

Vision 2047: Techno-Nationalism and the Military Industrial Complex as the Engines of India's National Power

Abhilash Roy¹

Abstract

This paper explores how techno-nationalism, when strategically harnessed through a robust and future ready military industrial complex, can act as a central driver of India's comprehensive national power in the run up to *Viksit Bharat 2047*. It argues that the convergence of technological self-reliance, indigenous defence production, and innovation-led strategic autonomy is essential for India to emerge as a leading power in an increasingly multipolar and competitive global landscape. With rising global militarisation, intensifying technology rivalries, and an unpredictable geopolitical environment, India's security and developmental imperatives are tightly interlinked. The study traces India's evolving defence-industrial ecosystem, highlighting key policy initiatives such as *Aatmanirbhar Bharat*, *Make in India*, and strategic private sector participation and defence exports. It analyses the challenges that have historically hindered indigenous capacity building, while identifying novel opportunities for accelerated transformation through public-private synergy, technology transfers, and integration into global supply chains.

By situating India's techno-nationalist trajectory in comparison with global power strategies of China and the US, the study underscores the need for India to adopt a more agile, innovation centric, export oriented and strategically coordinated approach. Focus is laid on dual use technologies, critical defence enterprises, and emerging domains like cyber, space, and AI based warfare. Ultimately, the findings contend that a powerful and self-sustaining military industrial complex, underpinned by a techno-nationalist ethos, will be indispensable to achieving the goals of *Viksit Bharat 2047*. It will not only enhance India's strategic deterrence and global standing but also contribute significantly to economic growth, employment, and technological leadership.

Keywords: Techno-Nationalism, Defence Indigenisation, Military-Industrial Complex, Defence Exports, Make in India, Comprehensive national power

¹ Abhilash Roy is a Faculty, Department of Political Science, The Bhawanipur Education Society College, Kolkata

Introduction

Vision 2047 embodies the legacy and aspirations of the Indian republic in its centenary since independence. It will be a seminal event, underlined by the celebration of what the nation has achieved and what it seeks to achieve further. The run up to 2047 is critical since India wants to achieve ‘developed’ status or *Viksit Bharat*, in a wide variety of fields. The vision is quite clear, enhancing India's comprehensive national power (CNP) and achieving broad ranging successes and dynamic advancements in integral fields like economy, infrastructure, education, health and quite critically, defence capabilities. In fact, hard power composed primarily of military capability composes a vital part of any nation’s CNP even by modern realist standards. While soft power and cultural capital is necessary, hard power through sheer military might still remains central to a country’s self-defence and global power projection.

Modern military and strategic doctrines have evolved since World War II, with the rise of industrialised warfare in the US. The concept of the ‘military industrial complex’ (MIC) emerged into global political discourse through US President Dwight D. Eisenhower’s farewell address in 1961 (Eisenhower, 1961) . He warned of the potential influence of a growing coalition of defence contractors, armed services and political institutions on democratic governance and foreign policy. However, Eisenhower’s warning was not a critique of defence preparedness or industry per se, but a caution against unchecked institutional entrenchment and profit driven militarism. The term came to symbolise a mutually reinforcing system wherein industrial production and military demand shaped national priorities and economic systems.

Initially coined in the context of the Cold War-era United States, the MIC soon emerged as a definable phenomenon in other advanced industrial economies. In the Soviet Union, for instance, the defence sector dominated technological innovation and heavy industry through a state commanded model, it not only embellished the Soviet defence capabilities but became an important tool for forging foreign partnerships. In fact, Soviet and US MICs have contributed to deep and lasting partnerships within and beyond their own allies and spheres of influence. In more recent decades, emerging powers like China have advanced their own variants through military-civil fusion (MCF) policies, integrating private technology firms, academia, and state R&D institutions into a cohesive national security-industrial framework.

However, the idea of the MIC has evolved beyond its Cold War pejorative. In the contemporary global order, the indigenous military-industrial base is increasingly viewed not only as a guarantor of national security but as a strategic enabler of technological advancement, economic competitiveness, and crucial geopolitical leverage. Countries now invest in military-industrial ecosystems not merely to defend territory, but to drive indigenous innovation, create employment, stimulate exports, and enhance strategic autonomy along with self-reliance.

In India's case, the MIC has historically been dominated by state run entities like the Defence Research and Development Organisation (DRDO), Hindustan Aeronautics Limited (HAL), Mazgaon Dock Shipbuilders (MDL), Cochin Shipyard Limited, Garden Reach Shipbuilders and Engineers Limited (GRSE), Bharat Electronics Limited (BEL), Bharat Heavy Electronics Limited (BHEL) among others. However, post-2014, there has been a deliberate shift towards a self-sustaining and innovation driven defence-industrial base. With the dynamic nature of non-conventional threat profiles facing India since the 21st century along with traditional vulnerabilities, a home grown and globally competitive defence industry fuelled by supportive government policy, became imperative.

The Strategic Logic of Techno-Nationalism

Techno-nationalism at its core is the linking of technological capability and security to national strength. Techno-nationalism “links technological advancement” to a nation’s social stability, economic prosperity, identity, and security (Lutkewich, 2023). The crucial rationale behind techno-nationalism lies in the fact that cutting edge, innovation driven innovation is intertwined closely with national power, sovereignty, and global stature. Technological self-sufficiency through home-grown capabilities and talent is critical to enhancing a nation’s CNP. While historically, technological growth and innovation was seen as an element of civilian-industrial growth, the 21st century has clarified that technology now constitutes a distinct strategic domain, shaping security, economic competitiveness and global influence.

Essentially for emerging powers like India, techno-nationalism is not merely a policy preference but a cardinal structural necessity. Where the international environment is marked by intensifying great power rivalries, fractured supply chains and the rapid weaponisation of critical technologies

as bargaining chips, is where the core logic of techno-nationalism stems from. It is essentially based on three imperatives.

First, national security. Modern warfare is incredibly technology driven. From precision-guided munitions, kinetic and non-kinetic defences and offences, cyberspace, satellite surveillance along with emerging fields like artificial intelligence and quantum computing, the battlefield is shaped by innovation cycles that blur the line between civilian and military applications. Dependence on external suppliers for such capabilities not only creates severe vulnerabilities in times of crisis but also subjects states to coercion and vulnerabilities through sanctions, exports restrictions, delays, and technology denial policies. For India, history has been replete with such instances, e.g. sanctions following the 1974 and 1998 nuclear tests and, more recently, delays in GE F414 engine deliveries for HAL Tejas. Self-reliance in core critical technologies intrinsic to national defence and deterrence is indispensable for credible defence preparedness.

Secondly, strategic autonomy. In a multipolar world where alliances are fluid and existing power hierarchies and structures are being closely contested, autonomy in policy and decision making depends on autonomy on critical technologies. Techno-nationalism as a strategy seeks to reduce asymmetrical dependencies, especially in areas like semiconductors, aerospace, defence platforms, and digital infrastructure. By indigenising production and building domestic military and security ecosystems and supply chains India can ensure that foreign policy choices are not constrained by external technological vulnerabilities. In its march to *Viksit Bharat 2047* these considerations will be integral to India's strategic autonomy, and initiatives like *Aatmanirbhar Bharat* and the Defence Acquisition Procedure (DAP) 2020, 2026 are designed precisely to embed this self-reliance in institutional practice.

Third, economic and geopolitical competitiveness. Advanced technologies are dual use in nature i.e. investments in defence R&D often spillover into civilian domains, driving innovation led growth in non-military uses. The US's internet revolution for instance traces its origins to ARPANET, an eventual defence funded research project. The idea of a globally interconnected set of computers emerged in the 1960s on genuine fears of a Soviet attack on the analog US telephone network (CfR Education. n.d) . In fact, geopolitical competition led to the development of a crucial military innovation which spilled onto the civil sphere, making the US the global leader in said

technology, revolutionising the world. China's rise as a technological power illustrates how civil-military fusion can simultaneously enhance industrial growth and global influence.

For India, building a robust defence industrial ecosystem not only consolidates national security but also transmits benefits into employment, advanced manufacturing and exports while enhancing its bargaining position in global institutions. Techno-nationalism thus transforms the MIC from a narrow security instrument into a growth engine of CNP, vital for India's holistic vision for 2047. Techno-nationalism tied with a robust and dynamic defence industrial complex is critical to tap India's potential in an emerging era of security and geopolitical challenges which are unconventional in nature.

India's Military Industrial Complex (MIC)

India's MIC has moved in three discernible phases: a state-dominated, import substitution era (1947-1990s); a slow, limited liberalisation and transfer of technology (ToT) phase (1990s-2013); and a rapid policy led, market-oriented consolidation and techno-nationalist push since 2014. The post 2014 pivot primarily driven by the *Make in India* manufacturing push and explicit defence-industrial policies has shifted the MIC from a supplier-centric, public-sector architecture to a hybrid ecosystem where public laboratories, corporatised Defence Public Sector Undertakings (DPSUs) and large private conglomerates cohere around innovation and export ambitions. This transformation is empirically measurable as India's defence sector has transformed radically between 2014 and 2026. During this decade, the nation enhanced its capability, capacity, and global credibility through reforms, higher investments, and a strong push for self-reliance. The Defence budget grew from ₹2.53 lakh crore in 2013–14 to ₹7.85 lakh crore in 2026–27. Meanwhile, indigenous defence production rose from ₹46,429 crore in 2014–15 to ₹1.78 lakh crore in 2025–26. Defence exports surged from ₹686 crore in 2013–14 to a record ₹38,424 crore in 2025–26, reaching over 80 countries. Key policy reforms like the Defence Acquisition Procedure (DAP) 2020, Positive Indigenisation Lists (2020), and iDEX catalyzed domestic manufacturing, innovation, and private sector participation, scaling defence diplomacy to new heights. (PIB, 2026).

Historically, India's MIC being anchored in DRDO, HAL, the OFB and a related constellation of ancillary DPSUs, prioritised platforms and sovereign capabilities over modular supply chains or

joint ventures or critical export potential. Over time, the deficiencies in this state owned and operated homogeneity were recognised through capability gaps in conspicuous areas like, advanced aero-engines, micro-electronics, submarine air-independent propulsion (AIP), guided munitions, and subsequently stimulated policy shifts. The Ministry of Defence (MoD) reworked procurement architecture through the DAP-2020 to prioritise indigenisation, technology transfer, and perhaps most crucially, strategic partnerships with private innovation.

From 2018-2021 several structural levers were introduced to operationalise effective techno-nationalism. The MoD introduced a set of structural reforms designed to reorient defence production away from import dependence towards indigenous innovation, private sector participation, and technology absorption. The Defence Production Policy along with related instruments like positive-lists, higher FDI thresholds, and strategic partnership models were not ad-hoc; but were meant to create an ecosystem of incentives and restrictions or ‘carrots and sticks’ that embed techno-nationalism into the ethos of the security architecture.

The Defence Production Policy laid the groundwork for Positive Indigenisation Lists (first announced in 2020) (MoD, 2020) that identified categories of defence equipment that would no longer be imported beyond a stipulated timeline. These embargoes covered hundreds of items, ranging from simple ancillary components to complex platforms like artillery guns, UAVs, and submarines. By doing away with the import of certain items, the government created a guaranteed and reliable domestic demand. Indian firms, both public and private are thus incentivised to invest in R&D and production capability enhancement, knowing that the armed forces must source locally. This is the ‘stick’ part of the spurring techno-nationalism in MIC through direct policy push whereby imports are discouraged through embargoes, nudging industry to innovate domestically.

Procurement categories were also reviewed in the DAP 2020 whereby Indigenously Designed, Developed and Manufactured (IDDM) were given preferential procurement status. This implies that all else being equal, a product that is designed in India gets preference over products that are merely assembled here or produced under license. This being the ‘carrot’ as it rewards genuine indigenous innovation and penalises superficial localisation. It indicates that true techno-nationalism necessitates domestic intellectual property, not just licensed production.

The strategic partnership model allows selected Indian private companies to tie up with foreign original equipment manufacturers (OEMs) to build complex platforms like submarines, fighter jets, helicopters, armoured vehicles, within India. This model seeks to encapsulate the attractiveness of Indian markets to leverage foreign technology while ensuring it is absorbed into Indian supply chains. It can be considered a hybrid instrument as foreign OEMs gain crucial market access, but only by embedding their technology into Indian industry and value chains. This simultaneously modernises India's MIC while building local capacity.

In 2020, India also raised the limit for foreign direct investment (FDI) in defence from the erstwhile 49% to 74% under the automatic route and up to 100% under the government route in special cases (PIB, 2024). The intrinsic rationale for this move was to attract foreign defence majors to set up joint ventures, R&D hubs, and manufacturing facilities in India, bringing with them critical technologies and far more crucially, global expertise and best practices. Policy-wise this was not liberalisation for liberalisation's sake, in fact, it was tied to techno-nationalism, as FDI is encouraged only if it results in ToT and local value addition.

This policy shift represents a deliberate calibration rather than an open-ended deregulation. By expanding the thresholds, the state leverages the global strategic interest in India's large domestic defence market to demand reciprocal commitments from multinational entities. Instead of relying on assembly lines for foreign designs, the enhanced foreign capital framework is structured to incentivize international original equipment manufacturers (OEMs) to deeply embed their engineering capabilities within the local industrial base.

Furthermore, tying 100% government-route FDI to specialized technology parameters ensures that entry is granted preferentially to foreign majors who deliver high-end, proprietary technologies that have historically been denied through export control regimes. This pragmatic approach safeguards national security prerequisites while accelerating the modernization of domestic infrastructure. The influx of international investments concurrently establishes domestic supply chains that link large scale assemblers with local small and medium enterprises, building resilient capacity and expanding employment within advanced manufacturing sectors.

Cardinal Challenges in India's MIC

The translation of fundamental research generated within Higher Education Institutions (HEIs) into deployable defence capabilities in India is hindered by persistent structural friction. Despite institutional initiatives such as the DRDO-Industry-Academia Centres of Excellence (DIA-CoE) and Innovations for Defence Excellence (iDEX) (PIB, 2022), key institutional, procedural, and regulatory gaps impede seamless technology transfer. Analysing these gaps are critical to understanding key stressors in the system and operationalising adept remedies.

A fundamental institutional bottleneck in the Indian defence research landscape is the structural separation between basic research and technology maturation i.e. the translational gap or the TRL ‘Valley of Death’. Academic institutions, such as the Indian Institutes of Technology (IITs) and the Indian Institute of Science (IISc), demonstrate high capacity in fundamental scientific discovery and early-stage proof-of-concept development (Technology Readiness Levels [TRL] 1–3). However, the ecosystem lacks robust translational infrastructure, specialized intermediary entities capable of advancing high-risk technologies through prototyping, environmental ruggedization, and industrial scaling (TRL 4–7). Consequently, promising academic intellectual property frequently stalls before achieving operational viability, falling into the classic innovation ‘Valley of Death’.

Case Study: DIA-CoE and iDEX Prototyping Bottlenecks

While programs like iDEX provide seed funding through Support for Prototype and Research Kickstart (SPARK) grants for TRL 3–5 prototypes, academic projects frequently hit an impasse at TRL 6. For example, indigenous quantum key distribution (QKD) algorithms and advanced sonar signal-processing models developed at IIT Delhi and IIT Madras achieved high theoretical performance in laboratory settings (IIT Delhi, 2023). However, due to a shortage of shared, specialized testing foundries and environmental ruggedization facilities, these projects faced multi-year delays in transitioning from academic software models into deployable hardware integrated with military platforms.

Effective defence innovation requires continuous alignment between technological research and operational deployment conditions. In the current framework, academic research agendas are predominantly driven by global scientific frontiers, peer-reviewed publication metrics, or broad

research grants, rather than the stringent operational constraints dictated by the Armed Forces' User Qualitative Requirements (UQRs). The absence of iterative feedback loops between frontline end-users and academic laboratories often results in prototypes that perform well in laboratory settings but fail when subjected to harsh environmental conditions.

Case Study: Unmanned Aerial Vehicle (UAV) Environmental Testing

Early-stage tactical drone and autonomous navigation research conducted under academic-defence grants frequently demonstrated high autonomy in suburban or controlled test fields. However, when evaluated against Service Qualitative Requirements (SQRs) in high-altitude terrain (e.g., Ladakh) or heavy electromagnetic interference environments, many prototypes failed due to inadequate thermal tolerance, battery degradation, and non-hardened communications protocols. The lack of early operational framing by military end-users meant researchers optimized for publication metrics rather than battlefield survivability.

The governance architecture of Indian defence R&D presents a structural conflict of interest that impedes rapid technology validation. Historically, the Defence Research and Development Organisation (DRDO) has functioned simultaneously as a primary developer of military technology and the regulatory authority responsible for testing and certifying competing solutions. This dual role, combined with a scarcity of autonomous, accredited third-party testing facilities and rigid Directorate General of Quality Assurance (DGQA) procedures, creates significant validation bottlenecks for academic and private sector innovations.

Case Study: Vijay Raghavan Committee Observations on Testing Governance

The 2024 Vijay Raghavan Committee report highlighted that academic spin-offs and private startups often wait up to two years to access state-owned test ranges (such as wind tunnels, naval hydrodynamic tanks, and firing ranges) managed by DRDO laboratories (Singh, 2023). Because DRDO's internal projects receive priority access, academic technologies face operational inertia. The committee recommended decoupling technology development from testing and certification by creating an

independent Department of Defence Science, Technology, and Innovation (DDSTI) to manage autonomous testing infrastructure.

Multi-stakeholder collaborative research involving public R&D bodies, academic institutions, and private industry partners often suffers from ambiguous Intellectual Property (IP) ownership models. Current regulatory frameworks lack standardized protocols for IP licensing, commercialization rights, and royalty-sharing mechanisms among contributing entities. As a result, private industrial partners, who are vital for scaling academic laboratory prototypes into mass manufacturing, remain hesitant to co-invest or license university-developed technologies due to uncertainties regarding proprietary rights and long-term risk allocation.

Policy Comparison: The Absence of an Indian "Bayh-Dole" Equivalent

Unlike the United States, where the Bayh-Dole Act of 1980 grants universities statutory ownership of IP generated through federally funded research (Loewenberg, 2008) enabling seamless exclusive licensing to private defence contractors. Indian public funding contracts under MoD/DRDO grants historically retained sovereign IP rights or imposed ambiguous joint-ownership terms. Consequently, when an academic lab develops dual-use algorithms (e.g., AI-driven target recognition), private manufacturing partners hesitate to invest in production lines without guaranteed exclusive commercial licensing.

A profound structural mismatch exists between the administrative procedures governing state procurement and the rapid evolution cycles characteristic of modern deep-tech innovation. Conventional defence procurement frameworks operate on multi-year acquisition cycles structured around rigid accounting rules suited for mature, standardized physical hardware. In contrast, emerging dual-use technologies such as quantum systems, software-defined radios, and artificial intelligence, evolve on logarithmic timelines. Because existing administrative auditing rules categorize unsuccessful R&D initiatives as financial liabilities rather than necessary iterative learning costs, systemic risk aversion dominates the administration.

Case Study: The 'Procurement Chasm' Between Prototype and Contract

Deep-tech startups emerging from university incubators that win iDEX challenges receive initial development grants, but face a multi-year "procurement chasm" when transitioning from successful field trials to formal procurement contracts under the Defence Acquisition Procedure (DAP). Traditional General Financial Rules (GFR) emphasizing Lowest Cost (L1) bidding models disincentivize high-risk, iterative software updates. By the time formal procurement sanctioning occurs, the underlying software architecture or microchip generation developed by the academic-startup team is often obsolete.

To resolve these systemic frictions, India's defence innovation policy must transition from disjointed grant funding to an integrated, end-to-end institutional architecture. To bridge the translational "Valley of Death," the Ministry of Defence (MoD) should fund specialized technology maturation centers co-located within key DIA-CoEs and industrial clusters.

- **Shared Ruggedization Facilities:** Establish open-access environmental, electromagnetic, and military-spec testing foundries dedicated to scaling academic software/hardware from TRL 3 to TRL 7.
- **Translational Engineering Corps:** Recruit teams of systems engineers, software architects, and manufacturing experts tasked specifically with translating academic proofs-of-concept into industrial-grade prototypes, freeing academic faculty to focus on primary research.

To align university research agendas with battlefield realities, the Armed Forces must actively participate in early-stage research design rather than serving merely as downstream evaluators.

- **Service Liaison Teams:** Formally assign dedicated Service Liaison Units (SLUs) consisting of active-duty operational officers to DIA-CoEs. These teams will co-frame research targets around dynamic military requirements.
- **Agile User Requirements (A-UQRs):** Replace static, rigid User Qualitative Requirements with dynamic, flexible requirements frameworks (A-UQRs) that evolve incrementally as technology prototypes demonstrate new capabilities during field trials.

Adhering to the core recommendations of the Vijay Raghavan Committee, the government should restructure testing governance to remove systemic conflicts of interest.

- **Establish the DDSTI:** Institutionalize an independent Department of Defence Science, Technology, and Innovation (DDSTI) separate from DRDO's development laboratories to oversee testing standards, range allocation, and certification.
- **Open-Access Test Infrastructure:** Mandate guaranteed, scheduled access windows for university-led spin-offs and private sector deep-tech startups at state-owned testing ranges and national laboratories.

To effectively catalyze private sector participation and ensure the commercial viability of breakthroughs, it is vital to establish a cohesive legal structure that regulates intellectual property rights emerging from state-sponsored defense R&D.

- **Institutional Patent Autonomy:** Codify the rights of higher education entities to hold title over innovations generated via public grants, facilitating the streamlined transfer of technology to industrial integrators through varied licensing arrangements.
- **National Security Prerogatives:** Preserve the state's inherent authority to access and deploy such intellectual assets without financial encumbrance during periods of strategic crisis or defense mobilization, safeguarding the overarching interests of the republic.

Ensuring that disruptive innovations do not succumb to the structural inertia of the "procurement chasm" necessitates a fundamental recalibration of the Defence Acquisition Procedure (DAP) to accommodate the rapid, non-linear trajectories of modern deep-tech evolution.

- **Quality and Capability-Based Selection (QCBS):** It is imperative to insulate high-risk, research-intensive procurements from the restrictive Lowest-Cost (L1) mandates of General Financial Rules (GFR), instituting instead QCBS frameworks that privilege sophisticated technological parameters and architectural modularity.
- **Fast-Track Production Offtake Contracts:** Institutionalizing streamlined acquisition conduits is essential, whereby academic-led or startup-driven prototypes achieving TRL 7 verification via iDEX or TDF are granted low-rate initial production (LRIP) status, bypassing the recursive redundancies of traditional administrative cycles.

The ethos of techno-nationalism plays a central role throughout. The primary institutional challenge identified is the existence of isolated "siloes" which leads to the academic community seeking theoretical recognition, the military seeking immediate operational readiness, and state R&D bodies protecting institutional turf. Techno-nationalism acts as an ideational catalyst to align these divergent incentives in three specific ways:

- **Reframing Academic Purpose:** Techno-nationalism shifts academic evaluation metrics beyond standard Western publication indices toward high-impact sovereign capability benchmarks. It incentivizes top-tier researchers at IITs and IISc to view strategic national challenges—such as indigenous high-temperature materials or secure military algorithms—as apex intellectual pursuits.
- **Legitimizing High-Risk State Investments:** Under traditional bureaucratic frameworks, financial auditing mechanisms (e.g., GFR) penalize failed R&D expenditures. Techno-nationalism introduces a strategic rationale that redefines R&D failures not as financial losses, but as necessary strategic investments in national technological learning and capability building.
- **Fostering Public-Private Strategic Alliances:** By framing industrial scaling as a national duty rather than merely a commercial contract, techno-nationalism encourages private defense capital to co-invest alongside university labs, accepting longer gestation periods for deep-tech development in exchange for national sovereign market access.

A potential risk of techno-nationalist sentiment in this scenario is autarkic insularity which is the tendency to attempt indigenous development of every sub-component at the expense of time and cost efficiency. For India, a mature techno-nationalist strategy must avoid isolationism. Instead, it should foster targeted technological sovereignty i.e. prioritizing indigenous control over high-leverage "chokepoint" technologies (e.g., encryption keys, critical software, sensor suites) while actively engaging in international technological alliances (such as iCET with the United States or Quad deep-tech initiatives) to co-develop dual-use foundational research.

Ultimately, techno-nationalism provides the necessary urgency to break through decades of institutional inertia, transforming disjointed academic grants and DRDO projects into a unified, outcome-driven national defense innovation engine.

Techno-Nationalism and the MIC in action

If the cumulative impact of the policy push is analysed, the impact is clear and profound. Indian Higher Education Institutions (HEIs) are increasingly moving beyond their historical roles as passive suppliers of human capital to become active, strategic participants in national techno-nationalist objectives. This operationalization manifests through an epistemic reorientation toward mission-oriented research, where top-tier institutions like the IITs and IISc prioritize national technological independence. By establishing specialized centers, academic leadership elevates strategic dual-use research in fields such as hypersonics and stealth metamaterials to apex scholarly endeavors.

Furthermore, HEIs are embedding techno-national imperatives directly into their educational curricula through the institutionalization of defence technology pedagogy. Initiatives like the joint DRDO-AICTE M.Tech program represent a formal effort to build specialized human capital aligned with national security priorities, bridging the historical gap between engineering concepts and military specifications. This is complemented by academic entrepreneurship and deep-tech incubation, with university-attached hubs like the IIT Madras Research Park evolving into engines of sovereign commercialization. By supporting spin-offs targeting iDEX challenges, HEIs demonstrate a capacity to internalize intellectual property, establishing a self-sustaining indigenous innovation ecosystem.

This strategic mobilization of academic expertise and specialized human capital serves as the foundational bedrock upon which practical, high-impact defense platforms are realized. The transition from engineering concepts in university labs to deployable battlefield assets is best exemplified by the evolution of indigenous weapon systems that have moved from developmental prototypes to global export successes.

The indigenous Akash surface to air missile system (SAM), developed by DRDO and Bharat Dynamics Limited (BDL) was once considered a stopgap measure, but the ban on imports of similar systems ensured that Akash variants (Akash-NG, Akash Prime) became the default solution. By 2021, the system had not only been adopted by the Indian Army and Air Force, but was also cleared for export to countries such as Philippines, Armenia, Egypt, Sudan, Malaysia, Vietnam (Atri, 2023). Going by its recent successes in India's effortless defence against Pakistani

drone swarms after Operation Sindoor, the interest is only set to grow. Captive demand spurred indigenous innovation in this case.

The Pinaka Multi-Barrel Rocket Launcher (MBRL) was originally a DRDO project but has evolved into a fully indigenous system with private participation through Tata Power SED, Larsen and Toubro, key private players in this sector. Its success under the IDDM category has made it one of the most widely produced artillery systems in India, now entering export markets like Armenia (DRDO n.d.). The IDDM tag gave Pinaka a strategic procurement advantage over imported systems like the Russian Grad. The inclusion of private enterprise in key integration areas like the Sagem Sigma 30 laser gyro navigation and pointing system during development of Pinaka Mk 2 by the Armament Research and Development Establishment (ARDE) Pune and Defence Research and Development Laboratory (DRDL) Hyderabad, shows veritable private-public linkages to create a symbiotic interface of innovation. It embodies techno-nationalism by preferring knowledge sovereignty over mere production sovereignty.

Where complex platforms are concerned, concerted efforts are being made to harness partnerships between Indian private firms and foreign OEMs such as the Tata-Airbus partnership since 2022, on the C295 transport aircraft Final Assembly Line (FAL). The landmark deal for 56 C295 transport aircraft signed in 2021, is being executed by Tata Advanced Systems Ltd (TASL) and Airbus Defence. Their Vadodara facility represents the first private sector FAL for military aircraft in India. Beyond supplying the IAF, it is positioned as a global export hub for Airbus, embedding India into international aerospace supply chains (Economic Times, 2025) .

Under the same model, for Project 75(I), Indian shipbuilders like MDL, L&T are competing and collaborating with global OEMs like Navantia, ThyssenKrupp to co-produce six advanced submarines with AIP (Philip, 2025). This model essentially enforces techno-nationalism pragmatically. India acknowledges its technological gaps but ensures foreign OEMs must embed expertise within Indian industry aligning with Indian participants. It accelerates capability absorption realistically.

In the FDI arena the impact is also quite clear. The biggest success story can be the AK-203 rifle produced out of a joint venture (India-Russia Rifles Pvt. Ltd), a synergy in Amethi between the Kalashnikov Concern (Russia) and the erstwhile OFB (now corporatised into Advanced Weapons

and Equipment India Ltd). It will produce over 600,000 assault rifles for the Indian Army and critically demonstrates how foreign capital and designs can be channeled into Indian factories under Indian management, ensuring long term technology absorption.

The emerging Defence Industrial Corridors are perhaps the most tangible drivers of India's technonationalist MIC. The Uttar Pradesh (UPDIC) and Tamil Nadu (TNDIC) Defence industrial corridors were launched to cluster suppliers and ancillaries, MSMEs, test beds, and anchor companies into integrated ecosystems. With investment commitments crossing ₹ 20,000 crore, these corridors seek to transform regional economies into defence hubs. In the TNDIC, the Avadi (home to Heavy Vehicles Factory and OFB units) and Hosur (auto components hub) have attracted private investment in aerospace, land systems, and electronics (Make in India, n.d.) In the UPDIC the Kanpur and Aligarh nodes are hubs of UAVs and defence components respectively. They are rapidly evolving as hubs for MSMEs producing sub-systems for larger integrators like BEL and Tata. Corridors reduce transaction and logistics costs by clustering capabilities, also stimulate local innovation.

The Human Angle

While policy reforms, industrial corridors, and procurement strategies provide the scaffolding for India's MIC, the ultimate determinant of success in human talent and ingenuity. In the age of knowledge economies, it is not simply factories or budgets that deliver national power, but the ability of a country to mobilize and harness its best minds and innovators in the service of national security and technological advancement. India boasts one of the youngest and largest STEM-capable populations in the world, harnessing domestic talent is the lynchpin for the path to realising Vision 2047. India's demographic profile offers both a challenge and an opportunity. By 2047, India will still be one of the youngest large nations, with an estimated 20% of the world's working age population. Already India produces nearly 1.5 million engineers annually (PwC, 2023) and has a vibrant global diaspora leading technology companies and research laboratories worldwide. This talent surplus positions India uniquely among emerging powers as developed nations grapple with aged populations and China's workforce shrinks.

Harnessing this talent for the MIC requires not only training but strategic channelling of skills into defence innovation. Vision 2047 demands that India not allow its brightest minds only to power

foreign enterprises but rather to integrate into national defence R&D, dual-use tech and indigenous industrial ecosystems. Despite India's talent pool, critical gaps persist in specialised areas such as propulsion systems, advanced materials, semiconductors, cyber-warfare, and quantum computing. To reverse this cycle three key pillars are essential:

- Retention, by offering competitive incentives, cutting edge laboratories and entrepreneurial support ecosystems that keep Indian scientists and engineers engaged domestically.
- Attraction, by creating pathways for the global Indian diaspora to contribute back, through joint projects, collaborations, domestic sabbaticals. If it seems lucrative, talent will seek it out.
- Upskilling by aligning curricula in engineering and technical institutes with future battlefield needs in AI, hypersonics, space systems and autonomous platforms.

The prevailing pedagogical frameworks within Indian STEM education often suffer from significant temporal lags, failing to keep pace with the kinetic evolution of contemporary conflict domains, including cognitive electronic warfare, autonomous robotic swarms, and quantum-encrypted communications. To address this, it is imperative to institutionalize state-backed, intensive "Defence Innovation Bootcamps," which would feature synergistic co-design involving academic faculty, lead scientists from the Defence Research and Development Organisation (DRDO), and private industrial stakeholders. These high-velocity, short-term modules, which emphasize rapid prototyping and hardware-in-the-loop simulations, are specifically designed to bridge existing talent deficits, thereby transforming foundational engineering graduates into mission-ready assets for the national defence-industrial base.

Furthermore, the fragmented dispersal of research funding across a vast network of institutions frequently diminishes overall institutional impact, precluding laboratories from achieving the critical research mass necessary for global competitiveness. Consequently, national strategy should prioritize a select tier of designated Institutes of Eminence (IoEs) for the receipt of high-density, multi-year capital grants specifically dedicated to dual-use technologies and advanced defence R&D. By consolidating state-of-the-art fabrication suites and high-performance

computing clusters within these centralized hubs, India can foster the emergence of world-class national reference laboratories, effectively mitigating the brain drain of elite deep-tech researchers.

Academic research productivity is also perpetually stymied by structural bureaucratic friction, ranging from restrictive General Financial Rules (GFR) governing equipment procurement to prolonged delays in grant disbursements and complex import clearances. To mitigate these impediments, policymakers must operationalize specific administrative exemptions for sovereign defence research, substituting conventional accounting pipelines with fast-tracked, high-trust governance frameworks for academic institutions. Simplifying logistics and hiring procedures in this manner empowers principal investigators to function with the agility essential for rapid iteration, thereby reducing latency within the translational research pipeline.

Finally, to effectively augment domestic human capital with global technological best practices, India must utilize its significant market leverage to integrate international defence primes into local academic ecosystems. This necessitates formulating structured incentives that award international Original Equipment Manufacturers (OEMs) expedited procurement status and guaranteed market access, contingent upon their R&D and intellectual property being generated in collaboration with Indian universities. Linking foreign investment directly to university-based joint ventures incentivizes multinational firms to establish advanced research hubs domestically, facilitating knowledge absorption and aligning academic output with global military standards.

The DRDO, Innovations for Defence Excellence (iDEX), and the corporatised DPSUs must become magnets for this talent. By 2047 the goal should be a highly skilled domestic cadre of defence technologists, comparable in prestige to the Indian Administrative Service of the mid-20th century. The private sector must also chip in. The start-up revolution provides India with a decentralised innovation reservoir. Major policy strides like the iDEX are aimed at start-ups working in key areas like aeronautics and aerospace. By institutionalising pathways for startups to scale from prototypes to military contracts, both domestic and foreign, India can prevent vital talent drain. Supporting dual use technologies will be conspicuous here, for instance, UAV startups that design targeted AI based agricultural drones can adapt their innovation for remote battlefield recon, and ensuring civilian innovation constantly feeds military capability and vice-versa.

Conglomerates like Tata, L&T, Adani, and Bharat Forge must position themselves as talent magnets. These firms have capital, infrastructure, and global exposure to provide high quality jobs to engineers. Through fostering public-private collaboration, India can engineer a system, whereby DRDO provides the research base, private firms deliver industrial scale, and startups bring disruptive innovation. At the heart of this system are Indian innovators, whose skills need to be cultivated and retained.

How this all converges into Vision 2047

India's military industrial transformation since 2018 must be understood, not as a set of policy initiatives, but as the consolidation of techno-nationalism into the core of national strategy. The logic is clear. In a fractured international system, the ability to design, produce and export advanced military technologies is synonymous with sovereignty, leverage, and global status. As the United States and China demonstrate, great power status today rests on who controls technology, not merely who fields the largest armies. India's pursuit of a future ready, self-reliant MIC, therefore represents both an insurance policy against dependency and a forward-looking positive strategy to embed itself among the world's decisive technological powers by 2047.

The structural levers introduced between 2018 and 2025, demonstrate the operationalisation of techno nationalism into the MIC. The 83 Tejas MK1A fighters ordered in 2021, followed by the rollout of the Tejas MK2 in 2024, and the approval of the AMCA stealth fighter in 2025, exemplify the prioritisation of indigenous aerospace. Parallel progress in land and naval systems such as the ATAGS artillery, K9 Vajra-T expansion, and 87 MALE UAVs cleared for production in 2025, signal that indigenous solutions are now the rule, not the exception.

These programmes embody techno nationalism's carrot and stick approach as they guarantee domestic producers long-term demand while restricting the import option. They also consolidate the role of private conglomerates, such as Tata, Bharat Forge, L&T, Adani, Reliance as strategic partners. Start-ups, like Ideaforge, Garuda Airspace provide cutting edge innovation in creating a triad of public-private-start-up ecosystem, instilling resilience, and competitiveness into India's system.

India's defence exports also mark a decisive shift from dependency to global influence. The BrahMos sale to the Philippines, deliveries of Akash and Pinaka systems to Armenia, and negotiations with Southeast Asian and African states show how arms exports serve as geopolitical currency. They create long-term defence dependencies, interoperability, and signal India's reliability as a security provider. When high value platforms like the Tejas fighter jets are exported and become strategic elements of foreign air forces, it creates undeniable Indian political, and economic capital globally. This export led trajectory embodies techno nationalism in its outward facing dimension. By 2047, India aims to be among the top five global defence exporters, with exports potentially reaching \$20 to \$25 billion annually (KPMG, 2025) . Defence diplomacy will thus be a fulcrum to expand India's influence across the global South and reinforce its identity as a net-security provider in the Indo-Pacific and beyond.

This will be no mean feat, and global powers have demonstrated how this can be achieved. Both the US and China have used their MICs to garner, regional, and global influence. In the US, it relies on DARPA led R&D, with defence contractors, like Lockheed Martin and Raytheon feeding the continuous turn of civil-military innovation. The US model demonstrates the power of integrating cutting edge science into military capability, and then recycling it back into the economy. Paired with that using it through exports to forge global partnerships.

China's MCF, institutionalised under Xi Jinping, aims at erasing the boundaries between civilian innovation and military application. State owned and private firms alike are compelled to serve PLA priorities, be it in shipbuilding, AI, or space. This has allowed China to become one of the world's largest naval producers and a leader in drones and hypersonic systems. India's techno nationalism shares the US and Chinese recognition that technology equals power, but its model must differ according to Indian characteristics and endemic requirements. Unlike China regimented fusion or America's contractor driven innovation, India relies on a plural ecosystem. DPSUs provide legacy strength and government vision while private players drive industrial scale and innovation.

Challenges also persist with technology gaps in critical areas such as jet engines and naval turbines. Slow bureaucratic processes, under investment in R&D, fragmentation between public and private sectors, characterised by coordination, challenges between research focused DPSUs and the

private sector, need further attention. India will also face stiff competition from entrenched players like the US, Russia, China, and Europe. However, India does possess the potentiality to overcome these challenges. Moving from Make in India to 'Design in India', incentivising true intellectual property creation, especially in propulsion systems, advanced materials, and semiconductors. Building a stronger defence talent pipeline to channel top engineering graduates into defence R&D through incentives, such as scholarships, global exposure, and high prestige fellowships will retain talent. Linking defence exports explicitly to India's foreign policy strategy will aid in arms sales. Targeting emerging markets in ASEAN, Africa and Latin America, will aid in this venture. India's unique selling point being, affordability and practical efficiency.

By 2047, if current trajectories hold, along with a dynamic policy push, India will have transformed from one of the world's largest arms importers into a global defence hub. Its MIC, with the right policies and conditions, will produce fifth-generation fighters, hypersonic missiles, indigenous submarines, among others; while exporting to Asia, Africa, and Latin America. Its private and public sector will collaborate seamlessly powered by an abundant pool of domestic minds. Defence exports will not merely be economic transactions, but strategic relationships, anchoring India's role as a security provider. By presenting itself as a security partner without question, India builds credibility distinct from Western conditionality or Chinese assertiveness.

Vision 2047 is not utopian. It is anchored in policy reforms, already underway, export successes, already visible, and talent, already being mobilised. This model not only safeguards India's autonomy, but also projects its influence integral to its comprehensive national power. When India marks its centenary of independence, the measure of its arrival as a major power on the global stage will not only lie in GDP figures, but also in whether it has succeeded in transforming its MIC into a techno-nationalist engine of sovereignty, innovation, and global heft.

References

- Council on Foreign Relations. (n.d.). Origins of the Internet: Timeline. CFR Education. <https://education.cfr.org/learn/timeline/origins-internet>
- Defence Research and Development Organisation. (n.d.). Pinaka Mk-I and Mk-II. <https://www.drdo.gov.in/drdo/pinaka-mk-i-and-mk-ii>
- Economic Times. (2025, February 16). Spain receives last batch of Airbus C-295 military transport aircraft from India. <https://economictimes.indiatimes.com/news/defence/spain-recieves-last-batch-of-airbus-c-295-military-transport-aircraft-fromindia/articleshow/123059677.cms?from=mdr>
- Eisenhower, D. D. (1961, January 17). President Dwight D. Eisenhower's farewell address. National Archives. <https://www.archives.gov/milestone-documents/president-dwight-d-eisenhowers-farewell-address>
- Indian Institute of Technology Delhi. (2023, October 6). Researchers at IIT Delhi achieve trusted-node-free secure quantum communication for 380 km in standard telecom fiber. https://home.iitd.ac.in/show.php?id=193&in_sections=Press
- KPMG India. (2025, May). Defence Blueprint 2047: India's strategic push for global defence manufacturing leadership. <https://kpmg.com/in/en/media/press-releases/2025/05/defence-blueprint-2047-indias-strategic-push-for-global-defence-manufacturing-leadership.html>
- Loewenberg, S. (2009). The Bayh-Dole Act: A model for promoting research translation? *Molecular Oncology*, 3(2), 91-93. <https://doi.org/10.1016/j.molonc.2008.12.004>
- Lutkevich, B. (2023). Techno-nationalism explained: What you need to know. TechTarget. <https://www.techtarget.com/whatis/feature/Techno-nationalism-explained-What-you-need-to-know>
- Make in India. (n.d.). Defence industrial corridors, India. <https://www.makeinindia.com/defence-industrial-corridors-india>
- Ministry of Defence. (2020). Defence Acquisition Procedure 2020 (as amended till 2030). Government of India. <https://www.mod.gov.in/dod/sites/default/files/DAP2030new.pdf>
- Philip, S. A. (2025, April 4). Germany's TKMS with MDL or Spain's Navantia with L&T? Navy set to decide who will make 6 new submarines. ThePrint. <https://theprint.in/defence/germanys-tkms-with-mdl-or-spains-navantia-with-lt-navy-set-to-decide-who-will-make-6-new-submarines/2262085/>
- Press Information Bureau. (2022, April 1). iDEX initiative. Government of India. <https://www.pib.gov.in/Pressreleaseshare.aspx?PRID=1812293®=48&lang=2>
- Press Information Bureau. (2024, February 9). FDI in defence sector. Government of India. <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2004475®=48&lang=2>

Press Information Bureau. (2025). The Defence Decade backgrounder. Government of India. <https://www.pib.gov.in/PressReleasePage.aspx?PRID=2273854®=3&lang=1>

PwC India. (2023). India@2047: A transformative journey. <https://www.pwc.in/research-and-insights-hub/immersive-outlook/india-at-2047.html>

Singh, D. (2023, August 23). Panel formed for 'restructuring and redefining' role of DRDO. BusinessLine. <https://www.thehindubusinessline.com/news/panel-formed-for-restructuring-and-redefining-role-of-drdo/article67227736.ece>

Sputnik India. (2023, December 21). What's behind rising foreign interest in India's Akash missile? <https://sputniknews.in/20231221/whats-behind-rising-foreign-interest-in-indias-akash-missile-5912917.html>

Declarations for Journal Submission

Originality Statement

I hereby declare that this manuscript is original and has neither been published nor submitted for publication, either in whole or in part, in any journal, edited volume, conference proceedings, or any other publication. The manuscript is not under consideration for publication elsewhere.

Conflict of Interest

The author declares that there are no financial, professional, or personal conflicts of interest that could have influenced the research, authorship, or publication of this manuscript.

Funding

This research did not receive any specific grant from funding agencies in the public, commercial, or not-for-profit sectors.

Author Consent and Copyright Statement

The author gives full consent for the publication of this manuscript in the Electronic Journal of Social & Strategic Studies if accepted for publication. The author retains copyright of the work while granting the journal the right to publish and disseminate the manuscript in accordance with the journal's publication policies.

Statement on the Use of AI-Assisted Tools

During the preparation of this manuscript, the author used OpenAI's ChatGPT (GPT-5.5) solely for language refinement, improvement of readability, and formatting assistance. The author independently conceived the research, conducted the analysis, verified all facts, reviewed all AI-assisted output, and assumes full responsibility for the accuracy, originality, and integrity of the manuscript.

Acknowledgements The author has no acknowledgements to declare.