

MP-IDSA

Issue Brief

Strengthening Defence R&D: Role of Academia

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S*ummary*

The government is promoting collaboration among public sector, academia, private industry (including start-ups) and global partners to boost defence R&D in India. Challenges such as low investment in defence R&D and limited private sector involvement need to be overcome for meaningful forward movement.

Introduction

As per the Stockholm International Peace Research Institute (SIPRI), India was the fourth-largest global military spender in 2023, with expenditures amounting to US\$ 83.6 billion.¹ Incidentally, India was also the largest global importer of defence equipment from 2019 to 2023 (9.8 per cent of global imports).² In a bid to counter this overdependence on defence imports, India has intensified efforts towards indigenisation, emphasising import substitution, enhancing contribution of MSMEs and SMEs, and expanding defence research and development (R&D) base incorporating start-ups and academia to expand defence innovation capabilities.

Reducing dependency on imported weapon systems and achieving self-reliance in state-of-the-art defence technology are crucial, given the increasing role of advanced technologies in modern warfare. Leading defence exporters in the world such as the US, France, Russia, China, Israel and South Korea rely on their resilient defence industry and R&D ecosystems.³

Over the past decade, India’s defence budget has steadily increased, underscoring a strategic focus on strengthening military capabilities and infrastructure. In 2024–25, Rs 23,855 crores was allocated to defence R&D out of the total defence budget of Rs 6,21,940 crores. Compared to countries that are leading defence exporters, India’s share in terms of defence R&D had been inadequate. In terms of R&D spending as a percentage of the GDP among the leading defence exporters, the US is the leading defence spender. India trails behind nations like China (2.4 per cent), Germany (3.1 per cent), South Korea (4.8 per cent) and the US (3.5 per cent).⁴ Additionally, India ranks sixth globally in patent grants, with 30,490 patents in 2022, reflecting its growing innovation ecosystem.⁵

Academia in India’s Defence R&D

Collaboration between academia and industry, including start-ups, is essential to foster creativity, exchange knowledge and shape the future research in disruptive technologies. Such partnerships advance R&D, build a skilled workforce, attract foreign investments and create jobs, encouraging careers in the fields of science and technology.

¹ Nan Tian, Diego Lopes Da Silva, Xiao Liang and Lorenzo Scarazzato, “[Trends in World Military Expenditure, 2023](#)”, SIPRI Military Expenditure Database, Stockholm International Peace Research Institute, April 2024.

² Pieter D. Wezeman, Katarina Djokic, Mathew George, Zain Hussain and Siemon T. Wezeman, “[Trends in International Arms Transfers, 2023](#)”, SIPRI Fact Sheet, March 2024.

³ Ibid.

⁴ Animesh Jain and Anurag Anand, “[India’s R&D Funding, Breaking Down the Numbers](#)”, *The Hindu*, 14 March 2024.

⁵ Ibid.

The current defence R&D ecosystem is spearheaded by the Defence Research and Development Organisation (DRDO). In order to meet India’s goal of attaining self-reliance through indigenisation, it is essential to have adequate resources to design, develop and produce military equipment, where the role of academia as a resource cannot be ignored. DRDO plays a pivotal role by collaborating with academia and industry to develop advanced weapon systems and achieve milestones in hypersonic technologies, reinforcing India's strategic capabilities and global standing.

The Defence Acquisition Procedure (DAP) 2020 encourages procurement contracts having minimum 50 per cent indigenous content. The ‘Make in India’ initiative has introduced various policies and reforms to promote the local design, development and production of defence equipment. Under the ‘Make in India’ initiative, India has achieved significant milestones in defence manufacturing, exemplified by the development of platforms like the Dhanush Artillery Gun System, Mission Divyastra, Advanced Towed Artillery Gun System (ATAGS), Zorawar light tank, Light Combat Aircraft (LCA) Tejas, submarines, frigates, corvettes and the newly commissioned INS Vikrant.⁶ These achievements highlight the expanding capabilities and self-reliance of India's defence sector.

Leading network of institutions like Indian Institute of Technology (IIT), Indian Institute for Science (IISc), the Defence Institute of Advanced Technology (DIAT), and other premier technical institutes have established world-class research parks, often in partnership with businesses, to foster R&D and incubate deep-tech start-ups that achieve global success through academia–industry collaboration.⁷ Following this, the Indian government has set up more such parks, starting with incubation centres for students and start-ups to enhance R&D recognition. DRDO has established a network of 300 academic institutes to address fundamental research challenges relevant to defence applications.⁸ To date, academic projects worth approximately Rs 1,100 crores have been sanctioned through various DRDO mechanisms.⁹

Multiple initiatives and frameworks have been developed to facilitate defence-specific research and development with the investment in academia. Some of these are mentioned below.

- *DRDO-FICCI ATAC Programme*

The DRDO-FICCI Accelerated Technology Assessment & Commercialization (ATAC) programme started in February 2009 promotes the commercialisation

⁶ [“Marching Towards Atmanirbharta: India's Defence Revolution”](#), Press Information Bureau, Ministry of Defence, Government of India, 29 October 2024.

⁷ [“Government is Opening Research Park to Promote Science & Technology and Augment Research Ecosystem”](#), Ministry of Education, Government of India, 7 August 2023.

⁸ G. Satheesh Reddy, [“Collaborative Pathways for Defence R&D Towards Atmanirbharta”](#), *Synergy*, August 2021.

⁹ *Ibid.*

of DRDO-developed technologies for industry adoption.¹⁰ The technologies covered under the scheme involved diverse fields such as electronics, robotics, avionics and disaster management and the programme has resulted in nearly a 100 Transfer of Technology (ToT) agreements.¹¹

- *Extramural Research (ER) Scheme*

The Extramural Research (ER) scheme fosters collaboration between DRDO, academia and industry, supporting basic research to address gaps in understanding critical to military R&D and advancing mission effectiveness through new knowledge, techniques and skilled manpower.¹²

- *Defence Grants-in-Aid Scheme*

The Ministry of Defence launched the Defence Grant-in-Aid scheme in April 1969 to harness indigenous research talent and facilities at IITs, universities, engineering colleges and service training schools for R&D on scientifically significant issues, especially those related to defence. The scheme provides grants to distinguished scientists working at approved research institutions, universities, colleges or reputable industrial firms.¹³ A total of 264 projects, with an approximate budget of Rs 930 crores, have been approved under DRDO’s Grants-in-Aid scheme.¹⁴

- *Contract for Acquisition of Research Services (CARS)*

The Contract for Acquisition of Research Services (CARS) allows DRDO Lab/Estt to collaborate with academia and select institutions for specific R&D activities as needed.¹⁵

- *M.Tech*

M.Tech programmes in defence technologies at Indian universities aim to establish a robust foundation for a dynamic defence R&D and manufacturing

¹⁰ [“DST-Lockheed Martin India Innovation Growth Programme”](#), Federation of Indian Chambers of Commerce and Industry (FICCI), 2022.

¹¹ [“Newspapers Clippings”](#), Defence Science Library, Defence Scientific Information & Documentation Centre, Vol. 46, No. 154, 5 August 2021.

¹² [“Extramural Research \(ER\)”](#), Roles and Responsibilities, Directorate of Extramural Research & Intellectual Property Rights (DER&IPR), Defence Research and Development Organisation (DRDO), Ministry of Defence, Government of India.

¹³ [“Chapter VII: Grant-in-Aid Scheme of Defence Research and Development Organisation”](#), Report No. 35 of 2014—Union Government (Defence Services) Army, Ordnance Factories and Defence Public Sector Undertakings, , Director General of Audit, Defence Services, New Delhi, Indian Audit & Accounts Department, 19 December 2014.

¹⁴ [“Research and Technology Hub in Defence Sector”](#), Press Information Bureau, Ministry of Defence, Government of India, 6 December 2024.

¹⁵ G. Satheesh Reddy, [“Collaborative Pathways for Defence R&D Towards Atmanirbharta”](#), no. 8.

ecosystem.¹⁶ It was launched in July 2021 along with the All India Council for Technical Education (AICTE).

- *DRDO Industry Academia Centres of Excellence (DIA-CoEs)*

Fifteen DRDO Industry Academia Centres of Excellence (DIA-CoEs) have been established at premier Indian universities and institutes such as IIT Delhi, IIT Bombay, IIT Madras, University of Hyderabad, Gujarat University, IISc Bengaluru, Mizoram University, Central University of Jammu, Bharathiar University, IIT Hyderabad, IIT BHU, IIT Jodhpur, IIT Kanpur, IIT Roorkee and IIT Kharagpur.¹⁷ These centres aim to build a collaborative research ecosystem involving DRDO labs, academia, start-ups and industries, leveraging the collective expertise of students, researchers, niche technology industries and DRDO scientists.¹⁸

- *TDF and iDEX*

The Technology Development Fund (TDF) under the DRDO supports MSMEs and start-ups and provides up to Rs 50 crores per project to facilitate prototype development in the technology gap areas in the sector.¹⁹ The iDEX (Innovations for Defence Excellence) framework under the Department of Defence Production (DDP) in the Ministry of Defence (MOD) offers grants up to 50 per cent of the Product Development Budget (PDB) with a cap of Rs 25 crores per project under the ADITI (Acing Development of Innovative Technologies with iDEX) scheme. In both the initiatives, i.e., TDF and iDEX, start-ups generally involve academia as incubator centres.²⁰

Table 1: Defence R&D Projects with Academia

Institute	Year	Agreement/ Objective	Participants
IIT Delhi	2024	Transfer of Technology of Light Weight Bullet Resistant Jacket (ABHED-	MIDHANI (Mishra Dhatu Nigam), Rohtak SMPP Pvt Ltd, Delhi, AR Polymers (MKU)-Kanpur

¹⁶ [“DRDO & AICTE Launch Regular M. Tech. Program in Defence Technology”](#), Press Information Bureau, Ministry of Defence, Government of India, 8 July 2021.

¹⁷ [“DRDO Industry Academia Centres of Excellence \(DIA-CoEs\)”](#), Defence Research and Development Organisation (DRDO), Ministry of Defence, Government of India.

¹⁸ Ibid.

¹⁹ [“DefConnect 2024: Raksha Mantri Launches ADITI Scheme to Promote Innovations in Critical & Strategic Defence Technologies”](#), Press Information Bureau, Ministry of Defence, Government of India, 4 March 2024.

²⁰ Arvind Khare, [“Technology Development Fund: Opportunities and Challenges”](#), Issue Brief, Manohar Parrikar Institute for Defence Studies and Analyses (MP-IDSA), 3 November 2023; [“Innovation for Defence Excellence \(iDEX\)”](#), Department of Defence Production, Ministry of Defence, Government of India, and Partners.

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		Advanced Ballistic High Energy Defeat) ²¹	
IIT Delhi	2024	Memorandum of Agreement (MoA) for development of Indigenous Ballistic Material	Reliance Industries Ltd
IIT Delhi	2024	MoA for limited series production of Extreme Cold Weather Clothing	Aeronav Industrial Safety Appliance, Delhi, Arnaf Industries Ltd, Arrow Garments, Tirupur
IIT Delhi	2024	MoA for limited series production of Extreme Heat Protective Clothing	Arrow Garments, Tirupur, Aeronav Industrial Safety Appliance, Delhi Katalyst TECHTEX Ltd, Delhi
IIT Kharagpur	March 2024	To drive innovation through research partnership	Indian Navy, MoU coordinated by INS Shivaji, Lonavala
DRDO Young Scientists Laboratory for Quantum Technologies (Pune), TIFR (Mumbai)	August 2024	End-to-end testing of 6-qubit quantum processor based on superconducting circuits	Quantum Processor Demonstration
IIT Kanpur	November 2024	Advancements in military logistics & defence innovation and Strengthening incubation with Kanpur University	IIT Kanpur, BEML, HAL, Kanpur University

²¹ [“DRDO, IIT Delhi & the Industry Sign 10 Tripartite Agreements During an Event Organised by DRDO-Industry-Academia Centre of Excellence”](#), Press Information Bureau, Ministry of Defence, Government of India, 19 December 2024.

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IIT Kanpur	November 2024	Development of Indigenous kamikaze UAV carrying warhead up to 6 kg with 100 km range	VU Dynamics (Start-up from IIT Kanpur)
IIT Kanpur	June 2024	UDAAN Drone Initiative	Acceleration of drone start-ups
IIT Madras	February 2024	Indigenously-designed 155mm Smart Ammunition with CEP of 10m	Munitions India Limited
IIT Madras	May 2023	Ramjet-Powered FSAPDS Development	Army Design Bureau (ADB)
IIT Hyderabad	May 2024	MoU Research on medical innovations, including drone-based patient transport and AI in medical devices	IIT Hyderabad, Armed Forces Medical Services (AFMS)
(Private Academia)	November 2024	Collaboration in research, technology, and academic excellence for national security and innovation	Defence Institute of Advanced Technology (Pune), Birla Institute of Technology and Science (Pilani)
Think Tanks	December 2024	Establishment of MCMM Chair of Excellence for research on munitions protocols and processes	Centre for Joint Warfare Studies (CENJOWS), Military College of Material Management (MCMM), Jabalpur
Think Tanks	July 2024	MoU to Promote Joint Academic Research in Defence Technologies	MP-IDSA, DRDO

Source: Compiled by the author from Press Information Bureau and institutes' websites

These MoUs have the potential to pave the way for translational research, bridging the gap between laboratory innovations and real-world applications, ultimately contributing to India’s journey towards self-reliance. In addition, DRDO’s four research boards—Aeronautical Research & Development Board (AR&DB), Naval Research Board (NRB), Armament Research Board (ARMREB) and Life Sciences

Research Board (LSRB)—have been driving numerous defence projects for decades, fostering significant academic contributions and regular collaboration with Higher Education Institutions (HEIs) nationwide to tackle scientific and technological challenges. To enhance collaboration between academia, industry and defence R&D, DRDO introduced the Long Term Directed Research Policy under the Ministry of Defence.²² This policy enables DIA-CoEs to conduct targeted research on advanced defence technologies, and is overseen by the Directorate of Futuristic Technology Management (DFTM) within DRDO’s Technology Management cluster.

In parallel, strengthening university research centres plays a pivotal role in accelerating the advancement of projects from early-stage Technology Readiness Levels (TRLs), such as TRL1, to more developed stages like TRL3, and further to intermediate stages including TRL6, thereby bridging critical gaps in the R&D ecosystem.²³ These initiatives also help improve the educational qualifications of the scientific and technical workforce.

Key Recent Initiatives

The Union Budget 2022–23 introduced key initiatives to strengthen India’s defence R&D ecosystem and promote self-reliance under the ‘Atmanirbhar Bharat’ initiative, by opening defence R&D to industry, start-ups and academia in order to strengthen indigenous capabilities. Notably, in an effort to decentralise and foster innovation in the defence sector, 25 per cent of the defence R&D budget was allocated for private industry, start-ups and academia.²⁴ Furthermore, DRDO in 2022 has allocated Rs 1,200 crores to support academic research in the area of defence.²⁵ These measures aimed to build a sustainable defence-industrial base and position India as a global leader in defence technology. DRDO’s Technology Foresight 2023 also identified a bouquet of 75 futuristic and priority areas to boost defence manufacturing by fostering indigenisation, innovation and collaboration between industry and academia, facilitating self-reliance and advanced military technology development.

In the vein of bringing reforms to the defence R&D infrastructure of India, a nine-member high-powered committee led by Prof. Vijay Raghavan, a former Principal Scientific Advisor to the Government of India, was set up. The committee was tasked with redefining the roles of the Department of Defence (R&D) and DRDO to

²² Ibid.

²³ Ibid.

²⁴ [“Union Budget 2022-23”](#), Press Information Bureau, Ministry of Defence, Government of India, 1 February 2024.

²⁵ [“Centre has Earmarked Rs 1,200 cr to Aid Academic Research in Defence, Says DRDO Chief”](#), *The Economic Times*, 27 February 2022.

strengthen India’s defence R&D ecosystem and industrial base.²⁶ It has also suggested creation of a new Department of Defence Science, Technology, and Innovation (DDSTI), where academia will certainly have a bigger and vital role to play.

In the Interim Budget of 2024–25, Finance Minister Nirmala Sitharaman announced a Rs 1 lakh crore corpus to foster innovation and start-ups, along with a dedicated scheme for deep-tech defence start-ups.²⁷ Besides this, a Rs 750 crores fund as part of the Acing Development of Innovative Technologies with iDEX (ADITI) initiative, was announced during the ‘DefConnect 2024’ event in March 2024, by the Ministry of Defence.²⁸ It aims to develop 30 deep-tech critical and strategic technologies with MSMEs and start-ups, where academia is also expected to be integrated.

Policies like the National Deep Tech Startup Policy (NDTSP) and the enactment of the Anusandhan National Research Foundation (ANRF) Act reflect the government’s commitment to fostering innovation and addressing R&D challenges.

The NDTSP aims to support deep tech start-ups through targeted interventions, fostering a research-driven innovation ecosystem vital for India's growth and development.²⁹ The ANRF 2023 Act aims to promote R&D and foster research culture across India’s academic and research institutions.³⁰ It is to serve as an apex body providing strategic direction for scientific research, aligned with the National Education Policy (NEP).

The government’s recent allocation of Rs 1 lakh crore fund for higher TRL research in Focused Research Organisations (FROs) and deep-tech start-ups aims to bridge the gap between foundational research and industry-oriented development.³¹ Together, these initiatives strive to build a holistic R&D ecosystem, spanning basic research to advanced, application-driven innovation involving academia.

The inadequate investment in defence R&D, with India allocating only 0.64 per cent of its GDP to this area, forms another limiting factor. This is substantially lower

²⁶ Rajat Pandit, [“DRDO Overhaul on Course, Government to Also Take Final Call on 'Contentious' Reforms”](#), *The Times of India*, 30 July 2024.

²⁷ [“Interim Budget 2024-25 Reflects the Emphasis on Innovation and Startups to Achieve the Goal of a Viksit Bharat @2047, Says Union S&T Minister Dr Jitendra Singh”](#), Press Information Bureau, Ministry of Science and Technology, Government of India, 1 February 2024.

²⁸ [“DefConnect 2024: Raksha Mantri Launches ADITI Scheme to Promote Innovations in Critical & Strategic Defence Technologies”](#), Press Information Bureau, Ministry of Defence, Government of India, 4 March 2024.

²⁹ [“National Deep Tech Startup Policy \(NDTSP\)”](#), Office of the Principal Scientific Adviser (PSA), Government of India, 2023.

³⁰ [“Anusandhan National Research Foundation”](#), Office of the Principal Scientific Adviser (PSA), Government of India, 2023.

³¹ Ajai Chowdhry, [“The Anusandhan National Research Foundation Aims to Make India a Knowledge-driven Economy”](#), *The Indian Express*, 10 September 2024.

than leading defence exporters like China and the US, which creates a considerable gap in R&D spending.³² Additionally, India’s R&D landscape is overly reliant on public funding, with minimal participation from the private sector.

Greater handholding and technological support by DRDO through its nodal labs, along with active involvement of the Services, is essential for TDF projects from inception to completion, ensuring synergy at both personnel and institutional levels.³³ As for the announcement regarding 25 per cent of the defence R&D budget to involve industry, start-ups and academia, analysts note that the MoD and the Finance Ministry have yet to issue Standard Operating Procedures (SOPs) or clear guidelines to monitor the implementation of this initiative.³⁴

In conclusion, while DRDO has traditionally led India’s defence R&D, advancing technologies demand a collaborative effort involving academia, industry and the armed forces. Achieving global leadership in defence manufacturing and technology requires addressing critical gaps through academic participation. Significant initiatives in this direction have been taken in recent years, as highlighted in previous sections. Further strengthening academia–industry–government collaboration, and fostering a culture of innovation are essential for building a dynamic, globally competitive defence R&D ecosystem that enhances national security and positions India as a key innovation partner.

³² Animesh Jain and Anurag Anand, “[India’s R&D Funding, Breaking Down the Numbers](#)”, no. 4.

³³ Arvind Khare, “[Technology Development Fund: Opportunities and Challenges](#)”, no. 20.

³⁴ Ibid.

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