India’s R&D Challenge: From Engineering Talent to Research Intensity

An evidence review of expenditure, institutions, people, patents and technological capability

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Direct answer. India’s research system combines genuine strengths with a persistent investment and institutional gap. The country has globally capable firms and public laboratories, a large science and engineering workforce, rising resident patent activity, and innovation clusters with international reach. Yet official data put gross domestic expenditure on R&D at only 0.64% of GDP in 2020–21, with government carrying a larger share than in most research-intensive economies. The strategic task is not simply to raise a headline ratio. India must expand competitive and patient funding, strengthen research careers and university infrastructure, induce more firms to perform R&D, improve collaboration and technology diffusion, and evaluate outputs for quality, reproducibility and public value.

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1 Definitions and evidence base

The review separates financing from performance and distinguishes R&D inputs, scientific outputs, invention, innovation and diffusion. It uses DST statistics, higher-education data, patent administration, WIPO indicators and official policy documents with explicit data years.

2 Expenditure level and intensity

Nominal GERD more than doubled between 2010–11 and 2020–21, while GERD remained 0.64% of GDP in 2020–21. The ratio is useful for comparison but must be read with sectoral structure, purchasing power and coverage.

3 Institutional composition

Public missions created world-class capabilities, while business and university research remain uneven. Sustainable expansion requires predictable grants, modern research administration, shared facilities and stronger links that preserve independent inquiry.

4 People and careers

Graduate and doctoral counts do not establish active research capacity. Researcher density, technical staff, supervision, career stability, inclusion, mobility and access to infrastructure determine the effective workforce.

5 Patents, publications and quality

Rising resident patenting and publication scale are meaningful, but counts differ in quality and economic relevance. Patent families, licensing, citations, replication, data availability, corrections and field-normalised peer assessment provide stronger evidence.

6 Innovation performance and clusters

WIPO's 2025 ranking characterises India as a long-running innovation overperformer with stronger outputs than inputs. Composite ranks depend on model and data availability; cluster success should be studied alongside regional concentration and diffusion.

7 Firms, procurement and technology diffusion

Business R&D responds to markets, competition, exports, finance, skilled labour and credible demand. Procurement and standards can support prototypes and adoption, while worker movement, suppliers and open tools spread knowledge beyond formal licensing.

8 Governance, integrity and evaluation

ANRF's promise depends on additional resources, transparent peer review and broad access. Programme evaluation should track money from call to outcome and reward rigor, public value and adoption rather than raw counts.

9 Strategic implications

A balanced portfolio combines investigator-led research, mission programmes, infrastructure, demonstrators and diffusion. International collaboration and diversified supply relationships complement domestic absorptive capacity.

10 Evidence assessment

Strong	India's measured R&D intensity has remained below 1% of GDP and was 0.64% in 2020–21.
Strong	India has substantial innovation outputs and internationally significant scientific and technology capabilities.
Strong	Research capacity and funding are concentrated across sectors, institutions and places.
Probable	Predictable competitive funding, stronger university capacity and greater business performance of R&D would raise the breadth and durability of innovation.
Contested	The exact economic return to individual tax incentives, missions and patent increases without programme-level counterfactual evaluation.
Unsupported	The claim that patent, publication or graduate counts alone prove a high-quality and widely diffused research system.

11 Conclusion

India's innovation system is neither a failure nor yet commensurate with the country's scale. Strong public missions, technology firms, scientific output and rising resident patenting demonstrate real capacity. A low and long-stagnant GERD ratio, uneven university infrastructure, limited firm participation and geographic concentration show the unfinished work. The next phase should finance excellent research predictably, build careers and institutions, stimulate experimental development in firms, and judge success through quality, diffusion and public value.

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This paper is an evidence review for public scholarship.

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