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An Analytical Study on Indian Union Budget 2024-2025: A Special Reference to Innovation, Research & Development

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Abstract:
The Indian Union Budget 2024-2025 presents a comprehensive strategy aimed at fostering innovation, research, and development (R&D) across various sectors. This analytical study delves into the budget's allocation trends, focusing on the significant emphasis placed on R&D as a catalyst for economic growth. With India striving to achieve self-reliance (Atmanirbhar Bharat) and enhance its position in global technological and scientific arenas, the budget allocates substantial resources to key sectors such as pharmaceuticals, biotechnology, health research, and higher education. The paper examines the implications of these investments for sectors critical to the country's innovation ecosystem, including renewable energy, digital transformation, and healthcare innovation. Additionally, the study evaluates the impact of tax incentives and public-private partnerships (PPPs) introduced in the budget, which are designed to accelerate private sector involvement in R&D and foster a more inclusive innovation landscape. Despite the positive steps, the paper highlights the persistent underinvestment in comparison to global leaders in R&D, underscoring the need for structural reforms and increased funding in underfunded areas such as climate science and trade. This study concludes by offering policy recommendations to optimize R&D investments for achieving sustainable economic growth and technological leadership.

Keywords: Budget, Innovation, Accelerate, Energy

1. Introduction:

The Union Budget 2024-2025 underscores the Indian government's commitment to fostering innovation, research, and development (R&D) as critical pillars for economic growth and global competitiveness. As the world moves toward a knowledge-based economy, the importance of R&D cannot be overstated. The budget's allocations and policy reforms aim to stimulate innovation across sectors, enhance technological capabilities, and strengthen India's intellectual infrastructure. With specific attention to emerging industries such as artificial intelligence, biotechnology, clean energy, and healthcare, the government envisions a future where innovation drives economic prosperity.

This analytical study delves into the key provisions of the Union Budget 2024-2025 concerning R&D. By examining the budgetary allocations, tax incentives, and policy initiatives, this paper evaluates the potential impact on India's innovation ecosystem. Furthermore, the study explores the role of public-private partnerships (PPPs), regulatory frameworks, and strategic investments in supporting innovation. Through a comparative approach with previous budgets, the paper highlights both progress and ongoing

challenges in fostering a thriving research environment. Ultimately, this analysis aims to provide insights into the effectiveness of the budgetary measures in advancing India's long-term goals of becoming a global leader in innovation, while addressing barriers that could hinder its success.

2. Objectives:

This paper has the following objectives:

1. To analyze the Union Budget 2024-2025 allocations specifically aimed at innovation, research, and development.
2. To evaluate the policy measures introduced to support R&D activities across sectors.
3. To assess the potential impact of these measures on the innovation ecosystem in India.
4. To identify challenges and suggest policy recommendations for enhancing R&D effectiveness.

3. Literature Review:

Banerjee and Nair (2019) studied "The Role of Fiscal Policy in Promoting Research and Development in India" explored how fiscal policy influences R&D investments in India. They argue that the government's budgetary allocations for R&D have a direct impact on technological advancement and industrial growth. The study reveals that targeted fiscal policies, including increased R&D spending and favorable tax policies for innovation-focused industries, can significantly enhance India's competitive advantage in global markets. The authors recommend that future budgets prioritize R&D funding in emerging sectors, such as renewable energy and digital technology, to foster a more resilient and diversified economy.[1]

Chaudhary (2020) studied "Public-private partnerships in R&D: Opportunities and challenges" and examines the role of public-private partnerships (PPPs) in research and development, identifying them as a strategic approach to innovation. The paper highlights that PPPs leverage both public funding and private sector expertise, resulting in faster technological advancements and improved resource allocation. Chaudhary's analysis reveals that PPPs have been particularly successful in sectors such as renewable energy and biotechnology. However, the study also identifies challenges, including regulatory hurdles and the need for robust legal frameworks, to ensure the effectiveness of such collaborations.[2]

Kumar and Verma (2021) studied on "Policy Incentives and Innovation: A Comparative Study of Emerging Economies" and explored the impact of policy incentives on innovation in emerging economies, comparing the cases of India, Brazil, and South Africa. They argue that government policies, such as tax breaks and grants for research initiatives, are crucial for promoting innovation. Their study finds that India has made significant strides in policy support for R&D, particularly in technology-intensive industries. However, Kumar and Verma note that bureaucratic inefficiencies can limit the effectiveness of these policies, and they call for streamlined administrative processes to maximize the benefits of R&D incentives.[3]

Singh and Sharma (2022) studied "Government Financing and its Role in Research and Development in India" and analyzed the role of government financing in boosting research and development (R&D) initiatives in India, particularly in the context of economic growth. They emphasize that government

[1] Banerjee, R., & Nair, V. (2019). The role of fiscal policy in promoting research and development in India. *Indian Journal of Public Finance*, 13(2), 101-116

[2] Chaudhary, M. (2020). Public-private partnerships in R&D: Opportunities and challenges. *Journal of Applied Economics*, 28(1), 65-78

[3] Kumar, P., & Verma, D. (2021). Policy incentives and innovation: A comparative study of emerging economies. *International Journal of Innovation and Development*, 9(4), 234-249.

funding is essential for R&D, as it often compensates for the lack of private investment in high-risk, high-reward projects. Their findings suggest that increased budget allocations for R&D directly contribute to enhanced technological innovation and productivity in sectors such as agriculture, healthcare, and information technology.[4]

Patel and Joshi (2023) studied "Innovation hubs and startup ecosystems: The case of India's knowledge economy" and investigated the development of innovation hubs and startup ecosystems in India, focusing on their role in the country's knowledge economy. They report that government initiatives to establish innovation centers in partnership with universities and research institutions have facilitated the growth of startups in fields like artificial intelligence, clean energy, and biotechnology. According to the authors, these hubs provide essential resources, such as funding, mentorship, and networking opportunities, which are critical for the survival and success of early-stage companies. However, Patel and Joshi emphasize that these initiatives require ongoing support and sustainable funding to remain effective in the long term.[5]

4. Research Methodology:

The study adopts an analytical research design, utilizing both doctrinal and empirical research methodologies. Data is sourced from government reports, academic studies, and financial reports of higher education institutions. The research relies heavily on secondary sources existing literature and online resources i.e. government reports, books, journals, papers, and articles.

5. Role of Research & Development in Economic Growth:

The theory of economic growth has its foundations in the seminal work of Adam Smith (1776), David Ricardo (1817), Malthus (1798), Ramsey (1928), Young (1928) and Schumpeter (1934). Later on with the passage of time, it took new directions. The introduction of Research and Development and imperfect competition began with the models of Romer (1987), Romer (1990), Aghion and Howitt (1992), Grossman and Helpman (1991) and other similar works (Barro and Sala - i -Martin, 2004).[6] In the modern era, according to UNESCO's data, the global expenditure on Research and Development (R&D) has crossed US $1.7 trillion. This signifies the importance of R&D in modern economies. Countries are now placing extensive focus on their R&D programs in order to gain a competitive edge in the fast changing technology driven world.[7] There are three major areas are categorized for the economic growth of the countries as mentioned below:[8]

1. **Innovation and Competitiveness:** R&D fosters innovation, enabling Indian companies to compete globally. This competitiveness is vital for sectors like IT, pharmaceuticals, and automotive industries. For instance, India's pharmaceutical exports reached $25 billion in 2023, showcasing its innovation potential (IBEF, 2023).

[4] Singh, A., & Sharma, R. (2022). Government financing and its role in research and development in India. *Journal of Economic Policy*, 45(2), 120-135

[5] Patel, N., & Joshi, S. (2023). Innovation hubs and startup ecosystems: The case of India's knowledge economy. *Economic Review*, 15(3), 145-160

[6] Devi, P. (2022). Role of Research and Development in Indian Economics Growth. Universal Rese Arch Reports, 09(04), pp.333-337

[7] ForumIAS. 2022. Research and Development in India: Status, Challenges and Recommendations – Explained, pointwise. Retrieved from https://forumias.com/blog/research-and-development-in-india-status-challenges-and-recommendation/

[8] Dares Technologies. (2024). The Importance of Research and Development in India's Economic Growth. Retrieved from https://www.linkedin.com/pulse/importance-research-development-indias-economic-growth-g4lac/

2. **Job Creation:** As industries innovate, new job opportunities emerge. The Indian IT sector is expected to add over 300,000 new jobs in 2023, reflecting the impact of R&D on employment (NASSCOM, 2023).
3. **Sustainable Development:** R&D can lead to the development of eco-friendly technologies, helping India meet its sustainability goals. The renewable energy sector is projected to attract investments of up to $15 billion in 2023 (MNRE, 2023).

6. The Current State of R&D in India:

In the *Global Innovation Index 2023*, India holds the 40th position, lagging behind nations such as China (12th) and South Korea (7th) (WIPO, 2023). India's investment in research and development is 0.7% of its GDP, significantly below the global average of 1.9% and far lower than countries like Israel (5.4%) and South Korea (4.8%).[9]

7. Analysis of Budget Allocations for Research & Development:

The Union Budget 2024-2025 has allocated substantial resources towards R&D. Key highlights include:

1. Increase in R&D Funding: An increase in R&D funding across sectors, with a focus on health, agriculture, and technology, marks a concerted effort to align with global R&D trends.
2. Tax Incentives for R&D Investments: New tax incentives aimed at attracting private sector investments in R&D, with a particular focus on emerging technologies.
3. Public-Private Partnerships: Establishment of collaborations between government research institutions and private entities to foster a more dynamic and inclusive innovation ecosystem.

Table 1: Budget Allocations on Research & Development in India (Union Budget 2024-2025) to major Sector/Departments:

Sector/Department	Year Wise Budget Allocation (INR crores)			
	22-23 Actual	23-24 RE	24-25 BE	% Change (23-24 RE to 24-25 BE)
Department of Science & Technology (DST)	4,436	4,892	8,029	64%
Department of Scientific and Industrial Research (DSIR)	5,852	6,202	6,323	2%
Department of Biotechnology (DBT)	2,045	1,607	2,276	42%
Department of Health Research	2061	2305	2740	19%
Ministry of Electronics & IT (MeitY)	275	1000	1148	15%
Department of Agricultural Research and	1993	2574	2780	8%

[9] Global Innovation Index (GII) 2023. Retrieved from https://www.wipo.int/web/global-innovation-index/2023/index

Education				
Atomic Energy	7675	7919	7529	0%
Department of Pharmaceuticals	1955	2304	4049	75%
Ministry of Coal	56	111	114	11%
Department of Commerce	6303	5244	3857	0%
Ministry of Defence (Civil)	142940	157228	172000	9%
Ministry of Earth Sciences	875	2071	1671	0%
Department of Higher Education	3800	3980	5673	42%

Sources: Union Budget 2024-25; PRS.

Note: BE: Budget Estimates; RE: Revised Estimates. Autonomous Bodies under DST include Indian National Science Academy, Bose Institute, Kolkata and others. Autonomous Bodies under DBT includes National Institute of Immunology, National Centre for Cell Science and others.

This report analyzes the year-wise budget allocations (in INR crores) for select Indian government sectors for FY 2022-23 (Actuals), FY 2023-24 (Revised Estimates or RE), and FY 2024-25 (Budget Estimates or BE). Additionally, the percentage change between FY 2023-24 RE and FY 2024-25 BE is assessed.

Key Highlights:

Significant Increases:

- **Department of Pharmaceuticals**: The budget saw the highest percentage increase of **75%**, rising from INR 2,304 crores (FY 2023-24 RE) to INR 4,049 crores (FY 2024-25 BE). This suggests a strong focus on boosting pharmaceutical production, R&D, and health sector self-reliance.
- **Department of Science & Technology (DST)**: Witnessed a **64% increase**, indicating enhanced investment in scientific innovation and research capabilities. The allocation rose from INR 4,892 crores to INR 8,029 crores.
- **Department of Biotechnology (DBT)**: An increase of **42%** reflects the government's intent to advance biotechnology research, likely emphasizing genomics, vaccines, and biomanufacturing. The budget rose from INR 1,607 crores to INR 2,276 crores.
- **Department of Higher Education**: The allocation increased by **42%**, signaling continued efforts to improve higher education infrastructure and quality under initiatives like NEP 2020.

Moderate Increases:

- **Department of Health Research**: With a **19% rise**, the budget moved from INR 2,305 crores to INR 2,740 crores, demonstrating growing emphasis on healthcare innovation and policy-driven medical research.
- **Ministry of Electronics & IT (MeitY)**: The 15% increase (from INR 1,000 crores to INR 1,148 crores) highlights the government's focus on digital transformation, cybersecurity, and electronics manufacturing.

- **Ministry of Defence (Civil)**: The 9% rise in allocation reflects the commitment to modernizing defense infrastructure and administration, with a significant increase from INR 1,57,228 crores to INR 1,72,000 crores.

Marginal Changes:

- **Department of Agricultural Research and Education**: The 8% rise indicates a steady commitment to agricultural innovation and education, rising from INR 2,574 crores to INR 2,780 crores.
- **Ministry of Coal**: The budget increase of 11% is relatively modest, reflecting stable investment in coal production and mining technologies.

Stagnant or Negligible Growth:

- **Atomic Energy**: The allocation declined marginally from INR 7,919 crores to INR 7,529 crores, showing a stable but slightly reduced focus.
- **Department of Commerce**: Significant reduction in allocation from INR 5,244 crores to INR 3,857 crores indicates potential realignment or reduced emphasis on trade facilitation.
- **Ministry of Earth Sciences**: The allocation dropped from INR 2,071 crores to INR 1,671 crores, which might impact programs related to climate change, oceanography, and geosciences.

8. Findings:

Based on the analysis of Research & Development (R&D) allocations and their implications for economic growth, the following findings are drawn:

1. **Critical Role of R&D in Economic Growth:** R&D plays a pivotal role in driving economic growth by fostering innovation, enhancing global competitiveness, creating jobs, and promoting sustainable development. It serves as a cornerstone for industries like IT, pharmaceuticals, and automotive, enabling them to compete globally; for instance, India's pharmaceutical exports reached $25 billion in 2023, reflecting the impact of R&D-driven innovation. Additionally, R&D advancements contribute significantly to job creation, as seen in the Indian IT sector, which added over 300,000 new jobs in 2023. Furthermore, investments in R&D promote the development of eco-friendly technologies, aligning with India's renewable energy goals and attracting substantial investments, such as $15 billion in 2023, to foster sustainability and economic resilience.
2. **Current Gaps in R&D Investment:** India's low global ranking of 40th in the Global Innovation Index 2023 highlights the challenges it faces in fostering innovation, trailing behind nations like China (12th) and South Korea (7th). This is compounded by underinvestment in R&D, with India allocating only 0.7% of its GDP to research, significantly below the global average of 1.9% and far behind leaders like Israel (5.4%) and South Korea (4.8%), underscoring the need for greater emphasis on research funding and innovation.
3. **Strategic Budget Allocations for R&D (2024-2025):** The 2024-2025 budget allocations reveal varying trends across different departments. Notable increases include the Department of Pharmaceuticals, which saw a 75% rise, signaling a strong push for pharmaceutical R&D, self-reliance, and healthcare innovation. The Department of Science & Technology (64%) and the Department of Biotechnology (42%) also received significant funding boosts, reflecting a focus on scientific research, innovation, and biotechnology advancements such as genomics and vaccine production. Similarly, the Department of Higher Education saw a 42% increase, supporting infrastructure improvements under NEP 2020. Moderate increases were noted in the Department of Health Research (19%), Ministry of Electronics & IT (15%), and the Ministry of Defence (9%),

highlighting efforts in medical research, digital transformation, and defense modernization. Marginal changes include the Department of Agricultural Research and Education (8%) and Ministry of Coal (11%), indicating steady focus on agricultural and energy sectors. However, some sectors saw stagnant or declining allocations, such as Atomic Energy (0%), signaling reduced emphasis on nuclear energy, and significant cuts in the Ministry of Earth Sciences (-19%) and Department of Commerce (-26%), which may affect climate research and trade facilitation priorities.

4. **Policy Measures Supporting R&D:** The Union Budget 2024-2025 introduces new tax policies aimed at attracting private sector investments in emerging technologies, thereby incentivizing innovation and technological advancement. Additionally, there is a strong emphasis on fostering Public-Private Partnerships (PPPs), which encourage collaboration between government research institutions and private entities. This strategic approach aims to create a more inclusive and dynamic innovation ecosystem, driving forward the development of cutting-edge technologies and accelerating economic growth.
5. **Broader Implications:** India's increased R&D funding in sectors such as pharmaceuticals, biotechnology, and digital transformation aligns with its strategic goals of achieving economic self-reliance (Atmanirbhar Bharat), advancing healthcare innovation, and fostering technological growth. However, the persistent underinvestment in R&D compared to global leaders highlights the need for structural reforms and greater allocation of resources, particularly in underfunded areas like climate science and trade. To maintain competitiveness on the global stage, India must prioritize these critical sectors and strengthen its overall research infrastructure.

9. Conclusion and Recommendations:

While the 2024-25 budget showcases a significant push for R&D in critical sectors like pharmaceuticals, science, and biotechnology, India must address its low GDP share in R&D and global ranking to achieve long-term economic growth and innovation leadership.

Based on the analysis, the following recommendations are proposed to enhance India’s R&D capabilities and align with its long-term economic and strategic objectives:

1. **Increase Investment in R&D**: To catch up with global leaders, India should allocate a higher percentage of its GDP to R&D, aiming for at least 1.5% of GDP over the next five years. This will ensure more resources are available to foster innovation across various sectors, particularly in emerging technologies, healthcare, and climate science.
2. **Focus on Emerging Technologies**: The government should prioritize funding for cutting-edge fields such as artificial intelligence, quantum computing, biotechnology, and renewable energy. This would help India stay competitive in the global innovation race and strengthen its position in key industries.
3. **Strengthen Public-Private Partnerships (PPPs)**: Expanding collaboration between public research institutions and the private sector can bridge funding gaps, enhance innovation, and bring technologies to market more effectively. Government initiatives to attract private investment through tax incentives should be coupled with robust policies that support long-term collaborations.
4. **Enhance Focus on Climate Science and Sustainability**: Given the global emphasis on climate change and sustainability, it is crucial for India to increase investment in climate science, renewable energy research, and environmental technologies. Increased funding in these areas will help achieve India’s sustainability goals and foster eco-friendly innovations.

5. **Re-align Trade and Commerce Strategies**: The significant reduction in funding for the Department of Commerce calls for a strategic review to re-align policies that facilitate trade, exports, and international collaborations. Revitalizing this sector will ensure India's participation in global supply chains and boost its export potential.
6. **Develop a National Innovation Strategy**: India should develop a comprehensive national strategy that prioritizes R&D in key sectors, including healthcare, agriculture, and defense. This strategy should include clear goals, timelines, and performance metrics to track progress and ensure that resources are effectively utilized.
7. **Promote Talent Development and Skill Building**: Investment in R&D should be coupled with a focus on building a skilled workforce, particularly in STEM fields. Strengthening education and training programs will ensure that India has the human capital necessary to drive future innovation.
8. **Monitor and Evaluate R&D Impact**: Regular monitoring and evaluation of R&D initiatives will ensure that funding is directed towards the most promising and impactful areas. Establishing a framework to assess the outcomes of R&D investments will help adjust policies and allocate resources more effectively.

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