India's Tech Trajectory

This editorial is based on **"Beyond the manifestos, technology challenges for India's next government**" which was published in The Indian Express on 01/05/2024. The article examines the global race for technological supremacy, urging India to revamp its technology strategy for global competitiveness.

For Prelims: Deep Tech, Artificial Intelligence, Internet of Things, Big Data, quantum computing, Telecom industry, Unified Payment Interface, Space Sector, India's Semiconductor Mission, IndiaAI Mission , Mission on Advanced and High-Impact Research.

For Mains: Sectors Driving India's Tech Growth, Major Technology Related Challenges in India.

The world is witnessing an unprecedented **race for technological supremacy**, with 5.44 billion people around the world using the internet as of April 2024, equivalent to **67.1%** of the world's total population.

Major economies recognise the pivotal role of **advanced technologies** in shaping their future. China has made significant strides in prioritising technology and innovation as a strategic objective as seen in its **Made in China 2025 plan,** aiming to reduce reliance on foreign technologies. Meanwhile, the **United States** and **Europe** have also intensified their efforts to regain and maintain their leadership in critical technology sectors.

India, with its **rich scientific heritage** and **aspirations for a** technology-driven economy**,** finds itself at a crossroads, facing both challenges and opportunities in this global technological race.

What is the Status of India's Technology Sector?

- **Current Scenario:** The Indian Technology Industry is expected to touch the **USD 300-USD 350 billion** revenue mark over the next 5 years (currently **surpassed USD 250 billion mark).**
  - The **Telecom industry** in India is the second largest in the world with a subscriber base of **1.1 Billion** as of February 2024.
  - India has also emerged as the **second largest manufacturer of mobile** handsets in the world.
  - India has emerged as the **world's third largest** startup ecosystem with over 1.25 lakh startups and 110 unicorns.
- **Key Sub Sectors Driving India's Tech Growth:**
  - **IT and Business Process Outsourcing (BPO) Services:** India's services exports have been driving the overall export growth.
    - IT and BPO services are the largest component and comprise over **60% of India's service exports.**
  - **E-Commerce:** India's **e-commerce market,** encompassing various sectors like online

travel, food delivery, health-tech, and more, is rapidly growing.
        - It is expected to reach **USD 1 trillion by 2030,** driven by factors such as a large consumer base, diverse demographics, cost-effective digital infrastructure, and a robust supply chain ecosystem.
    - **FinTech and Digital Finance:** India has one of the world's fastest-growing financial technologies markets.
        - Digital payments especially throughout **Unified Payment Interface (UPI)** are the primary driver of growth in this sector.
        - According to Invest India, the Indian FinTech market is expected to grow to **USD 150 billion by 2025.**
        - According to the **Reserve Bank of India (RBI),** total digital payments were recorded as **USD 2.4 trillion** in value in June 2023.
    - **Edtech:**The edtech sector has gained significant traction, especially during the **Covid-19 pandemic,** with companies offering online learning platforms, virtual classrooms, and innovative educational solutions.
        - India is the second largest market for e-learning after the US with a market size of **USD 6 billion,** and is expected to grow to **USD 10 billion by 2025.**
    - **Cleantech and Renewable Energy**: India's focus on **renewable energy** sources like solar and wind has spurred growth in the cleantech subsector.
        - Companies are developing innovative solutions in areas such as **energy storage, smart grids, and energy efficiency technologies,** contributing to the country's sustainability goals.
        - India ranks **4th globally** for total renewable power capacity additions. India has already achieved its target of **40% installed electric capacity** from non-fossil fuels in **November 2021** itself.
    - **Space Sector:** Indian **Space Sector** contributes **2%-3% of the global space economy.**
        - By 2030 India further aims to capture a larger share of close to **10% of the global economy.**
        - With the recent successful missions like Chandrayaan-3 **and** Aditya L1**,** India is leading the beacon of Space technology aiming for its own **Space Station** by 2035.

What are the Government Initiatives Driving Technological Growth?

- **India's Semiconductor Mission**: Launched in **2021,** It is part of the comprehensive program for the development of sustainable semiconductor and display ecosystems in the country.
- **IndiaAI Mission:** The IndiaAI Mission, with an allocation of over Rs 10,300 crore, aims to strengthen India's AI ecosystem through initiatives like **AI computing infrastructure, innovation centers, datasets platforms, application development,** FutureSkills programs, and startup financing, fostering AI leadership, ethical deployment, and democratizing AI benefits.
- **DigiLocker:** DigiLocker is a free, secure, online platform that allows users to store, share, and verify documents and certificates in the cloud. It's a flagship initiative of the Indian government's **Digital India program,** which aims to make India a digitally empowered society
- **Unified Payment Interface**: It is a real-time payment system developed by the **National Payments Corporation of India (NPCI).**
    - It enables individuals to transfer money instantly between bank accounts using their smartphones. .
- **Mission on Advanced and High-Impact Research (MAHIR):** Launched in 2023, this initiative focuses on the power sector.
    - It aims to accelerate research, development, and demonstration of cutting-edge technologies like clean energy solutions and smart grids.
- PLI Schemes **(Production Linked Incentive):** The government has introduced PLI schemes for various sectors like **semiconductors and electronics manufacturing.**
- **National Supercomputing Mission**: It is a first of its kind attempt to boost the country's computing power.
    - It is steered jointly by the **Department of Science and Technology (DST) and Ministry of Electronics and IT (MeitY)** and implemented by the **Centre for Development of Advanced Computing (C-DAC)**, Pune and the Indian Institute of Science (IISc), Bengaluru.

What are the Major Technology Related Challenges in India?

- **Digital Divide:** While India has a large and growing internet user base, there's a significant gap between urban and rural areas.
    - **Oxfam's India Inequality Report 2022** shed light on digital divide's impact on inequality, revealing that about **70% of India lacks proper Information and Communication Technology (ICT) access.**
    - Despite efforts like **BharatNet**, rural connectivity remains poor, with only **2.7% of the poorest households having computers and 8.9% internet access.**
- **Lack of Relevant Skilling:** The Indian IT sector is known for IT services, but there's a growing demand for specialised skills in areas like **AI, cybersecurity, and data science.**
    - India's education system currently lacks specialised skills leading to shortage of skilled professionals equipped with relevant technological expertise.
- **Lack of Adequate Focus on R&D:** Compared to developed nations, India invests relatively little in research and development **(0.64% of GDP).**
    - This hinders innovation and domestic production of cutting-edge technologies.
- **Cybersecurity Threats:** As India integrates more technology, cybersecurity threats are on the rise. With advancing technology, **cyber frauds, online financial frauds,** and **deep fakes** pose significant challenges, raising ethical and security concerns impacting decision-making processes.
    - In the year 2022, the **Indian Computer Emergency Response Team (CERT-In)** handled over 1.3 million security incidents reported across India.
    - Events like AIIMS Delhi Ransomware Attack **in 2023** highlights the sensitivity of the issue.
- **Lack of Comprehensive Regulation on AI**: India currently **does not have a single, comprehensive law** for regulating AI.
    - There are various initiatives and guidelines, but they are not legally binding. This creates uncertainty for businesses and raises concerns about potential risks.

Way Forward

- **Quantum Leap Alliances:** To stay ahead in the race for emerging technologies like quantum computing, India could forge strategic **"Quantum Leap Alliances"** with leading nations and research institutions.
    - These alliances could facilitate joint research projects, knowledge sharing, and collaborative efforts to develop next-generation quantum technologies.
- **AI-powered Rural Entrepreneurship Hubs:** India can set up **AI-powered kiosks in rural areas.** These kiosks, equipped with local language interfaces and AI assistants, can provide training, resources, and mentorship to aspiring rural entrepreneurs. They can connect them with online marketplaces, logistics providers, and financing options.
- **Moonshot Innovation Labs:** India can establish a network of "Moonshot Labs" modelled after **DARPA (Defense Advanced Research Projects Agency) in the US.**
    - These labs would focus on **high-risk, high-reward research** in areas like next-generation materials, and brain-computer interfaces.
- **TechnoSkilling for Future:** India needs to foster **"TechnoSkills Alliances"** between industry, academia, and government to collaboratively design and implement curricula aligned with emerging technology trends and market demands.
    - There is a need to introduce **"Immersive Learning Environments"** that combine virtual and augmented reality simulations with hands-on practical training, enabling experiential learning of cutting-edge technologies.
    - Also, promoting **"Skill Mobility" by creating flexible and modular learning pathways** that allow individuals to acquire new skills and transition across different technological domains throughout their careers.
- **Enhancing Cybersecurity:** India needs to implement more stringent Cyber Resilience Framework that integrates proactive threat intelligence, advanced security measures, and incident response capabilities across critical infrastructure and key sectors.
    - Also, promote **"Secure-by-Design" principles** by integrating cybersecurity considerations from the early stages of technology development and deployment.

Drishti Mains Question:

Assess the impact of India's technological advancements on economic growth, societal transformation, and global competitiveness. Also, propose strategic measures for sustainable tech-led development in India.

UPSC Civil Services Examination, Previous Year Questions (PYQs)

Prelims

Q. With the present state of development, Artificial Intelligence can effectively do which of the following? (2020)

1. Bring down electricity consumption in industrial units
2. Create meaningful short stories and songs
3. Disease diagnosis
4. Text-to-Speech Conversion
5. Wireless transmission of electrical energy

Select the correct answer using the code given below:

(A) 1, 2, 3 and 5 only

(B) 1, 3 and 4 only

(C) 2, 4 and 5 only

(D) 1, 2, 3, 4 and 5

Ans: (B)

Q. With reference to “Blockchain Technology”, consider the following statements: (2020)

1. It is a public ledger that everyone can inspect, but which no single user controls.
2. The structure and design of blockchain is such that all the data in it are about cryptocurrency only.
3. Applications that depend on basic features of blockchain can be developed without anybody’s permission.

Which of the statements given above is/are correct?

(A) 1 only

(B) 1 and 2 only

(C) 2 only

(D) 1 and 3 only

Ans: (D)

Mains:

Q. COVID-19 pandemic has caused unprecedented devastation worldwide. However, technological advancements are being availed readily to win over the crisis. Give an account of how technology was sought to aid management of the pandemic. **(2020)**