SSN Journal of Management & Technology Research Communications
Vol 2 No (2) May-Jun-Jul-Aug 2025
Society for Science and Nature
E-ISSN: 3049-0014
CrossRef DOI: https://dx.doi.org/10.21786/mntrc

OPEN ACCESS

Research and Development Fund Management Strategies in the Indian Subcontinent: Analytical Review

Shaima Ali Miraj*
Department of Public Health, College of Health Sciences,
Saudi Electronic University, 11673 Riyadh, Saudi Arabia.

ABSTRACT

Research grants are essential elements of scientific and technological development, directly affecting the calibre and extent of the scientific pool from colleges and universities. As the bulk of research in India is carried out by its vast number of colleges and universities, under the aegis of UGC and other state research funding agencies, the technological developments are far from the reach of industries and corporate organisations. It is not surprising that most of this research is career-oriented, aiming only to complete the formalities of career promotions, after the mandatory degrees of research, the PhDs. Institutional researchers under pressure of promotion and burden of teaching, only carry out aimless research, piling useless and irrelevant data. Though India has experienced a consistent rise in research spending, concentrating on critical domains such as healthcare, space exploration, artificial intelligence, renewable energy, and sustainable development. The mismanaged distribution of these monies frequently mirrors overarching governmental agendas and fiscal limitations, affecting the development of these high-tech fields and institutions that garner the most assistance. Such gaps need to be seriously looked into. This needs to be executed properly to compete with the developed world in research and development and to justify India's huge scientific manpower. It's a matter of proper and judicious management of both the funds and the potential of the country. We have to focus on calls for strategic planning and policy formulation that align with the aspirations of positioning India at the forefront of groundbreaking research and technological advancements. There is no dearth of talent and sources; only proper management is required for taking India's huge manpower in research and development to its true potential and efficient deliverables.

KEY WORDS: SCIENTIFIC RESEARCH AND TECHNOLOGICAL DEVELOPMENT FUND MANAGEMENT STRATEGIES.

INTRODUCTION

According to a recent article by Ali [1], choosing science as a career for teaching and research in higher education is on a decline, as other fast-track job options with fast and greater rewards are available in the corporate world. An example cited in his article shows an interesting instance in the US where a young, brilliant academic abruptly left her PhD to become a content provider on social media, earning millions.

If this is the situation, core science may have a back seat soon, as India's biggest educational disadvantage has been the lack of high-quality schools and colleges across the nation, mostly in the majority of the rural population. This is

Article Information: *Corresponding Author: shaima.s.ali@gmail.com
Received 25/03/2025 Accepted after revision 28/06/2025
Publication Date: 31st Aug 2025 Page Number: 50-55

Available at: https://mntrc.in/
DOI: http://dx.doi.org/10.21786/mntrc/2.2.1

mainly because, historically, out of all the sectors, in terms of funding, education has never been given much emphasis and priority. The annual higher education budgets speak of the tragedy, coupled with the fact that appointments in such structurally weak institutions, infamous for contractual and low salaries, have often been controversial.

Research grants are essential elements of scientific and technological development, directly affecting the calibre and extent of the scientific pool from colleges and universities. In India, research grants are predominantly allocated by governmental bodies, including the Department of Science and Technology (DST), the University Grants Commission (UGC), the Indian Council of Medical Research (ICMR), the Council of Scientific and Industrial Research (CSIR), Indian Council of Agricultural Research (ICAR) the Department of Biotechnology (DBT) and the Indian Space Research Organisation (ISRO).

Moreover, financial support from international entities such as the World Bank, UNESCO, and the Bill & Melinda Gates Foundation, along with private sector initiatives from firms and philanthropic foundations, enhances the research environment, which is limited to a few prestigious institutes like the IITs and IIMs. In this review, the reasons for the mismanagement of research and development grants to universities and colleges are discussed along with a futuristic perspective and analysis. It calls for strategic planning and policy formulation that aligns with the aspirations of positioning India at the forefront of groundbreaking research and technological advancements.

METHODOLOGY

Literature survey using library sources like PubMed, Scopus and Web of Science, along with articles from other databases have been critically examined and used in the study. Questions were designed to assess the research and development fund management strategies in the Indian subcontinent. Information was gathered from reliable sources, organising. Steps included researching the topic, drafting a clear summary and making a perspective for the review and concluding it with recommendations.

OBSERVATIONS AND DISCUSSION

According to the findings of Skill India Report [2], and other reports from industry, special-purpose committees formed over the years have only served to reinforce the challenges and negative perception of the broader education sector (The Indian Higher Education [3].

As the bulk of research in India is carried out by its vast number of colleges and universities, under the aegis of UGC and other state research funding agencies, the technological developments are far from the reach of industries and corporate organisations. It is not surprising that most of this research is career-oriented, aiming only to complete the formalities of career promotions, after the mandatory degrees of research, the PhDs. Institutional researchers under pressure of promotion and burden of teaching, only carry out aimless research on research.

Mainly for these reasons, the majority of the government educational institutions lack basic infrastructure and amenities in major, highly populated states of India. This is more so prevalent in areas where most of the schools are inadequately endowed with even the most basic facilities, such as ideal classrooms, sufficient washrooms, libraries, and laboratories.

This poor infrastructure has an impact on the learning of the students and their development all around, particularly in science and technology and its development meeting global standards. Though India has experienced a consistent rise in research spending, concentrating on critical domains such as healthcare, space exploration, artificial intelligence, renewable energy, and sustainable development. The distribution of these monies frequently mirrors overarching governmental agendas and fiscal limitations, affecting which fields and institutions garner the most assistance. This has been to compete with the developed world in research and development and to justify its huge scientific manpower. It is interesting to understand why Asia's one of the biggest countries' science and technology funding landscape is stuck, and how we can unstick it. Asia’s rise as a global innovation hub is undeniable—think China’s quantum leap in 5G, South Korea’s semiconductor supremacy, and India’s burgeoning biotech scene. Yet, beneath the glittering headlines lies a tangled web of funding friction that slows the pace of truly breakthrough research, leading to bridging the gap from lab to field.

India’s spending on research and development (R&D) is significantly lower than that of global leaders. Based on recent estimates, The United States invests approximately $784 billion annually in R&D, China allocates around $723 billion, whereas India spends about $71 billion. This places India’s R&D expenditure at roughly 10% of US and China’s levels. In terms of GDP share, India spends 0.65%, while the US spends around 3.5%, and China around 2.4%. According to an Indian Express Report [4], investments in science and technology are vital for building India’s capabilities to address developmental challenges and for securing its strategic future. They will determine the nation’s capacity to compete in emerging technologies such as artificial intelligence and quantum computing—especially amid shifting trade policies. This calls for greater investment in cutting-edge research and a stronger culture of innovation across universities, research institutions, and industry. The key question, however, is whether India is investing enough to strengthen its science and technology ecosystem.

Successive governments have repeatedly pledged to raise the gross expenditure on R&D (GERD) from the long-stagnant level of 0.7 per cent to at least 2 per cent of GDP. Yet, India’s GERD-to-GDP ratio has barely moved up for three decades. The country remains far below the OECD average of 2.7 per cent, and behind South Korea (4.9 per cent), Japan (3.4 per cent), and China (2.8 per cent), [5].

About 58-60 per cent of India's GERD is concentrated in strategic sectors such as atomic energy, space, and defence, leaving only 40 per cent for civilian agencies. The university sector—with over 1,100 universities and 48,000 colleges—receives just 7 per cent of GERD despite producing more than half of all science and technology publications, while public companies contribute a mere 4 per cent. How can India overcome this persistently low level of R&D funding? [5].

India's investment in research and development (R&D) has been quite slow, decreasing from 0.82% of its GDP in 2009-10 to 0.64% in 2020-21. As noted by the Department of Science and Technology in a 2023 report, most developed countries spend more than 2% of their GDP on R&D. However, India's R&D investment has been lower than that of Germany (3%), Japan (3.3%), the USA (3.5%), and China (2.4%) [5,10].

Gross expenditure on R&D is driven mainly by the central government, state government, private and public sector industries, and higher education institutions (HEI). The significant expenditure on research in India is incurred by the public sector. In the Union Budget 2025-26, to drive private sector investment in research and innovation, the amount allocated to the Department of Science and Technology (DST) has been increased from INR 8,029 crore to INR 28,508.90 crore, which is a significant share of the government, but how much is technically and scientifically useful is to be seen.

While the budget stressed the role of the private sector in R&D and academia, the issues about research in HEIs remain unresolved. Going forward, the question arises on the measures that need to be taken to ensure effective implementation of the budgetary allocations, keeping in mind the need for industry-academia cooperation, higher research impact, and more interdisciplinary collaboration. India must address the specific challenges that it faces in HEIs to advance its research landscape. Systematic issues such as delays in the disbursement of funds, excessive procedural barriers, bureaucratic inefficiency, and multiple barriers to fieldwork all hinder the development of research in HEIs.

Articles by Ali and Choudhary [1,9] have attempted to identify how these primary concerns make research unsustainable for scholars, especially about the accessibility of funding. The variations in the research impact of public and private education institutions, and recent developments in the research ecosystem, are also discussed. The responsibility of the institutions in the process of disbursing funds, through fellowships or scholarships, cannot be ignored. There have been instances of universities not completely utilising their funds. In 2017, CSIR decided to remove the role of universities for fund disbursement and began paying scholars directly, although the move was followed by further issues with the direct transfer scheme. There have been various instances of funds being withheld from scholars by their universities or colleges [9].

A large portion of R&D funding in India continues to come from the public sector, whereas in countries like the US and China, the private sector plays a major role. Government coffers still dominate R&D spending in many Asian nations (70-80% of total R&D funding in China and India comes from public sources). Private-sector investment lags far behind the OECD average, especially in basic research. Public money is great for long-term, high-risk projects (quantum computing, advanced materials), but it often gets trapped in bureaucratic red tape. Private capital, on the other hand, moves fast—think venture-backed startups sprinting to commercialise AI algorithms—but shies away from "pure science" that lacks immediate returns of investments (ROIs).

According to Ahmad [4], uncertainty is expected to impact research and development (R&D), a crucial sector of the economy for sustained growth. R&D is widely regarded as a critical source of long-term economic stability and sustainable growth, not only by increasing competition in industries, markets, and macroeconomic economies but also by encouraging production, consumption, and exports. Due to this fact, countries make their economic policies based on their past experiences, present needs, and visualizing futuristic development programs.

However, unfortunately, the plans seldom materialise as conceived because economic policy uncertainty (EPU) often distracts from economic outcomes [5]. On the other hand, in order to generate innovative patents, adequate financial resources for R&D are required. Unfortunately, when budgeting for economic policies, most countries do not prioritise R&D, as noted by Khan et al.[6].

Without proper economic development and planning, R&D will suffer beyond repair. Long-term economic development requires R&D, and countries develop economic policies that envision innovation development programs. However, economic policy uncertainty frequently distracts from economic outcomes [7]. Such economic distractions affect the country's planning and development of science and technology, leading to hindrance of research and development by creating delays and deficits, resulting in economic squeezing where it is required most.

It can be compared to a situation: Imagine a marathon where the government hands you a heavy backpack full of rules (delayed presentations and grant approvals, time-consuming appraisals, local and government audit cycles as obstacles) while the private sector is the sprinter who wants to dash ahead without carrying extra weight. The race stalls when neither can hand off the baton smoothly.

Or think of another situation: Picture a chef trying to cook a gourmet meal with a broken oven—talent is there, recipe is there, but the kitchen simply can't deliver, due to a shortage of ingredients. Indian labs complain this almost everywhere; national labs often rely on ageing instruments; a 2022 survey showed 43% of researchers cite "inadequate facilities" as the top barrier to high-impact work. In most of our institutions, rapid urbanisation strains grid

power, causing intermittent outages that disrupt sensitive experiments.

The large human capital with a continuous talent pipeline produces millions of STEM graduates yearly, yet many end up brain-draining to Western shores or slipping into non-R&D jobs because of limited research-specific funding and stipend support. Notwithstanding the augmented financing, numerous obstacles impede the efficient allocation and application of research grants. Bureaucratic obstacles, delays in money allocation, and a convoluted application procedure frequently dissuade researchers, especially early-career academics, from obtaining funding. Addressing the barriers to policy implementation in India's R&D landscape, specifically in higher education institutions, is essential for fostering a more sustainable research ecosystem. For instance, the budget for research-related initiatives—such as the National Initiative for Design Innovation, Startup India Initiative in Higher Educational Institutions, Unnat Bharat Abhiyan, Implementation of the IMPRINT Research Initiative, and more—dropped from INR 355 crore to INR 327 crore. However, only INR 74.5 crore was utilised in the last fiscal year. This is indicative of a gap between policy and implementation, leading to further deceleration in R&D in India.

The allocation of funding predominantly benefits established institutions like IITs, IISc, AIIMS, and central universities, whilst smaller universities, private institutions, a large number of well-equipped colleges, and regional research centres receive minimal financial assistance. This inequitable allocation hinders the advancement of research in nascent and rural institutions, resulting in a skewed academic and innovation landscape.

In China, more than 1.2 million PhD holders are in science/engineering, but only ~30% stay in domestic academia. In India, approximately 24,000 to 25,000 PhDs were awarded annually around 2017–2019, according to the OECD and All India Survey of Higher Education (AISHE) report. Total PhD enrolment has increased significantly in recent years, reaching over 2.12 lakh (212,474) in 2021-22 [8].

It is a harsh reality that we have rivers that feed fertile valleys but whose waters are siphoned off before reaching the fields. The "river" here is the massive graduate output; the "fields" are domestic research labs starved of funding to retain talent. Researchers spend more time filing paperwork than filing papers, and promising projects stall before they even start. Strategic blind spots are missing the "Blue-Ocean" Opportunities.

Governments often allocate funds to established sectors (defence, energy) while emerging "blue-ocean" fields—quantum sensing, synthetic biology, climate-resilient agriculture—remain underfunded. This harms the generations of the future, affecting scores of aspiring minds to change course. Instead of taking up science as a career, they opt for fast food-like courses to provide them quick returns, abandoning careers that can be nutrients of a starving nation,[1].

There are cases of so many young postdocs who secure modest grants from prestigious funding agencies but land elsewhere as their projects are stalled due to unforeseen and unpredictable events arising out of blues. The projects get stalled, post-doc positions get ended, and eventually, brilliant young scientists join foreign labs that offer thousands of dollars without any barriers. Without simpler IP-sharing frameworks and faster grant disbursement, we risk losing our brightest minds to overseas labs—exactly the opposite of what policymakers want.

We have to develop a policy to avoid this standing at a crossroads: we must leverage a massive public R&D spend or unlock private dynamism to fuel the next wave of breakthroughs. The path forward isn't rocket science—it's simpler processes, shared infrastructure, and strategic foresight that puts talent and risk-capital on the same side of the table.

According to the report of Deka in India Today [12] a Centre of Excellence in Artificial Intelligence for Education has been announced with an outlay of Rs 500 crore, aligning with the government's focus on emerging technologies. However, this promising initiative is overshadowed by a sharp cut in funding for the much-touted 'World Class Institution' scheme, which has plummeted from Rs 1,800 crore in the last Budget to Rs 475 crore, a staggering 73.61 per cent decline. The actual expenditure last year was Rs 1,000 crore, which further underscores the inconsistency between stated intent and financial support.

An allocation of Rs 20,000 crore has been earmarked to drive a private sector-led initiative focused on research, development and innovation. Additionally, over the next five years, 10,000 PM Research Fellowships will be awarded for technological research in IITs and IISc (Indian Institute of Science), with increased financial support. To truly revolutionise education, the government must move beyond incremental increases and substantially invest in research, digital transformation and foundational learning. Otherwise, Budget 2025 risks being yet another case of big promises, small funding [12].

Let us revise our methods of awarding Research Excellence Fellowships, giving priority areas like AI, quantum, and clean energy, using Dual appointment models, letting researchers split time between academia and industry with no bureaucratic red tape. We must adopt one-stop shop online portals (Singapore's Research Innovation Enterprise model) and set outcome-based milestones; reward speed over paperwork.

We do not have industry academic researches resulting in a big disconnect: Corporations prefer importing turnkey tech to nurturing homegrown R&D, leaving universities whispering into an empty void, leading innovations to stay stuck in lab notebooks, never reaching market shelves. We must develop co-funded labs, where industry pays 50 % of operational costs, and IP sharing frameworks that guarantee fair royalties for inventors.

Another complexity is the serpentine web of ethical clearance for clinical trials, which can take months and years, involving red tape of multiple agencies (ICMR/ CPSEA /AYUSH CDSCO) demanding overlapping paperwork. This needs urgent simplification and transparent single window platforms. For instance, let us have a single ethical review board for multi-centre studies. - Clear-cut guidelines on data privacy for genomic research patents and other top areas of public health and welfare.

Publication pressure and quality are another big issue. Publish or perish pushes researchers toward quantity over rigour, inflating low-impact journals. Consequently, it sends Indian research into chaos and sidelines it in global citation networks. This can be done by using quality over quantity incentives (rewarding high-impact papers, patents). Mentorship programs to teach robust experimental designs and achieve time-bound goals.

The barriers—funding scarcity, flaky infrastructure, brain drain, bureaucratic red tape, industry academia divide, regulatory complexity, and publication pressure—are not insurmountable. What can we do next? Pick one lever that resonates most with you—streamlined funding portals, facility upgrades, talent retention fellowships, simpler regulations, or industry academia partnerships—About 43% of researchers cite “inadequate facilities” as the top barrier, where rural labs report ~30% downtime due to grid failures [11, 12] .

DST funds ~₹3,000 crore annually, yet ~40 % of approved projects stall midway due to delayed disbursements [13] (DST Annual Report, 2022), resulting in frustration and brain drain. Only 30 % of Indian PhDs stay in academia domestically (2023 UNESCO Science Report).Top destination: USA (~45 %), followed by Germany (~20 %). Conclusively Indian government is striving hard to increase the nation's research output by several pathbreaking measures. Niti Ayog a Government of India initiative, [13] in its recent report on improving the culture of R&D in Indian Universities and Colleges, found that in response to this imperative, the Government of India has orchestrated various strategic initiatives to fortify R&D in India.

These endeavours encompass targeted missions such as the Startup India initiative, the implementation of schemes like FIST (Fund for Improvement of S&T Infrastructure in Universities and Higher Educational Institutions), PURSE (Promotion of University Research and Scientific Excellence), and the establishment of Science and Technology (S&T) clusters. While these measures have yielded certain improvements, the Global Innovation Index (GII) underscores that, despite progressing from 52 to 40 between 2019 and 2023, India still requires refinement in terms of institutes and infrastructure. Notably, India exhibits strength in market sophistication but lags in creating a robust research ecosystem [13].

According to the report of Niti Ayog [13], there is a considerable teaching-research imbalance in Indian colleges and universities: The challenge of teaching-research imbalance within State Universities and Institutes underscores a systemic issue that impacts the overall academic landscape. This imbalance, characterised by a disproportionate emphasis on teaching over research activities, engenders a host of challenges that permeate the core functions of these institutions.

At the heart of this challenge is the overshadowing of research pursuits by the predominant focus on teaching responsibilities. In an environment where teaching often takes precedence, the allocation of time for research endeavours becomes a scarce commodity. This temporal constraint directly translates into limitations on the depth and breadth of research activities undertaken by faculty members and researchers within these institutions. In addition to time constraints, the teaching-research imbalance manifests in the unequal distribution of resources.

State Universities and Institutes, grappling with competing demands, may allocate a larger share of resources to teaching-related initiatives, inadvertently neglecting the essential components required to foster a robust research ecosystem. This resource asymmetry can hinder the acquisition of research-specific tools, funding for projects, and support for scholarly publications. The detailed report systematically unpacks the diverse challenges faced by these institutions, ranging from funding constraints and teaching-research imbalances to faculty mindset and administrative hurdles. It puts forth actionable recommendations, spanning from the establishment of R&D committees and infrastructure development to faculty incentives, industry partnerships, and international collaborations.

As a nation's technological superiority is a major determinant in its global economic competitiveness, government-led support programs for private firms [14,15] and collaborative R&D projects have gained greater importance in developing technologies [16,17]. As depicted by Leydesdorff and the Stanford University Triple Helix Research Group [18,19], in the Triple-Helix Model, government, universities, and industries all play critical roles in collaborative R &D projects to succeed globally. Building on the triple helix model, the quadruple helix model adds a fourth component to the framework of interactions between university, industry and government: the public, consisting of civil society and the media [20]. Thus for a better understanding and management of research and development funding, it is necessary to bring all the concerned stakeholders together and work in a transparent manner for nations scientific and technological development.

CONCLUSION

In concluding this article, it is suggested that, as we have so many committees and experts working tirelessly, the conclusion of so many reports should not just be a mere summary gathering dust; it is a compelling plea for the Government of India to recognise the transformative power embedded in these vital recommendations. It calls for strategic planning and policy formulation that aligns with the aspirations of positioning India at the forefront of groundbreaking research and technological advancements. There is no dearth of talent and sources; only proper

management is required for taking India's huge manpower of research and development to its true potential and efficient deliverables.

Conflict of interest: The author declares no conflict of interest.

Data Availability: All data are available from the corresponding author on reasonable request.

REFERENCES

1. Ali A.S. Scientific Research and Development in Indian Higher Education: Problems and Challenges. Biosc. Biotech.Res. Comm. 2024;17(4).
2. India Skills Report (2019). All India Council for Technical Education (AICTE). https://www.aicte-india.org/sites /default/ files/India%20Skill%20Report-2019.pdf
3. The Indian Higher Education (2022): Vision 2040 (2021 February), FICCI
4. Ahmad, M., Haq, Z. U., Iqbal, J., & Khan, S. (2022). Dating the business cycles: Research and development (R&D) expenditures and new knowledge creation in OECD economies over the business cycles. Journal of the Knowledge Economy, 1–45.
5. Ahmad, M., Khattak, S. I., Khan, S., & Rahman, Z. U. (2020). Do aggregate domestic consumption spending & technological innovation affect industrialisation in South Africa? An application of linear & non-linear ARDL models. Journal of Applied Economics, 23(1), 44–65.
6. Khan, M. A., Qin, X., Jebran, K., & Ullah, I. (2020). Uncertainty and R&D investment: Does product market competition matter? Research in International Business and Finance, 52, 101167.
7. Bin Wang Samia Khalid Hamid Mahmood: R&D Spending and Economic Policy Uncertainty in Asian Countries: an Advanced Panel Data Estimation Study J Knowledge Economy 2023 March-30 1-20
8. All India Survey of Higher Education (AISHE) Report 2021-2022
9. Choudhary A Delay and Denial: Issues with Research Funding in Higher Education Institutions March 7, 2025 https://sprf.in/delay-and-denial-issues-with-research-funding-in-higher-education-institutions/
10. Research & development statistics at a glance 2022-23 Department of Science & Technology 2022-2023 Department of Science & Technology Ministry of Science & Technology Government of India New Delhi-110016 (India) March 2023
11. Survey of Indian Research Institutions, A Technical Report 2022
12. Deka A: Budget 2025: Big thrust on research, innovation, AI, but where's the money? https://bestcolleges.indiatoday.in/news-detail/budget-2025-big-thrust-on-research-innovation-ai-but-wheres-the-money
13. NITI (National Institution for Transforming India) Ayog Report On Improving the Culture of Research and Development (R&D) in State Universities and Institutes 2024 https://www.niti.gov.in/sites/default/files/2024-06/State Uni R&D _Final Report-Designedv3%20%281%29.pdf
14. Guo D et al. Government-subsidised R&D and firm innovation: evidence from China Res. Policy (2016).
15. Szczygielski K et al. Does government support for private innovation matter? Firm-level evidence from two catching-up countries Res. Policy 2017
16. Calvert J et al. University-industry research collaborations in the UK: bibliometric trends Sci. Public Policy (2003)
17. Katz JS et al. What is research collaboration? Res. Policy 1997
18. 18. The Triple Helix Concept. Stanford University Triple Helix Research Group. 11 July 1 2011.
19. Leydesdorff, Loet. The Knowledge-Based Economy and the Triple Helix Model. University of Amsterdam, Amsterdam School of Communications Research. arXiv:1201.4553. Bibcode:2012arXiv1201.4553L. 2012
20. Elias G. Carayannis EG and David FJ Campbell Mode 3' and 'Quadruple Helix': toward a 21st century fractal innovation ecosystem International Journal of Technology Management Vol. 46, No. 3-4 Published Online: February 23, 2009 pp 201-234https://doi.org/10.1504/IJTM.2009.023374.