

**ACCELERATING INDIGENISATION IN INDIAN NAVY'S FIGHT CATEGORY:
ROLE OF DEFENCE ECOSYSTEM**

Dissertation submitted to the Panjab University, Chandigarh for the award of degree of
Master of Arts Public Administration and Public Policy, in partial fulfilment of the
requirement for the Advanced Professional Programme in Public Administration
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**50th ADVANCED PROFESSIONAL PROGRAMME IN PUBLIC
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**INDIAN INSTITUTE OF PUBLIC ADMINISTRATION
NEW DELHI**

CERTIFICATE

It is hereby declared that this dissertation is my original piece of work and to the best of my knowledge and belief, it contains no material previously published or written by any other person. I am aware of the University's norms and regulations regarding plagiarism including the disciplinary action that it may invite. Any use of the works by any other author, in any form, is adequately acknowledged at their point of use or in the Bibliography.

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CERTIFICATE

I have the pleasure to certify that *Capt Manpreet Singh, Indian Navy*, has pursued his research work and prepared the present dissertation titled '***Accelerating Indigenisation in Indian Navy's Fight Category: Role of Defence Ecosystem***', under my guidance and supervision. The same is the result of research done by him and to the best of my knowledge; no part of the same has been part of any monograph, dissertation or book earlier. This is being submitted to the Panjab University, Chandigarh, for the purpose of **Master of Arts in Public Administration and Public Policy** in partial fulfilment of the requirement for the Advanced Professional Programme in Public Administration (APPPA) of Indian Institute of Public Administration (IIPA), New Delhi.

I recommend that the dissertation of *Capt Manpreet Singh, Indian Navy*, is worthy of consideration for the award of Master degree from the Panjab University, Chandigarh.

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Mar 25

A handwritten signature in black ink, appearing to read 'Manpreet Singh', written in a cursive style.

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DECLARATION

I, the undersigned, hereby declare that this dissertation entitled '*Accelerating Indigenisation in Indian Navy's Fight Category: Role of Defence Ecosystem*' is my own work, and that all the sources I have accessed or quoted have been indicated or acknowledged by means of completed references/ bibliography. The dissertation has not been submitted for any other degree of this university or elsewhere.

Mar 25



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ABBREVIATIONS

AESA	Active Electronically Scanned Array
AIP	Air Independent Propulsion
BDL	Bharat Dynamics Limited
BEL	Bharat Electronics Limited
BHEL	Bharat Heavy Electricals Limited
DAC	Defence Acquisition Council
DAP	Defence Acquisition Procedure
DIC	Defence Industrial Corridor
DIO	Defence Innovation Organisation
DND	Directorate of Naval Design
DPEPP	Defence Production and Export Promotion Policy
DRDO	Defence Research and Development Organisation
DSPU	Defence Public Sector Undertaking
EW	Electronic Warfare
FDI	Foreign Direct Investment
GRSE	Garden Reach Shipbuilders & Engineers
HAL	Hindustan Aeronautics Limited
HQIDS	Head Quarter Integrated Defence Staff
iDEX	Innovations for Defence Excellence
IN	Indian Navy
NIP	Indian Naval Indigenisation Plan
L&T	Larsen & Toubro
MDL	Mazagon Dock Shipbuilders Limited
MIL	Munitions India Limited
MOQ	Minimum Order Quantity
MSME	Micro, Small, and Medium Enterprises
NOC	No Objection Certificate
NSQR	Naval Staff Qualitative Requirements
OEM	Original Equipment Manufacturer
PSU	Public Sector Undertaking
QR	Qualitative Requirement
R&D	Research and Development

SIPRI	Stockholm International Peace Research Institute
SPM	Strategic Partnership Model
SSBN	Ship Submersible Ballistic Nuclear
TDF	Technology Development Fund

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EXECUTIVE SUMMARY

1. India's pursuit of self-reliance in defence manufacturing has been a longstanding objective to reduce its dependence on foreign suppliers and enhance maritime security. One of the foremost way to reduce this dependence is Indigenisation which plays a crucial part in enabling India to make, produce and sustain advanced naval platforms, weapons and sensors domestically. In addition, the indigenous capabilities will enhance India's strategic autonomy, which will ultimately allow the defence forces to operate freely without being constrained by the external geopolitical pressures. It will not only strengthen India's capabilities but also furthers India's long- term geopolitical objects of being a leading maritime power in future. Indigenisation is also imperative for the Indian Navy to reduce the Navy's dependence on foreign suppliers and enhance maritime security. It will promote technological advancement, cost effectiveness and strategic independence to make a strong and sustainable naval force.

2. Indian Navy's ship-building materials, equipment and systems on-board an Indian Naval warship are classified into three categories; 'Float' which encompasses all materials, equipment and systems associated with the hull structures and fittings including deck machinery, 'Move' which encompass equipment required for warships to move in water and 'Fight' which encompasses all types of ship borne weapons & sensors, armament that directly contributes to the combat capability of the platform and Special Operation Missions by MARCOs. While the indigenisation progress in 'Float' and 'Move' category has been satisfactory, the progress in 'Fight' category has not been very encouraging.

3. The study has been done to identify the current problems which have led to the roadblocks for indigenisation in the "Fight" category for Indian Navy. It critically examines

the current state of indigenisation in the fight category, assesses policy effectiveness, identifies key roadblocks, and proposes a strategic roadmap to accelerate self-reliance. Through a structured research approach, including comparative analysis with leading defence-industrial nations, industry feedback, and an evaluation of global best practices, the study aims to provide actionable recommendations to strengthen India's defence manufacturing capabilities.

4. The study follows a structured approach, using both secondary and primary sources. A literature review was carried to examine existing research on defence indigenisation and identify the key gaps. The study analyses government initiatives such as the Strategic Partnership Model (SPM), Defence Industrial Corridors (DICs) and Innovations for Defence Excellence (iDEX), assessing their impact on domestic defence manufacturing. A comparative analysis with select nations such as South Korea, Singapore, and South Africa provides global insights into best practices. A critical assessment of the Indian Navy's indigenisation roadmap was carried out highlighting the challenges faced in the 'Fight' category and how the strategies which have resulted in success in the 'Float' category can be applied to 'Fight' category. The study also attempts to understand the role of Qualitative Requirements formulated and how they can be modified to enhance the participation of the Defence Industrial ecosystem. Two separate surveys were carried out to capture the responses of Industry/ R&D to understand the effectiveness of current Government policies, how they can be improved and the effectiveness of the Qualitative requirements in enhancing the participation of Defence Industrial ecosystem.

5. The key findings of the study indicated that while policies such as Make in India and Atmanirbhar Bharat provide a strong foundation for defence indigenisation, their implementation is often hindered by bureaucratic inefficiencies, delays in procurement, and fragmented industry coordination. Multi-layered approval processes, sequential trials, and

regulatory hurdles further slowdown the indigenisation process, limiting private sector participation despite initiatives like the Positive Indigenisation List. Stringent and rigid qualitative requirements make it difficult for domestic industries, particularly MSMEs, to meet specifications, restricting their involvement in defence manufacturing. The lack of industry consultation in QR formulation further exacerbates this challenge. Additionally, India's defence R&D spending remains at only 0.65% of GDP, significantly lower than countries like the United States (3.5%) and Israel (5%), limiting technological innovation and indigenous capability development. Inadequate engagement between the government, private players, and research institutions has resulted in misaligned production capabilities, unrealistic specifications, and missed opportunities for technological advancement. The absence of an efficient, industry-friendly procurement mechanism and the lack of a coherent policy framework for defence R&D continue to act as major roadblocks to achieving strategic autonomy in defence manufacturing.

6. To overcome these challenges, the dissertation proposes several strategic measures:
 - (a) **Streamlining Procurement** – Establishing a single-window clearance system for defence acquisitions to reduce delays and improve transparency.
 - (b) **QR Reforms** – Shifting from rigid technical specifications to performance-based QRs that align with industry capabilities while ensuring operational effectiveness.
 - (c) **Enhancing R&D Investment** – Increasing defence R&D funding to at least 2% of GDP to support indigenous development of critical military technologies.
 - (d) **Strengthening Industry Collaboration** – Facilitating regular engagement with private sector players, MSMEs, and start-ups to ensure alignment between industry capabilities and military requirements.

- (e) **Leveraging Defence Offsets** – Ensuring meaningful technology transfer from foreign firms through structured offset policies that contribute directly to domestic manufacturing capabilities.
- (f) **Capacity Building** – Investing in skill development for emerging defence technologies such as AI-driven combat systems, cyber warfare, and advanced electronics.
- (g) **Government Support for MSMEs and Start-ups** - Government support for MSMEs and start-ups is essential for defence innovation. Timely evaluation of their technologies, backed by financial assistance or procurement orders, can sustain development. Establishing a Defence MSME and Start-up Portal (DMSP) will enable direct engagement with the military, streamline information sharing, and fast-track support for indigenous defence solutions.
- (h) **Defence Exports and Imports** - Expediting No Objection Certificate (NOC) issuance for MSME-led defence exports will enhance India's presence in global markets, while simplifying import restrictions on defence-grade materials for R&D will prevent delays in innovation.
- (j) **Strengthening the Domestic Supply Chain** - India must strengthen its domestic supply chain by developing indigenous semiconductor fabrication, advanced materials, and strategic partnerships focused on technology absorption. Leveraging its strong technological base, India should lead in emerging technologies like AI, IoT, and autonomous systems, supported by a user-friendly export policy. Enhancing complementary sectors, optimizing logistics, and defining core competencies through a long-term vision will boost defence manufacturing. Additionally, a targeted marketing strategy is needed to promote made-in-India defence products globally.

(k) **Improving Testing & Evaluation Infrastructure** - India must establish dedicated naval test ranges for weapons and sensors, fast-track sea trials through parallel evaluations, and develop advanced simulation centres for realistic naval combat testing to enhance indigenous defence capabilities.

7. The study is structured into eight chapters which will be as enumerated: -

(a) **Chapter 1 - Introduction.** The chapter will give an overview of the subject highlighting all the important aspects. It will cover the Problem Statement and the Research Objectives.

(b) **Chapter 2 – Review of Literature.** The chapter will document the learnings from the review of literature.

(c) **Chapter 3 – Govt Initiatives towards an efficient Defence Industrial Ecosystem.** The chapter will analyse the government initiatives and policies in place for establishment of an effective Defence Industrial ecosystem. A survey to gauge the effectiveness of the Government initiatives would be carried out to collect responses from the industry.

(d) **Chapter 4 – Defence Industrial Ecosystem: India and Select Countries.** This chapter will discuss the journey of defence industrial ecosystem in India. Pre and post release of the Indian Naval Indigenisation Plan in 2015. In addition, the growth of the Defence Industrial Ecosystem in select countries would be studied. It will also try to bring out the best practices that can be contextualised for India.

(e) **Chapter 5 – Overview of Indigenisation roadmap of Indian Navy.** This chapter will examine the indigenisation roadmap of Indian Navy over the last two decades. It will examine how the Indian Navy has fared in the indigenisation efforts in the three categories and assess if success made in one category can be replicated in other.

- (f) **Chapter 6 – Qualitative Requirements for Indigenous Production: Facilitator or Hindrance.** This chapter will analyse the formulation of Qualitative Requirements formulated by Indian Navy for indigenous production bringing out if the same act as a facilitator or hindrance.
- (g) **Chapter 7 – Findings & Analyses.** This chapter will analyse the findings which have been culled from the research done. Based on the analysis, it will assess what challenges are faced in the faster indigenisation of fight category requirements of Indian Navy by the existing Defence Industrial ecosystem.
- (h) **Chapter 8 – Recommendations & Conclusion.** This chapter will recommend any possible changes to the existing policy framework to make the Defence Industrial Ecosystem more effective, efficient and robust.

8. To conclude, while India has made significant progress in defence indigenisation, achieving self-reliance in the ‘Fight’ category remains a formidable challenge. The Navy has successfully indigenised platforms in the Float and Move categories but continues to depend on foreign technology for weapons and sensors. The primary barriers include cumbersome procurement procedures, rigid qualitative requirements, low R&D investment, and inadequate industry-government collaboration. By addressing these challenges and implementing the proposed recommendations, India can establish a robust defence industrial ecosystem. This will not only ensure self-reliance in critical military technologies but also position the country as a major global defence manufacturing hub, enhancing both national security and economic growth.

Chapter 1 - Introduction

1.1 Introduction

India is in a challenging geopolitical position since it is flanked on two sides by neighbours Pakistan and China with whom it has unfriendly relations. It has disputed boundaries with both the countries and has engaged in a border war with China in 1962 and four full scale conventional wars with Pakistan in 1947-48, 1965, 1971 and 1999, along with various border clashes and standoffs. India has largely been dependent on foreign suppliers not only for its defence platforms, equipments and weapon systems, but also for spares and maintaining them¹. This has meant that even during crises, the Indian military has been reliant on foreign spares and supplies.

One of the foremost way to reduce the dependence on foreign enterprises is Indigenisation. This will play a crucial part in enabling India to make, produce and sustain advanced naval platforms, weapons and sensors domestically. In addition, the indigenous capabilities will enhance India's strategic autonomy, which will ultimately allow the defence forces to operate freely without being constrained by the external geopolitical pressures. This is required not only to guard the land borders, but also to guard the maritime trade routes, EEZs and to establish India's influence in the Indo- Pacific region. Thus, indigenisation not only strengthens India's capabilities but also furthers India's long- term geopolitical objects of being a leading maritime power in future. Indigenisation is also imperative for the Indian Navy to reduce the Navy's dependence on foreign suppliers and enhance maritime security. It will promote technological advancement, cost effectiveness and strategic independence to make a strong and sustainable Naval force.

¹ Patel P, Patil S, Vishwanathan A, (2023), India's Quest for Defence Indigenisation: A Case Study of the Indian Navy, Sage: Journal of Asian Security and International Affairs, <https://journals.sagepub.com/doi/10.1177/23477970231207255>. Accessed on 20 Dec 24

The work “Accelerating Indigenisation in Indian Navy’s Fight Category: Role of Defence Ecosystem” has been done to identify the current problems which have led to the roadblocks for indigenisation in the “Fight” category for Indian Navy. The study also aims at suggesting the measures to eliminate the major challenges and shorten the time for achieving Atmanirbharta in the identified category. This will in turn enhance the resilience of the defence industrial base, to provide timely support and maintenance of defence systems with minimal reliance on external suppliers.

1.2 **What is Indigenisation?**

Indigenisation is the development, production and sustenance of necessary technologies, equipment and systems within a country and not importing them from other countries. This includes the adoption, improvement and propagation of technology, the development of domestic industries, and the build-up of domestic infrastructure and supply chains in order to achieve sustainability. The main goal of indigenisation is to enhance the level of security, strengthen the economy and autonomy of the nation in the technological field by importing less products from other countries. This is most important in strategic sectors such as defence, space, energy and manufacturing because dependency on foreign suppliers presents significant risks in terms of geopolitical tensions, supply chain disruptions and cost inflation. Therefore, it is possible to develop the indigenous capacity which will provide the necessary resources, operational autonomy and technology relevant to the country’s circumstances.

The effects of indigenisation are felt not only in the sphere of national security. It acts as a booster for the economic development by creating employment, enhancing the backbone of domestic industries and attracting investments in Research and Development. Indigenous technologies promote innovation and collaboration between government and

other institutions, industries and universities and, in turn, the entire industrial base. Furthermore, indigenisation improves the sustainability by minimizing the outflow of foreign exchange and enhancing export-led growth to make a country more market compliant. It also improves the human capital because the workforce is trained to work in new and developing fields of advanced manufacturing, engineering and technology. Indigenisation is a long term approach to the development of strong economies, technological development and the establishment of great powers in international relations.

The capability of adversaries has increased, which demands a good indigenisation plan to increase the national defence readiness. In recent history, as adversaries have increased their technological and military prowess, indigenisation has become essential in the competition of defence operations.

1.3 **Evolution of Indigenisation**

Post-Independence till Year 2000

After gaining independence in 1947 India's strategic policy was to foster good relation with the neighbouring countries and not to develop its own arms. In this regard, public sector enterprises were to be promoted, and ordnance manufacturing was prohibited to the private sector and public sector undertakings (PSUs). A large part of the defence equipment was imported which shows that there was a prejudice against the private industry in the defence sector.

However, the security environment has been evolving with the 1962 India-China conflict and the 1958 Pakistan military coup as well as the latter's acquisition of sophisticated US arms, the policy changed. These changes resulted in the establishment of the Defence Research and Development Organisation (DRDO) in 1958 after the recommendation of Prof. P.M.S. Blackett. Also, an audit by Arthur D. Little managed by

the US pointed out problems with India's production infrastructure, which led to the establishment of the Department of Defence Production. However, defence procurement was still the domain of the public sector, which got low-cost, unsophisticated components from private industries and rendered basic services.

India's strategic policies, which were determined by geographical situation, focused on the relationship with the USSR for the purchase of defence equipment. The Indo-Soviet Treaty of Peace, Friendship and Cooperation signed in 1971 provided a basis for government to government negotiations and licensed production contracts that further entrenched India's reliance on the USSR for defence technology. Although this ensured that there was a stronger production base for Indian PSUs, there was limited technology transfer and no indigenous design. By the late 1980s and early 1990s, India had become increasingly dependent on foreign arms and equipment² which is also evident by the Fig 1.1 showing the expenditure by India on arms imports.

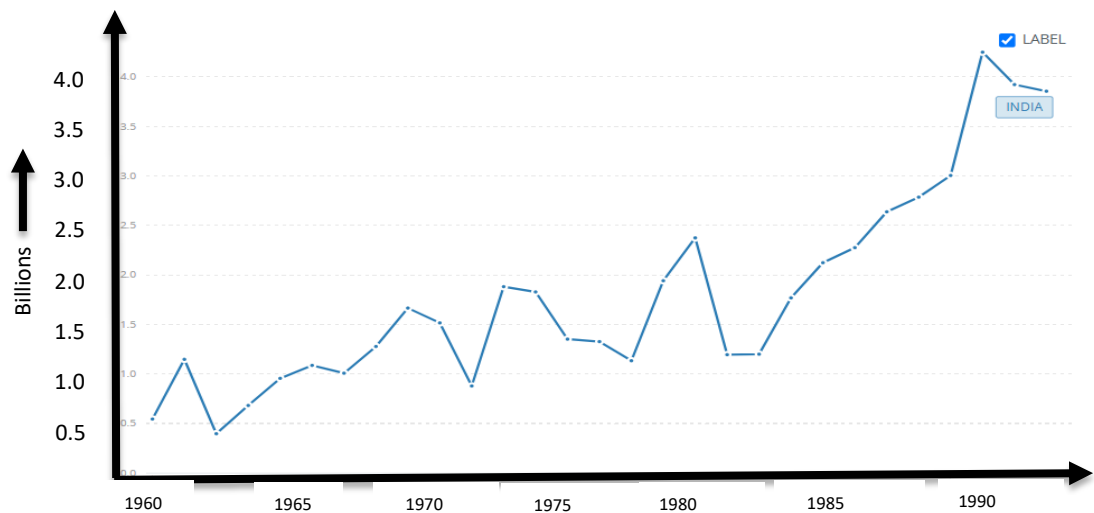


Fig 1.1: Expenditure by India on Arms Imports (SIPRI trend indicator)

Source:

<https://data.worldbank.org/indicator/MS.MIL.MPRT.KD?end=1988&locations=IN&start=1960&view=chart>

² <https://data.worldbank.org/indicator/MS.MIL.MPRT.KD?end=1988&locations=IN&start=1960&view=chart>.

From the Year 2001 to 2014

At the turn of the new millennium, India changed its policy and allowed the private sector to participate in defence manufacturing. This change was effective in 2001-02 and in the subsequent years, many long-term partnership agreements were signed with foreign countries for the purchase, manufacturing and technology transfer (ToT). India did not follow the conventional buyer-seller model but rather opted for production, Research and Development (R&D) and technology sharing agreements that would enable it to design, develop and procure more sophisticated and sophisticated systems that are appropriate for its defence requirements.

The post-Kargil reforms in defence procurement were meant to enhance partnership, alignment, and management. These reforms resulted in the development of a new acquisition procedure and the issuance of the Defence Procurement Procedure (DPP) in 2002, with subsequent updates in 2006, 2016, and the most recent one in 2020. The DPP created several categories of procurement, including “Make in India,” “Buy and Make,” and “Buy (Indian),” which were meant to induce indigenization. The 2011 Defence Production Policy, among other things, continued the emphasis on indigenization and minimizing the need to import defence equipment.

Between 2001 and 2014, the Indian Navy developed its weapons and sensors indigenously to a significant degree. Some of the achievements include the incorporation of the BrahMos supersonic cruise missile in 2005 and the successful development of the Barak-8 surface to air missile which was developed in collaboration with Israel. Indigenous sonar systems like Humsa-NG and Ushus were also incorporated into naval warships and submarines to improve India’s underwater warfare efficiency. The Mareech torpedo defence

system was also being developed to counter enemy torpedoes³. In shipbuilding, the Navy also improved by building the Shivalik class stealth frigates (Project 17), Kolkata class destroyers (Project 15A) and Kamorta class anti-submarine warfare corvettes (Project 28). It was also a significant milestone when INS Vikrant, India's first indigenous aircraft carrier was launched in 2013. The Navy's submarine program also reached fruition with the commission of the first of six Scorpene-class submarines (Project 75) with the launching of INS Kalvari in 2014⁴.

Despite these advancements, the period was not without challenges. Technological gaps, dependence on foreign components, delays in project execution, and limited participation of the private sector remained significant hurdles. The Navy continued to rely on foreign technologies for missile systems, propulsion, and sensors. Furthermore, defence manufacturing was still largely under the control of public sector entities, limiting efficiency and competition.

From the Year 2015 till Date

The post 2015 period has been characterized by the Indian Navy's greater emphasis on indigenization with the help of the 'Aatmanirbhar Bharat' initiative. The Indian Navy has accelerated the process of indigenesness by identifying and integrating indigenous technology in various domains such as missile systems, underwater warfare, electronic warfare and shipbuilding.

Some of the important developments that have took place during this period include the induction of the Extended Range (ER) BrahMos missile which has a range of more than 450km and the successful trial of the air launched BrahMos. India's first indigenous Naval

³ Patel, P., Patil, S., & Vishwanathan, A. (2023). India's quest for defence indigenisation: A case study of the Indian Navy. *Journal of Asian Security and International Affairs*, 10(3), 364–394. <https://journals.sagepub.com/doi/10.1177/23477970231207255>. Accessed on 20 Dec 24.

⁴ Ibid

Anti-Ship Missile (NASM) being launched and successfully tested, thus reducing the country's dependence on imported weapons. The installation of Barak-8 (MR-SAM) system on most of the frontline warships to enhance India's air defence system.

The Navy's underwater warfare capabilities have been enhanced with the full-scale production of the Varunastra heavyweight torpedo and the Mareech torpedo defence system. Humsa-NG, Ushus-2 and ATAS (Advanced Towed Array Sonars) have been installed on naval vessels. The construction of Scorpene-class submarines (Project 75) and the commissioning of the first indigenous aircraft carrier INS Vikrant (IAC-1) in 2022 are notable milestones.

1.4. **Defence Industrial Ecosystem in India.**

The Defence Industrial Base (DIB) of India is a developing environment comprising of Public Sector Enterprises (PSUs), Foreign and Indian firms, Micro, Small and Medium Enterprises (MSMEs), Startups, and Research organizations which are involved in the development of defence sector and technology of the country. Formerly, the Indian DIB was dominated by the government owned entities such as HAL, BEL, BDL, MDL, GRSE and DRDO, but of late there has been an increase in the participation of private sector. In this regard, policy initiatives such as Aatmanirbhar Bharat, Make in India and the Defence Acquisition Procedure (DAP) 2020 has induced domestic production, decreased dependence on foreign imports and promoting sustainability in defence technologies⁵.

The Indian DIB consists of aerospace systems, naval platforms, land-based weapon systems, electronics, cyber warfare, and AI enabled systems. It encompasses the design, development, and manufacture of aircraft, ships, submarines, missiles, radars, electronic warfare devices, armoured cars and drones. Also, there is a growing number of defence

⁵ Behera, L. K. (2016). *Indian defence industry: An agenda for Making in India*. Pentagon Press & Institute for Defence Studies and Analyses. ISBN: 978-81-8274-905-4. Accessed on 10 Dec 24.

startups and MSMEs coming up with new ideas in unmanned systems, hypersonic weapons, directed energy weapons and cyber defence. There has also been an enhancement of the ecosystem with measures such as positive indigenization lists, import ban on some defence items, and funding via iDEX (Innovations for Defence Excellence) to ensure that India is able to produce most of its defence equipment and also begin to export advanced defence equipment.

Over the past few years, the Indian defence industrial ecosystem has been on the rise due to government initiatives including Make in India and Aatmanirbhar Bharat. However, the ecosystem still has some drawbacks. The main challenges are: The first is the slow rate of technology development, and the second is the long lead time in the delivery of major projects. The domestic defence sector is also limited by bureaucratic slow down, complex procurement procedures and lack of efficient cooperation among the various agencies. Furthermore, while there has been improvement, the indigenous defence industry still depends on foreign suppliers for important components like engines, high technology sensors, major weapons and strategic metals. There is also a skills deficiency in some of the areas that are critical to defence R&D, which has restricted the innovation process and the ability to devise strategies that can enable the country to compete with other nations.

1.5. **Problem Statement**

The specific roles of the Indian Navy in future would continue to extend across the entire spectrum of security of the nation, from peace keeping, through the low intensity segment to high-intensity conventional hostilities up to and including nuclear conflict. The Indian Navy will necessarily need to perform its varied tasks in the expanding presence of neutral and multinational/ extra regional forces in the Indian Ocean Region (IOR). In the last two decades, the capabilities available with our potential adversaries have grown

considerably and are forecasted to only improve with time. The Indian Navy would therefore need to acquire adequate deterrent war fighting capabilities.

The Sweden-based Stockholm International Peace Research Institute (SIPRI) points out that ‘India was the world’s biggest importer of major arms in 2018–2022, a position it has held for the period 1993–2022’. It has accounted for 9.8 % share of the total global arms imports⁶ (SIPRI, 2023). This has a direct impact on the country’s foreign exchange reserves as defence imports over the last 5 years have amounted to an astronomical US\$ 23.17 billion as brought by Pandit (2023).

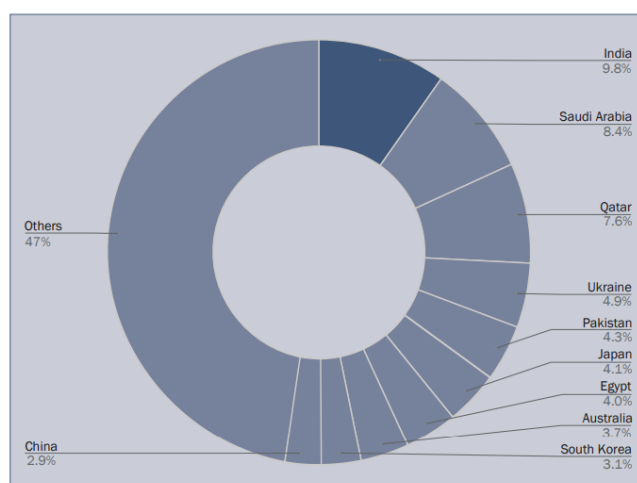


Fig 1.2: Global Share of Import of Arms

Source: SIPRI Arms Transfers Database, Mar. 2024

Navy has released two major documents in the public domain in the last decade: Indian Naval Indigenisation Plan (2015-2030) and Swavalaban (Ver 1, 2.0 and 3.0). Both documents brings out the current state of indigenisation and future roadmap towards achieving Atmanirbharta. Scrutiny of these documents in detail has brought out that Indian Navy’s ship-building materials, equipment and systems on-board an Indian Naval(IN)

⁶Trends in International Arms Transfer, SIPRI fact Sheet March 24. https://www.sipri.org/sites/default/files/2024-03/fs_2403_at_2023.pdf. Accessed on 20 Oct 24.

warship are classified into the following three categories⁷ wherein indigenisation efforts have been made:-

- (a) **Float**. This category encompasses all materials, equipment and systems associated with the hull structures and fittings including deck machinery.
- (b) **Move**. Equipment under this category encompasses propulsion system, power generation diesel/ gas/ steam turbine engines, alternators, associated control systems, Auxiliary Equipment/ systems viz. Pumps, AC & Refrigeration plants, Compressors, Switchboards, Communication equipment, Firefighting Systems etc.
- (c) **Fight**. Equipment under this category encompasses all types of ship borne weapons & sensors, armament that directly contributes to the combat capability of the platform and Special Operation Missions by MARCOs.

The current indigenous content of the three categories of warship equipment is depicted in the graph below.

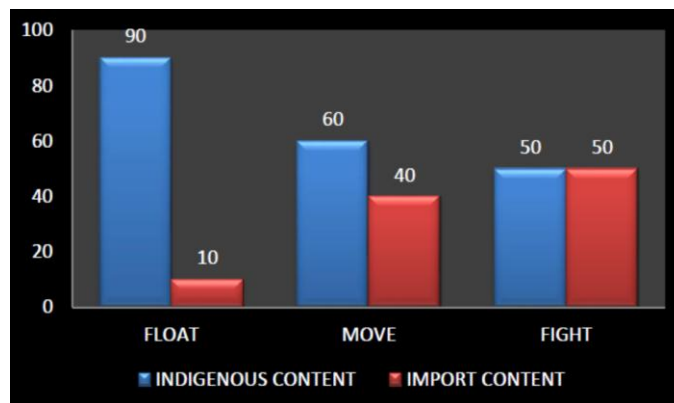


Fig 1.3: Indigenous Content in three Categories for Indian Navy

Source : Swavalamban 3.0 document released by IN in 2024

The analysis of these categories indicates that while sufficient self-reliance has been achieved in the first category and reasonable in the second category, there is a large shortfall

⁷ Indian Navy. (2024). *Swavalamban 3.0*. Directorate of Indigenisation, Government of India.

in the third category. The role of the Defence Industrial ecosystem becomes all the more important if Indian Navy has to achieve the desired indigenisation levels in the fight category. Accordingly, the broad scope of the research is to *examine effectiveness of defence industrial ecosystem in accelerating the timelines for indigenisation in fight category for Indian Navy and to suggest policy recommendations for strengthening the defence industrial ecosystem.*

The problem statement thus formulated appended below: -

Indian Navy has prioritized the indigenization of its defence capabilities to reduce dependency on foreign imports and strengthen national security. However, despite efforts to engage and partner with industrial ecosystem, there are ongoing challenges in meeting the required timelines for indigenizing critical defence technologies in the "Fight" category, which includes weapons systems and sensors. This research seeks to examine the effectiveness of the current defence industrial ecosystem in accelerating the indigenization process for the Indian Navy's 'Fight' category.

The study will aim to analyse the activities pre (2000 to 2014) and post (2015 till date) release of the INIP document by Indian Navy in 2015. The study includes major stakeholders but not limited to the following: -

- (a) DPSUs – BEL, BDL, BHEL, Erstwhile Ordnance Factories.
- (b) Pvt Industry - Mahindra, L&T, EEL, Bharat Forge, Godrej, Adani Defence.
- (c) Research - DRDO Labs involved in research on weapons and sensors
- (d) Indian Navy – Dte of Indigenisation & Dte of Armament Production & Indigenisation

1.6 Research Objectives

To identify and analyse the key challenges hindering the formulation of effective defence industrial ecosystem for achieving indigenisation in fight category for Indian Navy and propose strategies for addressing these challenges. It will have the following objectives:-

- (a) To examine the existing Govt initiatives for defence industrial ecosystem,
- (b) To analyse the defence industrial ecosystem in India and select nations,
- (c) To examine success mechanism employed by *IN* in Float category,
- (d) To examine the feasibility of replicating the same in Fight category,
- (e) To examine the efficacy of Qualitative Requirements formulated by *IN* for domestic production and
- (f) To develop a comprehensive set of possible policy recommendations for a robust defence industrial ecosystem for faster indigenisation of fight category for Indian Navy.

1.7 Chapterisation Scheme

The broad chapterisation scheme will be as enumerated: -

- (i) **Chapter 1 - Introduction.** The chapter will give an overview of the subject highlighting all the important aspects. It will cover the Problem Statement and the Research Objectives.
- (j) **Chapter 2 – Review of Literature.** The chapter will document the learnings from the review of literature.
- (k) **Chapter 3 – Govt Initiatives towards an efficient Defence Industrial Ecosystem.** The chapter will analyse the government initiatives and policies in place for establishment of an effective Defence Industrial ecosystem. A survey to

gauge the effectiveness of the Government initiatives would be carried out to collect responses from the industry.

(l) **Chapter 4 – Defence Industrial Ecosystem: India and Select Countries.**

This chapter will discuss the journey of defence industrial ecosystem in India. Pre and post release of the Indian Naval Indigenisation Plan in 2015. In addition, the growth of the Defence Industrial Ecosystem in select countries would be studied. It will also try to bring out the best practices that can be contextualised for India.

(m) **Chapter 5 – Overview of Indigenisation roadmap of Indian Navy.**

This chapter will examine the indigenisation roadmap of Indian Navy over the last two decades. It will examine how the Indian Navy has fared in the indigenisation efforts in the three categories and assess if success made in one category can be replicated in other.

(n) **Chapter 6 – Qualitative Requirements for Indigenous Production: Facilitator or Hindrance.**

This chapter will analyse the formulation of Qualitative Requirements formulated by Indian Navy for indigenous production bringing out if the same act as a facilitator or hindrance.

(o) **Chapter 7 – Findings & Analyses.**

This chapter will analyse the findings which have been culled from the research done. Based on the analysis, it will assess what challenges are faced in the faster indigenisation of fight category requirements of Indian Navy by the existing Defence Industrial ecosystem.

(p) **Chapter 8 – Recommendations & Conclusion.**

This chapter will recommend any possible changes to the existing policy framework to make the Defence Industrial Ecosystem more effective, efficient and robust

1.8 **Conclusion.**

In this chapter, indigenisation in general and then specific to Indian Navy, indicating where the Navy is as per the official documents in the three categories is discussed. It is clear that significant strides have been made in shipbuilding and propulsion ("Float" and "Move"), dependency on foreign technology persists in critical weaponry and sensors. A brief outline on evolution of India's defence industry from a state-controlled model to a more open, competitive ecosystem has been brought out. The problem statement regarding the slow pace of indigenisation in the "Fight" category for Indian Navy has been brought out and the role of robust industrial defence ecosystem to accelerate the same has been highlighted. The chapter concludes with the defining of the research objectives for the study.

Chapter 2 – Review of Literature

2.1 Introduction

The chapter covers the understanding and review of the various articles, papers and books on the topic of the study and their inferences. The literature from the period 2012 to 2024 was studied to have an understanding of the state before the release of Indian Navy Indigenisation Plan (INIP) in 2015 and after that.

2.2 Indigenization in defence industry –current status of future prospects

Kotwal (2012) in the paper published in USI journal has deliberated on the present status of indigenization in defence industry. He has stated that India is the third largest defence spender after USA and china. The three pathways followed by defence indigenization in India are indigenous technology development, transfer of technology and licensed manufacture. The author has brought out several constraints like increasing imports, need to enhance investment in R&D, production technologies, integration of complex systems and equipment platforms and development of human capital. Young and dynamic talented people must head the project teams for project management.

The author has further discussed defence production policy, defence offset guidelines and brought out issues in their implementation. He deliberated upon conflict of interest at the MoD of balancing between public and private sector. Also there is lack of accountability for building local capabilities, entry barriers for private players, required skill resources for the sector, lack of coordination between R&D institutes and private sector, skill up-gradation of the interested private participants and Foreign direct investment in defence industry and lack of an official defence export policy. Delay in issue of defence production licences is another major hindrance in indigenisation in defence sector. The

author has further cited various defence models of other countries like USA, UK and South Korea from secondary data which have organisations comprising of government officials, military and industry professionals, branches of armed forces, homeland security etc.

Finally the author has given recommendations as incentives to the private industry for providing end to end defence product, need for a dedicated department in MoD which will look after the interest of the private industry engaged in defence production. He has also recommended strict regulation of offset policy and utilization of skilled retired personnel of the Indian armed forces in various programmes and projects thereby enabling the private sector to produce equipment to the expected level of quality and satisfaction of users.

2.3 **Indian Navy Indigenisation Plan**

The Indian Naval Indigenisation Plan (INIP) 2015-2030, issued in 2014 by the Directorate of Indigenisation of the Indian Navy, is a strategic plan for the achievement of naval self-reliance in defence technologies over the period 2015-2030. The document identifies shipbuilding, weapon systems and key defence platforms as areas in which the Indian Navy wishes to develop indigenous capabilities and reduce dependence on imported systems. It identifies DRDO and academia as key contributors in the enhancement of research and innovation in the development of technologies crucial to naval warfare of the present day.

The INIP 2015-2030 of the Indian Navy has focused on the classification of the naval systems into three categories, Float, Move and Fight. Nonetheless, progress has been made in the Float (shipbuilding materials) and Move (propulsion and power generation systems) categories whereas the document has pinpointed challenges in the Fight category which includes weapons, sensors and combat management systems. The plan is to achieve

independence in these areas by exploiting the newly developed indigenous technologies and by not buying from foreign OEMs. It also covers the way forward for the domestic production of sophisticated weapons such as torpedoes, missiles, and electronic warfare systems.

The INIP 2015-2030 is in sync with broader national policies such as Aatmanirbhar Bharat and Make in India, with the objective of strategic autonomy in defence manufacturing. Policy measures such as preferential procurement of indigenous defence products, funding for research and development and promotion of public private partnerships are also highlighted. The positive indigenisation lists and innovation initiatives like iDEX (Innovations for Defence Excellence) are also consistent with the objectives of the INIP.

The INIP 2015-2030 is a more structured approach than the earlier indigenisation efforts, with quantified goals and time frames. It is a development from previous naval indigenisation plans, with lessons from past projects and with delays in procurement and technology development. The plan also addresses the need for sustained investment in critical areas of artificial intelligence, cyber warfare, and unmanned systems to keep the Navy's technological edge.

The INIP 2015-2030 is a cornerstone in the effort to induce self-reliance in India's naval capabilities, while also meeting strategic requirements to build a strong defence industrial base. Nevertheless, there are noticeable research gaps in technological advancement, policy coherence, and industrial collaboration, especially in the indigenization of high-tech weapons and sensors.

2.4 **Indigenization-key to self-sufficiency and strategic capability**

Gosh (2016) in the book published by Centre for Air Power Studies reviews the evolution and current realities of the Indian defence industry to arrive at the objective and

scope of the research work. In the second chapter, the book reviews the journey of the Indian Defence Industry. This is followed by analysing the international industrial practices adopted by two leading military powers US and China .Such an analysis further brings out valuable defence industry experiences and vital lessons for defence planners. The author in the concluding chapter suggests three plausible options for remodelling the Indian defence industry and indigenization programme, discusses the most pragmatic option and the resultant feasible model in detail, recommends the way ahead for India before suggesting an action plan for make in India in the defence sector.

The public sector perceives Make in India programme to be a capability-building exercise while private sector envisages it to be an opportune time to forge tie-ups with foreign OEMs to bring cutting-edge technology to India. Therefore, there is a need to adopt a result-oriented and graduated approach for the private sector to achieve compete self-reliance in defence sector. The author suggests three phases for induction of a private vendor i.e. initial induction phase in which designated private industry could initially be made execute a sub-system level upgrade programme on an allocated weapon system. This will be followed by an interim induction phase in which designated private industry could next be made to execute a major system-level upgrade program on an in-service weapon platform. Lastly, the final induction phase in which designated private industry could graduate to undertake the performance optimization for an in-service variant of the specific major weapon system it has been designated for. The author finally recommends appointing an apex-level body comprising domain experts, which will be solely responsible for Make in India initiative for defence sector. The study relies on secondary data sources, including government reports, policy documents, industry analyses, and expert opinions, to formulate its conclusions and recommendations

2.5 **Make in India: promoting indigenisation**

Kumar (2016) has brought out that the logo of make in India initiative is a lion which represent India's glorious past. The lion is made up of an iron cage which represents the industry. Author has stated the vision of make in India initiative comprising of increase in manufacturing, fostering innovation, protecting intellectual property and enhancing skill development. Further it is envisaged that mission make in India is not to be achieved by compromising quality standards. The slogan zero defect was coined by the prime minister which signifies production mechanism where in products have no defects and the process through which product is made has zero adverse environmental and ecological effects. The make in India initiative focuses on building physical infrastructure as well as creating a digital network to make India a global hub for manufacturing of goods ranging from cars to software, satellites to submarines, pharmaceuticals to ports and paper to power. The author has further elaborated various initiatives taken under Make in India programme and their impact on employment, infrastructure, exports and Foreign Direct Investment. Thereafter various success stories have been narrated by the author.

Finally the author has highlighted few concerns like skill development, conducive Labour laws, lethargic bureaucracy, low ranking in ease of doing business, logistic facilities, poor infrastructure, and availability of adequate power and efficient implementation of policies. He has expressed hope that make in India is a ambitious project and is not merely a slogan but a mission to be accomplished by a single minded commitment.

2.6 **Defence Production and Mission 'Make in India'**

Suman (2021) presents a detailed study of India's defence manufacturing sector and the obstacles that have prevented India from becoming self-reliant in the procurement of military hardware. The book looks at the past of arms imports, explaining how policy,

bureaucratic and other hurdles have retarded the development. The author also points out the problems with the PSUs' prominence and poor technology transfer agreements that have produced not real indigenous capability but mere assembly. He claims that India's defence industrial base has to shift from license production to innovation based manufacturing, with emphasis on research, development and system integration of modern technology.

The book also examines policy changes including the Aatmanirbhar Bharat, Defence Procurement Procedures (DPP) and the Strategic Partnership Model that has been adopted to enhance the Indian defence industrial base. Suman stresses on the importance of private sector, he says that public private partnerships, foreign direct investments and partnerships with foreign defence companies are essential to enhance the Indian defence industrial base. His findings are in harmony with the larger goal of indigenization of vital defence technologies, weapons, sensors and aerospace systems. Thus, the author through the advocacy for long term strategic planning, streamlined procurement and increased R&D investment, offers a way forward on how India can move away from being a defence import dependent economy and achieve Make in India in defence production.

2.7 **Defence Industries in the 21st Century: A Comparative Analysis**

Neuman (2021) offers a comprehensive assessment of global defence industries, reviewing the organization and operation of these industries and the policies underpinning their development. The book was published in 2021 and the author looks at how the economic power, the technological power and the government policies shape the defence industrial base of various countries. The book emphasises the differences between the mature military-industrial complexes (the United States, Russia, Europe, and so on) and the new defence industries (India, China, Brazil, and others) and focuses on the difficulties of the developing countries in the attempt to achieve military autarky. Neuman states that

technological dependence, high costs of R&D, and limited access to the strategic technologies hinder the development of the regenerative capabilities which, in turn, leaves the developing nations dependent on imports and technology transfer.

Neuman has particularly focused on the role of government intervention, policy frameworks and strategic partnerships in the development of defence production. She looks at the impact of globalization on defence procurement and note that, not even the advanced countries can be fully self-reliant in defence equipment procurement due to network of international suppliers. Her insights on offset agreements, joint ventures, and public-private collaborations are particularly useful to India's efforts to enhance its defence industrial base. Neuman stresses on the necessity of consistent engagement in the development of defence R&D, skills and industry infrastructure in the countries which aim to become military powerhouses on their own. Her approach is a comparative one and she offers some valuable insights into India's defence sector, both as to what has worked and what has not in the quest for self-reliance.

2.8 **Atmanirbharta in Defence: How has been the Journey So Far? Where are we Headed?**

Saxena (2022) has brought out that today the 'twin initiatives' of the Government — Make in India and Atmanirbhar Bharat, have come to occupy a position wherein they are seen as 'prime-movers' that sets the pace of the country's forward journey on the road to self-reliance - be it defence or civil sector. The journey to the current status has been full of challenges with many successes and many failures dotting the way. The present work traces this exciting journey and brings out updates about the current state of reality and suggests a likely way forward.

2.9 **India's Defence Industry: From Dependence Towards Self Reliance: International Ramifications**

Cowshish (2022) offers a detailed study of Atma Nirbhar Bharat Abhiyan or the initiative of building a self reliant defence industry of India, with the focus on problems like over reliance on foreign technology, slow policy making and implementation and bureaucratic hurdles. Though the article mentions positive steps like the 'Make in India' initiative and the role of public-private partnerships in indigenous defence production, it stresses that there are still many challenges especially in the areas of technology transfer and development of indigenous capability in critical components like propulsion systems, avionics and advanced sensors. The internal and international consequences of India's defence indigenisation, including changes in its relations with the main arms exporting countries and the perspective of India as a future arms exporter are considered in detail. However, certain research gaps which stem out are a deeper analysis of private sector participation, the technological gaps that hinder self-reliance, and long-term economic impact assessments of India's defence industrial growth. These gaps suggest that further research is necessary to fully understand the complexities and future potential of India's defence industrial ecosystem.

2.10 **Swavalamban 2.0**

Dte of Indigenisation, Indian Navy (2023) in the document -Swavalamban 2.0, released by the Indian Navy brings out that it is an effort to accelerate the indigenisation of naval systems and technologies and build on the foundations of the original Swavalamban initiative. It is an effort to define the Indian Navy's needs and identify the equipment/systems/subsystems that can be indigenised in the coming years by PSUs, DRDO and private industry. Swavalamban 2.0 also focuses on the collaboration between

public sector units, private industries and start-ups to innovate and reduce dependency on imports. The initiative also includes measures to streamline the procurement process, enhance R&D and develop the domestic defence manufacturing ecosystem. As a forward thinking document, the literature on Swavalamban 2.0 also highlights the slow rate of technology development, the limited capacity of the private sector, and the bureaucratic challenges that might hinder the achievement of Swavalamban 2.0 goals. Also, the document clearly shows the slow indigenisation pace in the 'Fight' category as compared to the other two categories and the need to enhance it.

2.11 **Defence Indigenisation: Progress and Perils**

Pant (2023), carries out a critical analysis of the efforts made by India to achieve self-reliance in defence production with a focus on the mixed outcomes of these efforts. The author notes the positive changes that have been brought about by policies such as 'Make in India' and the creation of indigenous platforms like Tejas fighter aircraft and INS Vikrant aircraft carrier. However, the article notes several problems, including project time overruns, technological gaps, and the country's import dependence for vital components like engines, sensors, weapons and advanced electronics from abroad. Pant also stresses the problems of bureaucratic delays and the absence of a clear and coherent long-term defence strategy as obstacles to the fulfilment of India's indigenisation objectives. He also highlights that although public-private partnerships have been relatively successful, there are still many structural and regulatory challenges. There is still a need to enhance the focus on research and development, improve the policy execution, and increase the private sector participation to tackle these challenges and make defence indigenization a path to sustainable self-reliance.

2.12 **India's Quest for Defence Indigenisation: A Case Study of the Indian Navy**

Patel (2023) provides a detailed analysis of the Indian Navy's drive towards indigenisation. The Navy, according to Patel, has had a long term plan of building up its indigenous capacity, especially in the construction of ships, which has received a boost with the completion of the INS Arihant and the Scorpene submarines. The Navy's partnerships with domestic industries and foreign collaborators to develop advanced systems, weapons, and sensors are also explored in the article. However, Patel points out some challenges, which include: -

- (a) The Indian Navy still depends on foreign technology for some critical components;
- (b) Delays in procurement processes; and
- (c) Limited research and development capacity in India's defence ecosystem.

She argues that although the Navy has been more aggressive in indigenisation than other services, much remains to be done to achieve complete indigenization, especially in the areas of propulsion, electronic warfare, weapons and advanced surveillance. The article does not establish whether the current defence industrial base is sufficient to address these challenges and whether government policy support, streamlining of the procurement process and deeper partnership with the private sector are necessary to boost indigenization in the Navy.

2.13 **Swavalamban 3.0**

Dte. of Indigenisation, Indian Navy (2024) in document - Swavlamban 3.0 which is built on the foundation of its predecessor documents, Swavlamban 1.0 and Swavlamban 2.0 offers an updated action plan for enhancing indigenisation within the Navy, with a particular focus on the achievement of self-reliance in the fight category, which includes weapons, sensors and combat systems. The document is in line with the larger vision of India for an

‘Aatmanirbhar Bharat’ and seeks to enhance the role of the domestic defence industrial ecosystem in the attainment of technological self-sufficiency.

Swavlamban 3.0 has a more refined approach towards the engagement of private industry, start-ups and academia. Whereas Swavlamban 2.0 limited itself to the identification of critical technology gaps and stipulation of indigenisation requirements, the new version furnishes structured collaboration mechanisms through strategic partnerships, defence innovation programs and focused funding. In addition, the iDEX framework has been broadened to enable startups and MSMEs to participate more actively in the development of critical technologies. It also offers a more detailed review of previous indigenisation efforts, with emphasis on the successes made in the 'Float' and 'Move' categories, and on the specific bottlenecks encountered in the 'Fight' category.

The comparison between the two documents reveals that Swavlamban 3.0 has placed more emphasis on naval export potential than Swavlamban 2.0. Whereas the earlier versions were more concerned with domestic self-reliance, Swavlamban 3.0 includes plans for making India a global supplier of naval defence equipment. It distinguishes possible collaborations, joint ventures and technology transfers that may be undertaken to enhance India's defence industrial base and expand its share of the global defence market.

2.14 **Research Gaps**

The existing literature on India's defence industrial ecosystem, particularly in relation to the indigenisation of weapons and sensors for the Indian Navy, reveals several research gaps that need addressing. Some of the research gaps are listed below: -

- (a) **Limited Analysis of Technological Challenges** – Existing literature lacks a comprehensive assessment of the specific technological hurdles in developing advanced naval sensors, radars, and electronic warfare systems domestically.

- (b) **Focus on Policy Over Technical and Logistical Barriers** – Most studies emphasize broad policy frameworks like "Make in India" while neglecting detailed technical, financial, and logistical constraints that impede the development of sophisticated weapon systems.
- (c) **Underrepresentation of Private Sector and SMEs** – There is insufficient research on the role of private companies and SMEs in high-tech defence R&D, particularly in areas crucial to the Indian Navy's operational needs.
- (d) **Inadequate Exploration of Technology Transfers and Offsets** – Studies do not thoroughly examine how foreign collaborations and offset agreements can be better utilized to enhance domestic defence capabilities.
- (e) **Lack of Critical Evaluation of Bureaucratic and Procurement Challenges** – There is a research gap in analysing how bureaucratic inefficiencies, procurement delays, and policy roadblocks impact defence Indigenisation efforts.
- (f) **Role of Qualitative Requirements** – Despite their critical role in defense procurement, no comprehensive study has analyzed the importance and effectiveness of Qualitative Requirements (QRs) in the Indian Navy.

2.15 **Conclusion**

Addressing these research gaps is crucial for strengthening India's defence industrial ecosystem, particularly in the context of naval weapons and sensor indigenisation. A more nuanced understanding of technological, financial, and logistical barriers, along with an in-depth evaluation of private sector contributions and technology transfer mechanisms, can provide strategic insights for policymakers and industry stakeholders. Overcoming bureaucratic inefficiencies and skill shortages will further accelerate self-reliance in advanced defence technologies. By bridging these gaps, India can move towards a more

resilient and self-sufficient defence manufacturing ecosystem, ensuring long-term operational effectiveness and security for the Indian Navy.

Chapter 3 : Government Initiatives Towards an Efficient Defence Industrial

Ecosystem

3.1 Introduction

In recent times the global security landscape has become more complex and is further complicated by rapidly changing technologies, new threats and increasing geopolitical tensions. In this regard a strong and sustainable defence industrial ecosystem has been identified as a key enabler of national security. The role of the DIE has expanded from merely fulfilling the needs of the armed forces; it also embraces strategic autonomy, technological development, creativity, and economic robustness. Given the importance of a continuous and viable defence sector, many governments have put in place different measures and procedures to create a good DIE. This chapter looks at the efforts made by the Indian government from the year 2000 up to the present time with regard to policies, measures, and changes that have been made towards the development of a proper and sustainable defence industrial ecosystem.

3.2 Government Initiatives

The Indian government has also marked a number of strategic initiatives, policy reforms and institutional support mechanisms to develop a self-reliant and efficient defence industrial ecosystem.

3.2.1 From Year 2000 to 2014

Between the years 2000 and 2014, the Indian government made the following: The necessary groundwork for the improvement of the defence industrial ecosystem was laid by implementing significant reforms and policies. The chief progress was the opening of the defence sector to private participation in 2001, which allowed 100 percent Indian private

sector investment and up to 26 per cent FDI (Foreign Direct Investment). To reduce dependence on imports and promote domestic manufacturing this move was made. Also in 2002 the Defence Procurement Procedure (DPP) was put in place to provide a structured framework for acquisitions, and to ensure that procurement processes were transparent and efficient. In order to induce further indigenous defence production the 'Offsets Policy' was launched in 2005, which specified that a minimum percentage of defence deals above a certain threshold must be reinvested in India through domestic partnerships. This policy brought about technology transfer and capacity building within Indian industries. The DPrP was introduced in 2011 and, among other things, promoted R&D, gave priority to procurement from Indian firms and supported MSMEs in the sector.

During this period, DRDO and Defence Public Sector Undertakings (DPSUs) were also encouraged to collaborate with private industries for the joint development of critical defence technologies. The development of Tejas Light Combat Aircraft (LCA) and the Advanced Towed Artillery Gun System (ATAGS) were also accelerated. These initiatives, when implemented collectively, helped in the building of a strong foundation for India's defence manufacturing ecosystem and the way to the extensive reforms undertaken after 2014.

Make in India Initiative

Make in India Initiative launched in 2014, has played a significant role in the revitalization of the Indian defence industrial ecosystem. The main objective of the initiative is to enhance domestic production, reduce dependence on imports and create employment. In particular, for the defence sector, the campaign works towards the development of indigenous defence technologies and products through public-private partnerships. The key elements of the Make in India initiative are: -

- (a) **Fostering innovation and R&D.** The government facilitates private players in investing in R&D and technology development by providing financial support and by facilitating their collaboration with DRDO, MoD and other agencies.
- (b) **Attracting foreign direct investment (FDI).** The policy permits FDI up to 74% in the defence sector through the automatic route and up to 100% through the government route in selected cases. This move was meant to infuse capital, technology and managerial expertise into the domestic defence sector.
- (c) **Procurement from Indian companies.** Integration of a preference for Indian firms in defence procurement contracts into the policy framework has offered an opportunity for domestic companies to compete on a level playing field.

The Make in India campaign has created a conducive environment for both public sector enterprises (PSEs) and private sector players to flourish and contribute significantly to India's defence industrial capabilities. This was followed by the Atmanirbhar Bharat campaign that further consolidated efforts to make India self-reliant in critical technologies and reduce dependency on imports. The Defence Industry Initiative, launched in 2015, is another significant example of continued government effort in this direction.

Defence Procurement Procedures (DPP)

The DPP, which was released in 2002 and has been amended many times since then. It provides a step by step approach to the acquisition of defence equipment.

3.2.2 From 2014 till date

Revision of DPP and Strategic Partnership(SP) Model.

One of the most important changes to the DPP was the establishment of the SP Model in 2017. The government has revised the procurement procedure through the DPP (now known as Defence Acquisition Procedure (DAP)). DAP 2020 brings in new

nomenclature like “Buy Indian (IDDM)” – Indigenously Designed, Developed and Manufactured – to encourage domestic procurement. The DAP-2020 has brought several changes in the policy framework, procurement categories and incentives to MSMEs, support to innovations etc to boost defence manufacturing. However, all these initiatives focus on indigenisation; at the core of it, they aim to encourage R&D and skill set that will help in developing our own capacity to absorb technology and thereafter import it⁸.

(a) **Policy Framework.** Three major changes over DPP-2016 have been introduced; The first change is “Forced Indigenisation”, that is, embargo on items that have been positively indigenized (e.g. LCA Tejas Mk IA) and future embargo to allow enough time to develop capability within the given time frame (LCAM import ban effective from Dec 2025). Such list of positively indigenized items with timelines is being updated regularly. The second is the greater emphasis on AI, indigenous military materials, software, aero engines and silicon wafers. The third is that the planning process has been changed to shorter time frames that will help in realistic planning and giving the industry a correct picture of forces’ requirements to plan for the future⁹.

(b) **Procurement Categories and Indigenised Content.** DAP 2020 has come up with various forms of indigenization. The Buy and Make has been replaced by Buy (Global – Manufacture in India), Make has been divided into three categories Make-I, II, III and innovation. However, Buy (Indian) and Buy (Indian-IDDM) and, Buy and Make (Indian) and SP Model could have been grouped together as they are of similar nature and to avoid confusion between the two¹⁰.

⁸ Gupte, K(2023), *Effectiveness of Latest Government Initiatives in Defence Industry Ecosystem*. Centre for Joint Warfare Studies (CENJOWS), <https://cenjows.in/effectiveness-of-latest-government-initiatives-to-strengthen-defence-industry-ecosystem/>. Accessed on 30 Nov 24.

⁹ Ibid

¹⁰ Ibid

- (c) **Leasing.** The Leasing category can help experience the technology real time and can help in ascertaining its usefulness for further development.
- (d) **Defence Offset Policy.** It is a very important mechanism of inducing technology transfer, local sourcing and investment in the Indian defence industry from foreign defence companies. This policy aims to achieve this by ensuring that foreign companies that get large defence contracts invest a part of the contract funds (30-50%) in India in the form of technology transfer, co-production or through sourcing of components from India. The policy has led to the formation of joint ventures and collaborations between Indian companies and international firms. Some of the collaboration brought about by this policy include the partnership between Tata Advanced Systems and Lockheed Martin for the manufacture of C-130 Hercules aircraft in India, and the joint venture between Bharat Forge and Rheinmetall for the production of artillery systems. Defence Offset Policy has helped in the development of a vigorous defence industry in India, which has enabled the country to develop the capacity to design and build advanced defence systems.
- (e) **Offset Guidelines.** The Offset guidelines have been revamped. It appears that the Offsets are costly and have failed to bring in significant value back to the system, hence, Offset from all single vendor cases including G2G deals and Foreign Military Sales have been removed. The new technology and investment board will oversee the offsets and focus more on technology and investment of the major platforms and not the components as earlier. Offset banking has been removed¹¹.
- (f) **Foreign Direct Investment (FDI).** FDI limit in defence Sector was increased to 74% from 49% with automatic route and 100% with government

¹¹ Gupte, K(2023), Effectiveness of Latest Government Initiatives in Defence Industry Ecosystem. Centre for Joint Warfare Studies (CENJOWS), <https://cenjows.in/effectiveness-of-latest-government-initiatives-to-strengthen-defence-industry-ecosystem/>. Accessed on 30 Nov 24.

permission in May 2020. The FDI cap limits are useful to protect the interests of Indian Vendors and at the same time offers the OEMs a way to try their hands at Defence Manufacturing in India. However, it may not always align with the goal of ToT as the low stakes may discourage the OEMs from revealing their IP rights, as has been the case so far¹².

(g) **Mandatory Indigenous Procurement.** In the 2024-25 budget, the Indian government has allocated 75% of the defence capital acquisition budget, which is approximately ₹1,05,518.43 crore, for purchase from domestic firms¹³.

(h) **Exports.** The government has realized the need to explore the defence export market and has come up with a Draft Defence Production and Exports Promotion Policy to enhance defence export.

(j) **Dedicated Acquisition Cadre.** DAP 2020 has started with provisions for institutionalized training of personnel in India and abroad. However, there is much to be done in terms of cadre strength and training. This will help to gain the necessary knowledge in the field of procurement and acquisitions in order to get the maximum from the contracts¹⁴.

(k) **Strategic Partnership Model.** The Strategic partnership model identifies a Indian private company to team up with foreign OEMs for acquisition of Fighter Aircrafts, Helicopters, Submarines and AFVs initially. Only one entity will be selected for each project. SP company must be owned by resident Indians i.e. 51% stake. This model which has been recommended by Dharendra Singh Committee to

¹² Gupte, K(2023), *Effectiveness of Latest Government Initiatives in Defence Industry Ecosystem*. Centre for Joint Warfare Studies (CENJOWS), <https://cenjows.in/effectiveness-of-latest-government-initiatives-to-strengthen-defence-industry-ecosystem/>. Accessed on 30 Nov 24.

¹³ Chawla, A K (2024), *Defence Budget 2024-25 — An Analysis*, *SPs Naval Forces*, SP Guide Publication, <https://www.spsnavalforces.com/story/?id=874&h=Defence-Budget-2024-25-andmdash;-An-Analysis>. Accessed on 15 Dec 24.

¹⁴ Gupte, K(2023), *Effectiveness of Latest Government Initiatives in Defence Industry Ecosystem*. Centre for Joint Warfare Studies (CENJOWS), <https://cenjows.in/effectiveness-of-latest-government-initiatives-to-strengthen-defence-industry-ecosystem/>. Accessed on 30 Dec 24.

implement based on, would provide the private sector a big chance to a part in big projects. However, there are some issues with the model; the first is that there is no institutional arrangement to steer and direct the new process, and the second is the long term sustainability of the SPs if they are not on par with the DPSUs¹⁵.

Defence Innovation Organisation (DIO) and Innovations for Defence Excellence (iDEX).

In the years a major change has been the creation of DIO, in 2020 along with the iDEX project which aims to encourage creativity by assisting startups and small businesses well as individual inventors focusing on cutting edge technologies, for defence and aerospace purposes. The key features of iDEX include: -

- (a) **Grant funding for R&D:** Funding, for research and development is offered through the program to support inventors and new businesses in creating technologies.
- (b) **Industry collaborations:** IDEX helps foster partnerships among the government and private sector companies, in defence and public sector enterprises.
- (c) **Testing and validation support:** Innovators are provided with assistance, for testing out their ideas and products through prototyping and validation processes.

The iDEX initiative has been quite successful far as many small businesses and startups are actively involved in creating cutting edge defence technologies, like AI systems and drones well as developing cyber security solutions and autonomous systems.

¹⁵ Gupte, K(2023), *Effectiveness of Latest Government Initiatives in Defence Industry Ecosystem*. Centre for Joint Warfare Studies (CENJOWS), <https://cenjows.in/effectiveness-of-latest-government-initiatives-to-strengthen-defence-industry-ecosystem/>. Accessed on 30 Nov 24.

National Defence and Defence Industrial Policy Framework.

In 2020 the government introduced a National Defence and Defence Industrial Policy with the aim of realizing the vision of Aatmanirbharta (self reliance, for India). The policy sets forth several key objectives:-

- (a) **Enhancing Indigenous Production.** Supporting the growth of manufacturing to create high quality goods and services that meet benchmarks.
- (b) **Private Sector Participation.** Encouraging increased private sector engagement, in defence manufacturing to drive innovation and production
- (c) **Export Potential.** Positioning India as a leading exporter of defence goods and services by enhancing the competitiveness of industries to boost export potential.
- (d) **Developing defence corridors.** Creating defence corridors is a component of the strategy outlined by establishing Defence Industrial Corridors (DICs), in Uttar Pradesh and Tamil Nadu These corridors aim to concentrate defence manufacturing and research efforts partnerships, between private and public entities and create job opportunities. The two DICs will set up Common Facility Centres, Centres of Excellence and Skill Development Centres as technology transfer facilitation centres to support the sharing of best practices, research and development and skill enhancement¹⁶. These Distribution and Industrial Centres offer a chance for manufacturers to produce goods in India by taking advantage of the cost resources and strong government backing—a beneficial scenario, for both parties involved.

¹⁶ Gupte, K(2023), *Effectiveness of Latest Government Initiatives in Defence Industry Ecosystem*. Centre for Joint Warfare Studies (CENJOWS), <https://cenjows.in/effectiveness-of-latest-government-initiatives-to-strengthen-defence-industry-ecosystem/>. Accessed on 30 Nov 24.

The policy also emphasizes the importance of fostering a culture of innovation and technology development in the defence sector, while ensuring that the military's operational needs are met in a timely and cost-effective manner.

Defence Production and Export Promotion Policy (DPEPP) 2020.

The DPEPP 2020 sets out a vision to position India as a leading hub, for defence manufacturing by aiming for a turnover of Rs 1,75,000 Crores (US\$ 25Bn) including export of Rs 35,000 Crore (US\$ 5 Bn) in Aerospace and Defence goods and services by 2025¹⁷.

The main highlights of DPEPP are: -

- (a) **Promoting Defence Exports.** Promoting Defence Exports involves positioning India as a leading exporter of defence equipment, by streamlining export processes and setting up an export promotion unit within the Ministry of Defence (MoD). The strategy aims to expand into markets through agreements and increased partnerships, with international nations.
- (b) **Strengthening Research & Development (R&D).** The policy encourages public-private partnerships in defence R&D, including support for startups, MSMEs, and academia through initiatives like iDEX (Innovations for Defence Excellence). It emphasizes DRDO to focus on core R&D while allowing private players to take up production and expands the Technology Development Fund (TDF) to support innovation in defence.
- (c) **Ease of Doing Business & Investment Promotion.** The policy simplifies licensing processes, reduces regulatory bottlenecks, and facilitates Foreign Direct Investment (FDI) in defence and strengthens Defence Industrial Corridors in Uttar

¹⁷ DDP, MoD (2020), Defence Production & Export Promotion Policy 2020," at www.ddpmod.gov.in. Accessed on 01 Dec 2024.

Pradesh and Tamil Nadu to attract global investments. It implements a robust offset policy to encourage foreign OEMs to invest in India.

(d) **Focus on Indigenisation & Reduced Import Dependency.** The emphasis is, on promoting self-sufficiency and reducing reliance on imports in the defence sector by broadening the Positive Indigenisation List to gradually prohibit the import of defence products and enhancing the Srijan portal function to foster partnerships, between defence producers and suppliers.

(e) **Digital Transformation & Defence Exports Portal.** A new Digital Transformation & Defence Exports Portal has been introduced to streamline defence production and procurement processes along, with the launch of a portal, for Defence Export Promotion to simplify export procedures and paperwork.

This policy is, in line with the vision of Aatmanirbhar Bharat and aims to turn India into a centre for defence production while boosting its share, in the global defence export market.

Corporatisation of Ordnance Factory Board (OFB).

In 2021 the Indian government made a change, in the defence industry by transforming the OFB with the goal of boosting effectiveness and self-sufficiency in defence production. The OFB used to be part of the Ministry of Defence. It was reorganized into seven defence public sector units to enhance autonomy and responsibility. These new units focus on areas, like vehicles, ammunition and military gear to cater to different needs. The aim of corporatization was to update production methods and enhance oversight while encouraging innovation, in defence manufacturing to compete on a global scale

effectively¹⁸. This effort is in line with the vision of Aatmanirbhar Bharat aiming to boost involvement of the sector and decrease reliance, on imported goods.

3.3 Response from Industry on Government Initiatives for Robust Defence Industrial Ecosystem

In order to understand the impact of the various Government initiatives on the Industry, a survey was conducted with the major stakeholders like DPSUs, Private firms, MSMEs and Start-ups. The survey questionnaire is placed at Appendix A. While stakeholders acknowledge several advantages of these initiatives, there are persistent challenges that hinder their effectiveness. The responses of the industry are brought out in the succeeding paragraphs.

3.3.1 **Impact of Defence Acquisition Procedure (DAP) 2020 on Private Sector Participation**

The Defence Acquisition Procedure (DAP) 2020 was introduced to streamline defence procurement and enhance self-reliance, but survey results suggest mixed success.

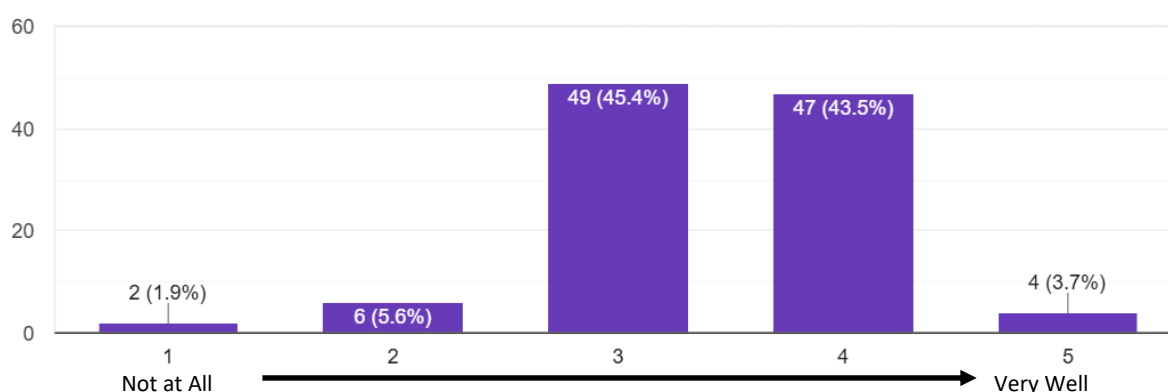


Fig 3.1: Impact of DAP on Private Sector Participation

¹⁸ Saxena, V K(2021), Corporatisation of Ordnance Factory Board –An Analysis, Vivekananda International Foundation, <https://www.vifindia.org/article/2021/august/12/Corporatisation-of-Ordnance-Factory-Board>. Accessed on 12 Dec 24

3.3.2 Positive Indigenization List – Progress but Challenges Remain

The Positive Indigenisation List (PIL) aims to boost domestic manufacturing by restricting imports of select defence equipment, but its impact remains inconsistent. As depicted in Fig 3.2, more than 72% feel that the PIL has been very effective in increasing the share of indigenous products. While it has definitely encouraged Indian manufacturers, many respondents believe that the government must support local firms with skill development, technology transfers, and financial aid to ensure that domestic production meets global standards and defence forces receive high-quality indigenous equipment.

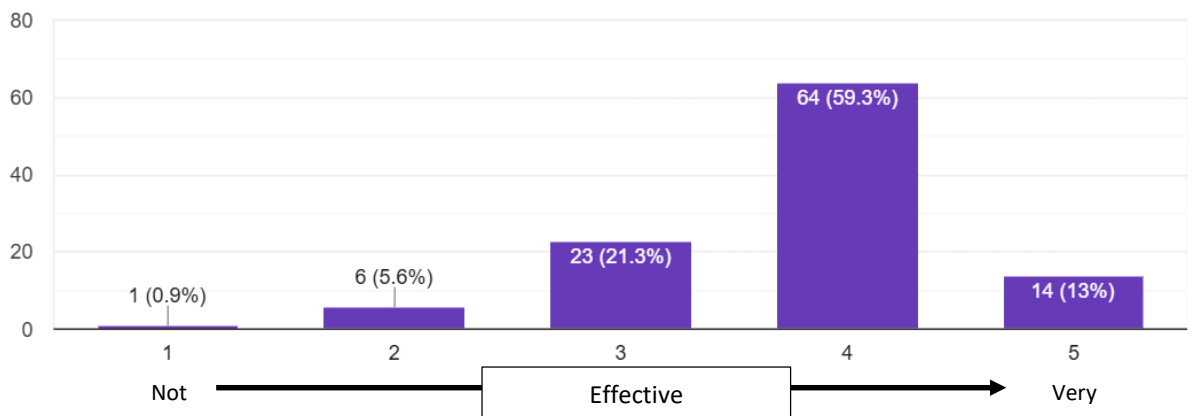


Fig 3.2: Impact of Positive Indigenisation List

3.3.3 Innovations for Defence Excellence (iDEX) – Encouraging Start-ups but Facing Hurdles.

The iDEX initiative was launched to foster innovation by supporting start-ups in defence technology, but the survey reveals moderate effectiveness. As per Fig 3.3, nearly 49.1% of respondents believe it has had some success, while only 43.5% think it has been able to meet its objectives. However, start-ups continue to face challenges such as limited funding, complex regulations, and delays in procurement by the armed forces. To maximize iDEX's impact, the government must ensure faster funding disbursement, ease regulations for start-ups, and enhance collaboration between defence firms and research institutions.

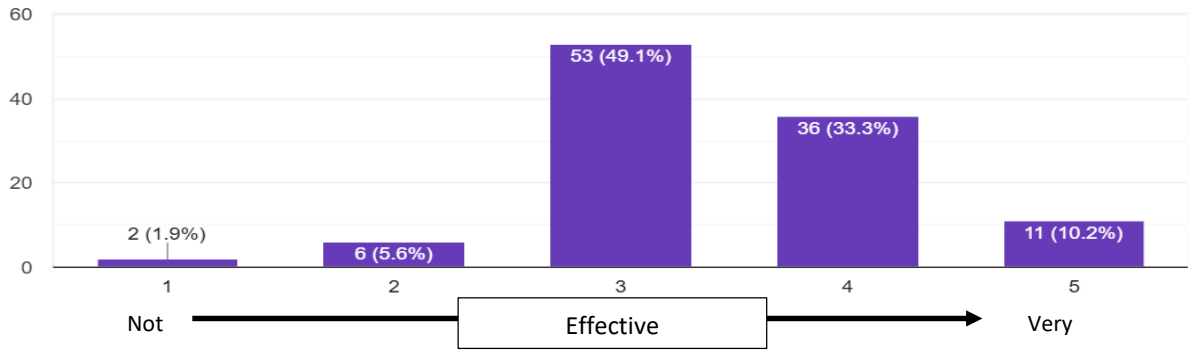


Fig 3.3: Success rate of iDEX Initiatives

3.3.4 Impact of Defence Industrial Corridors

The establishment of Defence Industrial Corridors (DICs) in Tamil Nadu and Uttar Pradesh was a significant step toward enhancing domestic defence manufacturing, but its effectiveness remains moderate. As per Fig 3.4, 63.9% of respondents believe DICs have had a positive impact, only 6.5% think they have reached their full potential. The major challenges include slow infrastructure development, difficulty in land acquisition¹⁹, and limited financial support for MSMEs²⁰. To ensure the success of DICs, the government must accelerate infrastructure projects, offer tax benefits, and promote private sector participation to attract large-scale investments.

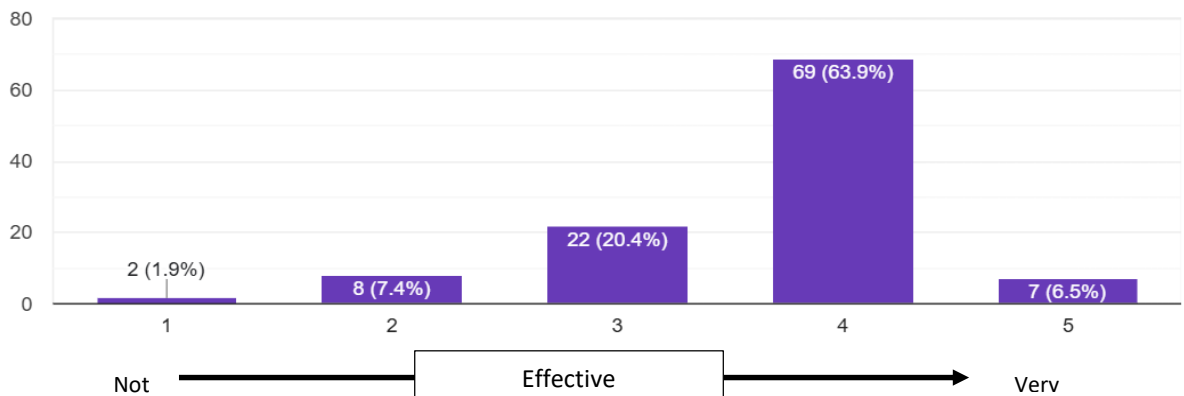


Fig 3.4: Impact of Defence Industrial Corridors

¹⁹ Ramchandran, H. (2019), Review of Industrial and Development Corridors in India, Indian Council of Social Science Research (ICSSR), New Delhi, <https://isid.org.in/wp-content/uploads/2022/07/WP217.pdf>. Accessed on 15 Dec 24.

²⁰ Maheshwari (2024), Defence Industrial Corridors in India: A Strategic Pathway to National Security, <https://www.maheshwariandco.com/blog/defence-industrial-corridors/>, Accessed on 10 Jan 25.

3.3.5 Bureaucracy in Defence Sector – A Major Hindrance

Bureaucratic hurdles continue to be a significant challenge for businesses in the defence sector, with majority of respondents stating that bureaucracy severely hampers ease of doing business. As per 3.5, around 61% believe the impact is high, while 20.4% rate it as extremely high. As per the responses received for issues impacting the ease of doing business, cumbersome approval processes, excessive paperwork, and lack of transparency are among the major ones. Addressing these issues through simplified regulations, digitalization of processes, and clear accountability mechanisms is crucial for fostering a more business-friendly environment.

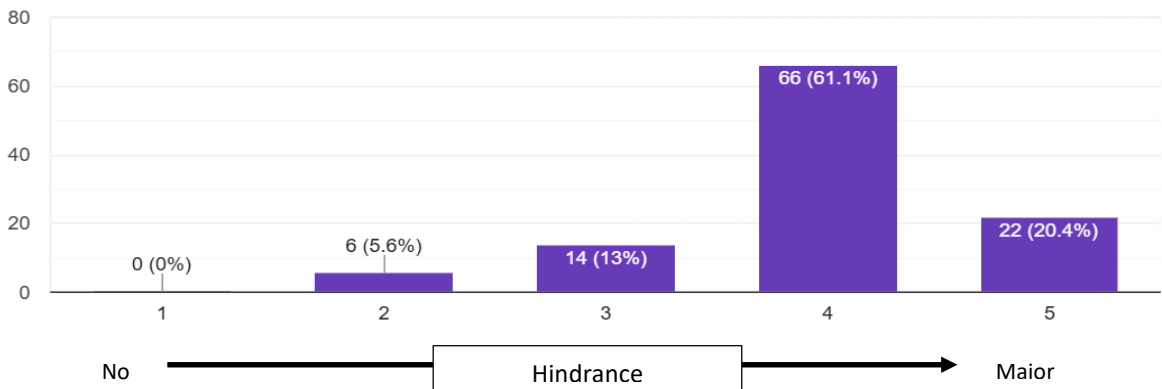


Fig 3.5: Bureaucratic Procedures in Ease of doing Business

3.3.6 Effectiveness of Export Promotion Strategy – Falling Short of Expectations

The government's export promotion strategy for defence firms has been largely ineffective as per the response received. As per Fig 3.6, while 42% rate the effectiveness as low, 33.3% consider it only moderately successful. Only 24% have found the policies effective.

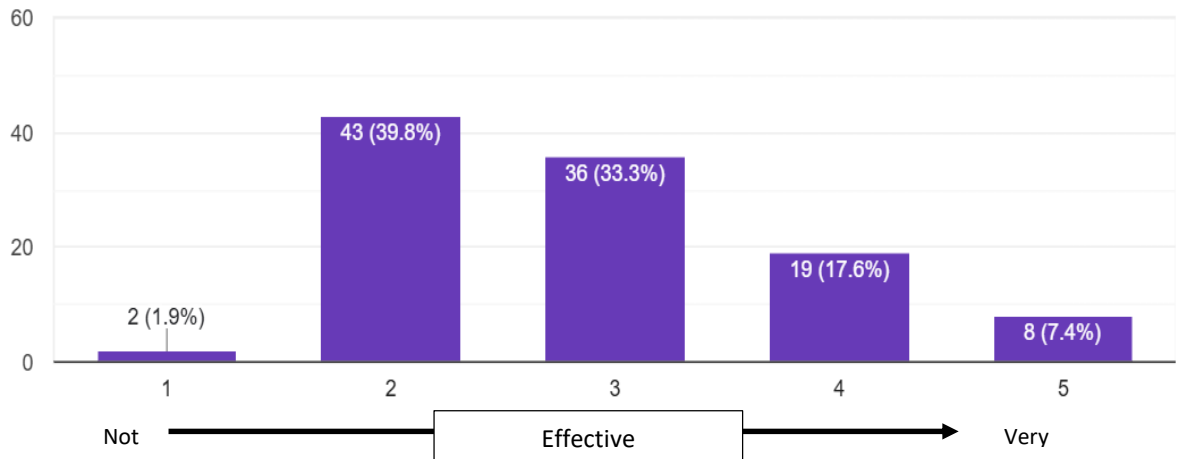


Fig 3.6: Effectiveness of Govt's Export Promotion Policy

3.3.7 R&D as a Career – Government Failing to Make It Lucrative

The Indian defence sector faces difficulties in attracting and retaining research talent, as indicated by majority of respondents who believe the government has not done enough to make R&D a lucrative career choice. As per Fig 3.7, around 59% rate the effectiveness of government efforts as poor, only 11% see it as effective. Low salaries, lack of long-term career opportunities, and funding constraints are major deterrents which the respondents conveyed for professionals entering defence R&D.

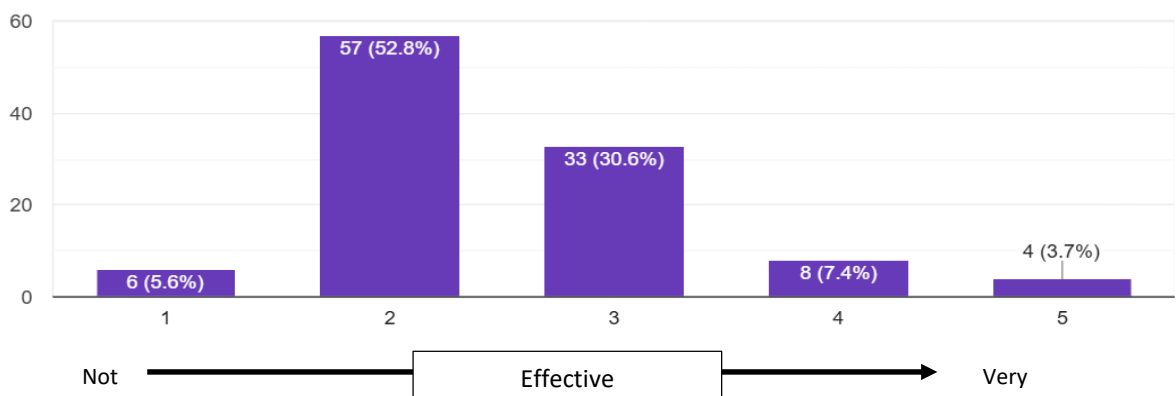


Fig 3.7: Effectiveness of Govt. in making R&D Lucrative

3.3.8 Defence MSME & Start-up Portal – A Promising Initiative with Strong Industry Support

The idea of a dedicated Defence MSME & Start-up Portal for direct engagement with the armed forces has received overwhelming support from the industry. As per Fig 3.8,

around 80% of respondents believe such a portal would be highly useful. This reflects a strong demand for a centralized digital platform that facilitates direct interaction between MSMEs, start-ups, and the armed forces, streamlining procurement processes and reducing dependency on intermediaries. If implemented effectively, such a portal could enhance transparency, accelerate decision-making, and provide small businesses with better access to defence contracts, ultimately strengthening India's defence manufacturing ecosystem.

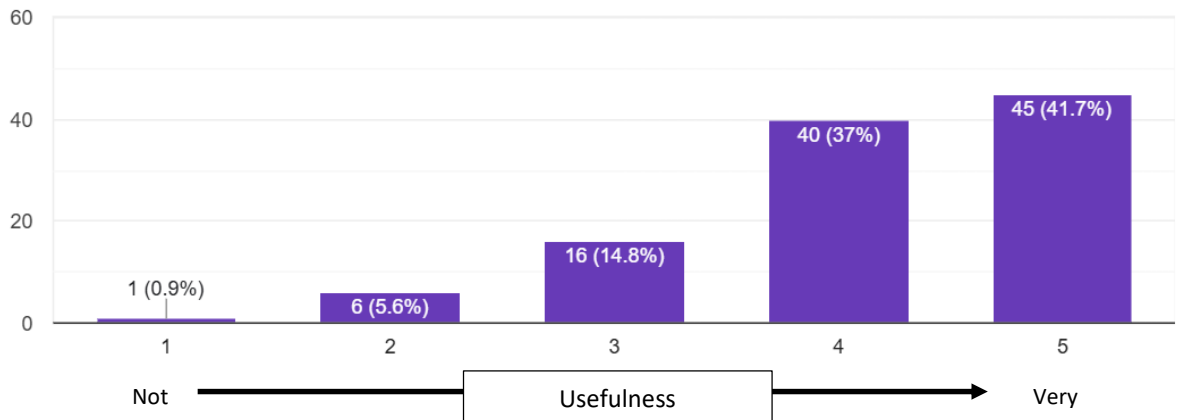


Fig 3.8: Usefulness of Defence MSME and Start-up Portal

3.3.9 Inadequacy of India's Defence R&D Spending

The survey results highlight a strong consensus that India's current defence R&D spending, which is less than 1% of GDP, is insufficient. As per Fig 3.9, around 69% of respondents believe that India's defence R&D investment should be aligned with global benchmarks of approximately 4-5% of GDP, while 20.2% of participants advocate for increasing it to at least 2% of GDP. In contrast, only a small fraction of respondents believe that the existing allocation is sufficient.

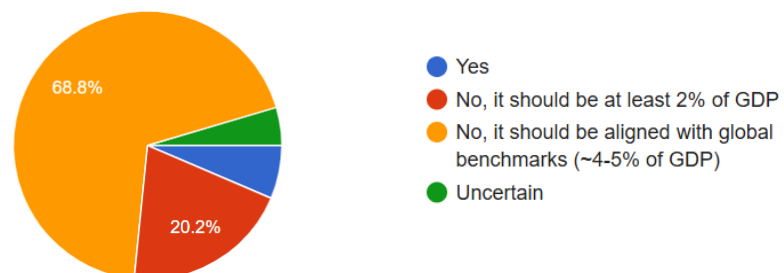


Fig 3.9: Sufficiency of India's R&D spending in Defence

3.3.10 Challenges and Roadblocks in Defence Manufacturing

- (a) **Limited Assurance of Orders for Indian Firms.** A significant **73.1%** of respondents highlighted the lack of assured orders for Indian firms as a major challenge. This uncertainty discourages private investment and hinders long-term planning for domestic defence manufacturers.
- (b) **Delays in Procurement Cycles.** 66.7% of participants pointed out that delays in procurement cycles cause financial strain on vendors. These delays disrupt cash flow, increase costs, and make it difficult for firms to sustain operations and invest in future projects.
- (c) **Preference for DPSUs Over Private Industry.** 51.9% of respondents believe that the defence sector continues to favour Defence Public Sector Undertakings (DPSUs), restricting opportunities for private companies. A more level playing field is needed to encourage competition and innovation.
- (d) **Lengthy Decision-Making Process in Approvals and Procurement.** 50% of respondents identified lengthy approval processes as a major bottleneck. The slow pace of decision-making delays projects, affecting both production timelines and industry growth.
- (e) **Insufficient Transparency and Accountability.** Procurement decisions are perceived as lacking transparency and accountability by 38% of respondents. This concern raises issues regarding fairness and trust in the system, which could discourage new entrants.
- (f) **Excessive Bureaucracy in Procurement.** 37% of participants cited excessive bureaucracy as a hurdle in procurement procedures. The complexity of regulations makes it difficult for firms to navigate the system efficiently, leading to delays and increased compliance costs.

- (g) **Inconsistent Defence Policies and Unpredictable Procurement Framework.** 76.9% of respondents highlighted policy inconsistency as a major roadblock to India becoming a global defence manufacturing hub. Frequent changes in regulations create uncertainty, discouraging long-term investments.
- (h) **Limited Collaboration between Private Sector, PSUs, DRDO, and ISRO.** 68.5% of participants pointed out that limited collaboration between key stakeholders hampers innovation and technological advancements. A more integrated approach is needed to drive sectoral growth.
- (i) **Lack of a Long-Term Vision for Core Competencies.** 37% of respondents believe that the absence of a well-defined vision document for core defence competencies weakens India's ability to position itself as a global leader in defence manufacturing.
- (j) **Need for a Stronger Talent Pool and Workforce Development.** 27.8% of respondents emphasized the need for skilled professionals in the defence sector. Workforce development and specialized training programs are crucial to addressing this gap.

3.3.11 Strategies to Improve Defence Exports and Fast-Track Defence Capacity Building

Enhancing Defence Exports

- (a) **More Incentives/Subsidies for Export-Oriented Firms.** A significant 72.2% of respondents emphasized the importance of financial incentives and subsidies to encourage export-driven defence firms. Reducing financial barriers would make Indian defence products more competitive in international markets.
- (b) **Better Coordination with Armed Forces.** 64.8% of participants highlighted the need for enhanced collaboration between defence firms and the

armed forces to better understand operational requirements. This would ensure the production of more relevant and high-quality defence equipment.

(c) **International Collaborations & Partnerships for Tech Transfer.** 60.2% of respondents support greater international cooperation and technology transfer agreements. Establishing global partnerships would facilitate access to advanced technologies and improve production efficiency.

(d) **Simplified Export Policies for MSMEs & Private Sector.** 48.1% of participants emphasized the need for streamlined export regulations to encourage greater participation from MSMEs and private firms. Simplifying processes can reduce bureaucratic delays and improve market access.

(e) **A Structured Global Marketing Plan.** 38% of respondents stressed the importance of a comprehensive global marketing strategy for promoting Make-in-India defence products. A well-defined marketing approach can enhance India's visibility in the global defence sector.

Accelerating Defence Capacity Building

(a) **Transparent Accountability Measures in Procurement.** The highest-rated strategy (77.8%) is ensuring transparent procurement policies to eliminate inefficiencies and enhance vendor trust. Greater accountability would lead to faster approvals and timely project execution.

(b) **Confidence Building through Expos & Global Outreach.** 64.8% of participants believe that increased participation in international defence expos will boost the global credibility of Indian defence products. Strengthening India's presence in global markets is essential for long-term growth.

(c) **Milestone-Based Selection with Defined Timelines.** 53.7% of respondents support a structured selection framework with clear timelines to ensure

efficient production cycles. Defining strict delivery milestones would reduce delays and enhance efficiency.

(d) **Fast-Paced Capacity Building for Global Production.** 42.6% of participants advocate for accelerating production capabilities to establish India as a leading global defence manufacturing hub. Investments in infrastructure, R&D, and skill development are crucial for achieving this goal.

3.4 **Issues to be Addressed**

With the government's efforts to improve India's defence industry sector through initiatives, as per the responses received from the industry, there are still ongoing challenges to overcome. The reliance, on imported defence technologies is worrisome due to the development of domestic manufacturing capabilities in areas such as jet engines, semiconductors and advanced weaponry. Slow defence procurement procedures and bureaucratic hurdles frequently cause delays, in projects affecting their completion and innovative progress. Despite efforts like iDEX and the Technology Development Fund being put into place there's a lack of investments in research and development which is holding back the progress of creating cutting edge home-grown technologies. Moreover issues, around export clearances not having workers and relying on foreign parts are all contributing factors that are slowing down India's goal of establishing itself as a prominent global defence manufacturing hub.

3.5 **Conclusion**

The actions taken by the government in the defence sector are definitely a move, towards achieving the vision of 'Self Reliance' or 'Aatmanirbhar Bharat'. Although stakeholders may have varying opinions it is crucial for them to provide input to enhance progress and make necessary adjustments as needed in the future. Certain aspects will need attention. Focus moving forward while others should be thoroughly evaluated for their

relevance and effectiveness. The government has set the stage for an competitive defence industry through initiatives such, as Make in India and various policy reforms like DPP and iDEX programs along with Defence Offset policies in place. Nevertheless achieving self-sufficiency, in defence will require efforts to address bureaucratic and structural hurdles along the way.

Chapter 4 - Defence Industrial Ecosystem: India and Select Nations

4.1 Introduction

The defence industrial ecosystem (DIE) is an important part of the security architecture of a country, contributing not only to the military readiness but also to the technological development, economic development, and sovereignty. A effective and sustainable defence industrial base is important for any country that wants to achieve strategic autonomy in the context of India's growing security risks and the general changes in the world's geopolitics. The release of the Indian Naval Indigenisation Plan (INIP) 2015-2030 was a major step in this direction and the Plan is in sync with the broader Make in India initiative. This chapter looks at the development of the Indian defence industrial base before and after the INIP 2015, as well as the challenges and achievements. In addition, the growth of the Defence Industrial Ecosystem in select countries would be studied and the best practices that can be contextualised for India would be brought out.

4.2 Historical Evolution of the Defence Industry in India

India's military-industrial complex is more skewed towards the public sector in the R&D and manufacturing activities. This includes joint ventures with foreign companies, collaboration with research institutes and partnership with the government of other countries. Pardesi & Matthews(2007) has brought out that modern arm production in India can be attributed to as far back as 1801 when the British East India Company established the Gun Carriage Agency in Kolkata. However, up to the time of India's independence, the development of India's defence industry was controlled by the British and indeed during the

Second World War there were only six ordnance factories in the country²¹. India's way to building up a effective defence industrial base is divided into several stages. India got freedom when the country had a very weak industrial base and had to rely on purchasing its military equipment from other countries. But with the beginning of the Cold War and understanding the need for strategic autonomy the country began to develop its own defence industry.

4.3 **Post-Independence Era (1947–1960s): Early Foundations**

At the time of independence India was not only economically backward but also militarily weak. India received 18 ordnance factories and a very limited defence production capacity²². The new government of India had to tackle many issues: absence of modern weapons, no defence industry at all, and the purchase of almost all the military supplies including arms, ammunitions and even uniform from abroad (Mohanty, 2004). The prevailing strategy was to rely on the British colonial legacy of military organization and structures, while simultaneously moving towards indigenous capability development.

The initial approach was state-led, emphasizing self-sufficiency in the production of basic weaponry. Hindustan Aeronautics Limited (HAL) was established in 1940, and after independence, it became a crucial player in India's nascent defence industry. The government focused on setting up public sector enterprises like Bharat Electronics Limited (BEL) and Mazagon Dock Shipbuilders Limited to support military requirements (Gosh, 2016). Despite these efforts India was still dependent on foreign countries for sophisticated weapons systems.

²¹ Singh, S.V.(2023), Policy Recommendations for Achieving India's Defence Export Ambitions, Observer Research Foundation, Issue Brief No 676, <https://www.orfonline.org/public/uploads/posts/pdf/20231123152955.pdf>, Accessed on 10 Jan 25.

²² Behera, L. K. (2016), *Indian Defence Industry: An Agenda for Making in India*. Pentagon Press, Chp 1, p 3.

This period was also characterized by low obsession with the research and development and the manufacturing capacity was based on the assembly of imported products with very limited development of systems. During this period, the defence budget was not flexible and the funds were utilized in other vital areas. Hence, there was minimal investment in the development of research and industrial capacity. As the country had limited resources and depended on the Western countries and the Soviet Union for her technological and material needs, India was practically procuring her defence equipment from these countries, thus making the country vulnerable to national security and defence equipment deficiencies.

4.4 **License Production and Soviet Cooperation (1960s–1980s)**

After the 1962 conflict with China and the 1965 conflict with Pakistan, India understood the necessity of increasing the level of indigenous production of weapons as India was becoming more and more dependent on foreign arms suppliers. The country signed several licensing agreements with the Soviet Union and the latter became India's major supplier of defence equipment. This enabled the local production of MiG-21 fighter aircraft, T-72 tanks and other military hardware with supervision from Soviet Union²³.

In this phase, DRDO enlarged its functions and responsibilities and began to develop major projects such as guided missiles, radar systems and combat aircraft. However, the license-production model still made India to be partly dependent on foreign companies for important components and technology. Moreover, delay in decision making and bureaucracy slowed down the rate of domestic production. More DPSUs were created, but they were ineffective and stagnant in innovation. The government kept the defence production under its control and there was no much scope for the private sector. The Indo-Soviet defence cooperation, which started in the 70s, helped India to acquire military

²³ Behera, L. K. (2016), *Indian Defence Industry: An Agenda for Making in India*. Pentagon Press,

hardware such as tanks, artillery and fighter aircraft. Although this cooperation contributed to the enhancement of Indian military capacity, it also cemented India's dependence on foreign suppliers. By 1980, roughly 70 per cent of Indian military hardware was of Soviet origin²⁴. The Indian Navy also initiated its path to self-reliance with initial projects like construction of small naval ships.

4.5 **Indigenous R&D Efforts (1980s–2000s)**

During the 1980s and early 1990s India was trying to develop its capabilities in such areas as aircraft engines, electronic warfare and missile technologies. In the 1980s, India sought to reduce its reliance on foreign suppliers by enhancing the research and development investments. The Integrated Guided Missile Development Programme (IGMDP) was launched by Dr. A.P.J. Abdul Kalam. This program led to the construction of missiles like Prithvi, Agni and Akash and therefore made India a missile power²⁵.

The 1990s was a turning point in the defence industrial policy of India. The end of the Cold War, the fall of the Soviet Union and the liberalization of the Indian economy made the government to change its policy. The defence procurement policy of 1992 also aimed at improving the local industry. The post Kargil period in the late 20th century also revealed the risks that India faces due to its dependence on foreign suppliers.

DRDO also developed plans for LCA Tejas and Arjun Main Battle Tank (MBT). But these projects were also marked by delays, cost overruns and technological deficiencies. However, India still had to rely on foreign countries for the latest weapons to meet its defence requirements. The strategy during this period was to develop strategic partnerships with foreign countries in order to build capacity while at the same time overcoming capability gaps. The Indian Navy's focus on indigenisation was proved by the construction

²⁴ Singh, R. (1990), Indo-Soviet military cooperation: expectation, trends and opportunities, *Strategic Analysis*, p. 1081.

²⁵ Kalam, A. P. J. (1999). *Wings of Fire: An Autobiography*. Universities Press.

of Shivalik class frigates and Arihant class nuclear submarines. Procurement of defence equipment was still done in a piecemeal fashion without a clear strategy for inducing self-reliance.

4.6 **The Defence Industrial Ecosystem in India: 2000-2014**

India's defence industrial base before the INIP 2015 was characterized by public sector dominance, limited private sector involvement, and a heavy reliance on foreign technology. Recognizing the limitations of the public sector, India opened its defence sector to private companies in 2001. The government allowed 100% private participation with a 26% FDI cap²⁶ (later increased to 49%).

The government introduced an offset policy in 2005, mandating foreign suppliers to invest a portion of their contract value into India's defence industry. These offsets aimed to develop local manufacturing capabilities and reduce import dependence. Behra (2016) has brought out that foreign vendors were mandated to invest at least 30% of major defence deals in India to boost domestic industry. The Indian Navy led the way in indigenous shipbuilding with initiatives such as the aircraft carrier Vikrant class. Some examples of collaborations are the BrahMos missile project with Russia, which shows that India is not a defensive power but also wants to develop its defence industry.

However, the private sector development was still modest due to the existence of bureaucratic obstacles, policy inconsistencies and the continuation of the public sector defence companies in defence contracts. There were no clear procurement guidelines, which also hampered private investment. Slower defence acquisitions and complex approval processes acted as a deterrent to innovation and large scale industrial development.

²⁶ Behra, L. K. (2016), *Indian Defence Industry: An Agenda for Making in India*. Pentagon Press.

4.7 **The Indian Naval Indigenisation Plan (2015) and Its Impact.**

The *Indian Naval Indigenisation Plan (INIP) 2015-2030* was released to provide strategic direction for indigenous capability development in shipbuilding and related defence sectors²⁷. It has been a landmark policy initiative aimed at transforming the defence industrial ecosystem of India. The INIP was identified as a strategic framework to address dependence on imports and to develop a strong domestic industrial base for naval defence needs. With the operational requirements of the Indian Navy, the initiative attempted to engage public and private sector industries, start-ups and academic institutions in the indigenisation process. The plan provided a systematic way of identifying critical technologies, encouraging indigenous innovation and streamlining the procurement process to build domestic manufacturing capacity. The plan was launched with the vision of achieving self-reliance in naval defence production and has greatly impacted India's industrial capacity, R&D activities, and strategic partnerships. Its key objectives²⁸ included:-

- (a) **Reducing Import Dependence:** A structured approach to achieving self-reliance in naval weapon systems, propulsion technology, and critical subsystems.
- (b) **Promoting Indigenous R&D:** Encouraging collaboration between DRDO, academia, and private enterprises.
- (c) **Enhancing Private Sector Participation:** Opening up avenues for domestic companies to participate in shipbuilding and ancillary defence manufacturing.
- (d) **Self-Sufficiency in Critical Areas:** Focus on indigenous development of sensors, torpedoes, radars, and navigation systems.

²⁷ Indian Navy. (2015). *Indian Naval Indigenisation Plan 2015-2030*. Ministry of Defence, Government of India.

²⁸ Ibid

4.8 **The Defence Industrial Ecosystem in India: 2015 to 2024.**

Some policy measures were adopted to enhance the defence manufacturing ecosystem after the implementation of the INIP. The Defence Acquisition Procedure (DAP) was also updated to provide higher preference to indigenous defence products. The ‘Make in India’ and ‘Atmanirbhar Bharat’ initiatives began to pick up steam, which provided policy benefits to private industries and start-ups to participate in defence manufacturing. The Make in India initiative was a notable policy change towards self-reliance in defence production. The government enhanced the FDI limit in defence, raising it to 49 per cent under the automatic route and above that on a case-by-case basis. Major defence programs including the Advanced Medium Combat Aircraft (AMCA), P-75I submarine project, and the Strategic Partnership Model for fighter jets, helicopters, and tanks were identified for enhancing domestic manufacturing capabilities. The conversion of OFB into seven corporate entities was for enhancing efficiency and accountability. Defence corridors in Uttar Pradesh and Tamil Nadu have been created to enhance industry cooperation and attract foreign investment.

Indian defence public sector undertakings (DPSUs) including Mazagon Dock Shipbuilders Limited (MDL), Goa Shipyard Limited (GSL) and Hindustan Shipyard Limited (HSL) played a very important role in implementing naval projects. Furthermore, the private sector including Larsen & Toubro (L&T), Bharat Forge, and Tata Advanced Systems Limited (TASL) has come into the defence manufacturing sector to develop the necessary naval platforms and subsystems.

There has been a high level of focus on research and development of new technologies to build domestic capabilities. The Defence Research and Development Organisation (DRDO) has been instrumental in developing radars, sonars, torpedoes and propulsion systems. India’s indigenous programmes such as the AIP system for submarines

and the improvement of electronic warfare capabilities showed that the country is becoming less dependent on imported defence technologies.

To accelerate indigenisation, more emphasis has been given to the partnership between defence PSUs, private industries and international technology firms. These partnerships include joint ventures, technology transfer agreements and collaborations with foreign OEMs to incorporate new technology into indigenous platforms. The armed forces has also worked closely with academia and research institutions like the Indian Institutes of Technology (IITs) for enhancing technological innovation and skill development in the sector. With the introduction of key policy reforms and strategic initiatives aimed at fostering self-reliance, the landscape of defence production has seen substantial growth.

4.9 **Challenges and Future Prospects.**

Despite notable progress, several challenges remain in the defence industrial ecosystem. The lengthy procurement process, bureaucratic hurdles, and limited access to advanced technologies continue to pose obstacles. Some of the hurdles that impede the progress of India's defence industry: -

- (a) **Dependence on Foreign Technology:** India's domestic defence industry continues to rely on foreign suppliers for critical technologies, limiting its ability to develop sophisticated weapon systems independently.
- (b) **Inefficiencies in Public Sector Units:** DPSUs and ordnance factories face challenges like low productivity, cost overruns, and bureaucratic inefficiencies, reducing their competitiveness compared to private and international firms.
- (c) **Limited Private Sector Participation:** Although private players like Tata, L&T, and Mahindra have entered the defence sector, they struggle with regulatory hurdles, lack of orders, and competition from DPSUs.

(d) **Delays in Defence Procurement:** Complex and time-consuming procurement processes, along with frequent policy changes, discourage both domestic and foreign investment.

(e) **R&D Constraints:** India's defence R&D expenditure as a percentage of GDP remains low compared to countries like the US, China, and Israel, hindering innovation and indigenous capability development.

4.10 **Growth of Defence Industrial Ecosystem in Select Countries.**

The study of defence industry set up of three select countries has been carried out and certain key take-aways which can be implemented for further improvement of Indian Defence Industrial Ecosystem have been summarised. South Korea, South Africa, and Singapore serve as compelling case studies for understanding the growth of a defence industrial ecosystem due to their unique yet instructive trajectories in defence industrialisation. South Korea transitioned from a war-ravaged nation heavily reliant on U.S. military aid to a global leader in defence exports, demonstrating the impact of sustained government investment, technology acquisition, and private sector collaboration. South Africa, despite facing international arms embargoes during the apartheid era, successfully built an indigenous defence industry, leveraging state-driven innovation and dual-use technologies. Singapore, with its limited geographical and natural resources, developed a highly sophisticated defence sector through strategic policymaking, public-private partnerships, and a strong focus on research and development. Each of these nations navigated challenges such as external dependencies, budget constraints, and geopolitical pressures to achieve self-reliance and global competitiveness.

Case Study - South Korea

Introduction.

Since the Korean War in 1950-1953, South Korea has developed its defence industry considerably. At first, South Korea was a military power that depended on the United States for military assistance. From North Korean security threats and the gradual reduction of the U.S. military in South Korea in the late 1960s, South Korea started to develop its DIB. This change was a beginning of South Korean indigenization process and strong state building approach to the defence sector development. During the last few decades, South Korea has grown to be one of the world's leading defence manufacturers and at the same time has reduced its imports of military equipment and has begun to supply the international arms market²⁹.

Early Development (1970s–1980s).

In the 1970s, the South Korean government took the lead in promoting the defence industry. The government of that country understood the need to be self-dependent in defence production and therefore took measures to create a defence industry. It assigned the big business enterprises commonly referred to as chaebols to engage in defence production along with their other civilian industries (Bitzinger, 2020). This decision was important because it helped the government to build on the manufacturing sector in order to develop defence production most rapidly. Several key initiatives were undertaken during this period. In 1971 the government created the Defence Procurement Agency (DPA) to handle procurement and supply chain management, and therefore, there were defined channels through which the military was to acquire its requirements. At the same time, in 1971, the Agency for Defence Development (ADD) was created to perform the role of conducting

²⁹ Hartley, K. & Belin, J. (2020), *The Economics of the Global Defence Industry*, Routledge Taylor and Francis Group, Chp 19, p 378.

defence research and development. These institutions played a crucial role in setting the foundation for a robust defence industry³⁰.

In 1974, the Special Law on the Promotion of the Defence Industry was passed in 1974. It also enhanced government spending on defence industry development through the provision of subsidies and relaxed regulations. Additionally, the defence tax law was also put in place in 1975 to provide funds for the military industrialization. In this early stage, South Korea's defence production was based on technology transfer from the United States, and the products were either assembled or imported directly. However, South Korea was able to create a foundation for the long-term strategy of technological self-reliance by establishing the necessary facilities and personnel.

Expansion and Modernisation (1990s–2000s)

By the year 1990, South Korea had attained a certain degree of defence technology autonomy. It moved from the initial stage of assembling and licensed production to the development of its systems. This change was due to the increased focus on defence research and development. The creation of the Korea Institute for Defence Analysis in 1987 gave the government important information on defence policy and the military equipment requirements. This research based approach allowed South Korea to make the right decisions on what to buy or manufacture in order to use the resources efficiently³¹.

Another significant development during this period was the enhancement of the offset policies. In this case, foreign suppliers were to transfer technology to South Korea as part of the defence contracts it had with the country. This approach helped in the development of indigenous advanced weapon systems which eventually reduced the

³⁰ Gosh, R. (2016), *Indigenisation: Key to Self Sufficiency and Strategic Capability*, Global defence Industrialisation and re-modelling the Indian Programme, Institute of Defence Studies and Analyses, New Delhi, Pentagon Press, Chp 4, p51-64

³¹ Moon, C. & Lee, J.Y. (2008), *The Revolution in Military Affairs and the Defence Industry in South Korea*, Security Challenges, Vol. 4, No 4, p117

country's dependency on imported weapons. With the development of South Korea, it was able to incorporate ideas of the Revolution in Military Affairs (RMA) into its defence sector to include electronics, aerospace and shipbuilding. These developments provided a good platform for South Korea to become one of the leading military powers in the region.

Defence Reform and Recent Developments (2000s–Present).

In 2006, South Korea launched the Defence Reform 2020 Plan, which was revised in 2011 to the 307 Plan and the reforms were to extend until 2030. These reforms were aimed at the modernisation of the armed forces and the reduction of troop strength while at the same time improving on the technological capabilities. One of the key aspects of the reforms was the transformation from a conscription-based military to a professional volunteer force. This shift was expected to enhance the quality of personnel and to make better use of technological advancements³².

Another major development was the establishment of the Defence Acquisition Programme Administration (DAPA) in 2006. This centralised agency was set to oversee defence procurement to guarantee better efficiency, transparency and accountability in acquisitions. DAPA played a crucial role in the reduction of bureaucratic delays, the streamlining of procurement processes and the promotion of partnerships with domestic and international defence firms³³. The government also encouraged private sector participation in defence research and manufacturing, so as to enhance innovation and competition in the industry.

³² Gosh, R. (2016), *Indigenisation: Key to Self Sufficiency and Strategic Capability*, Global defence Industrialisation and re-modelling the Indian Programme, Institute of Defence Studies and Analyses, New Delhi, Pentagon Press, Chp 4, p51-64

³³ Hartley, K. & Belin, J. (2020), *The Economics of the Global Defence Industry*, Routledge Taylor and Francis Group, Chp 19, p 380.

Defence Exports and Global Strategy.

South Korea has gradually moved up the ranks as a arms exporter of choice, capitalizing on its technological development and cost efficient production. Some of the high profile defence products that the country has developed include the K9 Self-Propelled Howitzer, T/FA-50 jet aircraft, K2 Main Battle Tank and advanced naval vessels and submarines. These products have entered the market of other countries and have helped South Korea to emerge as a major player in the global defence industry³⁴.

In order to expand its reach, South Korea has looked for defence cooperation beyond the U.S., and has been partnering with countries like Turkey and Indonesia. These collaborations have not only helped in the technology exchange but have also provided new opportunities for the defence exports of South Korea. The government has been actively supporting export initiatives by offering financial and policy incentives to domestic manufacturers for the growth of the sector.

Lessons for India

- (a) **Importance of Government Intervention.** South Korea's proactive policies, including financial incentives, regulatory support, and procurement guarantees, played a crucial role in fostering indigenous defence capabilities. India can adopt similar measures to strengthen its defence PSUs while also encouraging private firms like Tata and L&T to take on larger roles in defence manufacturing.
- (b) **Centralised Procurement System.** The creation of DAPA helped South Korea streamline its defence acquisitions, reducing inefficiencies and ensuring transparency. India's Defence Acquisition Council (DAC) and Defence

³⁴ Jung, S.K (2010), Korea Emerges as Arms Development Powerhouse, The Korean Times, available at http://koreatimes.co.kr/www/news/nation/2011/12/205_6771.html

Procurement Policy (DPP) could be enhanced to provide a more structured and efficient procurement process.

(c) **Emphasis on R&D.** The government's investment in defence research, coupled with strategic partnerships with foreign firms, has enabled the development of advanced indigenous weapon systems. India's Defence Research and Development Organisation (DRDO) should focus on building core technological capabilities rather than relying heavily on assembly and licensed production. Increased collaboration between academia, private industry, and government research institutions can accelerate innovation and reduce dependence on foreign imports.

(d) **Offset Policies.** Offset policies have also played a vital role in South Korea's defence industrialisation. By ensuring that foreign acquisitions are accompanied by technology transfers, South Korea has been able to build domestic expertise in critical areas. India's offset policy under the Make in India initiative should be strengthened to ensure meaningful technology transfers that contribute to long-term self-reliance.

(e) **Enhancing Defence Exports.** The transformation of South Korea's defence industry into an export-driven sector is another crucial lesson. By prioritising the development of cost-effective, high-quality defence products, South Korea has successfully penetrated global markets. India should focus on increasing its defence exports by identifying potential markets in Africa, Southeast Asia, and Latin America. Establishing dedicated export policies and providing incentives to defence manufacturers can help India become a leading arms exporter.

Case Study - Singapore

Introduction.

Singapore's defence industrial ecosystem has undergone remarkable transformation since its independence in 1965.

Despite the small size of the country and the absence of natural resources, Singapore has been able to develop a sophisticated and sustainable defence industrial base that supports national security and technological development. The country has been able to build up its indigenous capabilities with the help of appropriate government policies and effective collaboration with global defence companies.

Early Development and Strategic Foundations

When Singapore became independent in 1965, it required a strong and independent defence system. At first, Singapore received military equipment from other countries, especially from the United Kingdom and Israel. Singapore soon realised that reliance on external sources was unsustainable in the long run. In response, the government embarked on a path to develop an independent defence industrial base³⁵.

One of the first and most important steps was the creation of the Chartered Industries of Singapore (CIS) in 1967³⁶. This state-owned enterprise was to manufacture small arms and ammunition and thus relieve the country from the need to import arms. Over the years, CIS expanded its activities to other defence sectors and thus provided a good platform for the development of a broader defence industry. CIS eventually became Singapore

³⁵ Singapore Technologies Engineering. (n.d.). *25 years: The CIS story*. Retrieved from <https://www.stengg.com/getmedia/ab38ccfc-7355-4545-b0b0-1376a67f011e/25-years-the-cis-story?ext=.pdf>. Accessed on 10 Jan 25.

³⁶ Hartley, K. & Belin, J. (2020), *The Economics of the Global Defence Industry*, Routledge Taylor and Francis Group, Chp 25, p 529.

Technologies Engineering (ST Engineering) which is now one of the leading players in the global defence and engineering sector (Matthews & Koh, 2020).

Growth and Expansion of Defence Capabilities

Singapore's defence industrial ecosystem has developed over the years through the government's initiatives and with the help of the private sector. The government paid much attention to the development of particular industries including land systems, aerospace, naval systems, and electronics.

(a) **Land Systems Development:** To enhance its land capabilities, ST Kinetics, a subsidiary of ST Engineering, was developed in Singapore. Production of Bionix Infantry Fighting Vehicles (IFVs) and Terrex Armoured Personnel Carriers (APCs) showed that Singapore was capable of creating innovative native combat vehicles. These products have also found their way to the export market and thus have brought Singapore into the fold of leading defence suppliers.

(b) **Aerospace Industry:** The establishment of the defence aerospace industry and its growth in Singapore was through the collaboration with the aerospace companies and the development of the domestic industry. Another subsidiary of ST Engineering, ST Aerospace was one of the leading firms in aircraft maintenance, repair and overhaul services, as well as modification and upgrade of military aircraft. It also invested in the development of Advanced Jet Trainer (AJT) and Unmanned Aerial Vehicles (UAVs) to enhance its aerospace sector.

(c) **Naval Defence Capabilities:** The shipbuilding industry and the maritime and defence sector in Singapore were greatly enhanced by ST Marine through the construction of the Formidable-class frigates and the Independence-class LMVs. This paper shows that the country has been able to design and build sophisticated naval platforms to support its maritime security.

(d) **Electronics and Cyber-security:** As new threats emerged, especially in electronic warfare and cyber-security, Singapore spent a lot of money on ST Electronics and other technological companies that deal with C4I systems. The country has also improved in the area of cyber-security and AI-based defence systems to achieve technological advantage in the contemporary warfare.

Government Role and Policy Framework.

The government of Singapore has greatly influenced the development of the defence industrial ecosystem. The government provided policy incentives through organizations like the Defence Science and Technology Agency (DSTA) and DTC (Defence Technology Collaboration Office). These institutions helped in research and development, defence procurement, and technological innovation³⁷.

The government also guaranteed the appropriate liaison between the military and defence firms, which allowed the SAF to participate in the development of various products. This cooperation provided a good cycle of feedback that led to the improvement of the quality and appropriateness of the defence equipment developed domestically³⁸. In addition, Singapore engaged in defence diplomacy and formed strategic partnerships with countries in the United States, Israel, and some European countries to share technology, knowledge, and develop military hardware.

Lessons for India's Defence Industrial Ecosystem.

India, with its large defence requirements and aspirations for self-reliance, can derive several key lessons from Singapore's experience: -

³⁷ Singapore Technologies Engineering. (n.d.). *25 years: The CIS story*. Retrieved from <https://www.stengg.com/getmedia/ab38ccfc-7355-4545-b0b0-1376a67f011e/25-years-the-cis-story?ext=.pdf>

³⁸ Hartley, K. & Belin, J. (2020), *The Economics of the Global Defence Industry*, Routledge Taylor and Francis Group, Chp 25, p 534.

- (a) **Strategic Government Intervention and Policy Support:** The Singaporean model underscores the importance of government-led initiatives in building a robust defence industrial base. India should ensure a stable and long-term defence manufacturing policy that provides incentives for domestic companies, simplifies procurement procedures, and facilitates exports.
- (b) **Focus on Indigenous Research and Development:** Singapore's success in developing home-grown platforms highlights the importance of indigenous R&D. India should increase investment in organisations like the Defence Research and Development Organisation (DRDO) and establish collaborative mechanisms between academia, industry, and military establishments.
- (c) **Public-Private Sector Collaboration:** Both public and private sectors in Singapore worked together to create innovation. In order to promote the participation of private sector in India, more PPP should be encouraged, regulations should be eased and private investment in R&D and defence manufacturing should be encouraged.
- (d) **Defence Exports and Global Partnerships:** Singapore has successfully established itself as a producer of high-quality defence systems. India should also try to build its defence exports by forming strategic partnerships, establishing joint ventures, and improving its marketing section to promote Indian defence products in the international market.
- (e) **Integration of Military Feedback into Defence Production:** One of the major reasons for the success of Singapore is the feedback that is gotten from its armed forces to the defence industry. India should ensure that the armed forces are directly involved in the design, development, and procurement of weapons and technologies to meet the needs of the battle field.

(f) **Development of Dual-Use Technologies:** Defence industry is one of the most important sectors of the economy of Singapore and the country has been able to use this industry to develop technologies that can be used in both the military and civilian sectors. India should also encourage the development of dual use technologies in order to reduce the cost of technology development and to induce technological spill-overs to the civilian sectors.

Case Study: South Africa

Introduction

The South African defence industrial ecosystem has gone through a profound change since the mid-20th century. It shifted from a country that depended much on foreign suppliers of defence equipment up to a self-sufficient and international arms manufacturer. The growth of the South African defence industry has been influenced by past security issues, government policies and an emphasis on indigenous innovation.

Early Development and Strategic Foundations.

The history of the establishment of South Africa's defence industry can be linked back to the Second World War when the country played a very important role as a provider of military equipment to the Allies. But the most important change occurred during the 1960s and 1970s as the country was under international isolation because of its apartheid policy. The arms embargo especially by the United Nations in 1977 limited arms supply to South Africa, which in turn was forced to produce its arms. Hence the establishment of Armscor in 1968 to oversee the defence production and procurement of the country (Dunne, Lamb & Nikolaidou, 2020). Armscor was also involved in the coordination of R&D and

manufacturing to ensure that the country's military got the needed equipment despite the sanctions³⁹.

Growth and Expansion of Defence Capabilities.

The defence sector in South Africa began to develop rapidly in the 1980s because the government continued to invest in the development of the country, the innovation in technology and the need for the military. The industry was engaged in the improvement of the advanced capabilities in the areas of land systems, aerospace, naval defence and electronic warfare. One of the major companies in this shift was Denel which was established in 1992 as the successor to Armscor's manufacturing divisions⁴⁰. Denel was then the biggest state-owned defence company in South Africa, which focused on the development of advanced weapons systems, ammunition and aerospace technologies.

(a) **Land Systems Development:** South Africa developed indigenous armoured vehicles to suit the conditions of its regional conflicts. The Rooikat Armoured Reconnaissance Vehicle and the Ratel IFV (Infantry Fighting Vehicle) were some of the products that South Africa developed and which caught the attention of the international community. These vehicles were designed for mobility and adaptability which made them suitable for use in rough terrain.

(b) **Aerospace and Missile Systems:** In this area, the country heavily invested in the development of missile technology; developing the Umkhonto surface-to-air missile and the Ingwe anti-tank guided missile. Also, South Africa developed the

³⁹ Dunne, J. P., & Haines, R. (2019). The development of South Africa's arms industry. PRISM Working Paper 2019-2. Retrieved from https://commerce.uct.ac.za/sites/default/files/_media/documents/commerce_uct_ac_za/869/prism-workingpaper-2019-2-dunne-et-al.pdf. Accessed on 25 Jan 25.

⁴⁰ Hartley, K. & Belin, J. (2020), The Economics of the Global Defence Industry, Routledge Taylor and Francis Group, Chp 26, p 555.

Atlas Cheetah a locally modified Mirage III fighter aircraft which showed the company's capacity in aircraft modification and modernization.

(c) **Naval Defence Capabilities:** Although South Africa does not have a large naval defence sector, it developed the MEKO A-200 frigates in collaboration with German partners. Additionally, the country has expertise in maritime surveillance and coastal defence systems.

(d) **Electronic Warfare and Cyber Defence:** South Africa has made strides in electronic warfare and cyber defence, with companies like Reutech developing advanced radar and surveillance systems. The country's defence industry has also developed sophisticated electronic countermeasure systems used in modern warfare.

Government Role and Policy Framework.

The South African government has played a key role in supporting defence industrial development through policies that prioritise indigenous manufacturing, defence exports, and innovation. The Strategic Defence Package (1999) was a landmark policy aimed at modernising the country's military through procurement deals involving technology transfer agreements. Additionally, South Africa has actively promoted the involvement of private defence firms in manufacturing and R&D, reducing reliance on state-owned enterprises. The government has also encouraged dual-use technologies that benefit both the defence sector and civilian industries⁴¹.

The National Conventional Arms Control Committee (NCACC) is in charge of defence exports, and it ensures that the exports are consistent with the international arms

⁴¹ Le Roux, L. (2024). Reflecting on the rise and decline of the South African defence industry. *Scientia Militaria - South African Journal of Military Studies*, 52(1), 1-20.

control treaties. The country has also used its defence industry as an economic growth strategy, creating employment and foreign exchange through the sales of arms.

Lessons for India's Defence Industrial Ecosystem.

- (a) **Indigenous Defence Manufacturing:** South Africa's ability to develop a strong defence industry despite international sanctions highlights the importance of indigenous manufacturing. India should further invest in self-reliance by strengthening domestic R&D and reducing dependence on foreign suppliers.
- (b) **Public-Private Collaboration:** South Africa successfully integrated private sector participation into defence production. India should continue encouraging public-private partnerships (PPPs) in defence manufacturing, ensuring efficient resource utilisation and technological advancement.
- (c) **Focus on Exports and Global Markets:** South Africa strategically positioned itself as a defence exporter. India should expand its defence exports by identifying potential markets in Africa, Latin America, and Southeast Asia, backed by strong diplomatic and trade policies.
- (d) **Technology Transfer and Joint Ventures:** South Africa leveraged technology transfer agreements to advance its defence sector. India should negotiate technology transfer deals more effectively, ensuring long-term benefits in developing critical defence technologies.
- (e) **Development of Dual-Use Technologies:** South Africa's focus on dual-use technologies has contributed to both military and civilian advancements. India should integrate defence R&D with civilian applications to enhance overall industrial growth.

(f) **Improving Procurement and Governance:** South Africa's experience with procurement inefficiencies underscores the need for transparent and efficient acquisition processes. India should streamline its procurement policies and eliminate bureaucratic hurdles to ensure timely acquisitions and project execution.

4.11 **Conclusion.**

India's journey towards developing a robust and self-reliant defence industrial ecosystem is crucial for enhancing national security, reducing dependency on foreign imports, and positioning itself as a global defence exporter. While initiatives like Make in India and Atmanirbhar Bharat have set the foundation for indigenous defence manufacturing, there is still significant scope for improvement in areas such as research and development, public-private partnerships, and streamlined procurement processes. Lessons from countries like South Korea, South Africa, and Singapore offer valuable insights. South Korea's strategic government intervention, strong offset policies, and integration of private sector innovation highlight the importance of technology-driven defence growth. South Africa's experience in developing indigenous capabilities despite international sanctions underscores the need for self-reliance, technological adaptability, and an export-oriented approach. Singapore's success in leveraging defence R&D, fostering public-private collaboration, and focusing on dual-use technologies demonstrates the role of efficiency and innovation in sustaining a competitive defence sector. By adopting best practices from these nations—such as investing in advanced technologies, promoting local defence start-ups, and enhancing global defence cooperation—India can accelerate its path to becoming a formidable force in the global defence industry while ensuring long-term national security and economic growth.

Chapter 5 - Indigenisation Roadmap of the Indian Navy: An Overview

5.1 Introduction

Indigenisation has been an important part of the Indian Navy's strategic objectives, with the goal of the Navy to become self-reliant and not depend on foreign countries for vital naval systems and platforms. Indian Navy's indigenisation plan that has been developed over the last two decades is a part of India's Aatmanirbhar Bharat campaign and marks the country's ascent as a defence manufacturing power.

The Indian Naval Indigenisation Plan (INIP) 2015-2030 was released, and this was the biggest change in the Indian Navy's approach to indigenisation. This strategic document enumerated the Navy's vision of surgical self-reliance in shipbuilding, propulsion systems and combat technologies over a 15-year period⁴². The INIP 2015 was a result of change in strategic environment, experience of the past conflicts and the government's Make in India initiative. It identified where the Navy could try for self-reliance and set quantitative targets for reducing dependence on foreign suppliers. The plan was broken down into three broad categories which are the foundation of the Navy's operational capabilities: float, move, and fight.

This chapter will examine the indigenisation roadmap of the Indian Navy majorly over the past 20 years and covering the period prior to that in brief. The analysis of Navy's performance has been carried out in the three main categories of naval capability: **Float, Move, and Fight**. The chapter will also assess whether the Navy's successes in one category can be replicated in the others, and provide insights into the challenges and future prospects of indigenisation in the maritime domain.

⁴² Ministry of Defence, Government of India. (2015). Indian Naval Indigenisation Plan (INIP) 2015-2030.

5.2 **Strategic Importance of Indigenisation for the Indian Navy**

India's maritime environment demands a strong navy. With more than 7,500 km of coastline, vital sea lines of communication and strategic interests in the Indian Ocean, the Indian Navy has the mandate to protect national interests at sea. However the Indian Navy, similar to most of the Indian armed forces, was dependent on imported technology and platforms for many years.

The concept of indigenisation in the Indian Navy is not only a strategy to reduce the dependency on foreign vendors but also to enhance the operational efficiency, system resiliency during crisis and to develop a strong domestic defence industrial base. Indigenisation increases the Navy's loco stance to keep and refurbish its platforms at lower costs and in a shorter time. In addition, it is in line with the national economic, technological, and global defensive ambitions.

5.3 **Indigenisation Strategy of Indian Navy**

Indigenisation has been undertaken at three distinct levels of complexity viz. systems, subsystems and spares level⁴³. These are elaborated below: -

- (a) **System Level.** This level includes system as a whole and is primarily based on Naval Staff Qualitative Requirements (NSQR). Due to requirement of ab-initio development and inherent complexity, systems have typically been developed by DRDO till date. However in the recent past, efforts to develop some complex systems through Industry Partners have been successful.
- (b) **Subsystem Level.** At the second level are the subsystems which form part of individual systems. Subsystems are indigenised based on specifications generated by IN. Indigenisation at this level can be undertaken either through a combination

⁴³ Indian Navy. (2024). *Swavalamban 3.0*. Directorate of Indigenisation, Government of India. <https://www.ddpmod.gov.in/sites/default/files/41235140a03694a7eed4d3e2721a5cea70b8520427defe677852c6043e4b75de/8be04e6bdc02d771e69e5eed86f73c2cb6e027e1cd5c2a3b495f925a0b6b1a66.pdf>

of DRDO and industry or by industry alone, depending on the complexity of the technology involved.

(c) **Spares Level.** The third and very important aspect of indigenisation is sustenance of inventory through regular replenishment of spares. These are the low technology, fast moving items which can be indigenised directly by the industry.

5.4 **Agencies Involved in Indigenisation**

Though all directorates of Indian Navy form an inseparable and important part of the indigenisation of equipment/systems/spares, the indigenisation in the IN is coordinated by following three agencies for their respective verticals:-

- (a) Directorate of Indigenisation: Ship systems.
- (b) Directorate of Air Projects and Plans: Aviation systems.
- (c) Directorate of Armament Production and Indigenisation: Armament systems.

5.5 **Categories of Indigenisation**

(a) **Float Category:** The float category deals with the design and construction of naval platforms, such as ships and submarines. It encompasses the structural and platform-related aspects of indigenisation, including the use of indigenous materials and the local production of hulls and superstructures⁴⁴.

(b) **Move Category:** The move category focuses on propulsion systems and machinery, which power the platforms and enable their mobility. This includes the development of engines, gearboxes, and other mechanical systems⁴⁵.

⁴⁴ Indian Navy. (2024). *Swavalamban 3.0*. Directorate of Indigenisation, Government of India. <https://www.ddpmod.gov.in/sites/default/files/41235140a03694a7eed4d3e2721a5cea70b8520427defe677852c6043e4b75de/8be04e6bdc02d771e69e5eed86f73c2cb6e027e1cd5c2a3b495f925a0b6b1a66.pdf>

⁴⁵ Ibid.

(c) **Fight Category:** The fight category is the most critical in terms of combat capabilities. It includes weapon systems, sensors, communication systems, and electronic warfare technologies that equip the platforms for combat operations⁴⁶.

Float Category: Indigenous Warship and Submarine Building

The Indian Navy has achieved notable success in the **Float** category, which has been one of the cornerstones of its indigenisation roadmap. Over the years, the Navy has transitioned from being a predominantly import-dependent force to one that builds majority of its platforms domestically.

5.6 Indigenisation efforts from Independence to the year 2000

When India gained its independence in 1947, it faced the problem of having a naval fleet that was completely dependent on imports and had almost all its ships built abroad, particularly in the United Kingdom. Recognizing the strategic need to achieve shipbuilding self-reliance, the government established key shipyards such as Mazagon Dock Shipbuilders Limited (MDL), Garden Reach Shipbuilders & Engineers (GRSE), and Cochin Shipyard Limited (CSL). At first, these yards concentrated on repair and refurbishment and only began to build warships through licensed production arrangements later. INS Ajay, constructed at GRSE, was the first major ship to be built in India and therefore marked the beginning of India's shipbuilding indigenization efforts. The Nilgiri-class frigates of the 1960s, designed in collaboration with the British, provided Indian engineers with vital practical experience in the construction of modern warships and were the forerunners of indigenous naval shipbuilding.

⁴⁶ Indian Navy. (2024). *Swavalamban 3.0*. Directorate of Indigenisation, Government of India. <https://www.ddpmo.gov.in/sites/default/files/41235140a03694a7eed4d3e2721a5cea70b8520427defe677852c6043e4b75de/8be04e6bdc02d771e69e5eed86f73c2cb6e027e1cd5c2a3b495f925a0b6b1a66.pdf>.

The Directorate of Naval Design (DND) was established in 1964 to enable India to design its own warships and reduce its dependence on foreign designs and, therefore, build warships to suit specific operational requirements. By the 1980s, India had constructed the Godavari-class guided-missile frigates, India's first major warships, which were indigenously designed and constructed. The development of Delhi-class destroyers, which incorporated advanced indigenous technologies, weapons, and sensors, was also carried out in the 1990s. The shipbuilding sector received a boost from increased government investment. The Indian Navy also began working with Indian universities and research centers to develop new materials and design methodologies, strengthening its technical base.

5.7 The Leap Forward: 2000s and Beyond

The early 2000s was a significant revolution in the shipbuilding industry in India. The construction of the Shivalik-class stealth frigates was a reference in itself as these ships possessed indigenous stealth, sophisticated combat systems and improved radar. The Kolkata-class destroyers are the best example of indigenous naval shipbuilding capability with their advanced weapons and automation.

During this period, India also launched ambitious submarine projects. The construction of the Kalvari-class (Scorpène-class) submarines as part of Project-75 was completed in collaboration with France which helped India to develop expertise in building new generation submarines. On the other hand, the launch of INS Arihant, India's first indigenous nuclear-powered ballistic missile submarine (SSBN) showed that the country is capable of constructing strategic deterrent platforms.

The Indian Navy also paid attention to the development of smaller but powerful warships like Kamorta-class anti-submarine warfare corvettes and Offshore Patrol Vessels (OPVs). These vessels with a higher level of Indian participation especially from the private sector like Larsen & Toubro (L&T) enabled the country to enhance the indigenization of

the floating assets. The emphasis on using Indian-made materials, combat management systems and weaponry also reduced the Navy's dependence on foreign suppliers.

5.8 **Breakthrough with Indigenous Aircraft Carrier Development**

One of India's biggest achievements in naval shipbuilding came with the development of indigenous aircraft carriers. The construction of INS Vikrant, which was commissioned in 2022, was a major milestone in India's maritime self-reliance. The aircraft carrier was built by Cochin Shipyard Limited (CSL) and the propulsion, aviation facilities and combat systems were obtained from domestic as well as international partners. It proved that India is capable of designing and building warships of great complexity and thus enabled the country to join the club of aircraft carrier designers and builders.

The success of INS Vikrant has enabled the beginning of Indigenous Aircraft Carrier-2 (IAC-2) which will have some new features including electromagnetic aircraft launch systems (EMALS) and more sophisticated sensor and radar systems.

5.9 **The Role of Private Sector and MSMEs in Indigenisation**

In addition to government-run shipyards, private shipbuilding firms like Larsen & Toubro (L&T) have played an increasing role in India's defence manufacturing. L&T has contributed to submarine construction and played a key role in building nuclear submarine components. The participation of small and medium enterprises (MSMEs) in supplying components and sub-systems has further strengthened the indigenous shipbuilding ecosystem.

5.10 **Hull and Material Indigenisation**

The other most important achievement in the float category is the domestication of the hulls and materials. Currently, more than 90 percent of the materials used in the

construction of warship hulls are produced in India. SAIL produces high grade steel for warships and submarines and hence reduces the Navy's dependency on imported material.

The success of the float category has been attributed to the Navy's efforts in the indigenous design, the development of public sector shipbuilding industry and the partnership with private firms. However, the achievement has been rather inadequate in other areas for example the propulsion systems and combat technologies—areas that are more complex and sophisticated.

Move Category: The Challenge of Propulsion System Indigenisation

5.11 Indigenization of Propulsion Systems in the Indian Navy

The Indian Navy's journey toward self-reliance in propulsion systems—engines, gearboxes, shafts, and auxiliary power systems—has evolved over the decades. Initially, India depended entirely on foreign suppliers, but sustained efforts have led to the development of indigenous capabilities in several key propulsion technologies. The progress of indigenization in the "Move" category of naval systems can be divided into distinct phases based on technological advancements and policy shifts.

5.12 Indigenisation efforts from Independence to the year 2000

At the time of Indian independence in 1947 India had no capability to design and develop propulsion systems for warships or submarines and therefore depended on imported steam turbines, boilers and diesel engines. Ships like Leander class frigates and INS Vikrant were powered by British steam turbine propulsion systems, while patrol boats and auxiliary vessels were powered by imported diesel engines. India did not have an industrial base to construct simple or complex marine propulsion systems and as there was no Naval Propulsion R&D centre all the technologies had to be imported. But the seed of

indigenization was laid with the establishment of Mazagon Dock Shipbuilders Limited (MDL), Garden Reach Shipbuilders & Engineers (GRSE) and Bharat Heavy Electricals Limited (BHEL). By 1960s and 1970s India started shifting towards Soviet Union which provided propulsion systems like GTZA-674 steam turbines and M-15 gas turbines for large ships and Zvezda diesel engines for patrol craft. Despite assembling and repairing these systems locally and transferring technology to HAL and BHEL, the company did not have the technological capability to create marine gearboxes, transmission systems and submarine propulsion systems and thus had to buy them from foreign firms.

The indigenization of naval propulsion system started from India's path towards self-reliance in 1980s and 1990s. When Godavari class frigates were commissioned, India was able to monitor and service Soviet M-15 gas turbines and thus decrease the dependency on foreign suppliers. As a result of the work done by BHEL and Elecon Engineering, both companies developed marine gearboxes which are very vital in the warship propulsion system. India also developed its shafting system thus increasing its level of participation in the naval propulsion sector. Nevertheless, overall, Indian industry was not able to develop full indigenous propulsion systems, including gas turbines. The KMGT project, which was established by GTRE to design a marine gas turbine, had several problems and delays and the turbine was not ready for commercial use. In the submarine segment, India bought Type 209 submarines from German HDW which used MTU diesel engines that only sustained the country's dependence on imported propulsion systems. Attempts were also made to design APUs for the submarines but complete indigenous propulsion for marine platforms remained an elusive goal.

5.13 **2000–2015: Breakthrough in Indigenous Propulsion Components**

The early 2000s were characterized by the rapid indigenization of naval propulsion components. The Kaveri Marine Gas Turbine (KMGT) was tested successfully, but due to

performance shortfalls, it was not inducted into service. India kept on utilising Ukrainian Zorya-Mashproekt gas turbines for major warships like Delhi-class destroyers and Talwar-class frigates.

Even though, there were difficulties in the development of gas turbines, India has made great progress in marine gearboxes and shafting systems. BHEL and Elecon Engineering indigenized marine reduction gearboxes which have been used successfully in several warships. The development of Integrated Electric Propulsion (IEP) systems for future warships was also initiated during this period. A major milestone was the DRDO Air Independent Propulsion (AIP) system project, which was aimed to improve the submarine's underwater endurance. In conventional submarines, India has continued to employ MTU diesel engines in the Scorpene-class submarines (Project 75) but has developed its own support systems like cooling mechanisms and fuel monitoring units.

5.14 **2015–Present: Advancing Towards Full Propulsion Indigenization**

As early as 2015 India has begun the process of indigenization of propulsion technology in line with the Atmanirbhar Bharat initiative. The KMGT has been restarted for possible future use and an effort is made to construct a marine gas turbine that is all indigenous for large warships. The development of the DRDO AIP system has been a major achievement and this system has been tested successfully and is proposed to be fitted into the future submarines of Project 75-I . This technology will help reduce to a large extent India's dependence on imported submarine propulsion systems.

Indigenous Electric Propulsion technology is also being developed for future naval platforms. The UK and India have signed a statement of intent to design and develop an Integrated Full Electric Propulsion (IFEP) system for India's next-generation Landing Platform Dock (LPD) fleet . These will be important for the future warships and submarines, including the next generation of destroyers and aircraft carriers. Despite the achievements

in gearboxes, shafting and AIP systems, there is still a task to create a fully indigenous marine gas turbine. India continues to use Ukrainian Zorya turbines for its destroyers and frigates and the development of an indigenous equivalent is under consideration. The absence of an indigenous nuclear reactor for SSBNs (ballistic missile submarines) beyond the Arihant-class submarines is still a technological hurdle.

5.15 **Current Status of Naval Propulsion Systems**

India's naval propulsion has developed from being completely imported to having a high level of domestic production of gearboxes, shafting, and auxiliary power systems. Attempts are made on electric propulsion and a completely Indian gas turbine, but nuclear propulsion and high-performance marine engines are still a problem. Nevertheless, India is gradually shifting from the use of foreign-made propulsion systems including Zorya turbines and MTU engines. However, the Navy still uses foreign-made propulsion systems, especially for high-tech vessels like destroyers, frigates and submarines. Gas turbines and diesel engines for these platforms are provided by global suppliers like General Electric (GE) and Rolls Royce. For instance, India's first indigenous aircraft carrier INS Vikrant is equipped with four General Electric M2500 gas turbines and the Project 15B Visakhapatnam-class destroyers are also fitted with imported propulsion systems⁴⁷. This is because propulsion technology is still an area of technological complexity that India cannot yet address on its own in the design and manufacturing of high performance engines.

⁴⁷ GE Aerospace, (2022), GE's LM2500 Engines to Power India's First Indigenous Aircraft Carrier, <https://www.geaerospace.com/news/press-releases/marine-industrial-engines/ges-lm2500-engines-power-indias-first-indigenous-aircraft>. Accessed on 10 Dec 24.

Fight Category : Armament, Weapons and Sensors

At independence, India's defence-industrial production was mainly coming from the existing Ordnance Factories. Indian Navy in the early 80s embarked on indigenisation of fast moving components. Of late, Naval Armament stores are being indigenised through ab-initio design and reverse engineering using in-house expertise.

5.16 Categorisation of Naval Armament Stores.

Naval Armament stores can broadly be categorised into the following⁴⁸:-

- (a) Ammunition
 - (i) Gun Ammunition
 - (ii) Small Arm Ammunition
 - (iii) Pyrotechnics stores.
 - (iv) Demolition Charges
 - (v) Power Cartridges
 - (vi) Bombs & Mortars
 - (vii) Special Arms and Ammunition for MARCOS.
 - (viii) Countermeasures
- (b) Missile Systems
 - (i) Missiles (Air-to-Air, Air to Surface, Surface to Air, Surface to Surface and Shoulder launched).
- (c) Underwater Systems
 - (i) Torpedoes
 - (ii) Mines

⁴⁸ Indian Navy. (2024). *Swavalamban 3.0*. Directorate of Indigenisation, Government of India, Chp 7, p 37.

- (iii) Depth Charges
- (iv) Underwater Rockets
- (d) Ordnance
 - (i) Guns.
 - (ii) Rocket Launchers & Torpedo Tubes
 - (iii) Chaff Launchers

Indigenisation of ship borne weapons/ armament is very challenging and complex in nature. The indigenisation efforts of IN in the field of Armament Technology is spearheaded by DGNAI.

5.17 **Ammunition**

The Indian Navy has been steadily advancing in the indigenization of small arms ammunition, naval shells, fuzes, cartridge cases, and pyrotechnic stores to reduce reliance on foreign suppliers and enhance self-sufficiency in critical defence logistics. Traditionally, the Navy imported a significant portion of its medium and large-caliber naval gun ammunition, pyrotechnic cartridges, and specialized fuzes, but with the Make in India initiative, domestic production has received a major boost. Organizations such as Munitions India Limited (MIL), Ordnance Factory Board (OFB), Bharat Dynamics Limited (BDL), and the Defence Research and Development Organisation (DRDO) have played a crucial role in developing high-explosive shells, electronic and mechanical fuzes, and advanced pyrotechnic stores tailored for naval applications.

Significant progress has been made in the production of propellant-based ammunition and cartridge cases used in naval artillery and close-in weapon systems (CIWS). Indian manufacturers now produce naval gun shells of various calibers, such as 76mm and 30mm rounds, along with pyrotechnic cartridges used in ejection seats, signalling devices, and countermeasure systems. The development of indigenous percussion and

proximity fuzes has strengthened India's ability to sustain prolonged maritime operations without dependency on imported components. With ongoing research in smart fuzes, improved ignition systems, and long-lasting propellants, the Indian Navy is moving towards complete self-reliance in naval ammunition and associated pyrotechnics, ensuring enhanced operational preparedness and national security resilience.

5.18 **Underwater Systems**

Underwater systems mainly consist of torpedoes, decoys, rockets and underwater mines. Over the years there has been considerable amount of indigenisation in terms of primary and secondary batteries of torpedoes, torpedo launchers and ASW rockets launchers, explosive filling of depth charges etc.

Presently, IN holds a large number of torpedoes imported from western origin countries and of eastern origin. There is a huge opportunity for the private industries to contribute in indigenous development of the following sub-systems of torpedoes. IN has indigenised underwater rockets, Depth charges, limpet mines, Processor based ground mines, which are primarily used for combat role against submerged submarines and incoming torpedoes.

Other underwater NA stores like anti torpedo countermeasure system are being imported. Indigenous development / licensed production of anti-torpedo countermeasures will enable import substitution and also provide prompt and reliable product support for the Navy.

5.19 **Ordnance/ Gun Systems**

The ordnance/ gun systems held in the IN inventory are predominantly of eastern origin, inducted and procured from Original Equipment Manufacturers (OEMs). The Private industry has partnered with the IN in indigenisation of sub-assemblies of these vital gun systems. A large number of firms have been associated with the development of various gun

systems and sub-systems for IN. Successful development of these systems has given Navy enough confidence in the Indian Industry and displayed that such complex technologies can be evolved with concerted participation of the various lead stakeholders. There has been requirement of fast moving consumables of gun systems in the past and the requirement is envisaged to grow significantly in the upcoming years with the induction of a large number of ships.

5.20 **Missile Systems**

The missile systems held in the IN inventory and those which are being inducted are procured from Original Equipment Manufacturers (OEMs) or Indian DPSUs. The requirement of missile systems is envisaged to grow significantly in the upcoming years with the induction of a large number of ships, submarines and aircrafts.

The missile technology is ever changing and platforms would need to be equipped with state-of-art missiles with better capabilities at all times. IN has achieved success in indigenisation of various missile explosives viz. booster powder charges and ignitors, sustainer powder charges and ignitors, various pyros and missile batteries. Though the other missile components are being catered through the OEM, there exists a greater need to indigenise fast moving missile consumables.

5.21 **Electrical/ Electronic Systems**

The electrical/ electronic systems in NA stores play a very important role be it within the NA store or the test equipment being used. Most of the electrical/ electronic systems held in the IN inventory are predominantly procured from Original Equipment Manufacturers (OEMs). The electrical/ electronic systems primarily include:-

- (a) Test Equipment for Missile and Torpedo Preparation.
- (b) Simulators.
- (c) PCBs of Various Missiles Sections and Torpedoes.

Optimum self-reliance in these systems is of vital importance for both strategic and economic reasons. There is a requirement to enhance the participation of Private industry in indigenisation of various electronic/ electrical sub-assemblies of NA stores.

5.22 **Journey of Indigenisation.**

India's journey toward self-reliance in naval technology has been a long and evolving process. Over the decades, the Indian Navy has transitioned from complete dependence on foreign suppliers to the development of indigenous weapons, sensors, and armaments. This transformation can be divided into different phases based on technological advancements and policy changes.

5.23 **1947–1960s: Initial Dependence and Limited Indigenous Capabilities**

At the time of independence, the Indian Navy relied entirely on British and Western suppliers for weapons and sensors. The primary focus during this period was on acquiring and maintaining a basic naval force, with no indigenous production of armaments. The Navy's primary weaponry consisted of imported guns, torpedoes, and depth charges, while radars and sonar systems were sourced from the UK. The establishment of Naval Science and Technological Laboratory (NSTL) and Naval Physical & Oceanographic Laboratory (NPOL) under DRDO in the late 1950s laid the foundation for future research into indigenous sonar and weapons systems. However, during this period, there were no significant indigenous developments in missiles, torpedoes, radars, or electronic warfare (EW) systems. India's naval combat capabilities remained dependent on Western imports, with no domestic defence industry to support advanced naval armaments.

5.24 **1960s–1980: Indigenous Sonar Development and Soviet Dependence on Weapons**

The 1960s and 1970s saw a significant change in Indian naval strategy with the country shifting to weapons and sensors from the Soviet Union. P-15 anti-ship missiles, torpedoes and depth charges, all made by the Soviets, greatly improved India's naval might. The 1971 Indo-Pak war, for instance, revealed the effectiveness of missile boats and thus the inevitability of guided missile technology.

Thus, for the first time, India has attempted to design and develop its own sonar. The APSOH(Advanced Panoramic Sonar Hull Mounted) was developed by NPOL and it was fitted in Indian warships for the first time thus making the country a sonar power. However, all the radars, electronic warfare systems and the missiles were imported. Though the country made some progress in sonar development, the Navy still relied on Soviet weapons like AK-230, RBU-6000 anti-submarine rocket launchers and CET-65E torpedoes. There was no indigenous radar and Electronic Warfare (EW) systems and the absence of missile development programs meant that India had no indigenous strike capabilities to boast of.

Despite this progress in sonar development, the Navy remained dependent on Soviet weapons such as AK- 230, RBU-6000 anti-submarine rocket launchers, and CET- 65E torpedoes. Indigenous radar and Electronic Warfare(EW) systems were still absent, and the lack of missile development programs meant that India had no notable indigenous strike capabilities

5.25 **1980–2000: Breakthroughs in Sonar, Torpedoes, and Early Missile Development.**

India's attempts in creating indigenous sonar and torpedo systems underwent a sea change in the 1980s and 1990s, thereby enhancing the Navy's anti-submarine warfare

(ASW) capacity. Indian defence experts made major advancements in sonar technology during this time, which resulted in the HUMVAD sonar system and then the more sophisticated USHUS sonar suite, meant especially for Indian submarines. The HUMSANG sonar system greatly improved the Navy's capacity to identify and monitor subsurface threats, hence lessening reliance on foreign sonar technology on the front of surface warship development. These developments were very vital in arming Indian ships with native ASW capability and therefore increasing their strategic freedom in marine defence.

With the introduction of the Varunastra heavyweight torpedo project, torpedo development also witnessed a significant breakthrough. But the project ran beyond schedule, forcing its completion further into the future. In missile technology, India's Integrated Guided Missile Development Program (IGMDP) produced Dhanush, a naval derivative of the Prithvi ballistic missile, the first indigenous naval strike missile. Though developed from a land-based system, Dhanush was a significant first towards naval missile technology's self-sufficiency. A significant turning point also occurred in the late 1990s with the introduction of the Indo-Russian BrahMos supersonic cruise missile project in 1998, which would go on to become among India's most successful indigenous missile projects.

With the Ellora EW suite, meant to improve radar jamming and countermeasure capabilities aboard warships, India also advanced electronic warfare (EW). Due to the lack of an indigenous alternative, the Indian Navy kept depending on foreign air defence weapons, including the Russian Shtil and Kashmir surface-to-air missiles (SAMs) as well as Israeli Barak-1 SAMs, notwithstanding these successes. Although during this period sonars, torpedoes, and missile technology made great strides, air defence and long-range strike systems still lacked, therefore ongoing reliance on foreign suppliers is necessary but the developments during these two decades set the stage for next innovations in Indian naval defence technology.

5.26 **2000–2015: Indigenization of Missiles, Torpedoes, and Electronic Warfare Systems.**

The early 2000s saw rapid advancements in indigenous weapons, sensors, and armaments. Successful induction of the BrahMos supersonic cruise missile into the Navy gave frontline vessels high-speed, long-range anti-ship and land-attack capacity. Completed and put into use as the first entirely domestic torpedo for submarines and warships, the Varunastra heavyweight torpedo was also inducted. The Mareech torpedo decoy system, which gave warships soft-kill countermeasures against approaching torpedoes was also developed and put to rigorous testing by Indian Navy. Additionally, to increase submarine detection over long distances, Advanced Towed Array Sonar (ATAS) was also developed.

India inducted the Shakti EW suite and the Revathi 3D observation radar to provide warships enhanced situational awareness, jamming, and countermeasure capability in radar and electronic warfare. Developed in partnership with Israel, the Barak-8 Medium-Range Surface-to-Air Missile (MR-SAM) was successfully tested and induction was started in stages. Notwithstanding these achievements, problems with advanced missile technologies and submarine weapons persisted. India still used Russian 53-65KE torpedoes, and hypersonic missile development was still in its early years.

5.27 **2015–Present: Full-Scale Indigenization in Weapons, Sensors, and Missiles.**

Since 2015, India has aggressively pursued self-reliance in naval weaponry under the Atmanirbhar Bharat (Self-Reliant India) initiative. Successfully tested in 2022, the Naval Anti-Song Missile (NASM-SR) is the first entirely home-grown anti-ship missile for naval aircraft. Additionally unveiled was the BrahMos-ER (Extended Range) variant, which boasts a range exceeding 450km. Designed for long-range anti-submarine warfare, the SMART (Supersonic Missile Assisted Release of Torpedo) system is under development and should revolutionise ASW operations. The adoption of Advanced Towed Array Sonars

(ATAS) on frontline destroyers and frigates has improved the Navy's sonar capabilities even more. To offer extra submarine detection powers, the LFVDS (Low-Frequency Variable Depth Sonar) is currently under development. Uttam AESA radar is being modified for naval use in the radar domain; the Shakti EW suite has been fitted on several vessels to enhance electronic warfare capacity. By including NavIC (Indian GPS) into its navy navigation systems, India has also reduced its reliance on outside satellite-based location.

5.28 **Issues still Persisting**

Despite all the efforts, we have been able to achieve only about 50% indigenisation in the 'Fight Category'. Indigenization of weapons and sensors in the Indian Navy faces several challenges, leading to slower-than-expected advancements. One of the primary issues is the long development cycle of complex defence technologies, exacerbated by bureaucratic delays, stringent procurement procedures, and frequent changes in operational requirements. The lack of a robust defence-industrial ecosystem has historically made India dependent on foreign collaborations for critical technologies like active radar seekers, propulsion systems, and advanced materials, limiting full-scale indigenous production. Additionally, insufficient private sector participation and low R&D funding compared to global defence leaders hinder rapid innovation. The absence of a dedicated domestic supply chain for high-end electronic warfare (EW) systems, sonar transducers, and missile guidance technologies forces India to import key components, reducing self-sufficiency. Furthermore, delays in testing and evaluation due to a limited number of naval test platforms often slow down the induction of new technologies. While government initiatives like Atmanirbhar Bharat and increased funding for DRDO and private defence firms aim to address these issues, overcoming legacy dependencies and accelerating the transition to a fully indigenous naval arsenal remains a formidable challenge. Challenges

remain in the development of hypersonic cruise missiles (BrahMos-II) and indigenous submarine-launched ballistic missile (SLBM) technology.

5.29 **Indigenisation Envisaged.**

The list of equipment for which either spare parts/ components are required or the store itself needs to be taken up for indigenisation as brought out by Indian Navy in their document Swawlamban 3.0 are listed below : -

- (a) Homing Heads of Torpedoes of Eastern and Western Origin Countries.
- (b) Warheads and Exploders.
- (c) Exercise Heads and its Components.
- (d) Rubber Floats and Recovery Aids of Torpedoes.
- (e) Elastomers used as Sealants in Propulsion Systems and Propellers.
- (f) Anti Torpedo Countermeasures.
- (g) Barrels and Liners for Various Guns.
- (h) Proximity Cut-off Devices for Gun Systems.
- (i) Bore Gauges for Checking Condition of Barrels.
- (j) Various Elastomers for Gun Systems.
- (k) Mechanical Components such as Springs, Levers and Screws of Various Gun Systems.
- (l) Hydraulic Buffers and Recuperators of Various Gun Systems.
- (m) Proximity fuze for 30 mm and 76mm ammunition.
- (n) Steel cartridge case for 76mm ammunition.
- (o) MOC dispersal mechanism.
- (p) Homing Heads of Missiles.
- (q) Warheads, Rocket Motors and Exploders.

- (r) Airframes, Control Surfaces and Actuators of Missiles.
- (s) Sealants.
- (t) Enamels and Paints.
- (u) Various Elastomers and Rubber Components.
- (v) Weapon Health Monitoring System.
- (w) Muzzle Velocity and Discharge Pressure Measuring Device
- (x) Torpedo Simulators.
- (y) Invertors, Converters and Frequency Stabilisers for Torpedoes.
- (z) PCBs of Various Missiles and Torpedoes.
- (aa) Motors, Actuators, Power Amplifiers and Sensors of Torpedoes and Missiles.
- (bb) Portable and Ship Borne Presetters.

5.30 **Replicating Success Across Categories: Lessons Learned**

India's achievements in shipbuilding ("Float") offer valuable lessons for accelerating indigenization in weapons and sensors ("Fight"), where foreign dependence remains high. Key takeaways include:-

- (a) **Strong Domestic Ecosystem & Supply Chains** – Success in hull construction, marine gearboxes, and shafting was driven by a well-developed domestic supply chain. The "Fight" category must replicate this by strengthening local industries for missile propulsion, seekers, guidance systems, and naval gun components.
- (b) **Sustained R&D and Long-Term Vision** – Indigenous gearbox and AIP were made possible through decades of dedicated R&D. Similar long-term

investment in advanced sensors, hypersonic weapons, AI-enabled warfare, and electronic warfare (EW) systems is crucial.

(c) **Technology Absorption & Indigenous Adaptation** – The Move category leveraged foreign collaborations (Soviet, German, Ukrainian tech) to develop local expertise. A structured "license production to innovation" pipeline must be adopted for complex weapons like radars, torpedoes, and naval SAMs.

(d) **Private Sector Integration & MSME Participation** – Private firms like L&T and Bharat Forge played a key role in hull construction. The "Fight" category should promote private sector involvement in seeker technologies, RF components, and smart munitions, reducing dependence on global OEMs like MBDA, Raytheon, and Thales.

(e) **Dedicated Testing & Certification Infrastructure** – The lack of testing facilities for indigenous naval weapons causes long delays. Just as AIP systems and marine gearboxes were tested through dedicated naval test platforms, a similar approach is needed for missiles, torpedoes, and sonar systems to accelerate trials and induction.

(f) **Standardization & Modular Design** – The Float and Move categories benefited from standardized propulsion and hull components, allowing for easier integration across ship classes. A similar modular approach in the "Fight" category—common missile launchers, plug-and-play radars, and AI-driven combat systems—will enhance flexibility and cost efficiency.

(g) **Export-Oriented Mindset** – India's shipbuilding **success** has led to warship exports. The indigenous "Fight" sector must be export-driven, ensuring global competitiveness in missiles, torpedoes, naval guns, and EW suites to sustain production and innovation.

(h) **Strategic Policy Push & Industry Incentives** – Government-backed programs like Atmanirbhar Bharat and iDEX (Innovations for Defence Excellence) helped shipbuilding and propulsion. A similar policy-driven push is needed for smart munitions, stealth technology, and naval cyber warfare systems to attract investments and innovation.

By leveraging these lessons, India can fast-track indigenization in naval weapons and sensors, reducing foreign dependency and achieving a fully self-reliant combat capability.

5.31 **Conclusion: The Way Forward for Indian Naval Indigenisation**

India's journey toward naval indigenization has been a progressive yet challenging endeavour, marked by significant achievements in the Float and Move categories, while the Fight category still lags in self-reliance. The success in shipbuilding and propulsion systems demonstrates that with sustained R&D, strong domestic supply chains, and strategic collaborations, India can develop world-class defence capabilities. However, the indigenous development of advanced naval weapons, sensors, and combat systems remains crucial for achieving true maritime self-sufficiency. By leveraging the lessons from past successes—strengthening private sector participation, establishing dedicated testing infrastructure, ensuring material self-reliance, and fostering an export-driven mind-set—India can accelerate its progress in naval warfare technology. A holistic, long-term vision, backed by strong policy support, will be key to ensuring that the Indian Navy transitions from being a technology importer to a global leader in indigenous maritime defence capabilities.

Chapter 6 - Qualitative Requirements for Indigenous Production:

Facilitator or Hindrance

6.1 Introduction

The formulation of Qualitative Requirements (QRs) by the Indian Navy plays a pivotal role in shaping the capabilities of indigenous defence production. These requirements establish the technical, performance, and operational benchmarks for naval platforms, weapons, and systems, ensuring they align with the Navy's strategic and tactical needs. By defining precise specifications, QRs serve as a guiding framework for domestic defence manufacturers, driving them towards the development of high-quality, mission-ready equipment. In theory, well-structured QRs should act as an enabler, fostering technological advancements and reducing reliance on foreign imports.

However, in practice, the complexity, rigidity, and over-specification of some QRs may create significant hurdles for indigenous industries. Many requirements are modelled on imported systems with advanced technological maturity, making it difficult for domestic firms to meet them within the given timeframes and resources. Furthermore, the lack of flexibility in QR formulation often prevents an incremental approach, where systems could be developed in phases with continuous improvements. This has led to delays, cost overruns, and dependence on foreign components, undermining the very objective of self-reliance.

The argument about QRs mostly revolves on whether they support or impede indigenous defence manufacture. Although they guarantee quality assurance and standardisation, their strict character and limited industry consultation may create obstacles rather than possibilities for home producers. The success of India's defence indigenisation initiatives is strongly impacted by the manner QRs are organised and carried out. Realistic, industry-friendly QRs that support innovation while yet being pragmatic and feasible for Indian military companies are increasingly needed in order to find a compromise.

6.2 **The Role of Qualitative Requirements in Defence Procurement**

A basic framework guiding the operational, technological, and logistical expectations from defensive systems is provided by qualitative requirements. They are supposed to guarantee that each new tool satisfies high criteria of dependability, performance, interoperability, and lifetime. The Indian Navy creates QRs to guarantee flawless integration with its current fleet and meet changing maritime security issues.

A well-defined QR can drive innovation, encourage technological advancements, and enable indigenous manufacturers to develop cutting-edge defence solutions. However, excessively rigid and ambitious QRs can create hurdles for local industry players, particularly small and medium enterprises, by setting unrealistic expectations that are difficult to meet within the current technological and industrial ecosystem of India.

6.3 **Understanding Qualitative Requirements (QRs)**

Qualitative Requirements are the technical and operational parameters that a defence product must meet before being accepted for service. They include specifications for: -

- (a) **Performance:** Speed, endurance, detection range, lethality, etc.
- (b) **Technology:** Compliance with the latest military-grade electronics, materials, and systems.
- (c) **Interoperability:** Compatibility with existing naval platforms and future upgrades.
- (d) **Maintainability and Logistics:** Ease of maintenance, repair, and integration into existing naval infrastructure.
- (e) **Survivability and Redundancy:** Ability to withstand battle conditions and continue operations.

6.4 **QRs as a Facilitator of Indigenous Production**

Some of the advantages that are result of structured formulation of QRs and facilitate indigenous defence production:-

- (a) **Clear Definition of Requirements.** QRs provide a well-documented framework that helps Indian defence manufacturers understand the exact operational needs of the Navy. This clarity ensures that indigenous firms align their R&D and production to meet military-grade specifications.
- (b) **Driving Technological Advancement.** By setting high standards, QRs push domestic industries to innovate, invest in R&D, and adopt cutting-edge technologies. The Navy's emphasis on stealth, electronic warfare, and AI-driven **systems** has encouraged Indian companies to develop indigenous solutions.
- (c) **Standardization and Quality Assurance.** Well-defined QRs ensure that indigenously produced weapons and sensors meet the same standards as foreign imports. This prevents substandard production and ensures the Indian Navy operates with high-quality, battle-ready equipment.
- (d) **Atmanirbhar Bharat and Self-Reliance.** With structured QRs, domestic manufacturers are given a roadmap for long-term development, leading to **reduced** reliance on foreign defence suppliers. Successful projects like the BrahMos missile, DRDO-developed sonars, and Air Independent Propulsion (AIP) have demonstrated the positive impact of well-structured QRs.

6.5 **QRs as a Hindrance to Indigenous Production**

While QRs serve as essential benchmarks, their over-complexity and rigidity can often act as barriers to indigenous defence manufacturing. The key challenges include: -

- (a) **Over-Specification and Unrealistic Benchmarks.** In many cases, QRs are modelled on imported systems, setting unrealistic expectations for domestic

firms that lack equivalent technological maturity. Over-stringent specifications lead to delays, cost overruns, and failed indigenous development programs.

(b) **Lack of Flexibility and Incremental Development.** Unlike global defence industries that follow an evolutionary approach, Indian QRs often demand a fully developed, high-performance system from the start. A phased development approach—allowing for iterative improvements—could lead to faster indigenous capability-building.

(c) **Limited Industry Consultation in QR Formulation.** Private industry and MSMEs often have limited input in defining QRs, resulting in impractical or technologically infeasible requirements. Involving industry players early in the QR process could align expectations with real-world manufacturing capabilities.

(d) **Certification and Testing Bottlenecks.** Even when an indigenous system meets QR specifications, prolonged testing and certification cycles delay deployment. Lack of dedicated naval testing facilities further hinders rapid induction of home-grown solutions.

(e) **Import Dependency for Critical Technologies.** Some QR parameters require high-end propulsion, sensor, and electronic warfare technologies that Indian industries are yet to master. This forces developers to import key subsystems, negating the very objective of self-reliance.

6.6 **Industry and R&D Feedback Mechanism: The QR Survey**

To address these challenges, a comprehensive survey has been developed to collect structured response from defence manufacturers and R&D institutions on the formulation and implementation of QRs. The survey questionnaire is placed at Appendix B. This survey aims to: -

- (a) Identify areas where QR specifications are unrealistic or misaligned with current technological capabilities.
- (b) Assess how effectively QRs facilitate or hinder indigenous defence production.
- (c) Gather recommendations on how QRs can be made more industry-friendly while maintaining operational effectiveness.

6.7 **Results of the Survey**

The Indian defence sector is undergoing significant reforms to enhance self-reliance, improve private-sector participation, and strengthen the domestic manufacturing ecosystem. Government initiatives such as the *Defence Acquisition Procedure (DAP) 2020*, *iDEX*, and *Defence Industrial Corridors* aim to create a more efficient procurement system, encourage R&D investment, and boost exports. However, industry stakeholders have raised various concerns regarding the effectiveness, implementation, and impact of these initiatives.

This study presents a detailed analysis of industry responses on these initiatives, covering key observations, findings, and recommendations. The survey targeted companies engaged in the Indian defence sector, including large defence firms, MSMEs, start-ups, and R&D establishments. A total of 138 responses were received from across different sectors, including aerospace, land systems, naval technologies, and defence electronics.

6.8 **Key Observations**

6.8.1 **Clarity and Definition of QRs**

Based on the survey responses, it has been found that majority of the industry finds the QRs made by Indian Navy to be moderately clear to completely clear. As depicted in Fig 6.1 there are around 73 % of the respondents who have graded the QRs in this category while there are around 27% who have found issues in the clarity of QRs

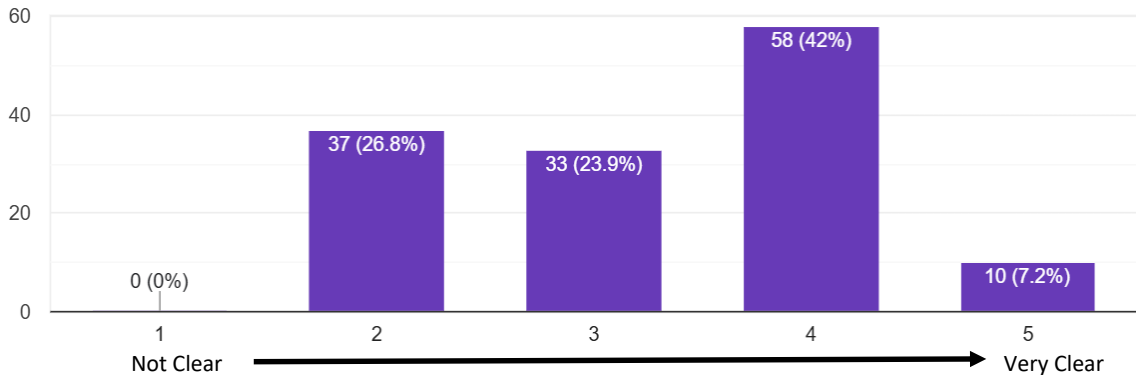


Fig 6.1: Distribution of QR clarity ratings

6.8.2 Industry Consultation Before QR Finalization

Industry consultation before finalizing QRs was rated inadequate by around 54% of respondents as shown in Fig 6.2, with many organizations highlighting a lack of engagement in the early stages of QR formulation. This limited participation often results in unrealistic expectations. Meanwhile, 28% of respondents acknowledged some level of consultation but felt that it could be improved significantly.

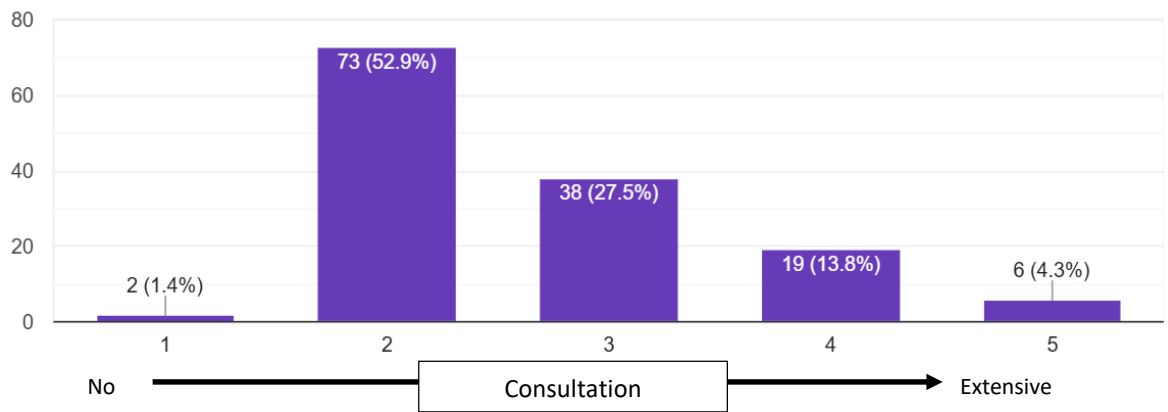


Fig 6.2: Level of Industry Consultation

6.8.3 Alignment with Global Standards

Fig 6.3 indicates that around 74% of the production and R&D industry felt that QRs developed by Indian Navy were somewhat aligned to global standards. There were concerns by around 24% that certain aspects impose unrealistic performance expectations derived from foreign technologies.

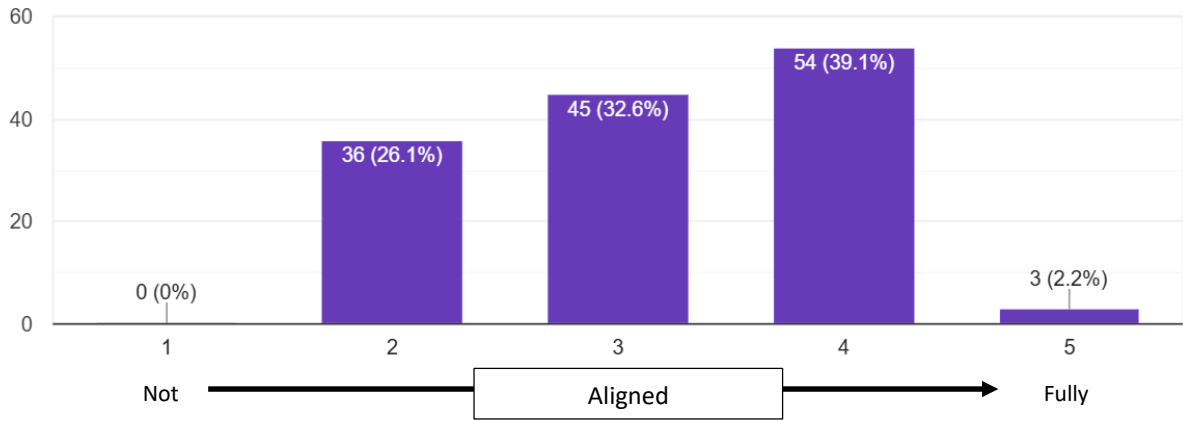


Fig 6.3: Alignment with Global Standards

6.8.4 Feasibility of QRs for Indian R&D and Manufacturing to meet within Timelines

As per Fig 6.4, nearly 61% of respondents found the QRs challenging to meet within given timelines, citing unrealistic performance expectations and strict technical specifications. On the other hand, 39% believed that, while difficult, the requirements were achievable with incremental improvements and phased development. Many organizations suggested adopting a spiral approach for gradual implementation of QRs to enhance feasibility.

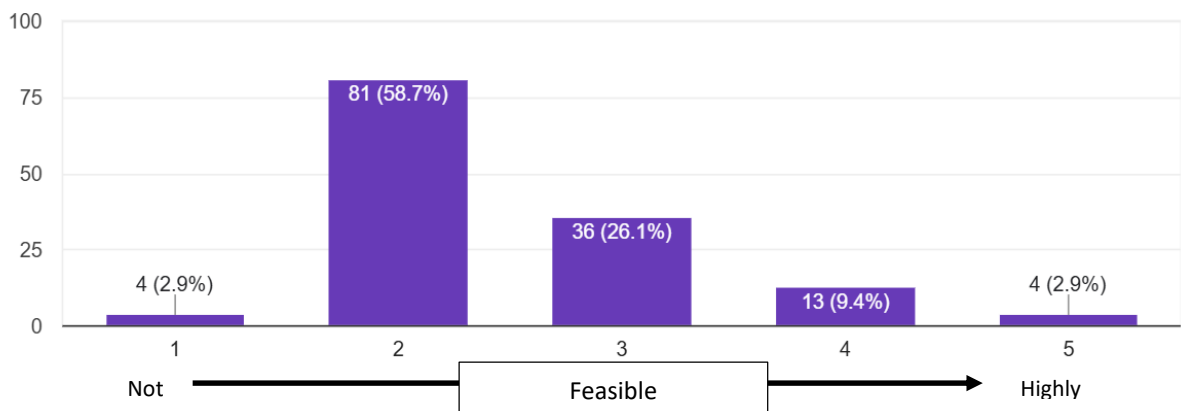


Fig 6.4: Feasibility of Industry to complete QRs within Timelines

6.8.5 QRs as Facilitators or Hindrances

Based on the responses significant number felt that QRs act as a hindrance rather than a facilitator. As per the Fig 6.5, the number of responses finding them as a hindrance where as high as 60%. In contrast, 40% considered them facilitators, believing they provide a clear roadmap for defence product development. The disparity in responses indicates that while QRs set a high standard, their rigid nature may prevent innovation and adaptability.

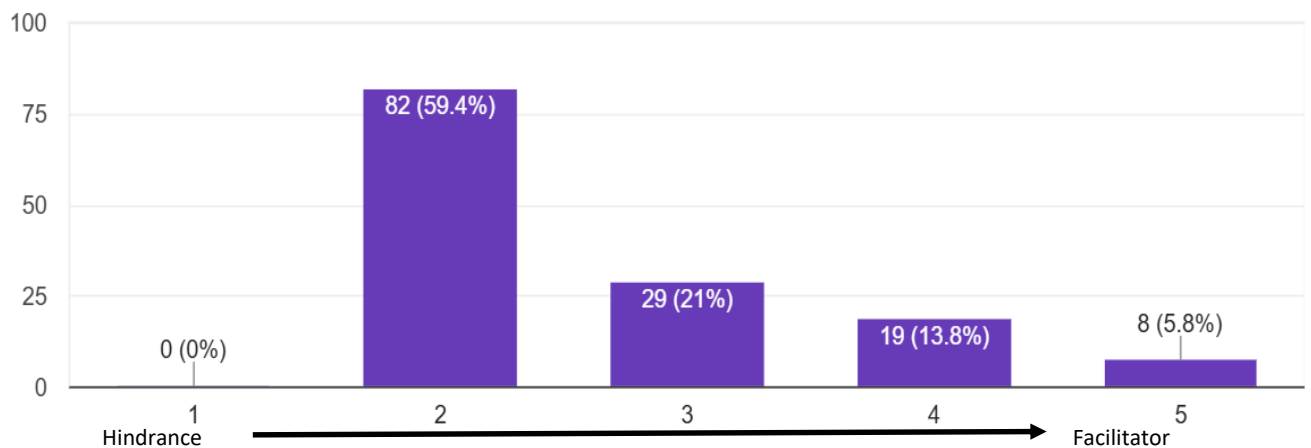


Fig 6.5: QRs being found as Facilitator/ Hindrance

6.8.6 Support for Indigenous Technology Development & Encouragement for Innovation

As regards to the support for indigenous Technology development & encouragement for innovation, majority of responses has indicated that QRs do not encourage innovation nor support indigenous production. As per Fig 6.6, more than 56 % responses from the industry found that the QRs did not encourage innovation. Majority of the industry felt that QRs impose excessive design constraints that limit creative solutions. To bridge this gap, several suggestions included shifting towards performance-based QRs rather than technology-specific mandates. Fig 6.7 indicates that around 67% respondents felt that QRs were not supportive towards indigenous development. Many industry representatives

emphasized the need for a centralized certification agency for naval systems to streamline approvals and encourage local innovation.

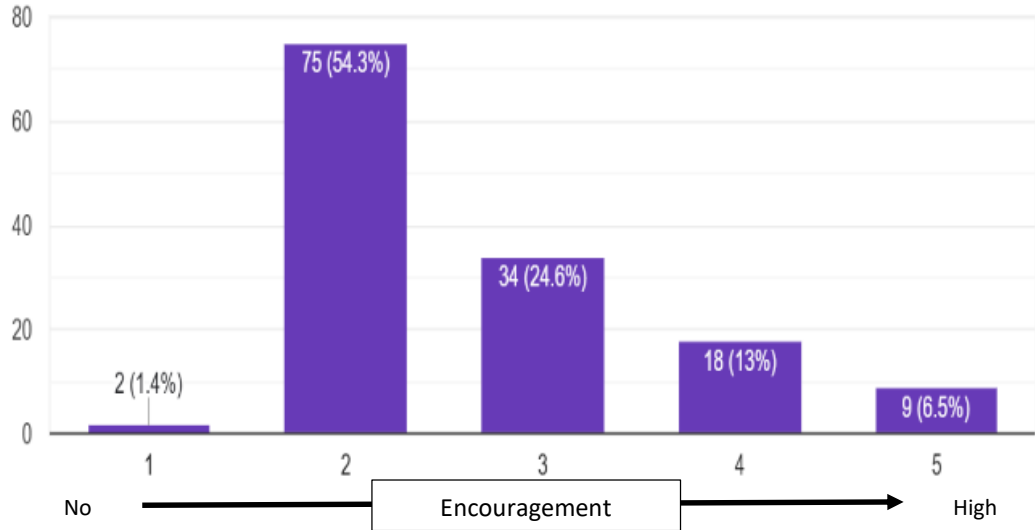


Fig 6.6 : QRs Encouragement for Innovation

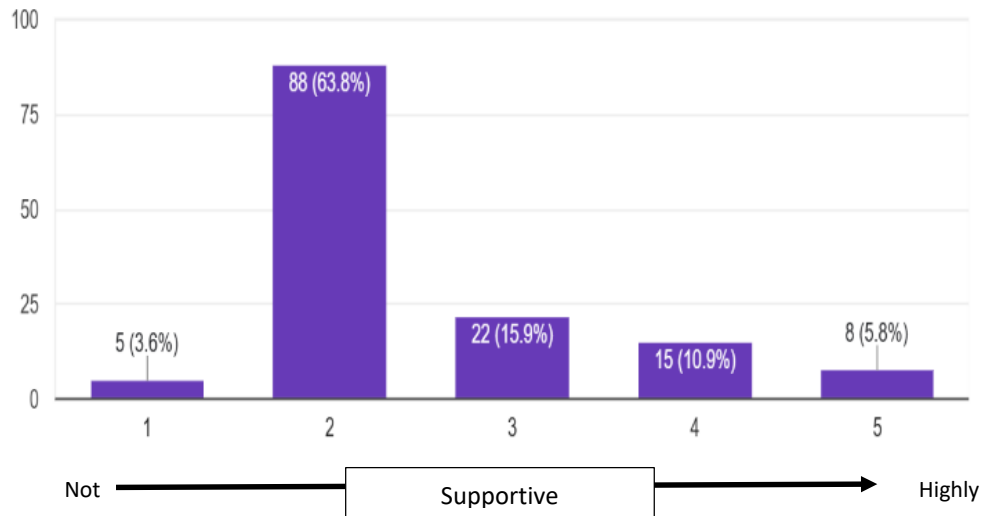


Fig 6.7: QRs Support for Indigenous Technology Development

6.8.7 QR Modification Based on Feedback

Modifications to QRs based on industry feedback are infrequent, according to responses received. As depicted in Fig 6.8, approximately 50% of respondents feel that QRs are rarely modified, while 30% felt that only sometimes the change happens based on the industry feedback. Accordingly, many organizations have emphasized the need for a

structured review mechanism to dynamically incorporate industry feedback and technological advancements into QR revisions.

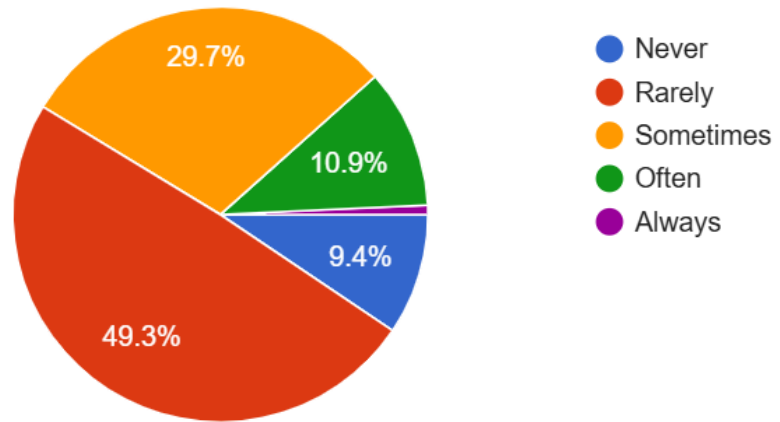


Fig 6.8 : Modification of QRs based on Industry/ R&D Feedback

6.8.8 Accessibility for Start-ups and MSMEs

As depicted in Fig 6.9, over 65% of start-ups and MSMEs found the current QRs restrictive due to high entry barriers, citing stringent technical requirements and procurement policies that favour larger firms. Meanwhile, only 18% felt that, QRs encouraged the participation of MSMEs and Start-ups in the defence sector.

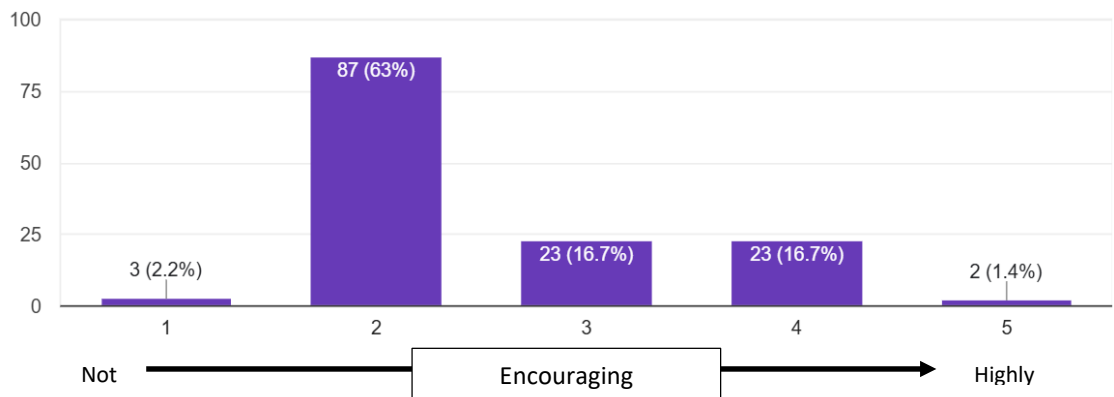


Fig 6.9: QRs Support for Start-ups & MSMEs

6.8.9 Challenges in Meeting Qualitative Requirements by Industry/ R&D

The challenges in meeting the Indian Navy’s Qualitative Requirements (QRs), as indicated by the survey responses, highlight several key constraints faced by the domestic defence industry. As depicted in the Fig 6.9, following can be concluded: -

(a) The most significant challenge, cited by 65.2% of respondents, is the lack of clarity in defining performance parameters, which creates ambiguity and hinders efficient product development.

(b) Additionally, 58.7% of respondents pointed to incompatibility with existing industrial capabilities, indicating that the current defence ecosystem may not be fully equipped to meet stringent specifications.

(c) The lack of consultation with industry before finalizing QRs (56.5%) further exacerbates the issue, as manufacturers struggle to align their production capabilities with the Navy's expectations.

(d) Overly stringent technical specifications (52.9%) and unrealistic timelines for product development (44.9%) also contribute to the difficulty in achieving seamless indigenisation, as they impose high technological and temporal demands that domestic firms may find challenging to fulfil.

Together, these factors underscore the need for a more collaborative and adaptive approach to QR formulation, ensuring that indigenisation efforts align with realistic industry capabilities and development timelines.

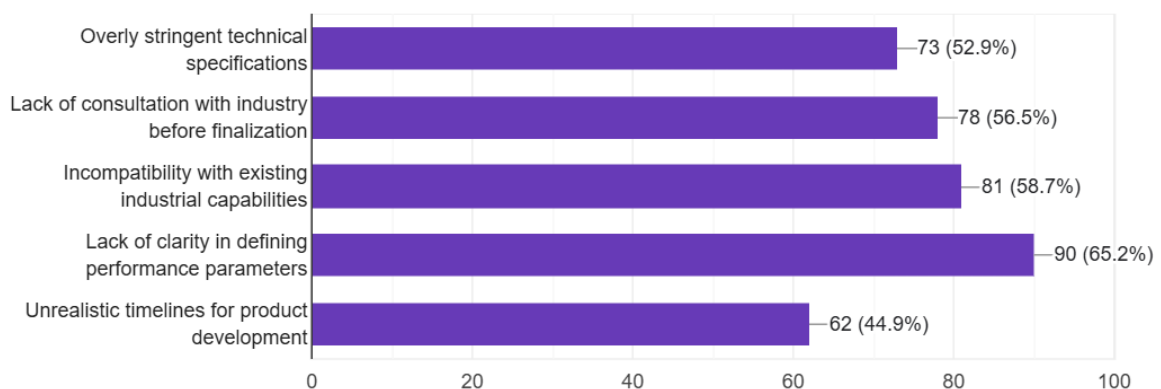


Fig 6.10: Challenges in meeting QRs by the Industry

6.9 **Areas of QR Formulation needing Improvement as per Survey**

6.9.1 **Enhanced Industry Collaboration**

- (a) 99% of respondents supported the establishment of a dedicated industry advisory panel to facilitate broader participation in QR formulation.
- (b) Regular consultations with private firms, MSMEs, and DPSUs before finalizing QRs were advocated by 83% of respondents.

6.9.2 **Realistic and Flexible QRs**

- (a) Phased implementation of QRs with incremental performance upgrades was recommended by more than 50% of respondents.
- (b) 60% suggested that consideration of existing indigenous capabilities should be prioritized before setting performance benchmarks.

6.9.3 **Transparency and Standardization**

- (a) 94% of respondents emphasized the need for a standardized framework for QR formulation to maintain consistency and transparency.
- (b) Ensuring clear documentation and accessible guidelines for all stakeholders was suggested by many respondents.

6.9.4 **Support for Indigenous R&D**

- (a) 64% of respondents advocated prioritizing technology developed within India to reduce dependency on foreign solutions.
- (b) Establishing a centralized certification agency for naval systems was suggested by many respondents to streamline approvals and regulatory compliance.

6.9.5 **Addressing Procurement Delays**

- (a) 71% of respondents identified the need to address bottlenecks arising from unclear or unrealistic QRs.

- (b) Implementing a periodic review system to dynamically adjust QRs based on industry progress was supported by majority of respondents.

6.10 **Additional Recommendations by Industry**

(a) **Continuous Stakeholder Collaboration**

(i) **Engage Industry Post-RFI and before QR Finalization.**

Presently, the industry is involved only after the QRs are finalised. This results in the variance between expectations of the user and the industry capability. Involving private industry, DPSUs, and MSMEs immediately after the Request for Information (RFI) stage and before finalizing QRs would aid in aligning the technical feasibility with user expectations, reducing later revisions.

(ii) **Frequent Interaction and Real-Time Feedback**

At present, there is no fixed mechanism for having a feedback from industry and others involved. Establish regular forums ie. once every quarter, workshops, and review sessions to gather feedback from industry, academia, and R&D organizations. Continuous engagement allows rapid course corrections and faster implementation.

(iii) **Leverage Expertise from DRDO, Veterans, and Academia**

QRs are formulated more often than not by the concerned Directorates of the Indian Navy only by consultation of data available in open source or based on the weapons available with developed countries. Rather than formulating QRs within closed doors, we have to encourage open, unbiased consultation with DRDO scientists, retired military personnel, and academic experts for well-rounded insights. This approach taps into diverse experiences while avoiding insular decision-making.

(iv) **Transparent Liaison Mechanisms.** The major issue of the industry is that frequent change of concerned officials with whom the industry interact. In addition, there is hardly a one point contact for a particular project. To remove this hurdle, qualified representatives or liaison officers needs to be appointed to ensure clear communication between the Navy and industry. Once a particular vendor is identified, fair opportunity need to be provided to develop or supply the required item.

(b) **Clear, Realistic, and Flexible QRs**

(i) **Set High but Achievable Standards.** While QRs should be ambitious to drive innovation, they must be grounded in current or near-future technological realities. Overly stringent specifications can stall projects and discourage industry participation.

(ii) **Adopt a Flexible, Phased Approach.** Allow for QR refinement during initial development stages to accommodate emerging technologies or unforeseen challenges. Once designs mature, more stringent requirements can be enforced to ensure performance.

(iii) **Focus on Measurable and Operationally Relevant Parameters.** Formulate QRs around clear metrics tied to real-world scenarios and operational needs. Avoid creating “utopian” specifications that lack practical application or burden industry with unrealistic targets.

(iv) **Simplify and Standardize.** Whenever possible, move from highly detailed technical specifications to broader, function-focused guidelines. Standardized QR templates across projects reduce confusion and streamline evaluation.

(v) **Periodic Review and Revision.** Establish a structured mechanism for regularly updating QRs based on technological advances, feedback from trials, and lessons learned from ongoing or completed projects.

(c) **System-Level and Spiral Development Approach**

(i) **Pre-Project Definition and Modelling.** Mandate a system-level analysis phase before finalizing QRs, including modelling, simulations, and risk assessments. This step clarifies trade-offs, feasibility, and potential technology gaps.

(ii) **Spiral or Incremental Upgrades.** Rather than shifting goalposts mid-development, use a phased or spiral approach to progressively enhance capabilities. This allows industry to build on a stable foundation while integrating new technologies over time.

(iii) **Prioritization and Categorization of Requirements.** Classify requirements based on availability (readily available, partially developed, or long-term R&D). This ensures immediate needs are met while planning for future capabilities.

(iv) **Emphasize CONOPS Alignment.** Align QRs with a clear Concept of Operations (CONOPS), detailing how the Navy intends to deploy and operate the equipment. This ensures the final product meets actual operational demands.

(v) **Trade-Off and Cost-Benefit Analysis.** Incorporate objective trade-off analyses in QR formulation. Balancing performance, cost, and feasibility prevents over-specification and keeps primary functionalities in focus.

(vi) **Maintain a Vendor Capability Database.** Track and update a repository of industry capabilities, technology readiness levels, and past performance. This data helps tailor QRs to realistic industrial capacities.

(d) **Institutional and Structural Measures**

(i) **Centralized Tri-Service Indigenization Cell.** Presently, each service is carrying out its indigenisation drives separately without major consultation with each other. Creation of a dedicated cell (independent of existing departmental silos) under Head Quarter Integrated Defence Staff (HQIDS) would aid in synchronisation of indigenization efforts across the Navy, Army, and Air Force. This will reduce duplication of effort and leverage common technologies.

(ii) **Dedicated QR Formulation Team.** Establish a permanent team with longer tenures, responsible for drafting, reviewing, and revising QRs. This will reduce most of the issues faced by the industry. In addition, the problems faced/ experience gained during one project can be aptly applied to subsequent projects which at present remains with Directorate/ officer dealing with the project and is hardly documented or passed down to others. A stable core of experts prevents rushed decisions driven by short-term deadlines.

(iii) **Standardized Templates and Governance.** Develop uniform QR templates and guidelines applicable to all defence projects. This consistency aids transparency, reduces administrative overhead, and helps industry navigate requirements more efficiently.

(e) **Supporting Domestic Production and MSMEs**

(i) **Encourage MSME Participation.** Stabilize quality norms and avoid frequent specification changes that deter smaller players. Provide clear, consistent standards and consider offering incentives for first-time entrants to the defence market.

(ii) **Rationalize Cost Evaluation.** Move beyond a purely lowest-cost Technically Acceptable (L1) model. Factor in the complexities of manufacturing processes, material lead times, and innovation potential, especially for smaller industries.

(iii) **Foster Long-Term Partnerships.** Promote multi-year procurement plans and repeat orders when feasible. Such stability encourages industries—particularly MSMEs—to invest in infrastructure, talent, and technology upgrades

6.11 **Conclusion**

The analysis of industry and R&D responses highlights critical gaps in the Indian Navy's QR formulation process. By fostering collaboration, ensuring flexibility, and adopting performance-based QRs, the defence ecosystem can enhance indigenous research, development, and manufacturing capabilities. Implementing these recommendations can lead to more efficient procurement, streamlined development timelines, and increased participation from private and public sector stakeholders.

Chapter 7: Analyses and Findings

7.1 Introduction

The journey towards an indigenous and self-reliant Defence Industrial Ecosystem in India has been shaped by a combination of government policies, strategic initiatives, and industry participation. The preceding chapters have provided an in-depth examination of the various dimensions influencing this ecosystem, from policy frameworks and global best practices to the Indian Navy's indigenisation roadmap. A key focus of the study has been to assess the progress made, identify existing challenges, and evaluate the extent to which current structures facilitate or hinder the faster indigenisation of critical defence requirements. This chapter consolidates the key findings drawn from the study, providing an analytical perspective on the state of India's defence industrial base, with a particular emphasis on the Fight category requirements of the Indian Navy.

7.2 Government Initiatives for establishing a Robust Defence Industrial Ecosystem.

The chapter analysed the various government initiatives to establish a robust defence industrial ecosystem, focusing on self-reliance and domestic manufacturing. Promulgation of DAP 20, Positive Indigenisation lists, establishment of DICs, iDEX and DPEPP are some of the steps in the right direction. However, based on the survey response from the industry partners, certain gaps are there in the present structure which are brought out in succeeding paragraphs.

7.2.1 Shortfalls in DAP 20.

While a lot of progress and improvements have been made in DAP 20 which have benefited the industry and the services, there still is scope for further improvements which

have been confirmed based on the responses of the survey elucidated in Chapter 3. Some of the suggestions of the industry have been elaborated below which would aid in improving the DAP further.

(a) **Long Procurement Timelines.** The presence of the multi-layered approval process in defence acquisitions tend to cause delays. In addition, consecutive reviews and long-running tests slow down the decision-making. Proposals go through multiple committees (e.g., Services Headquarters, Defence Procurement Board and Defence Acquisition Council) before final approval⁴⁹. Technical and user trials always happen in sequence, causing delays to the procurement process. Even the financial vetting is done separately by multiple agencies at different stages.

(b) **Compliance of Offset Policy.** India's offset policy mandates foreign defence companies to invest a percentage (typically 30-50%) of the contract value into Indian industries. However, this has not resulted in meaningful technology transfer. Foreign firms have often either defaulted on offset obligations or fulfilled offset obligations by investing in low-impact areas like IT services, training, or setting up assembly lines rather than sharing critical technology⁵⁰.

(c) **Implementation of Strategic Partnership Model.** The goal of SPM was to speed up domestic production, reduce reliance on imports, and enhance self-reliance in critical military platforms like fighter jets, submarines, helicopters, and armoured vehicles. Despite being in place for several years, the implementation of

⁴⁹ Kumar, B. (2025), Defence buying timelines to be 'significantly' cut by June: Defence Secy, Business Standard, 01 Mar 25, https://www.business-standard.com/external-affairs-defence-security/news/defence-procurement-timelines-to-be-significantly-shortened-by-early-june-125022801075_1.html. Accessed on 21 Mar 25.

⁵⁰ Raghuvanshi, V. (2022), Indian government clashes with foreign defence sector over offset demands, Defense News, <https://www.defensenews.com/industry/2022/04/21/indian-government-clashes-with-foreign-defense-sector-over-offset-demands/>. Accessed on 10 Jan 25.

the Strategic Partnership Model (SPM) has been extremely slow due to delays in selecting and approving Indian strategic and OEM partners, complex multi-agency approval processes, and unclear evaluation criteria that lead to repeated re-evaluations and postponements. For eg. Project 75I was envisioned to be executed under SPM to build six next-generation diesel-electric submarines in India with foreign collaboration. The project was approved in 2007 and post implementation of SPM in 2017, contract is still to be signed as there has been delays in selecting the foreign OEM⁵¹.

7.2.2 Effectiveness of Export Promotion Strategy – Falling Short of Expectations

The government's export promotion strategy for defence firms has been able to increase the defence exports to a large extent. There has been a rise of 32.5% in the growth of exports in the FY 23 -24 as compared to the FY 22-23⁵², which is the step in the right direction. However, the progress needs to continue and increase further if we are achieve the target of Rs 35,000 crores by 2025 and Rs 50,000 crores by 2029 (indicated by Govt. of India as target). Despite India's increasing focus on defence exports, challenges such as slow export clearances and lack of international marketing initiatives continue to hinder firms from competing in global markets. For eg. HAL's export deals of ALH to Philippines and Malaysia required clearances from multiple government agencies, including the Ministry of Defence (MoD), Directorate General of Civil Aviation (DGCA), and Defence Acquisition Council (DAC). However, delays in HAL's approvals and concerns over past

⁵¹ Vignesh, R. & Singh, A.K. (2025), The P-75I Saga and India's Submarine-Building Journey, Manohar Parriker Institute of Defence Studies and Analyses, Issue Brief, 12 Mar, <https://www.idsa.in/publisher/issuebrief/the-p-75i-saga-and-indias-submarine-building-journey/> . Accessed on 14 Mar 25.

⁵² Kumar, S. , Meena, S. & Kalia, S. (2025), Atmanirbhar Bharat in Defence, Press Information Bureau, Govt. of India, 01 Feb 25. https://static.pib.gov.in/WriteReadData/specificdocs/documents_/2025/feb_/doc_202521493301_.pdf. Accessed on 02 Mar 25.

safety records led both the countries to explore Western alternatives like the Airbus H145M and Sikorsky S-70 Black Hawk instead.

7.2.3 R&D as a Career – Government Failing to Make It Lucrative.

India has immense potential to become a global leader in research and innovation, with institutions like ISRO and DRDO making significant contributions. The government has taken steps to promote R&D through initiatives like Atal Innovation Mission and increased defence indigenization efforts. However, R&D as a career remains unattractive due to low salaries, lack of long-term career opportunities, and funding constraints. Researchers face funding shortages and slow career growth, pushing many toward private firms or foreign opportunities⁵³. ISRO engineers earn far less than their NASA counterparts, and DRDO scientists struggle with prolonged project cycles.

7.2.4 No Direct Engagement of Defence MSMEs and Start-ups with Armed Forces.

The idea of a direct engagement with armed forces with MSMEs and start-ups was put forward by majority of responses received from these two institutions. Presently there are options like iDEX and Srijan portal where one can see the requirements of armed forces, but there is no platform where these institutions directly interact with the armed forces to understand their requirements and showcase their products/ technologies developed⁵⁴.

7.2.5 Inadequacy of India's Defence R&D Spending.

The responses to the survey results highlight a strong consensus that India's current defence R&D spending is insufficient. With R&D spending at just 0.65% of GDP compared

⁵³ Kamble, K. (2025), Why India's R&D Dreams Are Falling Behind: Funding Aside, Here's A Look Inside The System, Swarajya.

⁵⁴ Gupte, K. (2023), Effectiveness of Latest Government Initiatives to strengthen Defence Industry Ecosystem, Centre for Joint Warfare Studies.

to 3.5% in the US and around 5% in Israel, India risks further brain drain⁵⁵. To retain talent, the government must boost funding, streamline approvals, and offer better incentives.

7.3 **Defence Industrial Ecosystem in India and Globally**

Post analysing the Government initiatives in place, we analysed the Defence Industrial ecosystem in India and select Global countries to formulate lessons for India in Chapter 4. While government initiatives like Make in India and Atmanirbhar Bharat have provided a strong foundation for domestic defence manufacturing, there are several areas that require urgent attention and improvement. Globally, several countries have successfully developed self-sufficient and technologically advanced defence industries, offering valuable lessons for India.

South Korea's defence industrial model stands out due to strong government intervention, strategic offset policies, and the effective integration of private sector innovation. The government plays a pivotal role in funding and directing defence R&D, supporting private defence manufacturers, and ensuring that domestic industries have the capability to meet the armed forces' needs. This proactive approach has allowed South Korea to transition from an importer to a major arms exporter, with companies like Hanwha Defence and Korea Aerospace Industries becoming key global players.

Similarly, South Africa's defence industry, despite facing international sanctions in the past, successfully built indigenous defence capabilities through technological adaptability, self-reliance, and an export-oriented approach. The country focused on developing dual-use technologies, fostering strong state-owned defence enterprises, and ensuring that domestic production remained competitive globally. This underscores the

⁵⁵ Economic Times. (2024, February 5). *India's R&D investment lags behind global peers, private sector involvement low: Economic Survey*. The Economic Times. <https://economictimes.indiatimes.com/news/science/indias-rd-investment-lags-behind-global-peers-private-sector-involvement-low-economic-survey/articleshow/111927926.cms>. Accessed on 10 Dec 24.

importance of self-reliance in defence production and the need for India to develop its indigenous capabilities without over-reliance on foreign suppliers.

Singapore's defence ecosystem is another example of how high-end research and development, strong public-private collaboration, and a focus on dual-use technologies can drive the growth of the sector. Singapore has successfully leveraged its research institutions, partnered with global defence firms, and built a highly efficient and technologically advanced military-industrial complex. The emphasis on dual-use technologies, which can be utilized for both civilian and military applications, has enhanced cost-effectiveness and sustainability.

To accelerate its transformation into a global defence manufacturing hub, India must adopt best practices from these nations while addressing its domestic challenges.

7.4 **Indigenisation Roadmap of India**

The indigenisation roadmap of India for the three categories namely 'Float', 'Move' and 'Fight' were studied and by replicating the success in the 'Float' category to 'Fight' category, certain progress can be achieved.

The successful development of indigenous warships and propulsion technologies highlights the importance of sustained research and development (R&D), a robust domestic supply chain, and strategic partnerships with both public and private players. However, indigenisation in the Fight category—comprising advanced weapons, sensors, and combat systems—remains a major challenge. The inability to fully develop cutting-edge naval combat technologies domestically continues to create dependencies on foreign suppliers, impacting both operational readiness and strategic autonomy. Achieving true maritime self-sufficiency requires India to address these gaps through a focused approach to technology development, testing infrastructure, and industry collaboration. Some of the challenges which have been found in the study for effective indigenisation in the 'Fight' category are:-

(a) **Technological Challenges**

Lack of Critical Subsystems and Components

(i) **Missile Guidance & Propulsion:** Advanced propulsion systems (e.g., ramjet, scramjet for hypersonic missiles) and precision guidance technologies (e.g., active radar homing, infrared homing) are still under development.

(ii) **Underwater Sensors & Processing Algorithms:** Next-gen sonar technology such as low-frequency active/ passive sonar, and real-time target processing are still evolving.

Electronic Warfare (EW) & Cyber-security Limitations

(i) **EW Systems:** Indigenous Electronic Countermeasures (ECM) and Electronic Support Measures (ESM) systems are yet to match the sophistication of global systems like ALQ-99 or Israeli EW suites.

(ii) **Cyber-security:** Indigenous software-driven combat systems require better resilience against cyber threats, ensuring data security in network-centric operations.

Lack of AI-Driven Autonomous Systems & Network-Centric Warfare Issues

(i) AI-driven autonomous torpedoes, loitering munitions, and intelligent target tracking systems are areas where India needs rapid technological advancements.

(ii) **Network-centric warfare (NCW):** Integration of indigenous sensors into a unified combat network with seamless data sharing is still in progress.

(b) **Industrial & Manufacturing Challenges**

Dependence on Foreign Subsystems & Materials

- (i) **Seeker technology (RF, IR, Dual-Mode):** India still imports seekers for missiles, impacting indigenous missile production (e.g., BrahMos).
- (ii) **High-performance processors & semiconductors:** Critical for AESA radars, sonar signal processing, and missile guidance but are not manufactured domestically.

Delays in Developing High-End Naval Sensors

- (i) **Active Electronically Scanned Array (AESA) Radars:** While India has developed some AESA radar systems (e.g., Uttam AESA for aircraft), naval variants need further advancement.
- (ii) **Next-Gen Sonar Systems:** Indigenous hull-mounted and towed-array sonars like NAGAN and HUMSA need better integration with real-time threat assessment algorithms.

Limited Private Sector Involvement in High-Tech Defence Manufacturing

- (i) While the Defence PSUs (DRDO, BEL, BDL, MDL) are leading the development of naval weapons and sensors, private sector participation is still limited.
- (ii) Complex licensing, security clearances, and lack of assured procurement orders discourage private companies from investing in high-end defence technology.

Delays in Testing & Certification

- (i) Stringent trials for naval weapons & sensors in harsh maritime environments take years before approval for operational deployment.

(ii) Testing infrastructure for sonars, radars, missile systems, and underwater weapons is limited in India, causing bottlenecks in indigenous production.

(c) **Operational & Testing Constraints**

Integration with Existing Naval Platforms

- (i) Indigenous sensors and weapons need **seamless compatibility** with existing foreign-made systems on-board Navy warships and submarines.
- (ii) Any integration failure can render a system ineffective, delaying deployment.

Limited Testing & Evaluation Facilities

- (i) Testing high-end missiles, torpedoes, radars, and sonars in real-world naval conditions is challenging due to limited domestic facilities.
- (ii) India needs more dedicated underwater testing ranges for developing torpedoes and sonar systems.

Indigenising weapons and sensors for the Indian Navy is a complex but essential goal to achieve strategic autonomy. Overcoming these technological, industrial and policy challenges requires strong government support, private sector involvement, and advanced R&D investments. Faster development and integration of indigenous naval weapons and sensors will reduce dependence on foreign suppliers and enhance India's maritime defence capabilities in the long run.

7.5 **Qualitative Requirements for Indigenous Production**

In Chapter 6, the Qualitative requirements of Indian Navy were studied from various sources and challenges faced by industry was understood through a survey questionnaire. The evaluation of industry and R&D feedback reveals certain shortcomings in the Indian

Navy's QR formulation process, which hinder the efficiency and effectiveness of indigenous defence development. A lack of clear communication between stakeholders, rigid QR frameworks, and insufficient flexibility in accommodating technological advancements has led to delays in procurement and underutilization of domestic innovation potential. Addressing these issues requires a collaborative approach that brings together the Indian Navy, research institutions, DPSUs, private industry, and policymakers to create a more dynamic, adaptable, and performance-driven QR process.

A well-structured and industry-friendly QR framework will enable faster product realization, improve cost efficiency, and strengthen India's self-reliance in defence technology. Ultimately, a transparent, flexible, and innovation-driven approach to QR formulation will position India as a leader in indigenous defence capabilities, ensuring long-term strategic autonomy and enhancing the operational readiness of the Indian Navy.

7.6 **Conclusion**

One of the major insights emerging from the study is the dichotomy between policy intent and execution. While the Indian government has undertaken significant reforms to promote indigenous defence manufacturing—such as the introduction of the Strategic Partnership Model, Defence Production and Export Promotion Policy (DPEPP), and various defence procurement initiatives—there remains a gap in translating these efforts into tangible outcomes. The defence industry in India continues to grapple with regulatory hurdles, technological limitations, and supply chain inefficiencies. The study of global best practices has highlighted that countries with mature defence ecosystems have successfully integrated robust public-private partnerships, strong research and development (R&D) investments, and well-defined long-term procurement strategies. In contrast, India's ecosystem still faces fragmentation, where the private sector struggles with access to critical technologies, and domestic defence production is often reliant on foreign collaborations.

Furthermore, the assessment of the Indian Navy's indigenisation roadmap has underscored both successes and areas of concern. Over the past two decades, the Navy has been at the forefront of driving indigenisation, achieving notable milestones in the float and move categories. However, progress in the fight category—which encompasses advanced weapon systems, sensors, and combat technologies—has been relatively slow. A crucial factor influencing this disparity is the formulation of Qualitative Requirements (QRs). While QRs are designed to ensure that indigenous products meet operational standards, they sometimes impose rigid specifications that make it difficult for domestic industry to comply, especially in the absence of prior technological expertise. This creates a paradox where the need for high-performance indigenous solutions conflicts with the industry's current capacity to develop them.

Chapter 8 : Recommendations & Conclusion

The preceding chapters have provided an in-depth examination of India's Defence Industrial Ecosystem, its evolution, and the various initiatives undertaken by the government to promote self-reliance in defence manufacturing. The study has explored the Indian Navy's indigenisation journey, analysing its roadmap over the past two decades and assessing the effectiveness of policies and frameworks that have shaped its progress. A comparative study of global defence ecosystems has further provided insights into best practices that can be adapted to the Indian context. Additionally, the research has critically examined the formulation of Qualitative Requirements (QRs) by the Indian Navy and their impact on indigenous production, evaluating whether they act as enablers or constraints in achieving self-sufficiency.

The analysis of findings and observations underscores both achievements and challenges in accelerating indigenisation, particularly in the complex and technologically intensive 'fight' category of defence equipment. While policy interventions and government-led initiatives have laid a strong foundation for growth, certain structural and procedural bottlenecks continue to hinder progress. Issues such as dependency on foreign technology, delays in procurement and approvals, constraints in Research & Development (R&D), and the formulation of stringent qualitative benchmarks have emerged as critical areas requiring attention. The comparative assessment of global defence industrial ecosystems offers valuable lessons on fostering innovation, strengthening private sector participation, and streamlining regulatory processes to create a more agile and responsive defence manufacturing base.

This chapter synthesizes the key insights derived from the study and presents a set of well-structured recommendations aimed at strengthening the Defence Industrial

Ecosystem in India which would in turn aid in accelerating the indigenisation in the ‘Fight’ category for Indian Navy. These recommendations focus on optimizing policy frameworks, enhancing industry-government collaboration, refining qualitative requirements to balance operational needs with indigenous capabilities, and leveraging international best practices to accelerate self-reliance.

8.1 **Recommendations**

(a) **Government Support for MSMEs and Start-ups.**

(i) **Timely Evaluation and Backing** – The government should evaluate defence technologies developed by MSMEs and start-ups within a set timeframe. If the technology meets requirements, the government must provide financial backing, orders, or reimburse R&D expenses to ensure sustained innovation.

(ii) **Creating a Defence MSME and Start Ups Portal.** Along with supporting thousands of MSMEs and start-ups, it is urgently necessary to establish direct contact between these MSMEs and start-ups and the military. It is now necessary to gather information on the products that MSME and Start-Up companies are launching, developing, or still planning to develop and make it accessible to the military through a web portal called “Defence MSME and Start-up Portal” (DMSP) with all fast track processes to support the same.

(b) **Training and Talent Development**

(i) **Specialized Skill Development** – The government must invest in creating talent pools for niche defence technologies such as AI, cyber warfare, and advanced electronics to build a skilled workforce.

- (ii) **Training & Skilling for Next-Gen Technologies** – Dedicated institutes for emerging defence technologies (e.g., sonar, missile guidance, electronic warfare, AI-driven combat systems) should be established, with active collaboration between DRDO, the Navy, and leading universities.
 - (iii) **Joint Training Programs with Global Partners** – Collaborate with friendly foreign nations to up skill Indian scientists and engineers in cutting-edge naval technology.
- (c) **Reverse Auction Concerns**
- (i) **Negative Impact on Indigenous Manufacturing** – The L1 (lowest bid) system in reverse auctions discourages high-quality and innovative defence products, as cost becomes the primary selection criterion.
 - (ii) **Need for a Balanced Approach** – The government must implement a system where quality, innovation, and indigenous content are considered alongside cost, rather than prioritizing the lowest price.
- (d) **Synergy among Stakeholders**
- (i) **Lack of Coordination** – The Aatmanirbhar Bharat initiative needs better collaboration between government agencies, private industries, and defence stakeholders to effectively implement self-reliance in defence.
 - (ii) **Veterans' Expertise** – Retired defence personnel should be actively involved in formulating problem statements, guiding R&D, and supporting manufacturing and quality assurance (QA) processes.
 - (iii) **Regular Interaction** – Defence services project teams should regularly engage with MSMEs to co-develop small-scale but crucial defence components tailored to military needs.

- (iv) **Integration of Military Feedback to Industry.** Armed forces should directly involved in the design, development, and procurement of weapons and technologies to meet the needs of the battle field.
- (e) **Strengthening the Private Defence Sector**
- (i) **War Clause in Contracts** – Defence contracts must include a clause that mandates private firms to continue supplying critical systems in emergencies (e.g., wartime) without cost escalations.
- (ii) **Academia-Industry Partnerships** – Private firms should collaborate with universities and defence forces to create an efficient research-to-production pipeline, ensuring smooth technology transfer and implementation.
- (iii) **Long-Term Contracts** – Private firms need long-term procurement commitments from the government to sustain their business and invest in R&D.
- (iv) **Simplifying Licensing & Procurement Policies** – The defence sector should streamline licensing and procurement processes to attract private sector participation. In addition the bureaucratic hurdles in obtaining manufacturing licenses for private firms developing naval weapons and sensors should be reduced.
- (v) **Public-Private R&D Collaboration** – Encourage DRDO and DPSUs to work jointly with private firms and start-ups for sensor fusion and indigenous combat system development.
- (vi) **Business relationship cell by Armed Forces.** To reduce the disconnect between the requirements of armed forces and the capability development vision of pvt industry, it is necessary to have regular interaction

amongst two stakeholders on critical issues. The same can be formalised through establishment of Business Relationship Cells by armed forces at suitable level (preferred at Corps HQ level) for real time basis update of upcoming requirements of the forces.

(f) **Procurement Process & Regulatory Framework**

(i) **Single-Window Clearance System** –MSMEs often face delayed payments from government agencies, disrupting cash flow. A transparent and time-bound payment clearance process is essential. Introduce a single-window approval system to reduce procurement delays and streamline compliance. Evaluations need to be conducted in parallel for technical compliance, field trials, and financial vetting to speed up decision-making. Even the financial approvals need to be consolidated into a single-stage process with pre-defined cost thresholds.

(ii) **Clear MOQ & Sustained Orders** – The government must guarantee a minimum order quantity (MOQ) and continued procurement to assure defence manufacturers of a steady market.

(iii) **Strengthening the Offset Policy.** Offset rules may be modified to require direct transfer of high-end defence technologies (e.g., radar systems, avionics, and missile guidance). For eg in Boeing P-8I aircraft deal, a more effective offset policy could have ensured transfer of anti-submarine warfare sensor technology to Indian companies rather than just parts manufacturing.

(iv) **Enhancing SPM.** The approval timeline for selection of strategic partner timeline may be streamlined and reduced to within 6 months. In addition, a single-window clearance system can accelerate decision-making

by reducing the need to go through multiple agencies which is being followed at present.

(g) **Modification to QR Formulation and Implementation Philosophy**

(i) **Flexible Qualitative Requirements (QRs)** – Defence procurement policies should allow minor modifications in product specifications during the R&D phase rather than rejecting projects for minor non-compliance.

(ii) **Performance Based QRs.** Adopt performance-based QRs that focus on the functional and operational effectiveness of defence systems rather than overly rigid specifications. This shift would encourage cutting-edge research and innovation while ensuring that indigenous manufacturers have the flexibility to develop technologically advanced solutions without unnecessary constraints.

(iii) Additionally, introducing regular consultations with industry experts, academia, and defence veterans during QR formulation can help align requirements with realistic technological capabilities and industry best practices. This will not only accelerate the development lifecycle of critical defence systems but also foster greater synergy between R&D institutions and defence manufacturers.

(l) **Defence Exports and Imports**

(i) **Faster No Objection Certificate (NOC) Issuance** – The process of obtaining NOCs for MSME-led defence exports must be expedited to help Indian companies enter global defence markets.

(ii) **Restricted Imports for R&D** – Import restrictions on defence-grade raw materials and subsystems for R&D purposes should be simplified to prevent delays in innovation.

(h) **Indigenization and Capability Building**

(i) **Clear-cut Indigenization Policies** – The government should offer structured financial assistance to defence manufacturers to develop indigenous solutions rather than relying on imports.

(ii) **Encourage Joint Ventures (JVs)** – Indian companies should be encouraged to partner with foreign OEMs to locally produce critical defence technologies, ensuring technology transfer.

(iii) **Monitoring & Handholding** – A dedicated monitoring body should oversee MSME progress and provide necessary support throughout the development cycle.

(iv) **Fast paced capacity building** - For the chosen capability development, the manufacturing capacities need to be developed with the aim to be the worldwide production hub of the selected core competencies. To achieve the same there may be requirement to revise the DP form the specific domains as well as fast tracking the development.

(j) **Transparent and Efficient Procurement**

(i) **Moving Beyond L1 Criteria** – Move away from lowest-cost selection models to a quality-focused procurement approach. If the same is not viable, then the lowest bid (L1) should not be the sole criterion for awarding defence contracts. Instead, factors such as quality, indigenous content, and long-term commercial viability must be considered.

(ii) **Multiple Qualified Vendors** – DRDO and defence labs should work with multiple vendors simultaneously to enhance competition and optimize price discovery.

- (iii) **Faster Payment Clearance & Incentives for High Indigenous Content** – Bureaucratic delays should be removed, ensuring quicker payments and better incentives for high indigenous content.
 - (iv) **Single-Window Clearance System** – Defence product approvals and exports should be managed via a **single-window** system for efficiency.
 - (v) **Dedicated Monitoring Team for Indigenization Policies** – A government agency should track and measure progress on defence indigenization policies.
 - (vi) **Accountability of delays.** Delay on part of the procurement agency be made transparent and accountable so as to reduce the cost overheads for the vendor.
 - (vii) **Collaboration Between DPSUs, Private Industry, DRDO & Armed Forces** – A holistic defence ecosystem should integrate contributions from all key stakeholders.
- (k) **Bureaucracy and Process Simplification**
- (i) **Industry Consultation** – Regular (monthly/bi-monthly) meetings should be held with the industry to resolve bottlenecks in procurement and manufacturing.
 - (ii) **Clear Communication Channels – A Single Point of Contact (SPOC)** should be designated in defence agencies to streamline approvals and clarifications.
 - (iii) **Need for Faster Decision Making.** Defence manufacturing and procurement being a long gestation process which requires a number of channels to be passed, the process can be made efficient with faster decision making

- (l) **Incentives for New Entrants in Defence Manufacturing**
- (i) **Encouraging MSMEs to Enter Defence Manufacturing** – Tax benefits, incentives, and dedicated support programs should make defence manufacturing attractive to new MSMEs.
 - (ii) **Review and Amend SRs Based on Technology Advancements** – Procurement policies should be revised periodically to align with global advancements in defence technology.
 - (iii) **Corporate Professional Responsibility (CPR)**. The establishment of a “Corporate Professional Responsibility” (CPR), “Technology Development Fund” under the Companies Act 2013 as a national effort for technology development will be in the best interest to increase the defence indigenisation base. In practise, this fund would be similar to the Corporate Social Responsibility (CSR) fund and would consist of about 2% of the company’s revenue and profit margins. The CPR must provide funding for industrial houses-based technological incubation centres, hubs, and start-ups under the direction of designated subject-matter experts.
- (m) **Strengthening R&D and Innovation**
- (i) **Increased R&D Funding** – More funding should be allocated to DRDO, private R&D, and academia-industry collaboration to strengthen India's indigenous capabilities. The R&D expenditure globally ranges up to 4.8% in case of Israel. However, India has the same as low as <1% of GDP. With assured and continued funding along with talent pool absorption policies, the same will flourish within India as well. In addition, to accelerate the indigenisation in ‘Fight’ category, Government should increase research

grants for DRDO, private firms, and academic institutions working on sonar, radar, missile guidance, torpedoes, and AI-driven combat systems.

(ii) **Accelerated Development of Advanced Systems** – Dedicated research hubs should focus on developing AESA radars, hypersonic missiles, and next-gen torpedoes. Some of the areas include: -

(aa) **Fast-Track Indigenous AESA Radars and EW Systems** – Establish a research hub focused on Advanced Electronically Scanned Array (AESA) radars **and** Electronic Warfare (EW) suites for naval platforms.

(ab) **Hypersonic & Long-Range Missile Development** – Accelerate R&D efforts in hypersonic cruise missiles **and** next-generation naval ballistic missile defence systems.

(ac) **Advanced Torpedoes & Naval Mines** – Prioritize the indigenous development of thermal torpedoes, wake-homing torpedoes, and seabed **mines** to reduce dependence on foreign systems.

(iii) **Integration of AI & ML in Sensor Systems** – Invest in AI-powered autonomous sonar detection, underwater surveillance, and predictive maintenance for naval assets.

(iv) **Modular and Upgradeable Systems** – Ensure **open architecture** for all new naval sensor and weapon systems to allow seamless upgrades.

(o) **Strengthening the Domestic Supply Chain**

(i) **Indigenous Semiconductor Fabrication & Advanced Materials** – India must develop domestic semiconductor fabs, warhead materials, and high-energy propellants.

(ii) **Strategic Partnerships for Critical Technologies** – Partnering with friendly nations should focus on actual technology absorption rather than mere product imports.

(iii) **Making India a Technological Hub.** The Four Ds—Data, Digitization, Digitalization, and Disruption—define the New Tech World Order. The time is right to strengthen the Industrial Fabric of India, with global ambitions, against the backdrop of a strong technological base provided by ISRO, DRDO, Technology and innovation centres of industries and PSUs, Startups, and T Hubs, through a well-thought-out technology strategy and the plethora of targeted initiatives.

(iv) **Low-Hanging Technology Fruits.** In the next five years, the worldwide market for unmanned autonomous systems (drones and robots) is expected to reach over \$50 billion. Does India need to lead in this low-hanging fruit sector? Megatrends in emerging technology include AI, AR, VR, meta, IoT, Big Data Analytics, Blockchain, EVs, software-defined networks, emerging technology stacks, and chip fabrication, to mention a few. To that extent, a user-friendly export policy would need to be redesigned for regional producers, including MSMEs and international recipients. India's capability growth and capacity building must become critically dependent on industrial corridors. The manufacturing sector in India must be regarded as a high-quality organisation by the international competition.

(v) **Develop Complementary Sectors.** We should simultaneously create a number of ancillary industries, such as communication alloys, composites, components, precision engineering goods, etc., to develop the defence sector. It will take a lot of effort to advance in areas like metallurgy

and alloys. Lack of a solid supply chain for logistics and suitable infrastructure drives up logistics expenses and lowers cost optimization and efficiency. In order to reduce costs, a defence manufacturing must have a good supply chain.

(vi) **Choose Core Competence Capabilities.** India need to identify its own strategic needs and operational requirements in specific so as to make explicit choices towards developing core competencies and manufacturing capabilities within the domestic defence ecosystem. The same can be done through vision document spanning next two decades under the overall guidance of national security strategy.

(vii) **Plan for Marketing Make in India Products.** It would be incorrect to think that streamlining the export process, which has been the government's top focus, is sufficient to increase export. What is required is an objective evaluation of the current rules and practises, but more significantly, a plan for marketing made-in-India defence products that will appeal to nations with significant financial resources to import defence products from India.

(p) **Promoting International Collaboration & Technology Transfer**

(i) **Strategic Partnerships for Key Technologies** – Establish agreements for joint development of naval weapons and sensors with countries that offer real technology absorption (e.g., France, Israel, the U.S.).

(ii) **Indigenous Manufacturing of Foreign Tech Under JV Models** – Encourage Indian private firms to license-build advanced naval systems instead of direct imports

- (q) **Creating a Fast-Track Indigenization Roadmap**
- (i) **Naval Indigenization Task Force** – Form a dedicated task force comprising the Indian Navy, DRDO, DPSUs, private industry, and academia to drive indigenization efforts.
 - (ii) **Defined Roadmap for Mission-Critical Systems** – Prioritize 100% indigenous development of the following naval systems within a clear timeline:-
 - (aa) AESA radars for ships and aircraft
 - (ab) Sonars and underwater surveillance systems
 - (ac) Anti-submarine weapons (lightweight & heavyweight torpedoes)
 - (ad) Electronic warfare and cyber defence systems
 - (ae) AI-based predictive maintenance tools for naval assets
- (r) **Improving Testing & Evaluation Infrastructure**
- (i) **Dedicated Naval Test Ranges for Weapons & Sensors** – Set up exclusive test ranges for validating indigenous torpedoes, missiles, radars, and EW systems.
 - (ii) **Fast-Tracking Sea Trials & Certifications** – Reduce procedural delays in field trials of new naval sensors and combat systems through parallel evaluations.
 - (iii) **Realistic Testing with Simulated Naval Combat Scenarios** – Establish advanced simulation centres for anti-submarine warfare (ASW), missile interception, and AI-based naval combat strategies.

8.2 **Conclusion**

India's Defence Industrial Ecosystem has made significant strides in advancing self-reliance in defence manufacturing, particularly in the naval domain. The study has explored various government initiatives, policies, and frameworks that have shaped this progress, alongside a comparative assessment of global best practices. Despite notable achievements, key challenges such as bureaucratic inefficiencies, technological dependencies, skill gaps, and regulatory hurdles continue to slow down the pace of indigenization.

A robust and sustainable defence ecosystem requires a multi-pronged approach, including strengthening research and development (R&D), fostering private sector participation, streamlining procurement processes, enhancing skill development, and creating an enabling policy environment. The role of strategic collaborations, both domestic and international, remains critical in bridging capability gaps and ensuring technology transfer for cutting-edge defence systems.

To accelerate the indigenization of weapons and sensors for the Indian Navy, targeted efforts must be made to enhance innovation, build a strong supply chain, improve testing infrastructure, and establish long-term commitments with private industry. With the right policy interventions and stakeholder synergy, India can achieve self-sufficiency in critical defence technologies and position itself as a global leader in defence manufacturing.

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Feedback on Government Initiatives for a Robust Defence Industrial Ecosystem

B *I* U ↻ ✕

Dear Participant,

This survey aims to assess the effectiveness of various government initiatives in strengthening the defence industrial ecosystem in India. This forms the part of the study carried out by Captain Manpreet Singh from Indian Navy who is pursuing his Advanced Professional Programme in Public Administration from Indian Institute Public Administration at Delhi.

Voluntary Participation: Participation in this survey is completely voluntary. You may choose to withdraw from the survey at any time without any negative consequences.

Anonymity & Confidentiality: All responses will remain anonymous and will be used solely for academic purposes. No personal identifiable information (PII) will be collected or stored, and all data will be kept confidential.

Data Usage: The responses you provide will be analyzed in an aggregate format, and no individual responses will be identifiable. By submitting your response, you consent to the use of your answers for academic research

Contact Information: If you have any questions or concerns about this survey, please feel free to contact the researcher at email [manpreetappa@gmail.com].

Your responses will help evaluate policies, challenges, and opportunities for improvement. The survey will take approximately **5-10 minutes** to complete. Your inputs will remain confidential.

Thank you for your valuable time and insights.

Name of The Firm/ Organisation

Short answer text

Type Of Industry *

- MSME
- DPSU
- Pvt Enterprise
- Start Up
- Other...

Primary Domain of Operation *

- Aerospace & Avionics
- Land Systems & Armaments
- Naval Systems
- Cyber & Electronic Warfare
- AI, Robotics & Emerging Technologies
- Other...

Years of Experience in the Defence Sector:

- 0-3 years
- 3-7 years
- 7-15 years
- More than 15 years



What are the key challenges faced by your industry in defence manufacturing and procurement? *(Select all that apply)*

- Lengthy decision-making process in approvals and procurement
- Excessive bureaucracy in procurement procedures
- Delays in procurement cycles, causing financial strain on vendors
- Limited assurance of orders for Indian firms, affecting investment in R&D
- Preference for DPSUs over private industry, restricting private sector growth
- Insufficient transparency and accountability in procurement delays



What are the biggest roadblocks to India becoming a global defence manufacturing hub? *(Select all that apply)*

- Lack of a long-term vision document for core competencies
- Need for stronger talent pool & workforce development
- Inconsistent defence policies & lack of a predictable procurement framework
- Limited collaboration between private sector, PSUs, and DRDO/ISRO



What strategies could improve India's defence exports? *(Select all that apply)*

- A structured global marketing plan for Make-in-India products
- Simplified export policies to encourage MSMEs & private sector participation
- Better coordination with armed forces for understanding operational needs
- More incentives/subsidies for export-oriented defence firms
- International collaborations & partnerships for tech transfer & co-development

Do you believe India's R&D spending in defence (currently <1% of GDP) is sufficient? *

- Yes
- No, it should be at least 2% of GDP
- No, it should be aligned with global benchmarks (~4-5% of GDP)
- Uncertain

What policy measures can further strengthen the defence industrial base? (Select all that apply) *

- Establishing Corporate Professional Responsibility (CPR) for tech funding
- Creating a dedicated Defence MSME & Start-Up Portal for direct engagement
- Setting up Business Relationship Cells in Armed Forces to reduce disconnect
- Improving industrial corridors & infrastructure for cost optimization
- Developing ancillary industries (e.g., metallurgy, logistics, advanced materials)

What technological advancements should India prioritize for defence manufacturing? (Select all that apply) *

- AI, IoT, Blockchain, and Cybersecurity
- Unmanned Aerial & Autonomous Systems
- Advanced materials, alloys, & composites
- Chip fabrication & indigenous electronic components
- High-end software-defined networks & Big Data Analytics

What strategies should be implemented to fast-track defence capacity building? (Select all ^{*} that apply)

- Fast-paced capacity building to position India as a global production hub
 - Clear milestone-based selection processes, with defined timelines for product delivery
 - Transparent accountability measures for procurement agencies to minimize vendor costs
 - Ensuring confidence in Indian products, with increased defence expos and global outreach
-

What additional measures can the government take to support the private defence sector?

Short answer text
.....

Appendix B
Refer to Para of Chap 6 Para 6.7

Section 1 of 5

"Survey on Qualitative Requirements (QRs) for Indigenous Defence Production" ✕ ⋮

B *I* U  

"This survey aims to gather insights from design agencies and industry stakeholders regarding the effectiveness of the Qualitative Requirements (QRs) formulated by the Indian Navy for indigenous defence production. The objective is to assess whether QRs facilitate or hinder domestic defence manufacturing, innovation, and industry growth. Your responses will contribute towards shaping an industry-friendly QR framework to strengthen India's defence ecosystem."

This forms the part of the study carried out by Captain Manpreet Singh from Indian Navy who is pursuing his Advanced Professional Programme in Public Administration from Indian Institute Public Administration at Delhi.

Voluntary Participation: Participation in this survey is completely voluntary. You may choose to withdraw from the survey at any time without any negative consequences.

Anonymity & Confidentiality: All responses will remain anonymous and will be used solely for academic purposes. No personal identifiable information (PII) will be collected or stored, and all data will be kept confidential.

Data Usage: The responses you provide will be analyzed in an aggregate format, and no individual responses will be identifiable. By submitting your response, you consent to the use of your answers for academic research

Contact Information: If you have any questions or concerns about this survey, please feel free to contact the researcher at email [manpreetappa@gmail.com].

Your responses will help evaluate policies, challenges, and opportunities for improvement.

 **Estimated Time:** 7-10 minutes

Thank you for your valuable time and insights.

After section 1 Continue to next section ▾

Section 2 of 5

SECTION A: RESPONDENT INFORMATION ✕ ⋮

Description (optional)

Name of Organization (Optional)

Short answer text

⋮

Type of Organization (Select one) *

- MSME (Micro, Small & Medium Enterprises)
- Private Defence Firm
- DPSU (Defence Public Sector Undertaking)
- Start-up
- Foreign OEM with Indian JV
- DRDO

Nature of Business (Select one or more) *

- Shipbuilding & Naval Systems
- Weapons & Armament
- Electronics & Communication Systems
- UAVs & Autonomous Systems
- Artificial Intelligence & Emerging Technologies
- Other

Experience in Defence Sector (Dropdown selection) *

1. Less than 3 years
2. 3-5 years
3. 5-10 years
4. More than 10 years

Do QRs encourage innovation & indigenous R&D? *

	1	2	3	4	5	
No Encouragement	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	High Encouragement

How often are QRs modified based on feedback from R&D organisation/ industry? *

- Never
- Rarely
- Sometimes
- Often
- Always

Do current QRs make it easier for startups & MSMEs to enter defence manufacturing? *

	1	2	3	4	5	
Not at All	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Highly Encouraging

How effectively do QRs allow for technology adaptation & future upgrades? *

	1	2	3	4	5	
Not Effective	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	Highly Effective

Would more flexible or performance-based QRs help in faster product design/development? *

- Yes
- No
- Not Sure

After section 4 Continue to next section

Section 5 of 5

SECTION D: SPECIFIC CHALLENGES WITH QR FORMULATION

Description (optional)

Which areas of QR formulation require significant improvement? (Select all that apply) *

- Timeliness of QR issuance
- Realism of performance parameters
- Industry participation in the formulation stage
- Alignment with global standards

⋮

How would you rate the transparency in QR formulation and evaluation process? *

- 1 2 3 4 5
- Not Transparent at All Highly Transparent

Have you faced procurement delays due to unclear or unrealistic QRs? *

- Yes, frequently
- Yes, occasionally
- No

Do QRs provide equal opportunity for both public and private sector companies? *

- Yes
- No
- Not Sure

Would a standardization framework for QRs help the R&D organisation/ industry? *

- Yes
- No
- Not Sure

⋮

Should the Indian Navy set up a dedicated industry advisory panel to improve QR formulation? *

- Yes
- No

⋮

What improvements would you suggest to make QRs more industry-friendly?

Long answer text

Any additional feedback on how QRs have either helped or hindered indigenous design/ development/ production?

Long answer text
