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India's next leap: Powering a rising nation through research and innovation

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Good research often stays inside academic journals because industry keeps funding incremental improvements



For most of the last three decades, India competed on scale. A young workforce, a fast-growing entrepreneurial base and an ability to execute at volume turned the country into the world's back office, a manufacturing destination, and one of the fastest growing large economies. That approach worked well, and it is still working. But it is no longer enough on its own.

The next round of global competition will be decided less by who can build more and faster, and more by who discovers something first, patents it first, and gets it to market faster. Artificial intelligence, biotechnology, quantum computing and clean energy are changing what counts as economic leadership. Scientific capability now matters as much as industrial capacity, and that is the shift India has to make.

There is no shortage of intent from the government. The Anusandhan National Research Foundation, the Research, Development and Innovation Scheme, the IndiaAI Mission, the National Quantum Mission, BioE3 and the India Semiconductor Mission all say the same thing: research is no longer treated as an academic pursuit, it is treated as an economic one. That is a genuine shift in how the state sees science.

Where things get harder is after the policy is announced. A mission or a fund can put money into a lab. It cannot, by itself, decide whether that lab's work ever becomes a product, a company or a patent that means anything commercially. That conversion, from research to enterprise, is where most of India's effort is still thin.

The spending gap gets too much attention

India's gross expenditure on research and development has more than doubled over the last decade, moving from about Rs [60,000 crore](#) in 2010-11 to close to Rs 1.27 lakh crore in 2020-21. Recent budgets have added significantly more on top of that, alongside new schemes meant to bring private capital into research funding for the first time.

Even with that growth, India's R&D spending sits around [0.64%](#) of GDP, well below countries like China, South Korea or Israel. It is easy to look at that number and conclude the problem is simply underfunding. The more useful question is what each rupee of that spending actually produces. Papers published and patents filed are simple to count, and simple to inflate, but they tell you very little about whether an idea ever turned into a working technology or a functioning business. Judged against that standard, the funding gap looks more like a symptom of a system that has not yet learned to convert research into value, rather than the root cause itself.

Talent is not the constraint

By almost any measure, India's scientific talent base is remarkable. Millions of STEM graduates enter the workforce every year, and the country produces one of the largest cohorts of doctoral researchers in the world. India also does better than most economies on gender representation in STEM with women comprising roughly 43% of its total STEM graduate pool, which deserves more credit than it usually gets.

The problem shows up after graduation. Good research often stays inside academic journals because industry keeps funding incremental improvements instead of taking bigger bets on unproven ideas. Plenty of capable researchers still choose to build

their careers abroad, and it is rarely because India lacks potential. It is usually because other countries offer steadier funding, better infrastructure and a clearer route from lab to market. So the real issue is not that talented people leave India. It is that India has not yet built enough places where staying is the more rewarding choice.

A few institutions already show what works

There are working examples of this done right. IISc, the IITs, CSIR laboratories, BIRAC and C-CAMP have all demonstrated that when a research institution builds a genuine working relationship with industry, science actually crosses over into commercial products. The task now is not inventing a new model. It is expanding what already works in a handful of institutions until it becomes how the whole system operates.

You can already see the early signs of this in specific sectors. India built its global reputation in healthcare as the pharmacy of the world through generics, and it is now trying to move further up the chain into biologics, genomics and personalized medicine, which means inventing new therapies rather than manufacturing cheaper versions of old ones. In artificial intelligence, the combination of digital public infrastructure and growing compute capacity under the IndiaAI Mission gives the country a real shot at building its own capability instead of importing someone else's models. Semiconductors, electric mobility and green hydrogen carry the same logic.

The goal in each case is to help set the direction of these technologies early, rather than adopting them years after other countries have already defined the standards.

Private capital has to show up

None of this happens quickly, and that is exactly why private industry needs to take on a bigger share of the burden. In the economies that actually lead on innovation, businesses fund most of the research because they see it as a long term competitive advantage rather than a cost to be trimmed whenever budgets tighten. Indian industry has not made that shift yet, and until it does, public money will keep carrying weight that should belong to the market.

Access to research infrastructure also needs to stop being concentrated in a handful of cities. I-STEM has made real progress giving researchers and startups shared access to expensive scientific equipment, but most of the country's serious research capacity is still sitting in a small number of metros. The talent in Tier-II and Tier-III India is real. What is missing is the lab access to actually put it to work.

And the pipeline needs to start earlier than graduate school. Undergraduate research opportunities, interdisciplinary programs, and classrooms built around solving problems rather than memorizing answers are what eventually produce people capable of doing any of the rest of this.

What 2047 will actually measure

India has set 2047, a century after independence, as the year it becomes a developed nation. Whether that happens will depend less on the headline GDP growth rate and more on something harder to put a number on: whether India starts building technologies the rest of the world adopts, instead of products the rest of the world simply buys.

History has a habit of remembering countries not for how efficiently they manufactured someone else's ideas, but for the ideas they had first. India already knows how to build at scale. What it has not yet proven is that it can turn scientific discovery into enterprise consistently, not just inside a few standout labs but across the system as a whole. The talent is there. The policy intent is there. What remains is whether the country can bring the two together into something that actually functions as one ecosystem, rather than a set of good ideas running in parallel.

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