Strengthening Indigenous Capabilities
Analysis of India's Defence R&D Ecosystem

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India's defence sector has witnessed a significant shift under the National Democratic Alliance (NDA) government's comprehensive 'whole-of-nation' approach to strengthen indigenous capabilities and reduce reliance on foreign imports. The government has implemented a multifaceted multi-stakeholder strategy encompassing policy reforms, funding mechanisms, infrastructure development, skill enhancement and technological partnerships to foster a robust domestic defence manufacturing ecosystem. These efforts have resulted in a tangible increase in the share of domestic procurement in the defence capital acquisition budget, enhanced defence exports and greater private sector participation in defence R&D and manufacturing. India's strategic thrust towards self-reliance (atmanirbharta) in defence production is aimed at strengthening the country's strategic autonomy, technological prowess and global influence in the defence domain.

Keywords: *Defence, India, Innovation, Reforms, R&D, Self-Reliance (Atmanirbharta)*

Introduction

According to Stockholm International Peace Research Institute (SIPRI) data, India has emerged as the largest importer of arms globally, accounting

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for 9.8 per cent of total global arms imports during the period 2019–23. This marks a slight increase from the previous period of 2014–18, where India's share stood at 9.1 per cent. The SIPRI report also indicates a 4.7 per cent change in volume of the total arms imports by India from 2014–18 to 2019–23.[1] It shows India's continued reliance on arms imports to meet its defence requirements. The country's defence spending is witnessing an increase over the years due to the heightened border tensions and territorial disputes with its neighbouring nations, China and Pakistan. This significant dependence on foreign suppliers for defence procurement exposes India to a multitude of risks associated with supply chain disruptions, escalating costs and geopolitical tensions. It is worth pointing out that the reliance on external sources not only compromises the country's strategic autonomy but also hinders its ability to foster indigenous technological innovation and self-reliance (hereinafter, *atmanirbharta*) in the defence sector.[2]

India's increasing defence import surge stems from a diverse interplay of strategic, economic and technological factors. At its core lies the nation's push to overhaul its military capabilities, moving beyond Soviet-era hardware to cutting-edge systems. This drive gains urgency from India's geopolitical calculations, marked by persistent tensions along its borders. While the country aspires to achieve *atmanirbharta* in defence production, its domestic industry currently lacks the capacity to fully meet the armed forces' diverse and sophisticated needs. This capability gap is particularly noticeable in emerging technologies, compelling India to look abroad for state-of-the-art weaponry and systems. Moreover, the country's evolving diplomatic ties, notably its warming relationship with the West alongside traditional Russian partnerships, have reshaped its procurement patterns. Also, pressing operational requirements often necessitate swift acquisitions, favouring off-the-shelf imports over lengthy indigenous development cycles.

It can be argued that disruptions in the supply chain, whether caused by trade disputes, political instability or unforeseen events, can severely impede India's access to critical military equipment and spare parts, potentially undermining its operational readiness and deterrence capabilities. Furthermore, geopolitical tensions and shifts in alliances can result in embargoes or restrictions on defence exports, leaving India vulnerable to potential shortages or delays in acquiring essential military hardware. Moreover, India's dependence on foreign suppliers for its defence needs can lead to escalating costs, as the country may be subject to fluctuations in exchange rates, pricing policies and market dynamics beyond its control.

For instance, the global shift of industrial manufacturing towards East Asia, particularly China, has magnified the challenges faced by India's supply chain and defence manufacturing capabilities. China's extensive Research and Development (R&D) budget and strong civilian industrial base, particularly in high-tech manufacturing, have led to its disproportionate influence over the global supply chain. This influence poses a significant threat to India's supply chain, particularly in times of conflict. Furthermore, complexities related to ownership of firms, including those situated in friendly countries but with Chinese ownership, compound these vulnerabilities.[3]

Against such backdrop, this article attempts to examine India's efforts to bolster its indigenous defence research, development and manufacturing capabilities. It explores how India is positioning itself in the global innovation landscape, the evolution of its domestic defence R&D ecosystem and the indigenisation drive underpinned by a 'whole-of-nation' approach. With specific recommendations at multiple levels, the article also does a deep dive into key government initiatives and schemes aimed at achieving *atmanirbharta*, as well as into the country's push to promote defence exports. The article provides a comprehensive assessment of the strategic importance of developing robust indigenous defence technological and industrial capabilities to enhance India's strategic autonomy and global competitiveness in the security domain.

Positioning India in the Innovation Landscape

The World Intellectual Property Organization (WIPO) determines the innovation landscape through seven central evaluative pillars, namely, institutions; human capital and research; infrastructure; market sophistication; business sophistication; knowledge and technology outputs; and creative outputs. According to the Global Innovation Index Database 2023 published by WIPO, India ranks first in the lower middle-income group. China leads the upper middle-income group and Switzerland tops the high-income group, followed by Sweden and the United States. India has been recognised as an innovation over-performer for 13 consecutive years from 2011 to 2023, relative to its level of economic development. It has performed relatively well on a few specific innovation pillars including market sophistication (credit/investment/trade/diversification and market scale) and knowledge and technology outputs (knowledge creation/knowledge impact/knowledge diffusion). However, its overall ranking among 132 economies at the 40th

position in the Global Innovation Index[4] points out substantial room for improvement at the global level.

Table 1 List of Top Three Economies (Income Group)

Position	High-income	Upper middle-income	Lower middle-income	Low-income
1	Switzerland	China	India	Rwanda
2	Sweden	Malaysia	Vietnam	Madagascar
3	United States	Bulgaria	Ukraine	Togo

Source: "Global Innovation Index Database", WIPO, 2023, available at https://www.wipo.int/edocs/pubdocs/en/wipo-pub-2000-2023-en-main-report-global-innovation-index-2023-16th-edition.pdf.

The global innovation landscape is increasingly dominated by East Asian economies, with the world's five biggest Science and Technology (S&T) clusters located in this region. Tokyo–Yokohama in Japan leads as the largest S&T cluster globally, while Cambridge is the most S&T-intensive cluster. China's presence is prominent, with Shenzhen–Hong Kong–Guangzhou, Beijing and Shanghai–Suzhou ranking among the top S&T clusters globally. Notably, India's performance in the innovation sector lags behind China's achievements. São Paulo (Brazil), Istanbul, Ankara (Turkiye), Moscow (Russian Federation), Tehran (Islamic Republic of Iran) and Bengaluru, Delhi, Chennai, Mumbai (India) are the only middle-income economy clusters outside China.[5]

China's dominance in the upper middle-income group shows its strategic focus on innovation-driven growth and its commitment to nurturing a robust ecosystem for R&D. To bridge the gap with China and emerge as a global innovation powerhouse, India must prioritise investments in cutting-edge technologies, nurture talent and forge strategic partnerships with leading international research institutions and industry players.

To overcome obstacles in India's defence innovation and production path, a multi-faceted approach is crucial. Boosting R&D investment to levels competitive with global leaders would provide the necessary financial backbone for innovation. Developing stronger industry–academia collaborations can create vibrant ecosystems for technological advancements. Investing in specialised skill development programmes is also essential to build a workforce capable of handling cutting-edge defence technologies. Negotiating more favourable terms in foreign defence deals for meaningful technology transfer can significantly enhance domestic capabilities. Finally,

offering targeted incentives to the private sector for defence R&D and production investments would broaden the innovation base. Implementing these strategies cohesively could propel India's defence sector towards greater *atmanirbharta* and technological parity with advanced nations, ultimately strengthening its strategic position and export potential in the global defence market.

Defence R&D in India

India's defence R&D ecosystem or defence industry comprises both public and private sectors. However, the public sector has played a predominant role so far. The Defence Research and Development Organisation (DRDO) had established 15 DRDO Industry Academia-Centres of Excellence (DIA-CoEs) at various Indian Institutes of Technology (IITs), Indian Institute of Science (IISc), central and state universities, with six already operationalised in 2023. Trained youths with specialised skills are being hired by both Defence Public Sector Undertakings (DPSUs) and the private sector for various projects in the defence sector.[6]

The Department of Defence Production, Ministry of Defence, oversees 16 Central Public Sector Undertakings (CPSUs) crucial to India's defence sector. These CPSUs cover a wide spectrum of capabilities, from aircraft and shipbuilding to manufacturing weapons, ammunition and troop comfort items.[7] These entities play a vital role in ensuring *atmanirbharta* and meeting the defence needs of the nation, contributing significantly to India's defence infrastructure and capabilities.

The National Democratic Alliance (NDA) government, led by Prime Minister Narendra Modi, has undertaken a comprehensive and multifaceted approach to achieve *atmanirbharta* in developing advanced technologies and complex systems, particularly in defence manufacturing. This strategic thrust towards indigenisation aims to create a robust domestic defence production ecosystem and reduce reliance on foreign imports.

As per the data,[8] India's defence expenditure has shown a consistent increase over the years, from Rs 218,694 crore in 2014–15 to Rs 432,604.72 crore (Budget Estimate) in 2023–24, reflecting the country's commitment to strengthening its defence capabilities. The author calculated the real defence R&D expenditure using the following formula: Real Expenditure = Nominal Expenditure/ (1+ Inflation Rate). This formula adjusts the nominal expenditure for inflation by dividing it by one plus the inflation rate. Additionally, Real Growth Rate = [(Real Expenditure in Current Year - Real

Expenditure in Previous Year)/Real Expenditure in Previous Year] * 100. This formula compares the real expenditure in the current year with the real expenditure in the previous year, calculates the difference, divides it by the real expenditure in the previous year and then expresses the result as a percentage. The data on defence R&D expenditure in India reveals some concerning trends when the real growth rate is analysed after adjusting for inflation. While the nominal defence R&D expenditure has shown a consistent increase over the years, the real growth rate has been volatile, with periods of substantial increases followed by notable declines.

Table 2 Defence R&D Expenditure in India

Year	Defence Exp. (Rs in Cr)	Defence R&D Exp. (Rs in Cr)	Defence R&D Exp. (as per cent of Def. Exp.)	Inflation* (in per cent)	Real Defence R&D Exp. (Rs. in Cr)	Real Growth (per cent)
2014–15	218694.00	13257.98	6.06	5.8	12531.17	_
2015–16	225923.00	13317.12	5.89	4.9	12695.06	1.30
2016–17	225900.00	13382.05	5.92	4.5	12805.78	0.87
2017–18	272560.00	15203.04	5.58	3.6	14674.74	14.59
2018–19	287689.00	17049.01	5.93	3.4	16488.40	12.35
2019–20	318664.58	17375.13	6.23	4.8	16579.32	0.55
2020–21	340093.51	15706.98	4.62	6.2	14790	-10.79
2021–22	347088.28	20457.44	5.89	5.5	19390.93	31.10
2022–23 (BE)	385370.15	21330.20	5.53	6.7	19990.81	3.09
2023–24 (BE)	432604.72	23263.89	5.38	_	_	_

Source: Table prepared by the author based on data obtained from: 'A Review of the Working of the Defence Research and Development Organisation (DRDO) Forty-Second Report', Ministry of Defence, Government of India, available at https://eparlib.nic.in/bitstream/123456789/2963532/1/17_Defence_42.pdf; and *Annual Report, Reserve Bank of India, available at https://www.rbi.org.in/Scripts/AnnualReportPublications.aspx?year=2023.

A closer examination of the real growth rate highlights the impact of inflation on the purchasing power of the defence R&D budget. For instance, in 2020–21, despite a nominal increase in defence R&D expenditure, the

real growth rate showed a significant decline of -10.79 per cent, indicating that the allocated funds could not keep pace with the rising inflation. This erosion of purchasing power can hamper the ability to undertake critical R&D initiatives, potentially compromising technological advancements and strategic capabilities. On the other hand, the data also reveals instances of impressive real growth, such as in 2021–22, when the real growth rate surged to 31.10 per cent. While such sporadic increases are encouraging, they may not be sufficient to sustain long-term R&D efforts, which require consistent and predictable funding streams.

To improve the real growth rate of defence R&D expenditure and ensure its sustainable growth, several measures could be considered:

1. *Indexation of defence R&D budget*: Linking the defence R&D budget to an appropriate inflation index could help mitigate the effects of rising prices and maintain the real value of the allocated funds over time.
2. *Prioritisation of R&D within the defence budget*: Increasing the share of defence R&D expenditure as a percentage of the total defence budget could provide a more robust resource base for R&D activities.
3. *Long-term planning and commitment*: Developing a comprehensive long-term plan for defence R&D, with well-defined objectives and consistent funding commitments, can provide stability and continuity to ongoing projects and initiatives.
4. *Collaboration and public–private partnerships*: Developing collaborations between government agencies, private sector entities and academic institutions could leverage collective resources, expertise and innovative capacities, thereby enhancing the overall impact of defence R&D investments.
5. *Efficient utilisation and monitoring*: Ensuring efficient utilisation of allocated funds through stringent monitoring mechanisms, periodic audits and performance evaluations can help identify areas for improvement and optimise resource allocation.

By implementing these measures, India can better insulate its defence R&D expenditure from the adverse effects of inflation and maintain a consistent real growth rate. This, in turn, can support the development of indigenous technologies, enhance self-reliance in strategic sectors and bolster the country's overall defence capabilities. It can pave the path to achieve the ambitious goal of witnessing the Indian nation as 'Viksit Bharat' (Developed India) by 2047 with increased defence R&D expenditure.

Indigenisation and Whole-of-Nation Approach

The whole-of-nation approach serves as a comprehensive and inclusive framework incorporating all stakeholders to achieve shared goals. Collaborative efforts with requisite resources make it easy to attain desired outcomes. In the context of Indian defence, a 'whole-of-nation' approach would extend beyond the traditional 'whole-of-government' approach by recognising that national security and defence affairs should involve all aspects of Indian society and not just the core defence and security establishments. It would involve engaging various facets of Indian life, such as business and investment, S&T, education, culture, media and civil society organisations, in contributing to the nation's defence preparedness and security objectives.

Under the whole-of-nation approach, ensuring national security and defence capabilities would not be viewed as the sole responsibility of the Ministry of Defence (MoD). Instead, a broader constituency including the private sector, academia, research institutions, cultural organisations and civil society groups would play an active role in enhancing India's defence capabilities through their respective domains. This approach aims to harness the collective resources, expertise and potential of various segments of Indian society, developing a comprehensive and integrated approach to addressing national security challenges and furthering the country's defence interests.

The government's most notable achievement has been the promotion of self-reliance in defence manufacturing, fundamentally reshaping the country's defence sector. Annual defence production, which was approximately Rs 40,000 crore in 2014, has now exceeded Rs 1.10 lakh crore.[9] To accurately assess the increase in annual defence production, it is essential to consider inflation over the years. The author has adjusted the nominal figures for each year to reflect their real values in terms of constant purchasing power. The formula used for adjusting for inflation is Real Value = Nominal Value / (1 + (Inflation Rate / 100). For 2014–15, Real Value = Rs 40,000 crore / [1 + (5.8 / 100)] = Rs 37,816.34 crore, while for 2022–23, Real Value = Rs 1.10 lakh crore / [1 + (6.7 / 100)] = Rs 1.03 lakh crore.

Exemplifying the whole-of-nation approach, the Indian defence sector witnessed the two-day brainstorming session, 'Impetus to Indigenisation,' organised under the aegis of the Department of Military Affairs (DMA) by the Headquarters of the Integrated Defence Staff in collaboration with the Society of Indian Defence Manufacturers on 5 March 2024. It emphasised on collaborative efforts between the government, armed forces, R&D and defence production. The session engaged stakeholders from MoD, DMA,

DRDO, academia and the industry to drive policy reforms for accelerating indigenisation and enhancing private sector involvement. Consultative discussions provided impetus to indigenisation with a focus on sustenance, Maintenance, Repair and Overhaul (MRO) issues affecting aviation, maritime and land assets. Discussions were centred on addressing policy challenges, promoting indigenous technologies, reducing import dependency and advancing private sector participation.[10]

DefConnect 2024 further emphasised inclusivity, featuring a panel on 'Women as Drivers of Change', acknowledging women's role in defence innovation and launching an Innovations for Defence Excellence (iDEX) internship programme to nurture young talent in defence innovation. The discussion featured noted participants from the Department of Space, Indian Air Force, financial institutions and start-ups, offering insights into the Indian defence landscape, technology, future trends, innovation and opportunities for the Indian start-up ecosystem. A special felicitation ceremony for iDEX women entrepreneurs was also organised. Additionally, a rolling iDEX internship programme was launched to nurture young talent and provide them with hands-on experience and mentorship in defence innovation.[11]

DPSUs are advancing the indigenisation of specified items through diverse routes within the 'Make' category and in-house development, leveraging the capabilities of Micro, Small and Medium Enterprises (MSMEs) and the private Indian industry. Such initiative stimulates economic growth, increases investment in the defence sector and curtails import dependence of DPSUs. Moreover, the government is augmenting the design capabilities of the domestic defence industry by involving research institutions and academia.[12] Such multi-stakeholder engagement with various entities depicts the emergence of a whole-of-nation approach that translates into India's positive progress in the defence sector.

Government Initiatives and Schemes

The NDA government has emphasised transforming the nation into a technology creator rather than a follower, cautioning against the pitfalls of imitating technology from developed nations, which can lead to addiction to second-class technology and a mindset of dependency.[13] Highlighting the vision of *atmanirbharta*, the focus has been given to domestic manufacturing of arms and equipment to avoid import dependence, which can undermine strategic autonomy and the ability to make independent decisions aligned with national interests.[14]

The NDA government initiatives cover policy reforms, funding mechanisms, infrastructure development, skill enhancement and strategic partnerships, demonstrating how the indigenous defence manufacturing ecosystem is helping in achieving *atmanirbharta* in advanced technologies and complex systems. Some of the most important schemes and initiatives have been mentioned and analysed in this section.

Atal Innovation Mission

The Atal Innovation Mission (AIM), launched by the Government of India's NITI Aayog in 2016, is a flagship initiative aimed at promoting a culture of innovation and entrepreneurship across the country. AIM adopts a holistic approach to promote a problem-solving mindset among students and create an entrepreneurial ecosystem in universities, research institutions and the private and MSME sectors.[15]

AIM's initiatives include the establishment of Atal Tinkering Labs (ATLs) in schools to nurture young minds through 21st century tools and technologies, the creation of Atal Incubation Centres (AICs) to support dynamic entrepreneurs in building scalable and sustainable enterprises and the development of Atal Community Innovation Centres (ACICs) to extend the benefits of technology-led innovation to underserved regions. Additionally, the Atal New India Challenge (ANIC) programme supports the commercialisation of technology-based innovations that address societal challenges. To enable the success of these initiatives, AIM has launched the Mentor India programme, engaging over 6,200 mentors from diverse backgrounds to provide guidance and support to the ecosystem.[16]

On 6 March 2024, AIM and Meta launched Frontier Technology Labs (FTLs), an initiative aimed at democratising access to emerging technologies for Indian youth.[17] This programme builds upon the foundation of 10,000 ATLs established across 722 districts in India, which focus on fostering creativity and innovation in young minds. FTLs represent an advanced iteration of ATLs, equipped with cutting-edge infrastructure to facilitate student engagement with technologies such as Artificial Intelligence (AI), Augmented and Virtual Reality, Blockchain, Cybersecurity, Robotics, 3D Printing and Internet of Things. Funded by Meta, with AIM serving as the knowledge partner, these labs will provide students access to Meta's tools and resources, including Lama and other AI tools.

On 22 July 2024, AIM and WIPO signed a Joint Letter of Intent (JLoI) to develop programmes for Innovation, Entrepreneurship and Intellectual Property (IP), targeting countries in the Global South.[18] This

collaboration builds upon India's robust innovation ecosystem, with AIM's initiatives such as ATL and AIC serving as templates for furthering innovation and entrepreneurship through South–South cooperation. The partnership aims to extend India's successful innovation models to nations on similar development trajectories, enhancing Intellectual Property Rights (IPR) awareness from the school level and unlocking global innovation potential.

Despite all the success of AIM, one of the key challenges so far has been the uneven distribution of ATLs and AICs across different regions, with some states having better infrastructure and support systems than others. Additionally, ensuring the sustainability and continuous funding for these initiatives is another challenge, as they require substantial resources and support from both the government and the private sector.

Defence India Start-up Challenge

The Indian MoD has launched the 'Defence India Start-up Challenge' (DISC) in partnership with AIM. This initiative aims to support start-ups, MSMEs and innovators in developing prototypes and commercialising products/solutions for national defence and security. The challenge has a two-fold vision: to create functional prototypes of relevant products/technologies for national security and to facilitate the entry of new technologies into the Indian defence market. DISC invites applications from start-ups recognised by the Department of Industrial Policy and Promotion, MSMEs and individual innovators. The applications are evaluated by a high-powered committee of defence and technology experts and selected applicants receive funding of up to Rs 1.5 crore in the form of equity or other relevant structures, disbursed in tranches based on milestones.[19]

The 11th edition of DISC introduced 22 problem statements from the Armoured Vehicles Nigam Limited (7), Indian Army (4), Indian Navy (5), Indian Air Force (5) and Hindustan Shipyard Limited (1), which were aimed at addressing critical defence challenges and inviting innovators to propose innovative solutions that can augment the country's defence capabilities and contribute to national security.[20] The DISC initiative reflects the Indian government's efforts to implement a 'whole-of-nation' approach, engaging various sectors of society, including start-ups, MSMEs and innovators, in contributing to the nation's defence preparedness and capabilities. However, one of the challenges has been the complex procurement processes and regulatory frameworks within the defence sector, which can sometimes hinder the speedy adoption of innovative solutions. Ensuring the seamless

integration of start-up solutions with existing defence systems and platforms is another area that requires attention.

Accelerating Growth of New India's Innovations (AGNIi)

The AGNIi (Accelerating Growth of New India's Innovations) initiative is a platform to commercialise innovative technologies developed by Indian start-ups, research laboratories and other entities. Operated under the Office of the Principal Scientific Adviser to the Government of India, AGNIi acts as a bridge between technology providers and technology users, including Indian and global enterprises, government agencies and non-profit organisations. The programme's primary objective is to facilitate the deployment of deployment-ready technologies by connecting the innovators with the relevant stakeholders who can effectively leverage these innovations to address various challenges and drive progress. AGNIi's holistic approach aims to accelerate the commercialisation of Indian-developed technologies and promote greater *atmanirbharta* across different sectors.[21] The AGNIi initiative also collaborates with Indian law enforcement and security agencies to identify opportunities where domestic technological innovations can be leveraged to enhance the capabilities of these agencies in safeguarding the country's citizens from diverse threats.[22] However, securing adequate funding and resources for the sustained development and scaling of innovative solutions can be seen as one of the significant challenges.

Srijan Portal

The Srijan portal is an indigenisation platform launched on 14 August 2020 to foster collaboration between the private sector, DPSUs and the armed forces of India. A total of 19 organisations, including 16 DPSUs and three Service Headquarters (SHQs)—army, navy and air force—are on the platform. This online marketplace functions as a non-transactional platform where DPSUs and SHQs can display items with a significant import value that they have either already imported or are planning to import in the future.[23]

The purpose of this portal is to enable the Indian industry to express their interest in items that they can design, develop and manufacture, either independently or through joint ventures with Original Equipment Manufacturers (OEMs). Based on their specific requirements and established guidelines and procedures, the concerned DPSUs and SHQs will then interact with interested Indian companies to explore opportunities for indigenisation. The portal also provides a channel for the interested Indian industry to communicate with the respective DPSUs and SHQs regarding any queries

or concerns related to the indigenisation process through the contact details provided for each item displayed on the platform.[24] The portal serves as a collaborative platform that aims to facilitate the indigenisation efforts of the Indian defence sector by bridging the gap between the public and private entities and leveraging the capabilities of the domestic industry to reduce reliance on imported defence equipment.

Mission Raksha Gyan Shakti

As part of continuous efforts to bolster *atmanirbharta* in defence, the Department of Defence Production has introduced a new framework called Mission Raksha Gyan Shakti (MRGS), aimed at nurturing an IPR culture within the indigenous defence industry. To coordinate and execute this programme, the Directorate General of Quality Assurance (DGQA) has been assigned as the authority. The overarching goal of MRGS is to instil an IP culture within the Indian defence manufacturing ecosystem.[25]

MRGS plays a crucial role in promoting indigenous innovation and safeguarding homegrown technologies within India's defence sector through multiple approaches, including awareness programmes, streamlined patent filing processes and collaborative initiatives. These efforts significantly contribute to indigenisation by stimulating domestic R&D, protecting Indian innovations and establishing a comprehensive defence-related IP knowledge base. The resultant strengthening of IPRs catalyses a cascading effect on defence exports, manifesting in enhanced quality assurance, competitive advantage in global markets, facilitated technology transfers and potential revenue generation through licensing. This symbiotic relationship between IPR protection, indigenisation and export promotion highlights the mission's strategic importance in elevating India's position in the global defence manufacturing landscape, while simultaneously addressing the dual objectives of *atmanirbharta* and economic growth through increased defence exports.

A central Intellectual Property Facilitation Cell (IPFC) has been established under DGQA to raise awareness about IPRs. Furthermore, a comprehensive policy regarding the creation and management of IP in DPSUs and Ordnance Factories (OFs) was enacted in November 2019. Innovative research conducted in DPSUs and OFs has led to the development of materials, components, assemblies and sub-assemblies, resulting in performance enhancements for existing systems/platforms while simultaneously decreasing India's reliance on imports. However, attracting private and public sector entities for IPRs poses certain challenges. Concerns

include the risk of disclosing classified information regarding defence technology due to mandatory disclosures associated with IPR filing, as well as combating infringement of IPRs.[26]

Table 3 Consolidated Data on IPRs (Organisation-wise)

Organisation	IPR Filing Target (Consolidated up to March 2022)	IPR Filed (Consolidated up to March 2024)	IPR Granted / Registered by Indian Patent Office (Consolidated till March 2024)
BEL	1349	1199	580
MDL	300	253	48
BEML	425	380	247
BDL	197	150	71
MIDHANI	202	199	94
GSL	169	68	49
HSL	159	65	14
GRSE	187	143	94
HAL	2530	2392	1008
MIL	511	336	70
AVNL	215	162	54
AWEIL	138	65	14
TCL	158	100	71
YIL	185	177	62
IOL	100	83	17
GIL	75	51	20
Total	6900	5823	2513

Source: Mission Raksha Gyan Shakti, Dashboard, Department of Defence Production, Ministry of Defence, Government of India, 1 April 2024, available at https://ddpdashboard.gov.in/MissionRakshaGyanShakti/MissionGyanShakti1, accessed on 30 April 2024.

Defence Acquisition Procedure 2020

The promulgation of the Defence Acquisition Procedure (DAP 2020) has prioritised the acquisition of defence equipment through indigenous sources and domestic manufacturing. The 'Buy Indigenously Designed Developed and Manufactured (IDDM)' category has been designated as the most

preferred option, followed by the 'Buy (Indian)' category.[27] DAP 2020 has undergone revisions to advance 'Make in India' and 'atmanirbharta' in defence while improving ease of doing business. Notable changes include mandating domestic sourcing for modernisation needs, simplifying financial procedures by replacing the integrity pact bank guarantee with earnest money deposit and reducing procurement timelines. The revamped procedure also promotes wider participation in defence manufacturing, simplifies the iDEX framework to foster innovation and streamlines the Make-II procedure to accelerate indigenisation through industry-funded projects.[28]

Defence Industrial Corridors

Two defence industrial corridors have been established in Tamil Nadu and Uttar Pradesh to catalyse indigenous production of defence- and aerospace-related items. The objective is to develop a domestic supply chain and strengthen a holistic defence manufacturing ecosystem. Both state governments have already released Aerospace & Defence Policies to encourage private and foreign investment, including from OEMs, in two designated industry corridors. As of 8 April 2024, Rs 3,116 crore has been invested, while Rs 24,121 crore has been announced in the Uttar Pradesh Defence Corridor, whereas the Tamil Nadu Defence Corridor has attracted investments of Rs 4,291 crore while Rs 18,651 crore has been announced.[29] Considering the aspect that the defence sector has a highly specialised nature, there will be need of skilled workforce to produce or procure domestic technologies. However, developing a skilled workforce and ensuring the availability of requisite talent for the defence manufacturing ecosystem remains a challenge. The way forward could involve streamlining land acquisition processes, providing incentives and tax benefits for companies investing in the corridors and establishing robust skill development programmes.

Innovations for Defence Excellence (iDEX)

iDEX was launched in 2018 by the Indian government as a comprehensive scheme with a budgetary allocation of Rs 498.78 crore from 2021–22 to 2025–26, spanning five years. The primary objective of this scheme is to deliver financial support to nearly 300 start-ups, MSMEs, individual innovators and approximately 20 partner incubators through the Defence Innovation Organisation (DIO). The iDEX framework aims to achieve *atmanirbharta* and foster innovation and technology development in the defence and aerospace sectors by engaging industries, including start-ups, MSMEs, individual innovators, R&D institutes and academia.[30]

iDEX Prime

To motivate young innovators, the iDEX initiative was expanded to iDEX Prime in 2022, with the assistance increasing from Rs 1.5 crore to Rs 10 crore. Problem statements from the Indian Air Force included challenges to build Expendable Active Decoys (EAD) and establish a Signals Intelligence (SIGINT) System for hilly terrains and high-altitude areas.[31] iDEX has continued its efforts to encourage investment in defence-focused start-ups. As part of this initiative, iDEX announced the establishment of a Memoranda of Understanding (MoU) with new investors through the iDEX Investors Hub (IIH). These partnerships are intended to facilitate increased investment in defence start-ups, providing them with the necessary capital and support to scale their ventures and drive innovation within the defence sector.[32]

Acing Development of Innovative Technologies with iDEX (ADITI) Scheme

A significant stride has been taken towards promoting innovations in critical and strategic defence technologies through the launch of the ADITI scheme. Unveiled on 4 March 2024, this scheme aims to nurture the innovative capabilities of the country's youth and propel India forward in the field of technology.[33] The scheme falls under the iDEX framework of the Department of Defence Production (DDP), MoD, where start-ups are eligible to receive a grant-in-aid of up to Rs 25 crore for their innovation endeavours and R&D in defence technology. With a total outlay of Rs 750 crore (2023–24 to 2025–26), the scheme aims to develop approximately 30 deep-tech strategic and critical technologies within the planned timeframe. The ADITI initiative additionally plans to develop a 'Technology Watch Tool' aimed at bridging the disparity between the contemporary needs and expectations of the armed forces and the capacities of the defence innovation ecosystem. In the inaugural edition of ADITI, 17 challenges have been launched, covering the Indian Air Force (5), Indian Navy (5), Defence Space Agency (4) and the Indian Army (3).[34]

Gaining a hold on state-of-the-art defence technology can be considered the most crucial aspect of achieving *atmanirbharta* due to the increasing role of cutting-edge technology in modern warfare. As technology can be mastered either by adopting the latest innovations from other countries or by developing indigenous capabilities, the Indian government is working on both methods, as is being done through the acquisition of technology through Foreign Direct Investment (FDI) under offset arrangements. However, there is a need to develop the required technologies domestically through

R&D, as countries are often reluctant to share their latest innovations.[35] On progressive lines, the government has been taking measures to promote domestic manufacturing, including allocating 75 per cent of the defence capital procurement budget exclusively for Indian companies.[36]

Technology Start-ups

The Indian government has taken significant steps to open up the defence R&D ecosystem to industry, start-ups and academia. This is being implemented through various existing and proposed new schemes, with 25 per cent of the defence R&D budget earmarked for this purpose. To promote indigenous design and manufacturing, the government has allocated funds for procurement from domestic sources. For the financial year 2023–24, the Capital Acquisition Budget of MoD has been allocated in the ratio of 67.75: 32.25 between domestic and foreign procurement, respectively. Additionally, MoD has directed the spending of Rs 1,500 crore towards procurement from start-ups.[37]

The Interim Union Budget 2024–25 announced a corpus of Rs 1 lakh crore to promote innovation and start-ups, signifying the Indian government's commitment to leveraging S&T for the nation's development. Notably, a new scheme for deep-tech start-ups in the defence sector was introduced to strengthen deep-tech technologies, catalysing *atmanirbharta* in S&T.[38] This emphasis on indigenous capabilities in advanced technologies, particularly for defence applications, underscores the government's strategic priorities and its recognition of the significant role of S&T in national development and security.

Consequently, a diverse array of innovative start-ups has started operating in India's defence sector. These emerging companies are at the forefront of advancements in critical areas such as AI, cybersecurity, undersea detection and communication, robotics, unmanned aerial vehicles, blast and ballistics-resistant structures and equipment, wearable technology and smart textiles. They showcase the considerable potential of India's innovation ecosystem to contribute significantly to the development of defence technologies and reinforce national security.[39]

DPP 2016, DAP 2020 and Make in India

Defence Procurement Procedure (DPP)-2016 encourages indigenous development and manufacture of defence equipment. It incorporates several industry-friendly provisions, such as relaxation of eligibility criteria, minimal

documentation and provisions for considering proposals suggested by industry or individuals. Till December 2021, 60 projects related to the air force, navy and army were accorded 'Approval in Principle'.[40]

The 'Make' category in India's DPP aims to foster indigenous capabilities ranging from design and development to manufacturing of defence equipment. The 'Make-I' category, as per DPP-2016, involves government funding of 90 per cent, released in phases based on progress, as per the terms agreed between MoD and the vendor. The 'Make-II' category, as per DPP-2016, requires industry funding for prototype development of equipment/systems/platforms or their upgrades, focusing on import substitution and innovative solutions. In February 2018, the government notified a simplified 'Make-II' procedure, allowing industries to submit proposals suo-moto.[41]

The 'Make-III' category was introduced in October 2020 under the DAP 2020. It encompasses import substitution through manufacturing in India, either independently or in collaboration with foreign OEMs, including through Transfer of Technology (ToT). Products under 'Make-III' are procured under the 'Buy Indian' category, requiring a minimum of 60 per cent indigenous content. While 'Make-I' is fully government-funded, 'Make-II' is industry-funded for prototypes and 'Make-III' facilitates import substitution through manufacturing in India, with the option of foreign collaboration or ToT.[42]

Defence Research and Development Organisation

The government has implemented several measures to support the defence industry. These include the provision of free access to DRDO patents for industries and the identification of systems that will be developed solely by the industry, with DRDO refraining from developing such systems. DRDO is also actively engaged in skilling the youth through internships, apprenticeships and electives in Bachelor of Technology (BTech) and Master of Technology (MTech) courses to prepare them for employment in the defence industries. Additionally, the government has accorded Acceptance of Necessity (AoN) for 43 DRDO-developed or under-development systems for induction into the Services during the last three years. Over the past three fiscal years (2020–21 to 2022–23), 122 contracts have been executed for the capital procurement of defence equipment. Among these, 100 contracts, representing 87 per cent of the total contract value, have been granted to Indian vendors.[43]

Several initiatives have been undertaken to bolster R&D in defence manufacturing. DRDO has instituted a ToT policy, waiving ToT fees for

Development-cum-Production Partners (DcPP), Production Agencies (PA) and Development Partners (DP). The industry is responsible for both development and production, including life cycle support, with no royalty charged for supplying to the Indian Armed Forces, paramilitary, or police forces and a 2 per cent royalty for exports and commercial markets. DRDO funds research through a grants-in-aid scheme to Indian research institutions and universities and operates 10 Centres of Excellence (CoEs) for focused research. About 108 technologies and products have been earmarked for R&D, with DRDO providing support, including testing and certification. DRDO patents are available to the industry at no cost and its test facilities are open to the industry for equipment and product testing.[44]

Furthermore, to promote start-ups, DRDO has launched two initiatives: the 'Dare To Dream' contest and the Technology Development Fund (TDF) scheme.

The Kalam Vision: Dare To Dream Scheme

This scheme, initiated by DRDO, seeks to cultivate an ecosystem conducive to technology development and innovation within the defence and aerospace domains. The scheme's primary objective is to unearth unexplored ideas and concepts from individual innovators and start-ups, facilitating the rapid development of indigenised and innovative technologies to enhance India's defence capabilities. The core objectives of the scheme are to accelerate the development of new technologies, from ideation to production, for the Indian defence and aerospace sectors, reducing the time-to-market; cultivate a culture of engagement and co-creation with individual innovators and innovative start-ups in the defence and aerospace domains; and empower a collaborative ecosystem for technology co-creation and co-innovation within these sectors.[45]

To achieve these objectives, the scheme undertakes various activities, including communicating defence and aerospace needs to innovators and start-ups; organising challenges and hackathons to identify potential technologies; evaluating and rewarding promising ideas, proofs-of-concept and prototypes based on their utility and impact; establishing and collaborating with incubation centres to support innovators and start-ups; interfacing with the Indian Armed Forces (navy, army and air force) to encourage the adoption of innovative technologies; facilitating participation in existing DRDO schemes and enabling pilots for successful technologies; and assisting in scaling up, indigenisation and integration of successfully piloted technologies into manufacturing facilities.[46] DRDO has successfully conducted Dare To

Dream (D2D) 1.0 (2019), D2D 2.0 (2020) and D2D 3.0 (2021), receiving over 5,600 applications. Among these, 86 technologies/ideas were recognised and Rs 3.97 crore in prize money was awarded to individual innovators and start-ups.[47]

Technology Development Fund (TDF)

This scheme, executed by DRDO, supports the indigenous development of products, components, systems and technologies by start-ups and MSMEs. The scheme operates in a grants-in-aid mode and was launched in September 2016. Winners of D2D are also motivated and given further consideration for funding to realise prototypes through the TDF scheme. Till December 2021, a total of 37 projects have been awarded to various industries, particularly start-ups and MSMEs, under the scheme.[48] Funding under the TDF scheme has been increased from Rs 10 crore to Rs 50 crore per project, further boosting the vision of *atmanirbharta* in developing advanced and critical defence technologies.[49]

Although DRDO has a large pool of institutions and resources with itself, its performance cannot be termed as highly successful as per the emerging needs of the country. DRDO in India has long maintained a near-monopoly on R&D in the defence sector, with limited involvement from industry and academia. Its approach has led to several challenges, including significant cost and time overruns in projects.[50] The Standing Committee on Defence, chaired by Mr Jual Oram, presented its report on 'A Review of the Working of the DRDO' on 20 December 2023.[51] The report highlighted several key observations and recommendations regarding DRDO's functioning. It noted concerns regarding the inadequate budget allocation for R&D, delays in project completion (23 out of 55 projects) and the need for greater emphasis on indigenisation to reduce dependency on foreign military platforms. The report recommended enhancing budgetary grants for DRDO, revisiting project review mechanisms to prevent delays and cost overruns, prioritising self-reliance, collaborating with universities for personnel training and focusing on emerging technologies such as AI and robotics. Additionally, the report emphasised the development of drone capabilities and TDF's focus on defence and dual-use technologies.

Defence Exports Promotion

India's defence exports have witnessed an unprecedented surge, reflecting the nation's concerted efforts to augment its indigenous defence manufacturing

capabilities and establish a robust foothold in the global arms market. Prime Minister Narendra Modi points out India's strength in the defence sector in the following words:

> India's size, scale, market and diversity present unique opportunity for developing and manufacturing world class defence platforms and products and positioning Indian industry in global supply chains. High quality manpower, outstanding research base, technological prowess and futuristic vision enable India to 'Make in India', for India, for the world.[52]

As mentioned in Figure 1, the data of the Financial Year (FY) 2023–24 indicates that defence exports have reached a record high of Rs 21,083 crore (approximately US$ 2.63 billion), marking a 32.5 per cent growth compared to the previous fiscal year. Remarkably, these figures highlight that defence exports have grown 31 times over the past decade when compared to the FY 2013–14.[53]

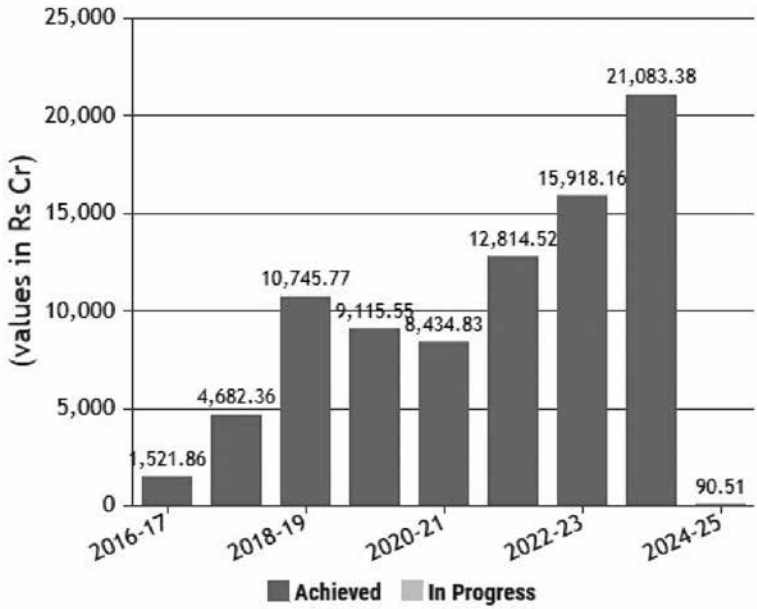

Figure 1 Defence Exports

Source: Department of Defence Production, Ministry of Defence, Government of India, 9 April 2024, available at https://ddpdashboard.gov.in/.

This achievement can be attributed to the concerted efforts of India's defence industry, encompassing both the private sector and DPSUs. The private sector and DPSUs have contributed approximately 60 per cent and 40 per cent, respectively. Furthermore, there has been a notable increase in the number of export authorisations issued to defence exporters, with the figure rising from 1,414 in FY 2022–23 to 1,507 in FY 2023–24. A comparative analysis of two decades, spanning from 2004–05 to 2013–14 and 2014–15 to 2023–24, reveals a 21-fold increase in defence exports. During the period from 2004–05 to 2013–14, total defence exports amounted to Rs 4,312 crore, which reached Rs 88,319 crore in the subsequent decade from 2014–15 to 2023–24.[54]

This growth can be attributed to the policy reforms and initiatives aimed at promoting 'ease of doing business'. These measures, coupled with the provision of end-to-end digital solutions for Indian industries to facilitate defence exports, have played a crucial role in catalysing this growth. The Indian government has undertaken several policy initiatives to promote defence exports.

Open General Export License

Standard Operating Procedures (SOPs) for the export of munitions list items have been simplified to reduce the processing time for export authorisations. A completely end-to-end online portal has been developed for receiving and processing authorisation permissions, where applications are digitally signed and authorisations digitally issued. An online portal has been created to disseminate export leads received from various stakeholders directly to registered Indian defence exporters. The government has introduced the Open General Export License (OGEL), a single-use export license, enabling the industry to export designated items to specified destinations outlined in the OGEL without the need for individual export authorisation throughout the license's validity period.[55]

Positive Indigenisation List and *Atmanirbharta*

The central aim of the Indian government's 'Atmanirbhar Bharat Abhiyan' (Self-Reliant India Campaign) is to revamp the defence sector and achieve self-sufficiency while enhancing defence item exports. This effort requires active engagement from both public and private sector entities. The MoD has implemented various measures to realise *atmanirbharta* in defence, with the introduction of Positive Indigenisation Lists (PIL) being a significant step in this direction. These lists, comprising four categories of defence

equipment and platforms, impose import embargoes to promote domestic production. PIL introduction is expected to accelerate indigenisation efforts, boost *atmanirbharta* in the defence sector and spur exports in the years ahead.[56]

The NDA government's efforts to promote *atmanirbharta* in the defence sector and reduce imports by DPSUs include the approval of the fourth PIL in May 2023. This list comprises 928 strategically crucial Line Replacement Units (LRUs), sub-systems, spares and components, with an import substitution value of approximately Rs 715 crore. These items will be exclusively procured from the Indian industry after specified timelines. This list builds upon the previous three PILs released in December 2021, March 2022 and August 2022, respectively, totalling 2,500 items already indigenised and 1,238 undergoing indigenisation within set timelines. By May 2023, 310 items from the 1,238 have been indigenised (262 from the first PIL, 11 from the second PIL and 37 from the third PIL).[57]

Defence Export Promotion Scheme

The Defence Export Promotion Scheme (DEPS) was launched by the Indian government in October 2018 to support its 'Make in India' initiative in the defence sector. The primary objectives of DEPS are to improve the global marketability of products from prospective Indian defence exporters and manufacturers, as well as to assist Indian private firms in achieving the 'Make in India' goals. To facilitate the testing and improvement of these defence products, the government recognised the need to streamline the guidelines for the allotment and utilisation of proof and field firing ranges. As a result, DEPS has granted the Defence Export Promotion Council (DEPC) status to 10 vehicles, equipment and systems, enabling these Indian-made defence products to be tested and refined for global markets.[58] An Export Promotion Cell has also been formed in DDP to coordinate and follow up on export-related actions, including enquiries received from various countries and facilitate private and public sector companies for export promotion.[59]

Defence Attaché (DA) Scheme for Export Promotion

A Defence Attaché (DA) Scheme for Export Promotion has been instituted, allocating resources to DAs to facilitate the export of indigenous defence products from both public and private sectors. Specific countries have been assigned to DPSUs for establishing marketing offices, aimed at promoting defence exports in those regions. Moreover, domestically manufactured defence products are strategically promoted through Lines of Credit (LoCs),

extended to friendly foreign governments, facilitating the import of goods and services from India under favourable credit terms.[60]

Reform in Ordnance Factory Board

The Indian Ordnance Factories organisation is comprised of 41 OFs engaged in the production, testing, logistics, research, development and marketing of a comprehensive range of products spanning land, sea and air systems. These factories play a crucial role in ensuring *atmanirbharta* in equipping the armed forces with cutting-edge battlefield equipment. Serving as an integrated base for indigenous defence hardware production, their primary goal is to achieve *atmanirbharta* to meet the armed forces' requirements. The widespread acceptance of OFs' products, both domestically and internationally, underscores the high quality and reliability of their offerings, reflecting their commitment to excellence in both products and services.

In its meeting on 29 July 2020, India's Cabinet Committee on Security sanctioned the transformation of the Ordnance Factory Board (OFB), an entity under MoD, into one or more 100 per cent government-owned corporate units. This corporatisation aimed to enhance the autonomy, accountability and efficiency of ordnance supplies.[61] Therefore, in order to strengthen operational independence, streamline efficiency and stimulate fresh avenues for growth and innovation within OFs, the production units of the OFB were restructured into seven DPSUs (AWEIL, GIL, TCL, AVNL, MIL, YIL and IOL) comprising a total of 41 units, effective from 1 October 2021.[62]

Defence Testing Infrastructure Scheme

To boost domestic defence and aerospace manufacturing, MoD has introduced the Defence Testing Infrastructure Scheme (DTIS) with a budget of Rs 400 crore, aimed at establishing cutting-edge testing infrastructure in collaboration with the private sector. Introduced in May 2020, the scheme operates over five years with the objective of establishing six to eight greenfield DTI facilities crucial for defence- and aerospace-related production. Projects under the scheme will benefit from up to 75 per cent government funding in the form of 'grants-in-aid', while the remaining 25 per cent of the project cost will be undertaken by the Special Purpose Vehicle (SPV) constituents, consisting of Indian private entities and state governments.[63] However, continuous upgradation and modernisation of testing facilities will be essential to keep pace with the rapidly evolving technologies in the defence and aerospace sectors.

Major Capital Acquisition Contracts

MoD signed five major capital acquisition contracts totalling Rs 39,125.39 crore on 1 March 2024, advancing *atmanirbharta* in defence and the Make-in-India initiative. Hindustan Aeronautics Limited (HAL) secured a contract for MiG-29 aero-engines worth Rs 5,249.72 crore to be produced at the Koraput Division under ToT from the Russian OEM. Larsen & Toubro Limited (L&T) received contracts for Close-in Weapon Systems (CIWS) and High-Power Radar (HPR) worth Rs 7,668.82 crore and Rs 5,700.13 crore respectively, enhancing air defence capabilities and fostering indigenous radar manufacturing technology. BrahMos Aerospace Private Limited (BAPL) clinched contracts for BrahMos missiles and ship-borne BrahMos systems worth Rs 19,518.65 crore and Rs 988.07 crore respectively, reinforcing maritime strike capabilities and generating significant employment opportunities across the country.[64] These deals are expected to further strengthen indigenous capabilities, save foreign exchange and reduce dependency on foreign OEMs in the future, aligning with the government's vision of *atmanirbharta* in defence.

The surge in defence exports is a sign of the global acceptability of Indian defence products and technologies, reflecting the nation's commitment to establishing itself as a formidable player in the international arms market. However, India's defence industry faces significant challenges in meeting government-set export targets and achieving technological *atmanirbharta*. Despite recent increases in international arms sales, DPSUs have struggled to secure major international contracts, as evidenced by HAL's failure to win a Malaysian tender for LCA Tejas and Garden Reach Shipbuilders and Engineers' loss in a Philippine bid. Additionally, the industry's technological limitations are highlighted by its heavy reliance on licensed manufacturing, which accounts for 58 per cent of India's defence procurement, indicating substantial external dependency.[65]

To upgrade its position, India needs to enhance its project management capabilities, improve coordination with buyer countries and build a reputation for reliable and timely delivery. For instance, the BrahMos missile deal with the Philippines, signed in January 2022, exemplifies both the potential and challenges of India's defence export ambitions. While securing this contract was a significant achievement, the subsequent delays in deployment due to monsoon-related construction setbacks[66] highlight an example of the complex hurdles India faces in the global defence market. India delivered BrahMos missiles to the Philippines in April 2024. However, these delays underscore a critical challenge: despite developing advanced technologies such as BrahMos,

India must overcome logistical and environmental obstacles to ensure timely contract execution. Such setbacks can significantly impact India's credibility as a reliable defence supplier in a highly competitive market dominated by established Western and Russian firms. Addressing these issues is crucial not only for economic gains, but also for India's strategic goal of becoming a key player in the international defence industry and expanding its geopolitical influence, particularly in regions like Southeast Asia.

Moreover, Indian defence exports encounter a multitude of challenges including complex procurement processes, intense global competition, risks associated with technology transfer, financing constraints and geopolitical considerations. Additionally, factors such as inadequate marketing and promotion, limited long-term support for equipment and logistical hurdles further impede the growth of Indian defence exports. A dedicated strategy is imperative to encourage defence exports within the broader framework of the Foreign Trade Policy (FTP) 2023. This strategy should encompass various measures aimed at promoting and facilitating defence exports through institutional mechanisms. Additionally, there is a crucial need to streamline the process of issuing No Objection Certificates (NOCs) and clearances for the export of military stores.[67]

Furthermore, the offset mechanism serves as a significant tool for domestic industries to bolster their export capacity. It is essential to consider reviewing the Offset Policy, aligning it with the ultimate goal of domestically integrating weapons and systems and fostering their export from India. Moreover, a reorientation of the policy could prioritise the acquisition of crucial technologies necessary for advanced weapons and platforms.[68] This approach can leverage such technologies for potential export opportunities, contributing to India's upgraded position in the global defence market.

Addressing these challenges will require comprehensive reforms and strategic initiatives to streamline regulations, enhance competitiveness, mitigate risks, improve marketing efforts and strengthen infrastructure and logistical capabilities to augment the prospects of Indian defence exports in the global market.

Conclusion

An attempt has been made in this article to bring together and assess Indian government's initiatives and schemes relating to defence innovation and defence export with particular focus on indigenisation for achieving

atmanirbharta in the defence sector. It has been done by contextualising India's existing defence R&D scenario *vis-à-vis* its existing position in the global innovation landscape. It has been observed that the 'whole-of-nation' approach has strengthened India's indigenous capabilities in defence sector, thereby reducing reliance on imports. Due implementation of a multifaceted multi-stakeholder strategy encompassing policy reforms, funding mechanisms, infrastructure development, skill enhancement and strategic partnerships to build and sustain a robust domestic defence manufacturing ecosystem in India is helping the country to progress on the path of *atmanirbharta*. However, much needs to be done to become a global player in the defence market. Therefore, certain recommendations have been made in many domains to harness India's demographic dividend through skilled workforce for achieving the goal of a developed India by 2047.

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