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DAILY EDITORIAL ANALYSIS

TOPIC

PREPARING INDIA FOR A TRUE INNOVATION-LED ECONOMY

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PREPARING INDIA FOR A TRUE INNOVATION-LED ECONOMY

Context

- India continues to **lag on the core drivers of innovation** i.e. low R&D intensity, weak private-sector participation, limited global technological impact, and poor research-to-market translation.
- It requires deeper systemic change, particularly **greater industry-led investment and stronger links between research, entrepreneurship, and capital**.

About Innovation-Led Economy

- An **innovation-led economy** is one where **economic growth is primarily driven by knowledge, research, technology, and entrepreneurship**, rather than by traditional factors such as labour and natural resources.
- In such economies, **R&D investment, technological innovation, and high-skill human capital** become the key drivers of productivity and competitiveness.
- Innovation-led growth is **important for India** because it helps:
  - Increase **productivity and global competitiveness;**
  - Move from **low-cost labour advantage to technology advantage;**
  - Promote **high-value manufacturing and deep-tech industries;**
  - Generate **high-skilled employment;**
  - Achieve the vision of **Viksit Bharat by 2047;**

Key Drivers of an Innovation Economy in India

- **Research and Development (R&D):** Investment in research institutions, laboratories, and industrial R&D.
- **Human Capital:** Availability of **scientists, engineers, and skilled professionals**.
- **Startup and Entrepreneurship Ecosystem:** Growth of **technology startups, venture capital, and incubation centres**.
- **Industry–Academia Collaboration:** Partnerships between **universities, research institutions, and private firms**.
- **Intellectual Property Protection:** Effective **patent systems and commercialization mechanisms**.

Structural Weaknesses in India's Innovation Ecosystem

- **Low R&D Expenditure:** India spends only **0.65% of GDP on R&D**, far below innovation leaders such as South Korea (~4–5%); Japan (~3%); United States (~3%); and China (~2.4%).
  - **Innovation-driven economies rely heavily on private-sector R&D investment**, whereas in India the government continues to fund the majority of research.
  - It reflects a **limited appetite among Indian firms for long-term, high-risk technological innovation**.
- **Limited Global Patent Presence:** Although patent filings are increasing, India's global innovation footprint remains modest.
  - **Domestic Patent Applications (approx.): China** (~1.8 million); **United States** (~600,000); **India** (~1,10,000)
  - **International Patent Cooperation Treaty (PCT) Applications (2024): China** (>70,000); **United States** (>54,000); **Japan** (>48,000); **India** (4,547);
    - Even **Switzerland**, a small country, filed more than **5,300 applications**.
    - It indicates that **scale and commercialization capacity remain major challenges**.
- **Human Capital Constraints:** According to the **Global Innovation Index 2025**:
  - Rank **95 in employment in knowledge-intensive sectors;**
  - Rank **80 in number of full-time equivalent researchers;**
- **Gender Gap in Innovation:** India ranks **101 out of 119 economies** in employment of women with advanced degrees.
  - Government initiatives addressing gender gap include the **WIDUSHI programme and WISE-KIRAN scheme**, but the impact of these initiatives remains limited so far.

- **Missing Research To Market:** The biggest weakness in India's innovation chain is the **commercialisation of research**. Although universities and public institutions produce growing scientific output, **technology transfer mechanisms remain weak**.
  - Key challenges include:
    - Limited university–industry collaboration;
    - Underdeveloped venture capital ecosystems for deep tech;
    - Weak technology licensing and commercialization structures;
    - High risk and long gestation of R&D projects;
  - Countries leading in innovation such as the **United States, South Korea, and Israel** have strong ***academia – industry – finance linkages***, which India still lacks.
- **Missing Industrialisation Phase:** Unlike major East Asian economies like South Korea or Taiwan, India did not experience **large-scale labour-intensive manufacturing-led industrialisation**. As a result:
  - The economy relies heavily on **services and agriculture**.
  - Many 'new-age unicorns' are **platform-based businesses relying on labour abundance** rather than deep technological innovation.

India's Push For Innovation Led Economy

- **Increased Public Funding for Innovation:** India has significantly increased funding for research and innovation:
  - **₹1,00,000 crore Research, Development and Innovation (RDI) Fund** announced earlier.
  - **₹20,000 crore corpus for deep-tech startups** announced in the Union Budget.
  - Expansion of **tax incentives and digital infrastructure investments**.
  - **Atal Tinkering Labs funding increased from ₹500 crore to ₹3,200 crore**, reflecting a focus on grassroots innovation and youth participation.
    - These initiatives align with the broader vision of **'Viksit Bharat powered by Yuva Shakti'.**
- **Regulatory Reforms for Innovation:** Several reforms aim to encourage research commercialization and private participation:
  - Removal of the **three-year eligibility requirement** for deep-tech startups under the Industrial R&D Promotion Programme.
  - Passage of the **SHANTI Act, 2025**, allowing patents for peaceful uses of nuclear energy and radiation.
  - Relaxation of restrictions on patenting nuclear-related technologies.
    - These measures aim to **unlock private-sector participation in strategic technologies**.

Improving Indicators in India

- **Global Innovation Ranking:** India ranks **38th among 139 economies in the Global Innovation Index (GII) 2025**, a steady improvement over the past decade.
- **Patent Filing Growth:** Patent filings increased from **about 59,000 in 2020–21 to more than 1,10,000 in 2024–25**.
  - Domestic filings now constitute **around 62% of total applications**.

Emerging Opportunities For India

- **Space Sector Startups:** India's commercial space ecosystem is expanding rapidly with private players entering satellite launch and space technology.
- **Deep-Tech Innovation:** The **RDI Fund** could significantly accelerate Artificial intelligence; quantum computing; semiconductors; advanced materials; and biotechnology.
- **Future Technology Standards:** The upcoming **6G global standard** will test India's innovation capacity.
  - The number of **Indian-origin Standard Essential Patents (SEPs)** will indicate whether India has become a **technology creator rather than a technology consumer**.

Way Forward

- **Increase Private-Sector R&D:** Industry must take greater responsibility for innovation investment.
- **Strengthen Industry–Academia Collaboration:** Create technology transfer offices and university spin-offs.

- **Expand Risk Capital for Deep Tech:** Encourage long-term venture capital funding.
- **Build Human Capital:** Increase researchers, improve STEM education, and promote gender inclusion.
- **Improve Patent Quality and Global Reach:** Focus on **commercially viable technologies and international patenting**.

Conclusion

- India's innovation story is at a **critical turning point**. Government initiatives have laid the groundwork through funding, regulatory reforms, and institutional support. However, **true transformation will depend on whether the industry steps up to invest in deep, long-term R&D**.
- India's challenge is no longer policy ambition but **execution and ecosystem maturity**. Bridging the gap between **research, industry, and markets** will determine whether India emerges as a **global technology leader or remains primarily a technology consumer**.

Source: TH

Daily Mains Practice Question

[Q] Discuss the key constraints in India's innovation ecosystem and suggest measures to strengthen industry participation, research commercialization, and technological leadership.

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