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CHAMPIONS 2025

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A Year of Consolidation, Resolve & Big Leap



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As 2025 draws to a close, the nation finds itself standing at a pivotal juncture, able to reflect on the progress and anticipate the ascent ahead. This was a year less of tentative steps and more of decisive consolidation—a powerful assertion of India's role on the global stage, defined equally by economic momentum, strategic resolve, and a phenomenal leap in technological prowess. It has served as a deliberate stroke on the canvas, steadily painting the vision of *Viksit Bharat*@2047.

The bedrock of this national confidence is undoubtedly the economy, which demonstrated both resilience and a deepening sense of global integration. Our Services Sector continues to be a primary cornerstone of growth, contributing a significant majority of the national Gross Value Added. More significantly, the growth trajectory is becoming more spatially inclusive, driving a regionally balanced development that is crucial for a developed nation. Significant economic policy shifts, such as the new rates of income tax rebate under the new tax regime and the simplification of the Goods and Services Tax structure to a two-slab system are poised to bolster consumption and stimulate economic growth.

This economic aspiration, however, is being pursued alongside an unwavering commitment to national security and sovereignty. The Operation Sindoor following the Pahalgam terror attack was a landmark display of India's new strategic clarity, defining a zero-tolerance policy against terrorism. This calibrated response involved precision strikes that successfully eliminated major terror camps, effectively crippling the infrastructure of terrorist groups. The operation was paired with an equally resolute diplomatic move: the immediate suspension of the Indus Waters Treaty until Pakistan credibly and irrevocably ceases its support for cross-border terror. This action made it abundantly clear that the state sponsorship of terrorism will be met with a decisive and multidimensional response, asserting that blood and water cannot flow together.

India has decisively claimed its place at the technological high table, particularly in the space sector, which recorded significant milestones including the spectacular feat of performing India's first-ever on-orbit docking experiment, SPADEx, making it only the fourth country in the world to master this complex in-space capability, and the sustained flow of scientific data from the Aditya-L1 solar observation mission, solidifying the nation's expertise and moving it from a consumer to a formidable producer and innovator of space technology. These domestic advancements are complemented by international achievements, such as Group Captain Shubhanshu Shukla becoming the first Indian astronaut to travel to the International Space Station (ISS) in June 2025 as part of the Axiom-4 commercial mission, providing crucial experience for the future *Gaganyaan* human spaceflight programme. Furthermore, the successful launch of the joint NASA-ISRO Synthetic Aperture Radar (NISAR) using an ISRO GSLV rocket, marks a major step in Earth observation and climate monitoring, while the November 2025 launch of the CMS-03 communication satellite, the heaviest communication satellite ever launched by ISRO from Indian soil, underscores the nation's growing heavy-lift capabilities and strategic communication strength.

Maha Kumbh Mela 2025 in Prayagraj was not merely a spiritual gathering—drawing an astonishing over half-a-crore devotees—but a masterclass in large-scale modern administrative capacity. The deployment of a seven-tier, AI-powered security system, coupled with the rapid construction of state-of-the-art medical and digital banking infrastructure, demonstrated the seamless integration of technology with governance to manage human congregation on a planetary scale. This capacity to harmonise tradition with cutting-edge technology reflects the spirit of the new India.

The year 2025 has, in essence, served as a period of national recalibration. The message is singular: India is ready to lead. The vision of *Viksit Bharat*@2047 is not a distant aspiration, but the inevitable destination of a journey already being undertaken, marked by the deliberate, confident, and powerful steps taken throughout this transformative year. ❑

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CONNECTIVITY

Sunil Kumar Batra



India on Fast Track

With concerted policy initiatives by the government, India has made significant progress in infrastructure development in the last few years and is on a fast track to reach the envisaged goal of Viksit Bharat by 2047. The World Bank has reaffirmed India's growing stature in the logistics sector, with the country climbing to 38th place out of 139 nations in its 2023 Logistics Performance Index (LPI).

Well-developed infrastructure is critical for a faster-growing economy as it boosts productivity, efficiency and competitiveness and speeds up economic growth. With concerted policy initiatives by the government, India has made significant progress in infrastructure development in the last few years and is on a fast track to reach the envisaged goal of *Viksit Bharat* by 2047. These policy initiatives have brought India closer to developed nations in terms of logistics performance. According to the World Bank's latest report, Logistics Performance Index (LPI) 2023, India has moved up by 6 places from 44 in 2018 to 38 in 2023. This became possible due to exponential growth in total infrastructure investment in the last decade. The budgetary allocation for the current financial year (2025-26) has been pegged at Rs 11.21 lakh crore as compared to Rs 2 lakh crore (capex) in 2014-15.

Today, India stands as the fourth-largest economy in the world and is the fastest-growing economy, with a



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real GDP growth rate of 6.5% in the year 2024-25. In its latest report released in October 2025, the International Monetary Fund (IMF) has upped the growth forecast for India to 6.6 per cent for the current financial year from 6.4 per cent estimated earlier while confirming India as the fastest-growing economy in the world.

Recognising that construction of world-class highways, logistics, and multi-modal connectivity expansion is central to the country turning into a global manufacturing and logistics hub, the government embarked on an ambitious programme of integrated infrastructure development spanning highways, roads and ports, logistics, multi-modal connectivity and digitalisation. It has helped in establishing India as a key logistics hub in Asia. However, it still has a long way to go to become a global hub in logistics and multi-modal connectivity before becoming truly '*Viksit*'.

Considering that stronger supply chains today mean a stronger, more resilient India tomorrow, the government launched three key policy initiatives over the last few years for facilitating integrated infrastructure development, namely *Bharatmala Pariyojana*, PM's GatiShakti National Master Plan and the National Logistics Policy.

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India's Biggest Highway Push: Bharatmala Pariyojana

India's most ambitious highway project, the *Bharatmala Pariyojana*, launched in 2017 to improve road connectivity, cut transport costs and support India's growing economy, has helped the country to come on par with other developed nations in terms of connectivity and road infrastructure. The government has set an ambitious target of building 34,800 km of roads across the country under this project in the Phase-I. Of this, 26,425 km of road projects have been awarded with an investment of over Rs 8.50 lakh crore, and 20,770 km have already been completed till mid-2025.

The total length of national highways in India increased by 60 per cent to 1,46,342 km till mid-2025 from 91,287 km in 2014. And the government is confident of achieving the highway construction target of 13,814 kilometres for the current fiscal year 2025-26. The annual pace of National Highway construction surged from just 12 km per day in 2014-15 to a peak of 37 km per day in 2020-21. While there has been some fluctuation in subsequent years, the pace remained robust, recording 34 km/day in 2023-24 and 29 km/day so far in 2024-25.

Construction of NHs 2014-15 to 2024-25

Year	Total Roads	kms/Day
2014-15	4,410 km	12 kms/day
2020-21	13,327 km	37 kms/day
2021-22	10,457 km	29 kms/day
2022-23	10,331 km	28 kms/day
2023-24	12,349 km	34 kms/day
2024-25	10,660 km	29 kms/day

Source: Ministry of Road Transport and Highways

Maharashtra led all states with over 15,400 km of NHs constructed since 2014, followed by Rajasthan (9,787 km), Madhya Pradesh (7,352 km), and Uttar Pradesh (8,293 km). Other significant contributors include Karnataka (5,601 km), Andhra Pradesh (5,339 km), and Odisha (4,978 km).

Bharatmala Pariyojana is envisaged to improve the logistics efficiency and connectivity in the country while simultaneously promoting safer transportation networks. Development of high-speed corridors has also reduced the travel time substantially between key economic centres. These projects include different types of roads, like economic corridors (8,737 km), expressways (2,422 km), border and international roads (1,619 km). Port and coastal connectivity roads are also covered under the scheme. Each of these roads is designed to connect different parts of India more smoothly and support faster travel, especially for trade and transport.

> ***"Strengthening of the logistics sector will not only make the life of common man easier but will also help in increasing the respect of labour and workers."***
>
> ***– Prime Minister Narendra Modi***

The Ministry of Road Transport and Highways (MoRTH) has recently announced the construction of 25 greenfield expressways, totalling 10,000 km across the country, at a cost of Rs 6 lakh crore. As of February 2025, 6,669 km length of high-speed greenfield corridor has been awarded with construction completed for 4,610 km.

The construction of expressways and economic corridors has helped reduce the logistics costs to 10% from 16% earlier. India's logistics costs are at par with 12% in the US and European countries and 8% to 10% in China and are likely to fall further to a single-digit 9%.

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Despite significant progress in Highways construction, many challenges still remain. Sufficient funds availability is an important factor holding back consistent growth. In view of this, State-owned National Highways Authority of India (NHAI) is considering launching a public Infrastructure Investment Trust (InvIT) on the lines of private InvIT to increase the overall investor base, develop a competitive environment in the InvIT market and mitigate the risk of a limited investor base. Additionally, public InvIT will also cater to retail investors, thereby providing access to infrastructure assets. The InvITs are regulated by Securities and Exchange Board of India (SEBI), giving confidence to financial investors. Simultaneously, the government is also trying to monetise its highway projects under private InvIT. The government is likely to generate cash flows of a whopping Rs 15 lakh crore by monetising the road projects.

Despite the overall positive momentum, a few projects have encountered predictable operational challenges. Some delays have happened due to issues like land acquisition, contractor problems, lack of raw materials, and environmental clearances. These challenges have resulted in a need for enhanced resource allocation, alongside some adjustments to the original timelines. In response, the government has taken several steps to fix these challenges and issues. For example:

- The *Bhoomi Rashi* portal has been used to speed up land acquisition.
- The *Parivesh* portal has been improved to fast-track environmental clearances.
- Online approvals for road and bridge drawings are now available.
- Regular meetings are being held with states and departments to keep work on track.

Major Projects completed under the scheme are:

1. **Atal Tunnel:** World's Longest Highway Tunnel above 10,000 Feet. The tunnel reduces the road distance by 46 kms between Manali and Leh and the time by about 4 to 5 hours.
2. **Eastern and Western Peripheral Expressway:** The two projects of Peripheral Expressways around Delhi, comprising 135 km Eastern Peripheral Expressway, were constructed by NHAI.
3. **Bogibeel Bridge:** The bridge, which spans the River Brahmaputra between the Dibrugarh and Dhemaji districts of Assam, is of immense economic and strategic significance for the nation.
4. **Dhola-Sadia Bridge (Bhupen Hazarika Setu):** The bridge in Assam connects far-off areas and paves the way for their socio-economic development. It was India's longest bridge in 2017, with a length of 9.15 km.
5. **Chenani-Nashri tunnel:** The tunnel in Jammu and Kashmir was opened in 2017. The 9 km long, all-weather tunnel between Udhampur and Ramban in J&K is not only India's longest highway tunnel under operation but also Asia's longest bi-directional highway tunnel, which is equipped with the Integrated Tunnel Control System (ITCS).
6. **Dibang-Lohit River Bridge:** The project provides the only link between Bomjur and Meka and Digaru to Chowkham on NH-52. The project established all-weather and 24x7 direct connectivity between Pasighat-Roing and Namsai-Tezu, thereby reducing dependence on ferry crossings and providing socio-economic benefits to the region. The distance between Roing and Pasighat and between Tezu and Namsai has been reduced from 310 km to 75 km and from 195 km to 57 km, respectively.
7. **Kollam Bypass:** Prime Minister Narendra Modi dedicated to the nation the 13 km, 2-lane Kollam bypass on NH-66 in Kerala on 15 January 2019. Constructed at a cost of Rs 352 crore, this highway has three major bridges over Ashtamudi Lake.
8. **Maitri Setu:** Maitri Setu between India and Bangladesh, also called the 'Gateway of North East', the crucial bridge built over the Feni River to link Tripura with Chittagong in Bangladesh, is 1.9 km long and built at a cost of Rs 133 crore.
9. **Sudarshan Setu (Beyt Dwarka):** The Sudarshan Setu connects Okha mainland and Beyt Dwarka island, built at a cost of around Rs 980 crores. It is the longest cable-stayed bridge in the country of around 2.32 km.
10. **Sonamarg Tunnel (Z-Morh):** The Sonamarg Tunnel of length 6.4 km on NH-01 in the UT of J&K was inaugurated in January 2025. Situated at an altitude of over 8,650 ft above sea level, it will enhance all-weather connectivity between Srinagar and Sonamarg en route to Leh.

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Besides, there are several projects under implementation. These include:

i) **Frontier Highway in Arunachal Pradesh:** Frontier Highway (NH-913) is a road of strategic importance along Indo-Tibet-Myanmar border with intent to arrest the population migration from border areas. The total design length of Frontier Highway is 1,824 km, out of which work on 271 km has been taken up by MoD/MoRTH before declaration as a National Highway. The balance length of 1,553 km is being sanctioned/awarded by MoRTH in 44 packages to be executed by three agencies, viz. State PWD, Border Road Organisation (BRO) and National Highways and Infrastructure Development Corporation Limited (NHIDCL);

ii) **Delhi-Mumbai Expressway**: The ministry has taken up construction of Delhi-Mumbai Expressway, including spurs, in 53 packages having a length of 1,386 km. The project, originally slated for completion in 2023, has been pushed back to a new deadline of 2026. The corridor provides connectivity to major economic centres within Delhi, Uttar Pradesh, Haryana, Rajasthan, Madhya Pradesh, Gujarat and Maharashtra. The impact includes reduction in distance from Delhi to JNPT by about 180 km and a reduction in travel time of up to 50% to connected destinations; and

iii) **Chardham Mahamarg Vikas Pariyojana:** The Ministry has taken up the connectivity improvement programme for *Char Dham* (Kedarnath, Badrinath, Yamunotri & Gangotri) in Uttarakhand. The programme includes projects for the improvement/development of 825 km of NHs at a total estimated cost of about Rs 12,595 crore. So far, 629 km has been completed, and the per centage progress is 76% w.r.t total length (825 km), among others.

The *Bharatmala Pariyojana* is building the road to a stronger India. While there are some delays, the overall pace is steady, and the government is working to solve the problems quickly. With over 20,000 km already done, the journey ahead looks promising.

PM GatiShakti National Master Plan (PMGS NMP)

Infrastructure is a vast field whose development spans a number of sectors and subsectors, making it difficult to coordinate among various ministries and departments. This invariably led to long delays and cost escalation in many projects. To avoid such difficulties, the government launched the PM GatiShakti National Master Plan (NMP) in October 2021 to integrate different modes of transport into a coordinated network. As the name translates to 'Power of Speed', it symbolises the plan's focus on faster, seamless and ambitious infrastructure and logistics development strategy aimed at transforming India's multimodal connectivity. The NMP has brought together 57 Central Ministries/Departments and all 36 states and union territories under its ambit for infrastructure development. It has also integrated massive 1,700 data layers, creating a truly unified and comprehensive platform for infrastructure planning.

PM GatiShakti is based on the six core principles to simplify the entire journey from planning to implementation. From an integrated development approach to planning connectivity, it looks at incorporating allied infrastructure such as laying utilities during the planning phase, enhancing additional connectivity to help seamless movement, ensuring ecological focus on conservation of forests, rivers, etc., and faster land acquisition and expedited clearances.

The six principles are:

1. **INTEGRATED DEVELOPMENT**: Development of adequate connectivity infrastructure for the region;
2. **CONNECTIVITY IMPROVEMENT**: Additional connectivity from existing networks assessed at the planning stage for seamless movement of goods, services and people;
3. **REDUCED ECOLOGICAL IMPACT**: Ensuring minimum possible interference with forest environment, wildlife, and waterbodies;
4. **EXPEDITED CLEARANCES**: Drawing of alignment on the National Master Plan to minimise interaction with existing assets;
5. **ALLIED INFRASTRUCTURE**: Laying of utilities along with infrastructure network; and
6. **EXPEDITED LAND ACQUISITION**: Land revenue data on the National Master Plan (NMP) facilitating ease of understanding ownership and cost of acquisition.

Since its launch four years ago, substantial progress has been made, including the development of the geospatial platform, the integration of multiple georeferenced data, the provision of planning tools/ software for planning infrastructure projects (including socio-economic infrastructure) and capacity building. Mechanism of Network Planning Group (NPG) has been institutionalised, under which infrastructure projects are evaluated for integrated planning, multimodality,

inter-modality, synchronisation of efforts, whole of government approach and last-mile connectivity in and around the project catchment area. So far, 293 infrastructure projects amounting to Rs 13.59 lakh crore have been evaluated through the NPG mechanism. It is important to mention here that the NPG has met 100 times till October 2025 to evaluate various infrastructure projects focusing on enhancing multimodal connectivity and logistics efficiency in alignment with the PM GatiShakti National Master Plan (PMGS NMP).

National Logistics Policy

India's logistics sector, once synonymous with congestion, high logistics costs, and fragmented supply chains, is now being transformed through bold policy initiatives such as the PMGS-NMP, dedicated freight corridors and the development of multimodal logistics parks. These initiatives promise to lower transportation costs, improve efficiency, and build a more competitive backbone for trade and mobility. The National Logistics Policy (NLP) was launched in September 2022 to complement the National Master Plan (NMP), has a primary objective of creating a seamless logistics ecosystem by improving efficiency and reducing logistics costs. As part of this reform, digital initiatives like the Unified Logistics Interface Platform (ULIP) and the Logistics Data Bank (LDB) are now fully operational, aiming to enhance ease of doing business and enable tracking of containerised Export Import (EXIM) cargo.

"The World Bank has reaffirmed India's growing stature in the logistics sector, with the country climbing to 38th place out of 139 nations in its 2023 Logistics Performance Index (LPI). This is a notable improvement of six places since the last ranking in 2018. The steep climb in rankings reinforces the government's commitment to modernise and streamline India's logistics sector. India aspires to be among the world's top 25 logistics performers by 2030, aiming to bring logistics costs below 10 per cent of GDP." (Source: PIB)

Multi-Modal Logistics Parks (MMLPs)

Expanding trade, both domestic and international, is conditional on large-scale warehousing and storage facilities. Multi-Modal Logistics Parks are being created under the *Bharatmala Pariyojana* to bring together different aspects of logistics in one location. Based on the regional feasibility and demand, 35 key locations, such as Chennai, Bengaluru, Nagpur, Indore, and others, have been approved in different parts of the country through both private and public sector efforts for the development of Multi-Modal Logistics Parks (MMLPs). Out of these, 5 are expected to be operational by 2027. These parks are designed to boost logistics efficiency, thereby bringing down overall logistics costs further to make the supply chain business-friendly and improve the overall competitiveness of our products.

Together, these innovations are not only reducing costs but also elevating service quality, thereby enhancing the global competitiveness of Indian logistics. The logistics sector in India has traditionally been an informal sector. However, a systematic transition from informal to formal logistics with government support and training programmes has driven improvements in skilling, job creation, and overall workforce productivity. These efforts are also strengthening India's demographic dividend by creating new employment opportunities and enhancing human capital. The sector currently employs 22 million people and is expected to create 10 million more jobs by 2027.

These reforms together have improved India's infrastructure and logistics landscape. Yet, challenges persist, from high costs and infrastructure gaps to a shortage of skilled manpower. High logistics cost, a fragmented supply chain, over-reliance on roads (70% of freight movement) and lack of modal integration inflate costs. This affects medium and small enterprises (MSMEs) more, reducing their margins and limiting global competitiveness. Despite initiatives like PM GatiShakti, infrastructure bottlenecks and project delays due to delays in land acquisition and regulatory clearances continue to be a critical challenge for overall infrastructure development. Multiplicity of government departments and agencies creates regulatory overlap and inefficiencies.

Given the vast expanse of our country and size of the economy, it is not going to be easy to overcome these challenges. But streamlining regulatory processes to harmonise state-level regulations, fast-tracking infrastructure development, strengthening last-mile connectivity and introducing a robust project monitoring framework similar to PMGS-NMP can determine whether logistics becomes a bottleneck or a backbone in India's growth story.

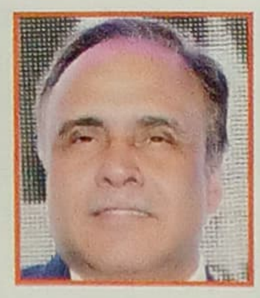
India's logistics sector is poised to become a driver of sustainable growth if reforms are matched with decisive execution. By embracing technology, green mobility, and workforce skills, the sector can strengthen competitiveness. A future-ready logistics backbone will be central to India's journey toward *Viksit Bharat@2047*.❑

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Dr Subhash Chandra Pandey



Indian Industries : Issues, Challenges, and Opportunities

The sheer size and diversity of enterprises in India does not allow for a one-size-fits-all approach to regulation and management of businesses. The National Manufacturing Mission seeks to integrate policies, improve governance and boost a sustainable manufacturing ecosystem to transform India into a 21st-century industrial powerhouse.

Indian industry has undergone significant transformation from the pre-independence era of small-scale handicrafts and textiles to the post-independence, State-led industrialisation. Post-independence industrial policies and liberalisation since 1991 have transformed India from a largely agrarian economy to an emerging industrial hub. Industries have expanded and diversified rapidly, joining the global supply chains with remarkable resilience in the face of global competition.

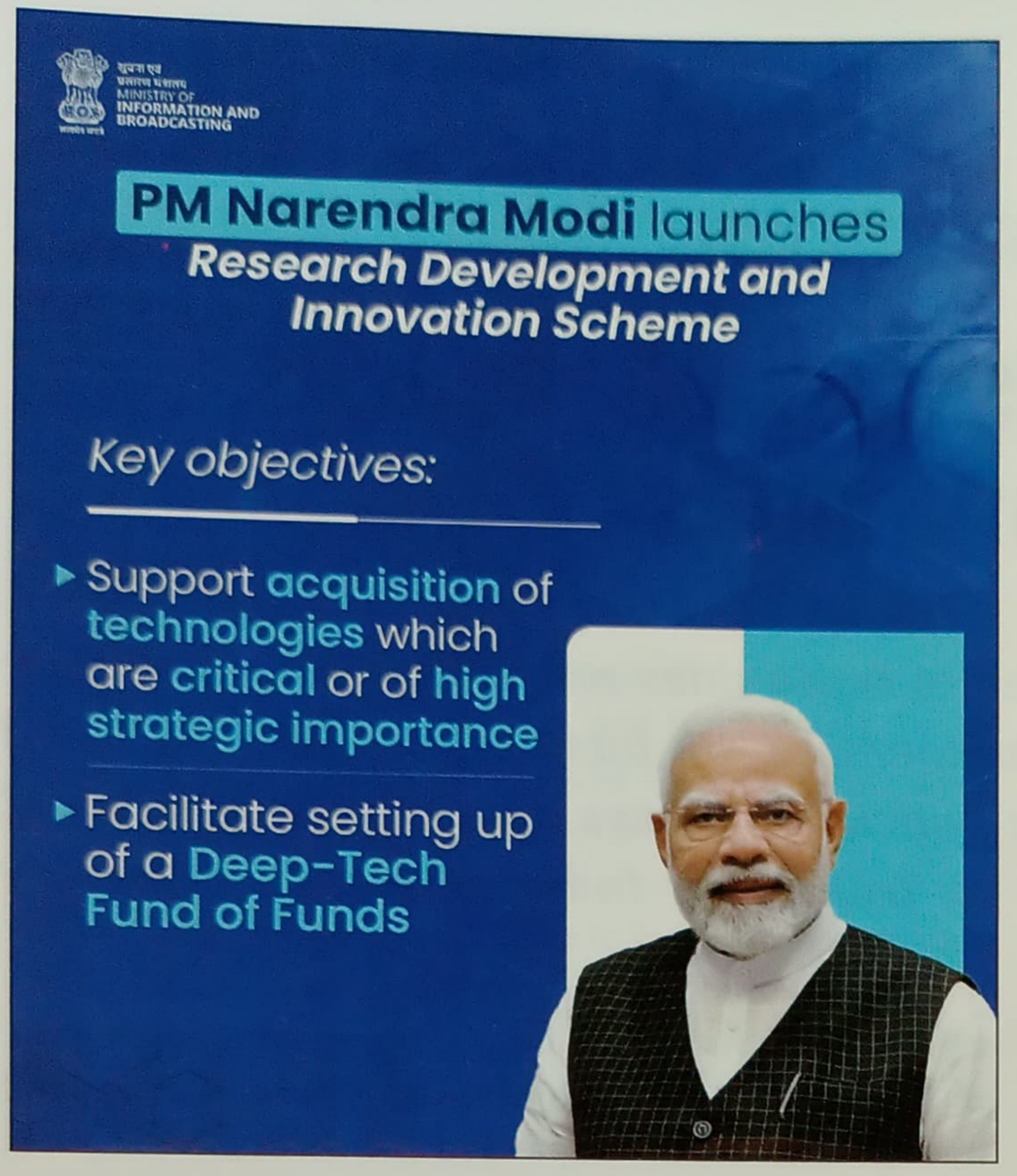
Since the 1990s, India's industrial landscape has evolved from a state-controlled, protected economy



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to a liberalised, globally integrated, technology-driven system. It now emphasises innovation, sustainability, and competitiveness, positioning India as a rising industrial and service powerhouse. Increasing the share of high-tech manufacturing, increasing employment intensity, decreasing import intensity of exports and pursuing environment-friendly, sustainable development based on local resources and skill development are key priorities of policy planners and industry captains. Abundant natural resources and a youthful workforce provide fertile ground for sustainable growth and innovation.

The industrial sector (mining/quarrying, manufacturing, electricity/gas/water utilities and construction) has been contributing approximately 28-30 per cent share in our GDP (manufacturing approximately 14-16 per cent and construction approximately 8-10 per cent) for the last 3 decades. In a major structural transformation since Independence, the share of the primary sector (agriculture & allied activities) has shrunk from approximately 50 per cent to approximately 15 per cent with a corresponding increase in the tertiary/services sector. Our share in global manufacturing output is about 2 per cent. India contributes to less than 2 per cent of the global manufacturing. These shares have remained unchanged for a considerable period, a characteristic that poses key policy challenge for growth.

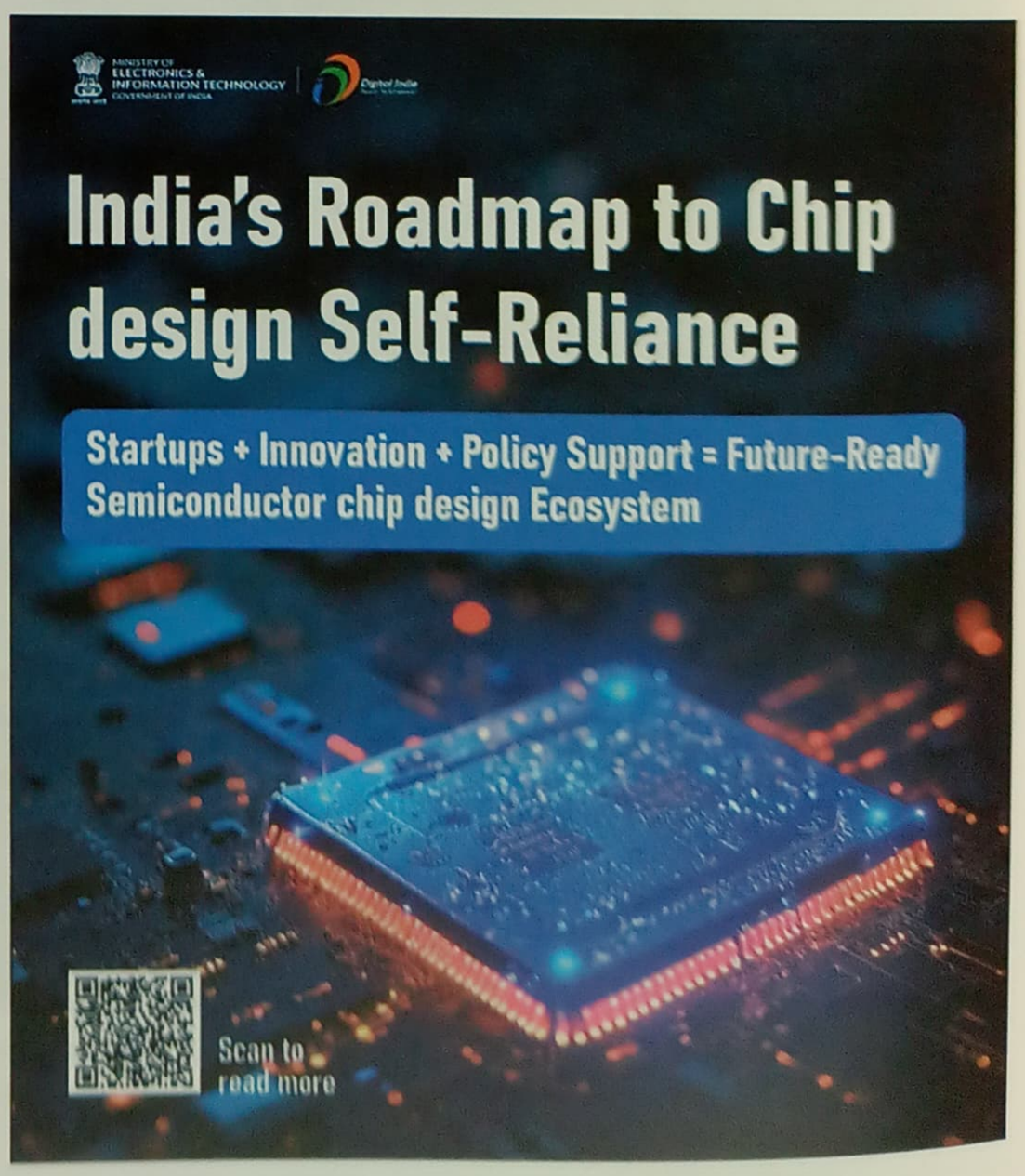
Today, Indian industries span textiles, automobiles, pharmaceuticals, IT, electronics, and renewable energy, catering to domestic and international markets. However, industrial growth is uneven across industries and regions even as systemic issues and challenges are being addressed and new opportunities are visible for sustainable industrial growth from technology adoption, policy support, and global demand shifts.

The Industrial Policy of 1991 marked a major shift by deregulating the industrial sector, abolishing licensing requirements for most industries, enabling privatisation and allowing foreign direct investment in many areas to increase efficiency, competitiveness, and integration with the global economy.

The reforms ushered in increased competition, efficiency, and modernisation. Accelerated growth in capital-intensive and import-intensive industries and an increase in exports have been marked trends since the 1990s.

Prolonged stagnation in the share of manufacturing (targeted to be raised to 25 per cent by 2025 as per the National Manufacturing Policy 2011); a steady increase in import-intensity; steady decline in labour-intensity and almost half of manufacturing output being contributed by a single industry (automobiles) have been matters of concern for long.

Aggressive trade unionism, air/water pollution, clean quality of water/power supply and law &



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order situation, militancy/security issues and cheap imports have been major reasons for low/slow/ negative industrialisation in particular subsectors (pharmaceuticals, textiles, leather, metals and chemical processing industries) and geographies like border states. Many enterprises, across public and private sectors, struggled to remain viable under evolving economic and regulatory conditions.

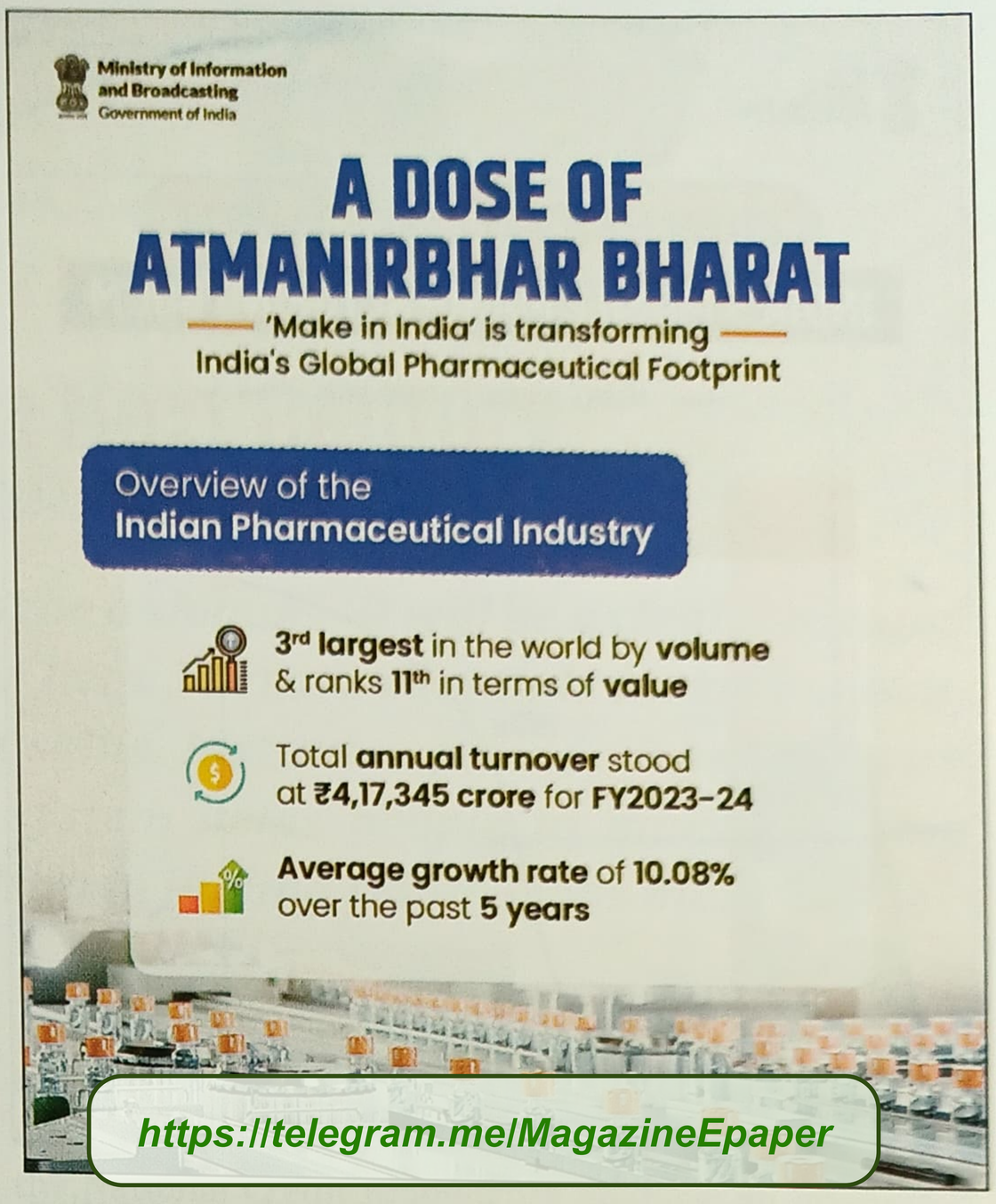
The phasing out of several Pharma PSUs—Indian Drugs & Pharmaceuticals Ltd, Rajasthan Drugs & Pharmaceuticals Ltd, Hindustan Antibiotics Ltd and Bengal Chemicals & Pharmaceuticals Ltd has coincided with a growing reliance on imported bulk drugs. The Sterlite Copper plant in Tamil Nadu has been closed since May 2018 following environmental concerns and public protests, forcing dependence on imported copper.

The 'Services' sector is leading in employment generation, but over 85 per cent of 'workers' are unorganised workers outside the full-scope social safety net. Efforts are afoot to expand their social security and enlist them in general welfare schemes.

The 'Industrial' sector is highly fragmented, with about 7 crore MSMEs (Micro, Small, and Medium Enterprises) accounting for approximately 99 per cent of all business enterprises. This promotes entrepreneurship and flexibility but also leads to low economies of scale, higher production costs, quality issues and weak bargaining power in global markets. There is a real policy dilemma here. To build globally competitive products, we need large-scale production and a reduction in the variety of standards and specifications, but that inevitably leads to reduced employment intensity, the emergence of monopolies and attendant risks.

The sheer size and diversity of enterprises in India does not allow for a one-size-fits-all approach to regulation and management of businesses. Even after recent drives to weed out bogus companies created for money laundering, tax evasion or other questionable motives, one-third of about 29 lakh registered companies are still inactive. This gives an idea of the stress on the regulatory system.

High logistics costs account for around 14 per cent of GDP, compared to 8–10 per cent in developed economies. Power shortages and unreliable energy supply hinder manufacturing efficiency, particularly for energy-intensive industries. Poor transport connectivity increases logistics costs, reduces

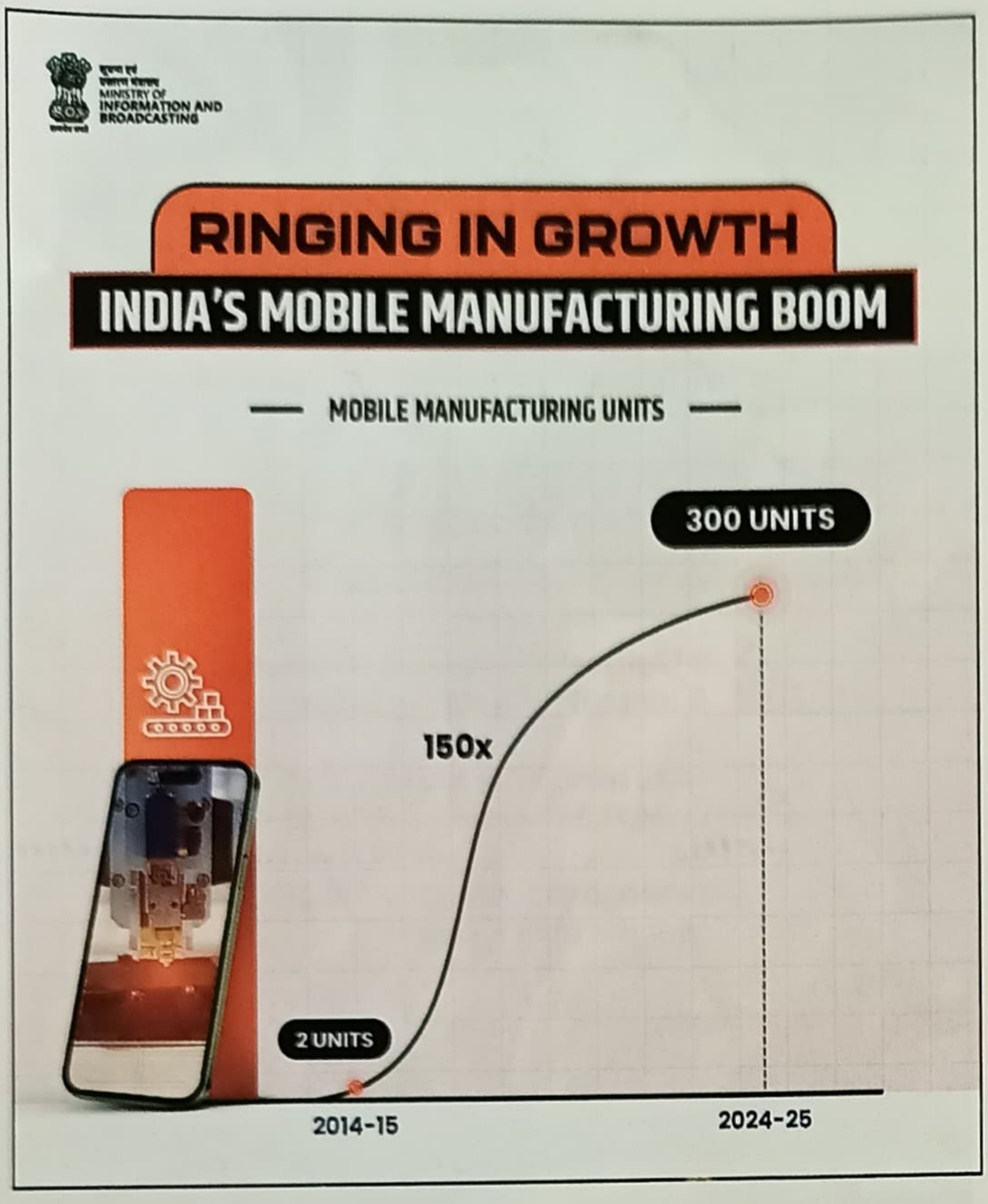


competitiveness. In recent years there has been significant investment in improving rail/road/air connectivity between industrial hubs, transport corridors and ports, and markets to accelerate the pace of manufacturing expansion of roads, railways, air and sea ports and power supply. The ongoing National Infrastructure Pipeline, the development of industrial corridors such as the Delhi-Mumbai Industrial Corridor, the *Bharatmala* Project aiming to connect 550 District Headquarters with a minimum 4-lane highway, *Sagarmala* (for maritime and port infrastructure development), Dedicated Freight Corridors, the complete electrification of Railways and the targeted expansion to 10,000 MTPA (Million Tonnes Per Annum) seaport capacity are all part of a massive effort at infrastructure development.

Industry faces a high burden of cross-subsidies. Railways use increased tariffs on goods hauled to finance the losses in the passenger segment of their business. The industrial power faces higher tariffs to enable lower tariffs on the agriculture and household sectors. These cross-subsidies add to the cost to industries and have led to substantial diversion of rail freight to road freight and captive power generation, having wider economic implications.

The fourth industrial revolution (Industry 4.0) poses both opportunities and challenges for Indian

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industries. Going beyond traditional automation, artificial intelligence, robotics, the Internet of Things (IoT), and advanced analytics are transforming production processes to enhance productivity, reduce costs, and enable innovation-driven growth. We need to adapt to these technologies or risk obsolescence. Adoption is costly and requires skilled labour and significant investment in R&D. Industries such as pharmaceuticals, electronics, renewable energy, and aerospace have significant potential for technology-led expansion.

Customers are looking forward to not just buying products but complete system solutions to meet their functional requirements. The emergence of the shared economy (lease/rent rather than buy/own) and changes in consumer behaviour is having major impact on business models of industries. Additive manufacturing technologies (3D printing) allow customisation of consumer products at a large-scale catering to highly personalised needs of discerning customers. It enables decentralised, small-scale production reducing the need for mass production under one roof of traditional, polluting factories.

Demographic Dividend offers a big opportunity for Indian industries. We have one of the youngest populations in the world, offering a large, cost-competitive labour pool as well as a large consumer base capable of sustaining industrial growth for decades with right-skilling and policy support.

Mass production based on local resources for domestic consumers and an increasing switch to green/sustainable products present new opportunities in electric vehicles, energy storage, renewable energy (solar/wind), and environmentally friendly manufacturing practices. Indian industries can leverage innovation in these areas to gain a competitive advantage while addressing environmental challenges.

The Production Linked Incentive (PLI) scheme launched in 2020 covers 14 sectors attracting investments worth Rs 1.76 lakh crore, with total sales over Rs 16.5 lakh crore by mid-2025, creating over 12 lakh direct/indirect jobs.

The electronics and defence industries hold great potential to ramp up the value-addition chain. PLI aligns closely with the Semiconductor Mission backed by a Rs 76,000 crore package to support investments in this subsector. Steady increase in defence manufacturing and export in recent years boosted our manufacturing growth.

For capital-intensive industries like Defence, domestic demand is insufficient to allow large-scale production at a competitive cost. Export demand is also needed. It is a challenge amidst stiff competition, global uncertainties and the collapse of rule-based multilateral trade regimes.

In the pursuit of national interests, international relations are rarely defined by permanent friendships or immutable enmities. We need not be distracted by near-term surprises and continue to build up a skilled workforce and robust infrastructure. Policy support and industry actions must sync to create and fulfil huge domestic demand. We must build the India brand as synonymous with quality and let the substandard business units bringing shame to the country perish.

We are a service-led/consumption-led economy moving from 10th to 4th largest during the last 10 years with strong integration into global value chains. Huge investments in physical and digital infrastructure and tax reforms have nurtured a conducive business environment. The National Manufacturing Mission seeks to integrate policies, improve governance and boost a sustainable manufacturing ecosystem to transform India into a 21st-century industrial powerhouse. ❑

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Debashree Mukherjee



Education for the Next Century

The path from learning to earning won't just be a slogan—it will be a clear, repeated journey that millions take throughout their lives. Micro-credentials make learning flexible and easy to continuously upgrade skills. Institutes provide learning with real work experience. A national digital system helps people to make learning transparent and accessible and supports them in finding related jobs more easily.

India's demographic trajectory all but guarantees that the education and employment landscape of the twenty-first century will be shaped by our choices. Improvements in healthcare, longevity, and working life mean that India will remain among the world's largest working-age populations, with a relatively low dependency ratio for decades. The task before us is to convert this window into widening pathways from school and college into decent jobs and entrepreneurship, enabled by stronger employability. Crucially, this is no longer a matter of intent alone; it is embedded in our reforms and is visible in execution on the ground.

The National Education Policy 2020 captured the imperative with unusual clarity: in a rapidly changing global ecosystem, children must not only learn, but also "learn how to learn", with pedagogy that is experiential, inquiry-driven, and multidisciplinary. It also commits the system to "no hard separations" between arts and sciences, co- and extra-curricular, and most importantly between vocational and academic streams, so that lifelong learning and permeability become the organising principle of Indian education. Removing these boundaries aligns with the emerging jobs and skills landscape, where technical skills can quickly become obsolete and the importance of soft skills is rising.

This vision comes to life when short, focused learning counts, that is, when it is credit-bearing, quality-assured, and visible to employers. That is what the National Credit Framework enables: an integrated credit accumulation and transfer system spanning school, higher education, and skilling, jointly developed by the University Grants Commission, the All India Council for Technical Education, the National Council for Vocational Education and Training, and others. Within the framework, micro-credentials are defined as smaller units that certify coherent sets of skills, with learning outcomes tied to industry need and suitable for stacking into larger qualifications. In other words, a solar safety module a worker completes this month can be stacked towards an energy technician certificate next year, rather than remaining a one-off certificate.



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Table 1: Micro and Nano Credentials At-a-Glance

Feature	Micro-credential	Nano credential
Primary purpose	Upskilling/bridge modules; can be combined into full qualifications (30-hour blocks across theory/practical/field/OJT)	Ultra-specialised credential-for example, if there is a new technology tool update, this would teach just the skills for that element (e.g., tool/firmware/process change)
Size (hours)	7.5 / 15 / 22.5 / 30 (in 7.5-hour multiples upto 30 hours)	1–4 hours, more focussed on particular skillsets
Stackability	Standalone; can aggregate multiple micro-credentials into larger pathways	Stacks into a micro-credential (aggregates towards 5–30 hours)
Delivery modes	Online, blended, or on-site	Online, blended, or on-site
Assessment	Brief, competency-based assessment required (quiz/practical/viva with scores)	Light check or evidence of completion; final assessment embedded within the parent micro-credential
NSQF guidance	Applicable for any NSQF level	No separate level; maps upward to the parent micro-credential's NSQF level
NOS/QP alignment	Outcomes mapped to NOS/QP performance criteria	References the same NOS/QP items as the parent micro-credential

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Source: NCVET

The National Council for Vocational Education and Training, the regulatory body for curriculum development and credentialisation for skill courses has given clear instructions on how to develop, approve, and use National Occupational Standards, micro-credentials, and nano credentials. These instructions cover required learning goals, assessment rules, credit hours, and how different awarding bodies should adopt them. Templates used by implementing bodies now require evidence of need, industry validation, and anticipated scale before a micro credential is approved, strengthening labour market signalling. This quality spine ensures that micro-credentials function as a genuine currency that travels with the learner across providers and over time.

These guidelines are paving the way for lifelong learning and agility in the system. Small, credit-carrying courses and capsules will nudge people towards reskilling and upskilling. In the long term, when human and machine collaboration is, on the one hand, lessening the burden of tasks and, on the other, making continuous learning a necessity, these reforms will help transform the balance between work and education and produce a workforce that remains employable for longer, thereby extending the demographic dividend window. International evidence also points to the importance of short-duration courses and micro-credentials. The International Labour Organization's 2025 synthesis on micro-credentials for youth highlights their value for faster school-to-work transitions, reskilling during technological change, and recognition of prior learning, while warning that weak standards and poor portability blunt labour market impact. India's framework-linked, quality-assured approach is specifically designed to avoid those pitfalls.

Institutional modernisation is the second leg of the stool. Industrial Training Institutes, which have been the bedrock of vocational education, are being upgraded from standalone centres into hub-and-spoke Centres of Excellence with modern equipment, industry-aligned trades, and stronger apprenticeship pipelines. In May 2025, the Union Cabinet approved a centrally sponsored national scheme named PMSETU (Pradhan Mantri Skilling and Employability Transformation through Upgraded ITIs) to upgrade one thousand Government Industrial Training Institutes and to set up five National Centres of Excellence for Skilling anchored in National Skill Training Institutes, with multi-source financing and explicit industry participation. The design emphasis is clear: simulators and contemporary equipment, dual system models and structured

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on-the-job training, and faculty development through master trainer pipelines and industry exchanges.

This matters because when classrooms act like real workplaces and training uses the same equipment as the actual jobs, people get better placements and higher wages. The Centres of Excellence help small and medium businesses save money by sharing testing and prototyping tools at the centre. This way, skill training complements local industry needs.

The third leg is digital public infrastructure. The Skill India Digital Hub integrates courses and schemes, assessments, credentials and opportunities into a single public platform, linking learners, providers and employers. Core services such as examination results and credential access are already being delivered, familiarising trainees and employers with a single window for skills transactions and discovery. As the Hub grows, the focus is moving from general job listings to smart guidance that shows workers how to move to related, higher-paying jobs. For example, a general electrician can move to a solar panel installer, a warehouse worker to a cold chain coordinator, or a basic machine operator to a 3D printing technician. As the system improves, tools like skill maps, wage information, and future job forecasts will make career advice more accurate. This will especially help women re-entering the labour force and workers pivoting into green and digital roles. With digitally verified profiles, recognised micro-credentials, and credits linked to a learner's profile, every short course adds up to a bigger career path. Verified employers can search for skills, offer apprenticeships, and see these portable credentials all in one place.

All these reforms work together. Micro-credentials make learning flexible and easy to continuously upgrade skills. Institutes provide learning with real work experience. A national digital system helps people to make learning transparent and accessible and supports them in finding related jobs more easily. The National Education Policy's idea of no strict separation between academic and vocational paths is now real. Short courses build on each other, credits and skills are understood by all, and employers can trust and see what learners can do.

If we focus on real results by tracking skills, job placements, and wage growth instead of just counting training sessions, India's young population will lead to better wages for families, immediate productivity for companies, and a stronger, greener economy. The path from learning to earning won't just be a slogan—it will be a clear, repeated journey that millions take throughout their lives. ❑

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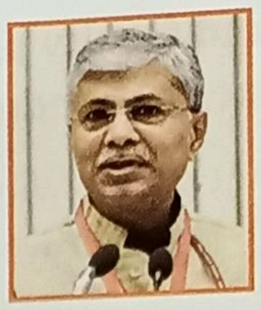
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Vaidya Rajesh Kotecha



AYUSH Integration for Holistic Healthcare

The integration of Ayush systems with mainstream healthcare and the promotion of evidence-based traditional medicine have become major national priorities. India's Ayush sector is emerging as a significant contributor to economic growth, with the market now valued at approximately USD 43.4 billion, with an eight-fold rise in the last decade.

Traditional medicine in India, rooted in Ayurveda, Yoga & Naturopathy, Siddha, Unani, Sowa-Rigpa, and Homoeopathy, has long been a symbol of the country's civilisational wisdom. Over the last decade, this sector has witnessed remarkable policy attention, institutional expansion and economic growth. Today, the Ayush sector stands as a key component within India's healthcare landscape, achieving notable progress in education, research, public health, international collaboration, digitalisation, trade and global outreach.

Since the establishment of the Ministry of Ayush in 2014, Prime Minister Narendra Modi has provided a clear and visionary roadmap for its growth, recognising its immense potential at national and global levels. This year began with a landmark moment for the sector, as the Prime Minister chaired a high-level review meeting underscoring Ayush's growing importance in holistic wellbeing, preservation of traditional knowledge, and India's wellness ecosystem. During the meeting, the Prime Minister reviewed key achievements and emphasised the need for strategic interventions to unlock the sector's full potential.

Following the Prime Minister's guidance and under the esteemed leadership of the Minister of State (Independent Charge) for Ayush and Minister of State for Health & Family Welfare, Prataprao Jadhav, the Ministry has undertaken several strategic initiatives to accelerate the growth of the Ayush sector. It is prioritising evidence-based research, quality enhancement, capacity building, integration of Ayush systems and global promotion of Ayush systems.

Research, Evidence-Based Practice and Integrative Healthcare

Research in the Ayush sector is rapidly evolving, supported by stronger scientific validation, modern methodologies, and collaborative studies. Partnerships with premier institutions such as ICMR, CSIR, DBT, IITs and global universities have introduced advanced tools



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like genomics, metabolomics, AI-based analysis, and digital monitoring into Ayush research frameworks.

The Prime Minister launched the *'Desh Ka Prakriti Parikshan Abhiyan'* to promote health awareness and highlight the importance of holistic wellbeing as part of daily life. The campaign received a huge response from people across the country, with over 1.40 crore individuals taking part in the *Prakriti Parikshan*. It also created five Guinness World Records, showing how widely the initiative was supported by the public.

AYUSH निवेश सारथी

YOUR TRUSTED PARTNER IN AYUSH INVESTMENTS

देश का प्रकृति परीक्षण अभियान

।। संकल्प स्वास्थ्य का, आधार आयुर्वेद का ।।

The integration of Ayush systems with mainstream healthcare and the promotion of evidence-based traditional medicine have become major national priorities. This vision is reflected in initiatives such as the co-location of Ayush facilities under the National Health Mission and the establishment of advanced centres like the Ayush–ICMR Advanced Centre for Integrative Research (AI-ACIHR) and the Department of Integrative Medicine at NIMHANS, Bengaluru. The extensive network of National Institutes and Research Councils under the Ministry of Ayush is further strengthening this ecosystem by delivering specialised healthcare services and undertaking cutting-edge research to generate robust evidence on the safety and efficacy of Ayush interventions. The Ayush Research Portal, hosting more than 43,000 research papers, stands as a testament to the growing scientific rigour, accessibility, and global interest in Ayush systems.

Strengthening this progress, a recent addendum to the ICMR Ethical Requirements for Research in Integrative Medicine introduces essential measures to ensure scientific rigour, ethical transparency, and participant safety.

Market Size and Economic Potential of the Ayush Sector

India's Ayush sector is emerging as a significant contributor to economic growth, with the market now valued at approximately USD 43.4 billion, with an eight-fold rise in the last decade. This growth is being strengthened through focused efforts in quality assurance, standardisation, research, innovation, global collaborations, and MSME empowerment. Key initiatives such as the launch of the 'Ayush Nivesh Sarthi' portal and dedicated industry interactions on MSME schemes are helping boost investments and global competitiveness.

A major milestone was the release of the 'Guidelines for Processing Patent Applications of Ayush Systems and Related Inventions' on the 10th Ayurveda Day at AIIA–Goa. These guidelines have been developed by the Office of the Controller General of Patents, Designs and Trade Marks under DPIIT, Ministry of Commerce & Industry, with support from the Ministry of Ayush. These guidelines will serve as a vital tool to guide and support Ayush stakeholders as well as patent officers for innovations in Ayush systems. Additionally, the inclusion of Ayush drugs and medical devices under the Promotion of Research and Innovation in Pharma MedTech Sector (PRIP) Scheme marks a transformative step towards strengthening evidence-based growth, advancing research, innovation, and MedTech development in the Ayush sector.

Ayush Infrastructure, Capacity Building and Skill Development

The Ministry of Ayush has been at the forefront of capacity building through innovative initiatives that integrate traditional wellness into modern work culture. Its flagship programme, Yoga Break at Workplace (Y-Break), recognised as the top-performing course on the iGOT Karmayogi Bharat platform, has empowered over 8.6 lakh government officials to adopt yoga-based self-care practices.

The Ministry is also collaborating with the Capacity Building Commission to strengthen training and skill development across its institutions. So far, 2,330 officials from the Ministry of Ayush and its organisations

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have been onboarded on the iGOT platform, resulting in 12,982 course completions and over 13,640 learning hours, reflecting strong engagement from Ayush institutes. To encourage a positive learning culture, the Ministry has also introduced incentive initiatives such as Certificates of Recognition, *Chai Pe Charcha*, and *Tiffin Baithak* to promote continuous learning, teamwork, and leadership interaction.

Currently there are 11 National Institutes, 01 Institute of National Importance i.e., Institute of Teaching and Research in Ayurveda, Jamnagar, and 05 Research Councils under the Ministry of Ayush, strengthening education, research, and healthcare in Ayush systems of medicine.

Ministry of Ayush is also promoting public health awareness through the Central Sector Scheme for Promotion of Information, Education and Communication (IEC), aimed at familiarising citizens with the benefits of Ayush systems, including Ayurveda. Through seminars, workshops, multimedia campaigns, and community engagement programmes, the Ministry highlights the preventive, promotive, curative, and rehabilitative strengths of Ayush systems. These sustained efforts are empowering individuals to make informed health choices and adopt Ayush-based lifestyles for overall wellbeing.

Quality and Standards in Ayush

Ayush drugs are regulated under the Drugs & Cosmetics Act, 1945 to ensure their quality, safety, and proper standards. The Pharmacopoeia Commission for Indian Medicine & Homoeopathy (PCIM&H) develops official standards for Ayurveda, Siddha, Unani, and Homoeopathy medicines. This year, Ayursuraksha Portal was launched to monitor adverse drug reactions and misleading advertisements. Further, Bureau of Indian Standards has set up a dedicated department for Ayush standardisation, with 7 Sectional Committees and 56 Working Groups formulating 200 Indian Standards. Under ISO/TC249 on Traditional Medicine, a subcommittee on Ayurveda and Yoga has also been established.

The release of the 'Guidelines for Processing Patent Applications of Ayush Systems and Related Inventions' marks an important milestone in promoting innovation within Ayush systems, providing clear information for Ayush innovators and patent officers in evaluating and supporting Ayush inventions. Similarly, the recent inclusion of Ayush drugs under the Promotion of Research and Innovation in Pharma MedTech Sector (PRIP) scheme is a major step toward strengthening research, innovation, and evidence-based growth in traditional medicine.

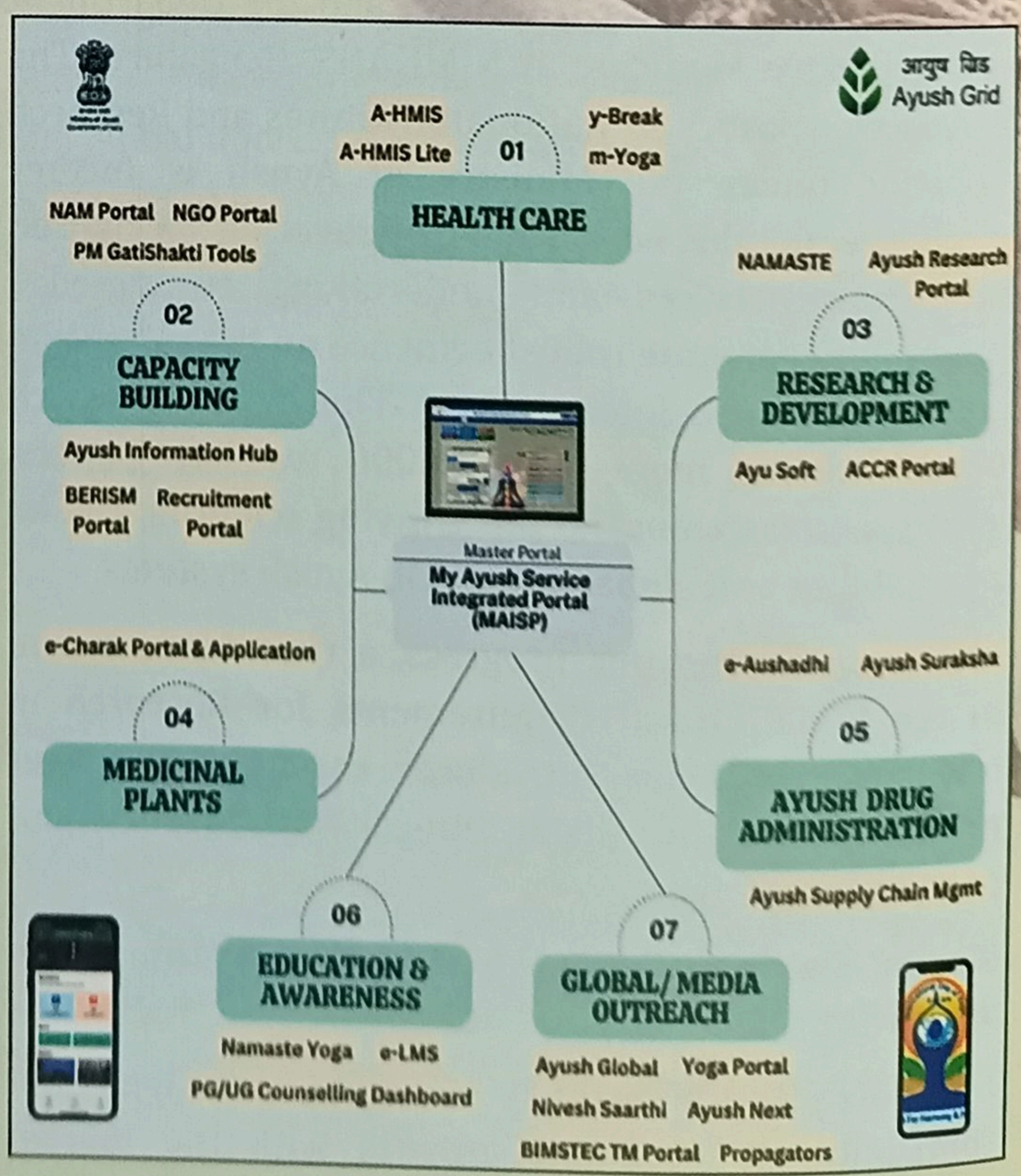
Ayush Grid: Building the IT Backbone of Ayush Healthcare

The 2030 Agenda for Sustainable Development recognises digital health as an essential tool for empowering communities and reducing digital gaps. In India, the integration of Ayush systems with digital technology gained momentum after the Ministry of Ayush was formed in 2014, leading to major initiatives such as the Ayush Grid under the Digital India programme. The Ayush Grid brings together multiple systems to enhance transparency, accessibility, and efficiency across the sector. Digital platforms like AHMIS, e-Sanjeevani, the WHO m-Yoga app, and the NAMASTE portal are expanding healthcare reach, supporting personalised care, and speeding up research and drug development in Ayush systems.

Further, the WHO's technical brief titled 'Mapping the Application of AI in Traditional Medicine' highlights global trends, emerging opportunities, and essential safeguards for the responsible use of artificial intelligence in this field.

Global Leadership in Traditional Medicine

India's integrative health initiatives are increasingly aligning with global efforts, particularly those outlined in the WHO Traditional Medicine Strategy. A major



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milestone in this journey is the establishment of the WHO Global Traditional Medicine Centre at Jamnagar, India, reflecting the global commitment to ensuring the safe and effective use of traditional medicine. This shared vision was further reinforced through the 2023 Gujarat Declaration. Strengthening India's international engagement, the country has entered into 25 country-to-country level MoUs, 52 institute-to-institute (Collaborative Research) MoUs, 15 academic chair MoUs, and established 43 Ayush Information Cells in 39 countries, significantly expanding global collaboration in the Ayush sector.

In a landmark development poised to transform the global standing of traditional medicine, the Ministry of Ayush and the World Health Organization (WHO) signed an agreement on 24 May 2025 to begin work on a dedicated Traditional Medicine module under the International Classification of Health Interventions (ICHI). Further, during the BIMSTEC Summit held in Bangkok, Prime Minister Narendra Modi announced the establishment of a BIMSTEC Centre of Excellence for Traditional Medicine to advance research, capacity-building, and dissemination among member nations.

To strengthen global collaboration on the safety, regulation and effectiveness of herbal medicines, the Pharmacopoeia Commission for Indian Medicine & Homoeopathy (PCIM&H), Ministry of Ayush, in collaboration with the World Health Organization (WHO), organised a three-day WHO–IRCH workshop in Ghaziabad from 6th to 8th August 2025.

The first Global Traditional Medicine Centre (GTMC) Summit, hosted in 2023 alongside the G20 Health Ministers' Meeting, convened leading global experts and Nobel laureates. Building on this momentum, the second WHO Traditional Medicine Global Summit is scheduled from 17 –19 December 2025 at Bharat Mandapam, New Delhi, to advance the WHO Global Strategy for Traditional Medicine (2025–2034).

Ayush@2047: Future of Global Health and Economy

As India moves towards a healthier and stronger future, traditional medicine is becoming an important pillar of both public health and economic growth. With steady policy support, alignment with modern research methods & digital tools and increasing global cooperation, Ayush sector is growing at an impressive pace. Considering economic potential and significance, the Ministry of Ayush has envisioned transforming the sector into a USD 200 billion industry by 2029 and enhancing its contribution to 5% of the national GDP.

Ministry of Ayush is shaping a future-ready ecosystem that positions India as a global leader in traditional medicine and holistic healthcare. By harnessing artificial intelligence and advanced technologies, Ministry is driving innovation, strengthening research, and enhancing patient care, paving the way for an evidence-based Ayush sector aligned with global health priorities. ❑

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SMART SOLUTIONS

Dr Arvind C Ranade



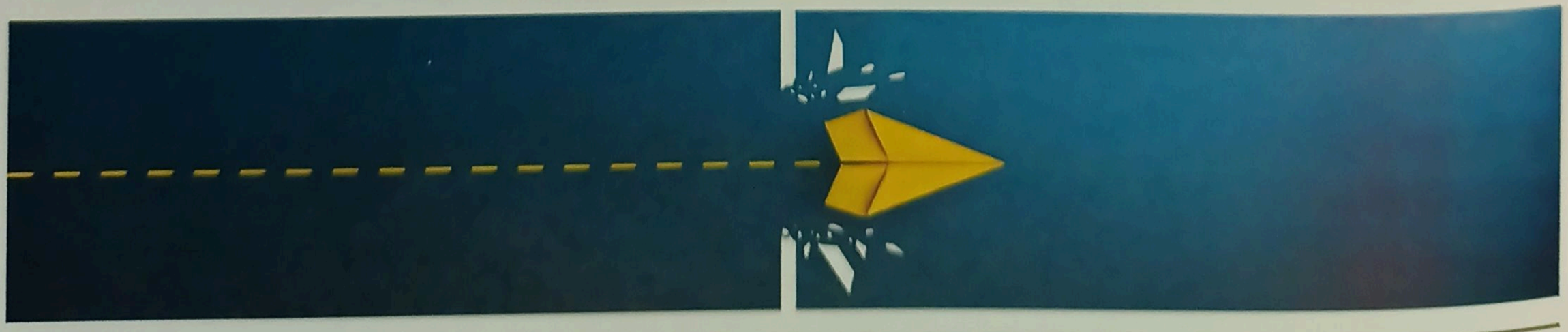
Quantum Leap in Global Innovation Landscape

India's remarkable ascent in the Global Innovation Index (GII) ranking, over the years, represents one of the most significant transformation stories in the global innovation landscape. As India marches forward on the path to Viksit Bharat@2047, sustained investment in R&D, patent quality, decentralised innovation hubs, and inclusive digital infrastructure will metamorphose India into the eminent global innovation leader, shaping technologies that solve local, national, and global challenges.

The Global Innovation Index (GII), published annually by the World Intellectual Property Organization (WIPO) in collaboration with Cornell University and INSEAD business school, stands as the world's most comprehensive innovation ranking framework. Established in 2007, the GII has evolved into a critical benchmarking tool that evaluates the innovation ecosystems of 139 economies worldwide, representing 93.6% of the world's population and 98% of the world's GDP. The Index is based on 80 indicators falling under a two-pillar structure of the Innovation Input Sub-Index and Innovation Output Sub-Index. The Input Sub-Index measures factors that enable innovative activities across five pillars, viz., Institutions, Human Capital and Research, Infrastructure, Market Sophistication, and Business Sophistication. The Output Sub-Index captures the results of innovative activities through Knowledge and Technology Outputs and Creative Outputs.

India's remarkable ascent in the Global Innovation Index (GII) ranking, over the years, represents one of the most significant transformation stories in the global innovation landscape. The country has climbed an impressive 42 positions, from 81st rank in 2015 to 38th in 2025, establishing itself as a leading hub of innovation and the top performer in Central and Southern Asia. This also represents the fastest sustained rise by any large economy in the GII index's history. The report explicitly notes that India performs above expectations relative to its GDP per capita and effectively translates costly innovation investments into more and higher-quality outputs. This positions India as an 'innovation overperformer' relative to its level of economic development.

This remarkable progress warrants careful reflection on India's systematic approach to building a comprehensive innovation ecosystem through strategic policy interventions, expansion in research



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and development capabilities, strengthening of digital infrastructure, and promotion of entrepreneurship.

Transformative Policy Architecture

The story of India's innovation transformation begins with Startup India, launched in January 2016 when the Prime Minister of India announced the ambitious programme to transform India from a nation of job-seekers into a nation of job-creators. At that moment, India had approximately 500 recognised startups. Today, that number exceeds 1.61 lakh startups creating around 17 lakh direct jobs. Previously, starting a business meant navigating complex and fragmented approvals across various departments, viz., company registration with the Ministry of Corporate Affairs, tax registration with the Income Tax Department, various state-level clearances, labour compliance certificates, and more. Each step consumed weeks to months. Startup India facilitated a single digital portal where entrepreneurs could register their ventures in hours rather than months, seamlessly accessing a large network of incubators and accelerators spread across the country. Moreover, the programme created a Rs 10,000-crore Fund of Funds to provide seed funding for promising startups. It also offered tax exemptions and incentives for the first three profitable years, giving new ventures time to establish themselves before facing full compliance costs. By spreading resources beyond major cities, the initiative helped tier-2 and tier-3 cities now account for nearly 51% of India's new startups.

The rule of law and better risk resolution process have also enhanced investor and entrepreneurial confidence, a critical ingredient for an innovation-friendly ecosystem. Since 2016, the Insolvency and Bankruptcy Code (IBC) has provided a credible, time-bound path to rescue or close down stressed firms. In FY24, IBC accounted for nearly 48% of banks' total recoveries, ahead of SARFAESI Act (32%), Debt Recovery Tribunals (17%), and Lok Adalats (3%). Lifetime data show approximately 32–33% recovery against admitted claims, with an improving resolution-to-liquidation ratio; as a result, more companies are being revived rather than liquidated.

Digital Public Infrastructure Revolution

The Digital India Mission, launched in 2015, has created the techno-digital foundation upon which thousands of innovations could thrive. This initiative encompasses three key vision areas: digital infrastructure as a core utility, governance and services on demand, and digital empowerment of citizens. The trinity of Aadhaar, providing every resident with a unique digital identity; the Unified Payments Interface (UPI), creating a common digital payment system; and open Application Programming Interfaces (APIs) for data sharing created a universal platform that levelled the playing field between large corporations and individual entrepreneurs. Now, a vendor in a remote area can accept digital payments via a simple QR code printed on paper, without owning a point-of-sale terminal or a merchant bank account. Customers scan the code with their phones, enter the amount, and the payment routes instantly through the National Payments Corporation of India's common infrastructure, arriving in the vendor's bank account within seconds. In September 2025 alone, UPI processed over 24.9 lakh crore transactions.

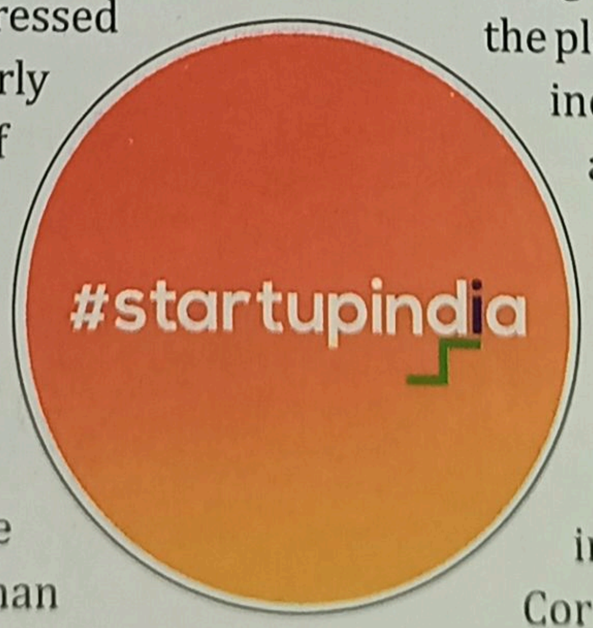
This infrastructure is not only convenient but also enabling because when payments become frictionless

India's Global Strengths

India's Global Rank	Assessment Parameters
#1	Share of exports from IT & other tech services
#3	Size of India's domestic market
#4	Share in global late-stage Venture Capital deals
#8	Value of big firms driven by intangible value (brand, software, IP)
#9	Access to funding for startups & scaleups
#11	Value of Indian unicorns (as % of GDP)
#12	Entrepreneurship policies & culture
#13	Share of exports from cultural & creative services
#14	Investment rate in the economy (gross capital formation, % of GDP)
#16	R&D spend by top 3 India-based global corporate investors

Source: GII 2025

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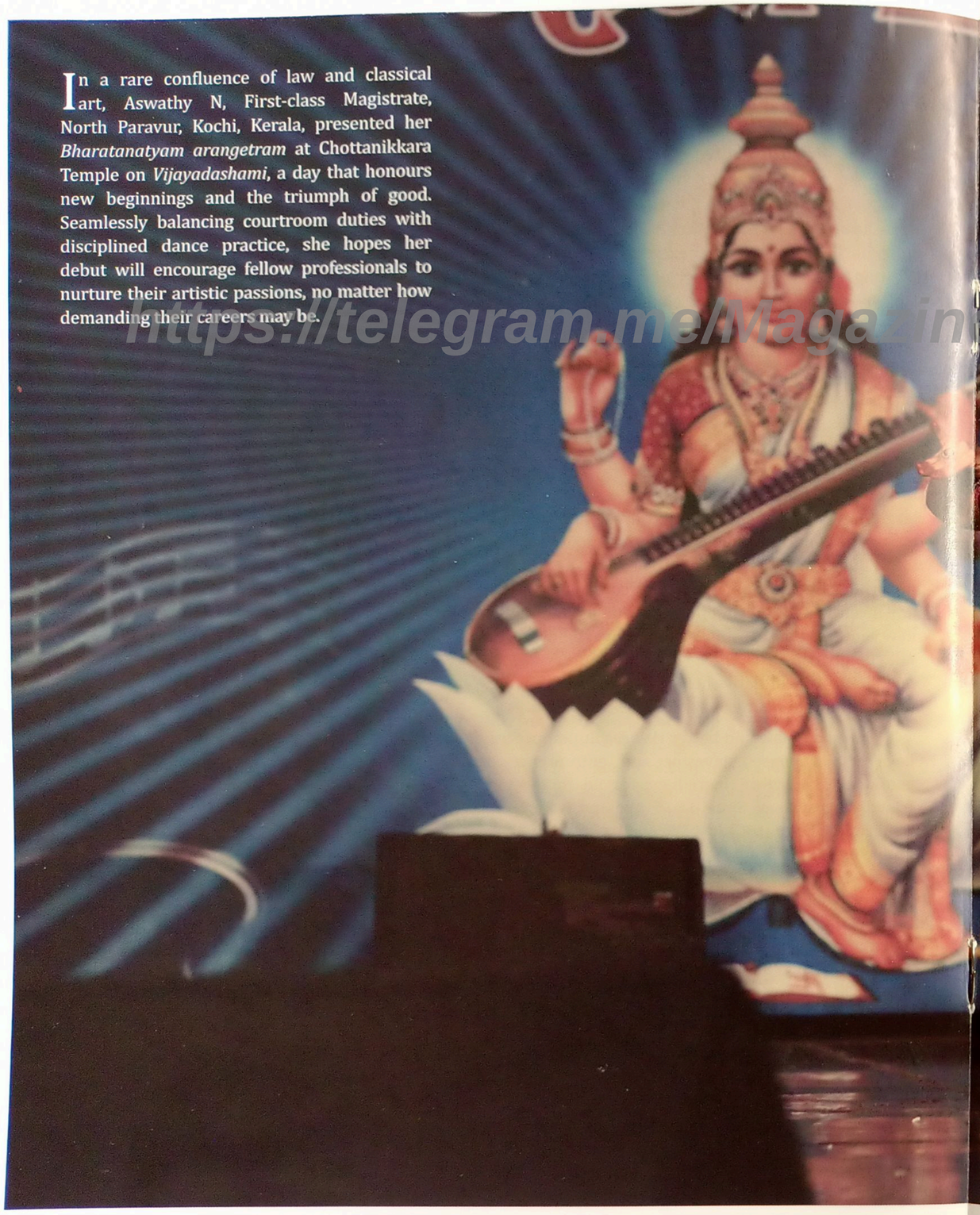


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In a rare confluence of law and classical art, Aswathy N, First-class Magistrate, North Paravur, Kochi, Kerala, presented her *Bharatanatyam arangetram* at Chottanikkara Temple on *Vijayadashami*, a day that honours new beginnings and the triumph of good. Seamlessly balancing courtroom duties with disciplined dance practice, she hopes her debut will encourage fellow professionals to nurture their artistic passions, no matter how demanding their careers may be.

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and universal, entirely new entrepreneurial models emerge. For example, Account Aggregator processes MSME loans, e-consultations, freelancing, fast grocery delivery at the city scale, weather-index crop insurance payments based on rainfall or temperature data, etc. The same DPI now supports Open Network for Digital Commerce (ONDC), ensuring that a home-based seller or a *kirana* owner can be discovered online and paid in seconds. This digital foundation has been instrumental in enabling fintech innovation, with UPI democratising financial transactions and contributing to India's leadership in ICT services exports, where it ranks 1st globally.

Integrating Manufacturing and R&D

In the year 2020, the Production-Linked Incentive (PLI) scheme, spanning fourteen sectors including semiconductors, pharmaceuticals, and electronics manufacturing, has mobilised over Rs 1.76 lakh crore in investment and created over 12 lakh employment opportunities. The programme's significance extends beyond these aggregate metrics to encompass a more nuanced innovation strategy embedded within its structural architecture. To qualify for PLI eligibility, firms must demonstrate progressive domestic value addition and establish the R&D facilities within India. This mandate has driven the creation of design centres, prototype laboratories, and testing facilities in the country and accelerated India's transition toward smart manufacturing and Industry 4.0 technologies. When multinational corporations establish design laboratories to qualify for PLI benefits, they embed advanced R&D capabilities within India's technical ecosystem. This generates knowledge spillovers, transferring cutting-edge methodologies throughout the innovation system. Consequently, electronics manufacturing surged 146% from Rs 2.13 lakh crore (FY 2020-21) to Rs 5.25 lakh crore (FY 2024-25), while India achieved 60% import substitution in telecom products and turned the drone sector into a seven-fold growth story driven by MSMEs. Continuing this momentum, the government has launched PLI 2.0 with special emphasis on Electronics & IT Hardware, and the Automobile sector to position India as a global electronics leader by 2030.

Moreover, to scale and fortify 'Design-in-India,' the Union Cabinet has recently approved a Rs 1 lakh crore Research Development and Innovation (RDI) scheme to encourage private-sector R&D in sunrise and strategic technologies. This holistic institutional governance and incentive architecture is propelling India towards 'invent, design, and make' and transforming the country into an innovation originator. This policy synergy is observable by India's 22nd global rank in Knowledge and Technology Outputs.

National Education Policy and Research Excellence

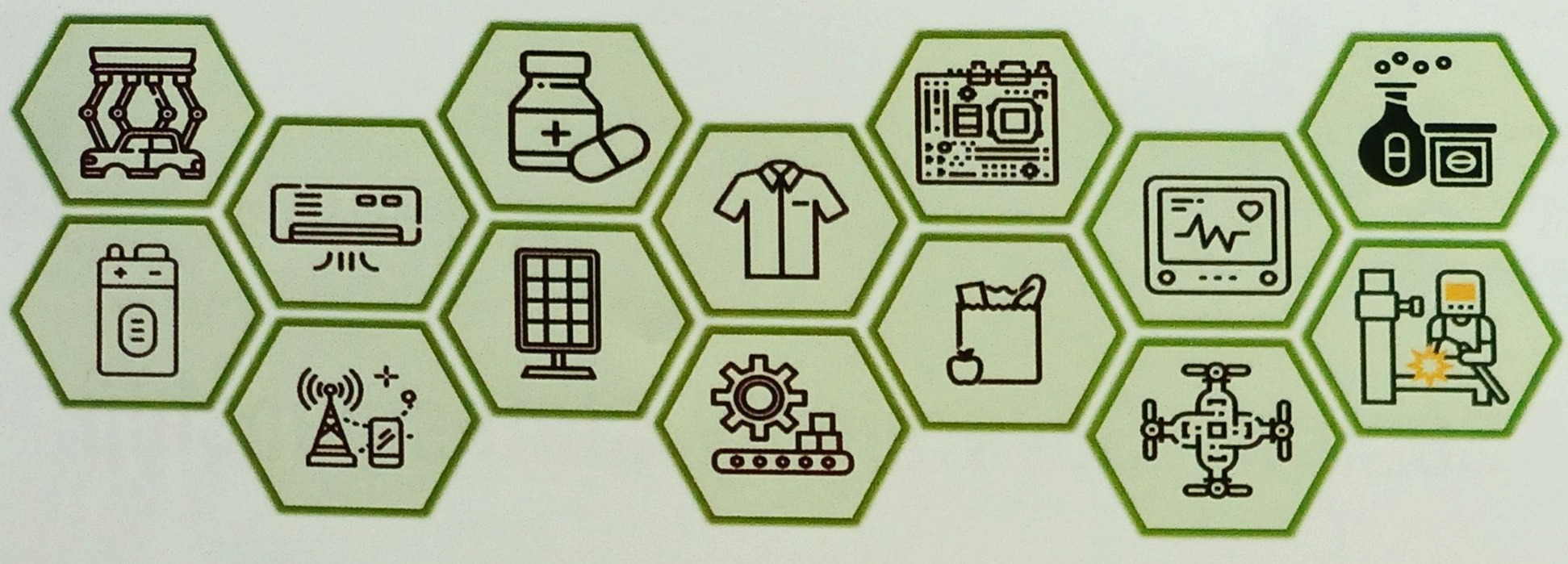
In the context of India's evolving education landscape, the National Education Policy 2020 stands as a landmark reform resembling the synthesis between Mahatma Gandhi's *'Nai Talim'* (Wardha Scheme of Basic Education 1937) and the visionary pedagogy of Rabindranath Tagore. Building upon the Gandhian ethos of holistic, vocational, value-oriented, and self-reliant learning and Tagore's vision of creativity, multidisciplinary scholarship, and cosmopolitanism, the National Education Policy 2020 advocates for interdisciplinary research to address complex societal challenges and promotes collaboration across disciplines, departments, and institutions. A key milestone has been the establishment of Anusandhan National Research Foundation (ANRF) with a Rs 50,000 crore hybrid funding model to support cutting-edge research across all disciplines.

The new education policy push has catalyzed remarkable growth in research outputs.India now ranks 3rd globally (from 7th position in 2010), in research publications, with research output rising 142% since 2015. Moreover, since 2015, Ph.D. enrollment has also doubled to over 2.34 lakh, with female enrollment increasing by over 135.6%. The policy's emphasis on industry-academia collaboration has been strengthened through initiatives like the KAPILA programme, which has



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promoted intellectual property literacy in academic institutions through capacity building of faculties and students.

Expansion of Technical and Institutional Capacity

India's commitment to expanding its modern technical capability infrastructure is evident in the establishment of 42 new Central Higher Educational Institutions since 2014, including new central universities, IITs, IIMs, NITs, IIITs, and IISERs The recent Union Cabinet approval of Rs 11,828.79 crore for expanding five new IITs will increase student capacity by over 6,500 students and establish five state-of-the-art research parks to strengthen industry-academia linkages.

The Atal Innovation Mission (AIM), established in 2016, has created a comprehensive innovation ecosystem through 10,000 Atal Tinkering Labs in schools and more than 3,500 startups incubated at Atal Incubation Centres, creating over 32,000 jobs. This grassroots approach to innovation cultivation has been recognised internationally, with WIPO (World Intellectual Property Organization) entering into partnership agreements with AIM to showcase these models globally. Moreover, India's intellectual property ecosystem has undergone a remarkable transformation, securing a position among the global top 10 for patents, trademarks, and industrial designs according to the WIPO 2024 report. The country ranks sixth globally in patent applications with 64,480 filings in 2023, with over half (55.2%) now coming from domestic residents, which is a historic moment demonstrating India's growing indigenous innovation capacity.

Way Forward

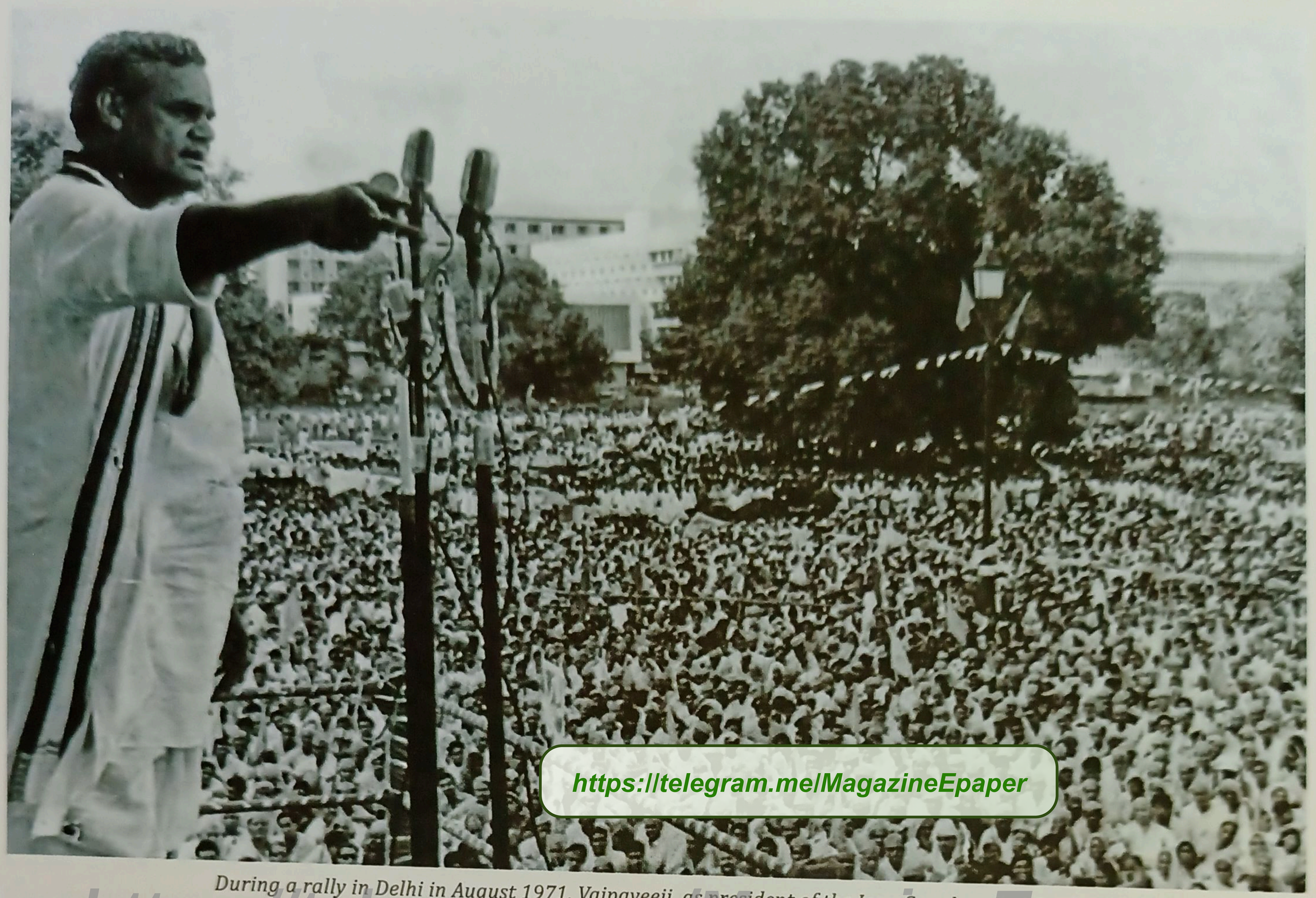
To sustain and accelerate India's innovation trajectory toward *Viksit Bharat*@2047, the following pathways are critical:

- Increasing private sector R&D contributions, which are currently at 37% of the total, and taking Gross Expenditure on R&D (GERD) from the current 0.7% to 2% of GDP, to match top global innovators like China (2.4%), USA (3.5%), and Israel (5.4%), etc.
- Enabling multinational corporations to co-innovate with Indian universities and startups and creating homegrown design capabilities.
- Increasing the number of accelerators/incubators across rural areas and fast-tracking quality assessments, and patent commercialisation.
- Widening digital access by greater decentralisation of ONDC, UPI, and Digital Public Infrastructure networks to remote hinterlands of the country.
- Establishing nationwide, regional, and district innovation hubs to harness local expertise and address community-specific challenges, powering a nationwide *Vocal for Local* movement.

विकसित भारत

India's impressive rise in the GII is a testament to visionary policy architecture rooted in *Atmanirbhar Bharat* to transform the nation into an innovation-driven global powerhouse. Over the years, India has systematically built institutional capacity, entrepreneurial ecosystems, and research excellence. The rise in domestic patent filings, frontier technology startups, the UPI-led fintech revolution, etc., signals a structural shift toward an indigenous innovation paradigm. As India marches forward on the path to *Viksit Bharat*@2047, sustained investment in R&D, patent quality, decentralised innovation hubs, and inclusive digital infrastructure will metamorphose India into the eminent global innovation leader, shaping technologies that solve local, national, and global challenges. ❑

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During a rally in Delhi in August 1971, Vajpayeeji, as president of the Jana Sangh, called for the Indian government to promptly recognise Bangladesh

figures in Indian politics. He served as a Member of Parliament (MP) for ten terms in the Lok Sabha and two terms in the Rajya Sabha.

First elected to Lok Sabha in 1957 from Balrampur, Uttar Pradesh, representing the Bharatiya Jana Sangh (BJS), the ideological precursor to the BJP, Vajpayee was always interested in issues related to India's national security. He had very strong views about the country's territorial integrity and sovereignty. He frequently criticised the then PM Jawaharlal Nehru's foreign policy as overly conciliatory and indecisive towards Pakistan, particularly on issues related to Kashmir, Tibet, and the boundary dispute with China.

Barring the two years when he was the External Affairs Minister (EAM) between 1977 and 1979, Vajpayee was an opposition MP for about forty years beginning in 1957.

There are a few key strands that can be discerned from Vajpayee's public speeches and policies in the realm of defence, national security and foreign policy.

Territorial Integrity of India

In his speech on 15 May 1957 in the Lok Sabha Debate on the President's Address, Vajpayee lambasted Nehru's Kashmir policy. During this period, both as a member of the Lok Sabha and the Rajya Sabha between 1957 and 1967 and as the Bharatiya Jan Sangh parliamentary spokesperson, Vajpayee made multiple speeches decrying Nehru's handling of Pakistan-related issues, including the government's stance on the 1965 Indo-Pak War and the ongoing Kashmir issue. He viewed Pakistan's actions as aggressive expansionism. He urged full integration of Kashmir and rejection of UN-mediated solutions that legitimised the occupation by Pakistan of a part of Kashmir—what we now call Pakistan Occupied Jammu and Kashmir (PoJK).

Similarly, regarding the border incursions by China in the late 1950s, he repeatedly urged the government to develop India's military capability and take serious note of the Chinese actions. Pointing towards China's construction of the road through Aksai Chin (G219 linking Xinjiang to Tibet), he consistently urged the government to make efforts to recover the occupied territory.

In June 1962, as tensions with China intensified, Vajpayee termed India's China policy as "ludicrously

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unrealistic and ineffective". He proposed that, as a realistic reorientation of India's China policy, India should first sever diplomatic ties with China. Second, that all diplomatic and defence policies and postures vis-à-vis China should clearly be directed towards the early recovery of lost territory. Third, that conscious and concerted efforts should be made at international fora and in India's neighbourhood to expose China's expansionist policies against India.

Contrary to the then Nehru government's position, Vajpayee called for the improvement of defence preparedness to protect India's borders. He also suggested establishing diplomatic relations with Taiwan, which called itself the Republic of China (ROC) and claimed to be the sole representative of all of China.

As we have seen, he was unwilling to compromise on his views regarding the country's territorial integrity. This was evident from the strong positions he took against aggression committed by Pakistan and China. His speeches in the Rajya Sabha during the 1965 Indo-Pak War emphasised the robust defence of Indian territory, particularly Kashmir. While pressuring the government of the then Prime Minister Lal Bahadur Shastri to be even more decisive in countering Pakistan's aggression, he did not, at the same time, hesitate to call for the opposition to unite and rally behind the government during the 1965 war.

Tibet and Taiwan

On the issue of Tibet, he urged the Indian government to actively support the Tibetan cause by virtue of India's own struggle against imperialism and colonialism. In 1959, when the internal Khampa rebellion against Chinese occupation reached its peak with the Dalai Lama seeking refuge in India, Vajpayee criticised India's silence in the UN debate over Tibet in the Parliament. Highlighting Tibet's importance to India's security, he had urged the government not to accept Chinese claims on Tibet. It did not help matters since the major powers had never supported the Tibet cause even when the Chinese PLA had occupied Tibet in October 1950.

Vajpayee was farsighted about the adverse implications of the People's Republic of China replacing Taiwan (the so-called Republic of China) as a permanent member of the UN Security Council. Criticising the government position that membership of the UN could temper the aggressive tendencies of the People's Republic of China, he had pointed out that Beijing could well use the veto and its diplomatic influence to thwart India's policy objectives and disseminate unfavourable narratives about India.

In hindsight, one can say that Vajpayee's apprehensions were well justified, as the unfolding events of succeeding decades revealed after Beijing replaced Taipei in the UN Security Council in 1971. China, thereafter, held up for a while recognition of newly independent Bangladesh and later continued its support for self-determination for Jammu and Kashmir on the basis of the so-called UN Security Council resolutions. China's veto power has continued to dog India's interests.

The most recent examples are China's blocking of the listing of Pakistan-based terrorist networks and individuals under the relevant provisions of the UN Security Council and dilution of references to 'The Resistance Front' in the UN Security Council statement of 25 April 2025, which condemned the terrorist attack in Pahalgam.

It is clear that in his early years as a parliamentarian, Vajpayee emerged as a hardcore realist. Later, one can say that he veered towards greater pragmatism, but without abandoning his core beliefs about sovereignty and territorial integrity.

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Building on Unfinished National Task

The second aspect is that Vajpayee was quick to take forward the unfinished national task of India becoming a nuclear-weapons state. He firmly believed that India should possess nuclear weapons to bolster its national security. He believed that peace lay in strength.

Vajpayee had long dreamt of India as a nuclear weapons state. During discussions in the Rajya Sabha on 22 December 1964, Vajpayee raised the issue of nuclear tests carried out by China in October of that year. He urged the government to discuss the issue of India developing the nuclear bomb with an 'open mind'. He cited the example of the US dropping an atomic bomb on non-nuclear Japan, asserting that had Japan possessed nuclear weapons, the US would not have dared to use an atomic bomb against that country.

For Vajpayee, the development of nuclear technology was a matter of self-reliance. He firmly believed that the possession of nuclear weapons would enhance India's strategic autonomy as well as deterrence capability.

Vajpayee had predicted that China's possession of a nuclear bomb would change the military balance of the

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Prime Minister Atal Bihari Vajpayee at the Pokhran test site in 1998, with Dr APJ Abdul Kalam, the DRDO Secretary and Chief Scientific Adviser to the PM, who later became the 11th President of India

region to the detriment of India. It was in this context that, despite being on the opposition benches, Vajpayee had welcomed India's Peaceful Nuclear Explosion (PNE) on 18 May 1974, convinced as he was that it was in the national interest.

According to Dr APJ Abdul Kalam, in May 1996, the then PM P V Narasimha Rao, had asked him to prepare for conducting nuclear tests. However, when the Congress government fell in the 1996 national election, Rao asked Dr Kalam to share details with Vajpayee, the incoming Prime Minister. According to Vajpayee's media adviser Ashok Tandon's book *'The Reverse Swing'*, at Vajpayee's swearing-in ceremony in 1996, Rao quietly passed the former a 'chit' that said "Now is the time to accomplish my unfinished task".

It was well known that P V Narasimha Rao, as Prime Minister, had virtually decided to carry out the nuclear tests but was forced to withhold action under US pressure. However, the Vajpayee government in 1996 proved short-lived and lasted a mere 13 days. India had to wait for some more time.

In 1998, India faced a harsh external environment. The China-Pakistan nexus in missile production and in the nuclear domain was at its peak. And there was reason to believe that the US was deliberately ignoring these developments. It was in this context that Vajpayee acted decisively when he returned to office for the second time that year. India conducted three underground nuclear tests on 11 May 1998 and two underground tests on 13 May 1998 in quick succession. Vajpayee declared that the decision was "based on the same policy tenets that guided India for five decades, due to an underlying national consensus". He magnanimously presented it as a continuation of the policies set into motion by the previous administrations. Further, he ensured that India would stand firm and resist global pressure to sign the Nuclear Non-proliferation Treaty (NPT) and the Comprehensive Test Ban Treaty (CTBT).

Pragmatic Realist

Another dimension of interest was Vajpayee's pragmatic realism, something that had defined his political career over the years. While the decision to carry out the nuclear tests in 1998 was driven by realistic security considerations, the decision to impose a self-imposed moratorium on further testing was founded on pragmatism.

Earlier, during the 1971 war, Vajpayee had transcended party lines and pledged support to the then government of Prime Minister Indira Gandhi. This demonstrated the value he attached to pragmatic

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nationalism and his commitment to prioritising national unity over opposition politics.

Even as EAM in the Janata Party government under Morarji Desai in 1977, Vajpayee the 'realist' had pragmatically tempered his strong views about China and Pakistan. It is no wonder that Vajpayee is equally remembered today for his peace overtures to both these countries as for his firm stance against them on issues of national security.

In 1978, he became the first Indian Foreign Minister to visit Pakistan in over a decade, meeting with General Zia-ul-Haq during the latter's military rule. Normalisation of ties was high on his agenda. He pushed for enhanced trade, cultural exchanges, and people-to-people ties, famously proposing a bus service between Delhi and Lahore—a vision that would materialise two decades later under his Prime Ministership.

As the EAM, he also welcomed normalisation of diplomatic ties with China. In an effort to revive high political contacts with India's northern neighbour, Vajpayee undertook a visit to that country in February 1979. The two sides agreed during the visit to develop bilateral relations while continuing the dialogue to resolve the boundary question.

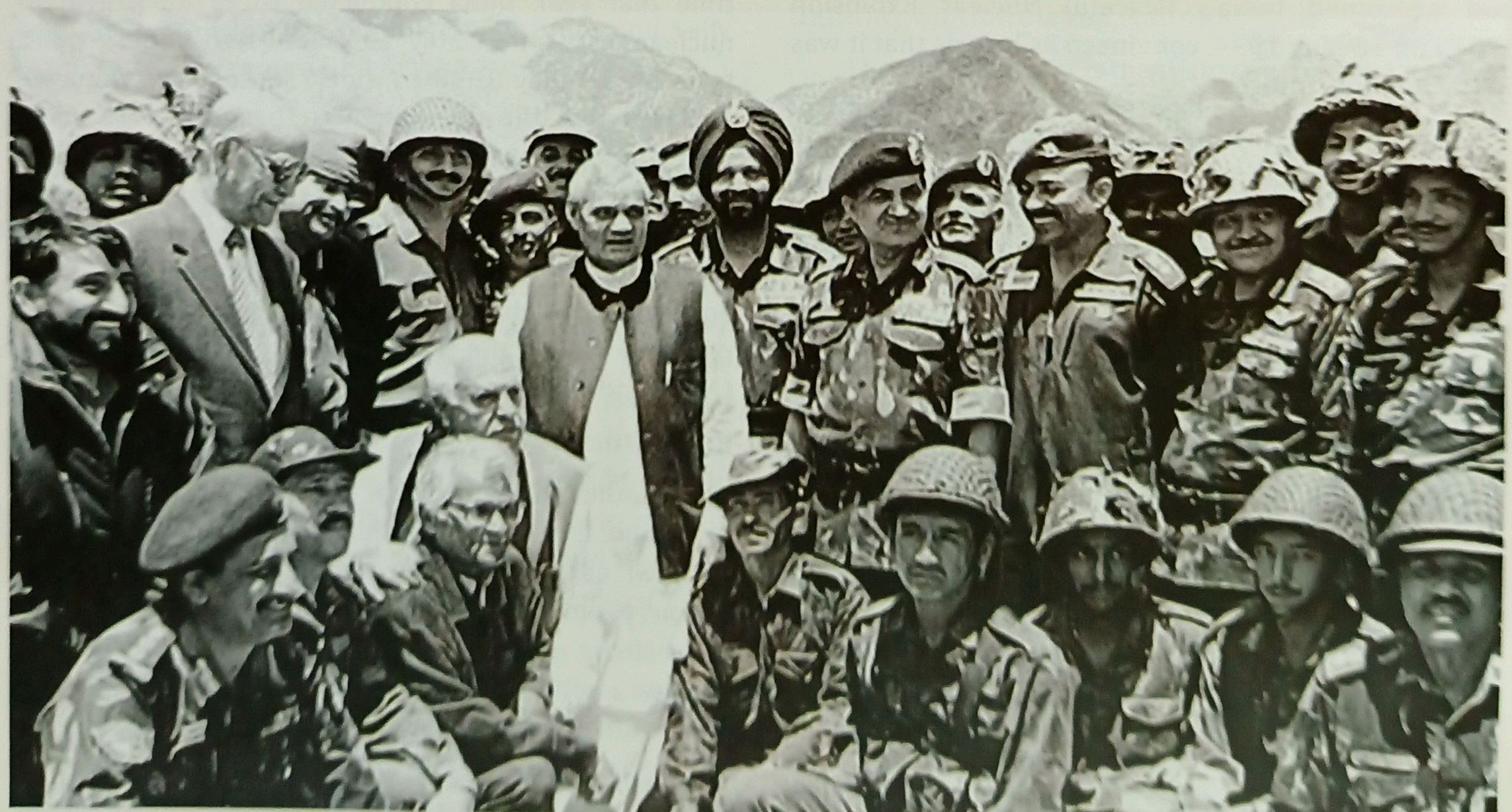
Though he raised with the Chinese side serious security issues like China's support to Pakistan on Kashmir and the assistance to Naga rebels, he also endeavoured to build a better relationship with China through pragmatism and mutually beneficial cooperation.

This phase, as the EAM between 1977 and 1979, highlighted the Vajpayee brand of diplomacy, blending idealism with realism. He emphasised that neighbours could not change geography, advocating dialogue to resolve issues. This was amplified when he became Prime Minister. As PM between 1998 and 2004, Vajpayee once again took a number of steps to normalise ties with Pakistan and China.

Outreach to Pakistan and China

After India's Pokhran II nuclear tests in 1998, Vajpayee resorted to normalising relations with Pakistan. During the 1999 Lahore Bus Yatra, when he personally travelled to Pakistan, he signed the Lahore Declaration with Nawaz Sharif (the then Pakistan Prime Minister). It committed the two sides to implementing the Simla Agreement in letter and spirit, reducing the risk of accidental or unauthorised use of nuclear weapons and resolving all issues, including the issue of Jammu & Kashmir.

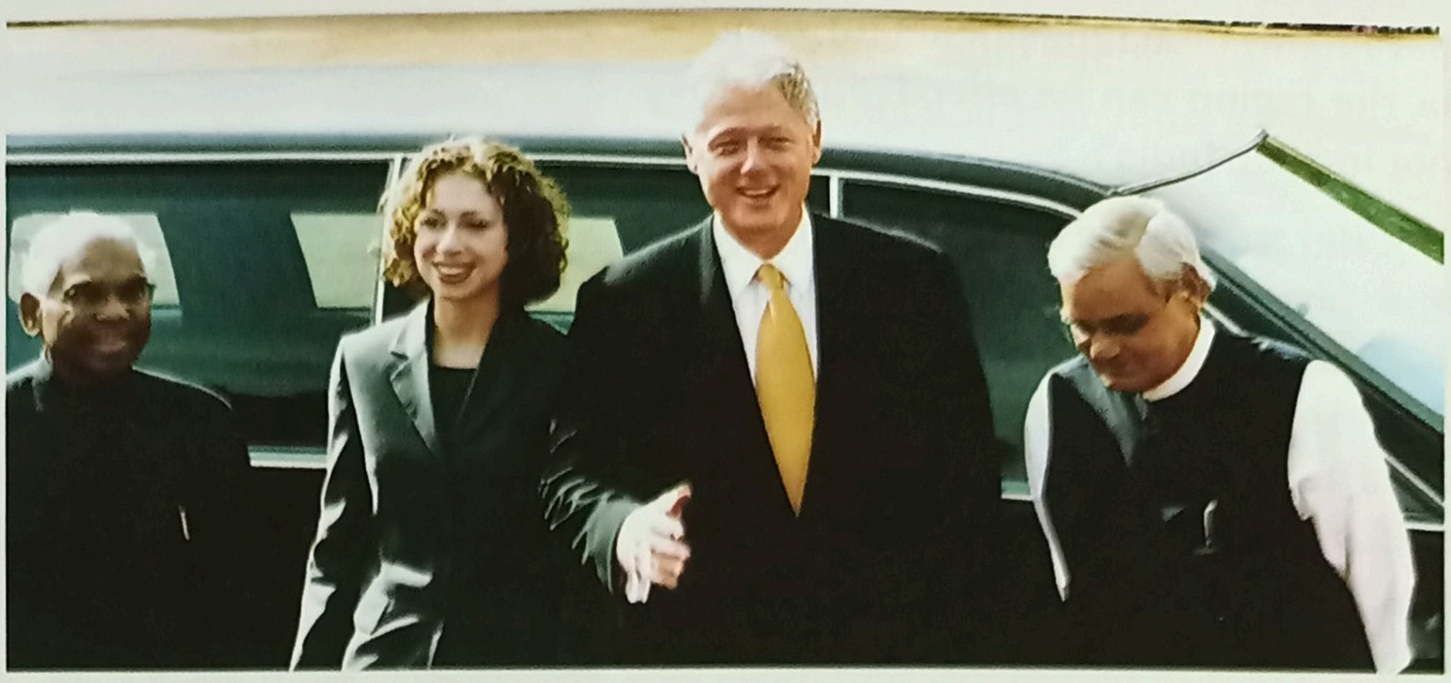
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During the Kargil conflict in 1999, Prime Minister Atal Bihari Vajpayee, accompanied by Defence Minister George Fernandes (seated third from left), Jammu and Kashmir Governor Girish Chandra 'Gary' Saxena (standing second from left), and Army Chief General Ved Prakash Malik (fourth from right), met with the troops on the front lines

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Tragically, this olive branch was betrayed by Pakistan's intrusion in the Kargil region of the Indian state of Jammu & Kashmir in 1999. Vajpayee responded decisively, authorising forceful military eviction while refraining from crossing the Line of Control (LoC). The decision showcased a calibrated escalation. In the aftermath of the terrorist attack on the Indian Parliament in 2001, Vajpayee flexed India's military muscle to warn Pakistan. The massive troop mobilisation under Operation Parakram in 2001-2002 brought the nuclear-armed neighbours onto the brink. At the same time, it was Vajpayee's restraint that stayed India's hand and averted war.



US President Bill Clinton (centre), with daughter Chelsea Clinton (immediate right) after receiving ceremonial welcome at Rashtrapati Bhavan, accompanied by President K R Narayanan (extreme left) and Prime Minister Atal Bihari Vajpayee (extreme right) in March 2000

As regards China, he visited that country again in June 2003, this time as Prime Minister. Until then, China had a long-standing policy of showing Sikkim as a separate country. It had never formally accepted Sikkim's merger with India in 1975. During his term as Prime Minister, Vajpayee convinced Beijing to recognise Sikkim as an integral part of India and to reprint their maps accordingly. The process took some time. Premier Wen Jiabao stated during his visit to India in 2005 that China regarded Sikkim as an 'inalienable part of India' and that Sikkim was no longer an issue in India-China relations. PM Vajpayee stated in Parliament that the Joint Statement signed by the two sides explicitly refers to 'Sikkim State of the Republic of India'. He informed the House that the Chinese side had officially handed over a revised map showing Sikkim as within the international boundaries of India.

PM Vajpayee's visit to China also catalysed a rapid rise in bilateral trade and investment ties. The period from 2000 to 2005 coincided with the author's term as the Consul General of India in East China, based in Shanghai. It was one of the most optimistic phases in bilateral economic ties, with major Indian IT companies establishing their campuses across China, along with pharmaceutical majors and some manufacturing companies as well.

Notably, during his 2003 visit, Vajpayee addressed the first-ever conference in Shanghai focussed on bilateral cooperation in the Information Technology (IT) sector. He called for a strategic alliance between Indian and Chinese IT companies, urging them to combine their respective strengths. Today, this idea may appear idealistic, given the several areas of differences that continue to cast a shadow on India-China relations. At the same time, it is relevant to note that the thaw in bilateral relations in 2025 has been accompanied by Beijing's calls for cooperation between India and China in diverse fields, including in global norm setting in artificial intelligence.

Boundary Dispute with China

An important aspect of the China visit in 2003 was the decision to fast-track the talks on the boundary dispute by initiating the framework of the Special Representatives (SRs) of the two Prime Ministers. Broadly speaking, the SR dialogue mechanism has survived, with some gaps in between, and has contributed, along with other dialogue mechanisms, to the recent disengagement and reduction in tensions in the border areas caused by the Galwan incident of June 2020.

It is pertinent to note that the exercise of clarifying and confirming the Line of Actual Control (LAC) on the basis of the bilateral border agreements of 1993 and 1996 acquired salience after Vajpayee was elected as PM for the third time in 1999. The maps showing either side's perception of the LAC in the Middle Sector were exchanged, informally in 2000 when this author was the Head of the Indian Side in the India-China Diplomatic and Military Expert Group and later, formally, in 2002. However, the Chinese side refused to go ahead with a similar exercise for the Western and Eastern Sectors, where the differences are much larger as compared to the Middle Sector.

Multipolarity and India's Rise

Atal Bihari Vajpayee had strategic foresight. He visualised India as a great power long before its economic growth rates made this a realistic possibility. He said that he could not "imagine that any future

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paradigms or arrangements for security in the region can be effective if it does not include India".

He saw India's security, stability, and prosperity as central to security, stability, democracy and prosperity in Asia. He wanted an "Asia where power does not threaten stability and security" and rejected an Asia in which some would dominate and crowd out the others.

In today's parlance, he was seeking a multipolar Asia. His vision was prophetic. Today, the world recognises that India is indispensable for a rules-based order in the Indo-Pacific.



Prime Minister Atal Bihari Vajpayee meets with the Chinese Foreign Minister Tang Jiaxuan at his office in New Delhi on 22 July 2000

Engaging the United States

In a sense, Vajpayee was also the architect of the close strategic partnership between India and the US following the end of the Cold War. Vajpayee was clear, though he did not articulate it directly, that India must not only 'engage' with the US but also move away from the beaten path and forge good relations.

Notwithstanding stringent US sanctions after the Pokhran II tests, Vajpayee readily initiated the nuclear dialogue with the US. He surprised Washington by coupling his nuclear defiance with the declaration that India and America were 'natural allies'.

In June 1998, Vajpayee sent veteran politician Jaswant Singh to New York and Washington to explain India's strategic motives and to assess the situation. Diplomatic negotiations began the same month, with the Indian side represented by Jaswant Singh, Deputy Chairman of the Planning Commission and later the EAM, and the US side led by Strobe Talbott, the Deputy Secretary of State.

By 2000, the tensions generated by the Pokhran tests had eased. It paved the way for the first US presidential visit in 22 years. The last visit before Bill Clinton's visit was that of Jimmy Carter in 1978. Notably, Clinton's visit took place less than two years after the nuclear tests.

In 2004, the two countries announced the 'Next Steps in Strategic Partnership' (NSSP) agreement. It was heralded as a breakthrough in India-US strategic collaboration because it committed both countries to working together in four key areas—civilian nuclear energy, civilian space programme, high-technology trade, and missile defence — where India's possession of nuclear weapons had previously made meaningful cooperation all but impossible.



Prime Minister Atal Bihari Vajpayee (right) speaks to the US Secretary of State Colin Powell during a meeting in New Delhi, India on 28 July 2002

Atmanirbharta and *Atmaraksha*

There are notable aspects of Vajpayee's strategic thinking that remain relevant today as India navigates a world in flux, characterised by major power conflict and the weaponisation of trade and technology.

The first is Self-Reliance or *atmanirbhata*, including in the defence sector. It may be recalled that Vajpayee

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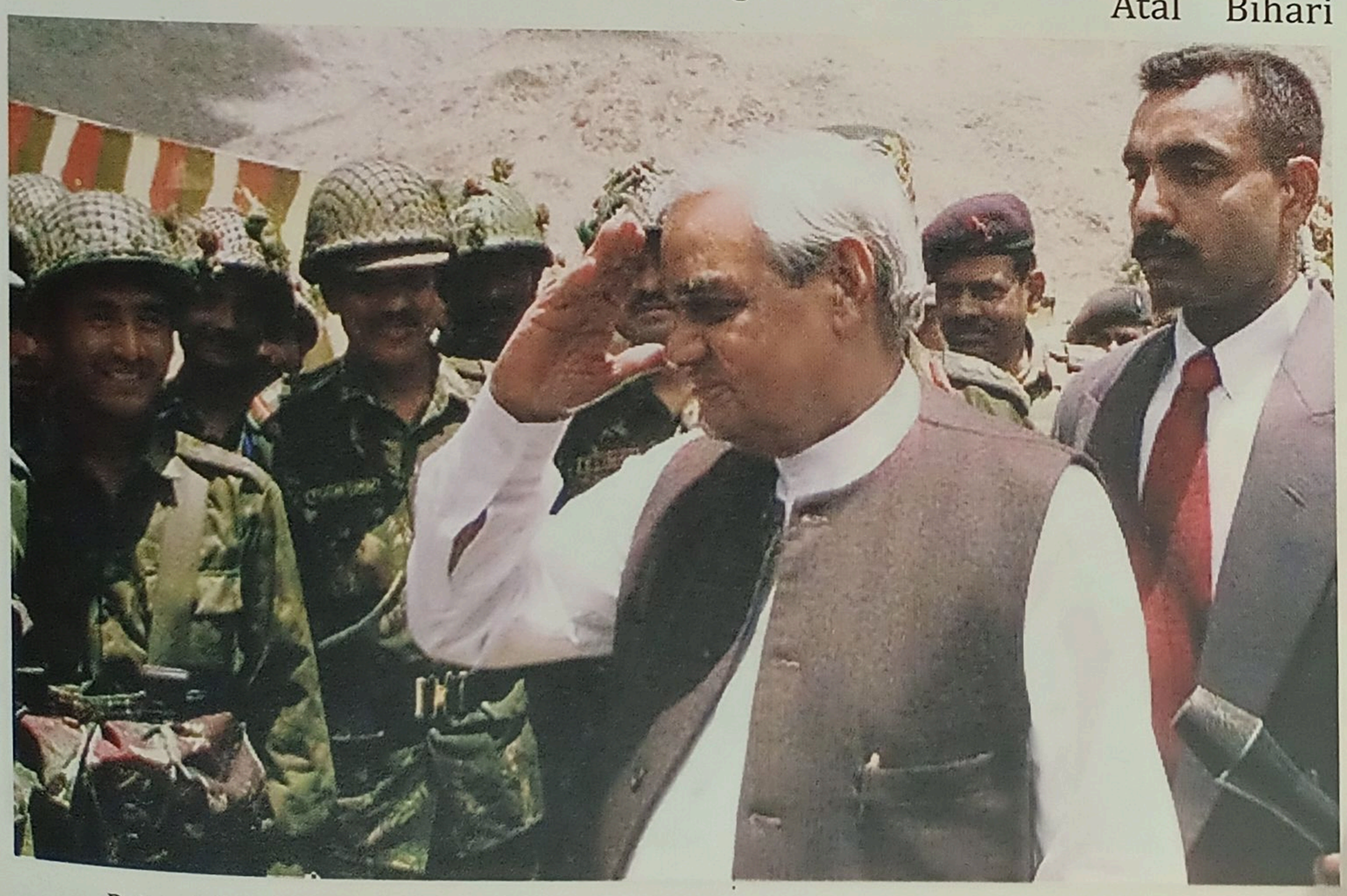
wanted India to strive for self-sufficiency in the strategic domain, as evident in his address to the nation following the test-firing of the Agni II missile in 1999. In another address, at the 24th Conference of DRDO directors on 6 August 1999, Vajpayee congratulated the DRDO for the indigenous development of a spectrum of disciplines ranging from missiles, electronics, aircraft, tanks, armaments, and ship-related technologies, among others. Vajpayee firmly believed that indigenous development of science and technology and the defence sector would help the country overcome challenges of technology denials and control regimes enforced by the developed world.

Today, India, under PM Narendra Modi, has given a new salience to *atmanirbharta* in defence manufacturing, critical technologies as well as supply chains. India is endeavouring to build domestic capacities as well as to forge cooperation with trusted partners. For e.g., PM Narendra Modi spoke of a national mission to build an indigenous fighter aircraft engine on the occasion of the 79th Independence Day. Operation Sindoor highlighted the success of indigenously manufactured weapons and platforms in a network-centric war.

Vajpayee also decisively directed the Kargil War under a nuclear overhang. He unleashed the full might of the Indian armed forces on the intruding Pakistani forces in Kargil in 1999, even though both countries were declared nuclear weapon states by then. PM Modi too decisively used the Indian armed forces to carry out cross-border strikes in 2016, 2019 and more recently during Operation Sindoor after the Pahalgam terrorist attack, despite Pakistan's bluff about its nuclear weapons. The key difference is that India's approach has evolved since the Vajpayee era and is even more forceful today. From conducting cross-border surgical strikes by Special Forces in 2016 after the terrorist attack on an army camp in Uri to using the Indian Air Force to bomb a terrorist target in Balakot deep inside Pakistan after the terrorist strike on a paramilitary convoy in Pulwama in 2019, India's military doctrine has now set a new benchmark.

Vajpayee was clear that the Indian military would not cross the LoC in Kargil. On the other hand, India today has clearly demonstrated that it will carry out punitive missions against terrorist infrastructure well inside Pakistan. In fact, the 'New Normal' since Operation Sindoor is that a terrorist attack carried out from Pakistani soil would invite a robust military response against terrorists as well as their supporters in Pakistan.

At the same time, PM Modi, like Vajpayee before him, has also exhibited a capacity for pragmatism and realism in his foreign policy. A desire for regional peace and stability and a strong belief in *Sabka Saath, Sabka Vikas, Sabka Vishwas, Sabka Prayas* for the region have guided his approach. PM Modi reached out to Pakistan soon after taking office in 2014. In fact, he invited then Prime Minister Nawaz Sharif to his oath-taking ceremony along with other South Asian leaders. In December 2015, like Vajpayee before him in 1999, Modi visited Lahore to promote peace. Like Vajpayee, he too was let down by Pakistan.



Prime Minister Atal Bihari Vajpayee with the Indian Armed Forces in Kargil in 1999

Atal Bihari Vajpayee's strong commitment to sovereignty and territorial integrity is also reflected today in decisions taken by the NDA-2 government. In fact, the Modi government has gone a step further in actually fulfilling the nation's long-standing commitment to India's sovereignty and territorial integrity by revoking Article 370 of the Indian Constitution in 2019. This has enabled Kashmir to become part of the mainstream of national progress. Moreover, PM Modi's government has shown firm commitment to the recovery of Indian territory that is still under adverse possession. ❑

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International Day of Persons with Disabilities
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Rajiv Vijayakar



Ravindra Jain: Maestro who saw Music

Ravindra Jain was a rare audiovisual phenomenon: a top-tier lyricist, composer, and singer for both movies and television.

He had been blind almost since birth, yet he composed powerful cinematic imagery that transcended sight, supported by filmmakers as astute as Raj Kapoor and Ramanand Sagar. His lyrics, born out of sheer emotions, enrapture the core of one's heart, and the words and music synergise often to generate gooseflesh in the listener and a film viewer: all seemingly incredible for a visually challenged individual.

A *Padma Shri*, Ravindra Jain was a rare audiovisual phenomenon: a top-tier lyricist, composer, and singer for both movies and television. And while one can understand that music composition is spontaneous and also boosted by the foundation of classical music training, Jain achieved the impossible in three more ways: his meaningfully perfect lyrics for diverse situations, his work as a lyricist for other composers, and his background scores, which, by definition, need a study of a scene in great detail.

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The author is a veteran film journalist and has served as an eminent jurist of the National Film Awards. Email: rajivvijaykar@gmail.com

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The Miracle Visionary

His foremost supporter, the late Rajkumar Barjatya (father to whiz-kid filmmaker Sooraj R Barjatya), has categorically said that Jain was an even better lyricist than composer! And reflecting on his lyrics, one could not help but agree with Barjatya.

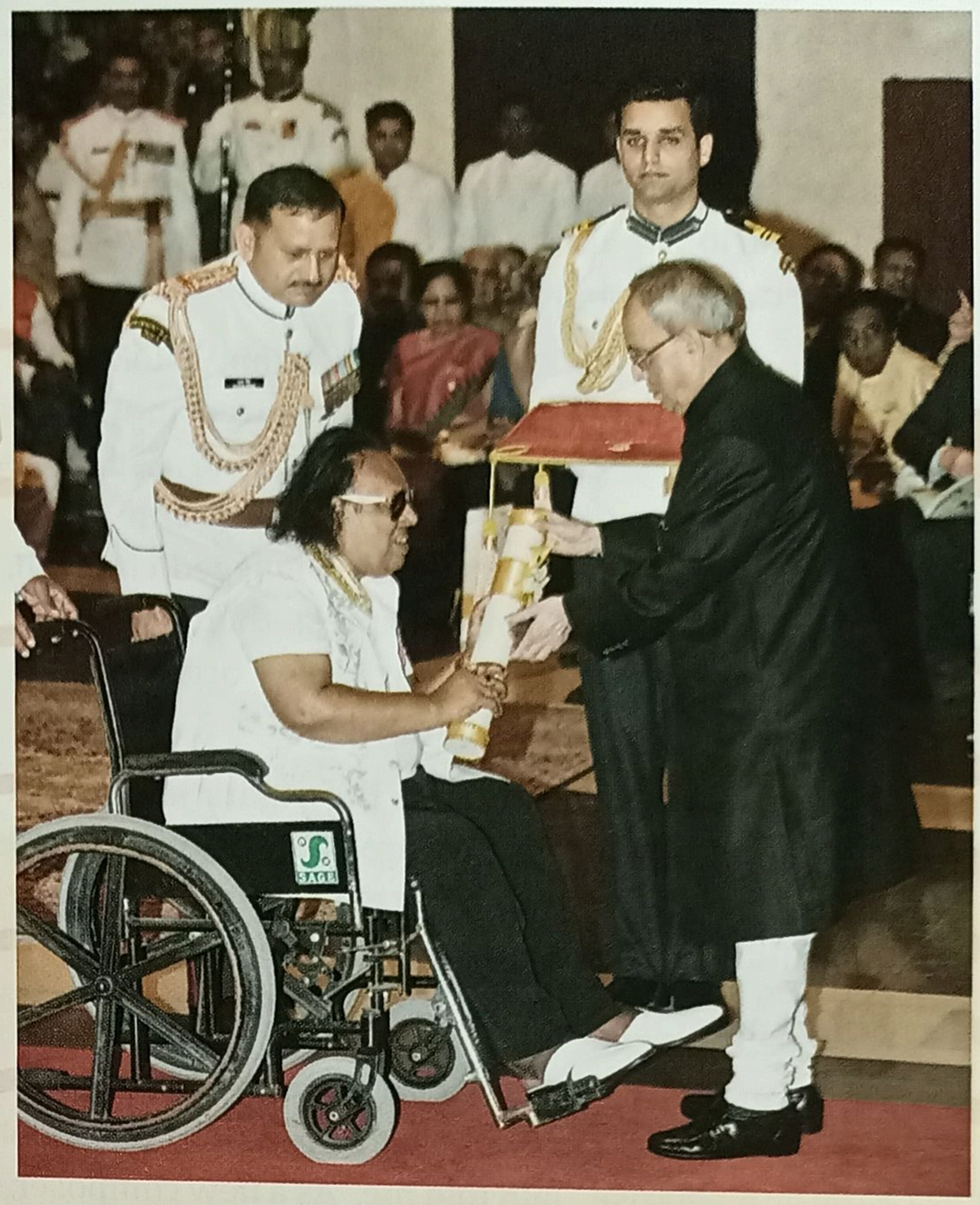
Listen carefully to *"Ankhiyon Ke Jharonkhon Se"* (a 1978 title-track), *"Le To Aaye Ho Hamein Sapnon Ke Gaon Mein"* (*Dulhan Wohi Jo Piya Man Bhaaye, 1977*), *"Main Hi Main Hoon"* (*Ram Teri Ganga Maili, 1985*), *"Main Hoon Khushrang Henna"* (*Henna, 1991*) or even *"Ek Daal Pe Tota Bole"* (*Chor Machaye Shor, 1974*) and we see a composer who has mentally 'witnessed' and observed the splendours of nature probably better than one with conventional sight!

Incidentally, Barjatya was part of Rajshri Productions, for whom Jain did a record 18 films in four decades, with just one film, *Tapasya*, having lyrics by its director Anil Ganguly's preferred writer, M G Hashmat.

Jain did an overwhelming majority of his work as composer with his own lyrics. He once said that this was the "only way out, as established lyricists were not keen to work with me". Looking back, this was just as well, for film music would have been robbed of some of the finest poetry and situational verse we have heard since his pensive *"Nazar Aati Nahin Manzil"* (in his debut film, *Kaanch Aur Heera*) in 1972. Nevertheless, Naqsh Lyallpuri, Anand Bakshi, Sahir Ludhianvi, Hasrat Jaipuri and some others did write for Jain.

As a lyricist, Jain effortlessly also brought in subtle erotica (note the lines *Rut Yeh Suhani Hai / Ke Sardi Se Dar Kaisa / Sang Garam Jawani Hai* in the *Ram Teri Ganga Maili (1985)* hit song, *"Husn Pahadon Ka"*) in his own classy manner, and wrote every possible genre of song. A masterpiece, as strongly visual as always, was *"Der Na Ho Jaaye"* (*Henna, 1991*) in which the obstacles the hero was facing in reaching the venue on time were eloquently described. The lyrics were as layered as the composition (*Mar Gaye Hum Khuli Rahi Aankhen/ Yeh Tere Intezar Ki Hadd Thi*), which was also a part-*qawwali*.

But what was truly remarkable was the way Jain wrote for fellow composers (and rarely even sang, like a duet with composer Ravi for a small film composed by Usha Khanna)! Jain's best-known lyrics here are *"Gaddi Jaandiye"* for Usha Khanna's *Dada* (1979) and the two songs he penned for N N Sippy's 1976 film *Kalicharan* (his *Chor Machaye Shor* and *Fakira* producer), *"Dekh Mouqa Jaaye Na Nikal"* and *"Yeh Log Bhala Kya Pehchane"* with music by Kalyanji-Anandji. He also wrote the full album (seven lyrics) for Anu Malik in Mehmood's swan song, *"Dushman Duniyaa Kaa"* (1996), and worked with Dilip Sen-Sameer Sen, Biddu and Aadesh Shrivastava.



The President, Pranab Mukherjee presenting the Padma Shri Award to the Ravindra Jain, at a Civil Investiture Ceremony, at Rashtrapati Bhavan, in New Delhi on 8 April 2015

When we met, I remember asking how he managed to score background music as well for almost 150 films and serials that he has done, and his explanation was simple and concise: "If the timing is given, background music can be easily done."

Non-Film Works

Jain has done multiple TV serials in his long career of 43 years, like *Ramayana* (1987-1988), *Alif Laila* (1993–1997 (first season on DD National), and 2001–2002 (second season on DD National and SAB TV)), *Shri Krishna* (1993–1999), *Jai Ganga Maiya* (2003), *Jai Mahalaxmi* (2000), *Shree Brahma Vishnu Mahesh* (2000-2002), *Sai Baba* (2005-2009), *Jai Maa Durga* (2007-2009), *Jai Hanuman* (1997). He also composed albums in Hindi, Bengali and Malayalam. In a rare case, he acted in the 1988 movie, *Chintamani Surdas*.

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Author of several books of poetry and prose exploring themes of love, nature and spirituality, he translated ancient scriptures and philosophical texts into accessible language and contributed articles and essays to various publications, sharing his insights on music, literature and Indian culture.

In the socio-philanthropic arena, Jain established a foundation to support visually impaired musicians and artists and also provided them financial assistance and work opportunities. He would organise free music workshops and concerts for underprivileged children, providing them a platform to express their creativity, and donated money to charitable organisations working for the disabled and the needy.

He has thus advocated for the rights and social inclusivity of visually impaired individuals and supported campaigns promoting education and literacy among children, particularly in rural areas.

His Fundamentals

"My name is associated with an easily identifiable style of melody and my filmmakers are aware that I do not copy or plagiarise," Jain told me. "As a new composer, unless the setup was big, I would have lost films had I not opted for new singing talents like Aarti Mukherjee, Jaspal Singh and Suresh Wadkar. The strength of any song lies primarily in its words and composition, and I gave hits with them as well as with Yesudas and Hemlata."

Another remark of his was about whether he felt the tune was more important or the words. "It is the situation that inspires you!" he replied. "The music first strikes a chord, but instrumental music does not sell in India. This proves that words are necessary to appeal to the emotions. But I prefer the tune first for a fast dance number and the words before for a weightier situation."

Unveiling the secret of his lyrical genius, he said, "I have always tried to count my blessings and not focus on my minus points. Being blind, I have been able to concentrate better and get involved in my work better. Imagination has nothing to do with physical vision. Ultimately, all senses reach the mind and brain. I have never thought of lack of vision as an obstacle. Because *"Tan Ke Hisse Mein Sirf Do Aankhen Hain / Man Ki Aankhen Hazaar Hoti Hain / Tan Ki Aankhen So Bhi Jaati Hain / Man Ki Aankhen Kabhi Nahi Soti Hain."*

He went on, "I took the '*Sangeet Prabhakar*' degree from the *Prayag Sangeet Samiti*. My unquenchable thirst for knowledge and literature saw my elder brother recite entire books of poetry to me as well. I attended recordings and music concerts and can describe the orchestration I need for any song. Every song has its own needs and instruments, and come films or serials, where only the size of the screens are different, I work on them."

The Man Behind the Genius

Ravindra Jain, the third of seven brothers and one sister, was born on 28 February 1944 to Sanskrit *Pandit* and *Ayurvedacharya*, Indramani Jain and Kiran Jain in Aligarh. His eyes were tightly closed at birth and had to be operated upon to open them. But they were very weak and would not take the strain of reading for studies.

Jain's formal education therefore ended after Standard five. But his eagerness to learn saw the young lad absorbing everything narrated to him. His flair for writing songs began in school and he would make his own tunes and words when playing *Antakshari* with friends. He later learnt music from Ghamandilal Jain, Janardan Sharma and Nathuram Sharma. At a young age, he started singing *bhajans* in temples.

Jain then went to Kolkata and stayed with a Bengali family, where he also fell in love with *Rabindra Sangeet*, taught music in schools, gave music tuitions, sang and wrote for radio and even recorded his first song in Bengali with Aarti Mukherjee.

It was N N Sippy who gave Jain a break with a film *Silsila Hai Pyar Ka* (1999), for which he recorded a song, "*Maana Ki Tere Honth Mera Jaam Nahin Hai*" with Mohammed Rafi before it was shelved. His debut film was *Kaanch Aur Heera* (1972), and his first tryst with fame was with the Nutan-Amitabh Bachchan film that marked his entry into Rajshri Productions—*Saudagar* (1973). The film had memorable songs like Lata Mangeshkar's "*Tera Mera Saath Rahe*", Kishore Kumar's "*Har Haseen Cheez Ka Main*" and Asha Bhosle's brilliantly worded "*Sajnaa Hai Mujhe Sajna Ke Liye*". But fame finally came with *Chor Machaye Shor* (1974) and its hit soundtrack.

Jain was married to Divya, who first fell in love with his work and then with the person he was. They wed in 1982 after she declared that she would either marry him or stay single. Their son, Ayushman, is a content creator.

Jain passed away on 9 October 2015, months after receiving his highest of many honours—the *Padma Shri*. And his rich legacy shows what a great visionary he was. ❑

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M Ganesh Pillai



NISAR: Science from Orbit, Impact on Earth

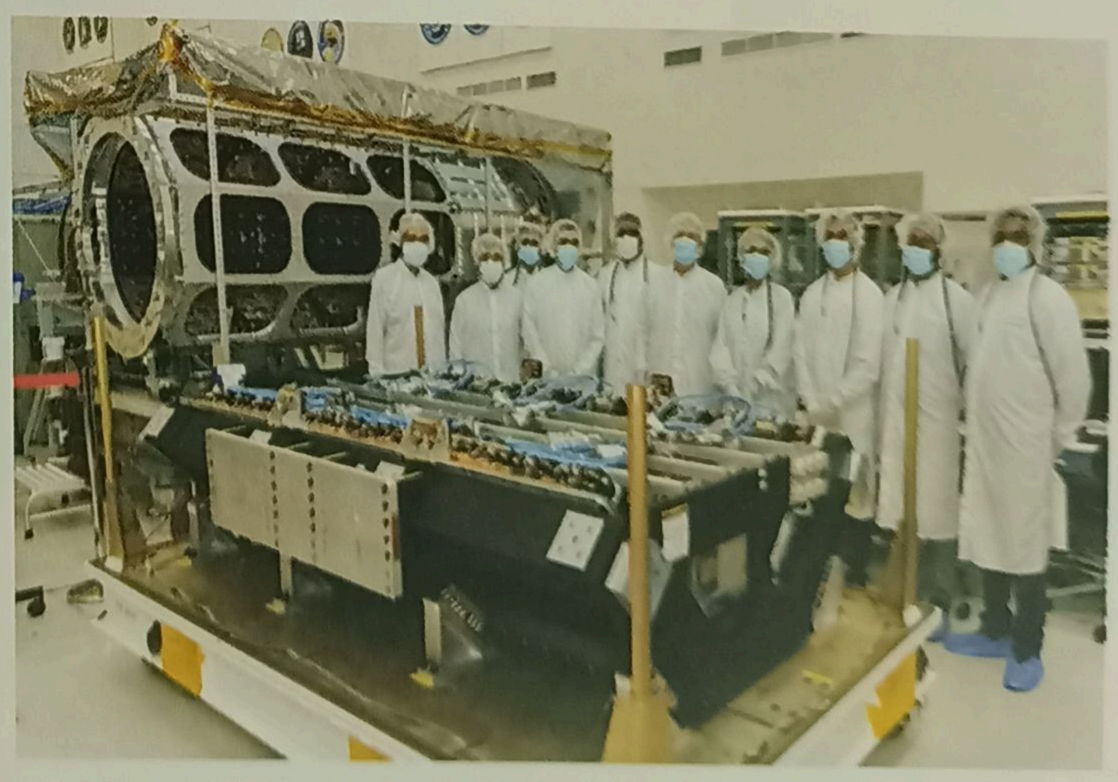
NISAR has capability to map the entire globe in 12 days and provide spatially and temporally consistent data for understanding changes in Earth's ecosystems, ice mass, vegetation biomass, sea level rise, groundwater and aid in the study of natural hazards like earthquakes, tsunamis, volcanoes and landslides. The project has been a testimony to the great partnership between ISRO and NASA which has fructified into the NISAR mission.

NASA-ISRO SAR (NISAR) is a Low Earth Orbit (LEO) observatory launched into a Sun Synchronous Polar Orbit (SSPO) at an altitude of 747 km. NISAR has capability to map the entire globe in 12 days and provide spatially and temporally consistent data for understanding changes in Earth's ecosystems, ice mass, vegetation biomass, sea level rise, groundwater and aid in the study of natural hazards like earthquakes, tsunamis, volcanoes and landslides.

The all-weather, day-night imaging satellite carries L and S dual-band Synthetic Aperture Radar (SAR), which operates with the Sweep SAR technique to achieve a large area on ground (swath) and with high-resolution data. The SAR payloads mounted on the Integrated Radar Instrument Structure (IRIS) and the spacecraft bus are together called an observatory. The NISAR spacecraft is configured using ISRO's I3K bus utilising the capabilities to the fullest with respect to accommodation, power generation, thermal management, etc.

NISAR Science — Over India

India has varied topographical features comprising the Himalayan mountains, plains, plateau, desert, coasts and islands. During the monsoon season heavy rain, cyclones and storms make the Indian landmass very vulnerable to disasters like floods, landslides, glacier dam breaches, etc. Being a tropical country, India is naturally covered with clouds, which limits the use of optical imagers. NISAR carries all-weather, day-night imaging-capable dual-band SAR, which not only aids in overcoming the above-said limitations but also provides significant support to the disaster management systems. The L-band acquisition is



Members of the integration and test team, from NASA's Jet Propulsion Laboratory and the Indian Space Research Organisation, with NISAR's S-synthetic aperture radar instrument at JPL

The author is the Scientific Secretary, ISRO. Email: scisec@isro.gov.in

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NISAR being launched aboard ISRO's GSLV at SDSC, Sriharikota

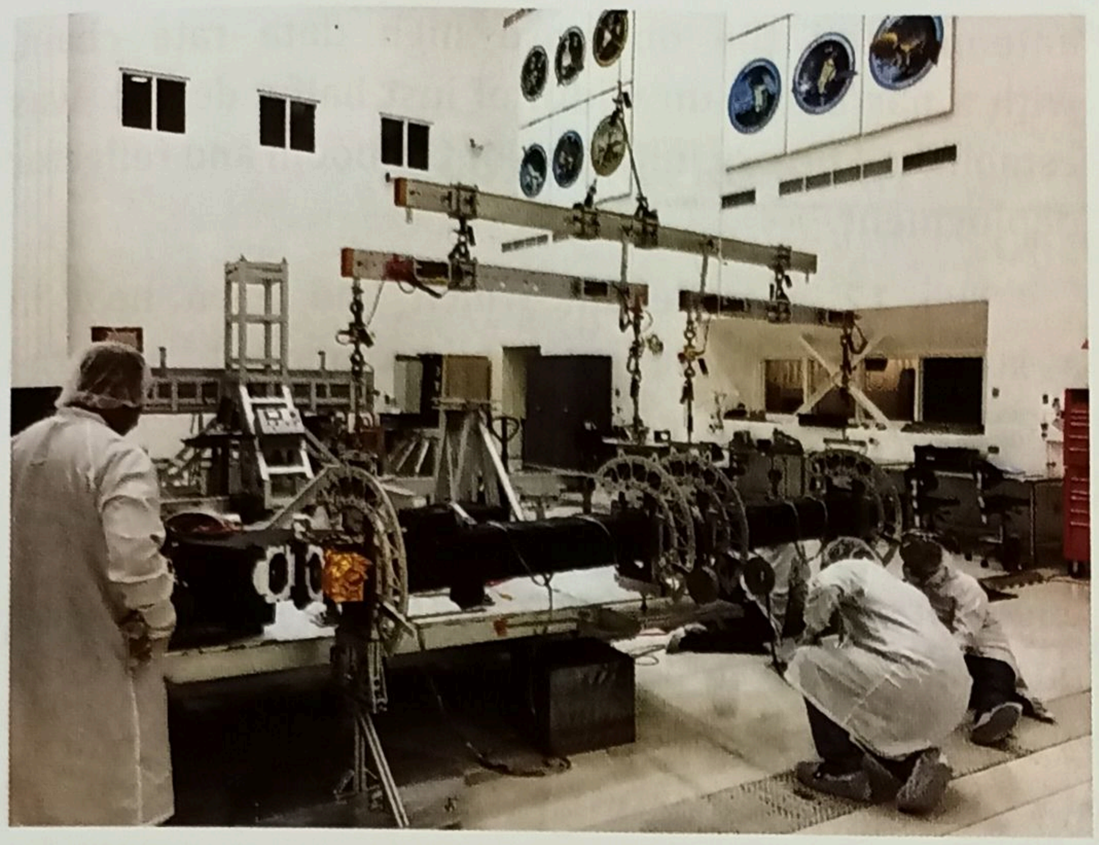
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planned over the entire global landmass, including most of the ice-covered regions and coastal seas while S-band is planned jointly with L-band over the Indian subcontinent, Antarctica. While both NASA and ISRO have overlapping science objectives, ISRO's science products would be generated over Indian and Antarctic regions using L&S joint mode data. A few key measurement capabilities are listed below:

- Time-varying displacements over Himalayan and Antarctic cryosphere regions at 12 days interval at a scale of 100 metres,
- Measure the glacier faces and wet snow cover in the Himalayan region at 12-day intervals, and sea ice drift near Indian Antarctic stations at 3 days or better,
- Above-ground woody biomass of forests and its disturbance over the Indian region at the hectare scale,
- Actively growing cropland and inundated areas over India,
- Soil moisture at 100 m resolution over Indian regions,
- In support of response to major natural or anthropogenic disasters, the mission system is capable of providing revised scheduling for new acquisitions within 24 hours of an event or an event forecast notification and delivering data within 5 hours of being collected,
- Mangrove cover map of India every year at a spatial resolution of 25 m,
- Sea ice characteristics over the seas surrounding India's Antarctic polar stations at 500 m resolution at an average sampling interval of 6 days.

Making of NISAR: The Joint Collaboration

The NISAR observatory has three major components: The satellite bus system developed by UR Rao Satellite Centre, the boom-reflector system developed by Jet propulsion Laboratory (JPL) and The Integrated Radar Instrument jointly



Engineers and technicians inspecting NISAR's upper antenna boom assembly after deployment checks at NASA's Jet Propulsion Laboratory

developed by JPL and Space Application Centre (SAC) Ahmedabad. The decadal journey of NISAR development has been very enriching for both the organisations in understanding different processes, design & planning aspects, and qualification philosophies. The common goal enabled the teams to adapt, understand and work with each other, capitalising on individual strengths and expertise. NISAR Integration and Test was carried out in four stages, and the major activities at each stage are given below:

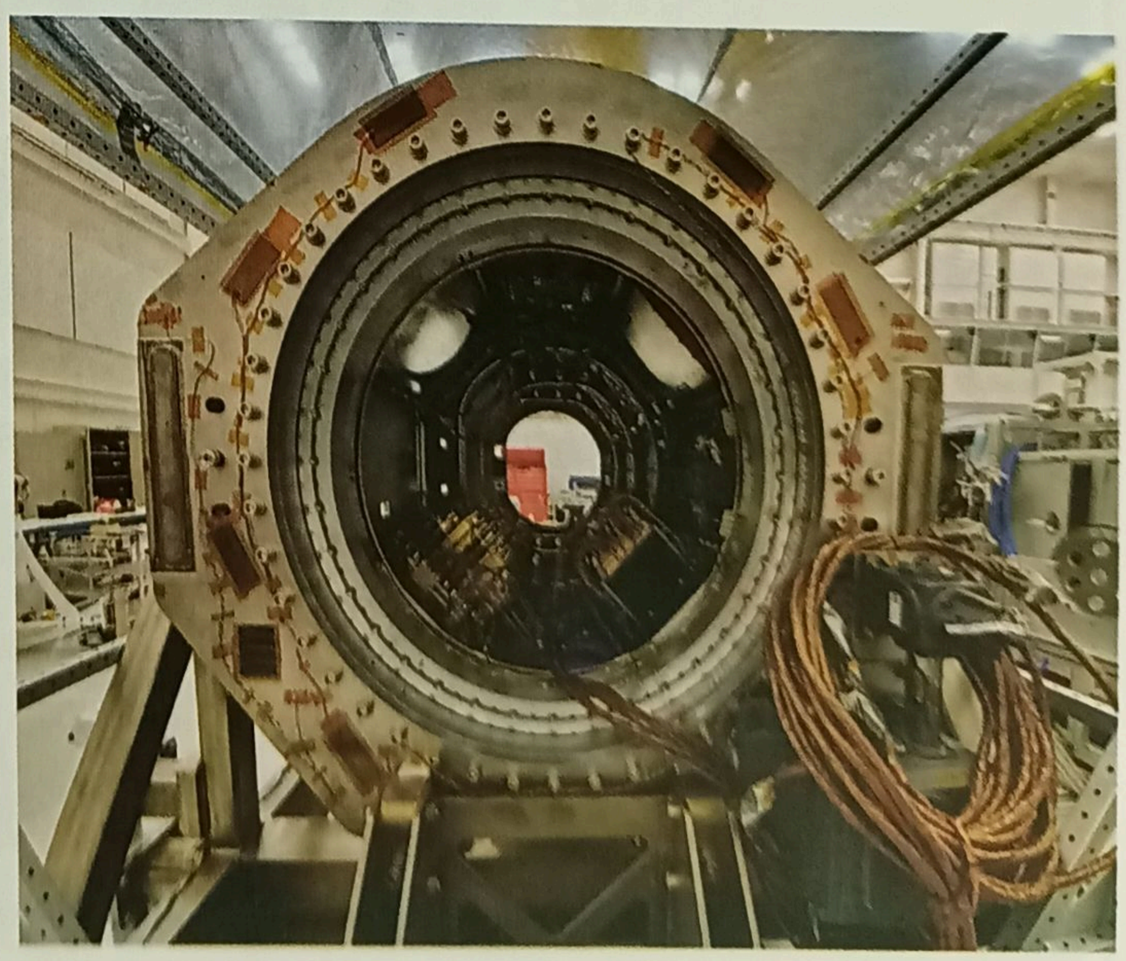
- Stage-1, when the L-SAR, S-SAR, and other deliverables were designed, integrated and tested in their respective countries.
- During Stage-2 the two radars, the L-band Synthetic Aperture RADAR (L-SAR) and the S-band Synthetic Aperture RADAR (S-SAR) by ISRO, were mechanically and electrically integrated, and the two systems were tested together for joint operations at JPL.
- The third stage provided confidence in the system performance as an Integrated Radar Instrument System (IRIS) during which the Payload Chain Systems (Radar, Data Handling, Recorder, Boom, Reflector, Data Downlink) were evaluated in the space environment.
- During Stage-4 the IRIS was integrated with the spacecraft bus. The deployable 12 m reflector, solar panels and the data downlink antenna were finally assembled, preparing NISAR for launch tests.

The Technology Development

NISAR carries many advanced technologies onboard. The first and foremost being the dual-band SAR instruments, which feeds data to numerous applications in the areas of ecosystems, cryosphere & solid Earth. The Sweep SAR technique is globally first flown in NISAR and enables getting almost 240 km data captured with high resolution. This was impossible without the deployable boom and the high-gain reflector of 12 m diameter. The multistage boom accommodation wound around the spacecraft was a challenge which otherwise would have required a bigger launch vehicle.

Both the RADARs put together generate several terabits of data which is possible to be downloaded to the ground stations only because of the high data rate downlink system incorporated in NISAR. The spacecraft and the payload systems, being independent systems developed by different agencies, are implemented with fault detection, isolation and recovery logics. The electromagnetic interference was one of the biggest challenges resolved in NISAR due to the simultaneous operations of all the radiating systems.

The integration and checkout activities were carried out in several phases to make sure all the interfaces are thoroughly checked and the interactions are as expected. The operation procedures were shared, discussed, and debated and a common understanding was brought to carry out the mission operations seamlessly. The micrometeoroid and orbital debris shield was implemented for the first time in NISAR to protect the fuel tank from any impacts. The shield was indigenously designed, built, tested and implemented in NISAR.



Internal view of NISAR's integrated L-SAR and S-SAR instruments at NASA's Jet Propulsion Laboratory

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The most challenging part of the mission was the time difference when the teams had to work extended hours attending to their organisation needs during the day and discussing with the partnering team during the nights. The project has been a testimony to the great partnership between ISRO and NASA which has fructified into the NISAR mission.

NISAR in Orbit

NISAR was launched into the designated orbit by GSLV Mark-11 (F16) on 30 July 2025. The spacecraft had carried fuel to correct its orbit, maintain it (altitude: 727 and 767 km, 6 PM descending node, mean local time +/- 5 minutes), safeguard itself from threats and also enough to de-orbit once its life is completed. However, the initial orbit given by the launch was well within the error bounds such that NISAR life extends by several more years.

Subsequent to injection of the satellite, the solar panels were deployed successfully, and within a few minutes, the satellite attained its intended orientation towards Earth. The performance of all systems onboard the NISAR spacecraft bus was evaluated for the next few days, ensuring its readiness to support the operations ahead. The link between the ground antenna and the on-board high data rate chain, with a narrow beam width of just half a degree, was established before initiation of the boom and reflector deployment.

The 12 m reflector, which had been held in a stowed condition, was fully deployed, and the events were captured by the on-board camera. And even with the limited lighting, deployment could be visually appreciated. The tireless work of hundreds of engineers and technicians took the final shape, gently pushing the milestone further towards radar imaging.

The S-SAR and L-SAR saw their first light in orbit on 21st and 22nd of August respectively. The SAR images, commonly called pepper & salt images, are not visually appreciable, but the satisfaction on the faces of the engineers who processed the data showed that the quality of the images was as expected. Subsequently, NISAR fired its thrusters to achieve the final science orbit and began the calibration of the RADARs. NISAR during its science phase will generate almost 80Tb, which will be downloaded on ground stations of both ISRO and NASA. L-SAR data is downloaded on NASA stations and S-SAR data on ISRO stations. ❑

(Photos Courtesy : ISRO/NASA)

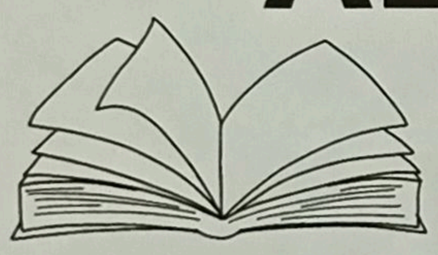
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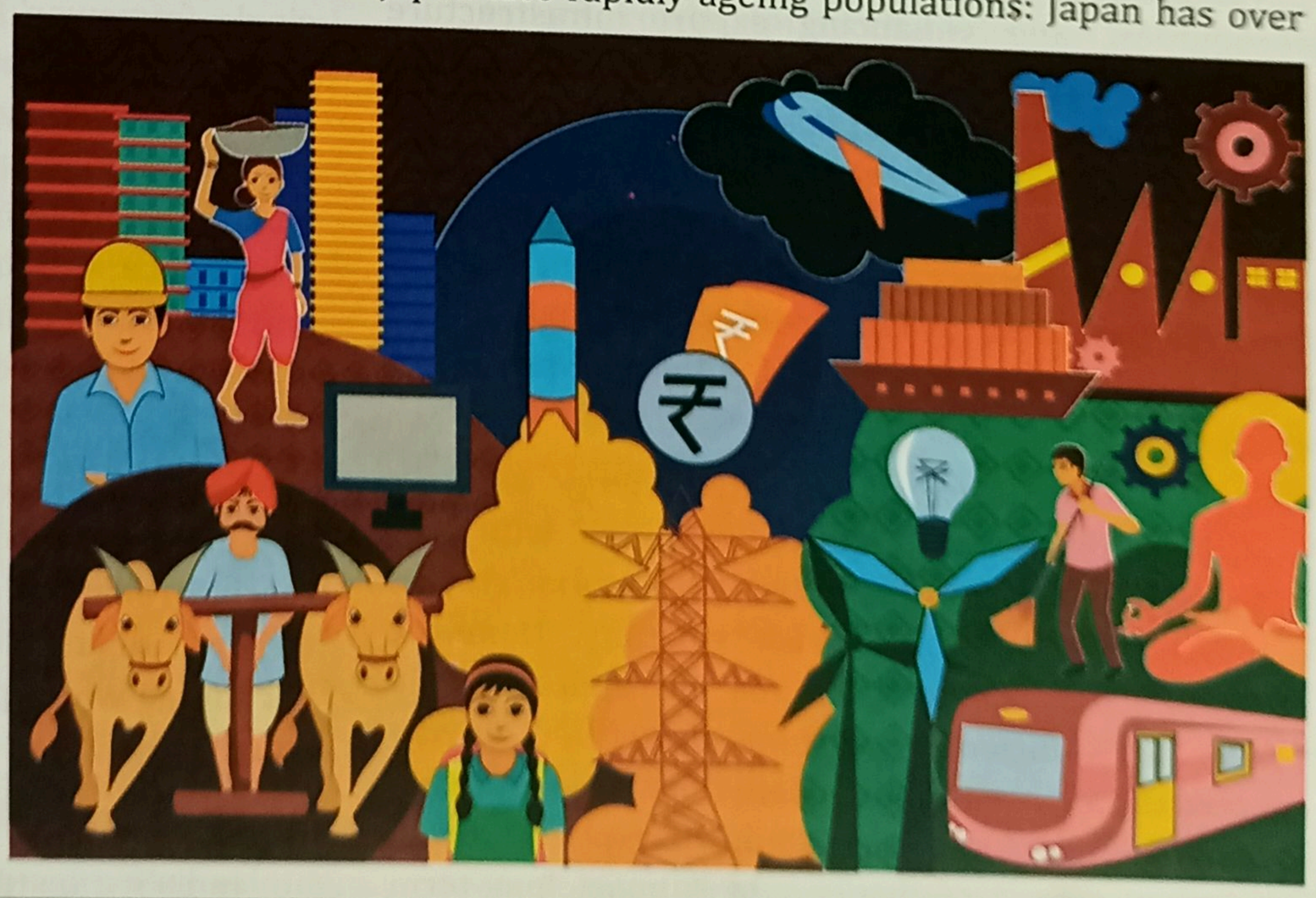
Rising GDP: Charting India's Growth Story

Private consumption, constituting nearly 60% of India's GDP, remains the cornerstone of economic momentum, powered by rising disposable incomes, digital adoption, and an aspirational middle class. Manufacturing contributes about 17% to GDP with aspirations to reach 25% by 2030.

India is experiencing robust economic growth, with GDP expanding at 6.5% in FY 2024–25 and accelerating to 7.8% in Q1 of FY 2025–26, establishing it as the world's fastest-growing major economy. This momentum is supported by strategic reforms, demographic vitality, and policy initiatives that have created a distinctive growth ecosystem. The government's vision of *Viksit Bharat*@2047 aims to advance the nation through pillars of economic prosperity, inclusive growth, social advancement, environmental sustainability, and strong governance, reflecting India's aspirations for continued development.

Domestic Consumption and Demographic Dividend: Fuelling Growth

India's growth is propelled by dual engines: private consumption and its youthful demographic profile. Private consumption, constituting nearly 60% of India's GDP, remains the cornerstone of economic momentum, powered by rising disposable incomes, digital adoption, and an aspirational middle-class. The digital revolution has deepened this transition through platforms like UPI and e-commerce, bringing modern retail to tier-2 and tier-3 cities and broadening access and inclusion. GST collections during festive seasons consistently exceed expectations, underlining resilient domestic demand. Complementing this consumption wave, India's demographic advantage is unmatched among major economies: over 65% of the population is under 35 with a median age of 28, and the working-age population is projected to touch 1 billion by 2047. Female labour participation has risen sharply from 19.7% in 2011 to 37% in 2023, signalling a more inclusive workforce. Initiatives like *Pradhan Mantri Kaushal Vikas Yojana* are enhancing employability, ensuring that India's youth power translates into productivity. The startup boom exemplifies this energy, with India ranking third globally in innovation with 1.9 lakh recognised startups. In contrast, China and Japan face rapidly ageing populations: Japan has over



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29% above 65, while China's elderly share approaches 30% by 2050. Both countries are experiencing working-age population shrinkage with higher dependency ratios. India's challenge is to harness its demographic dividend through sustained investments in health, education, and job creation, while strengthening social safety nets for inclusive development.

Exports: Gateway to Global Markets

Growth in India's exports reflects growing competitiveness in global markets. Services exports led the surge, growing at a rate of 13.6%, while merchandise exports excluding petroleum products touched $374.1 billion. Electronic goods exports have surged in recent years, driven by the Make in India initiative and Production-Linked Incentive (PLI) schemes, with mobile phones emerging as a major contributor to this growth. Pharmaceuticals and engineering goods continue to perform strongly, strengthening India's role in global value chains. Diversifying destinations, from the US and Japan to the UAE and France, has reduced market dependence and increased resilience.

However, India's export growth faces challenges like infrastructure bottlenecks, deeper market penetration and market diversification. High financial costs, technology and quality gaps, and skill gaps further constrain competitiveness. Sustaining and accelerating export growth will require continuous innovation, quality upgrades, and stronger supply chain integration. Investing in research and development, building stronger international brand recognition, and enhancing export infrastructure can further enhance competitiveness. Exploring new geographic markets and deepening partnerships in emerging and developed economies present significant opportunities for expansion. Unlike other developing countries, India has not been able to increase her share of labour-intensive goods in the world market. This is a must for the perspective of employment creation.

A key consideration remains energy security. India's dependence on imported crude oil, with over 88% of requirements met through imports, creates vulnerabilities to global price volatility. Domestic oil production remains limited at approximately 11.6% self-sufficiency. Pursuing diversified energy sources through renewable energy expansion, biofuel development, and improved domestic exploration can strengthen energy resilience and support long-term export competitiveness and industrial growth.

Manufacturing and Industrial Reforms

Manufacturing contributes about 17% to GDP with aspirations to reach 25% by 2030. Supported by the Make in India initiative and PLI schemes, the sector has demonstrated positive momentum. Electronics manufacturing has expanded considerably over the past decade, making India a competitive production hub. Foreign Direct Investment in manufacturing has also shown growth. Industrial corridors, semiconductor parks, and textile clusters are expanding regional opportunities and building supply-chain capabilities.

However, India's manufacturing sector faces challenges like inadequate infrastructure, high energy costs, and complex regulatory procedures that deter investment. Limited access to affordable finance, shortages of skilled labour, and slow technology adoption hinder productivity and innovation. To further strengthen the manufacturing ecosystem, there is considerable scope for enhancing skill development programmes tailored to sector-specific needs, improving infrastructure connectivity to industrial hubs, and fostering deeper linkages between large industries and MSMEs. Facilitating technology transfer and promoting green manufacturing practices can ensure growth is both robust and environmentally sustainable, positioning India competitively for the future.

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GST and the Formalisation of the Economy

The Goods and Services Tax (GST) has simplified India's tax system by unifying multiple levies into a single framework, and creating a seamless national market. It has improved tax transparency, boosted logistics efficiency, enhanced ease of doing business, and encouraged greater formalisation of the economy, while strengthening revenue collection through better compliance. Measures like AI-based audits, e-invoicing, and return reconciliation have supported revenue stability and improved compliance.

Looking ahead, further rate rationalisation, expanded coverage of sectors, and continued technology upgradation can enhance the system's effectiveness and reach. Strengthening taxpayer education and providing targeted digital support for smaller businesses can encourage wider participation in the formal economy and deepen tax-to-GDP improvements.

Reform Agenda: Finance, Labour, and Investment

India's institutional framework is further strengthened by reform momentum, including raising

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FDI limits in insurance and strengthening risk-based regulation for market development and depth, labour reforms through four comprehensive codes to balance worker protection with enterprise flexibility, etc.

Refining these frameworks through stakeholder feedback, addressing remaining sectoral gaps, and ensuring smooth implementation across states can enhance policy effectiveness. Capacity building for financial regulators, labour boards, and investment facilitation agencies can support more effective policy execution and investor experience.

Infrastructure and Public Investment Momentum

Infrastructure plays a significant role in India's growth trajectory. The National Infrastructure Pipeline encompasses over 13,000 projects worth Rs 185 lakh crore across 33 sectors. Public investment in capital expenditure has increased substantially, reaching nearly Rs 11 lakh crore in FY 2024–25. Projects under *GatiShakti* and *Bharatmala* are advancing connectivity, while Dedicated Freight Corridors and *BharatNet* are enhancing logistics and digital reach. Renewable energy capacity expansion and smart cities initiatives reflect long-term strategic focus. The National Monetisation Pipeline has generated substantial revenue by unlocking value from brownfield assets.

Moving forward, accelerating project execution timelines, improving quality assurance mechanisms, and ensuring regular maintenance of completed infrastructure can maximise returns on public investment. Strengthening last-mile connectivity in rural and remote areas and enhancing intermodal transportation links can ensure infrastructure benefits reach all regions equitably.

FDI: Beyond Capital to Knowledge Transfer

FDI inflows have also increased over the past decade, driven by economic reforms, market potential, and policy liberalisation. Sectors such as services, manufacturing, IT, telecommunications, and renewable energy have attracted significant investment. Beyond financing, FDI has contributed to technological and managerial capabilities in various sectors. Collaborations in manufacturing, pharmaceuticals, and digital services have supported productivity gains. India maintains a liberalised FDI regime with 100% FDI permitted under the automatic route in many strategic sectors, including manufacturing, telecom, infrastructure, railways, agricultural activities, mining, non-banking financial companies, e-commerce, and renewable energy. Enhanced FDI provisions in the space sector reflect openness to emerging sectors.

However, complex regulatory procedures, bureaucratic hurdles and delays in land acquisition often deter investors. To deepen technology transfer and knowledge spillovers, there is potential to strengthen linkages between foreign and domestic firms, encourage joint research initiatives, and develop sector-specific technology partnerships. Facilitating R&D collaborations and supporting Indian firms in adopting advanced technologies can amplify FDI benefits.

Green Growth and Sustainability

There is increased emphasis on integrating sustainability into India's development approach. India's *Panchamrit* commitments include 500 GW of non-fossil energy capacity by 2030 and net-zero emissions by 2070. India has expanded renewable energy capacity and is building capabilities in solar manufacturing and green hydrogen innovation. The Perform, Achieve and Trade (PAT) scheme sets energy efficiency targets for designated consumers in energy-intensive industries, with 1,333 units across 13 sectors covered to date, contributing to measurable energy savings and emissions reductions. Schemes like subsidies for rooftop solar installation, concessional financing for efficient appliances, and energy labelling initiatives further support the cause.

The Road Ahead: Sustaining Inclusive Growth

India's growth story is characterised by expanding consumption, demographic advantage, infrastructure push by the government, and digital transformation. Sustaining this trajectory requires deepening human capital through quality education and healthcare, building resilient and inclusive cities, expanding manufacturing capacity, and advancing financial inclusion. Aligning growth with environmental responsibility through renewable energy expansion, climate-resilient infrastructure, and sustainable resource management ensures long-term viability. The path forward involves balancing growth momentum with inclusive development and strengthening foundational institutions. With sustained focus on reform and inclusive growth, India is positioned to achieve its development objectives. ❑

(The co-authors, Raktimava Bose, a consultant and Sanjib Pohit, a Professor, are both affiliated with the National Council of Applied Economic Research, Delhi.)

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