

DAILY EDITORIAL ANALYSIS

TOPIC

HISTORY OF LEARNING IN R&D: BEYOND EXPENDITURE

***Context:** India needs technological capabilities along with increasing R&D expenditure and private-sector participation to be globally competitive.*

India's R&D Landscape

- India's R&D ecosystem has expanded through public institutions, universities, start-ups and strategic sectors.
- However, R&D expenditure remains modest relative to major innovation economies, and private-sector participation is uneven.
- Recent policy discussions increasingly emphasise better mapping of R&D finance, outcomes and institutional capabilities, not merely higher expenditure.

Current Landscape of R&D in India

- Emerging technologies such as artificial intelligence, semiconductors, biotechnology and clean energy make indigenous technological capability strategically important.
- As per 'Research & Development Statistics 2025-26' Report of Department of Science and Technology (DST), the GERD as a percentage of GDP was around **0.84% (2023-24) from 0.66% 2019-20**. It is significantly **lower than major economies**:
 - ♦ The **United States and China** spend above 2% of GDP on R&D.
 - ♦ **Israel and South Korea** spend more than 4% of GDP on R&D.
- India's R&D funding is heavily dependent on **public funding** (with about 64% contribution), unlike the case in several leading innovation economies which have more than 60% of the R&D budget contributed by the private sector.
- India's future competitiveness will depend on translating research into products, processes and globally viable firms.
 - ♦ It requires stronger links between laboratories, industry, skilled workers and production ecosystems.

Issues and Concerns in India's R&D Landscape

- **Attention on Inputs:** R&D is generally judged by money spent not capabilities generated, technologies absorbed, products developed or productivity increased.
- **Weak Industry-Research Linkages:** Research institutions and enterprises often operate in isolation, constraining the commercialisation of information and feedback from production.
- **Limited Private Sector Participation:** Businesses may under-invest in long-gestation research because of uncertainty, inadequate risk capital and weak incentives for technological development.
- **Technology Transfer Without Learning:** Importing technology or assembling foreign-designed items does not necessarily generate the capacity to design, improve and produce them on one's own.
- **Fragmented Innovation Ecosystem:** Skills development, R&D, tooling, manufacturing, and market feedback are typically considered as discrete operations rather than pieces of a continuous learning system.

Related Efforts and Initiatives

- **National Research Foundation and ANRF:** Institutional reforms to promote research ecosystems and to stimulate more participation by universities, industry and philanthropy actors.
- **Research, Development and Innovation (RDI) Initiatives:** It is meant to bring in more private sector engagement and long-term funding for strategic and developing technologies.
- **Atal Innovation Mission and Start-up Ecosystem:** Innovation programs support entrepreneurship, incubation and conversion of ideas into commercial viable solutions.
- **Make in India and Production-linked Manufacturing Policies:** Manufacturing policies that relate demand to domestic technological capabilities, skill development, design and indigenous innovation are good.

Tata Motors Case Study: Capability Creation as Technology Transfer

- Starting with the Daimler-Benz joint venture, TELCO evolved beyond assembly to component manufacture and indigenous design.

- ♦ By 1966, it had set up its own R&D facility.
- The successful transfer of technology is thus largely a function of the timing of the end of the foreign partnership in 1969. Telco had acquired the ability to produce trucks by itself.

Way Forward: Bolstering India's R&D Landscape

- India needs to transition from an expenditure-based approach to a capability-based innovation strategy.
 - ♦ The results of R&D should be evaluated in terms of technology absorption, patents of commercial significance, indigenous design competence, productivity benefits and successful products.
 - ♦ Universities, public laboratories, and business need to be connected by joint research platforms and mission-oriented projects.
 - ♦ Manufacturing itself should be a site of learning. Companies need better apprenticeship schemes, design centers, toolmaking capacities and feedback loops between shop floors and researchers.
 - ♦ The use of public procurement and strategic industrial policy can help build markets for local innovation while preserving performance and quality requirements.
- India should benefit from China's emphasis on rapid capability accumulation but not mechanically duplicate its model.
 - ♦ In a world that is very competitive, the ability to learn faster is the differentiator.

Daily Mains Practice Question

India's challenge in research and development is not merely one of inadequate expenditure, but of insufficient organisational capability to learn, absorb and translate knowledge into competitive products. Discuss

