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Examining India's Defense Innovation Performance

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India has expended a great deal of energy and resources to set up a vast defense economy to innovate and produce state-of-the-art weapon systems for use by the armed forces. However, the performance of the defense economy has been largely suboptimal, leading to poor self-reliance in arms procurement and heavy dependence on foreign sources for meeting the key defense requirements. An examination of the causes of poor performance exhibits a number of shortcomings related to India's both 'hard' and 'soft' innovation capacities. Inefficiency and lack of reforms of the main research and development (R&D) and manufacturing players, meager R&D and procurement budgets, poor management of human resources, lack of strong support from the political leadership, and a weak acquisition system, leave India's defense innovation in a poor state.

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Self-reliance in defense procurement has been a key objective of Indian policymakers since the country's independence in 1947. The country has expended a great deal of energy and resources to set up a vast defense economy to innovate and produce state-of-the art weapon systems for use by the armed forces. To the credit of this defense economy, India is one of the few countries in the world to have achieved a credible, multi-level nuclear deterrence, as well as being one of the few to have designed, developed, and produced a fourth-generation combat fighter aircraft, a main battle tank, and nuclear-powered submarine. It is also one of a handful of countries that can boast of using its own ballistic missile system to send a military satellite into geostationary orbit. With an active ballistic missile defense program, and an array of other high-profile research & development (R&D) projects that include a range of missile systems, airborne surveillance systems, and unmanned aerial vehicles, India's defense innovation image looks quite impressive. However, behind these impressive feats lie many gaping holes, resulting in the country's overwhelming dependence on external sources for conventional arms, and the country repeatedly earning the dubious distinction of being the largest arms importer in the world. This, in turn, raises questions about the efficiency and efficacy of the Indian defense innovation system and whether India can ever achieve its long-cherished goal of reaching 70 percent self-reliance in defense procurement.

This research brief evaluates India's defense innovation performance. In so doing, it also briefly maps India's approach to defense innovation, especially as related to big platforms. The brief follows two approaches for the evaluation of innovation performance. In the first, innovation performance is measured through a self-reliance index, defined as the percentage share of indigenous procurement in total defense procurement. The second approach deals with India's "hard" as well as "soft" innovation capabilities.

AN AD HOC APPROACH TO INNOVATION

India's approach to defense innovation can be described as ad hoc at best. Unlike some other countries—particularly China, which has methodically gone through the different innovation stages one at a time, India has sought to leap to the highest forms of innovation from the very beginning. India's big-bang entry into radical defense innovation was heralded as early as 1956, when the country launched an ambitious program to design and develop its HF Marut combat aircraft. The attempt was truly ambitious, not least because India's industrial and technological base at that time was rudimentary. Predictably, when the program did not live up to expectations, it was abandoned in favor of direct arms imports and/or licensed production of foreign-designed weapons. The abandonment of innovation was also accelerated by the need to equip the armed forces quickly after India's 1962 defeat in a border war with China.

Although India has attempted to return to pursuing higher forms of innovation, big innovations, especially those related to next generation of fighter aircraft, submarines, helicopters, and armored fighting vehicles, have been pushed aside in favor of assembly and licensed production of foreign designs. At the same time, India continues an ad hoc approach where it pursues design and development of some high-end platforms, while relying on the innovation capability of other countries for lower-end items as assault rifles and carbines.

SELF-RELIANCE INDEX

In the early 1990s, the Indian government set up an expert committee under the chairmanship of Dr. A. P. J. Abdul Kalam, then scientific advisor to the defense minister, to chart out a self-reliance road map for the country.[1] As per the prepared road map, the self-reliance index in defense purchases was to increase from 30 percent to 70 percent by 2005. The target has yet to be achieved. A 2012 study found the self-reliance index between 36–48 percent for procurement in 2006–2007 and 2010–2011.[2] In the post-study period, the index does not seem to have increased in any significant manner.[3]

Apart from the direct imports undertaken by the Ministry of Defense, domestic industry imports a significant quantity of parts, components, and raw materials for production purposes. The latter, which can be categorized as India's indirect arms imports, amount to nearly 30 percent of the value of sales of defense public sector undertakings (DPSUs) and the ordnance factories (OFs), the two main state-owned players in the Indian defense production set-up. If this 30 percent indirect import is deducted from domestic supplies, which account for about 60 percent of India's arms, self-reliance in total defense procurement would be in the region of 40 percent, far below what was planned to be achieved by 2005.[4]

1 Dr. Kalam was later the eleventh president of India, from 2002 to 2007.

2 Laxman Kumar Behera, "Indian Defense Industry: Issues of Self-Reliance," IDSA Monograph Series, No. 21, July 2013, 52.

3 Laxman Kumar Behera, "Indian Defense Industry: A Reform Agenda," in *Defense Reforms: A National Imperative*, ed. Gurmeet Kanwal and Neha Kohli (New Delhi: Pentagon Press, 2018), 181.

4 Author's database.

ASSESSING INDIA'S HARD AND SOFT INNOVATION CAPABILITIES

Over the years, India has cultivated a vast array of both hard and soft innovation capabilities. Hard capabilities include an R&D and manufacturing network, a dedicated R&D and procurement budget, and a large pool of scientists, engineers, and other workforce talent. Soft capabilities include both the institutions and processes pertaining to higher decision-making, planning, and acquisition. However, numerous challenges are encountered on both the hard and soft innovation sides, limiting the innovation potential of Indian defense economy and leading to and perpetuating India's arms import dependency.

Inefficient R&D and Manufacturing Apparatus

India's giant state-owned/controlled entities dominate the defense economy. They have vast operational experience, beginning with the first production of arms dating back to the early nineteenth century. Among these entities, the Defense Research and Development Organization (DRDO), is the dedicated defense R&D agency of the government responsible for design and development of weapons ranging from missiles, aircraft, tanks, and radars to ammunition. The DPSUs and OFs, on the other hand, are more like captive production houses. However, most of their production is based on technologies sourced from either the DRDO or foreign entities. Together, the DRDO, DPSUs and the OFs employ more than 185,000 people.[5]

The performance of these entities, however, leaves much to be desired. Despite some notable successes, especially in missiles, the performance of the DRDO is well below expectation. Time and cost overruns together with performance shortfalls are the notable features of the DRDO's major R&D programs. For example, the DRDO's two flagship programs, the light combat aircraft (LCA) and the Arjun main battle tank (MBT), have seen mammoth cost increases and time slippages besides eliciting poor customer response. Although the organization is presently engaged in a number of high-profile R&D projects, it is not a party to some of the major ongoing procurement projects, which include fighter aircraft, submarines, tanks, and helicopters, indicating lack of trust on the part of the users and the government on organization's capacity to undertake complex, large-scale innovation in a time bound manner.

The performance of the DPSUs and OFs is no better. Measured in terms of key innovation parameters such as R&D spending, patents, in-house design and development, and technology assimilation and indigenization, the defense industry is often found wanting. In terms of the number of patents and copyrights, by far the most common yet powerful indicator of innovation, the DPSUs and OFs rank far below their global peers. By March 2012, they together held a mere 23 patents. In comparison, the US-based aerospace major Boeing claims more than 1,000 patents in a single program, the 787 Dreamliner.[6]

Meager R&D Expenditures

Although India has often touted the goal of self-reliance in design, development, and production of military equipment, it has hardly backed up this goal with adequate resources. Compared to the United States and China, which spend in excess of ten percent of their defense budgets on R&D, India's current spending is less than six percent. Before the 1980s, India's R&D allocation was negligible: about one percent of the defense budget in the 1960s, rising to about 2 percent in the early 1980s. This low percentage, together with India's relatively small overall defense budget (about $43 billion in 2018–2019), means that India's defense R&D budget is minuscule in comparison to other major countries. In absolute terms, DRDO's 2017–2018 budget of Rs 148 billion (US$ 2.3 billion) amounts to a mere three percent of the US Department of Defense's more than $76 billion R&D budget.[7] With such a small budget, there is a limit to which types of innovation can be funded.

Poor Human Resource Management

Although the Indian defense innovation apparatus has a huge workforce to draw from, its management leaves much to be desired. On one hand, there is a shortage of high-quality scientists, engineers and designers; while on the other, there is a surplus of workers at the shop floor. The latter is evident from the low productivity of the state-owned entities. In the case of the DPSUs, average sales per employee is less than one-fifth of that of their global peers.[8] The shortage of high-quality workers is a particular problem in the DRDO, which is supposed to be at the heart of India's defense innovation. For example, there are only about 7,500 scientists at DRDO, who are responsible for nearly 260 projects (excluding strategic programs). In other words, on aver-

5 Ibid.

6 "Guarding the 'Gold'," *Boeing Frontiers*, May 2010, http://www.boeing.com/news/frontiers/archive/2010/may/i_eot.pdf.

7 Figures for the DRDO's budget are calculated from Indian Ministry of Defense, *Defense Services Estimates 2017–18*, and for the US defense R&D budget from US Department of Defense, *National Defense Budget Estimates for FY 2018*, 10.

8 Laxman Kumar Behera, *Indian Defense Industry: An Agenda for Making in India* (New Delhi: Pentagon Press, 2016), 51.

age, there are fewer than 30 scientists devoted to each project.[9] With such a small number, there is a built-in constraint as to how much focused attention a scientist can provide to any assigned project.

Lip Service from Political Leaders

The country's political leadership has a vital role in driving defense innovation in a number of ways: by setting goals in key policy documents, monitoring progress on projects of national importance, removing obstacles through timely reforms, and providing adequate resources for procurement and R&D. In India, however, the role of leadership in defense issues in general, and innovation in particular, does not often go beyond lip service. The self-reliance goal cherished by successive leaders has not yet been mandated in any high-level policy document. The planning documents of the Ministry of Defense, which are formulated with three time horizons in mind (annual, five year, and fifteen year), are more oriented toward procurement, and do not outline any concrete national goals for the defense economy. Without a plan that can be monitored by the senior policy leaders, various projects are sanctioned in an ad hoc manner without consideration of the long-term consequences.

The political leadership's lack of interest in defense innovation is particularly visible on the various reform fronts. Key reforms suggested in the past either are ignored or are implemented at an extremely slow pace, negating any benefit that could accrue. In addition, the leadership's lack of commitment to defense innovation is clearly visible on the resource front. In the last several years, India's defense procurement and R&D budget has been on a downward trend, largely due to increased personnel costs because of hikes in salaries and pension benefits. There is, however, no concrete plan to stem these rising costs nor to find resources to keep innovation amply funded. As a result, defense procurement and R&D, which was more than 45 percent of the defense budget in 2007–2008, has been reduced to around 30 percent in 2017–18. With a shrinking share of resources, it is not surprising that funding for indigenous projects remains constrained.

Acquisition Structure and Process

Since the turn of the present century, India has attempted to evolve a structure and a set of procedures to streamline defense acquisition, not only to strengthen the country's defense preparedness but to do so through greater participation of domestic R&D and production agencies. The evolved structure, known as the defense procurement organization, consists of the Defense Acquisition Council (DAC) at the top and a number of subordinate bodies under it, including a defense procurement board, defense production board, and defense R&D board. The evolved procedures are set out in a document known as the Defense Procurement Procedures.[10]

This new structure and procedures notwithstanding, key weakness have limited their utility in driving innovation. This is largely due to animosity and mistrust among the major stakeholders. Although there are different bodies responsible for various aspects of innovation, there is no unity of purpose among the stakeholders, especially between the users on one side and development and production agencies on the other. This lack of unity has prevented timely decision-making and performance trade-offs that are crucial for driving developmental projects.

CONCLUSION

Except for a few successes, especially in the nuclear, space, and missile arenas, India's defense innovation performance can be described as lackluster at best. This is amply evident from India's continued high import dependency for major conventional arms. The poor innovation performance can be attributed to a number of factors, related to both hard and soft innovation capabilities. Lack of vision and commitment of higher political leadership combined with a weak governance structure has ensured an ad hoc approach to defense innovation. The problem has further been aggravated by inefficiency and lack of accountability on the part of major players in the defense economy (especially the DRDO, the DPSUs, and the OFs), poor human resource management, and insufficient allocation of resources for design and development. It would take an effort of gigantic proportion to reverse the trajectory of Indian defense innovation capability.

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9 Defense Research and Development Organization, *Annual Report 2015*, 3–4.

10 See Indian Ministry of Defense, "Defense Procurement Procedure 2016: Capital Procurement," https://mod.gov.in/sites/default/files/DPP-2016.pdf.