

Review Article

Digital Transformation and Innovation in Achieving Viksit Bharat

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A B S T R A C T

Digital transformation and innovation are pivotal in achieving India's vision of Viksit Bharat—a developed and self-reliant nation. Leveraging advancements in technology, fostering a culture of innovation, and promoting inclusivity can transform sectors like healthcare, education, agriculture, and governance. This paper explores the role of digital transformation in driving economic growth, empowering marginalized communities, and bridging urban-rural divides. The challenges of digital inclusion, cybersecurity, and policy frameworks are also addressed. By integrating modern innovations with traditional wisdom, India can create a sustainable roadmap toward becoming a developed nation.

Keywords: Digital Transformation, Innovation, Viksit Bharat, Inclusivity, Policy Frameworks, Sustainable Development

Introduction

India is undergoing a transformative journey marked by rapid advancements in technology and innovation. As one of the fastest-growing economies in the world, the nation has set its sights on achieving Viksit Bharat—a vision of a self-reliant, inclusive, and technologically advanced India. Digital transformation lies at the heart of this vision, serving as a catalyst for socio-economic development, bridging disparities, and propelling the nation into the global forefront of innovation and technology.

The concept of Viksit Bharat represents a developed and empowered India where citizens enjoy equitable access to opportunities, resources, and services. This vision aligns with the United Nations' Sustainable Development Goals (SDGs), emphasizing inclusive growth, innovation, and sustainability. However, realizing this aspiration requires a robust digital ecosystem that can address the unique challenges posed by India's diversity, scale, and socio-economic disparities.

Digital transformation refers to the integration of digital technologies into all aspects of society, fundamentally

changing how individuals, businesses, and governments operate and deliver value. It encompasses advancements in technologies such as Artificial Intelligence (AI), the Internet of Things (IoT), blockchain, cloud computing, and data analytics, which have the potential to redefine sectors like governance, healthcare, education, agriculture, and industry.¹

India has already made significant strides in its digital journey through initiatives like Digital India, which aims to empower citizens with digital tools and infrastructure. Programs such as Aadhaar, India's biometric identification system, and the Unified Payments Interface (UPI) have set global benchmarks for innovation and scalability. These initiatives not only improve access to services but also lay the groundwork for inclusive growth.²

Key Drivers Of Digital Transformation In India

E-Governance and Public Services

Digital transformation has revolutionized public service delivery through initiatives like Digital India, which emphasizes transparency, efficiency, and accessibility. Projects like

Aadhaar, Unified Payments Interface (UPI), and MyGov exemplify India's progress in leveraging technology for governance.³

Education and Skill Development

Innovative digital platforms such as DIKSHA and SWAYAM have transformed access to education. By integrating Artificial Intelligence (AI) and Virtual Reality (VR), India can enhance skill-based learning and address challenges like the urban-rural education divide.

Healthcare Innovation

Telemedicine platforms, digital health records, and mobile apps have improved healthcare access in rural areas. Drawing inspiration from the integration of traditional and modern healthcare (as discussed in the reference document), a hybrid model of digital healthcare could further enhance service delivery.

Smart Agriculture

Precision farming, blockchain-based supply chains, and IoT-driven monitoring systems are reshaping Indian agriculture. These technologies not only increase productivity but also empower farmers with real-time data and market access.⁵

Entrepreneurship and Innovation Ecosystem

Startups and innovations are crucial to driving Viksit Bharat. Initiatives like Startup India and Make in India promote an ecosystem of creativity, with focus areas such as fintech, green energy, and biotechnology.

Challenges in Digital Transformation

While digital transformation has the potential to redefine India's developmental trajectory, it is not without its challenges. The sheer scale and diversity of India, combined with systemic, cultural, and infrastructural issues, make the implementation of digital technologies a complex endeavor.

Addressing these challenges is critical to ensuring that the benefits of digital transformation are inclusive, sustainable, and impactful.

Digital Divide

Urban-Rural Disparities

India's urban centers are rapidly adopting digital technologies, yet rural areas lag significantly in digital penetration. According to recent reports, only about 37% of rural households have access to the internet, compared to 67% in urban areas. This divide is exacerbated by a lack of infrastructure, such as broadband connectivity and reliable electricity in rural regions.⁴

Gender Inequality in Access

Women, especially in rural areas, often face limited access to digital resources due to cultural norms, financial

constraints, and lower digital literacy. This gender gap restricts their ability to participate in digital education, entrepreneurship, and job markets.

Socioeconomic Barriers

Low-income groups struggle with the affordability of smartphones, internet services, and digital tools. Without subsidized access or affordable alternatives, many remain excluded from the benefits of digitization.

Digital Literacy

Lack of Awareness and Skills

Although smartphones and internet access are spreading, many Indians lack the necessary skills to use digital technologies effectively. The absence of formal digital literacy programs in schools and communities limits the potential impact of initiatives like Digital India.⁶

Generational Divide

Older generations, particularly in rural and semi-urban areas, often resist adopting digital technologies due to a lack of familiarity. Bridging this generational gap requires targeted training programs and user-friendly digital interfaces.

Cybersecurity Threats

Rising Cybercrime

India witnessed a 500% increase in cyberattacks during the COVID-19 pandemic, highlighting vulnerabilities in its digital infrastructure. Phishing scams, ransomware attacks, and identity theft are growing concerns.⁷

Weak Data Protection Frameworks

The absence of a robust data privacy law leaves individuals and organizations vulnerable to breaches. Although the Personal Data Protection Bill aims to address this, its implementation and enforcement remain uncertain.

Critical Infrastructure Risks

Digital transformation of essential services like healthcare, power grids, and financial systems introduces risks of targeted cyberattacks, which could disrupt large-scale operations.

Policy and Regulatory Challenges

Regulatory Uncertainty

The rapidly evolving nature of technology often outpaces regulatory frameworks. Ambiguity in policies regarding cryptocurrencies, data localization, and artificial intelligence (AI) can deter investment and innovation.

Fragmented Governance

India's federal structure sometimes leads to inconsistent policies across states. For instance, differences in e-gover-

nance adoption levels between states create inefficiencies in nationwide digital programs.

Balancing Innovation with Regulation

Overregulation can stifle innovation, while underregulation may lead to misuse and exploitation. Striking a balance is a constant challenge for policymakers.

Cultural Resistance to Change

Trust Deficit

Many individuals, particularly in rural areas, distrust digital systems, fearing job losses, privacy violations, or misuse of data. Building awareness and confidence is critical for adoption.

Resistance from Traditional Sectors

Industries with deeply entrenched traditional practices, such as agriculture and small-scale manufacturing, may resist adopting digital technologies due to perceived risks or lack of immediate benefits.

Infrastructure Limitations

Connectivity Issues

Despite initiatives like BharatNet, internet penetration remains uneven, with many remote areas still unconnected. Challenges such as high costs of infrastructure deployment and difficult terrain hinder progress.

Energy Constraints

Reliable electricity is a prerequisite for digital technologies. Frequent power outages in rural areas make digital adoption impractical in these regions.

Affordability of Technology

High Costs for Emerging Technologies

Technologies like AI, IoT, and blockchain require significant investments in infrastructure, research, and development. These costs often limit adoption by small businesses and underserved communities.

Dependency on Imports

India's reliance on imported hardware and software increases costs and creates vulnerabilities in its supply chain. Encouraging domestic manufacturing under initiatives like Make in India is essential to address this issue.

Ethical and Social Challenges

Exclusion of Vulnerable Groups

If not implemented inclusively, digital transformation could widen existing inequalities, leaving marginalized groups further behind.⁸

Misuse of Technology

The misuse of AI for surveillance, data manipulation, or spreading misinformation poses significant ethical chal-

lenges. Strong governance mechanisms are required to prevent such abuses.

Erosion of Traditional Practices

As digital technologies become widespread, there is a risk of traditional knowledge systems and practices being overshadowed or undervalued.

Challenges in Integration

Digital transformation and innovation present immense opportunities for India to realize the vision of Viksit Bharat. By leveraging cutting-edge technologies and fostering a culture of creativity, India can bridge existing gaps, drive economic growth, and ensure inclusive development. This section explores various opportunities across sectors and highlights the innovative solutions that can propel India toward a sustainable and equitable future.⁹

Bridging the Digital Divide

Digital inclusion is critical for ensuring that the benefits of technology reach every corner of the country. Bridging the digital divide opens new avenues for education, healthcare, financial services, and governance.

Expanding Internet Connectivity

India has made significant progress in internet penetration, with programs like BharatNet aiming to connect over 250,000 Gram Panchayats with high-speed internet. The deployment of 5G networks promises to bring faster and more reliable connectivity to underserved areas.

Regional Language Interfaces

Developing digital tools in regional languages can make technology accessible to non-English-speaking populations. For example, platforms like Koo (a microblogging site) and digital banking apps in vernacular languages cater to India's diverse linguistic needs.

Affordable Digital Tools

Startups and private-sector players are introducing low-cost smartphones and data plans to bring digital technology within the reach of low-income households. The collaboration between Jio and Google to launch affordable smartphones is a notable example.

Revolutionizing Education and Skill Development

Digital transformation offers unprecedented opportunities to enhance education and workforce readiness, addressing issues of access, quality, and relevance.

E-Learning Platforms

Digital initiatives like SWAYAM and DIKSHA provide online courses, training, and learning resources to students and teachers nationwide. AI-driven personalized learning sys-

tems can further tailor educational content to individual needs.

Virtual and Augmented Reality (VR/AR)

Innovations in VR and AR allow students to experience immersive learning environments. For instance, virtual labs can simulate scientific experiments for students in remote areas, eliminating the need for physical resources.

Skill Development for the Future Workforce

The rise of Industry 4.0 demands skills in AI, robotics, IoT, and blockchain. Programs like the National Skill Development Mission (NSDM) focus on upskilling India's workforce in emerging technologies, ensuring competitiveness in global markets.

Advancing Healthcare Access and Innovation

Digital technologies are transforming India's healthcare landscape by improving access, affordability, and outcomes, particularly in remote regions.

Telemedicine and Remote Monitoring

Platforms like eSanjeevani enable virtual consultations between doctors and patients, reducing the need for physical visits. Wearable devices and IoT-enabled sensors allow real-time health monitoring, improving disease management and early detection.¹⁰

Digital Health Records

The National Digital Health Mission (NDHM) is creating a unified health ID system that integrates patient records across facilities, improving continuity of care and reducing administrative burdens.

AI in Diagnostics

Artificial intelligence is revolutionizing diagnostics by analyzing medical images, detecting diseases like cancer, and predicting outbreaks. AI-based tools like Qure.ai are already enhancing diagnostic accuracy in India.

Integrating Traditional Medicine

India's rich heritage in Ayurveda and traditional medicine can be digitized and integrated with modern healthcare. Platforms that promote evidence-based traditional therapies alongside digital health tools can expand treatment options.

Transforming Agriculture through Smart Technologies

Agriculture remains the backbone of India's economy, and digital innovation holds the key to addressing its challenges, from low productivity to market inefficiencies.

Precision Farming

IoT devices, drones, and satellite imagery provide farmers with real-time data on soil health, weather conditions,

and crop requirements, enabling precise interventions and higher yields.

Blockchain in Supply Chains

Blockchain technology enhances transparency and traceability in agricultural supply chains. It can ensure fair pricing for farmers by reducing middlemen and improving trust in transactions.

Digital Marketplaces

Platforms like eNAM (National Agriculture Market) connect farmers with buyers directly, improving market access and offering better price discovery for their produce.

Agri-Tech Startups

Startups such as DeHaat and Ninjacart leverage technology to deliver farming solutions, including advisory services, input supplies, and logistics support. Boosting Entrepreneurship and Innovation Ecosystems India's vibrant startup ecosystem is a testament to its entrepreneurial spirit. By fostering innovation, the country can drive job creation, economic growth, and global competitiveness.

Startup India Initiative

The Startup India initiative has nurtured thousands of startups by providing funding, tax benefits, and mentorship. Sectors like fintech, healthtech, and edtech are witnessing rapid growth.

Innovation Hubs and Incubators

India is home to numerous innovation hubs and incubators that support budding entrepreneurs. Institutions like IITs and IIMs play a significant role in mentoring startups and facilitating research and development.

Global Leadership in Fintech

India's fintech sector, driven by innovations like the Unified Payments Interface (UPI), has transformed financial transactions. The scalability of UPI has made India a global model for digital payments.

Focus on Green Technology

Startups working on renewable energy, electric vehicles (EVs), and sustainable solutions are driving India's green revolution. Initiatives like FAME (Faster Adoption and Manufacturing of Hybrid and Electric Vehicles) support this transition.

Sustainability through Digital Transformation

Sustainability is a critical component of Viksit Bharat, and digital innovations can address environmental challenges effectively.

Smart Energy Management

IoT-enabled smart grids optimize energy consumption, reduce waste, and promote the use of renewable energy

sources. Technologies like solar microgrids in rural areas ensure sustainable power distribution.

Water Resource Management

AI and IoT applications monitor water levels, predict shortages, and optimize irrigation, addressing water scarcity in agriculture and urban areas.

Circular Economy Initiatives

Blockchain-based systems can track waste and promote recycling, enabling a circular economy model that minimizes environmental impact.

Blending Traditional Knowledge with Modern Innovation

India's rich cultural and traditional heritage offers unique opportunities for innovation. By integrating traditional knowledge systems with digital platforms, India can create hybrid solutions that are both effective and culturally relevant.

Blockchain for Indigenous Knowledge

Blockchain can secure intellectual property rights for indigenous practices, ensuring fair compensation for communities and preventing exploitation. Promoting Traditional Crafts

E-commerce platforms that showcase traditional arts and crafts can provide global market access to artisans, preserving cultural heritage and generating income.

Modernizing Traditional Agriculture

Combining traditional farming techniques with modern technology can improve productivity while maintaining ecological balance.

Global Collaboration and Leadership

India's IT expertise positions it as a global leader in technology-driven diplomacy and partnerships.

Knowledge Sharing

India's digital solutions, such as Aadhaar and UPI, can be exported to other developing nations, fostering global collaboration and leadership.

Participation in International Tech Forums

India's active role in global initiatives like the Global Partnership on Artificial

Intelligence (GPAI) ensures that its interests and expertise shape global tech policies.

Policy Recommendations

Achieving the vision of Viksit Bharat requires a robust, forward-thinking policy framework to harness the full potential of digital transformation and innovation. Policies must address the challenges of inclusivity, affordability,

cybersecurity, and sustainability while fostering a thriving innovation ecosystem. Below are detailed policy recommendations across key areas to support India's digital journey.¹¹

Strengthening Digital Infrastructure

A strong digital infrastructure is foundational for inclusive digital transformation.

Broadband and Connectivity Expansion

Universal Broadband Access

Expand initiatives like BharatNet to ensure high-speed internet connectivity in every Gram Panchayat, with a focus on last-mile connectivity for remote and tribal regions.

5G Deployment: Accelerate 5G rollout across urban and rural areas to enable faster, more reliable internet services.

Affordable Data Plans:

Public Wi-Fi Networks

Deploy free or low-cost public Wi-Fi hotspots in schools, hospitals, and community centers to enhance access for underserved populations.

Digital Infrastructure for Enterprises

Establish cloud computing centers and data storage hubs to support small and medium enterprises (SMEs) in their digital transformation.

Promoting Digital Literacy and Inclusion

Equipping citizens with digital skills is essential for inclusive growth.

Digital Literacy Campaigns

Launch nationwide programs focused on basic digital literacy, targeting rural areas, women, and senior citizens.

Integrate digital skills into school curricula, emphasizing practical applications like online banking, e-governance services, and cybersecurity awareness.

Skill Development for Emerging Technologies

Establish training centers offering courses in AI, blockchain, IoT, and data analytics under programs like the National Skill Development Mission.

Provide specialized training programs for marginalized groups, ensuring they are not left behind in the digital economy.

Gender Inclusion in Digital Policies

Implement policies aimed at increasing women's participation in the digital economy, including grants for women-led startups and incentives for businesses promoting gender diversity in technology.

Strengthening Cybersecurity and Data Privacy

Robust cybersecurity measures and data privacy frameworks are crucial to building trust in digital systems.

National Cybersecurity Policy Implementation

Develop a comprehensive:

National Cybersecurity Strategy focused on proactive threat detection, rapid incident response, and secure critical infrastructure.

Set up cybersecurity task forces to monitor and mitigate threats in real-time.

Data Privacy Legislation

Expedite the implementation of the Data Protection Act to safeguard citizens' data.

Ensure stringent enforcement mechanisms for data breaches, with penalties for non-compliance.

Awareness Campaigns on Cyber Hygiene

Conduct public awareness drives to educate citizens about online safety practices, such as using strong passwords and avoiding phishing scams.

Encouraging Innovation and Entrepreneurship

Fostering a culture of innovation and supporting entrepreneurs can unlock economic growth and job creation.

Startup Ecosystem Support

Expand funding under initiatives like Startup India, with special funds allocated for startups in underserved regions.

Provide tax breaks and incentives for startups in emerging technologies like green energy, AI, and medtech.

Incubation and Innovation Hubs

Establish incubation centers in every state, linked to universities and research institutions, to mentor entrepreneurs and develop market-ready solutions.

Promote public-private partnerships (PPPs) to drive innovation, offering funding and resources for R&D.

Intellectual Property (IP) Rights Protection:

Simplify and expedite the IP registration process to protect innovations.

Establish frameworks to safeguard traditional knowledge, ensuring fair benefit-sharing for indigenous communities.

Enhancing E-Governance

E-governance can improve transparency, efficiency, and citizen engagement.

Interoperable Platforms

Develop interoperable e-governance systems that allow seamless sharing of data across departments, reducing redundancy and improving service delivery.

AI-Driven Governance Tools

Use AI to analyze public data and optimize resource allocation for schemes such as rural employment guarantees and health services.

One-Stop Digital Portals

Create unified digital portals for accessing multiple government services, simplifying processes like applying for subsidies, paying taxes, or reporting grievances.

Policies for Sustainability and Green Technology

Sustainability is integral to India's long-term digital transformation goals.

Green Energy Adoption

Offer subsidies and incentives for companies developing renewable energy technologies like solar panels and wind turbines. Mandate the use of energy-efficient technologies in data centers and IT infrastructure.

Waste Management in Technology

Implement e-waste management policies that encourage recycling and safe disposal of obsolete electronics.

Introduce programs for refurbishing old devices and distributing them to underserved communities.

Strengthening Global Collaboration

India's position as a global technology leader can be enhanced through international partnerships.

Bilateral Agreements on Technology

Sign agreements with countries excelling in technology innovation, such as Estonia for e-governance or Finland for green tech, to share best practices and co-develop solutions.

Exporting Digital Solutions

Promote global adoption of Indian digital solutions, such as Aadhaar and UPI, as models for other developing nations.

Participation in Global Tech Forums

Play an active role in international bodies like the Global Partnership on Artificial Intelligence (GPAI) to shape global technology policies and ethics frameworks.

Integrating Traditional Knowledge with Digital Platforms

India's cultural heritage and traditional knowledge systems can be preserved and promoted through digital tools.

Blockchain for Heritage Preservation

Use blockchain to document and protect traditional knowledge, ensuring fair benefit-sharing with indigenous communities.

E-Commerce for Traditional Crafts

Develop government-supported e-commerce platforms for artisans to sell

traditional crafts globally, empowering rural economies.

Digital Agriculture

Integrate traditional farming methods with modern IoT and AI solutions to improve yields and maintain ecological balance.

Monitoring and Evaluation Frameworks

A robust mechanism to monitor and evaluate digital transformation initiatives is essential for sustained impact.

Real-Time Dashboards

Implement dashboards to track the progress of digital initiatives, such as broadband connectivity or e-governance adoption rates.

Independent Audits

Conduct third-party audits of major programs to ensure transparency and accountability.

Citizen Feedback Systems

Enable citizens to provide real-time feedback on digital services, using their insights to drive continuous improvement.

Conclusion

India stands at a transformative juncture where digital technology and innovation are no longer optional but essential pillars for achieving Viksit Bharat. The vision of a developed and inclusive India is deeply intertwined with the country's ability to leverage digital tools, foster innovation, and create sustainable ecosystems across sectors. This paper has explored the immense potential of digital transformation and innovation while addressing the challenges and presenting actionable policy recommendations.

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