



## Mains Practice Question

**Q.** Analyze the strategic significance of technological indigenization for India's and economic sovereignty, with reference to recent developments in this area. (150 words)

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### Approach

- Introduce by defining Technological indigenization
- Delve into Strategic Significance of Technological Indigenization
- Give Challenges in Achieving Technological Indigenization
- Suggest a way forward
- Conclude suitably.

### Introduction

**Technological indigenization** involves the **development, adaptation, and production of technologies domestically**, reducing reliance on imports. It is essential for India's economic sovereignty, which is rooted in strategic autonomy, robust national security, and a self-reliant economy.

### Body

#### Strategic Significance of Technological Indigenization:

- **Strategic Autonomy and National Security**
  - **Reduced Dependency on Imports:** Indigenization minimizes reliance on foreign suppliers in critical sectors like **defense, energy, and telecommunications**.
    - **Example:** Indigenous missiles like **Agni** and **Prithvi** under the Integrated **Guided Missile Development Program (IGMDP)** bolster India's defense capabilities.
  - **Mitigating Geopolitical Risks:** By reducing exposure to foreign control over critical technologies, indigenization ensures that national security is not compromised during geopolitical tensions.
    - **Example:** The indigenization of fighter jets like **Tejas** and submarines like **INS Arihant** strengthens defense preparedness.
- **Economic Sovereignty**
  - **Boosting Domestic Industries:** Local production of technologies fosters industrial growth and job creation.
    - **Example:** Electronics manufacturing, a key sector under "Make in India," has seen growth, reducing imports.
  - **Savings on Import Bills:** By developing indigenous capabilities, India can curb outflows of foreign exchange and support its trade balance.
    - **Example:** Indian scientists have indigenously developed **highly stable, low-cost Carbon-based perovskite solar cells** with superior thermal and moisture stability
- **Fostering Innovation and Technological Sovereignty**
  - **Promoting R&D:** Indigenous technology development encourages research and

innovation, enabling India to build a competitive edge in global markets.

- **Example:** India's R&D achievements in space through **Chandrayaan-3** and **Aditya-L1 missions** highlight technological advancement.
- **Economic Resilience:** Indigenous technologies help insulate India from supply chain disruptions caused by global events, such as the **semiconductor shortage during the Covid-19 pandemic and recent Red Sea Crisis**.
- **Healthcare Leap:** Development of India's first indigenous Covid-19 vaccine, **Covaxin**, showcased the nation's self-reliance in biotechnology.
  - Advances in **indigenous medical devices and nano-vaccines** are reducing import dependency in healthcare.
- **Digital and IT Technologies:** Development of **Bharat Operating System Solutions (BOSS)** as a domestic alternative to foreign operating systems ensures cybersecurity and technological sovereignty.
  - Leap in **Unified Payment Interface, Aadhar** are paving the way for India's digital leadership.

### Challenges in Achieving Technological Indigenization

- **R&D Investment Deficit:** India spends only **0.7% of GDP** on R&D, significantly lower than countries like the US (**2.8%**) and China (**2.2%**).
- **Skill Shortages:** India is projected to confront a potential **skill deficit of 30-32 million people by the end of fiscal 2025** especially in cutting-edge sectors like AI, semiconductors, and biotechnology hampers progress.
- **Dependence on Critical Imports:** High reliance on foreign-made components such as **semiconductors** limits self-reliance. ( India imports **95% of its semiconductors from countries like China, Taiwan, South Korea, and Singapore**)
- **Policy and Ecosystem Gaps:** Weak linkages between **academia, industry, and government** slow down innovation and technology transfer.

### Way Forward

- **Increased R&D Investments:** Raise R&D spending to at least **2% of GDP**, with a focus on cutting-edge technologies.
- **Skill Development Initiatives:** Upskilling programs in emerging fields like AI, renewable energy, and quantum computing should be prioritized under initiatives like **Skill India**.
- **Strengthen Public-Private Collaboration:** Promote partnerships between academia, research institutions, and industries to accelerate innovation.
- **Focus on Semiconductor Manufacturing:** Investments under the **Semiconductor Mission** must be targeted towards **advanced nodes (below 10nm)** to remain competitive in cutting-edge technologies like **AI, quantum computing, and 5G**.
- **Sector-Specific Policies:** Develop targeted policies for critical sectors such as **space, defense, healthcare, and agriculture** to incentivize indigenous technology adoption.

### Conclusion

Technological indigenization is central to **India's economic sovereignty and strategic autonomy**. With sustained efforts, indigenization will **not only bolster India's national security but also drive innovation, industrial growth, and global competitiveness**, cementing its position as a resilient and self-reliant economy.