



Boosting R&D for India's Growth

For Prelims: [Science, Technology, Engineering, and Mathematics \(STEM\)](#), [Global Innovation Index 2024](#), [Deep-tech Startups](#), [Quantum Computing](#), [Semiconductors](#), [Anusandhan National Research Foundation \(ANRF\)](#), [DRDO](#), [ISRO](#), [BARC](#).

For Mains: Challenges associated with India's R&D ecosystem and ways to address them.

[Source: HT](#)

Why in News?

India is the **2nd-largest** producer of [Science, technology, engineering, and mathematics \(STEM\)](#) graduates after China. Despite this achievement, **India ranks 39th** on the [Global Innovation Index 2024](#), significantly behind **China (11th)** showcasing **low Research and development (R&D) funding** in India.

What are Key Highlights of the R&D Ecosystem?

- **R&D Funding Status:** India spent **only 0.65%** of its [GDP](#) on R&D in 2022, **China** spent **2.43%**, and **Brazil 1.15%**.
- **Need to Prioritize R&D:**
 - **Economic Growth:** R&D is crucial for India to **compete globally** and shed its [lower-middle-income status](#), and achieve its **productivity potential**.
 - **Industrial Development:** Key sectors such as **pharma, chemicals, and automotive** require technological advancement to compete with developed nations and emerging economies.
 - Also, R&D is needed for [deep-tech startups](#) involved in [quantum computing](#), [biotechnology](#), [robotics](#), and [nanotechnology](#).
 - **Labour-Intensive Sectors:** Rising labor costs demand **innovation** like **automated assembly lines**, integration of **AI & digital tools** for productivity, value, and exports.
- **Global R&D Scenario:**
 - **South Korea:** In 1970, South Korea was **poor but grew rapidly** over two decades, increasing R&D spending from **0.4% to 2.5% of GDP**.
 - Between **1975 and 2005**, it became a **developed nation**, and R&D investment by its corporate sector **rose 800 times**.
 - **China:** R&D spending rose from **0.6% of GDP** in the late 1990s to **2.4% currently**, coinciding with its **best growth years**.

What are the Challenges in India's R&D Ecosystem?

- **Low Investment:** India's R&D spending is much lower than that of advanced economies such as the **US (3.46%)**, **Japan (3.30%)**, **Israel (5.56)**, and **South Korea (4.93)**.
- **Government-Centric R&D:** Indian R&D still **relies heavily on government funding** and

institutions. e.g., In **2020-21**, the **Private Sector Industry** contributed **only 36.4%** of R&D funding.

- **Weak Academia-Industry Link:** Indian research institutions and industries operate in **silos**, **reducing innovation potential**, and **interdisciplinary research**.
 - e.g., **Stanford University** played a central role in the early development of **Silicon Valley** but such coordination lacks in India.
- **Lack of Diversification:** India's R&D efforts have historically focused on a few priority sectors, particularly **defense and space** and ignored **industrial R&D**. e.g., more focus on **missiles (Agni, BrahMos)**, at the cost of **semiconductors**.
 - Indian industries prefer **importing technology (risk averse)**, while **startups** and firms focus on **IT and e-commerce** over deep-tech innovation.
- **Hurdles in Technology Transfer:** Research conducted by **DRDO, ISRO, and BARC** often does not translate into **commercial products** due to bureaucratic hurdles.

What are India's initiatives Related to R&D?

- [Vigyan Dhara Scheme](#)
- [Rashtriya Vigyan Puraskar \(RVP\)](#)
- [Science, Technology, and Innovation Policy 2020](#)
- [VAIBHAV Fellowship](#)

What Reforms Can Strengthen India's R&D Ecosystem?

- **Increased R&D Investment:** India should **increase R&D spending** over the next decade, with a **significant** share coming from the **private sector**.
 - Utilise [Anusandhan National Research Foundation \(ANRF\)](#) by encouraging **private sector and philanthropic investments** in research.
 - **Rs 1 lakh crore innovation fund** announced in the **union budget 2025-26** should be disbursed **within 3-5 years to boost deep-tech R&D**.
- **University-Led Research Model:** Indian **Higher Education Institutions (HEIs)** can carry out **upstream research** pushing forward the **frontiers of knowledge** and can help industry **commercialise mature technologies** for the market.
- **Efficient Project Management:** ANRF can follow the [US Defense Advanced Research Projects Agency \(DARPA\)](#) model with efficient programme managers, transparent funding, and a **CEO-led team**.
- **Risk Taking:** Early-stage research involves **open-ended exploration** that may not always succeed but leads to **future breakthroughs**.
 - The government should **track projects** while allowing some **risk-taking**.

Conclusion

India's **economic future** hinges on **robust R&D investment, industry-academia collaboration, and policy reforms**. By increasing **funding, fostering innovation** in universities, and embracing **risk-taking**, India can break free from the **middle-income trap** and emerge as a **global S&T leader**, driving economic growth and technological self-reliance.

Drishti Mains Question:

Analyze the challenges in India's R&D ecosystem and suggest measures to enhance innovation-led growth.

Prelims

Q. Which of the following statements is/are correct regarding National Innovation Foundation-India (NIF)? (2015)

1. NIF is an autonomous body of the Department of Science and Technology under the Central Government.
2. NIF is an initiative to strengthen the highly advanced scientific research in India's premier scientific institutions in collaboration with highly advanced foreign scientific institutions. Select the correct answer using the code given below:

- (a) 1 only
(b) 2 only
(c) Both 1 and 2
(d) Neither 1 nor 2

Ans: (a)

Mains

Q. Give an account of the growth and development of nuclear science and technology in India. What is the advantage of fast breeder reactor programme in India? (2017)

Q. Scientific research in Indian universities is declining, because a career in science is not as attractive as are business professions, engineering or administration, and the universities are becoming consumer-oriented. Critically comment. (2014)

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