



# INDIGENISATION OF DEFENCE INDUSTRY: FROM NECESSITY TO OPPORTUNITY

## INTRODUCTION

The road to becoming a global power goes through economic prosperity, global presence and most importantly a robust security architecture. An indigenous defence ecosystem is a sin-qua-non for building this architecture. This is especially true for India given its geopolitical ambitions in the Indo-Pacific region and perennial hostility that it faces from neighboring China and Pakistan.

In the quest for building a robust defence ecosystem, India has touched upon many milestones from designing and producing a fourth-plus-generation fighter aircraft to building a state-of-the-art cruise and an intercontinental ballistic missile. These efforts had been vindicated by Stockholm International Peace Research Institute (SIPRI) when it put India in **the arms exporters list of 2019 for the first time**. However, despite all these endeavors and achievements, India remains **primarily dependent on imports** when it comes to the critical needs in the defence sector. For instance, **during 2015-19**, India emerged as the **second largest arms importer** in the world just behind Saudi Arabia.

In this background, it is important to understand what is defence indigenization and why should India pursue it; How has our defence ecosystem evolved over the years; What is the current situation of India's defence architecture; Why India's efforts towards defence indigenization have led to suboptimal results; What are the recent steps taken by India to overcome these challenges and what more should be done? In this article, we will attempt to answer these questions.



## WHAT IS DEFENCE INDIGENIZATION AND WHY ITS PURSUANCE IS IMPORTANT FOR INDIA?

Defense Indigenisation broadly means **creating an ecosystem where indigenous development of defense equipment can thrive**. In other words, it implies improving the capability to design, develop and manufacture equipment within the country, using our own skills and resources. Indigenization largely manifests in two forms- firstly, the **capability to maintain and repair** indigenously built equipment, as well as the equipment sourced from abroad and secondly, **self-sufficiency** with respect to manufacturing of **critical defense equipment**.

With this understanding, it becomes important to elucidate why India should pursue the idea of defense indigenization:

- » **Self defence:** Despite being fundamentally averse to war as a nation, the subject of self-defense is of critical importance to India, especially given the hostile neighborhood on both its eastern and western land borders. Having the requisite self-defense capability and preparedness at all times will keep the country in good stead for any military conflict, or even better, act as an effective deterrent for conflicts altogether.
- » **Strategic leverage:** Self-reliance on defence capabilities boosts India's standing of as a net security provider in the IOR and further deepens its strategic ties in the region. A successful defence industry also provides leverage with neighbors who may otherwise turn to competitors for security.
- » **Technological development:** Indigenous development in the defence sector goes hand-in-hand with the associated technological development. For instance, a case in point is the refusal of the U.S. to provide a supercomputer to India in 1987, because of which India was forced to build its own indigenous capability in the form of supercomputer PARAM.
- » **Economic Drain:** Currently, India **spends close to 3% of its GDP on defence** (compared to 1.6% on Health Sector), **of which about 60% is imported**. This leads to a large economic cost to the country and **dents the foreign exchange repository**.



## HOW HAS INDIA'S DEFENCE ECOSYSTEM EVOLVED OVER THE YEARS?

Development of India's defence ecosystem started immediately post-independence in 1947 when India inherited its defence infrastructure and equipment from the British. Since then, the ecosystem has seen several policy changes, alarms in the form of war and fluctuations in international relationships. Developments in the sector can be briefly treaded through following events:

Decade	Major developments
1950s	<ul style="list-style-type: none"><li>» During the 1950s, India focused on its capability to indigenously produce equipment with little technical know-how, <b>leaving the advanced equipment requirements to be addressed through imports</b>.</li><li>» In 1956, the revised <b>Industrial Policy Resolution reserved the arms and ammunition</b> industry, which were included in '<b>core</b>' industries, with the public sector.</li><li>» In 1958, the <b>Ordnance Factories (OFs)</b> set up under the British rule became the <b>core group of industries that formed the Defence Research and Development Organization (DRDO)</b>.</li></ul>
1960s	<ul style="list-style-type: none"><li>» The <b>impetus for India's defence industry</b> arrived when the country faced drastic reverses in its <b>conflict with China in 1962</b>. This prompted India to increase its defence expenditure from 1.5% of the nation's gross domestic product (GDP) to 2.3%.</li><li>» Following India's war with <b>Pakistan in 1965</b>, the <b>embargo imposed by the US</b> upon export of arms to India <b>heralded an era of defence ties with the Soviet Union</b>.</li></ul>
1970s	<ul style="list-style-type: none"><li>» A lion's share of India's defence equipment was <b>supplied by the Soviet Union</b>. India received advanced weaponry and even <b>commenced manufacturing of equipment, albeit by way of license</b>. The MIG21 fighter aircraft, manufactured by Hindustan Aeronautics Limited (HAL) in Bangalore, stood as a stark symbol of this arrangement.</li><li>» Although the nation received advanced weapons, manufacturing via the license-route, from States and foreign companies, <b>led to stagnation in India's domestic capabilities</b> in terms of research, development and production.</li></ul>



<b>1980s</b>	<ul style="list-style-type: none"> <li>» India began a renewed effort to galvanize its domestic defence industry by investing largely into DRDO and development of <b>indigenous missile systems, under the Integrated Guided Missiles Development Programme (IGMDP)</b>, such as 'Prithvi', 'Akash' and 'Nag'.</li> <li>» India also began the <b>development of its flagship aeronautical project, the Light Combat Aircraft (LCA)</b> during this period.</li> </ul>
<b>1990s</b>	<ul style="list-style-type: none"> <li>» Post economic liberalization, the <b>manufacture of components, assemblies and sub-assemblies was thrown open to the private sector</b> which mostly supplied these items to the OFs/ Defence Public Sector Undertakings (DPSUs).</li> <li>» Since indigenous efforts were not adequate to meet the armed forces requirements, <b>focus shifted towards co-development and co-production in partnership</b> with foreign firms. Thus, in 1998, India entered into an agreement with the Soviet Union to develop a supersonic cruise missile system, <b>the 'Brahmos', through a joint venture.</b></li> </ul>



## WHAT IS THE CURRENT SITUATION OF INDIA'S DEFENSE ARCHITECTURE?

India's current situation can be broadly understood through its policy and legislative framework, its defence production network and its defence budgetary profile.

» **Policy and Legislative Framework:** The Government in 2001, **opened defence production to 100% Indian private sector** participation and **permitted Foreign Direct Investment (FDI)**. However, both were **subject to industrial licensing** conditions to be set by the Ministry of Commerce and Industry. Following policies have tried to enable the same:

- **Defence Procurement Policy (DPP), 2006:** Introduced the **'Make' type of procurement** from the private sector in order to develop and produce advanced defence equipment, with government commitment to provide 80% of the development costs.
- **DPP, 2013:** It laid a **hierarchy of acquisition programmes**. Accordingly, a higher preference has now been accorded to the 'Buy (Indian)', 'Buy and Make (Indian)' and 'Make' categorization over the 'Buy (Global)' category making it a preferred choice to develop, design or manufacture defence equipment indigenously.

### Current Legal and Regulatory framework to support the policies

Policy	Ministry of Defence	All defence and security related matters
<b>Legislations and Procedures</b>	<ul style="list-style-type: none"> <li>» Industries (Development and Regulation) Act, 1951</li> <li>» Defence Procurement procedure, 2016</li> <li>» Foreign direct investment policy &amp; regulations under foreign exchange management act, 1999 (FEMA)</li> <li>» Other Acts; Indian Army Act 1950; Indian Air Force Act 1950; Indian Navy Act 1957, in the</li> </ul>	<ul style="list-style-type: none"> <li>» Governs industrial licensing for manufacture of defence items</li> <li>» Governs procedure for capital acquisitions in the defence sector</li> <li>» Statutory provisions and supplementary rules concerning government, regulation, administration, enrolment and discipline of the Army, Air Force and Navy.</li> </ul>
<b>Regulators and Agencies</b>	<ul style="list-style-type: none"> <li>» Department of Industrial Policy and Promotion, Ministry of Commerce &amp; Industry (DIPP)</li> <li>» Department of Defence Production, Ministry of Defence</li> <li>» Defence Acquisition council, Ministry of Defence</li> <li>» Defence Offsets Management wing, Ministry of Defence</li> </ul>	<ul style="list-style-type: none"> <li>» Formulation and implementation of industrial policy, including the relevant FDI policies from time to time.</li> <li>» The primary agency dealing with the production of defence equipment in India.</li> <li>» Responsible for the purchases to be made for the Indian defence forces.</li> <li>» Review the post contract status of all the offset agreements entered into by IOPs.</li> </ul>

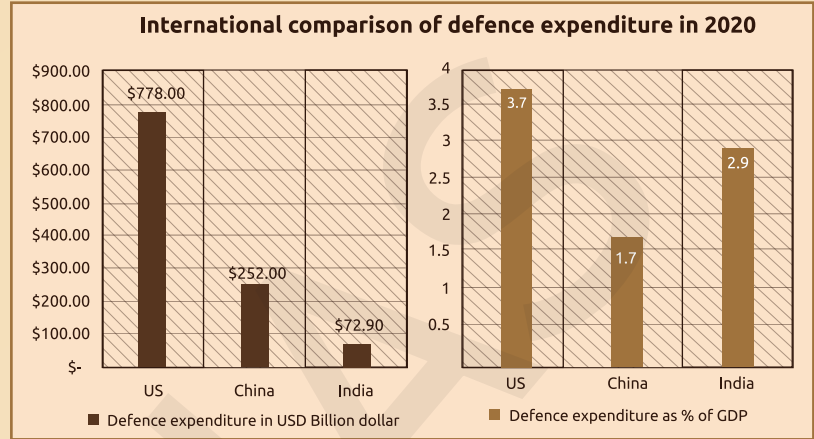
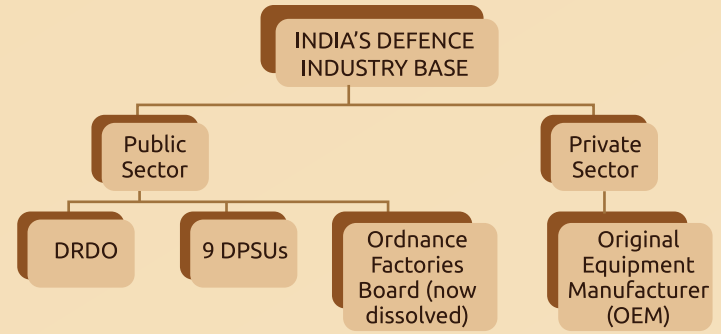
➤ **Defence Production Network:** This network includes 52 labs belonging to the Defence Research and Development Organisation (DRDO), nine Defence Public Sector Units (DPSUs), and 41 ordnance factories under the Ordnance Factory Board along with Private sector involvement as Original Equipment Manufacturers.

➤ **Defence Budgetary Profile:** The recently released **Trends in International Arms Transfers, 2020**, a report by the SIPRI, has highlighted the following about India's defence budget-

- **India's defence import:** India has emerged as the **second-largest importer** of arms transferred between 2016-20. Although, its **imports fell 33%** when compared with the years 2011-2015.

- India depends heavily on Russia, US, France and Israel for vital platforms and weapons. Around 86% of all weapons, equipment and platforms deployed in India are of Russian origin.

- **India's defence export:** India increased its share of global arms exports from 0.1% between 2011-2015 to 0.2% between 2016-2020. Its top recipients include Myanmar, Sri Lanka, and Mauritius.



Despite having an elaborate legislative and regulatory framework, a large production network and considerable budgetary spending, India has not been able to achieve the desired level of indigenization.



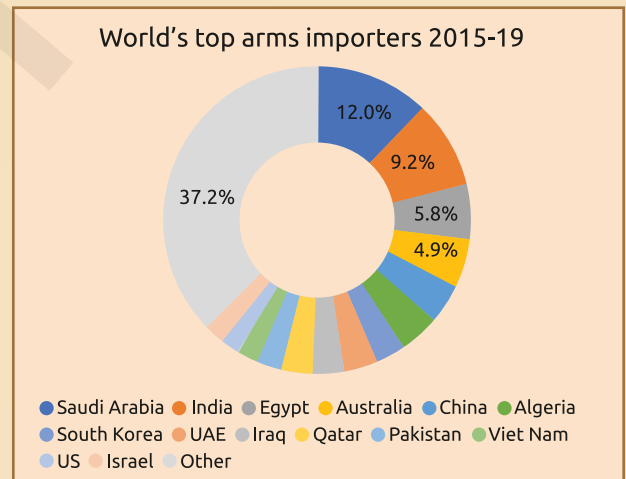
## WHY INDIA'S EFFORTS TOWARDS DEFENCE INDIGENIZATION HAVE LED TO SUBOPTIMAL RESULTS?

➤ **Shortcomings in Defence Planning:** For defence planning, the National Security Council (NSC) has been in existence since 1999. However, the Group of Ministers (GoM) Report in 2001 had observed that the defence planning process is greatly handicapped by the absence of a national security doctrine and the commitment of funds beyond a year. It also suffers from a lack of inter-Service prioritization as well as the requisite flexibility.

- Thus, it was then suggested that there is a **need to set up a Defence Planning Board (DPB)** under the chairmanship of the Defence Minister. However, the suggestion is yet to be implemented.

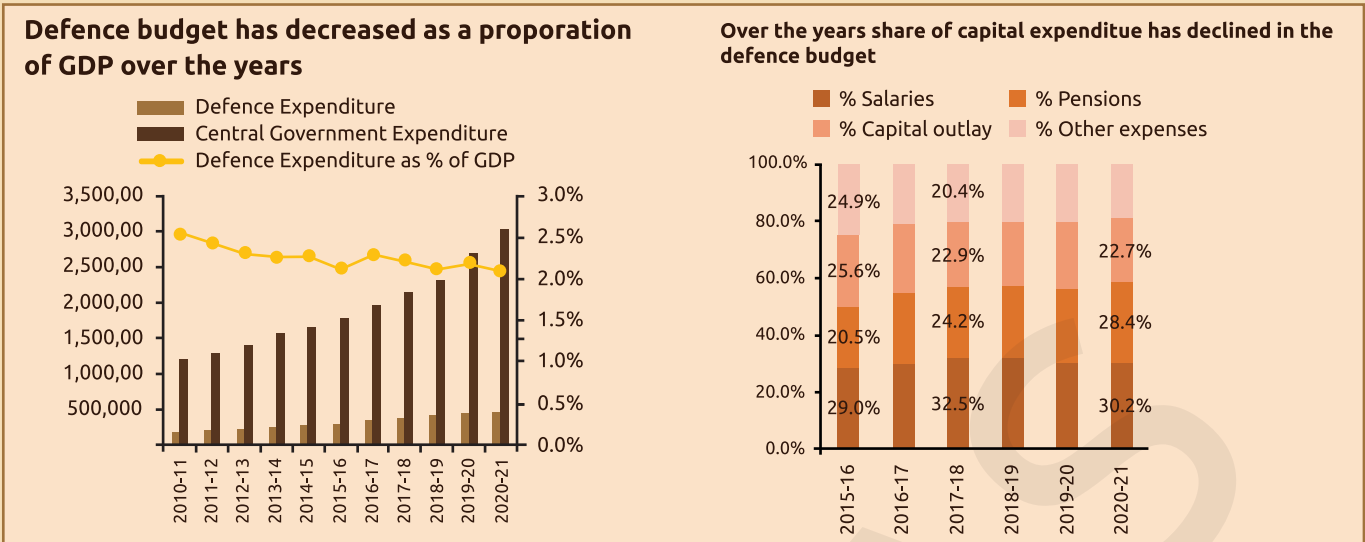
➤ **Hierarchical and skewed decision-making:** A 2018 internal report of the MoD identified skewed decision-making process, bureaucratic red-tape, and multiple decision-making heads as the reason for inordinate delays in defence procurement. In addition, there is a lack of input from the Armed Forces in the decision-making on defence and national security strategy.

➤ **Budgetary issues:** The defense budget in recent years has fallen with an increasing component of funding allocated towards salaries, pensions and other operating expenses. The shrinking amount for capital expenditure on domestic defence production, and research and development has been a major obstacle to India's self-reliance goals.





- For instance, **India's budget allocation for research and development is only 4% of the total defence budget for 2020-2021** (compared to 12% and 20% for USA and China respectively).



➤ **Dominance of PSUs:** Their dominance has been associated with inefficiency and lack of accountability on delivery, productivity and quality.

- **Production and time delays:** Indigenous defence production has been wrought with production delays. For example, according to a 2018 report by a parliamentary Committee on Estimates, the DRDO failed to meet timelines in all 14 mission projects for the Indian Air Force, thereby severely affecting the country's Air Defence plans.

➤ **Not competitive for attracting global investment:** Post-COVID-19, out of 56 companies which have closed shops in China; only three have come to India. Maximum have shifted base to countries like Indonesia, Taiwan and Thailand. This has happened despite India's revived push for attracting investment in the defence sector. Reasons for this anomaly could be:

- **Discouraging regulatory regime:** A domestic or foreign company wishing to do business in the Indian aerospace and defence industry must comply with often conflicting policies of Defence Procurement Procedure (including the Offset Policy), FDI, Industrial Licensing, Foreign Trade (Export/Import) and Taxation.
- **Volatile exchange rate variations:** A number of components and sub-systems are not available in India and have to be imported. This puts domestic manufacturing at a disadvantage to foreign manufacturing by disturbing the financial flows of the process.
- **High cost of capital:** A critical issue impacting investment in India is the high cost of capital which adversely impacts all Indian companies across sectors.

➤ **Issues faced by domestic private entities:** The biggest hindrance in the private sector's participation so far has been distrust. This reflects in the procedural hurdles that they face, narrow range of products that they are allowed to manufacture and most importantly low confidence of the armed forces in locally and privately manufactured products.



## WHAT ARE THE RECENT STEPS TAKEN BY INDIA TO OVERCOME THESE CHALLENGES?

➤ **Import embargo on defence items:** Recently, the MoD has added 108 more items to its existing list of 101 defence items banned for import to give further impetus to self-reliant defence manufacturing.

- The list, called the '**positive indigenization list**', will be implemented progressively from 2021 to 2025. This list comprises systems, sensors, weapons and ammunition like helicopters, mini-UAVs, mine-protected vehicles, wheeled armored platforms, etc.

➤ **Expanding the FDI window:** The Department for Promotion of Industry and Internal Trade (DPIIT), in 2020 **increased the FDI in the defence sector from 49% to 74% under the automatic route** to increase domestic defence production, development of new technology in India and maximize expansion of private sector in defence production.

### Certain committees that pushed for defence indigenization

- Dr A.P.J. Abdul Kalam committee in 1995.
- A Group of Minister's (GoM) Task Force on the Management of Defence headed by Arun Singh in 2001.
- Kelkar Committee on self-reliance and revitalizing DPSUs in 2005.
- Sisodia Committee on improving defence acquisitions in 2007.
- Naresh Chandra Committee on national security in 2012.

➤ **Defence Acquisition Procedure (DAP) 2020** has increased the indigenous content requirement in all categories of defence procurement. It has also proposed other measures to increase indigenization such as increase in indigenous availability of high-end military materials, the use of indigenous software in equipment/systems and a boost to innovation by start-ups and Micro, Small and Medium Enterprises (MSMEs).

➤ **Exploring the global arms marketplace:** The government has drafted a Defence Production & Export Promotion Policy 2020 with a goal of Rs 175,000 crore in turnover and Rs 35,000 crore in exports of aerospace and defence goods by 2025. Towards this target, defence PSUs have been asked to earn 25% of their revenues via exports by 2023 and diplomatic missions have been tasked with actively promoting defence exports.

➤ **Capital procurement budget:** Earlier, the capital procurement budget comprised of both domestic as well as foreign procurement. But for the year 2020-2021, the Ministry has created a separate budget head for domestic capital procurement and has allocated a budget of INR 52,000 crore for domestic procurement. According to the government, this move will reduce the defence import bill and encourage domestic manufacturing of defence equipment.

➤ **Innovations for Defence Excellence (iDEX):** The MoD has approved the budgetary support of ₹498.8 crore to iDEX challenge under the Defence Innovation Organisation (DIO) for the next five years. The iDEX framework and establishment of the DIO by the Department of Defence Production (DDP) is aimed at promoting innovation and indigenisation in the aerospace and defence sector at the start-up level.

➤ **Defence corridor:** A defence corridor refers to a route or a path along which domestic production of defence equipment by public sector, private sector and MSMEs are lined up to enhance the operational capability of the defence forces. The work on building defence corridors is on at a rapid pace in states of Uttar Pradesh and Tamil Nadu and Rs 20,000 crore investment would be made for this in the next five years.

➤ **Implementation of few recommendations made by Vijaya Kelkar Committee (2004) which inter alia include:**

- Creation of a 15-year equipment acquisition plan.
- Introduction of offsets in defence purchases.
- Corporatization of the OFB.
  - Recently, the GoI has **dissolved the 220-year-old OFB and restructured it into seven new DPSUs, which will govern 41 ordnance factories across the country.**
  - The seven corporate entities are expected to be formed by this year. These seven DPSUs will be **100% government-owned** corporate entities, registered under the Companies Act 2013.

➤ **Developing AI enabled products:** Artificial Intelligence (AI) based tools would aid the defence forces constructively in areas such as decision support, sensor data analysis, predictive maintenance, situational awareness, accurate data extraction, security, etc. These tools will assist defence personnel in better operations, maintenance and logistics support. Therefore, project named, **Energy Harvesting Based Infrared Sensor Network for Automated Human Intrusion Detection (EYESIRa)**, which is partially based on the principles of IoT, has been sanctioned.

Collectively these steps are expected to increase private sector participation in defense, increase export potential, encourage technological development and modernization. But these may not be able to address some of the structural issues with the decision-making process; effective use of funds among others.

**Content requirements by category under DAP-2020**

Category	Proposed Indigenous Content	DPP 2016
Buy (Indian-IDDM) Indigenously Designed Developed and Manufactured	Indigenous design and > 50%	Min 40%
Buy (Indian)	In case of indigenous design ≥ 50% otherwise ≥ 60%	Min 40%
Buy and Make (Indian)	≥ 50% of the 'Make' portion	Min 50% of Make
Buy and Make	≥ 50%	Case to case
Buy (Global - Manu- facture in (India)	≥ 50%	
Buy (Global)	Foreign Vendor - Nil Indian Vendor ≥ 30%	







# WHAT STEPS NEED TO BE TAKEN TO ENABLE LONG-TERM DEFENCE INDIGENIZATION?

Dr. Kalam committee had set a target for 70 per cent indigenization by 2005, but this target is yet to be achieved. To realize this objective, following approach can be adopted-

## ➤ Restructuring of the decision-making process:

- **Creating a national security doctrine:** An official document outlining a National Security Strategy is essential to achieve consensus of all political parties on national security issues and thus provide the inputs to formulate the military security strategy and the security objectives. The attainment of these military security objectives would determine the required national military capabilities and the consequent long and medium term defence plans.
- **Strategic planning for future needs of the Armed Forces:** There is a need to clearly identify critical strategic capabilities or platforms where India needs to develop core capabilities. In these areas, India must build end-to-end scale and competitiveness on every front, which will boost both indigenous capability and exports.
- **Inclusive decision making:** Representatives from the three forces should be included in defence procurement and national security decision-making for a more inclusive and efficient decision-making. Establishment of Chief of Defence Staff (CDS) is a positive step in this direction. This body needs to be endowed with adequate human and financial resources.
- **Defence Capital Acquisition Authority (DCAA):** The expert committee headed by Professor Pritam Singh recommended setting up the DCAA outside the MoD to reduce delays and corruption in defence procurement. The DCAA would be responsible for the entire defence acquisition process including legal, financial, costing and technical, and include experts for each stage.
  - This will drastically reduce the time delays in defence procurement. Similar models have been adopted by countries such as France, the United Kingdom and Australia.

## ➤ Enabling defence forces entering into for-profit public and private sector projects: such as repair and maintenance of machinery and aircraft for private companies, building and repairing highways and expressways, among others. It could be done through:

- **Altering the practice of reimbursement:** As of now, whenever defence forces aid the state government for services like rescue during any disaster, the concerned state governments reimburse the money to the Centre in the Consolidated Fund of India. This could be repatriated back to the Service concerned (Army, Navy or Air Force) to utilise for equipment purchase or refurbishing.

## ➤ Collaborate to thrive:

- **Addressing the concerns of various stakeholders:** It would help if the Defence Ministry issues a formal order addressing the concerns expressed by various stakeholders about certain aspects of the negative list as well as the purpose of bifurcating the capital budget without increasing the overall allocation, which is the core problem besetting modernisation of the armed forces.
- **Setting-up the defence-academia Linkage:** India could link IITs and other research institutions and the private defence manufacturing sector to DRDO to upgrade research quality and broaden the base and spectrum of futuristic capabilities needed by the armed forces.
- **Supporting private sector:** Accreditation and fostering of Raksha Udyog Ratnas, or industrial 'jewels', in the private sector that could undertake major defence manufacturing projects and joint ventures.

## CONCLUSION

Defence Indigenisation has remained the inner calling of the nation, which has the third largest Army, is one of the largest military spender and has emerged as the second largest importer of weapon systems and platforms in the world. As India inches to achieve its rightful strategic autonomy, it needs to do more in planting the seeds for a commercially viable and technologically robust indigenous defence industrial base. It must be more strategic with its goals for self-reliance in the defence sector, with careful planning of future needs and effective participation from the industry. This can be ensured through a more streamlined acquisition process, addressing concerns of various stakeholders, developing private sector innovation and manufacturing capability and building a vibrant export market.



# TOPIC AT A GLANCE

**What** - ecosystem where indigenous development of defense equipment can thrive.

## Components

- Self Defence
- Strategic Leverage
- Preventing Economic Drain
- Technological Development

## Evolution- Major achievements-

1958-Formation of DRDO

1960s- Defence ties with USSR

1980s- Integrated Guided Missile Development Program

1990s- BrahMos JV

## Current Status-

- Evolved from DPP 2006, 2013 and 2016
- 2.9% of GDP on Defence
- 2nd Largest Arms Importer
- Heavy Dependence on Russia, France, US & Israel.
- 0.2% share in arms export

## Why achievements have been suboptimal-

- Shortcomings in Defence planning due to absence of a national security doctrine.
- Red-tapism
- Low budgetary spending on capital acquisitions
- Dominance of PSUs
- Distrust among private players

## Recent steps taken

- 209 items in Positive indigenization list of import embargo
- 74% FDI under Automatic route
- Defence Acquisition Procedure 2020 for increasing indigenous content
- Separate Capital procurement budget from 2021
- iDEX platform
- Defence Corridors
- AI based interventions like EYESIRa

## Way forward

- Restructuring of decision making process
  - Creation of a national security doctrine.
  - Defence Capital Acquisition Authority
- Judicious use of funds like for-profit public and Private sector projects
- Defence Academia Linkage
- Industrial Jewels in the private sector.



## Appendix: India's Indigenously developed Defense Systems

Missiles	
<b>Akash Missile system</b>	<ul style="list-style-type: none"> <li>› Cabinet approved <b>export of indigenously developed Akash missile systems</b> to friendly countries.</li> <li>› It is a <b>mid-range surface-to-air missile (SAM)</b> system built by DRDO.</li> <li>› It was developed under the <b>IGMDP</b>. <ul style="list-style-type: none"> <li>● The programme also involved the development of the <b>Nag, Agni and Trishul missiles, as well as the Prithvi ballistic missile.</b></li> </ul> </li> <li>› Two versions of the missile have been built <b>for the Indian Air Force and the Indian Army.</b></li> </ul>
<b>Akash-NG Missile</b>	<ul style="list-style-type: none"> <li>› Recently, <b>DRDO</b> successfully conducted the maiden test of the New Generation Akash missile (Akash-NG).</li> <li>› Akash-NG is a <b>new generation Surface to Air Missile meant for use by Indian Air Force</b> with the aim of intercepting high manoeuvring low RCS (Radar Cross Section) aerial threats.</li> </ul>
<b>NAG Missile</b>	<ul style="list-style-type: none"> <li>› The final user trial of Nag was <b>successfully carried at the Pokhran range</b> in Rajasthan.</li> <li>› It is India's third-generation, <b>anti-tank guided missile.</b></li> <li>› <b>Features:</b> All-weather, fire-and-forget, lock-on after launch, with an operational range of 500 m to 20 km. It has a single-shot hit probability of 90%.</li> </ul>
<b>Prithvi-II missile</b>	<ul style="list-style-type: none"> <li>› Recently India conducted a successful night testfire of its indigenously developed nuclear capable surface-to-surface Prithvi-II missile. <ul style="list-style-type: none"> <li>● Prithvi-II is <b>capable of carrying 500 to 1,000 kg of warheads.</b></li> </ul> </li> <li>› Prithvi missile have been <b>developed by DRDO under the Integrated Guided Missile Development Programme (IGMDP).</b></li> </ul>
<b>Anti-radiation missile- Rudram</b>	<ul style="list-style-type: none"> <li>› It is <b>first indigenous anti-radiation missile</b> of the country <b>developed by DRDO.</b></li> <li>› Anti-radiation missiles are designed <b>to detect, track and neutralise the adversary's radar, communication assets and other radio frequency sources</b>, which are generally part of their air defence systems.</li> <li>› It can be launched from a <b>height ranging from 500 metres to 15 km.</b></li> <li>› With this, IAF now has the capability to <b>perform SEAD (Suppression of Enemy Air Defence)</b> operations deep into enemy territory to destroy enemy air defence setup.</li> </ul>
<b>Dhruvastra anti-tank guided missile</b>	<ul style="list-style-type: none"> <li>› It is a <b>helicopter-launched Nag Missile (HELINA)</b>, also known as 'Dhruvastra'.</li> <li>› It is a <b>third-generation fire-and-forget-class missile</b> and uses an imaging infrared seeker in lock-on-before-launch mode.</li> <li>› It is <b>indigenously developed by the DRDO.</b></li> </ul>
<b>Quick Reaction Surface-to-Air Missile (QRSAM) System</b>	<ul style="list-style-type: none"> <li>› DRDO successfully test-fired QRSAM from the Integrated Test Range at Chandipur, off Odisha coast.</li> <li>› QRSAM is a <b>short-range surface-to-air missile system, indigenously designed and developed.</b></li> <li>› It provides a protective shield to moving armoured columns of the Army from enemy aerial attacks. <b>It has a range of 25 to 30 km.</b></li> </ul>
<b>Shaurya Missile</b>	<ul style="list-style-type: none"> <li>› India successfully test fired its <b>indigenously developed nuclear capable hypersonic missile 'Shaurya' with a strike range of around 1,000 km.</b></li> <li>› Shaurya is a canister-based system, which means that it is <b>stored and operated from specially designed compartments.</b></li> <li>› Shaurya is a <b>land-based parallel of the submarine launched K-15 missile.</b> <ul style="list-style-type: none"> <li>● The K family of missiles are primarily Submarine Launched Ballistic Missiles, which have been indigenously developed by DRDO and are named after Dr Kalam.</li> </ul> </li> </ul>
<b>Stand-off Anti-tank (SANT) Missile</b>	<ul style="list-style-type: none"> <li>› India <b>has successfully test-fired air-to-surface SANT missile</b> from a roof-top launcher at the Integrated Test Range (ITR).</li> <li>› SANT missile is an <b>upgraded version of the Helicopter Launched Nag (HeliNa) missile</b>, equipped with an advanced nose-mounted seeker.</li> <li>› It is <b>developed by DRDO</b> for the Indian Air Force (IAF).</li> <li>› It will have both Lock-on After Launch and Lock-on Before Launch capability.</li> </ul>
<b>Astra</b>	<ul style="list-style-type: none"> <li>› It is India's first <b>indigenously developed Beyond Visual Range (BVR) Air-to-Air missile.</b> The indigenously developed missile from the DRDO is an all-weather weapon with active Radar terminal guidance.</li> </ul>
<b>Nirbhay</b>	<ul style="list-style-type: none"> <li>› It is India's first <b>indigenously designed and developed long-range subsonic cruise missile</b> with a strike range of over 1,000 kms.</li> </ul>

<b>Brahmos Supersonic Cruise Missile</b>	<ul style="list-style-type: none"> <li>➤ India successfully test-fired <b>land-attack version of BrahMos supersonic cruise missile</b>. <ul style="list-style-type: none"> <li>● Supersonic includes speeds <b>up to five times faster than the speed of sound</b>.</li> <li>● <b>Cruise missiles are Self-propelled till the end of flights</b> and are used to deliver large warhead over long distance with high precision.</li> </ul> </li> <li>➤ The range of the <b>new land-attack version has been extended to 400 km from 290 km</b> but speed has been maintained at 2.8 Mach.</li> <li>➤ BrahMos Aerospace, is an <b>India-Russian joint venture</b> to produce lethal weapons that can be launched from submarines, ships, aircraft and land platforms.</li> <li>➤ <b>Air-launched version and Naval version of the BrahMos missile</b> were also successfully test fired.</li> </ul>
<b>Medium-Range Surface-to-Air (MRSAM) Missile</b>	<ul style="list-style-type: none"> <li>➤ MRSAM, <b>developed by the DRDO in collaboration with Israel Aerospace Industries (IAI)</b> for Army has been tested successfully</li> <li>➤ <b>MRSAM Army version</b> consists of a command-and-control post, multi-function radar and mobile launcher system.</li> <li>➤ The propulsion system, coupled with a thrust vector control system, <b>allows the missile to move at a maximum speed of Mach 2</b>.</li> <li>➤ The weapon has the ability to engage multiple targets simultaneously at ranges of 70km.</li> <li>➤ In May 2019, Indian Navy, DRDO and IAI successfully tested Naval version of MRSAM.</li> </ul>
<b>Submarines</b>	
<b>Scorpene Class Submarine Vagir</b>	<ul style="list-style-type: none"> <li>➤ It is the <b>fifth among the six Kalvari-class submarines</b> being constructed by Mazagon Dock Ltd.</li> <li>➤ <b>Other vessels in the class</b> are INS Kalvari, INS Khanderi, INS Karanj, INS Vela and INS Vagsheer (under construction).</li> <li>➤ Design of Kalvari class of submarines, a class of diesel-electric attack submarines, is <b>based on Scorpene class of submarines with technology transfer from France</b>.</li> <li>➤ These submarines have <b>capability of operating in a wide range of Naval combat</b> including anti-warship and anti-submarine operations, intelligence gathering and surveillance and naval mine laying.</li> </ul>
<b>Ships and other vessels</b>	
<b>INS Vikrant</b>	<ul style="list-style-type: none"> <li>➤ India's Cochin Shipyard Limited (CSL) has completed the basin trials of INS Vikrant.</li> <li>➤ It is India's <b>first domestically built aircraft carrier</b>.</li> <li>➤ It is lead ship of the Indian Navy's Vikrant-class, to be designed and <b>built in India under Indigenous Aircraft Carrier (IAC) program</b>.</li> <li>➤ It <b>operates a ski-jump assisted Short Take-Off But Arrested Recovery (STOBAR) launch systems for launching aircraft</b> and is capable of accommodating MiG 29K fighter jets and helicopters.</li> <li>➤ <b>INS Vishal</b>, also known as Indigenous Aircraft Carrier 2 (IAC-2), is to be the second aircraft carrier to be built in India after INS Vikrant (IAC-1).</li> <li>➤ The proposed design of the second carrier class will be a <b>new design, including an increase in displacement with Electromagnetic Aircraft Launch System (EMALS) and Catapult Assisted Take-Off But Arrested Recovery (CATOBAR) system</b>.</li> <li>➤ <b>INS Vikramaditya (India's only active aircraft carrier)</b> is Indian Navy's largest short take-off, but assisted recovery (STOBAR) aircraft carrier, converted from the Russian Navy's decommissioned vertical take-off and landing (VTOL) missile cruiser carrier.</li> </ul>
<b>Fast Patrol Vessel (FPV) ICGS Kanaklata Barua</b>	<ul style="list-style-type: none"> <li>➤ It is the fifth and last in a series of FPV built by Garden Reach Shipbuilders and Engineers Ltd. <ul style="list-style-type: none"> <li>● <b>Other four are</b> ICGS Priyadarshini (named after Indira Gandhi), ICGS Annie Besant, ICGS Kamala Devi (after Kamala Devi Chattopadhyay), and ICGS AmritKaur.</li> <li>● It is <b>named after a teenage freedom fighter</b> who was shot dead in Assam during the Quit India Movement.</li> </ul> </li> <li>➤ These FPVs are <b>upgraded versions of the inshore patrol vessels</b>.</li> <li>➤ These are <b>suited for patrolling, maritime surveillance, anti-smuggling, anti-poaching operations</b> and for fishery protection, and rescue and search missions.</li> </ul>
<b>Project 17 A</b>	<ul style="list-style-type: none"> <li>➤ Under Project 17A program, <b>a total of seven ships (guided missile frigates) are being built with enhanced stealth features, advanced indigenous weapon and sensor fit</b> along with several other improvements.</li> <li>➤ Recently, <b>Indian Navy's 2nd Project 17A Frigate 'Himgiri'</b> was launched by India's shipbuilder Garden Reach Shipbuilders and Engineers Limited.</li> </ul>



<b>INS Kavaratti</b>	<ul style="list-style-type: none"> <li>➤ INS Kavaratti has been commissioned in the Indian Navy.</li> <li>➤ It is the <b>last of the 4 indigenously built Anti-Submarine Warfare (ASW) stealth corvettes</b> built under Project 28 (Kamorta class) by Garden Reach Shipbuilders &amp; Engineers (GRSE), Kolkata. <ul style="list-style-type: none"> <li>● It joins 3 other ships of the same class namely - <b>INS Kamorta, INS Kadmatt and INS Kiltan.</b></li> </ul> </li> <li>➤ It is <b>named after the capital of the Lakshadweep group of islands and has been constructed using high-grade DMR 249A steel</b> produced in India.</li> <li>➤ It has <b>90% indigenous content</b> with the state-of-the-art equipment and systems to fight in <b>Nuclear, Biological and Chemical (NBC) warfare conditions.</b></li> </ul>
<b>Others</b>	
<b>Light Combat Aircrafts (LCA) Tejas</b>	<ul style="list-style-type: none"> <li>➤ Cabinet approved procurement of <b>83 LCA Tejas from Hindustan Aeronautics Limited (HAL) for IAF.</b> <ul style="list-style-type: none"> <li>● It is the <b>first Buy (Indian-Indigenously Designed, Developed and Manufactured) category procurement</b> of combat aircrafts with an indigenous content of 50%.</li> </ul> </li> <li>➤ Tejas is an indigenously designed, developed and manufactured <b>state-of-the-art modern 4+ generation fighter aircraft.</b></li> <li>➤ It is equipped with operational capabilities like <b>Active Electronically Scanned Array Radar, Beyond Visual Range Missile, Electronic Warfare Suite and Air to Air Refuelling.</b></li> </ul>
<b>Pinaka</b>	<ul style="list-style-type: none"> <li>➤ Recently the <b>first ever pinaka rockets fully manufactured by the private sector</b> have been successfully test fired by the army.</li> <li>➤ Pinaka is <b>indigenous multibarrel rocket launch system</b> developed by DRDO.</li> <li>➤ Each Pinaka rocket is capable of <b>carrying a 100kg payload for a range of 40km.</b></li> </ul>
<b>ABHYAS</b>	<ul style="list-style-type: none"> <li>➤ Abhyas is a <b>High-speed Expendable Aerial Target (HEAT)</b> which is designed and developed by Aeronautical Development Establishment under the DRDO.</li> <li>➤ It is an <b>unmanned aerial vehicle based on microelectromechanical systems (MEMS) navigation system.</b></li> <li>➤ It uses indigenously developed MEMS-based navigation system for its navigation and guidance.</li> </ul>
<b>Smart Anti-Airfield Weapon (SAAW)</b>	<ul style="list-style-type: none"> <li>➤ <b>DRDO</b> successfully test fired SAAW from Hawk-1 jet of Hindustan Aeronautics Limited (HAL).</li> <li>➤ SAAW is <b>indigenously designed stand-off weapon developed</b> capable of engaging ground enemy airfield assets such as radars, bunkers, taxi tracks, and runways etc. up to a <b>range of 100 kms.</b></li> </ul>
<b>Supersonic Missile Assisted Release of Torpedo (SMART)</b>	<ul style="list-style-type: none"> <li>➤ DRDO has <b>successfully flight-tested SMART.</b> It will have a range of over 600 km.</li> <li>➤ SMART is a Torpedo System for <b>Anti-Submarine Warfare (ASW)</b> operations far beyond Torpedo range.</li> <li>➤ Torpedo is a weapon consisting of a <b>self-propelled, self-guided, cigar-shaped underwater projectile</b> that carries a conventional or nuclear warhead.</li> </ul>
<b>Varunastra</b>	<ul style="list-style-type: none"> <li>➤ Recently, first production Varunastra Heavyweight Torpedo was delivered to Indian Navy.</li> <li>➤ Varunastra is a <b>ship launched, heavy weight, electrically-propelled anti-submarine torpedo</b> which is capable of targeting quiet submarines, both in deep and shallow waters.</li> <li>➤ The weapon has a <b>range of 40 kilometers, can travel at a speed of up to 70 kilometers per hour</b> and dive to a maximum depth of 400 meters.</li> <li>➤ It is developed by <b>DRDO.</b></li> </ul>
<b>Network Traffic Analysis (NETRA)</b>	<ul style="list-style-type: none"> <li>➤ It is a software network developed by India's Centre for Artificial Intelligence and Robotics (CAIR) and the DRDO for Intelligence Bureau (IB) and Research and Analysis Wing (R&amp;AW). <b>NETRA can intercept messages</b> with code words like "attack, bomb, blast and kill" and can analyse voice traffic passing through software such as Skype and Google Talk.</li> </ul>
<b>Arjun battle tank</b>	<ul style="list-style-type: none"> <li>➤ It is a <b>third-generation main battle tank developed by the DRDO.</b> The Arjun features a 120 mm main rifled gun with indigenously developed armour-piercing fin-stabilized discarding-sabot ammunition, one PKT 7.62 mm coaxial machine gun, and a NSVT 12.7 mm machine gun.</li> </ul>