PROPOSED REFORMS FOR DRDO: CHALLENGES AND THE WAY FORWARD

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INTRODUCTION

Economic liberalisation came in the defence manufacturing sector in 2001, 10 years after India decided to become a free market economy in 1991. The policy mosaic included 100 percent participation of private sector players in defence manufacturing and permitted Foreign Direct Investment (FDI) of 26 percent from global players.[1] This was in sharp contrast to Nehru's socialist policy of 1956, in which military manufacturing, space, and atomic energy remained under the exclusive purview of the government.[2] The Defence Research and Development Organisation (DRDO) was created in 1958 to pursue Research and Development (R&D) in defence in order to reduce dependence on imports. From a

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1. Franz-Stefan Gady, "India Pulls out of Joint Stealth Fighter Project with Russia," *The Diplomat*, April 2018, https://thediplomat.com/2018/04/india-pulls-out-of-joint-stealth- fighter-project-with-russia. Accessed on February 16, 2024.
2. Statement of Industrial Policy Resolution, April 30, 1956, No. – 91 / SF / 48, Ministry of Small-Scale Industries, Government of India, New Delhi. Accessed on January 28, 2024.

fledgling set-up, the 1980s, under the stewardship of Dr APJ Abdul Kalam, witnessed mega programmes like the Integrated Guided Missile Development Programme (IGMDP) for building a comprehensive range of missiles like the Agni, Prithvi, Akash, and Naag.[3] With 52 DRDO labs engaged in the design and development of small arms, Electronic Warfare (EW) systems, tanks, armed vehicles, sonar systems, missiles, and Command and Control (C2) systems, a team of 5,000 scientists is engaged in 900 projects, with 25,000 support staff, and a budget of Rs 23,264 crore.[4] The prototypes developed by DRDO are produced by Defence Public Sector Undertakings (DPSUs) and the private sector. DRDO is the flag bearer of 'Make in India' as it will substitute imported technologies with indigenous ones. In this pursuit, time and cost overruns of many of these programmes and the low level of self-reliance achieved bedevil DRDO and have been a recurring concern. Several committees have been engaged to bring out the innards of the problems that have ailed DRDO in the past like the Kalam Committee in 1992 and the Ramarao Committee in 2008. The latest committee is headed by Vijay Raghavan, who retired as a principal scientific advisor and is an old DRDO hand. This was in response to the report of a parliamentary committee that observed that 23 out of 55 high-mission projects are running behind schedule.[5]

This paper aims to provide an overview of: (a) major policy initiatives to bolster the military industry capability of India; (b) committees recommending structural and functional changes in DRDO; (c) critical challenges for achieving high self-reliance; (d) contrarian voices; and (e) the way forward.

3. "Integrated Guided Missile Development Programme (IGMDP) - BrahMos.com." n.d., *BrahMos Aerospace*, https://www.brahmos.com/content.php?id=10&sid=25. Accessed on December 17, 2023.
4. "Examining India's Interim Defence Budget 2024-25" (n.d.), https://www.orfonline.org/research/examining-indias-interim-defence-budget-2024-25. Accessed on March 14, 2024.
5. Rajat Pandit, "Half of DRDO's Mission Mode Projects Running Behind Schedule, Parliament Informed," *The Times of India*, February 14, 2023, https://timesofindia.indiatimes.com/india/half-of-drdos-mission-mode-projects-running-behind-schedule-lok-sabha- informed/articleshow/97889332.cms. Accessed on April 9, 2024.

MAJOR POLICY INITIATIVES TO BOLSTER MILITARY INDUSTRY CAPABILITY

The military manufacturing sector has been the exclusive preserve of the government through the DPSUs and Ordnance Factories (OFs) as per the Industrial Policy Resolution, 1956.[6] The DPSUs and OFs have the sole prerogative of receiving technology from abroad and manufacturing and integrating sub-systems. DRDO has also been supplying indigenous technology in respect of small arms amd ammunition, tanks like the Main Battle Tank (MBT), fighter aircraft like the Light Combat Aircraft (LCA), and missiles like the Prithvi, which are then produced, either by the OFs or by the DPSUs. The role of the private sector has been confined to being the suppliers of components or parts, without being considered partners in military industry manufacturing.

The following eight major policy initiatives are tabulated below bringing out how the Services are now better integrated with the Ministry of Defence (MoD) in the decision-making process and how the private sector is being involved on equal terms with the highly protected DPSUs and OFs (see Table 1).

Table 1: Major Policy Initiatives for Bolstering the Military-Industrial Complex (MIC)

Kargil Review Committee (1999)	Integrated Defence Services
Liberalisation in Defence Manufacturing (2001)	Full private sector participation and 25 percent in FDI
Kelkar Committee (2005)	Public-Private Partnerships (PPP)
Defence Procurement Policy (2005)	Buy, Buy & Make, Make
Offset Policy (2006)	Leverage big buys to get critical technology
Dhirendra Singh Committee (2015)	Strategic partnership
Chief of Defence Staff (2020)	Single point military advice
Make in India in Defence (2022)	Focus on indigenisation & SMEs

Source: Ministry of Defence, https://mod.gov.in/

After the disastrous experience in Kargil, the government paid better attention to the integration of the MoD with the Service

6. Department for Promotion of Industry and Internal Trade, Ministry of Commerce and Industry, GOI, Chapter 1. (1956), https://dpiit.gov.in. Accessed on February 28, 2024.

Headquarters and coordinated intelligence gathering. A decade after economic liberalisation in other sectors, the defence sector witnessed full participation of the private sector in defence manufacturing and 25 percent FDI inflow. This was the first attempt to bust the monopoly presence of the DPSUs and OFs. The Kelkar Committee in 2005[7] went a step forward by promoting public-private partnerships, and the defence procurement policy made India's procurement system transparent to all suppliers and gave primacy to 'Make in India' which puts a premium on developing indigenous technology that can be converted into production later on. The offset policy in 2006, drawing on the experience of Brazil in developing the Embraer aircraft by availing technology from the USA, tried to leverage India's big-ticket acquisition to get critical technology, FDI, and outsourcing orders from the Original Equipment Manufacturers (OEMs).[8]

The Dhirendra Singh Committee in 2015 made a strong pitch for strategic partnerships between the DPSUs and the private sector in India.[9] The appointment of the Chief of Defence Staff (CDS), which was one of the major recommendations of the Kargil Review Committee and was put on the back-burner for a long time, saw the light of the day in 2020 with the appointment of the CDS.[10] This has helped the defence Services acquire a preeminent position for single-point military advice, thereby denuding civilian control over military advice. 'Make in India' in defence[11] focusses on greater indigenisation, protecting domestic manufacturers from imports and bolstering the footprints of Small and Medium

7. "Kelkar Committee Submits Report on Defence Acquisition," 2005, Pib.gov.in. Ministry of Defence, April 5, 2005, https://pib.gov.in/newsite/erelcontent.aspx?relid=8386. Accessed on February 15, 2024.
8. Pranab Mukherjee, "Defence Procurement Procedure (Capital Procurements)," Ministry of Defence, August 22, 2006, https://www.mod.gov.in/dod/sites/default/files/dpp2006.pdf. Accessed on January 25, 2024.
9. Dhirendra Singh, "Committee of Experts for Amendments to DPP 2013 Including Formulation of Policy Framework, Report of the Expert Committee", Ministry of Defence, July 23, 2015, https://www.mod.gov.in/sites/default/files/Reportddp.pdf. Accessed on March 3, 2024.
10. "The Kargil Review Committee Report", n.d. New Delhi, Ministry of Defence, Government of India, https://www.claudearpi.net/wp-content/uploads/2019/08/Kargil-Report.pdf. Accessed on March 3, 2024.
11. "Department of Defence Production", n.d. www.makeinindiadefence.gov.in. Ministry of Defence, Government of India, https://www.makeinindiadefence.gov.in/. Accessed on January 13, 2024.

Enterprises (SMEs). This has brought in a high degree of protection to indigenous industries from imports.

COMMITTEES FOR IMPROVING OUTCOMES FROM DRDO

***Kalam Committee* (1992)**

This committee, with representatives from the three defence Services had assessed that the equipment being built through indigenous design or technology transfer amounted to only 30 percent. It set a target to improve the self-reliance quotient to 70 percent in a decade.[12] It identified critical sub-systems wherein India lacked design and development capability, and suggested building national facilities, while strongly batting for Joint Ventures (JVs) with OEMs, and joint design and development with global design houses. The critical sub-systems where the committee found India to be critically deficient were in the area of radars [Active Electronically Scanned Array (AESA)], seekers (passive and active), Unmanned Aerial Vehicles (UAVs), smart munitions, and aero-engines. The three deficient areas were propulsion, detectors, and weapons. While missile programmes like the Prithvi witnessed substantial success, the Agni showed promise, but programmes like the Akash, Trishul, and Naag faltered. Dr Kalam envisaged the BrahMos programme through a joint venture with the Russians. These cruise missiles are possibly the best example of 'Make in India', where export potential is substantial. Dr Kalam also achieved a high modicum of success in the joint design and development of the Medium Range Surface-to-Air Missile (MR-SAM) in collaboration with Israel. However, the Fifth Generation Fighter Aircraft (FGFA) programme as a joint design and development production with Russia for developing a stealth aircraft did not succeed.

12. SN Misra, "Self-Reliance Index and the Enduring Legacy of Kalam," *Indian Defence Review,* October 15, 2015, https://www.indiandefencereview.com/news/self-reliance-index-and-the-enduring-legacy-of-kalam/. Accessed on February 21, 2024.

Ramarao Committee (2008)

The Ramarao Committee highlighted the importance of greater involvement of the Services in the programmes being untaken by DRDO to cut down on time and cost uncertainties. It also proposed a major structural change by suggesting that the research and development organisation should function under the production organisation so that there is complete synergy between design and development, and seamless technology transfer as well as single point accountability[13] It was particularly anguished by the delay in the development of the Kaveri engine for the LCA aircraft because of the lack of synergy among DRDO, Aeronautical Development Agency (ADA), and Hindustan Aeronautics Limited (HAL).[14] While the government tried to ensure greater involvement of the Services in the DRDO programmes, its suggestion to bring DRDO under defence production was stoutly resisted by DRDO. Besides, the Ramarao Committee's recommendation to create a board of research for advanced defence science on the Defence Advanced Research Projects Agency (DARPA) model of the USA was not accepted.[15] It would be in the fitness of things to mention that the Kelkar Committee in 2005 had suggested a public-private partnership and a level playing field between captive DPSUs and the private sector players, and the government had warmed up to the idea.[16]

Vijay Raghavan Committee (2024)

The Vijay Raghavan Committee has suggested that the focus of DRDO should be on high-end futuristic technology by associating

13. Samir Raj, "Restructuring of DRDO," Pib.gov.in. Ministry of Defence, Government of India. May 3, 2010, https://pib.gov.in/newsite/erelcontent.aspx?relid=61315. Accessed on January 16, 2024.
14. "A Critical Juncture for India's DRDO: Navigating the Path to Modernisation", *Indian Aerospace & Defence Bulletin*, November 3, 2023, https://www.iadb.in/2023/11/03/a-critical-juncture-for-indias-drdo-navigating-the-path-to-modernisation/. Accessed on January 10, 2024.
15. "Committee on Functioning of DRDO," 2015, Pib.gov.in. Ministry of Defence, Government of India. December 11, 2015, https://pib.gov.in/newsite/PrintRelease.aspx?relid=133031. Accessed on March 14, 2024.
16. "Kelkar: Involve the Best in Defence Production," *The Times of India*, April 6, 2005, https://timesofindia.indiatimes.com/india/kelkar-involve-the-best-in-defence-production/articleshow/1069797.cms. Accessed on January 11, 2024.

academic institutions and start-ups and greater private sector participation. It has suggested a major structural change wherein DRDO will come under the Prime Minister's Office (PMO), as is the case with atomic energy and space.[17] The PMO will be supported by a defence technology council in which the Raksha Mantri (RM), and National Security Advisor (NSA), two persons from the field of academics and two from the industry will be members. This committee will decide on suitable players for specific defence technology. The Defence Technology Council (DTC) will be assisted by an empowered committee with the CDS and Principal Scientific Advisor (PSA). The committee has also recommended the creation of a new Department of Defence Science Technology and Innovation to promote defence R&D in academia and bolster the start-up ecosystem. Most importantly, DRDO's role would be limited to research and development and not the development of prototype and technology demonstrators. The committee has also suggested that five national test centres should be set up where private players also are allowed to test their systems. It suggests that deep technologies like Artificial Intelligence (AI), Machine Learning (ML), and robotics should be promoted.

Quite clearly the report suggests that the Special Assistant (SA) to the Raksha Mantri (RM) should be a fringe player in defence R&D, and the private sector, under the watch of the PMO, CDS, and NSA, would drive the design, development, and production of major weapons, systems, and platforms. The committee has found that 60 percent of the delays in DRDO are due to internal issues and the absence of the required technology, while around 18 percent are due to the armed forces changing their qualitative requirements frequently.

17. Pradip R Sagar, "Top Panel Recommends Shake-up in DRDO, Bigger Role for Private Players in Defence Research", *India Today*, January 9, 2024, https://www.indiatoday.in/india-today- insight/story/top-panel-recommends-shake-up-in-drdo-bigger-role-for-private-players-in-defence- research-2486516-2024-01-09. Accessed on January 12, 2024.

CRITICAL CHALLENGES FOR ACHIEVING HIGH SELF-RELIANCE

India as the Largest Importer of Conventional Arms

Table 2 provides the trends of major exporters and importers globally.

Table 2: Largest Exporters and Recipients of Major Arms (2019-23)

Exporters		Importers	
Country	**Share (%)**	**Country**	**Share (%)**
USA	42	India	9.8
France	11	Saudi Arabia	8.4
Russia	11	Qatar	7.6
China	5.8	Ukraine	4.9
UK	3.7	Pakistan	4.3
Israel	2.4	Japan	4.1
South Korea	2	Egypt	4

Source: *SIPRI Yearbook 2023: Armaments, Disarmament and International Security: Summary,* pp. 10-11, https://www.sipri.org/sites/default/files/2023-06/yb23_summary_en_0.pdf.

It would be seen from the above table that India is the largest importer of major arms and the USA, the largest seller. Even China has a share of 6 percent in global arms exports. Eighty percent of the arms inventory of the three Services is sourced from Russia, from which our DPSUs like HAL have received technology for building the MiG aircraft and Su-30, and the ordnance factory Heavy Vehicles Factory (HVF), Avadi, has received technology for building the T-72 and T-90 tanks and Infantry Combat Vehicles (ICVs) at Medak.[18]

The reasons for such humungous imports are largely due to our excessive dependence on critical sub-systems. The Kalam Committee[19] had identified gaps in the following areas (Table 3).

18. *SIPRI Yearbook 2023: Armaments, Disarmament and International Security: Summary,* https://www.sipri.org/sites/default/files/2023-06/yb23_summary_en_0.pdf. Accessed on February 5. 2024.
19. "DRDO Pays Tribute to Dr. APJ Abdul Kalam.", https://Drdo.gov.in/Drdo/. Defence Research and Development Organisation, Ministry of Defence, Government of India, https://www.drdo.gov.in/drdo/sites/default/files/newsletter-document/Nov_18.pdf. Accessed on February 13, 2024.

Table 3: System and Technology Gaps

System	Technology Gaps
Gas Turbine Engine	Single crystal and special coating in turbine blades FADEC
Missile	Uncooled FPA seekers
Aeronautics	Smart aerostructures
	Stealth technology
Material	Nano materials. carbon fibres
Naval Systems	Super cavitating technology
Sensors	AESA, radar, RLG, INGPS
Communication	Software defined radio
Avionics	Gen III, II Tubes
Surveillance	UAVs, Satellites

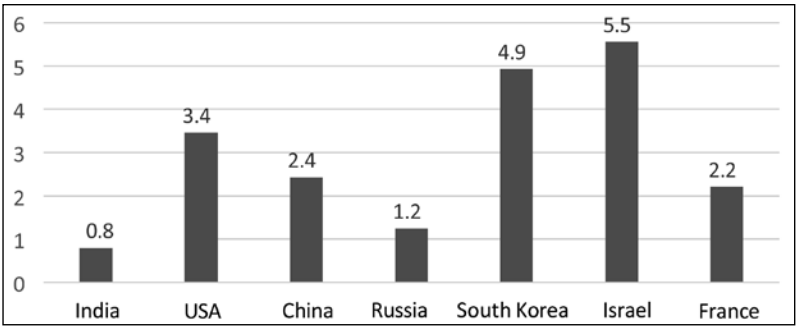
Source: Kalam Committee, in discussion with DRDO scientists.

The three major areas are propulsion, weapons, and sensors. The Kaveri, which was to power the LCA aircraft, has failed the test and is instead powered by a GE 404 engine imported from the USA. The MBT tank is powered by a German MTU engine. The Active Electronically Scanned Array (AESA) radar is sourced from Israel and the air-to-air missile is sourced from France. Carbon fibres are sourced from Japan to build Advanced Light Helicopters (ALHs). DRDO's record in terms of indigenisation of these critical systems lacks credibility. There is a huge gap between promise and delivery. DRDO's ability to develop passive seekers and focal plane arrays has come a cropper. During the Kargil conflict, DRDO's inability to supply a gun locating radar was considered to be a major handicap, which has been remedied by importing these from the USA under the Foreign Military Sales (FMS) route.

Criticality of R&D Investment

One of the prime reasons for the USA achieving its preeminent position globally is due to its huge investment in R&D. In fact, as per Robert Solow, the Nobel Laureate in economics, 60 percent of America's growth has been contributed by research and innovation and the high factor productivity. Fig. 1 brings out the comparative position globally.

Fig 1: R&D as a Percentage of GDP



Source: World Bank Data 2020, https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS

The poor share of R&D in India's Gross Domestic Product (GDP) (Fig 1) is also reflected in its low self-reliance index. Besides, in developed countries, the private sector contributes nearly 60 percent of the R&D expenditure, where it is predominantly driven by the government (90 percent). Israel, which was exporting only $1 million worth in 1995 to India moved up to $1 billion by 2005, thanks to its amazing attention to R&D and collaboration with the USA.[20]

The Parliamentary Standing Committee on Defence in 1998[21] had suggested that India should earmark at least 10 percent of its defence budget for R&D as against 6 percent which is being allocated. However, in reality, the capability of DRDO to absorb higher allocation is doubtful as its ability to design state-of-the-art sub-systems, as alluded to above, is limited. Like most DPSUs, DRDO also gets derided for being an assembler of sub-systems from abroad, instead of designing them indigenously. Value addition is minimal. Besides, since DRDO is mainly in the project mode, with applied

20. The World Bank. "Research and Development Expenditure (percent of GDP) | Data." 2021Worldbank.org, 2021, https://data.worldbank.org/indicator/GB.XPD.RSDV.GD.ZS. Accessed on March 14, 2024.
21. Kamal Chaudhry, "Standing Committee on Defence (1998-99), Twelfth Lok Sabha," https://Eparlib.nic.in/. Lok Sabha Secretariat, Ministry of Defence, New Delhi. 1998, https://eparlib.nic.in/bitstream/123456789/56858/1/defence_12_02_1998.pdf. Accessed on April 4, 2024.

technology, basic research gets short shrift, with only 20 percent of funding getting earmarked for basic research.

CONTRARIAN VOICES

The Vijay Raghavan Committee,[22] on the face of it, has made many sensible suggestions like putting the PMO into the loop, divesting DRDO of its monopoly status in designing state-of-the-art technology sub-systems, investing more in basic research, and asking the private sector players to play an important role in indigenous design, development, and production. The major resistance to the proposed reforms in DRDO is the suggestion to place the organisation under the PMO as in the case of atomic energy and space. The insiders feel that unlike the closed system in the Indian Space Research Organisation (ISRO) and Department of Atomic Energy (DAE) where both design development and production are taken up by them, in the case of DRDO, the prototypes are built by DRDO but produced either by the DPSUs or the OFs. Besides, the suggestion that DRDO should disentangle from the development of prototypes and technology and concentrate on basic research and development goes against the general drift of DRDO for applied technology. Nearly 80 percent of the DRDO budget is spent on prototype development, with the balance spent on basic research. Be it the missile programme, main battle tank, LCA or EW systems, prototype development, and technology transfer have been DRDO's bread and butter.

Many observers believe that the Vijay Raghavan Committee is heavily influenced by the DARPA model of the USA which was set up in 1958.[23] This organisation is responsible for the development of emerging technology for use by the military. To its credit, DARPA has developed the Personal Computer (PC), the internet, stealth technology, Global Positioning System (GPS), drones, weather satellites, and lately, the COVID-19 vaccine. DARPA functions with

22. S N Misra, "Proposed Reforms for DRDO: Debates and the Way Forward," *Indian Defence Review*, March 16, 2024, https://www.indiandefencereview.com/news/proposed-reforms-for-drdo-debates-and-the-way-forward/. Accessed on March 17, 2024.
23. Roberto Verganti, "'Special Forces' Innovation: How DARPA Attacks Problems," *Harvard Business Review*, October 1, 2013, https://hbr.org/2013/10/special-forces-innovation-how-darpa-attacks-problems. Accessed on March 3, 2024.

a very small component of scientists and contracts out core functions to universities, industries, and government R&D institutions. Unlike DRDO where close to Rs 23,264 crore are invested by the government, the US government does not make any allocation to DARPA for developing emerging defence technology. Replicating the DARPA model would be far-fetched and illusionary. The suggestion to involve the private sector and academia in a bigger way is most welcome, as the present DRDO structure is highly bureaucratic and tries to protect its inherent inefficiencies. The suggestion to put DRDO under the PMO should be seriously considered as it will provide the PM with a closer look at the emerging defence technologies, the capability of adversaries, and the need to improve our indigenous military industry capability. In any case, our missile programme is very closely linked to the Department of Space and the Department of Atomic Energy, and they should form the trinity under the PMO. The Vijay Raghavan Committee must be complimented for suggesting this fundamental change in the organisational structure.

It must be remembered that DRDO's pursuit of niche technology is seriously hamstrung by the lack of investment in R&D, poor academic foundation in our universities and Indian Institutes of Technology (IITs), and denial regime for critical technologies. Except for IIT Kharagpur, which has a Centre for Naval Design Technology, we do not have a single university where specialised defence technology is being pursued as a career by the students. The Subramaniam Committee in 1964, after the Chinese debacle, had rightly observed that India couldn't successfully design and develop a gas turbine engine as its academic institutions did not have the necessary academic wherewithal. It had rightly suggested that we should go for technological collaboration with global engine houses instead of making grandiose claims to develop gas turbine engines indigenously. The failed Kaveri engine programme is testimony to the prescience of the Subramaniam Committee.

THE WAY FORWARD

The critical technologies thumbnailed by the Kalam Committee in 1992 still elude DRDO in a substantial measure. It had rightly

suggested that the way forward for India is to opt for joint ventures with foreign OEMs where both private sector players and India's DPSUs can be collaborators. He was also prescient that given our inadequate design capabilities in niche technologies, we need to have joint design and development collaboration with reputed global design houses. A truly knowledge economy believes in producing out of indigenous design. To quote Kalam: an ignited mind is more powerful than anything on the earth, over the earth, and above the earth. To its credit, DRDO designed the MBT which is a reality for the armoured regiment. So is the success story of the Prithvi. The LCA is being successfully flown by the air force. The sonars and torpedoes are testimony to our indigenous underwater design potency. Sadly, the 'Make in India' campaign is not fostering the indigenous capability quotient but trying to protect indigenous manufacturers from potential competition from superior foreign suppliers by building a tariff wall. Instead of bolstering free trade and globalisation, PM Modi is turning the clock back on globalisation. Be it DPSUs or DRDO, India's biggest lament is that instead of improving value addition or indigenous design capability, they have become integrators of sub-systems. This is where China has stolen a march over us in terms of its global value chain addition. This lack of design and development capability in critical technology can be surmounted by establishing appropriate design institutes and investing in IITs and important academic institutions. We need to increase our R&D investment of only 0.8 percent of GDP to at least 3 percent, like most developed countries.[24] The private sector must invest more in R&D instead of integrating imported sub-systems in the liberalised milieu. Unless we realise this and put in place Kalam's vision of self-reliance through joint ventures and design of development collaboration, DRDO will never be able to spring on its heels and pave the way for *Atmanirbhar* and *Viksit Bharat*.

24. Organisation for Economic Cooperation and Development (OECD), "Research and Development (R&D) - Gross Domestic Spending on R&D - OECD Data.", 2022, https://data.oecd.org/rd/gross-domestic-spending-on-r-d.htm. Accessed on March 7, 2024.