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DAILY EDITORIAL ANALYSIS

TOPIC

INDIA & CHINA-US TECH RACE

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Context

- The second World Humanoid Games in Beijing highlighted China's ambition to combine AI, robotics and manufacturing to become a global science superpower amid intensifying US-China technological competition.

About Manufacturing to Scientific Leadership of China & US

- The emerging technology race is about **integrating scientific research, AI, manufacturing, capital, energy, supply chains and markets** into a single innovation ecosystem.
- **China** has promoted **'new quality productive forces'**, arguing that future growth must increasingly come from innovation rather than cheap labour, infrastructure and capital accumulation.
  - AI is central to this strategy because China seeks to diffuse it across robotics, machine tools, automobiles, biotechnology, materials, energy, agriculture and scientific research.
  - **China's traditional advantage** is its **massive manufacturing ecosystem**, and it now seeks to move upstream, from technological adaptation to **original scientific discovery** having spent decades absorbing and improving foreign technologies.
  - China's R&D expenditure reportedly reached about **2.8% of GDP in 2025**, with basic-research expenditure rising by **11%**.
- The **United States** is pursuing a **complementary strategy** from the opposite direction.
  - Its strengths lie in **world-class universities, laboratories, technology companies, venture capital and financial markets**, but globalisation has **weakened the link** between American innovation and domestic manufacturing.
  - The USA increasingly seeks to rebuild this connection and reduce vulnerabilities exposed by the pandemic, supply-chain disruptions and strategic dependence on China.
- Thus, **China** is moving from manufacturing towards science, while the **US** is seeking to reconnect science with manufacturing.

China's Shift & US-China Competition

- China possesses manufacturing depth, supply-chain integration and large-scale deployment capacity **(science-industrial ecosystem)**.
- The US retains major advantages in frontier research, advanced semiconductor technologies, universities, capital markets and high-end innovation.
- AI could become the bridge between the two domains by making discovery, design and manufacturing increasingly continuous.
- It explains why technological competition has become a component of **national security and geopolitical power**.
- **Both countries fear strategic dependence:** China on American advanced technologies and the US on Chinese manufacturing and supply chains.

India's Challenges Ahead of the China-US Tech Race

- **Low R&D Intensity and Weak Private-Sector Participation:** The **Economic Survey 2025-26** places India's R&D expenditure at **only about 0.64% of GDP**, compared with approximately **2.8% in China and 3.5% in the US**.
  - WIPO estimates India's R&D spending at about **$75 billion (PPP-adjusted)**, against **$786 billion for China and $782 billion for the US**.
  - India **lacks sufficient private-sector participation** in basic and applied research.
- **Institutional and Scientific-System Reform:** India's 1990s economic reforms did not produce a comparable transformation of the scientific ecosystem.

- Bureaucratisation, fragmented funding, limited university-industry collaboration and inadequate incentives for researchers continue to constrain innovation.
- Scientific temper needs to remain central: civilisational pride cannot substitute mythology for evidence, experimentation and scientific inquiry.

Related Efforts of India

- India has recognised the emerging challenge through initiatives such as:
  - **IndiaAI Mission:** Developing computing infrastructure, datasets, indigenous AI capabilities and AI applications.
  - **India Semiconductor Mission:** Strengthening semiconductor manufacturing and the electronics ecosystem.
  - **National Quantum Mission:** Building capabilities in quantum computing, communication, sensing and materials.
  - **National Research Foundation/Anusandhan-related Reforms:** Seeking to strengthen research funding and industry-academia collaboration.
  - **Draft National Robotics Policy:** It aimed at developing India's robotics ecosystem and industrial adoption.
- However, initiatives need to translate into **research capacity, commercialisation and manufacturing scale**, rather than remain primarily policy announcements.

Way Forward: Roadmap for India

- India needs a **two-legged strategy of global integration and domestic capability**:
  - Raise R&D spending progressively towards **2–3% of GDP**, with greater private-sector contribution.
  - Reform universities and public laboratories through competitive funding, autonomy and outcome-based evaluation.
  - Build stronger **university-industry-government linkages** and technology-transfer institutions.
  - Create incentives for Indian scientists and global Indian talent to return.
  - Integrate AI with manufacturing, agriculture, healthcare, defence, energy and materials science.
  - Deepen partnerships with global universities, firms, capital and technology networks rather than pursuing isolationist 'technological sovereignty'.
  - Develop domestic capabilities in **semiconductors, robotics, quantum technologies, advanced materials and compute infrastructure**.

Conclusion

- The decisive technology race will not be won by the country with merely the cleverest AI model or most impressive robot. It will be won by the country that best connects **knowledge with production**.
- **India's objective** should therefore be **not to replicate China or the US**, but to **build an open, competitive and scientifically rigorous innovation ecosystem** capable of converting its demographic and intellectual strengths into technological and strategic power.

Daily Mains Practice Question

[Q] Examine the challenges faced by India in building a globally competitive science–technology–manufacturing ecosystem ahead of emerging US-China technology competition

Source: IE

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