

TECHNOLOGICAL DEVELOPMENT TOWARDS VIKSHIT BHARAT 2047



VIRENDRA KUMAR TEWARI





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**TECHNOLOGICAL
DEVELOPMENT TOWARDS
Vikshit Bharat 2047**

Virendra Kumar Tewari

Former Director,
Indian Institute of Technology, Kharagpur

Odisha Research Centre, Bhubaneswar

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TECHNOLOGICAL DEVELOPMENT TOWARDS VIKSHIT BHARAT 2047



Vikshit Bharat is India's story of transformation, the India we know and the India we want to be. Today, we stand united under the banner of Vikshit Bharat—our determined vision of a developed India. This vision transcends numbers and policies; it is a testament to our collective spirit and our unyielding belief in a brighter tomorrow.

In recent years, India has made remarkable strides towards its goal of becoming a leading global player. Our economic growth is on an upward trajectory, with the GDP reaching approximately \$3.5 trillion and a target set to expand to \$5 trillion by 2025. We have made significant progress in enhancing the ease of doing business, climbing from 142nd place in 2014 to 63rd in 2020, thereby fostering a more dynamic and investor-friendly environment. Our infrastructure is evolving with a \$1.4 trillion investment, building bridges and roads that symbolize our commitment to connecting every corner of our great land. The digital revolution is upon us, with over 700 million internet users and 1.2 billion mobile connections, making us a beacon of connectivity and innovation. In education and healthcare,

we are sowing the seeds of a better future. The Pradhan Mantri Jan Arogya Yojana is a lifeline for over 100 million families, and our educational reforms are set to uplift and empower the minds of tomorrow. Our commitment to sustainability reflects our respect for the planet we call home. With ambitions to derive 50% of our energy from renewables by 2030 and a pledge to achieve net-zero carbon emissions by 2070, we are leading with responsibility and a vision.

Quality Education for all

India's future roadmap aligns with changing trends, emphasizing stronger industry-academic collaboration, understanding and leveraging technology, and riding the wave of disruption that defines the contemporary landscape. Under the flagship of Vikshit Bharat, the New Education Policy (NEP) 2020 has been successfully implemented that democratize education with multidisciplinary academic programmes so that the students can assimilate knowledge from multiple disciplines like Precision Agriculture, Affordable Healthcare, Advanced Manufacturing Systems, Safety Engineering & Analytics, Quality and Reliability, Precision Agriculture & Food Nutrition, Smart Infrastructure and Advanced Transportation that will place India as the **Vishwaguru**.

Digital literacy through a range of transformative initiatives like the **National Scholarship Portal** has supported 1.40 crore students with ₹5,295 crore in scholarships over the past three years. The **Pradhan Mantri Gramin Digital Saksharta Abhiyan**, the world's largest digital literacy program, has already trained 1.96 crore individuals in rural areas, aiming

to reach 6 crore. Digital learning platforms like **NPTEL** and **MOOCs** are expanding access to education, complemented by the rollout of cutting-edge smart classrooms for enhanced learning environments. The **National Education Policy (NEP) 2020** is driving near-universal primary education enrollment and focusing on improving quality and inclusivity. Efforts are underway to boost female participation in STEM fields and attract international students and faculty to Indian IITs. The **Integrated Teacher Education Program (ITEP)** is developing a skilled teacher workforce, while internships and global study opportunities are enhancing practical experience for students. Collectively, these measures are fostering a more inclusive, high-quality education system equipped for future challenges.

Precision Agriculture and Food Nutrition

As the global population is projected to reach 9.8 billion by 2050, food demand will surge, requiring an estimated 14,060 trillion crop calories. The global food demand is expected to increase by 35% to 56% between 2010 and 2050, making long-term food security a critical focus. With shrinking land resources, there is an urgent need to diversify food products beyond traditional farming. To address these challenges, India is pushing for innovative solutions such as digital farming, precision agriculture, and advanced technologies like drones and remote sensing. By integrating data analytics and creating a comprehensive agricultural data platform, the goal is to boost productivity, reduce food waste, and ensure financial resilience among the 130 million smallholder farmers. The government's initiative to establish a 2,500 km natural

farming corridor along the Ganges is set to promote organic farming, aiming to enhance farm productivity by 1520% and reduce dependence on costly edible oil imports.

India's agriculture sector is also seeing significant technological and entrepreneurial advancements. The potential economic value of digital agriculture is estimated at \$50-65 billion by 2025, representing a 23% increase in agricultural produce value. Despite the promise of technologies like AI, IoT, and blockchain, there is a need for practical application and validation among farmers. Initiatives such as the Krishi Machinery Mahotsava, and the promotion of low-cost technology through Agri Business Incubations are driving innovation. The "Innovation and Agri-Entrepreneurship Development" program has supported 173 women entrepreneurs, highlighting the vital role of women in agriculture. The Kisan Bhagidari, Prathamikta Hamari campaign further engages farmers through insurance education and support, fostering collaboration between rural entrepreneurs, farm scientists, and farmers. Embracing these advancements and fostering partnerships will be crucial for advancing India's agricultural sector and ensuring food security.

The Role of MSMEs

Micro, Small, and Medium Enterprises (MSMEs) play a pivotal role in India's economic landscape, contributing significantly to the nation's GDP and employment. Accounting for about 30% of the GDP through employment generation, exports, and lending, MSMEs are integral to the country's industrial

ecosystem. With approximately 63.4 million units spread across India, MSMEs contribute 6.11% to the manufacturing GDP and 24.63% to the GDP from service activities, while generating 33.4% of India's manufacturing output. The sector encompasses an estimated 6.3 crore units employing over 11.10 crore people, with public investment projected at ₹7 lakh crore. This investment is expected to attract Foreign Direct Investment (FDI) and foster modern infrastructure. The digital transformation of MSMEs, coupled with e-commerce, has significantly impacted exports, contributing to 50% of India's export share over the past five years. Platforms like Udyam, e-Shram, NCS, and ASEEM facilitate business registration, job identification, and talent sourcing, acting as crucial digital enablers for small businesses.

Recent advancements in the MSME sector are underscored by several key government initiatives and financial supports. **The PM Vishwakarma Yojana** offers financial aid and skill development for traditional artisans, while the **MSME Sustainable (SS)** and **ZED Certification** programs focus on enhancing quality and sustainability. Financially, the **Emergency Credit Line Guarantee Scheme (ECLGS)** has provided over ₹5 lakh crore to MSMEs impacted by COVID-19, and the **MSME Credit Guarantee Scheme (CGS)** corpus has been increased to ₹50,000 crore. The **Digital MSME Scheme** promotes technology adoption and e-commerce, and new export support measures like the **National Export Insurance Account (NEIA)** and the **MSME Export Promotion Council** are being introduced. Looking ahead, India envisions a transformative 20-year plan to advance sustainable agriculture and modernize agricultural

practices, with MSMEs at the forefront. Technologies such as additive manufacturing, 5G/6G, and AI are expected to enhance the MSME sector, supported by flagship programs like the Advanced ESDP and MDP, which aim to integrate AI into MSME operations.

Promoting Skill Development & Entrepreneurship

India is making extensive progress in skill development and entrepreneurship, driven by a comprehensive strategy to enhance continuous learning and employability. Key initiatives include the introduction of **750 virtual labs** and **75 skilling e-labs** to provide simulated learning environments, alongside the expansion of Industrial Training Institutes nationwide to align with industry demands. The **National Skill Qualification Framework** is being updated to focus on digital skills, supported by the launch of the **DESH-stack e-portal**, which facilitates online training, credentialing, and job placement. The National Education Policy 2020 further underscores a multidisciplinary approach to technical studies, promoting inclusivity through resources like the **National Digital Library** and **Digital University**.

Government programs such as the Innovation and **Agri-Entrepreneurship** Development under **Rashtriya Krishi Vikas Yojana** and the **Skill India Mission** aim to bolster innovation and support agri-tech startups, with a projected economic value of \$50-65 billion by 2025. The **Startup India Scheme** has recognized over 80,000 startups, while the Stand-Up India Scheme has allocated over ₹20,000 crore to SC/ST and women

entrepreneurs. Focused efforts on reskilling and upskilling, alongside support for rural entrepreneurship and integration of emerging technologies, are set to enhance India's global competitiveness and foster sustainable economic growth.

Implementation of e-governance

India's e-governance landscape is rapidly evolving with notable advancements aimed at improving service delivery and accessibility. The **Unified Mobile Application for New Age Governance (UMANG)** app now consolidates over 1,000 government services, while eSanjeevani has facilitated more than 40 million telemedicine consultations. The **One Nation One Ration Card (ONORC)** scheme supports ration portability for 80 crore beneficiaries. The **National Single Window System (NSWS)** streamlines business approvals, integrating services from 20 ministries, and the e-Courts Project has digitized over 50 million cases with 3,000 courts equipped for video conferencing. The adoption of AI, automation, and enhanced cybersecurity, alongside expanded broadband access, is set to further enhance digital governance.

Additionally, the **Jeevan Pramaan** initiative has simplified pensioner verification with 2.48 crore **Digital Life Certificates** submitted since 2014, while **Digi Locker** provides access to over 349 crore certificates digitally. India recorded approximately 175 billion digital payments in FY 2024, supported by 3.6 lakh **Common Services Centres (CSCs)** offering around 400 services in sectors such as education, health, and agriculture. These CSCs have created employment for nearly 12 lakh people, including 68,000 women, and benefited 14 lakh individuals. The

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Energy for all

India's "**Energy for All**" initiatives have made substantial progress, with the **Saubhagya Scheme** achieving nearly 99.5% household electrification and renewable energy capacity expanding to around 180 GW, making up 30% of the total power capacity. The PAT Scheme and the Standards & Labeling Program are improving energy efficiency, while the FAME India Scheme (Phase II) has established over 5,000 EV charging stations and facilitated the sale of approximately 4 lakh electric vehicles. Looking ahead, India aims to scale up renewable energy capacity to 500 GW by 2030, broaden electric vehicle adoption, and modernize the grid to better integrate renewable sources.

In addition, the electrification of Leisang village in Manipur marked the completion of the **Deen Dayal Upadhyaya Gram Jyoti Yojna**, symbolizing a major milestone in equitable electrification. Despite challenges, the mining sector demonstrated resilience with 80 million tonnes of minerals produced in 2022-2023, valued at ₹7,000 crore. Projected coal demand is expected to rise to 1.5-1.7 billion tonnes by 2030,

driving domestic production of advanced mining equipment and reducing import dependency. India is also focusing on building smart grids, advancing renewable energy technologies, and researching new materials and sustainable energy solutions to meet its future energy needs.

Make for India and Make for the World – Industry & Academia linkages

"Make for India" and "Make for the World" initiatives are fueling remarkable growth in domestic manufacturing and global exports. **The Production-Linked Incentive (PLI)** Scheme has attracted over ₹2 lakh crore in investments, aiming to create 1.5 million jobs, while the **Atmanirbhar Bharat** Initiative is focused on reducing import dependency by boosting local production. For global competitiveness, the RoDTEP scheme has helped India achieve \$350 billion in exports for FY 2024. The National Manufacturing Policy is working on developing new industrial hubs to enhance production capabilities.

In the electronics sector, 268 mobile and component manufacturing units have been established in the past four years, providing jobs to 6.7 lakh people. The government's push to facilitate end-to-end supply chains and e-commerce has improved efficiency and could add \$5 billion to \$10 billion in economic value by 2025. Additionally, a ban on global tenders for government procurement up to Rs 200 crore aims to boost domestic manufacturing. Collaborative initiatives with international universities and the launch of Joint Doctoral Programs are promoting the

internationalization of Indian education. Future efforts will focus on integrating global markets, advancing manufacturing technology, and promoting sustainability to align with international standards.

Blue Economy

India's Blue Economy initiatives are making substantial progress with key government efforts aimed at sustainable ocean resource use. The **National Blue Economy Policy (2021)** focuses on sustainable practices in fisheries, shipping, and marine tourism. The **Sagarmala Project** is actively expanding port infrastructure with over **800 projects** to enhance capacity and logistics. The Blue Economy Fund is dedicated to marine conservation and pollution control, while Marine Spatial Planning aims for effective management of marine areas. The **Pradhan Mantri Matsya Sampada Yojana (PMMSY)** has been allocated **₹20,050 crore to boost fish production** and create employment opportunities.

Looking forward, India is prioritizing ship design, autonomous vessels, and deep-sea exploration through initiatives like the **Deep Ocean Mission**. Investments in tidal and wave energy technologies, along with climate-resilient coastal development projects, are being spearheaded by the **National Institute of Ocean Technology**. Data-driven approaches are improving shipbuilding and coastal management, while advanced satellite monitoring and energy harvesting prototypes reflect India's commitment to sustainable maritime innovation and resource management.

Advancement of New Technologies & Research Innovation

New technologies and research innovation in India is bolstered by key initiatives such as the **India's Semiconductor Mission** with 76,000 crore budget, **National Mission on Quantum Technologies & Applications (NM-QTA)** with ₹6,000 crore budget, and the Digital India R&D Fund's ₹20,000 crore allocation for emerging technologies like AI and blockchain. The Atal Innovation Mission (AIM) continues to support startups through **Atal Tinkering Labs** and **Incubation Centers**. Space advancements are highlighted by ISRO's **Gaganyaan mission** and ongoing developments in satellite technology. India is also advancing 6G technology with a goal of nationwide coverage by 2025, while investing heavily in AI and robotics. Future focus areas include boosting research funding, furthering quantum technology, expanding 6G, and integrating AI and robotics across industries.

To cement its global role, India is focusing on leadership in 12 major areas outlined in G-20 declarations, including advanced materials, energy sustainability, and smart cities. The **Scheme for Promotion of Academic & Research Collaboration (SPARC)** is enhancing international academic ties, while collaborations with tech giants are fostering the development of Technology in the Research Parks.

As we move forward, **Vikshit Bharat** is more than a goal; it is a promise—a promise of growth, unity, and unparalleled potential. It is a call to every Indian heart to contribute to a narrative of greatness and to embrace our role as leaders on the global stage as a **Vishwaguru**.





AUTHOR

Prof. Virendra Kumar Tewari



Prof. Virendra Kumar Tewari is an Indian academician and institution-builder who completed his tenure as Director of IIT Kharagpur on 30 December 2024, and was also entrusted with additional charge as Director of IIT Bhubaneswar and Director of IIIT Kalyani. Trained at IIT Kharagpur, he earned his B.Tech. (Hons.) in Agricultural Engineering (1979), M.Tech. in Farm Machinery and Power Engineering (1981), and Ph.D. in Engineering (1985) a trajectory that anchors his work at the intersection of engineering design, field realities, and national capacity-building.

Professionally, Prof. Tewari joined IIT Kharagpur as a faculty member in 1990 and rose to the rank of Professor in Farm Machinery and Power Engineering in the Department of Agricultural and Food Engineering. Prior to his faculty career, he served as Junior Research Engineer and Senior Research Engineer (1982–1990). Alongside teaching and research, he has played consequential academic-administrative roles most notably through his work with the JEE system (2003–2006),

including serving as Chairman of the All India Organizing Committee of JEE (2005–2006), where he is credited with pioneering reforms relating to question-paper design and examination security systems. He also served as Head of the Department of Agricultural and Food Engineering and as Head of the Rural Development Centre for three years, focusing on academic and infrastructural transformations.

At the level of research and applied innovation, his core areas include tractor system design, ergonomics and industrial safety, design of agricultural machines, and precision agriculture and machinery system management. His project portfolio includes initiatives such as the Centre of Excellence for Digital Farming Solutions (robots, drones, and AGVs) and engagements under NAHEP, along with extensive collaborative work with industry ranging from tractor manufacturers (TAFE, M&M, John Deere, Escorts, Eicher) to applied ergonomics and safety work in industrial settings (including Tata Steel, Jamshedpur, and mine-project environments), and technology design in the tea sector. His scholarly and innovation output includes 18 design patents, one copyright, 200+ publications, and long-standing leadership of sponsored research and consultancy.



Odisha Research Centre, Bhubaneswar