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Issue Brief

Does Acquisition of Critical Technologies through ToT truly benefit India?

Kevin A. Desouza

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Summary

Ever since the Abdul Kalam committee of 1993 recommended the developing of critical technologies to 'raise the nation to a position of greater strength', this has been an area of focus for the DRDO and the Government of India. Government policies on procurement as laid down in the Defence Procurement Policy (DPP) also now stipulate the acquisition of critical technologies through Transfers of Technology. This issue brief, which takes a critical look at such acquisitions, finds that there are numerous complexities involved with ultimately limited benefits and suggest that the policy itself bears revisiting in light of the lessons learnt so far.

The importance of developing critical technologies in the defence sector was first highlighted by the committee headed by the then Scientific Advisor (SA) to the Raksha Mantri (RM), Dr Abdul Kalam, in their report submitted on 27 October 1993. The report stated that this would act as a safeguard against technology denials by developed countries and that 'technology power will raise the nation to a position of greater strength, militarily and economically'. The committee, underscored the need to improve India's self-reliance quotient from 30% in 1992 to 70% by 2005 and also identified critical technologies such as Gallium Arsenide devices, fiber optics, smart weapon subsystems, heavy particle beams, focal plane array and hypersonic propulsion for future research and development. [1]

Since then, a very strong emphasis has been placed by the Government of India (GoI) and the Defence Research and Defence Organisation (DRDO) on the acquisition of these critical technologies. As quoted by a DRDO scientist, the DRDO has maintained a 'focus on its primary aim of establishing self reliance in critical defence technologies, guided principally by compulsions of national security.' [2] The reasons for developing such technologies were enumerated as 1), 'immunity against technology denials', 2), 'enabling the pursuit of an independent foreign policy without having to kowtow to global powers' and 3), that 'an indigenous technology base provides an impetus for a country's economic development.'[3] This was also brought out in the comments of the then Prime Minister in 2008 that 'at the heart of self reliance is our ability to define the strategic and critical areas in which to build national capability'. [4]

In the absence of any evidence to the contrary, it appears that the GoI, while communicating the overall objective of achieving self reliance, has accordingly stressed on the acquisition of critical or key technologies through imported Transfers of Technology (ToT) in its successive editions of the Defence Procurement Procedure (DPP). The DPPs stated that these technologies need to be identified in consultation with the DRDO and would necessarily have to be identified at the Request for Information (RFI) stage so that they could be included in the Request for Proposal (RFP) issued to the vendors. [5]

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1 S.N. Mishra, *Self-Reliance Index and the Enduring Legacy of Kalam* , Indian Defence Review, 15 October 2015, available at http://www.indiandefencereview.com/news/self-reliance-index-and-the-enduring-legacy-of-kalam/

2 Nabanita R. Krishnan, *Critical Defence Technologies and National Security - The DRDO Perspective,* JDS Vol 3. No 3. July 2009 p. 91

3 Nabanita R. Krishnan, *Critical Defence Technologies and National Security - The DRDO Perspective,* JDS Vol 3. No 3. July 2009 p. 91

4 '*Self-reliance is not just a function of numbers or of percentages. At its heart is our ability to clearly define those strategic and critical areas in which development of national capability is a must. We must pursue this goal with determination and a long-term perspective.'* Prime Minister Dr. Manmohan Singh, May 2008 as quoted in Nabanita R. Krishnan, *Critical Defence Technologies and National Security - The DRDO Perspective,* JDS Vol 3. No 3. July 2009, p. 91

5 See DPP 2008, p.2, 122, DPP 2011, p. 2,9,10,127, DPP 2013, p. 2,4,9,12, 135 and DPP 2016, p. 1, 2, 33, 103, 128 all available at www.mod.nic.in

The Defence Production Policy (DPrP) 2011 of the GoI, while emphasising the objectives of achieving substantive self reliance and providing equipment with a superior edge over the adversaries, states that 'in all cases of Transfer of Technology, DDP along with DRDO, HQ IDS and SHQs will be involved in identification and evaluation of *requisite* technology, and subsequently would be responsible to ensure that appropriate absorption of technology takes place in the Indian industry. Thereafter, successive generations of the weapon systems/ platforms will be developed in the country.' [6]

While both the Abdul Kalam Committee report and the DPPs stress the importance of holding critical technologies, there is a significant difference between the two. While the committee stresses on *developing* them, the DPPs stress on *acquiring* them through ToT. *Developing* them would result in the building up of the all important know-whys for design and development in addition to the know-hows for manufacturing. *Acquiring* them *through ToT* (especially the licensed manufacture mode mentioned in the DPPs) only provides the know-hows of manufacturing. [7] Hence, while the former leads to capabilities to build an unlimited number of successive upgrades and variants, the latter enables only the limited manufacture of the current version with the added burden of the inevitable dependence on the original vendor for proprietary parts. [8] To this extent, theDPrP's assumption that after acquisition and absorption of the technology through ToT, 'successive generations of the weapon systems/ platforms will be developed in the country' appears to be weakly premised and overly optimistic.

This notwithstanding, one can assert that acquiring the manufacturing technologies of critical subsystems will still benefit the DRDO and enable it to develop systems with greater indigenous content. Therefore, leveraging acquisition contracts for filling gaps in knowledge of critical technologies through ToT appears to be a commendable approach to 'kill two birds with one stone'. Unfortunately, since the DPP and DPrP do not explain what is considered 'critical' technology, there is a void in the understanding of this aspect which even the well informed in the system have been unable to explain. One can arrive at, five explanations, on

6 DDP is the Department of Defence Production, HQ IDS the HQ Integrated Defence Staff and SHQ the Service HQs of the three military services. See the Defence Production Policy 2011, available at www.mod.nic.in, para 12

7 For an understanding of know-hows and know-whys see Kevin A. Desouza (2016): Transfer of Defence Technology to India: Prevalence, Significance and Insights, Journal of Defence Studies, Vol. 10, No. 4 October-December 2016, pp. 40-42 at http://idsa.in/jds/jds_10_4_2016_transfer-of-defence-technology-to-india

8 Foreign firms do not provide proprietary technology in ToT. See Kevin A. Desouza, IDSA COMMENT, Examining the Case for Complete Transfer of Technology**,** March 21, 2017 available at http://www.idsa.in/idsacomments/examining-the-case-for-complete-transfer-of-technology_kadesouza_210317. It is also an accepted fact that attempts at reverse engineering or derivative engineering using such know-hows have not been successful in building the know-whys required for independent development of the next major upgrade or variant.

what 'critical' technologies could mean, with each of these raising its own sets of questions.

One is that it is technology without which the system will not perform its key function.[9] Going by that explanation, if we take a missile boat, would this mean that the missile system is critical and the floatation, propulsion and surveillance and communication systems are not? Similarly, in a battle tank, the armour plated hull, the power transmission, gun, missiles system and even optronic sights are all important to enable its functioning. So which of these are critical and which are not?

The second is that it is technology that is desired by India and included in the 20 critical technologies list of the DPP which can be offered to DRDO for Offset credits.[10] These correspond to the critical technologies identified by the Abdul Kalam committee and are all highly advanced technologies, many still in the development stage in foreign countries. Over the past few years, some of these offset offers have been received and evaluated by the DRDO. During interactions with the Original Equipment Manufacturers (OEMs), the DRDO made it known that the know-hows as well as the know-whys of these are required, to which it is believed that the OEMs responded with unaffordable prices up to a hundred times the cost of manufacture.[11] The foreign OEMs also indicated their apprehension that their technology would be used by the transferee to compete with them in the future. Another angle on this definition is that contemporary systems being procured with ToT (which are typically a couple of generations behind the cutting edge) are not likely to have any of these advanced technologies. So does that mean that there are no technologies in these contemporary systems which need to be classified as critical?

The third explanation for what constitutes critical technology, is that it is technology which is available in contemporary systems not available in India and can be used in DRDO designed systems in the future.[12] Does this mean that the Service HQs/DRDO should identify which subsystems of the system being procured are not being manufactured in India? What if the critical technology has very limited demand in the industry and hence setting up a manufacturing capability becomes uneconomical? Or the technology of the subsystem is already halfway through its life and is likely to be replaced soon? There are 6000 Medium, Small and Micro Enterprises MSMEs, 60 private firms, 9 DPSUs and 41 Ordnance factories manufacturing defence equipment. How are the voids to be identified

9 This is one of the interpretations by a senior DRDO scientist

10 See the Defence Offset policy in DPP 2016 p. 63, 64, 83. This view was expressed by a DRDO scientist as a possible interpretation.

11 Information gleaned during an interview with a senior DRDO official in April 2017

12 Palhan, S.K., H.C. Gandhi and Brig S. Bhalla (Retd), Defence Industrial Base 2025, New Delhi: Centre for Joint Warfare Studies, 2010, p. 49. This view has also been expressed by a senior DRDO scientist.

since a comprehensive competency map of the Indian industry is yet to be fully collated.[13] Current databases in DRDO laboratories cover manufacturing technology available for systems which are being developed by them and not country-wide capabilities. Another question is whether the foreign OEM will share all the intricate details of his technology at the RFI stage since, as per the DPP, the critical technologies need to be specified in the RFP?

The fourth is that these are technologies that are not available in India and the absence of which can negatively impact operational availability, combat capability, and long term life cycle support of a system.[14] This would mean that subsystems and parts which are likely to fail during the life of the system should be manufactured in India using the requisite critical technology. What if the numbers needed are too few to allow for efficient economic utilisation of such a technology? Such a requirement of holding spare assemblies and parts or the capability of their repairs are normally assessed scientifically by the maintaining agencies of each of the three military services during their maintainability and maintenance evaluation trials and requisite solutions worked out. These solutions are typically, the stocking up of spare assemblies/parts and contracting of Maintenance ToTs (MToT) for their repairs. There is no need therefore to supplement such a requirement with additional 'critical' technology unless it makes economic sense.

The fifth is that these are technologies 'the withholding of which would bring the production or operation of a particular system to a halt'. [15] This definition presupposes that foreign countries may decide to suddenly and without good reason, stop the supply of certain parts including the critical proprietary parts, thereby halting production or preventing replacement of failed parts of systems in operation. Does this mean that technologies of all the proprietary parts are to be considered critical? OEMs are unlikely to provide such proprietary technology, and even if they did, they would be priced exorbitantly and possibly a drain on the economy with no matching returns. [16] OEMs will however, be open to providing spares of the proprietary assemblies or parts as part of the MToT package mentioned above. As regards halting of production, why would a foreign seller suddenly withhold a proprietary part which he has agreed to supply in a contract? Such a situation may only occur if sanctions are suddenly imposed on India for a violation of international regulations or treaties, or a violation of the seller's Intellectual Property Rights (IPR), by the Indian buyer firm, both of which are highly unlikely.

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13 As mentioned by a senior Niti Aayog consultant in a seminar on 20 May 2017 at IDSA

14 This has been received as one possible interpretation, from a member of the Committee of Experts which approved the DPP 2016

15 Ajai Shukla, *Indigenisation – a false debate*, at http://www.business-standard.com/article/economy-policy/indigenisation-a-false-debate-113091001027_1.html accessed on 12 Apr 2017

16 See n.8

From a study of the above five, the third definition of what constitutes critical technologies seems to be the most relevant, supported somewhat by some aspects of the others. So 'critical' technology to be acquired through ToT would be those manufacturing technologies which are desirable in India for the production of subsystems, which can be used in DRDO developed systems. These desired technologies would comprise both the product technology (which covers the specifications and engineering drawings) as well as manufacturing process technology in the form of process description documents, special machines and know-how, in case the latter is not already available in India.

Unfortunately, product technology/design cannot be used to produce more than the licensed/contracted number due to contractual restrictions as well as the foreign seller's control on the proprietary items.[17] Hence its utility during and after the contract period is limited to technology diffusion among the workforce or some amount of the contractually prohibited reverse or derivative engineering. Reverse/derivative engineering is not always successful and does not provide tacit knowledge or the know-whys necessary for independent design and development.[18] There is no doubt that some successful defence systems have been modeled after others, but such efforts are akin to 'chasing the tail' of older technologies which are matured and on their way out and hence will squander precious R&D resources.[19]

Manufacturing process technologies, such as laser drilling, wave soldering, X-ray testing etc and the know-how to use them can be of great use but are expensive and typically purchased separately by Indian firms since they have wide applicability over a range of products, both military and civil. Hence, acquisition of these through ToT contracts may only skew ToT prices due to their high cost. Also, what if a process technology was acquired but cannot be put to economic use due to inadequate demand, both domestic and export? What if such processes are required only intermittently, with the danger of the loss of workforce skill? What if the raw materials required for these processes are not available in India and have to be imported at great expense? These are uncertainties in the 'business case' that are extremely difficult to analyse and gauge in the current acquisition system which processes a wide range of relatively smaller orders of equipment, by SHQ

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17 See Kevin A. Desouza (2016): Transfer of Defence Technology to India: Prevalence, Significance and Insights, Journal of Defence Studies, Vol. 10, No. 4 October-December 2016, pp. 40-42 at http://idsa.in/jds/jds_10_4_2016_transfer-of-defence-technology-to-india pp. 45, 46 on restrictive trade practices, many of which continue to be prevalent in defence contracts. Also see N.9

18 See Shenoy, Ramadas P., *Defence Research and Development Organisation 1958-82,* DESIDOC, DRDO 2006 Delhi, p. 177 where he presents how ARDE scientists placed an importance of acquiring tacit knowledge required for independent design and development, through learning by doing

19 'Chasing the tail' is a very apt expression used by a senior consultant of the Niti Aayog in a seminar at IDSA on 20 May 2017

officers, DRDO scientists and Department of Defence Production (DDP) officials who are under-informed on the business angle of manufacturing technology.[20]

We now come to the biggest challenge in acquisition of critical technologies through ToT; competing defence systems of different countries employ technology developed in their country's R&D eco-system and therefore, may greatly differ from each other. Let us take the hypothetical example of competing Russian, Swedish and Israeli search radars, which use, say, the technology of older and cheaper, cascaded Radio Frequency (RF) amplifiers, more current and expensive Travelling Wave Tubes (TWT) and advanced, very expensive solid state devices respectively. If the SHQ and DRDO select solid state technology (which is the most advanced), and that is specified in the RFP, it would rule out the first two competing systems. Since foreign OEMs are well aware of the broad technology used in their competitor's systems, they could take advantage of the single vendor situation to overprice their system.

One suggestion offered to overcome this situation is that the technology of all the three competing radar systems should be listed in the RFP as acceptable.[21] This can be done and will probably be successful if any of the three technologies can be utilised by the DRDO. Unfortunately, none of these would be compatible with the Indian DRDO developed radars which now use Active Electronically Scanned Arrays (AESA) based technology. This leads us to infer that the technology identified as critical must be in consonance with or at least compatible with DRDO / indigenous technology. Ensuring such compatibility, however, greatly limits the competition and increases the probability of the occurrence of single vendor situations.

With different technologies comes different strengths. What if the DRDO wanted to obtain the best technology from each country – the rugged hulls/bodies/airframes of Russia, the superior electronics of Europe and the advanced digital systems of Israel? How would all these be acquired when only one vendor can be ultimately selected?

With so many vexing issues plaguing the 'critical' technology aspect, it is no wonder that a senior official in the government posed a question - If the DRDO requires a technology why does it not simply purchase it? The question is extremely pertinent and valid. The primary function of the acquisition process is to procure equipment and systems which meets the needs of the defence forces. By 'leveraging' the process to obtain 'critical technologies', which as we have discussed here, deliver

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20 Service HQs (SHQ) officers are not given much exposure to manufacturing, DRDO scientists do not have experience in building 'business models' and Department of Defence Production (DDP) officials deal with manufacturing technology used in the Ordnance Factories and Defence Public Sector Undertakings (DPSUs) which are generally speaking , considered not as up to date as their private counterparts.

21 A suggestion put forward by a DRDO scientist

very limited benefits to the Indian defence industry, is it possible that we are losing the primary focus and bogging it down with secondary, complex requirements?

Clearly, there is a need to analyse and understand the true benefits of acquiring of 'critical technologies' through ToT. A study of all the contracts in the past 15 years for material benefits gained may shed some light and show the way forward. Numerous alternatives such as shifting the critical technologies clause to the offset package, setting clear definitions in the DPP or doing away with the 'critical' technology requirement altogether, if it can be directly purchased by DRDO or an Indian firm etc. could then be evaluated for optimal benefits to the acquisition process and the Indian industrial base at large.

About the Authors

Kevin A Desouza is a Research Fellow at the Institute for Defence Studies and Analyses (IDSA).

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Institute for Defence Studies and Analyses
1, Development Enclave, Rao Tula Ram Marg
New Delhi 110 010 India
T +91-11-2671 7983 F +91-11-2615 4191
contact.idsa@nic.in www.idsa.in
Twitter @IDSAIndia
www.facebook.com/InstituteforDefenceStudiesAnalyses