaborations beyond just trade. Saudi Arabia, for instance, is a major energy exporter, while Jordan serves as a cost-effective storage hub for merchandise. With these advantages, IMEC integrates commercial interests across the region, supported by the political stability of its member nations, increasing feasibility and long-term success."

He also dismisses concerns over prohibitive infrastructure investment requirements. "Most essential networks, including railways in Israel, Saudi Arabia, and the UAE, already exist. A missing 200 km railway link in Jordan remains a key gap, but its construction is feasible and well within the capabilities of Indian firms. While logistical coordination among governments is necessary to ensure seamless trade flows, financial investment in the corridor is relatively moderate."

Manish R Sharma, Partner & Leader of Infrastructure, Transport and Logistics at PwC India, shares this view. In a recent PwC-

Vishwamitra Foundation report, *The India-Middle East-Europe Economic Corridor: Paving a New Path for Global Trade,* he notes, "Both public and private sector financing is essential for fulfilling the investment needs in such infrastructure projects. Mechanisms need to be established to efficiently attract funding from different sources and allocate it efficiently for maximum benefits and returns. There are several mechanisms available currently which can be used to attract funding for infrastructure development." These include establishing public-private partnerships (PPPs), securing international funding, and leveraging financial instruments such as bonds, guarantees, and equity funds to raise capital. Strategic resource allocation to prioritise projects with the highest economic impact will also be critical. The report also advocates a four-pillared development approach—encompassing multimodal transport, institutional alignment, ease of doing business, and capital mobilisation—to streamline trade across IMEC nations.

Most importantly, as Mehrotra of Welspun One points out, countries like India are committed to making IMEC a success. The groundwork has already been laid through infrastructure creation initiatives such as the PM Gati Shakti National Master Plan and the National Logistics Policy. "India's expanding port capacity, DFCs (Dedicated Freight Corridors), and industrial corridors are aligned with IMEC's long-term vision. However, inter-ministerial coordination, single-window clearances for transnational logistics, and incentivising private investment in infratech will be key to unlocking IMEC's full potential." This is already evident in efforts to close critical gaps. For instance, the under-construction 7.6 billion Vadhavan deep-sea port near Navi Mumbai will be connected to the Western Dedicated Freight Corridor.

Recipe for Success

Realising IMEC's full potential requires sustained diplomatic engagement, institutional collaboration, and private sector investment, supported by transparent governance and timely execution. Global financial institutions must mobilise funding and expertise, while stakeholders develop a robust framework for arbitration and multilateral cooperation to ensure long-term success. Chandwani recommends a binding IMEC Charter to enforce standardised tariffs, environmental compliance, and security protocols across participating nations, supported by a centralised arbitration tribunal for impartial dispute resolution.

"In under three years, we have established a robust foundation with 16 air and ground hubs across India's key commercial centres. IMEC now empowers us to scale that momentum globally. With India's diplomatic leadership and a thriving diaspora driving demand, we are uniquely positioned to support businesses with speed, reliability, and reach."

- Grégory Goba Blé, Director, MOVIN Express & Head, UPS India

"Regular summits, facilitated by a permanent IMEC Secretariat, would align stakeholders and preempt conflicts. Private-sector engagement through PPP contracts with clear dispute-resolution clauses is vital." This framework, prioritising transparency and enforceability, would mitigate potential discord, foster trust, and ensure project continuity across complex and volatile regions.

Mehrotra maintains that to make IMEC viable, stakeholders must go beyond physical infrastructure. "What's needed is a corridor mindset, integrating digital trade, seamless customs, energy cooperation, and skilled human capital exchange. India should use this opportunity to champion green corridors and set sustainability benchmarks. Moreover, IMEC

Development Pillar 3: Towards Ease of Doing Business

Simplifying Regulatory Norms - Integrated customs procedures reduce bureaucratic barriers, ensuring efficient trade flows across borders.

Policy Harmonisation - Aligned regulations and policies streamline operations, enabling seamless goods movement across regions.

Digital Solutions - Blockchain and real-time data sharing enhance transparency, accuracy, and efficiency in global supply chains.

Investment Climate - Robust legal frameworks and swift dispute resolution foster private sector confidence in infrastructure investments.

Market Access - Free trade agreements unlock new economic opportunities, driving business expansion and competitiveness.

Source: PwC India-Vishwamitra Research Foundation

▲ **The Sharjah-Ras al Khaimah section of the UAE's Etihad Rail project exemplifies how West Asia's rail networks will be key to IMEC—enhancing freight movement, streamlining supply chains, reducing transit costs, and driving regional economic integration.**

must be aligned with India's port-led development." Leveraging technologies such as AI-driven logistics, blockchain for supply chain transparency, and renewable energy integration will be key to ensuring the corridor remains future-proof and resilient.

India's role as the anchor of IMEC stems from its reputation as a more trusted growth partner than China. This perception is rooted in Beijing's weaponisation of BRI through debt-trap diplomacy, dual-use infrastructure, and economic coercion, fostering dependency among participating nations. By controlling critical supply chains and shaping domestic policies, China has expanded its strategic reach. Minister Goyal states unequivocally: "The strength of IMEC lies in its respect for the sovereignty of every nation. It does not impose a single vision, nor does it seek to create an economic union or dominate any region. In contrast, BRI is increasingly recognised as a political tool aimed at controlling the economic future of certain areas."

This sovereignty-first approach strengthens IMEC's credibility as a viable alternative to politically driven infrastructure projects, reinforcing global trust in its multilateral framework. Azar underscores its resilience, highlighting how it adds a crucial alternative route to existing maritime trade networks, complementing pathways such as the Suez Canal and international shipping lines around Africa. "In today's interconnected economy, shipping firms operate across multiple nations, employing global crews and navigating diverse regulatory frameworks. By providing a stable, high-connectivity corridor through strategically positioned countries, IMEC reinforces resilience within international trade networks, facilitating smoother commerce across regions."

Grégory Goba Blé, Director, MOVIN Express—an InterGlobe Enterprises and UPS Group B2B logistics joint venture for the Indian market—views IMEC as a transformative shift in global trade, driving cross-border logistics expansion and future-ready solutions. "In under three years, we have established a robust foundation with 16 air and ground hubs across India's key commercial centres. IMEC now empowers us to scale that momentum globally. With India's diplomatic leadership and a thriving diaspora driving demand, we are uniquely positioned to support businesses with speed, reliability, and reach."

This strategy not only meets the demands of an increasingly multipolar world but also places India at the forefront, shaping multilateral cooperation and global prosperity on a foundation of mutual trust.

Development Pillar 4: Mobilising Capital

Public-Private Partnerships Collaborative financing to leverage private expertise for developing critical infrastructure.

International Funding
Capital and technical expertise from global financial institutions for supporting large-scale infrastructure projects.

Financial Instruments
Innovative funding tools like bonds, guarantees, and equity funds to attract investment and mitigate risks.

Resource Allocation
Prioritising high-impact projects to ensure efficient investment, enhancing connectivity and economic growth.

Source: PwC India-Vishwamitra Research Foundation

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“Logistics parks, multimodal cargo hubs poised for rapid growth.”

Following the successful launch of the Bangalore Logistics Park at India’s third-busiest international airport in late April, **Ramanathan Rajamani, CEO, AISATS**, is now focused on the seamless operationalisation of the country’s largest multimodal cargo hub at the upcoming Noida International Airport. An engineering graduate and a master’s in logistics from the National University of Singapore, Rajamani tells ***INFRASTRUCTURE TODAY*** that he is actively scouting new airports in tier-1 and tier-2 cities for expansion. Edited excerpts.

What is your outlook on the opportunities in India’s logistics sector?

India’s freight and logistics market is projected to grow 8.8 per cent annually, reaching $484.43 billion by 2029, up from $317.26 billion in 2024. This expansion is driven by infrastructure modernisation, policy reforms, and technological advancements. Multimodal logistics hubs are enhancing domestic and international trade efficiency. DFCs (Dedicated Freight Corridors) of the Indian Railways, Bharatmala, and Sagarmala are cutting transit times by up to 50 per cent, while air cargo infrastructure growth is strengthening supply chains. The express logistics market is set to reach $25 billion by 2026, fuelled by e-commerce expansion and last-mile delivery demand. AI-powered logistics, automated warehousing, and blockchain-based tracking are improving efficiency and transparency. With India emerging as a preferred global logistics hub under the China Plus One strategy, government initiatives like Make in India, Krishi Udan 2.0, and the National Logistics Policy are attracting foreign investments. As multimodal connectivity and digital transformation accelerate, the country is on track to become a global leader in logistics efficiency.

Is that one of the reasons you often characterise the expansion in air cargo infrastructure as a ‘milestone moment’ for Indian logistics?

There are two main reasons. First, the cargo market in India is experiencing phenomenal growth. Bangalore airport, for example, already handles 500,000 metric tonnes (MT) per year, with a target of 1 million MT within the next five years. And this is just Bangalore. Across India, the growth trajectory is even stronger. Second, India’s logistics sector is still somewhat unstructured. A well-defined approach to cargo movement, storage, and handling is essential to achieving the government’s aim of reducing logistics costs from 14 per cent of GDP to 9 per cent. This can only happen with the development of modern, well-planned infrastructure to support industry needs.

Ramanathan Rajamani, CEO, AISATS

Many have termed the current growth in air cargo ports as transformative. How valid is that assessment?

That assessment is valid. For the air cargo

industry to scale sustainably and move higher volumes efficiently, both within cities and across borders, a well-integrated ecosystem of logistics parks, multimodal transport, and digitised infrastructure is essential. The development of structured, tech-enabled facilities delivers immense value to cargo handlers, freight forwarders, and transport providers by enhancing speed, transparency, and operational efficiency. This isn't just growth — it's a structural transformation of the logistics backbone that supports India's trade ambitions.

What industry segments do you see as boosting the ongoing expansion in the medium and long term?

In the medium term, e-commerce is one of the biggest drivers. Online shopping continues to grow at an extraordinary pace, increasing demand for express courier terminals, distribution hubs, and sortation centres. Seamless first-and last-mile connectivity will be essential in supporting this expansion. In the long term, multimodal cargo hubs will become increasingly important, especially in larger cities where airports and seaports act as major cargo conduits. While distribution hubs and sortation centres will drive short-to medium-term growth, multimodal cargo hubs will underpin long-term logistics expansion.

You particularly single out the expansion in aviation infrastructure as being a major contributor to this trend. As India looks to develop aerotropolises, what kind of push can they provide to the air cargo business?

Aerotropolises have the potential to transform the way air cargo operates in India. By developing integrated ecosystems around major airports, these hubs bring together businesses, logistics providers, traders, and ancillary services in one location. This proximity drives faster turnaround times, lowers operational costs, and ensures seamless access to warehousing, customs, and value-added services. In effect, an aerotropolis functions like a satellite city, enhancing cargo efficiency while catalysing regional economic growth. As India accelerates its aviation and logistics ambitions, aerotropolises will play a pivotal role in enabling greater connectivity, streamlined operations, and global trade competitiveness.

With a state-of-the-art logistics park inaugurated at Bengaluru's Kempegowda International Airport and the large multimodal cargo hub underway at Noida International Airport, why is now the right time to invest in India's logistics sector?

Bengaluru's logistics ecosystem was already well-developed, with established cargo terminal operators. We have now introduced the logistics park concept here to enhance efficiency. Noida International Airport, on the other hand, is a greenfield project where we are developing both the integrated cargo terminal and the integrated warehouse and logistics zone, making it a multimodal cargo hub connected by air, rail, and road. Beyond these two projects, further opportunities are emerging, particularly in brownfield developments. For example, Kolkata airport issued a tender last year for the redevelopment and operation of its cargo terminal, and similar projects are taking shape elsewhere. With India's air cargo market expanding rapidly, we anticipate a growing demand for logistics parks and multimodal cargo hubs.

What are the key highlights of your newly opened logistics park in Bengaluru?

The Bangalore Logistics Park is strategically located near the airport cargo terminal, allowing efficient cargo movement between storage areas and the terminal. Another major advantage is its proximity to the national highway, which ensures faster transportation of goods between the airport and the hinterland. Our warehouse model is designed to accommodate MSMEs (micro, small, and medium enterprises) alongside larger players. The availability of common-user warehouse space and pay-per-use options supports

▼ **The AISATS team, alongside key stakeholders, took part in the inauguration of Bangalore Logistics Park near Kempegowda International Airport, India's third-busiest international airport, on April 22.**

AISATS: Elevating Aviation and Cargo Experience

- **Founded -** Established in 2008, AISATS is a JV between Air India (Tata Group) and SATS, a global leader in aviation services.
- **Comprehensive Ground Handling Services -** Offers passenger assistance, ramp handling, baggage handling, flight operations, and cabin dressing.
- **Air Cargo Expertise -** Operates state-of-the-art cargo terminals, including the Air Freight Terminal and COOLPORT in Bengaluru, handling diverse shipments from perishables to pharmaceuticals.
- **Presence Across India -** AISATS has a strong footprint in major airports, including Delhi, Bengaluru, Hyderabad, and Thiruvananthapuram.
- **Strategic Infrastructure Investments -** Committed to ₹2 billion in Bengaluru and ₹10 billion in Noida, reinforcing India's logistics capabilities.
- **Technology-Driven Operations -** Pioneering digitised cargo handling and advanced logistics solutions to enhance efficiency.
- **E-Commerce & Express Logistics Growth -** Supporting the booming e-commerce sector with distribution hubs and courier terminals.
- **Aerotropolis Vision -** Contributing to India's airport cities, integrating logistics with commercial and trade ecosystems.
- **Talent Development & Training -** Addressing manpower shortages through a dedicated training academy, ensuring skilled professionals in logistics.
- **Commitment to Sustainability -** Implementing eco-friendly logistics solutions and optimising cargo operations to reduce environmental impact.

Source: Company, IT Research

smaller enterprises while fostering a collaborative logistics environment.

How much have you invested in the facility?

We have invested ₹2 billion.

How has the market responded to the Bengaluru facility?

The response has been very positive. Over 70 per cent of the space has already been occupied, with key industry players such as DHL Express, FedEx, DB Schenker, Blue Dart, and Kuehne+Nagel already operating within the facility. Demand remains strong, with more companies seeking space.

With Noida airport set to host a multimodal cargo hub upon completion, how will it transform India's logistics landscape?

With Noida airport set to host a state-of-the-art multimodal cargo hub, it will be a game-changer for India's logistics sector. As several multinational companies relocate their manufacturing operations to Noida, the facility's connectivity to road, rail, and air networks will create a fully integrated logistics ecosystem. This seamless multimodal integration will significantly streamline cargo movement, reducing time and costs. Since we are developing both the cargo terminal and the associated warehousing and logistics zones, our focus is on ensuring smooth coordination across these areas, which will drive operational efficiency and help position Noida as a key logistics hub in India and globally.

What kind of investment have you allocated for the Noida airport project?

The project is being developed in phases under a long-term concession framework. We have earmarked an investment of approximately ₹10 billion for the creation of world-class cargo infrastructure at Noida International Airport. This includes the integrated cargo terminal as well as warehousing and logistics facilities that will form the backbone of the multimodal cargo hub.

WE HAVE EARMARKED AN INVESTMENT OF APPROXIMATELY ₹10 BILLION FOR THE CREATION OF WORLD-CLASS CARGO INFRASTRUCTURE AT NOIDA INTERNATIONAL AIRPORT. THIS INCLUDES THE INTEGRATED CARGO TERMINAL AS WELL AS WAREHOUSING AND LOGISTICS FACILITIES THAT WILL FORM THE BACKBONE OF THE MULTIMODAL CARGO HUB.

What would you recommend to spur the growth of logistics parks?

The focus should be on developing logistics parks that serve as one-stop service centres, offering shared resources such as safety and security services to multiple players. The industry must avoid duplication of infrastructure within these spaces, ensuring cost efficiency and optimal resource utilisation. If every operator had their own security personnel, handlers, and forklift drivers, congestion would increase significantly. A

centralised service provider like AISATS enables more effective use of available space while reducing costs for users.

What more may be required to enhance or improve the overall logistics infrastructure framework?

India's logistics sector is undergoing rapid modernisation, but further improvements will unlock even greater efficiency, cost optimisation, and sustainability. Expediting the full operationalisation of DFCs and expanding multimodal logistics parks will play a crucial role in enhancing freight movement. The Union Budget 2025-26 has prioritised investments in air cargo hubs, smart warehousing, and multimodal connectivity, ensuring a more seamless and efficient supply chain network. With DFCs expected to reduce transit times by 50 per cent, rail logistics is poised for a transformation. Strategic initiatives such as dynamic pricing models, targeted incentives, and improved intermodal coordination will further encourage cargo movement via rail, reducing dependence on road transport and lowering emissions. Additionally, regulatory simplification remains a key priority, while platforms like, ULIP (Unified Logistics Interface Platform) and the E-Logistics Marketplace have streamlined operations, AI-driven clearance systems can accelerate approvals and improve predictability for businesses.

Sustainability is also emerging as a defining factor in this transformation. Green logistics initiatives, including the electrification of trucking, carbon credit incentives, and renewable energy-powered logistics parks, will drive long-term environmental benefits. As India continues to integrate AI-powered cargo tracking, automation, and blockchain-based transparency, the country is well-positioned to become a global leader in logistics innovation and supply chain excellence.

With AISATS firmly established in the Indian market, which regions are next on your expansion radar?

We are actively exploring new opportunities, particularly as more airports undergo privatisation. Whenever a new tender is issued, we conduct a thorough business case evaluation and, if viable, pursue participation. Our strategy prioritises tier-1 and tier-2 cities, where cargo volumes justify large-scale infrastructure investments. With the backing of our two parent organisations—the Tata Group, known for its excellence, and SATS, a global leader in cargo services—we aim to expand our footprint while ensuring efficient and high-quality logistics solutions.

▲ **Leading logistics firms, including DHL Express, FedEx, DB Schenker, Blue Dart, and Kuehne+Nagel, have secured a substantial share of warehousing space at the newly inaugurated Bangalore Logistics Park.**

As you expand your footprint, how are you addressing the manpower shortage?

We have adopted two key approaches. Firstly, we hire talent from the local communities around our operational sites. Secondly, we provide extensive training through our in-house academy, equipping recruits with the skills necessary to integrate seamlessly into the workforce.

Given your experience with Singapore Airlines—one of the world's leading airline systems—how do you view the growth prospects for air freight services here?

Growth will ultimately be dictated by market dynamics. The aviation sector frequently sees the emergence of new companies, alongside consolidations and mergers. However, in the end, success depends on market forces and the economic viability of the business.

How will the proposed India-Middle East-Europe Economic Corridor (IMEC) benefit the region's logistics sector?

The India-Middle East-Europe Economic Corridor (IMEC) is not just a new trade route, it's a strategic leap that will reshape the future of logistics. As someone deeply involved in building integrated cargo infrastructure, I see this corridor as a game-changer for global supply chains. IMEC is expected to reduce transit times by up to 40 per cent and bring down logistics costs by nearly 30 per cent. That's transformative, particularly for Indian exporters eyeing faster access to Europe and vice versa.

- MANISH PANT

Greening India's Freight Economy

As India's freight volumes continue to expand, the associated CO2 emissions are rising just as rapidly. To establish itself as a global leader in sustainable logistics, the country must pursue bolder, deeper, and more deliberate systemic reforms, argues **Vivek Lohia**.

India is moving fast, whether by roads, rails, and across seas. With its freight economy driving economic expansion, the country is transforming how goods move across its vast geography. The logistics market, projected to grow from $317.26 billion in 2024 to $484.43 billion by 2029 at a CAGR of 8.8 per cent, according to global management consultancy IMARC, is undergoing a major overhaul. Digital upgrades, infrastructure expansion, and multimodal integration are reshaping the sector. Behind this push is a clear ambition: to position India as a globally competitive manufacturing and trade hub.

Yet, with this momentum comes a pressing challenge: rising CO2 emissions. As freight volumes surge, so do emissions, posing a direct conflict between economic ambition and climate responsibility.

India ranks 44th in the World Bank's Logistics Performance Index (2023), behind countries like Vietnam and Malaysia. With over 60 per cent of freight emissions coming from trucks, there is a critical need for greener transport solutions to stay globally competitive. The country has already made some important strides in this regard. However, to truly lead in sustainable logistics, the next phase must be bolder, deeper, and more deliberate.

The freight landscape

Globally, countries like Germany, Japan, and the Netherlands have optimised freight logistics through railways and inland shipping. In contrast, India's heavy reliance on roads aligns with trends seen in rapidly urbanising economies. The country moves over 4.6 billion tonnes of freight annually—about 70 per cent

by road, 26 per cent by rail, and the remaining 4 per cent via inland waterways, pipelines, and air. While roads offer extensive reach and flexibility, they are also the most emission-intensive. Rail transport, despite emitting up to 75 per cent less CO2 per tonne-kilometre compared to trucks, remains significantly underutilised.

India's road-heavy logistics model comes at a cost. Logistics expenditure accounts for 13-14 per cent of GDP—well above the global average of 8-10 per cent. The reasons are clear: congested highways, idle fleets, and last-mile unpredictability. These bottlenecks hinder competitiveness, particularly in exports and e-commerce fulfilment. Recognising this, the government has introduced a suite of initiatives, including the National Logistics Policy for systemic reform, the PM Gati Shakti masterplan, Bharatmala for road connectivity, and Dedicated Freight Corridors (DFCs) to enhance rail freight. The ambition is clear: reduce logistics costs to single digits, increase rail's freight share to 45 per cent by 2050, and decarbonise logistics in parallel.

Revamping rail and road

The Indian Railways, traditionally a passenger-centric system, is being reoriented to carry more freight, faster, cleaner, and more efficiently. The Eastern and Western Dedicated Freight Corridors (DFCs) are nearing completion, enabling freight trains to run at speeds of 70 km/h, three times the current average. These corridors will significantly ease congestion on passenger rail lines, reducing delays and cutting fuel use. In Gujarat and Maharashtra, Indian Railways is piloting short-haul freight services under 300 km, offering competitive rates to shift cargo from roads to rail. By lowering tariffs and streamlining booking and handling, the goal is to make rail viable even for intra-state logistics.

In parallel, multitracking projects—including key routes like Delhi-Mumbai and Chennai-Bengaluru—are being fast-tracked, while over 99 per cent of the broad-gauge network is now electrified, drastically reducing diesel reliance and improving energy efficiency. Hydrogen-powered locomotives may no longer be a distant dream, while self-propelled passenger trains like the Vande Bharat have been successfully rolled out. Freight Smart Cities are being envisioned to integrate warehousing, terminals, and rail-road connectivity, improving end-to-end cargo flows.

Trucks remain indispensable to India's freight future. Over 7 million heavy-duty trucks currently ply the country's roads, with that number expected to double by 2030. Decarbonising this sector is crucial. Commercial EV adoption is gaining momentum, with improved vehicle range, falling battery costs, and government-backed subsidies such as Faster Adoption and Manufacturing of Hybrid and Electric Vehicles (FAME) and state EV policies, making electric trucks increasingly viable for last-mile and intra-city deliveries. Companies plan to invest in and deploy thousands of liquefied natural gas (LNG) and electric trucks by 2026, serving clients across e-commerce, manufacturing, and mining. Biofuels, ethanol-blended petrol, and hydrogen are being explored, particularly for long-haul fleets. Under the e-FAST India programme, the country's first zero-emission

Green Freight: Rising Emissions, Bold Targets

Logistics Market Boom

India's logistics sector is projected to grow from $317.26 bn in 2024 to $484.43 bn by 2029, expanding at a CAGR of 8.8%, positioning the country as a global logistics powerhouse.

Emission Challenge

Over 60% of India's freight emissions stem from road transport, underscoring the urgent need to accelerate rail freight expansion, clean energy adoption, and multimodal solutions.

Skewed Modal Mix

Despite rail being up to 75% more efficient, 70% of India's freight still moves by road, making the system costly and CO2-intensive. Scaling rail and inland waterways is critical for sustainable logistics.

Railway Modernisation Push

India is transforming rail freight with DFCs and 99% broad-gauge electrification, reinforcing Indian Railways as a freight-first backbone for economic growth.

Vision 2040

By 2040, India aims to reduce logistics costs by 30% and double freight volumes, without doubling emissions through policy integration, clean tech, and infrastructure modernisation.

Source: Government data, Jupiter Group

▼ In FY2025, Indian Railways set new benchmark by loading a record 1.61 billion tonnes of freight, overtaking the US to become the world's second-largest rail freight carrier, behind only China.

road freight cluster is being developed along the west coast, supported by government-industry partnerships.

Logistics infrastructure is evolving, too: 35 multimodal logistics parks (MMLPs) are under development to co-locate road, rail, and warehousing operations, streamlining cargo movement.

While these initiatives are commendable, much work remains. Freight emissions continue to rise sharply, with heavy-duty vehicles—just 2-3 per cent of India's fleet—accounting for over 30 per cent of transport-related CO2 emissions. According to the think tank, Council on Energy, Environment and Water (CEEW), India's freight demand is set to soar from 2,000 billion tonne-km in 2020 to over 10,000 billion tonne-km by 2050. Without decisive intervention, freight emissions alone could derail India's climate goals.

So, how can India sustain its freight expansion while meeting net-zero targets?

Pulling the five strategic levers

Currently, rail freight is most competitive over distances exceeding 500 km. However, most domestic cargo moves within shorter ranges, making the expansion of short-haul rail services an urgent priority for India. Achieving this will require dynamic pricing models to compete with trucking rates, containerised movement for greater flexibility, investments in smaller terminals and sidings to speed up loading and unloading, and app-based freight booking systems to onboard micro, small, and medium enterprises (MSMEs) along with local players. By making rail transport nimble and cost-effective on 200-400 km routes, India can unlock a significant modal shift.

Designate clusters near DFCs, ports, and industrial parks as green freight economic zones (GFEZ), with dedicated infrastructure and policy support. Each GFEZ could mandate that 50 per cent of freight movement be done via rail, EVs, or LNG trucks, incentivise EV adoption through electricity subsidies and priority loading, and power warehouses with renewables, turning them into net-zero logistics hubs. Such zones can serve as incubators for clean technologies while delivering scale.

Here, the framework for taxing freight transport also needs an overhaul. Conduct a dedicated awareness campaign in close collaboration with the auto manufacturers on implementing technologies to reduce emissions. Offer reduced GST slabs or

▲ India transports over 4.6 billion tonnes of freight annually, with approximately 70 per cent moved by road, 26 per cent by rail, and the remaining 4 per cent via inland waterways, pipelines, and air.

tax holidays for operators switching to electric or alternative fuel fleets. Provide green credits to logistics companies that meet carbon efficiency benchmarks. Beyond tax incentives, regulatory transparency can further accelerate freight decarbonisation. Establishing a national, publicly accessible green freight registry would track emissions intensity across fleets, routes, and modes, providing critical data for ESG-aligned supply chain decisions. Such a registry could also enable government procurement to favour green logistics providers and offer data-driven eligibility for green loans and carbon markets. Ultimately, transparency is the first step toward accountability.

Finally, the future of Indian freight isn't about road vs. rail, but it is about orchestrating both, along with inland waterways and coastal shipping. Therefore, the country must expand inland waterway cargo movement, especially along the rivers Ganga and Brahmaputra, improve port-hinterland rail connectivity, cut down on road congestion, and integrate Unified Logistics Interface Platform (ULIP) with private transport management systems to create an end-to-end freight visibility network

The goal should be clear: the most efficient route, regardless of mode.

Impossible is nothing!

India is making all the right moves, but now is the time to stitch them together into a cohesive, scalable green freight strategy. The pieces are there: dedicated corridors, zero-emission trucks, logistics parks, and progressive policies. What is needed is urgency and unity of action. A cleaner freight economy is not a luxury. It is a necessity. It will bring down logistics costs, open up global trade lanes, and improve air quality for millions. It will also solidify India's position as a leader not just in growth, but in green growth.

The foundation is set, the momentum is building, but will India seize the moment to redefine green freight for the world?

If India can move 10 billion tonnes of goods without wrecking its air, burning more fuel, or clogging its highways, it would do more than decarbonise logistics. It would define how a developing economy leaps into the future, cleanly, competitively, and confidently. Imagine a 2040 where India's freight runs on clean energy, costs 30 per cent less, and powers not just the economy but global leadership in green growth. This is not a utopian vision; it is entirely achievable with sustained policy action and private sector resolve. IT

ABOUT THE AUTHOR:
Vivek Lohia, Managing Director, Jupiter Group. He also serves as Chairman of the National Railway Council of ASSOCHAM and is a member of several industry chamber committees, including those of FICCI and CII.

Empowering Aatmanirbhar Infra Financing

With the right safeguards and incentives, India can lay the groundwork for a truly aatmanirbhar (self-reliant) infrastructure financing ecosystem—one where citizens don't just contribute to the nation's development but actively co-build and co-benefit from it, argues Shivam Bajaj.

Once marred by mounting non-performing assets, regulatory gridlock, and land acquisition hurdles, the Indian infrastructure industry was viewed with trepidation by investors. Projects routinely stalled, timelines stretched endlessly, and returns were unpredictable. The period 2010 to 2014 was particularly grim, characterised by stalled projects, delayed milestone payments, and ballooning project costs. Infrastructure companies struggled to survive, and waves of bad debts surged across the banking system.

During this phase, infrastructure development revolved largely around roads, highways, and coal-based thermal power plants. However, in both segments, fundamental issues derailed progress. In roads and highways, acquisition delays, sluggish clearances, and unmet traffic projections led to massive project stress. Several developers went bust or entered insolvency proceedings, with assets landing at the National Company Law Appellate Tribunal (NCLAT) for resolution. Meanwhile, in the power sector, developers heavily invested in coal-fired plants, only to face coal supply constraints that prevented many from reaching commercial operations.

The turning point

As these traditional models faltered, India began pivoting toward renewable energy, with significant capital inflows into solar and wind projects. Initially viewed with scepticism due to high capital intensity and uncertain returns, renewable energy gradually proved its commercial viability, marking a fundamental shift in India's power strategy and climate commitments.

Responding to the broader crisis in the infrastructure sector, the government launched sweeping reforms. Among the most consequential was the implementation of the Insolvency and Bankruptcy Code (IBC), which transformed promoter behaviour and instilled financial discipline across the sector. The fear of losing control through insolvency proceedings served as a powerful deterrent against irresponsible financial management.

Another game-changer was the introduction of infrastructure investment trusts (InvITs). Designed to unlock developer capital, InvITs

Infrastructure Expansion Over Last Decade

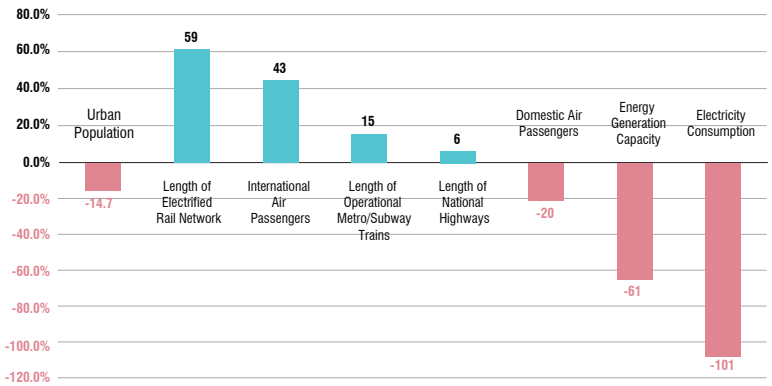
Indicator	2013	2023	2030 Target
Central Govt Capex Allocation to Core Infra (% of GDP)	0.5	2.20%	-
Length of National Highways (Kms)	97,991	1,46,145	~2,00,000
National Highway Construction Per Day (Kms/day)	12	34	-
Modernisation of Railways: Operational Vande Bharat Trains	-	100+	800
Length of Operational Metro (Kms)	248	945	1595
% of Cargo Transhipment Handled by Indian Ports	-	25%	>75%
Power Generation (GW)	243	442	1100
Renewable Power (GW)	30	175	500
Tele density (% of Population)	75.23	85.69	NA
EV Charging Stations (Units)	-	12,146	3.9 mn

Source: Government Data, Knight Frank Research

▼ A 2022 CREDAI-Anarock study estimates that India will require approximately $3.8 billion in investments over the next three years to develop 223 million sq. ft of Grade-A warehousing.

Infrastructure Availability: in India 2023 ahead of China 2007 in some and lags in others

Infrastructure Availibility: India 2023/China 2007 (%)



Source: RBI, Govt Data, National Bureau of Statistics of China, Knight Frank Research, Private Participation In Infrastructure (PPI) Database, 2023

helped them deleverage balance sheets while offering institutional and retail investors a regulated, tax-efficient vehicle for infrastructure exposure. Over the years, InvITs have become a linchpin of the country's infra-financing toolkit, increasingly attracting global institutional capital, including Canadian pension funds, sovereign wealth funds, and global infra-focused platforms.

Looking ahead, the next generation of InvITs is expected to have a stronger retail orientation, empowering citizens to own and earn from the infrastructure they use daily. Whether through toll roads or power lines, InvITs offer a route to financial democratisation, with returns often 200-300 basis points higher than traditional savings products. This shift not only deepens public participation but also unlocks large-scale domestic capital essential for India's ambitious infrastructure buildout.

Enter financial innovation

India's financial innovation extended further with the development of the Gujarat International Finance Tec-City (GIFT City), offering Indian firms a platform to tap global capital. By enabling foreign currency listings and creating an internationally competitive financial ecosystem, GIFT City is now a key gateway for infrastructure companies seeking long-term offshore funding.

At the heart of India's current infrastructure strategy lies asset monetisation—a model designed to generate upfront capital by leasing out revenue-generating public assets to private players, without relinquishing ownership. This framework—championed through the National Monetisation Pipeline (NMP)—aims to recycle capital into new infrastructure while boosting private sector participation.

The response from global investors has been overwhelmingly positive. Supported by a stable regulatory regime, long-term policy visibility, and improving governance standards, the country is now seen as a reliable destination for 'patient capital'. Recent marquee transactions across roads, transmission lines, airports, and warehousing reflect rising foreign interest and confidence in the Indian infra story.

However, despite these advances, significant challenges persist. Land acquisition delays—especially in roads—and issues related to grid connectivity in the power sector remain formidable bottlenecks. For engineering, procurement and construction (EPC) players, the environment remains tough: stretched working capital cycles, compressed margins, and liquidity stress continue to hamper their sustainability. Additionally, policy clarity and long-term planning are still evolving in newer areas such as electric vehicle infrastructure, battery storage, and green hydrogen.

Emerging Frontiers for Private Capital

Emerging Segment	Compelling Propositions
EV Charging Infra	Policy Support, EV growth
Green Hydrogen	PLI Schemes, Global Demand
Battery Storage	Grid Stability, Renewable Integration
Data Centres	AI Adoption, Big Data

Source: Avener Capital

Democratising infrastructure

While large global institutional investors have anchored India's infrastructure resurgence, the next phase of growth must involve a more inclusive capital base, most crucially, retail investors. InvITs represent a unique opportunity to transform infrastructure financing from a sophisticated investor-dominated activity into a grassroots movement. By offering Indian households regulated access to income-generating infrastructure assets, like toll roads, transmission lines, and renewable energy, InvITs can democratise asset ownership and make the infrastructure story more participatory.

Retail participation is not only a funding solution it is a strategic national priority. Currently, infrastructure capital in India flows disproportionately from foreign institutions, often at higher costs and with currency risks.

For domestic EPC players and asset developers, this can inflate project costs and limit competitiveness. By allowing Indian citizens to co-own infrastructure assets, we keep domestic capital within our ecosystem and foster a cycle of local value creation.

Recent moves by the stock market regulator Securities and Exchange Board of India (SEBI), such as its proposal to reclassify InvITs as equity instruments, are a step in the right direction. This reclassification will simplify the investment thesis for retail investors, potentially widen participation, and provide InvITs with a clearer identity in the capital markets. But to truly unlock the power of retail capital, India must also craft a robust infrastructure investment policy framework—one that builds investor trust, ensures regulatory clarity, enforces risk-mitigation mechanisms, and protects retail investors' capital over the long term.

After all, these investors are already paying tolls, electricity bills, and gas charges—they are consumers of infrastructure. By enabling them to become co-owners, the country can generate a multiplier effect across the economy. If structured transparently and backed by strong governance, infrastructure investments can offer inflation-hedged, long-duration returns superior to traditional savings instruments.

A renewed policy push focused on investor education, risk transparency, governance, and capital safety can make infrastructure investing mainstream. With the right safeguards and incentives, India can lay the foundation for an aatmanirbhar (self-reliant) infrastructure financing ecosystem—where ordinary citizens co-build and co-benefit from the nation's development.

India's infrastructure sector has come a long way from policy paralysis and financial distress to becoming a high-priority engine of growth. Key reforms such as the IBC, InvITs, asset monetisation, and capital market access via GIFT City have all reshaped the investment landscape, attracting both domestic and global long-term capital. The sector is no longer just about building roads and power plants; it is about creating a resilient, inclusive, and investor-friendly ecosystem that supports a trillion-dollar economy.

As India moves toward becoming the third-largest economy in the world, infrastructure will remain the bedrock of that journey. The vision ahead is clear: mobilise patient capital, democratise asset ownership, and drive inclusive growth. With continued reforms and policy stability, the Indian infrastructure sector is poised to not just build the nation but to build lasting wealth for its investors, both local and global.

ABOUT THE AUTHOR:
Shivam Bajaj, Founder & CEO, Avener Capital

▲ **India needs ₹30 trillion in infrastructure, transmission, and storage by 2030 to power its green energy transition, according to MNRE data.**

Collaborating Beyond Bricks and Steel

All stakeholders, including industry, government, investors, institutions, and communities, need to work together to build infrastructure that is not only functional but also resilient, inclusive, and sustainable, opines YR Nagaraja.

In India, infrastructure is more than just roads, bridges, and buildings; it's the foundation of our growth story. It determines how efficiently we live, how sustainably we grow, and how inclusively we progress. Over the years, this sector has evolved rapidly. From mega highways to smart cities, from metro networks to renewable energy parks, India's ambitions have never been higher. The ₹10 trillion investment in the 2023-24 Union Budget underscores India's ambitions, but the real challenge is ensuring longevity and impact. But here is the real question: how do we ensure this infrastructure stands the test of time and truly serves people?

The answer, in my view, lies in partnerships. Today, we are facing an unprecedented wave of urbanisation. Cities are growing faster than ever, and the pressure on infrastructure is immense. Building in silos won't work anymore. What we need now are collaborative models for partnerships that bring together the strengths of governments, private players, financial institutions, communities, and even academia. Because when we come together, we don't just build projects, we build purpose.

Public-private partnerships (PPPs) are a great example of this. They have helped unlock

innovation, reduce risks, and ensure efficient execution. And more importantly, they offer tailor-made solutions suited to India's diverse and complex landscape. But collaboration is not just about sharing responsibilities; it's about co-creating outcomes. Infrastructure should respond to real needs, not just policy plans. And this only happens when diverse voices are heard and included from the start.

Demonstrable successes

We have already seen this working well. Take India's waste management efforts, for example. In several cities, local governments, NGOs, and private tech firms have come together to build integrated waste management systems. These are helping to not only solve sanitation challenges but also promote recycling, energy recovery, and circularity. Similarly, in renewable energy, collaboration has powered India's phenomenal growth. We are now generating over 46 per cent of our total capacity from clean sources, and we are well on track to meet our 500 GW target by 2030.

But that is just the beginning. What excites one the most is how this spirit of partnership is expanding into other critical areas of urban infrastructure. Just recently, IIT-Delhi partnered with the Centre for Railway Information Systems to jointly improve the security, connectivity, and digital capacity of India's railway networks. This is a perfect example of how academic research can directly support real-world infrastructure challenges.

Seven Pillars of Collaboration

The Scale of India's Infrastructure Growth

₹10 trillion allocated in the 2023-24 Union Budget for infrastructure development.
Projects span roads, railways, smart cities, and renewable energy parks.

The Power of Collaboration

PPPs unlock innovation and efficiency.
Academic and industry partnerships drive real-world solutions.

Infrastructure and Sustainability

46% of India's energy capacity now comes from renewables; targeting 500 GW by 2030.
Water and sanitation initiatives leveraging tech-driven solutions for underserved communities.

Financing the Future

Punjab National Bank & India Infrastructure Finance Company Ltd co-financing major projects.
NaBFID & New Development Bank (NDB) funding clean energy and urban mobility.

Global Impact of Indian Infrastructure Expertise

RITES partnered with UAE's Etihad Rail for their National network.
India's transport and Infrastructure expertise is now shaping international projects.

Overcoming Challenges

Streamlining regulations, incentive frameworks, and local governance to improve execution.
Policy needs to ensure alignment, transparency, and accountability in large-scale projects.

A Vision for the Future

Infrastructure is more than roads & bridges; it determines sustainability and inclusivity.
True success depends on partnerships between industry, government, and communities.

Source: Data Compiled by Author

▲ **Local governments, NGOs, and tech firms are driving integrated waste management solutions that enhance sanitation, boost recycling, and advance circularity.**

On an international front, RITES—India's transport consultancy—has joined hands with Etihad Rail in the UAE to work on their national rail network. Indian expertise is now being exported globally, creating value not just at home but also abroad.

Even in financing, collaboration is making waves. Punjab National Bank and India Infrastructure Finance Company Ltd have entered a partnership to co-finance long-term infrastructure projects. It is strategic, and it reduces the burden on any single institution. Similarly, NaBFID and the New Development Bank (NDB) have signed an MoU to co-fund sustainable development initiatives in clean energy and urban mobility, proving that development finance can be a powerful enabler when aligned with global priorities.

And there's more. In the water and sanitation sector, the Dr. Syama Prasad Mookerjee National Institute and Arghyam are working together to create digital public infrastructure for water, sanitation and hygiene (WASH) services. Their work could redefine how underserved communities access clean water and hygiene services, using data and technology as drivers of inclusion.

Each of these partnerships tells the same story: we are stronger together. And as we move forward, the success of our infrastructure journey will depend on how well we nurture this culture of collaboration.

Policy support critical

Of course, partnerships are not always easy. They require trust, alignment of goals, open dialogue, and a willingness to listen. Everyone involved must stay equally committed, right from project conceptualisation to delivery and operations. And for this to work seamlessly, policy support becomes crucial. Policy frameworks should not only incentivise investment but also streamline execution and accountability. India has made encouraging progress on that front, but we can still do more regarding simplifying procedures, creating better incentive frameworks, and empowering local decision-makers.

At the end of the day, building infrastructure isn't just about cement and steel; it is about people. It is about how we live, move, and thrive. And no single organisation, however resourceful, can go it alone. It will take all of us, including industry, government, investors, institutions, and communities, working in tandem to build infrastructure that is not only functional but also resilient, inclusive, and sustainable.

If we get this right, we won't just be building roads and rails—we'll be laying down the path for India's future.

ABOUT THE AUTHOR:
YR Nagaraja, Managing Director, Ramky Infrastructure

Operation Sindoor: The Indigenous Edge

India's aerial strikes on terror infrastructure inside Pakistan under Operation Sindoor have been more than a tactical success. They are also a defining moment for India's indigenous defence manufacturing. The first phase of the operation, running from May 7-10, saw homegrown technologies in air defence systems to precision-strike capabilities outperform foreign alternatives, proving India's strategic autonomy in modern warfare. Scaling up the defence production and exports will further strengthen the nation's position as a global military powerhouse.

Indigenous Air Defence Systems: The First Line of Protection

India's multi-layered air defence network proved instrumental in thwarting enemy attacks during Operation Sindoor. The deployment of Akash surface-to-air missiles, alongside legacy air defence systems like Pechora and OSA-AK, low-level air defence (LLAD) guns created an impenetrable shield against incoming threats.

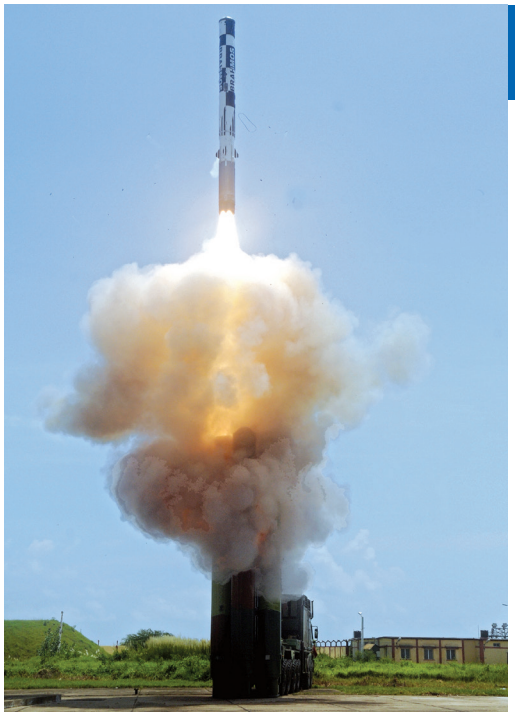
Key Contributors:

Akash Missile System: Successfully intercepted multiple aerial threats, including hostile drones and incoming ballistic missiles.

Integrated Counter-UAS Grid: The Unmanned Aerial System (UAS) effectively neutralised enemy Unmanned Aerial Vehicles (UAVs) attempting to breach Indian airspace with precision.

Electronic Counter-Counter Measures (ECCM): Ensured resilience against advanced enemy electronic warfare tactics.

The Integrated Air Command and Control System (IACCS) played a crucial role in coordinating responses across the Army, Navy, and Air Force, ensuring seamless defence operations.



Precision Strikes with Indigenous Missiles

India's offensive strategy relied heavily on homegrown missile systems, enabling surgical precision in targeting enemy installations. The BrahMos supersonic cruise missile, developed through an Indo-Russian collaboration, was a standout performer.

Key Contributors:

BrahMos Missile: Launched from land and air, obliterating terrorist infrastructure with unmatched speed.

Pinaka Rocket Launcher: The multi-barrel rocket launcher (MRBL) delivered rapid-fire strikes, ensuring sustained firepower.

Loitering Munitions: Enabled autonomous target engagement, reducing collateral damage.

These indigenous systems outperformed foreign alternatives, reinforcing India's strategic autonomy in modern warfare.

Strengthening Defence Manufacturing Through Policy Reforms

India's defence manufacturing sector has witnessed unprecedented growth, driven by strategic reforms and private sector involvement. The Make in India initiative has catalysed the development of advanced military platforms.

Key Contributors:

Light Combat Aircraft (LCA) Tejas: Strengthening India's modern aerial capabilities with agility.

Advanced Towed Artillery Gun System (ATAGS): Enhancing precision firepower in ground operations with effectiveness.

Indigenous Aircraft Carriers & Submarines: Expanding naval dominance.

Defence exports have surged to ₹240 billion in FY2024-25, with a target of ₹500 billion by 2029, reinforcing India's position as a major global arms supplier.

The Rise of Indigenous Drone Warfare

Drones have played a critical role in surveillance, reconnaissance, and precision strikes during Operation Sindoor. India's domestically produced UAVs, such as Nagastra-1 and SkyStriker, showcased their effectiveness.

Key Contributors:

Surveillance Drones: Provided real-time intelligence, enhancing battlefield awareness.

Combat UAVs: Delivered precision strikes, neutralising high-value targets.

Counter-Drone Technology: Successfully intercepted enemy UAVs attempting coordinated retaliatory strikes.

India's ban on imported drones and the Production-Linked Incentive (PLI) scheme have accelerated domestic innovation, positioning the country as a global drone hub.

The Future of Indigenous Defence Manufacturing

Operation Sindoor has validated India's self-reliance in defence technology, setting the stage for next-generation innovations.

Key Priorities:

Hypersonic Missiles: Enhancing strike capabilities.

AI-Driven Autonomous Drones: Revolutionising warfare tactics.

Green Defence Technologies: Reducing carbon footprint and environmental impact.

India's commitment to technological self-reliance ensures that future military operations will be powered by indigenous innovation, reinforcing national security and global leadership.

Source: Ministry of Defence, Open Source Intelligence, News Reports

Securing India's New Crown Jewels

As India advances its economic growth and strengthens its global presence, embedding security-by-design into the infrastructure being built will ensure resilience, safety, and long-term national prosperity, writes Pushkar Gokhale.

The story of India's transformation is inseparable from the story of its infrastructure. Roads, railways, airports, smart cities, digital highways, and energy corridors, you name it, these are not just public assets but vital arteries powering our economic engine and social progress. As the world's fifth-largest economy sets its sights on becoming the third-largest within the next decade, infrastructure development has become central to the national agenda. Beyond concrete, steel and coding, security is an understated pillar of progress. As India builds bigger and faster, the need to secure infrastructure assets being created has never been more critical.

India is undergoing an infrastructure renaissance. Mega projects like the Delhi-Mumbai Industrial Corridor, the Bharatmala and Sagarmala initiatives in road and water transport, trans-harbour links, and the redevelopment of more than a hundred railway stations are redefining connectivity nationwide. Simultaneously, the Digital India mission is laying the groundwork for a nationwide network

Source: Grand View Research

of data centres, fibre optic infrastructure, and smart grids. The government's allocation of ₹10 trillion in capital expenditure in the latest Union Budget underscores the urgency and ambition with which the nation is moving. However, infrastructure is not merely about execution and engineering; it is also about preservation, accessibility, and above all, resilience. And in this regard, security must become as fundamental to the national development narrative as construction.

Building robust security frameworks

Around the world, developed economies have recognised that robust infrastructure must be matched by an equally robust security

▼ **India's ₹11.21 trillion infrastructure allocation in the Union Budget 2025-26 drives the Viksit Bharat @ 2047 vision, advancing roads, railways, urban development, and logistics.**

Securing India's Infrastructure Renaissance

A Changing Risk Landscape: Infrastructure faces evolving threats—from cyberattacks to climate-related vulnerabilities—requiring proactive security integration.

Emerging Threats: Data centers, transport hubs, and energy grids face new vulnerabilities as India's infrastructure expands and interconnects.

Smart Security Adoption: Global models like Singapore and UAE embed AI surveillance, biometric access, and automated emergency protocols into public assets—India must follow suit.

Policy-Driven Protection: Dedicated security budgets, national audits, tax incentives, and certification standards are essential for resilient infrastructure.

Future-Proofing Growth: Investing in security-focused talent pipelines ensures India's infrastructure remains protected as it expands with advanced technology.

Source: Godrej & Boyce

framework. Countries such as Singapore and the UAE have institutionalised security-by-design, integrating advanced access controls, AI-powered surveillance, biometric verification systems, and resilient emergency response protocols into the very foundation of their public assets. These are not reactive measures—they are proactive strategies rooted in foresight. For India, where physical and digital infrastructure are advancing in tandem, the imperative to follow this integrated approach is not aspirational, but necessary.

The threat landscape today is multidimensional. From physical intrusion and vandalism to sophisticated cyberattacks targeting smart cities, data centres, and transport networks, our growing reliance on interconnected systems brings new vulnerabilities. Neglecting security in the planning stage leads to exponentially greater costs—economic, operational, and reputational—at a later stage. The ransomware attack on the prestigious New Delhi's All India Institute of Medical Sciences (AIIMS) in 2022 served as a wake-up call, revealing how even institutions of national importance are not immune. When a railway station, airport, port terminal or energy grid is compromised, the impact reverberates through the entire ecosystem, disrupting not just services but also shaking public trust and investor confidence. To safeguard these assets is to safeguard the nation's future.

Besides, there is growth in security. The Indian security market was valued at $8.77 billion in 2024 and, as the fastest-growing regional market across Asia-Pacific, this is projected to reach $16.97 billion by 2030, according to market consultancy and research firm Grand View Research. This represents a projected growth rate of 11.3 per cent CAGR in the five years, from 2025 to 2030. This expansion in demand is expected to be driven by increasing concerns over cybersecurity, rising demand for surveillance systems, and government initiatives to enhance security infrastructure. In 2024, the world's fastest-growing major economy accounted for 6.1 per cent of the global security business. In terms of sub-segments, systems is currently the largest revenue-generating component, while services are expected to register the fastest growth during the forecast period.

We must fundamentally shift our approach and reimagine security as infrastructure. It must shift from an afterthought to a core design principle. As India's cities grow smarter and our transport and energy systems become more integrated, embedding security at every layer—from architectural planning and system design to operations and maintenance—is vital. In this effort, collaboration between public institutions and private industry will play a

▲ **The modern threat landscape spans physical intrusions to cyberattacks, exposing smart cities, data centres, and transport networks to new vulnerabilities.**

defining role. The private sector must step up not just as suppliers of equipment, but as strategic partners in resilience-building. Meanwhile, policy must act as an enabler. Dedicated allocations for infrastructure security within every public project, tax incentives for developers who adopt certified security systems, periodic security audits, and national-level certification standards for infrastructure assets—these are the kinds of interventions that can shift the paradigm. Furthermore, India must invest in building a talent pipeline for infrastructure security, creating a new generation of professionals trained at the intersection of engineering, technology, and safety.

THE PRIVATE SECTOR MUST STEP UP NOT JUST AS SUPPLIERS OF EQUIPMENT, BUT AS STRATEGIC PARTNERS IN RESILIENCE-BUILDING. MEANWHILE, POLICY MUST ACT AS AN ENABLER.

Encouraging developments

We are already witnessing encouraging signs in this regard. The Atal Setu in Mumbai—an engineering marvel—is equipped with over 400 marine-grade security doors that are designed to withstand coastal corrosion and intrusion, demonstrating the integration of protection with purpose. In Delhi, the Common Central Secretariat redevelopment under the Central Vista project has incorporated smart surveillance and access control technologies, including bollards, X-ray baggage inspection systems, under-vehicle surveillance systems, turnstiles, door frame metal detectors, boom barriers and more. Even heritage projects like the conservation of Humayun's Tomb have embraced access control systems that preserve while protecting. We have also been instrumental in leading initiatives such as the oil & gas major BPCL's deployment of an Integrated Outsourced Workforce Management System across 140 sites nationwide that redefine security-focused digitalisation. Furthermore, the iconic Taj Mahal has enhanced its security infrastructure by implementing biometric access control systems for entry and exit. These are not isolated success stories—they reflect a growing realisation that resilience is no longer negotiable.

India's growth is no longer a question of potential; it is a question of preparedness. In the coming decade, as trillions of rupees flow into infrastructure, the country has a chance to build not just expansively, but securely. The decisions we take today—whether through public policy, private investment, or urban planning—will determine whether our infrastructure can withstand the tests of time, technology, and threats.

A resilient nation is a secure nation. As India builds for the future, it must secure what it creates today, because a resilient nation is built not just on ambition, but on protection.

Resilience as the Backbone of Progress

Security as a National Imperative: Beyond rapid expansion, India must embed resilience into every infrastructure project—protecting assets from cyber threats, physical vulnerabilities, and operational disruptions.

Infrastructure at Risk: The AIIMS ransomware attack in 2022 exposed vulnerabilities in national institutions—transport hubs, energy grids, and data centers require reinforced security measures.

Private Sector as Strategic Partner: Companies must go beyond supplying security solutions and actively collaborate in resilience-building across major infrastructure projects.

Technology-Enabled Protection: From biometric entry systems at the Taj Mahal to marine-grade security doors at Atal Setu, India's flagship projects demonstrate security integration.

The Next Decade of Safeguarding Growth: National security and economic stability are interlinked—securing India's infrastructure today ensures uninterrupted progress tomorrow.

Source: Godrej & Boyce

ABOUT THE AUTHOR:
Pushkar Gokhale, Head, Security Solutions Business, Godrej Enterprises Group

Bharatmala: Driving Efficiencies with Technology

From cost overruns and procedural hurdles to technology-driven savings and timely execution, Bharatmala Pariyojana demonstrates how adaptive infrastructure ensures efficiency and future readiness, explains Shailesh Agarwal.

The Bharatmala Pariyojana, launched in 2017, was conceptualised as a nationwide highway development initiative to optimise freight and passenger movement. In its first phase, the programme aimed to develop 34,800 km of national highways with a financial outlay of ₹5.35 trillion by September 2022, per the Comptroller and Auditor General's (CAG) annual report, with implementation progressing in phases across various regions.

Hitting roadblocks

Challenges started appearing once the project rollout began in the right earnest. The initially approved target length of 24,800 km was later increased to 34,800 km, a 160 per cent rise post-optimisation. However, this expansion was carried out without corresponding financial approvals, resulting in a gap between the revised targets and available resources.

Despite the Cabinet Committee on Economic Affairs' (CCEA) mandate, several projects were awarded without securing 80-90 per cent of the right of way (RoW). Consequently, projects such as Barhi-Koderma and Chordaha-Gorhar suffered multi-year delays due to pending forest clearances and land acquisition disputes.

The skew towards engineering, the procurement and construction (EPC) model increased the fiscal burden on the government and reduced private sector risk sharing. Detailed Project Reports (DPRs) lacked

site-specific feasibility alignment and were often prepared without adequate traffic studies or stakeholder consultation.

Issues concerning fund utilisation and borrowing oversight also cropped up. The National Highways Authority of India's (NHAI) cumulative borrowings stood at ₹3.00 trillion against ₹2.09 trillion approved for Bharatmala as a whole. The financial outlay of ₹10.55 trillion projected by NHAI for 2019 was almost double the original allocation.

Technology in various forms, i.e., artificial intelligence (AI), internet of things (IoT), drones, robotics and other digital initiatives, is reshaping how highways can be planned, built and maintained. Before delving deeper into how technology can be an enabler, its key areas are summarised in the table below.

AI-based route modelling

One of the most transformative applications of AI in highway development lies in route optimisation. Using AI-powered modelling, satellite imagery, and geospatial analytics, planners can determine the most feasible highway alignments. These tools factor in terrain, population density, environmental sensitivity, and infrastructure constraints, thereby minimising land acquisition hurdles, costs, and ecological disruption.

It is estimated that the Delhi-Mumbai Expressway, India's longest expressway at 1,386 km, where AI-based geospatial modelling helped authorities reduce land acquisition by nearly 15 per cent, translating to estimated savings of over ₹100 billion. Furthermore, the AI-optimised alignment supported the inclusion of over 70 wildlife crossings, including animal underpasses and India's first dedicated wildlife overpass, enhancing ecological connectivity without compromising infrastructure goals.

Internationally, the Stockholm Bypass (Förbifart Stockholm) in Sweden—a 21-km expressway with 18 km of tunnels—used machine learning and building information modelling (BIM) to simulate over 50 alignment options. This approach enabled planners to select a route that not only reduced environmental disruption but also cut projected costs by SEK3 billion (around ₹240 billion) in a project budgeted at SEK37 billion (₹295 billion).

IoT in construction

The deployment of IoT-enabled sensors across project sites has revolutionised project construction. These sensors track parameters such as material quality, temperature, and stress levels. When integrated with AI-based image recognition systems, engineers can monitor structural health, construction quality in real time and take corrective actions.

The Automated Intelligent Machine-aided Construction (AIMC) initiative by the Ministry of Road Transport and Highways (MoRTH)

Bharatmala Pariyojana: Cost Escalation Challenges*

Particulars	Approved	Awarded	Completed
Length (Kms)	34,800	27,391	17,411
%	-	78.68%	50.04%
Pre-Construction Cost (Incl. land acquisition, utility shifting, clearances, consultancy and admin)	10 mn per km	80 million per km	
Pre-Construction Cost Escalation (%)	-	800% ▲	
Construction Cost	140 million per km	24 Crore per km	
Construction Cost Escalation (%)	-	171% ▲	

*Till March 31, 2023

Source: Data Compiled by the Author

Progress Achieved in First Phase*

Corridors		National Highways Length Awarded Under Phase-1	National Highways Length Completed
Economic Corridors	EC	8527	3807
Inter Corridors & Feeder Roads	ICR & FR	3963	1614
National Corridors/National Corridors Efficiency Improvement Programme	NC/NEIP	2601	1638
Border & International Connectivity Roads	BR & IR	1600	1256
Coastal & Port Connectivity Roads	CR & PR	415	104
Green Field Expressways	Green Field Expressways	2422	958
Residual NHDP	Residual NHDP	6788	4122

*Till March 31, 2023

Source: Data Compiled by the Author

- **Economic Corridors (9000 km):** To unlock full economic potential
- **Inter Corridor and Feeder Route (6000 km):** Ensuring holistic connectivity
- **National Corridors Efficiency Improvement (5000 km):** Enhancing efficiency
- **Border Roads and International Connectivity (2000 km):** Boosting Border Connectivity
- **Coastal Roads and Port Connectivity (2000 km):** Leveraging Ports for Progress
- **Green field Expressways (800 km):** Express speeds for Express gains
- **Balance NHDP works (10,000 km):** Boosting all round connectivity

redefines highway construction by integrating automated machinery, GPS-based controls, and real-time digital monitoring through certain key technologies.

Utilising 3D machine-guided graders for precision earthwork ensures accurate cutting and filling operations, leading to optimal subgrade preparation. Traditional paving uses physical stringlines to guide equipment, often leading to delays and human error. Stringless technology replaces these with GPS and robotic total stations, enabling precise control of paver alignment and elevation. This improves surface smoothness, cuts setup time, and reduces manual errors.

Similarly, IoT-enabled systems feed live data to cloud dashboards for transparent monitoring. A standout feature is intelligent compaction (IC), using GPS-equipped rollers with onboard sensors to track pass count, stiffness (CMV), amplitude, and frequency across the entire compacted area, far beyond traditional point testing. This ensures uniform density, reduces post-construction defects, and enhances pavement life. This results in faster, high-precision execution with minimal or almost no rework, real-time quality control and documentation, greater durability, improved ride quality, and reduced manual errors and enhanced productivity.

Piloted successfully on the Lucknow-Kanpur Expressway, AIMC is now being scaled across select expressway and greenfield projects, supporting India's vision of advanced highways by 2047.

Telangana's Hyderabad Outer Ring Road is a prime example, equipped with IoT-enabled smart poles that monitor environmental conditions, structural strain, and traffic density, contributing to data-driven infrastructure management. The system has already helped substantially reduce traffic incident response time, notably by 30 per cent, and is integral to the city's broader smart mobility initiatives.

One of the most prominent global examples is Australia's WestConnex project, where IoT systems are embedded across tunnels and bridges. The sensors stream real-time data on stress levels and material fatigue to an AI-integrated dashboard for predictive maintenance. The WestConnex Maintenance Dashboard has been credited with cutting down

Technology as Enabler

Technology	Application Area	Examples	Impact
Artificial Intelligence (AI)	Route Modelling & Planning	Delhi-Mumbai Expressway	Reduced land acquisition costs
		Stockholm Bypass (Sweden)	Optimised alignment
			Ecological preservation
AI Forecasting	Procurement & Supply Chain	Bharatmala Dashboard (MoRTH)	Efficient procurement
			Reduced pilferage
Drones & Robotics	Construction Monitoring	Dwarka Expressway, Sheikh Zayed Corridor (Dubai)	Timely execution
			Better quality control
Internet of Things (IoT) & Image Recognition	Real-Time Monitoring	Hyderabad ORR, Lucknow-Kanpur Expressway, WestConnex (Australia)	Enhanced quality assurance, predictive maintenance
Automated & Intelligent Machine-aided Construction (AIMC)	Construction Execution	Lucknow-Kanpur Expressway	Faster and precise construction, uniform pavement quality, reduced defects
Smart Highways	Predictive Maintenance	Bengaluru STRR, E16 Electric Road (Sweden)	Lower maintenance costs
			Longer asset life,
			Readiness for autonomous vehicles

Source: Data Compiled by the Author

reactive maintenance needs by up to 25 per cent since its deployment.

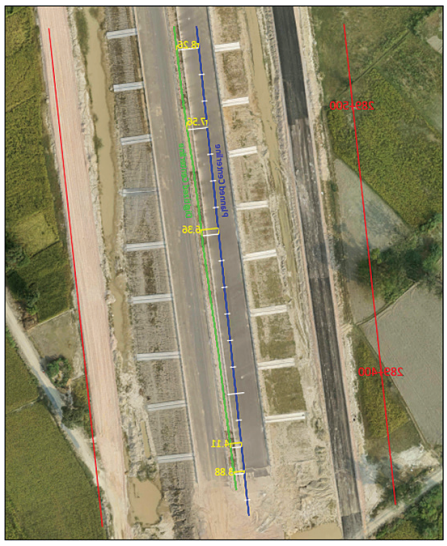
Drone deployment

To accelerate project timelines and improve execution precision, drones are being widely adopted. From earthmoving and grading to paving and structural inspections, these intelligent systems are enhancing the quality of construction and timeliness.

As part of our ongoing efforts for EPC contractor under Bharatmala Pariyojana for the Unnao-Lalganj section of NH 31, we conducted drone-based inspections across sample stretches to assess both centreline alignment and cross-section accuracy of the main carriageway. High-resolution aerial mapping revealed deviations in centreline positioning, enabling timely corrective measures. Additionally, drone-captured cross-section analysis identified issues such as excess shoulder work and reverse slope, particularly between chainages. These insights have proven valuable in minimising rework, enhancing accuracy, improving compliance with design specifications, and ensuring higher construction quality under Bharatmala.

India's Dwarka Expressway is a strong domestic example. The project deployed automated construction technologies and drones to monitor execution quality and ensure efficient resource management, streamlining the timeline and reducing human error. According to NHAI reports, this technology-led monitoring resulted in a 10-15 per cent reduction in project delays and significantly improved material management efficiency, while also reducing on-ground human dependency.

A noteworthy international reference is Dubai's Sheikh Zayed Corridor upgrade, which is part of the emirate's smart roads initiative. Here, AI-powered drones and robots have



▲ **High-resolution drone-based aerial mapping of the Unnao-Lalganj section of NH 31 enabled early identification of potential gaps during the construction phase.**

▼ **Bharatmala Pariyojana's most ambitious goal is to develop 34,800 km of highways across India, integrating economic corridors, expressways, border roads, coastal connectivity routes, and feeder roads to enhance freight and passenger movement.**

Status Under Different Development Modes

Category	Approved Model Mix	Actual Awarded Mix
BOT* (Toll)	10%	1.75% ▼
HAM**	60%	49.90% ▼
EPC***	30%	48.35% ▲

*Built-operate-transfer; **Hybrid annuity model; ***Engineering, procurement and construction
Source: Data compiled by the author

reduced construction timelines by over 30 per cent while enhancing safety and data precision for remote monitoring.

Enhanced transparency

AI is also transforming supply chain management in highway construction. Predictive algorithms analyse historical usage patterns and project timelines to forecast material needs to prevent shortages and delays. In parallel, blockchain-based procurement represents a next-generation approach to infrastructure governance, where every transaction from tendering to delivery is recorded on an immutable digital ledger, ensuring transparent, traceable, and tamper-proof documentation.

A successful implementation of this approach can be seen in MoRTH's Bharatmala Dashboard. The platform leverages AI and analytics to forecast material demand and monitor procurement efficiency, while integration with e-tendering platforms ensures contract transparency and reduces pilferage.

Smart highways, smarter maintenance

The future of road infrastructure is intelligent and responsive. AI-powered sensors embedded in highways can monitor parameters like vibration, stress, and temperature, allowing authorities to undertake predictive maintenance before problems escalate. This extends asset life and reduces operating costs.

This strategy has been effectively deployed in Bengaluru's Satellite Town Ring Road (STRR), where embedded sensors are planned for real-time monitoring and integration with autonomous vehicle systems, enabling proactive maintenance and connected mobility. The system is expected to significantly improve response times to maintenance issues and reduce downtime by up to 30 per cent, based on projections from NHAI.

A compelling international application is Sweden's E16 Electric Road, which uses AI-driven embedded sensors to analyse wear patterns, facilitate real-time EV charging, and alert authorities to pre-emptive maintenance needs, demonstrating how highways can be both smart and sustainable. Per the Swedish Transport Administration, 2021 trials indicate that this setup could reduce EV charging-related downtime by 40 per cent and extend pavement life through precise, condition-based interventions.

Technology is no longer a support function—it is central to the future of India's highway development. With AI-powered route planning, drone-based construction monitoring and IoT-driven asset tracking, the Bharatmala Pariyojana is steadily transforming into a smart, data-led infrastructure programme that truly epitomises innovation in motion. These innovations improve efficiency, transparency, and long-term sustainability across the project lifecycle. As India scales this initiative, the seamless integration of digital intelligence into every layer, from planning to maintenance, will be key. The next chapter in highway development must not only focus on building more roads, but on building them smarter, faster, and greener—laying the foundation for truly intelligent, adaptive, and future-ready infrastructure.

▼ **AI-powered highway sensors track vibration, stress, and temperature, enabling predictive maintenance that prevents escalation, extends asset life, and lowers operating costs.**

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“India is ready to build for the world!”

With a proposed $3 billion capex plan, INOXGFL Group—a 90-year-old chemicals-to-renewables powerhouse—is making big bets on India’s transition to green energy. **Devansh Jain, Executive Director, INOXGFL Group,** tells ***INFRASTRUCTURE TODAY*** in this exclusive interview that, driven by geopolitical realignments, India is uniquely positioned to scale its manufacturing capabilities across electronics, solar, wind, and battery technologies. Edited excerpts.

Since its inception, the INOXGFL Group has been known for adaptability and proactive planning. What are your capex plans for the next few years?

Our capex plans are clearly defined for the next three years. Across the group, we are heavily investing in INOX Clean, while INOX Solar is receiving significant funding for cell and module manufacturing. Meanwhile, our group subsidiary, GFCL EV, is expanding in its segment. We have outlined a major capex strategy, and although standalone investments may not seem substantial, they total approximately $200 million at the group level—our largest capex exercise to date. As a group, we are planning nearly $3 billion in capex over the next three years, constituting around 95 per cent of our total investment plans. The remaining 5 per cent, or roughly $150 million, will be allocated to other entities like INOX Wind.

You have also been working towards expanding your EPC (engineering, procurement, and construction) business…

EPC has always been integral to our operations. Wind energy is a complex space dominated by only a few players in India. Unlike solar, where multiple entities operate, the wind energy market is highly specialised, and turnkey solutions are critical. We are the largest turnkey providers, and we aim to maintain this position within India’s energy transition. Wind energy presents significant barriers to entry, not just in terms of investment, but also due to its long gestation period. We now approach the ecosystem holistically, evolving from selling

Devansh Jain, Executive Director, INOXGFL Group

wind turbines to addressing market demand for FDRE (firm and dispatchable renewable energy) and RTC (round-the-clock) power supply. To support this, we are integrating solar and BESS (battery energy storage systems). GFCL EV leads our BESS and EV business, with BESS as a forward integration strategy.

Our EPC services also reflect this growth. We noticed that cranes were major capex and opex drivers. To optimise costs, we decided to procure our fleet. The first batch has arrived, and additional cranes will be deployed every alternate month, with 10 to 15 operational within six to eight months to meet our internal requirements.

Additionally, we have ventured into transformer manufacturing for turbines and

scaled up turbine technology from 2 MW and 3 MW models to 4.5 MW. As part of this expansion, our EPC division is expected to soon be listed as INOX Renewable Solutions (formerly Resco Global Wind Services). We expect regulatory approval shortly. The three publicly listed operating entities will be INOX Wind, Gujarat Fluorochemicals, and INOX Green Energy Services, with multiple other group entities progressing toward eventual listing.

Another key focus area is O&M (operations and maintenance). Could you elaborate?

Our approach prioritises preventive maintenance. We have long deployed SCADA (supervisory control and data acquisition) across our projects. A centralised control centre at our corporate office oversees our nationwide fleet of nearly 4 GW, complemented by local control centres at major wind sites. Advances in AI-driven drone technology are improving efficiency while lowering costs. These innovations are being increasingly implemented as we expand our digital capabilities. With INOX Solar growing, our capacity will expand significantly. Our goal is to scale up to 10 GW within three years. Given this trajectory, digital integration will be critical for cost efficiency and operational excellence.

Is servicing the C&I (commercial & industrial) sub-segment still as attractive as it was a decade ago?

Many large business groups are now setting up captive power capacities. At INOX Clean, our IPP and solar manufacturing arm, we are developing significant capacity to meet our requirements. The rationale is simple: if we have the expertise to develop, build, and scale power, why source it externally? Similarly, major steel players are increasingly becoming captive IPPs (independent power producers) to capitalise on the benefits of power generation.

While the C&I segment remains a substantial opportunity, its attractiveness has evolved. Earlier, margins were higher due to fewer players and strong demand from large businesses. However, many companies now meet their energy needs internally, shrinking that particular market. Even among smaller entities requiring 10-30 MW, competition has intensified. To some extent, C&I solutions can be more viable than a SECI (Solar Energy Corp. of India) or NTPC PPA (power purchase agreement). However, risks remain, particularly with short-term deals. Instead of committing to a rigid 25-year PPA, we adopt a balanced strategy. Within our ecosystem, we have a mix of captive power, centrally bid tenders, state-level PPAs, and exchange power. Earlier, participation was profit-driven; today, sustainability and regulatory shifts play a crucial role.

What factors are driving this transformation?

Firstly, renewable energy is now the most cost-effective power source. Businesses prefer investing in renewables rather than purchasing power externally. Secondly, sustainability policies—such as the EU's CBAM (Carbon Border Adjustment Mechanism), which takes effect next January, are shaping energy decisions. Carbon taxes are progressively being introduced, and industries, whether green steel, green chemicals, or green hydrogen for ammonia, require renewable energy. Consequently, businesses are scaling up renewables for operational power and to meet environmental targets.

Thirdly, multinational corporations are prioritising green energy to fulfil sustainability commitments. India's domestic emissions trading scheme, already in the public domain, will likely accelerate demand from power-intensive industries. Voluntary carbon trading standards are emerging and, within two years, could become a major driver of renewable adoption. Lastly, green hydrogen is gaining traction. It replaces thermal power with wind and solar to generate hydrogen. With government policies mandating refinery

▼ **Noida-based INOXGL Group has earmarked nearly $3 billion for capital expenditure over the next three years, representing 95 per cent of its total planned investments.**

transitions to green alternatives—including green ammonia, green methanol, and green hydrogen—thermal-based energy requirements are gradually shifting to renewables.

How have policy initiatives like ALMM (Approved List of Models and Manufacturers) and PLI (Production Linked Incentives) benefited the sector?

India was proactive in responding to global tariff challenges. Prime Minister Narendra Modi's policy direction has been instrumental, particularly the PLI scheme, which provided the necessary incentive to give thrust to domestic manufacturing. While PLI has supported front-end production, we now advocate expanding its scope across the renewable supply chain. If components are imported from China and assembled in India due to domestic content requirements, the Make in India vision remains incomplete. To ensure a truly domestic ecosystem, PLI should extend across the entire supply chain.

Under ALMM for solar, modules must be manufactured in India. Initially, many firms sourced cells from China, but with the upcoming ALCM (Approved List of Cell Manufacturers) policy effective from June 2026, solar cells must be produced domestically. While wafering remains a smaller component, contributing roughly 25 per cent of the value, this policy shift will bring at least 75 per cent of solar manufacturing to India.

Some components may continue to rely on competitive global supply chains. However, India's long-term strategy is clear: it seeks complete self-sufficiency in manufacturing,

▲ Group subsidiary Inox Wind delivers comprehensive wind energy solutions, from resource assessment to turbine manufacturing.

INOXGFL Group: From Chemicals to Clean Energy

- **Legacy of Over 90 Years:** A pioneering Indian conglomerate with a strong foundation in chemicals and renewable energy.
- **Global Leadership in Fluoropolymers:** Gujarat Fluorochemicals Ltd (GFL) is India's largest producer of fluoropolymers, serving industries worldwide.
- **Diversified Business Segments:** Expertise spanning fluorochemicals, battery chemicals, wind turbines, and renewable energy.
- **Strong Sustainability Focus:** Deeply integrated into the green ecosystem, driving innovation in clean energy solutions.
- **Market Capitalisation:** ~$12 Billion, a testament to its robust growth and industry leadership.
- **End-to-End Wind Energy Solutions:** INOX Wind Ltd is a fully integrated player providing turnkey solutions in the wind energy sector.
- **Global Presence:** Offices and warehouses across Europe and the US, ensuring seamless international operations.
- **Backward-Integrated Operations:** Vertical integration from natural minerals to high-value-added products.
- **Cutting-Edge Research & Innovation:** Two modern research centers in Gujarat focusing on product innovation and application development.
- **Revenues:** INOXGFL Group reported consolidated revenues of ₹61.4 billion for FY2024.

Source: Company, IT Research

reducing dependency on neighbouring countries. PLI has already spurred front-end manufacturing growth in electronics, with multinational corporations expanding operations in India. Given the geopolitical shifts between the US and China, India is uniquely positioned to advance its manufacturing capabilities across electronics, solar, wind, and battery technologies.

How will the auction for 37 GW of offshore wind across Gujarat and Tamil Nadu impact demand for wind turbines?

Offshore wind is an ambitious move, but significant groundwork remains. India is a developing nation prioritising cost-effective power solutions. If electricity costs ₹3.5 per unit, states will likely hesitate unless it's available at around ₹3. Offshore energy costs 2.5 times more than onshore—so why would buyers opt for ₹6-7 per unit when they can secure power at half the price?

Unlike Europe, where wind turbines are often seen as aesthetic infrastructure, or China, which mandates 25 per cent offshore investment, India's focus is on meeting essential energy needs. Offshore projects in Tamil Nadu and Gujarat face multiple approval

▲ INOXGFL's Dahej plant in Gujarat produces fluoropolymers, specialty chemicals, and LiPF6, a vital electrolyte salt for lithium-ion batteries.

processes, followed by lengthy site assessments. Realistically, the first operational offshore turbine is at least five years away.

As one of India's top three wind turbine manufacturers, INOX Wind has developed competitive products like the 3.3 MW, 2 MW DFIG (doubly-fed induction generator) turbine, and the upcoming 4.5 MW model. All are offshore-capable, positioning us to enter the market when the opportunity materialises. However, offshore wind is unlikely to scale meaningfully soon. A 50-100 MW demonstration project is not true market expansion. India's onshore wind potential is estimated between 300 GW and 1,200 GW based on current technology, yet installed capacity is just 50 GW. Over the next 30-40 years, there is ample room for growth within onshore wind alone.

As a leading renewables player, how do you contribute to green hydrogen's viability?

We are among the world's top two fluoropolymer producers. In electrolysers, PEM (proton exchange membrane) accounts for nearly 40 per cent of fluoropolymer costs. This space is currently dominated by a few global players. We are developing and patenting fluoropolymer technology, with years of R&D backing our advancements. As India's green hydrogen ecosystem matures, electrolyser costs will likely decline around 2026, making domestic solutions more competitive.

INOX Clean will eventually enter green hydrogen production. As scalability improves, we will expand into front-end operations within this sector.

Where do you currently stand in component manufacturing?

Our products are undergoing certification across categories, with large-scale commercial sales expected within a year.

How much of your budget is allocated to R&D?

We don't follow a fixed percentage; investments are need-based. Across our group, dedicated teams work on battery storage, solar, fluoropolymers, and EV chemicals.

You have been actively working in the battery sector. Are you exploring new chemistries?

The global battery supply chain is overwhelmingly China-dominated, with about 95 per cent of production concentrated there. Under President Donald Trump's tariff strategy, the US is effectively cutting off China from the renewables and EV ecosystem. In response, GFCL EV is setting up the world's largest battery chemical complex outside China. We recently raised ₹10 billion at a $3 billion valuation through a pre-series funding round. We are building this business at an unprecedented speed and scale. It's a global endeavour aligning with India's Aatmanirbhar Bharat (self-reliant India) vision for BESS and EV mobility. Fluorine is the backbone of battery chemistry, and we are actively working across multiple formulations, including LiPF6, NAPF6, LFP, and LIFC. Our teams are continuously optimising efficiencies through advanced permutations, combinations, and material improvements.

What growth do you anticipate from exports in the future?

India is at a strategic inflection point in the EV revolution, well-positioned to build for the world. As global EV adoption accelerates, we aim to capture a significant share of the domestic market. Historically, GFL exports nearly 70 per cent of its production, spanning refrigerants, fluoropolymers, and now EV chemicals, through a distribution network covering 80 countries. Our export strategy, however, will depend on the scale and scope of opportunities. If the demand is primarily domestic, we will prioritise local markets. If it presents a global play, we will actively pursue export expansion. For instance, given India's growing power demand, establishing an IPP plant in the UAE or Canada wouldn't be a priority.

- MANISH PANT

Defence Budget Set for ₹500 Billion Top-up

Following successful missile strikes on nine major terror camps in Pakistan, India is reportedly considering an additional ₹500 billion defence allocation this fiscal, according to government sources. The military operation, which began on 7 May, was later extended to 11 air bases, crippling Pakistan's air defence infrastructure. The neighbouring country has long been accused of harbouring terrorist training facilities. The strikes were in retaliation for the killing of 26 Indian and international tourists in Kashmir by Pakistan-trained terrorists on 22 April. In the Union Budget for 2025-26, India allocated ₹6.81 trillion for defence, marking a 9 per cent increase from ₹6.22 trillion last year. The proposed supplementary budget, expected to be tabled during the Parliament's winter session, would bolster the acquisition of weapon systems, ammunition, and equipment. A substantial share of contracts is likely to go to domestic defence firms across the public and private sectors. The four-day Operation Sindoor demonstrated the effectiveness of indigenous air defence systems, neutralising enemy counterattacks involving swarm drones and ballistic missiles. In his national address on 12 May, Prime Minister Narendra Modi stated, "During this operation, the credibility of our Made in India weapons was also proven. Today, the world is witnessing that in 21st-century warfare, the time has come for Made in India defence equipment."

Gaganyaan Scheduled for 2027 Launch

India's first crewed spaceflight programme, Gaganyaan, has entered its final phase, with the maiden human spaceflight now scheduled for the first quarter of 2027, according to Jitendra Singh, Minister of State, Department of Space. Singh said the successful test vehicle earlier this year laid a strong foundation for the next trial in 2025, followed by two uncrewed orbital flights in 2026, culminating in India's first human spaceflight. Calling it a historic endeavour, Singh emphasised that the programme's significance extends beyond scientific achievement. "It represents India's rise as a global space power built on indigenous technology, fiscal prudence, and visionary political leadership," he said. He added that the mission's technological and economic returns far exceed its costs. "The expenditure being incurred on the Gaganyaan project is minimal when compared to similar human spaceflight missions conducted by other countries." Astronaut training is progressing steadily. Four Indian Air Force pilots, selected as astronaut-designates, have completed training in Russia and are now undergoing mission-specific preparation in India. Their health, psychological fitness, and simulation-based readiness are continuously monitored.

India Committed to Unlocking Energy Potential: Puri

With an economy reliant on imports for 80 per cent of its crude oil and 50 per cent of its natural gas, India is focused on building a resilient, future-ready energy ecosystem, Hardeep Singh Puri, Union Minister for Oil & Natural Gas, has said. Launching the Open Acreage Licensing Policy (OALP) Round-IX and Special Discovered Small Field (DSF) Signing Ceremony on April 15, Puri noted that India would account for 25 per cent of global incremental energy demand growth over the next two decades. He contrasted this with the 2006-16 period, when leading global energy players, including BG, ENI, and Santos, exited India's upstream sector. "We were determined to unlock India's untapped energy potential, estimated at approximately 42 billion tonnes of oil and oil equivalent of gas,"

he said. A series of transformative reforms has expanded exploration activity, increasing the explored area of India's sedimentary basins from 6 per cent in 2014 to 10 per cent today, with a target of 15 per cent. Puri said exploration acreage would reach 1 million sq km by 2030, highlighting a 99 per cent reduction in 'No-Go' areas within India's Exclusive Economic Zone (EEZ). This has been driven by scientific data-led exploration, a ₹75 billion investment in seismic data acquisition, aerial surveys, and stratigraphic wells. Under OALP Round-IX, 28 blocks across eight sedimentary basins have been awarded, covering 136,000 sq. km. Similarly, DSF Round-IV includes 55 discoveries across nine contract areas, with estimated reserves of 258.59 million metric tonnes of oil equivalent (MMTOE).

Major Ports Handle Record Cargo Throughput in FY2025

As India expands its global trade footprint and modernises its logistics infrastructure, the country's major ports have recorded an impressive 4.3 per cent annual growth in cargo handling, increasing from 819 million tonnes (MT) in FY 2023-24 to 855 MT in FY 2024-25. This growth was driven by higher container throughput (10 per cent), fertiliser cargo handling (13 per cent), petroleum, oil and lubricants (POL) cargo handling (3 per cent), and miscellaneous commodities (31 per cent) compared to the previous fiscal. Among commodities handled at major ports, POL—including crude, petroleum products, liquefied petroleum gas (LPG), and liquefied natural gas (LNG)—led the charts with a volume of 254.5 MT (29.8 per cent), followed by container traffic at 193.5 MT (22.6 per cent), coal at 186.6 MT (21.8 per cent), and other cargo categories such as iron ore, pellets, and fertilisers. Thanking all stakeholders, Sarbananda Sonowal, Union Minister for Ports, Shipping & Waterways, stated: "From record-breaking cargo handling to significant improvements in operational parameters and financial performance, the achievements of FY2024-25 reflect the resilience and readiness of our ports to support India's growing trade ambitions." For the first time in the history of major ports, Paradip Port Authority (PPA) and Deendayal Port Authority (DPA) surpassed the 150-million-tonne cargo handling mark, reinforcing their status as key hubs of maritime trade and operational excellence. Meanwhile, Jawaharlal Nehru Port Authority (JNPA) set a record by handling 7.3 million twenty-foot equivalent units (TEUs), reflecting a 13.5 per cent YoY growth. Operational performance continued to improve in FY 2024-25, with pre-berthing detention (PBD) time on port account improving by nearly 36 per cent compared to FY 2023-24. Financially, major ports witnessed an 8 per cent increase in total income, rising to ₹242.03 billion in FY 2024-25 from ₹224.68 billion in FY 2023-24. Similarly, operating surplus grew 7 per cent to ₹123.14 billion in FY2024-25 from ₹115.12 billion in FY2023-24.

India Revokes Security Clearance to Turkish Firm Çelebi

India's aviation security regulator, the Bureau of Civil Aviation Security (BCAS), has revoked the security clearance of Turkish firm Çelebi Aviation Holding on national security grounds. The decision follows concerns raised by Indian authorities regarding the firm's alleged ties to Turkiye's ruling Erdogan family. The move comes in the wake of heightened tensions between India and Turkey, particularly after Turkey's open support for Pakistan following Operation Sindoor, India's military action against Pakistan-based terrorist launch pads. Reports indicate that Turkish-made drones were widely used in Pakistan's failed counterstrikes against India, and two Turkish military operatives were allegedly killed while coordinating drone attacks on Indian territory. In a government statement, Kinjarapu Ram Mohan Naidu, Union Minister for Civil Aviation, reaffirmed India's commitment to national security, stating that it remains "paramount and non-negotiable." He assured that passenger convenience, cargo operations, and service continuity would not be affected. "We are deploying special teams to oversee operations and address all emerging issues in real time. We will continue to uphold national security while ensuring ease of travel and cargo movement across the country," he added. To ensure seamless operations at affected airports, four firms have stepped in to take charge of ground handling services: AISATS, Bird Worldwide Flight Services, Indo Thai Airport Management Services, and Air India Airports Services. The Ministry of Civil Aviation is actively monitoring the situation to facilitate a smooth transition, ensuring that personnel employed by Çelebi are retained wherever possible.

Mumbai-Ahmedabad Bullet Train's 300 km Viaduct Milestone

India's first bullet train corridor between Mumbai and Ahmedabad has reached a significant milestone with the completion of 300 km of viaducts. This achievement was marked by the launch of a 40-metre-long full-span box girder near Surat, Gujarat. The project has leveraged indigenously designed and manufactured equipment, including straddle carriers, launching gantries, bridge gantries, and girder transporters, with support from the Japanese government. The adoption of the full-span launching method has accelerated girder erection, making it ten times faster than conventional segmental methods. Each full-span box girder weighs 970 metric tonnes. To facilitate construction, 27 dedicated casting yards have been established along the corridor. Additionally, steel bridges are fabricated in seven workshops across Gujarat, Uttar Pradesh, Tamil Nadu, Maharashtra, and West Bengal. More than 300,000 noise barriers have been installed along the viaducts to mitigate noise once operations commence.

India Calls for Inclusive Energy Governance at BRICS Meet

Inviting BRICS nations to participate in the 2026 BRICS Energy Gathering in India, Manohar Lal Khattar, Union Minister for Power, highlighted energy security as one of the most pressing global challenges. Speaking at the BRICS Energy Ministers' Meeting in Brasília on May 19, he emphasised the need to strengthen BRICS cooperation to ensure economic stability, sustainability, and equitable access to energy resources. An informal association of the five emerging economies of Brazil, Russia, India, China, and South Africa, BRICS aims to foster economic and geopolitical coordination among its members. Reaffirming India's commitment to a sustainable and inclusive energy future, Khattar underscored the critical role of energy security, access, and affordability in advancing global development goals. He cited India's rapid progress in clean energy, including a 90 per cent increase in electricity capacity over the past decade, reaching 475 GW in 2025, with a target of 900 GW by 2032. The country has become the world's third-largest producer of solar and wind energy while also achieving a 20 per cent ethanol blending milestone. India has set ambitious goals for green hydrogen and nuclear energy, including a 100 GW nuclear capacity target by 2047, and has launched a domestic carbon credit market to encourage global collaboration. He also highlighted the Global Biofuels Alliance's role in advancing cooperation in the biofuels sector and reiterated India's commitment to energy efficiency through initiatives such as the Energy Conservation Sustainable Buildings Code, rooftop solar programmes, and efficient appliance standards. Acknowledging the continued importance of fossil fuels, especially for developing countries, he urged greater cooperation to promote cleaner and more efficient use through technologies such as coal gasification, carbon capture and storage, and green chemical innovations.

GAIL Reports Record Profit Surge

India's largest natural gas company, GAIL (India), has reported its highest-ever financial performance in FY2025, achieving record EBITDA, PBT, and PAT despite global economic challenges. Sandeep Kumar Gupta, Chairman & Managing Director, attributed the robust results to strong operational and financial performance across all major segments. The company's revenue from operations rose to ₹1.37 trillion in FY2025, up from ₹1.31 trillion in FY24, while EBITDA increased to ₹191.68 billion from ₹155.83 billion. Profit before tax stood at ₹148.25 billion, compared to ₹115.55 billion in the previous year, and profit after tax reached ₹113.12 billion, marking a significant YoY growth. On a consolidated basis, revenue from operations was ₹1.42 trillion, with EBITDA at ₹206.43 billion, PBT at ₹160.96 billion, and PAT (excluding minority interest) at ₹124.50 billion. The board of directors has recommended a final dividend of ₹1 per equity share, in addition to an interim dividend of ₹6.50 per share, bringing the total dividend payout ratio to 43.59 per cent. GAIL incurred a capital expenditure of ₹105.12 billion during the fiscal year. Operationally, natural gas transmission volumes grew by 6 per cent to 127.32 million metric standard cubic meters per day (MMSCMD), while polymer production increased by 6 per cent to 827 thousand metric tonnes (TMT). The company has also proposed transferring six geographical areas to its subsidiary, GAIL Gas, to enhance its city gas distribution operations, subject to approval from the Cabinet Committee on Economic Affairs.

REC Reports Strong Profit Growth

Power sector financier, REC, has reported a robust profit after tax of ₹157.13 billion for the financial year ended March 31, 2025, driven by strong growth across all verticals, recalibration of interest rates on loan assets, and effective financial cost management. Earnings per share rose to ₹59.55, up from ₹53.11 in the previous year. The company's assets under management expanded to ₹5.66 trillion, maintaining its growth trajectory from ₹5.09 trillion in FY24. Net credit-impaired assets declined to 0.38 per cent following the resolution of five stressed loan accounts worth ₹61.71 billion. REC's net worth increased 13 per cent YoY to ₹776.38 billion, while its capital adequacy ratio stood at a comfortable 25.99 per cent, underscoring its strong financial position. The company continues to expand its lending portfolio, supporting key infrastructure projects, including renewable energy and transmission systems. As part of its commitment to shareholder returns, the board has recommended a final dividend of ₹2.60 per equity share, bringing the total dividend for FY25 to ₹18 per share, up from ₹16 in FY24. The company has said it remains well-positioned to capitalise on future growth opportunities while ensuring stability in its financial and operational performance.

Sr. No.	Company Name	Project Title / Details	Location	State	Budget (₹ Million)	Contacts
1	National Hydroelectric Power Corporation Limited	240 MW Uri I Stage II Hydro Electric Project	Baramulla District, UT of Jammu & Kashmir	Jammu & Kashmir	1,069.60	Sanjay Kumar Singh, Director (Projects), Off Add- NHPC Office Complex, Sector-33, Faridabad - 121003, Phone No- 1292588110
2	National Highways Authority of India	4 Laning of Marakkanam - Puducherry Section of NH-332A from Km 62.000-Km 108.047 in Tamil Nadu on HAM (Project Length-46.047 km)	Marakkanam - Puducherry Section, Tamil Nadu	Tamil Nadu	1,178.50	Santosh Kumar Yadav, Chairman, Off Add-1, Sri Balaji Towers, 54 - 28, Butt Rd, near Kathipara Junction, South Phase, SP Industrial area, Parangi Malai, Guindy, Chennai, Tamil Nadu 600016, Phone No- 4422251885
3	Madhya Pradesh Rural Road Development Authority	DPR of Bridges/Box culvert in the district named below for one or more consultancy packages of MPRRDA	Madhya Pradesh	Madhya Pradesh	2,680.42	Deepak Arya, Chief Executive Officer, Phone No- 7554265737, Off Add- 2nd Wing, 5th floor, Paryawas Bhawan, Arera Hills, Bhopal, Madhya Pradesh 462027, Phone No- 7554265737
4	National Highways Authority of India	Up-gradation of existing 2 lanes highway to 4 lane at grade with 4 lane elevated flyover - Approved Talegaon Chakan Shikrapur of NH-548D	Talegaon-Chakan-Shikrapur, Maharashtra	Maharashtra	5,234.10	Rajat Trivedi, Manager, Office Add- Sector 11, 1, Sector 11, CBD Belapur, Navi Mumbai, Maharashtra 400614, Phone No- 2265140560
5	National Highways Logistics Management Limited	Development, Operation and Maintenance of Ropeway from Sonprayag to Kedarnath - Approved in the State of Uttarakhand on DBFOT Mode	Sonprayag to Kedarnath, Uttarakhand	Uttarakhand	3,589.70	Sanjeev Patil, Senior Vice President, Mobile No- 9923410878, G-5 & 6, Sector 10, Dwarka, 110075, Phone No-1125308800
6	Public Health Engineering Department Rajasthan	Chambal Alwar Bharatpur Water Supply Project Package 1 - Tendering Based on Hybrid Annuity Model	Alwar, Bharatpur	Rajasthan	2,444.52	Shaitan Singh, Additional Chief Engineer,shaitan.singh@rajasthan.gov.in , Mobile No- 9461089288, Off Add- Jal-Bhawan, 2, Civil Lines Rd, Keshav Nagar, Civil Lines, Jaipur, Rajasthan 302006

Sr. No.	Company Name	Project Title / Details	Location	State	Budget (₹ Million)	Contacts
7	Andhra Pradesh Industrial Development Corporation Limited	Design, Construction, Testing, Commissioning and Operation Maintenance of Infrastructure Works at Orvakal Node under Hyderabad Bengaluru Industrial Corridor (HBIC) - Tendering	Orvakal Node, Andhra Pradesh	Andhra Pradesh	1,128.10	M. Rama Raju, Chairman, Off Add-APIIC Towers, Plot No-1 (9th , 10th & 11th floors), IT Park, Mangalagiri, Guntur(Dist), AP-522503, Phone No-8632381850
8	MSRDC	Hadapsar - Yewat Elevated Corridor on Pune - Solapur Highway - Approved	Hadapsar - Yewat, Maharashtra	Maharashtra	5,262.36	Samay Nikose, Superintending Engineer, Off Add- MSRDC, Opp. Dena Bank, Adjacent to Priyadarshini Park, Nepean Sea Road, Mumbai-36, Phone No-23685909
9	Government of Telangana	Telangana E-City – Future City Project - Proposed/Conceptual	Ranga Reddy, Telangana	Telangana	NA	Nethi Muralidhar, Managing Director, Phone No- 4023443822, Off Add- 4F- 39, Dr. B.R. Ambedkar Telangana Secretariat, Phone No- 4023454449
10	Urban Development Authority	Construction of New Secretariat Complex Including Campus Infrastructure in New Shillong City, Meghalaya - Pre-Construction	New Shillong City, Meghalaya	Meghalaya	1,121.40	L Rymbui, Architect, Mobile No-8837379820, lazmedy@gmail.com, Off Add-Meghalaya Urban Development Authority MUDA Complex, Police Bazaar Shillong -793001 Meghalaya
11	Assam Government IITG Healthcare Foundation	Construction of a Centre of Excellence in Healthcare R and D Facility - Includes Super-Specialty Hospital, PG Medical and Allied Education and Ancillary Facilities at IIT Guwahati campus - Pre-Construction	Assam	Assam	1,160.75	SIDDHARTH SINGH, Director, Off Add- Centre for Nanotechnology, IIT Guwahati, North Guwahati, Guwahati-781039

Projects & Tenders

IMPACCT

Sr. No.	Company Name	Project Title / Details	Location	State	Budget (₹ Million)	Contacts
12	Ropeway and Rapid Transport System Development Corporation	Shimla Ropeway Project - Tendering	Shimla, Himachal Pradesh	Himachal Pradesh	4,997.20	Sanjay Gupta, Chairman cum Managing Director, Off Add- U.S. Club, Shimla , Himachal Pradesh, Phone No-1772811001
13	Department of Health Services	Public Private Partnership Request for Proposal for Setting up of Medical College and Upgradation of District Hospital - Tendering	Various cities, Madhya Pradesh	Madhya Pradesh	5,980.00	Dinesh Shrivastava, Director, Off Add-6th, Floor, Satpuda Bhawan Bhopal (MP) Phone No-7672238226
14	MSRDC	Pune - Shirur of NH-753F Elevated Highway Corridor Project - Approved	Pune, Shirur	Maharashtra	7,514.00	Anilkumar Gaikwad, Vice Chairman & Managing Director, Off Add- MSRDC, Opp. Dena Bank, Adjacent to Priyadarshini Park, Nepean Sea Road, Mumbai-36, Phone No-23685909
15	Andhra Pradesh State Housing Corporation Limited	Construction of Balance Housing and Infrastructure Works under RR Polavaram in Eluru District - Tendering	Eluru District, Andhra Pradesh	Andhra Pradesh	1,539.53	Golla Naresh Kumar, Senior Civil Engineer, Off Add- APIIC Towers, Plot No-1 (9th , 10th & 11th floors), IT Park, Mangalagiri, Guntur(Dist), AP-522503, Phone No-8632381850
16	Rajasthan Cooperative Dairy Federation Limited	Empanelment of Cattle Feed Raw Material Suppliers	Rajasthan	Rajasthan	1,200.00	Sunil Agarwal, General Manager , Off Add-Saras Sankul, Jawahar Lal Nehru Marg, Jaipur - 302015, India.

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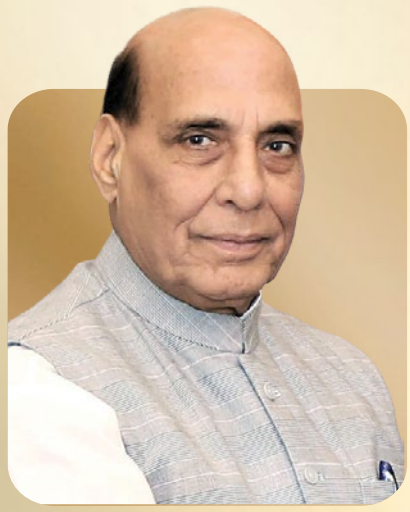

Shri Rajnath Singh
Defence Minister,
Government of India

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