Research Paper

Indian Defence Manufacturing Industry: Import Substitution, Self-Reliance and Public Policy

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Abstract

Defence is a cornerstone of national security, essential for safeguarding against both internal and external threats. A robust defence apparatus not only deters adversaries but also enhances a nation's geopolitical standing. In the rapidly evolving landscape of defence manufacturing, India has embarked on a transformative journey since the 1990s. Despite stable trends in military expenditure as a percentage of GDP, indicative of consistent resource allocation, India remains a significant importer of defence equipment. However, efforts to bolster domestic manufacturing have resulted in an 11% reduction in defence imports between 2013-17 and 2018-22. The emergence of India as a defence exporter is evident from the gradual increase in export revenue, reaching an all-time high of INR 16,000 crores (approximately USD 190.69 million) in 2023. India is emerging fast at the global stage as the fastest growing economy aiming to become a developed economy by 2047 with catching up to become a US $ 5 trillion economy shortly. In this context, the paper aims to present the nature and structure of India's defence manufacturing sector since 1990 which is transforming at a fast rate. With ambitious targets set by the government, including a revenue goal of USD 25 billion (INR 2,257.75 billion) by 2025, India aims to strengthen its position in the global defence market. The establishment of defence industrial corridors in Tamil Nadu and Uttar Pradesh underscores the government's commitment to fostering Indigenous defence production. Key players in India's defence manufacturing sector include Defence Public Sector Undertakings (DPSUs) such as Hindustan Aeronautics Limited (HAL) and Bharat Electronics Limited (BEL). However, the study reveals a disparity in R&D investments among production agencies, with most relying on the Defence Research and Development Organization (DRDO). Encouraging private sector participation is pivotal in augmenting the capabilities of DPSUs and fostering innovation in defence technologies. Through transformative public policies, the Indian government aims to fortify national borders while bolstering national income. By incentivizing private sector involvement and prioritizing domestic procurement, India seeks to achieve self-reliance in defence production.

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INTRODUCTION

The defence manufacturing sector in India is pivotal for fostering self-reliance, promoting indigenous technology, and minimizing import dependencies. This quest for autonomy is not merely strategic; it's fundamental for the country's economic resilience and security. Minimizing foreign dependency enables India to maintain sovereign decision-making and mitigate external influences or disruptions in global supply chains. Furthermore, nurturing the domestic defence industry stimulates economic growth, job creation, innovation, and technological advancements across multiple sectors. By investing in research, development, and innovation, India can tailor defence solutions to its specific requirements and operational environments. Encouraging import substitution also strengthens the national industrial base, conserves financial resources domestically, and enhances economic independence. This study aims to evaluate the defence sector's impact on India's economic expansion and its role in realizing the ambition of a USD 5 trillion economy. It investigates defence spending patterns and the ratio of services in total defence expenditures since 1991, explores the dynamics of Defence Public Sector Undertakings (DPSUs) and their sales trends from 1990, and identifies challenges hindering the growth of the indigenous defence industry. Additionally, the paper aims to study the changes in India's arms exports as a strategy to boost the defence sector, highlighting how increased arms exports can contribute to the sector's growth and the nation's economic development. The analysis concludes with a review of the Indian government's reform measures under the "Atmanirbhar Bharat" (self-reliant India) initiative, designed to empower and invigorate the defence manufacturing sector. This comprehensive approach not only addresses the internal factors affecting the defence sector but also positions India's defence exports as a key element in strengthening the country's defence industrial base and achieving its economic goals.

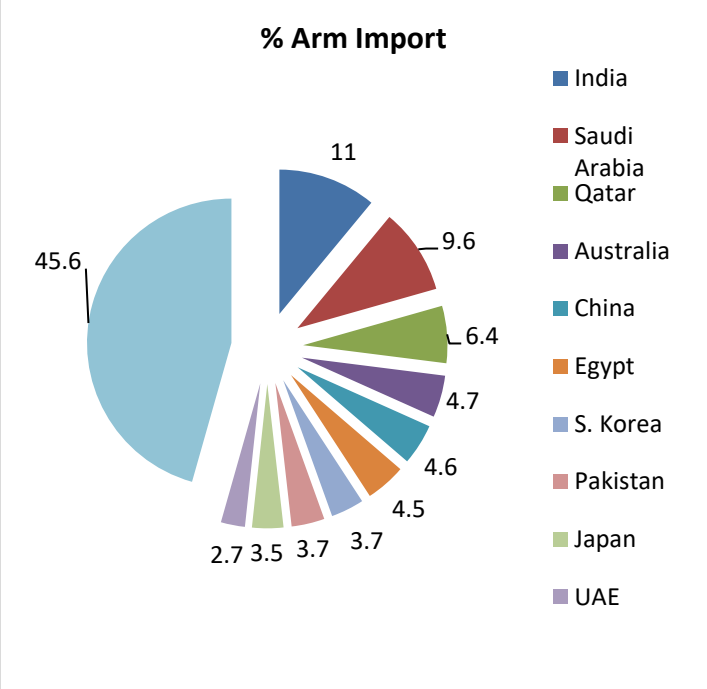
The ambitious goal of propelling India's economy to USD 5 trillion by the fiscal year 2024-25, as outlined by the finance minister, builds on the current GDP of USD 3.7 trillion. India crossed the USD 1 trillion GDP milestone in 2009, supported by a 1.22[1] billion population. At that time, the nation's annual budget was around USD 38.79 (INR 1893.81), with an active military strength of 2.62 million. By 2014, the GDP nearly doubled to USD 1.97 trillion (INR 125.71 trillion), with a defence budget of USD 50.91 billion (INR 3.1 trillion) and an active military personnel count of 2.74 million.[2] By 2019, these figures further increased to a GDP of USD 2.69 trillion (INR 188.3 trillion), a defence budget of USD 71.47 billion (INR 5.03 trillion), and a military force of 3.04 million.[3] To safeguard its growing economy, India is enhancing its military capabilities and increasing defence expenditure. From 2009 to 2019, the defence budget saw an 84% rise, with a modest 16% increase in active military personnel. The defence minister emphasized the need for greater private-sector involvement in defence manufacturing to meet the economic goal of USD 5 trillion by 2024.[4]

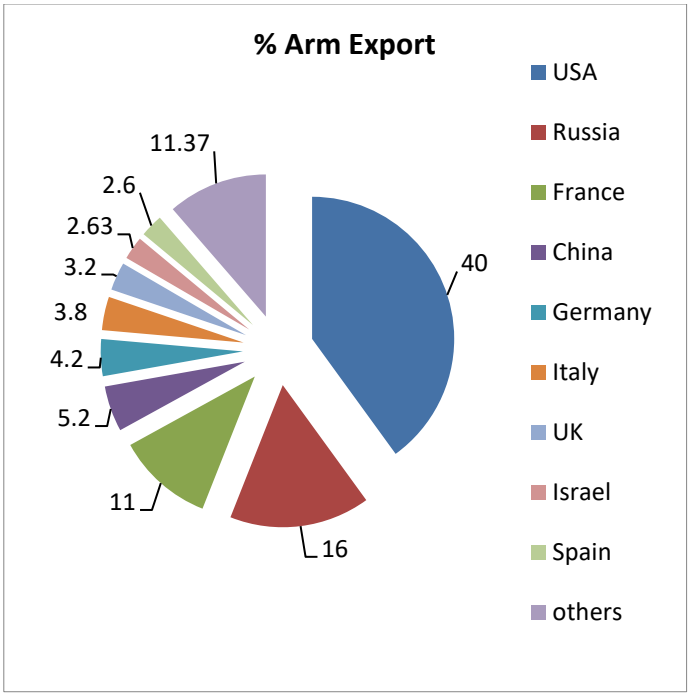
The manufacturing sector, buoyed by initiatives like Make in India and policies to boost the digital economy and human capital, holds substantial potential for contribution. The Make in India initiative promotes domestic industry participation in defence contracts through measures such as expanding local business opportunities in tenders, simplifying industrial licensing; raising the FDI limit, easing defence export regulations, enhancing the defence offset policy, and encouraging start-up and SME engagement.[5]

Defence production aims to meet armed forces' needs while boosting export capabilities. DPSUs are urged to allocate 25% of their turnover to exports, with the government providing credit lines and grants to friendly nations.[6] Additionally, the government has relaxed foreign equity restrictions, inviting more investment into the defence sector. India's pursuit of defence industrial self-reliance since independence includes licensed production of Western and Soviet defence platforms from 1950, indigenous manufacturing of jet engines by 1957, and development of combat aircraft, jet trainers, rifles, and radar in the 1960s with international technological support.[7]

Despite being a major arms importer, India reduced its arms imports by 11% between 2013-2017 and 2018-2022[8], reflecting a strategic shift towards diversifying suppliers and domestic production, as per the Stockholm International Peace Research Institute. This shift aims to enhance national security in the face of diverse challenges and commitments, underscoring the significance of indigenous defence capabilities in India's strategic framework.

Figure 1: Percentage of Arms imports and Exports from India 2018-22





Gupta (1990) [39] examined the state of the Indian arms industry and explored its challenges and potential for growth. To achieve the primary goal of efficiency and profitability, the Indian arms industry would have to do away with high-tech projects for the time being, as it could lead to wastage of valuable resources. The government should have tried to ensure that a major part of armed purchases was made from the country's ordinance factories and the private sector if they aimed to have a cost-efficient arming industry. Kaushal's (1995) [40] analysis, akin to Gupta's, focused on the prospect of reducing India's defence budget, noting its significant escalation over the years, making India one of the world's largest defence spenders. He identified key components of the defence budget, emphasizing that a substantial portion is allocated to salaries and allowances for the expansive 1.2 million-strong army. Mohanty's (2004) [8] examined India's defence industry and its potential for development in the 21st century; he highlighted India's historical dependence on defence imports, hindering the growth and autonomy of its defence sector. Emphasizing the need for strategic independence, He advocated for the development of indigenous defence capabilities. Behera (2009) gave an overview of India's defence expenditure, highlighting its steady growth over the years. The author examined India's defence spending from global and neighborhood perspectives and also the allocation of resources for the defence of national resources. Bitzinger (2014) [41] concluded that despite having the largest and most ambitious defence industrial base in the Asia Pacific region and the developing world, India's defence industry has underperformed in the past 15 years**.** Das (2019) [42] emphasized the imperative of fostering a resilient defence industry in India to meet national security needs and diminish reliance on imports. He highlighted the pivotal role of the Defence Procurement Procedure (DPP) in transforming the industry but also outlined challenges such as budget constraints, underperformance of DPSUs/Ordnance factories, limited participation in research and development, insufficient foreign direct investment (FDI), outdated production structures, delays in procurement, and a lack of a robust defence ecosystem.

While previous studies have examined various aspects such as the escalation of defence spending, reliance on imports, and the potential for indigenous defence capabilities, there is a need for a more integrated approach that addresses these issues holistically. Additionally, there is a dearth of analysis on the comparative performance of India's defence industry vis-à-vis its counterparts in the Asia Pacific region and globally, considering factors such as innovation, competitiveness, and export potential. Addressing this gap would provide valuable insights for policymakers, industry stakeholders, and researchers aiming to enhance India's defence industrial base and strengthen its position as a major playerin the global defence market to catch the target of 5 trillion.

The structure of the paper is as follows: After the present section on introduction, section 2 presents the evolution of the defence industry during the Pre-Independence and post-independence times. In Section 3, the Rationale of data sources and the methodology used in the paper is presented. Section 4 presents the trends of defence expenditure in India along with the share of services since 1990-91. In Section5, the nature of Trend Analysis of DPSUs is presented followed by Section 6 on Defence Exports and recent policy initiatives to boost the Indian defence sector. The last section concludes the study.

Evolution of India's Defence Industry: A Historical Analysis

The development of the defence industry since India gained independence has been thoroughly detailed by Mohanty in his work. He skillfully outlines the progression and advancements in the sector over the years. The history of India's defence industry traces back to the early 19th century with the establishment of the Gun Carriage Agency in 1801. However, during the pre-independence era, India's defence industrial structure was limited, primarily focusing on repair and overhaul activities for essential weapon systems. The British colonial rulers maintained strategic capabilities for themselves, relegating Indian industries to a subordinate role. For instance, the Walchand Aircraft Factory in Bangalore primarily undertook aircraft repair and maintenance under the management of the US Air Force during World War II.[9]

Post-independence, there was a notable expansion in the scale and capability of India's defence industries. Pre-existing entities like the Mazagaon Docks in Mumbai and the Garden Reach Shipyard in Calcutta, originally focused on warship repairs, saw significant development. Similarly, the 16 ordnance factories established before independence primarily

aimed to complement British-produced land-based weapons and equipment.[10]

Following independence, India prioritized self-sufficiency across all sectors, including defence, leading to the creation of a comprehensive defence industrial infrastructure. The Defence Research and Development Organization (DRDO) was established in 1958, overseeing defence R&D activities, while Defence Public Sector Undertakings (DPSUs) managed production establishments under governmental control. Initially, no new defence factories were built, but in the late 1950s, recognizing the need for expansion, new facilities were established. However, the Indo-Pak war in 1947-48 underscored the nation's defence inadequacies.

The 1962 Indo-China conflict exposed significant gaps in India's defence capabilities, prompting a strategic reassessment and urgent efforts to enhance military preparedness and modernize defence infrastructure. Challenges in acquiring suitable fighter aircraft from the international market were compounded by complexities surrounding US-supplied F-104 aircraft in Pakistan's possession. The Soviet Union emerged as a crucial ally, providing support through MIG-21 aircraft and other weaponry, bolstering India's indigenous defence manufacturing capabilities significantly.[11]

Post-1962, India embarked on an ambitious mission to address defence industry shortcomings and increase domestic production. Key initiatives included establishing ordinance factories, which expanded in number throughout the following decades. By the mid-1990s, India's defence acquisitions heavily relied on Soviet military suppliers, constituting over 70% of total weapon acquisitions.

An additional milestone was the inauguration of the 40th ordinance factory in Nalanda, Bihar, signalling India's commitment to bolstering its defence manufacturing capabilities.[12] This expansion aimed to address the heightened demand for defence hardware, with the total number of factories reaching 41, distributed across 24 different locations, Maharashtra emerged as the state with the largest concentration of factories, with 10 establishments, followed by Uttar Pradesh, reflecting a geographically diversified approach to defence production.[13]

These ordinance factories were strategically categorized into distinct groups, focusing on ammunition and explosives, weapons, vehicles and equipment, materials and components, and armoured vehicles, thereby facilitating efficient production processes.[14] The overall performance of the ordinance factories during this period was deemed modest, with a predominant focus on producing relatively low to medium-technology items.

METHODOLOGY: RATIONALE OF DATA SOURCES

This study relies on secondary data sources spanning from 1990 to 2022, with a focus on the defence sector using data from annual reports from the Ministry of Defence, reports from major defence public sector units, and periodic reports from the Comptroller and Auditor General of India to delve into the nature, trends, and structure of Indian defence manufacturing.

Additionally, the study incorporates secondary sources like SIPRI, a renowned Stockholm-based think tank, served as the primary data collector since 1966, offering reliable data on the defence industry. Their extensive database covers information from 1949 for around 190 countries, making it an invaluable resource for researchers. Utilizing data from international organizations such as the World Bank, SIPRI Yearbooks, and IISS, the present research draws on databases, like SIPRI Military Expenditure Database and the SIPRI Arms Transfers Database. Particularly, the latter provides comprehensive information on international arms transfers since 1950, aiding in monitoring and measuring the global flow of major conventional arms. The present study also focuses on Indian defence exports, employing SIPRI data from 2010 to 2023. By leveraging this dataset, the research aims to analyze the trends and patterns in India's defence exports over the specified period. Renowned for its comprehensive and objective methodology, SIPRI data enjoys widespread recognition among researchers for its reliability.

Trends of defence expenditure and share of services since 1990-91

Despite facing criticism for what some view as unnecessary spending, countries around the globe persist in dedicating substantial funds to support their defence capabilities, emphasizing the persistent significance of military strength in governmental and security planning.

Trends in India’s defence expenditure

In the realm of defence economics, it is important to assess the amount of military expenditure as a percentage of GDP that signifies the priority of defence spending in the national economy. Over the past two decades, the trends of military expenditure as a percentage of Gross Domestic Product (GDP) have remained relatively stable, hovering around 2%. This consistency in the ratio reflects a consistent allocation of national resources towards defence, indicative of the government's commitment to national security. In absolute figures, the expenditure has shown significant growth over the years. For instance, in 1991, the military expenditure stood at Rs 15426.48 crore, which increased to Rs 49622.04 crore in 2000-2001, marking a notable 3.21% increase over the decade. Subsequently, in the fiscal year 2010-2011, there was a remarkable 3.10-fold increase in expenditure compared to 2000-2001. Similarly, ten years later, in 2020-2021, the allocation witnessed a substantial increase, rising by 2.20 % times compared to the expenditure a decade earlier.

Another significant metric involves the comparison of military expenditure with the central government expenditure, providing insights into the portion of government revenue specifically earmarked for defence-related activities. This comparative analysis sheds light on the prioritization of defence spending within the broader spectrum of governmental financial allocations. Despite these increases in

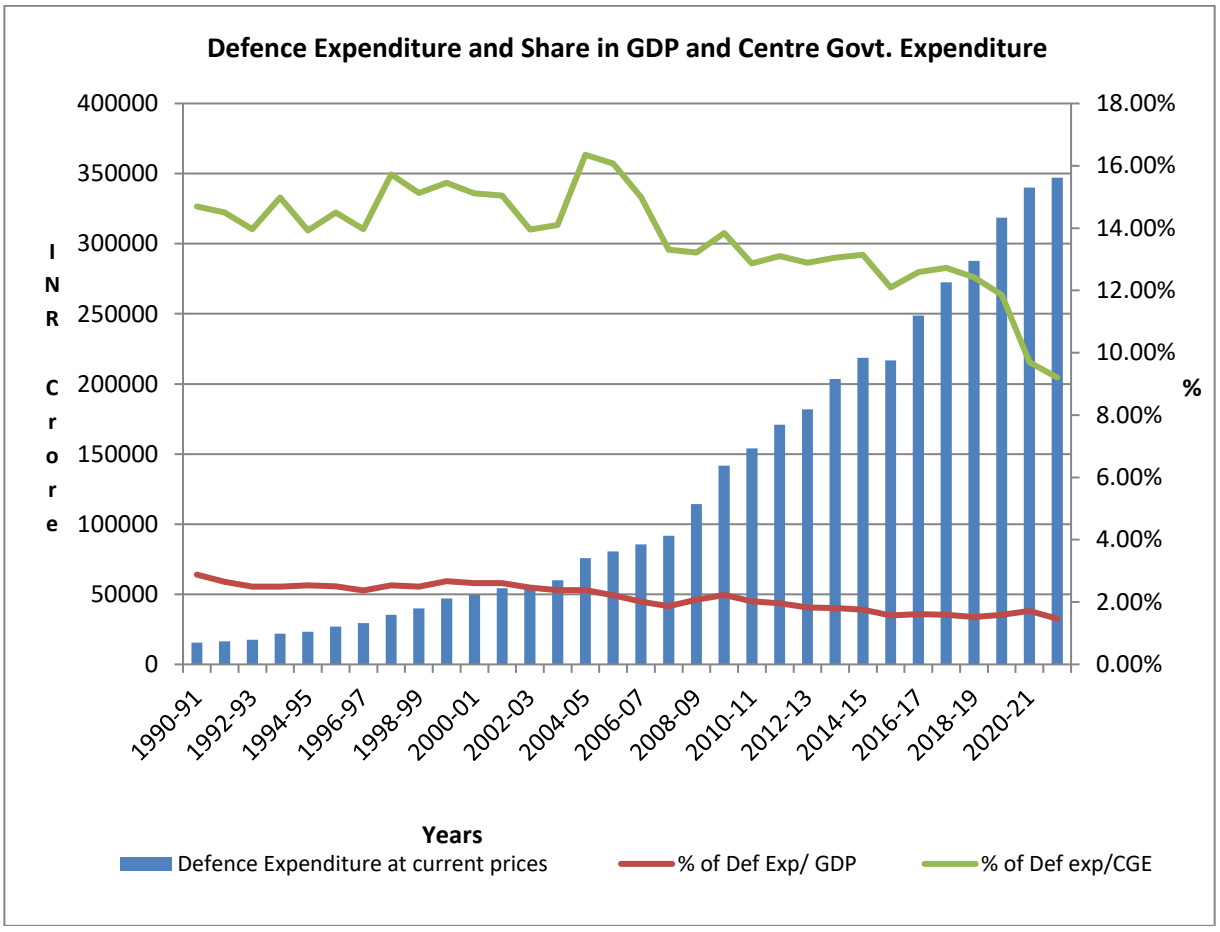
absolute figures, the percentage of military expenditure relative to the central government's total defence expenditure has remained relatively consistent, ranging from 14% to 15% over the past two decades. This suggests a balanced approach in allocating government resources, with defence receiving a consistent share of the overall expenditure. Such stability in the percentage allocation underscores the government's prioritization of defence spending within the broader fiscal framework, ensuring a steady commitment to national security objectives.

Table 1: Defence Expenditure, GDP and Centre Government Expenditure (1990-91 to 2021-22)

Financial year	Defence Exp as a percentage of GDP	Population in Mn	Armed Forces in Thousands	Defence expenditure as a percentage of Central Govt. Expenditure
1990-91	2.88%	870	1260.00	14.70%
1995-96	2.50%	964	2149.50	14.50%
2000-01	2.61%	1,060	2372.00	15.12%
2005-06	2.22%	1,155	3047.00	16.07%
2010-11	2.02%	1,241	2625.59	12.87%
2015-16	1.57%	1,323	2798.80	12.10%
2016-17	1.62%	1,339	2981.05	12.59%
2017-18	1.59%	1,354	3031.00	12.72%
2018-19	1.52%	1,369	3026.50	15.66%
2019-20	1.59%	1,383	3045.00	15.51%
2020-21	1.72%	1,396	3068	12.37%
2021-22	1.47%	1,408	0	11.91%

Source: 1. Economic Survey of India, Govt. of India, for relevant years. **2.** Defence service estimates: Govt. of India for the relevant year

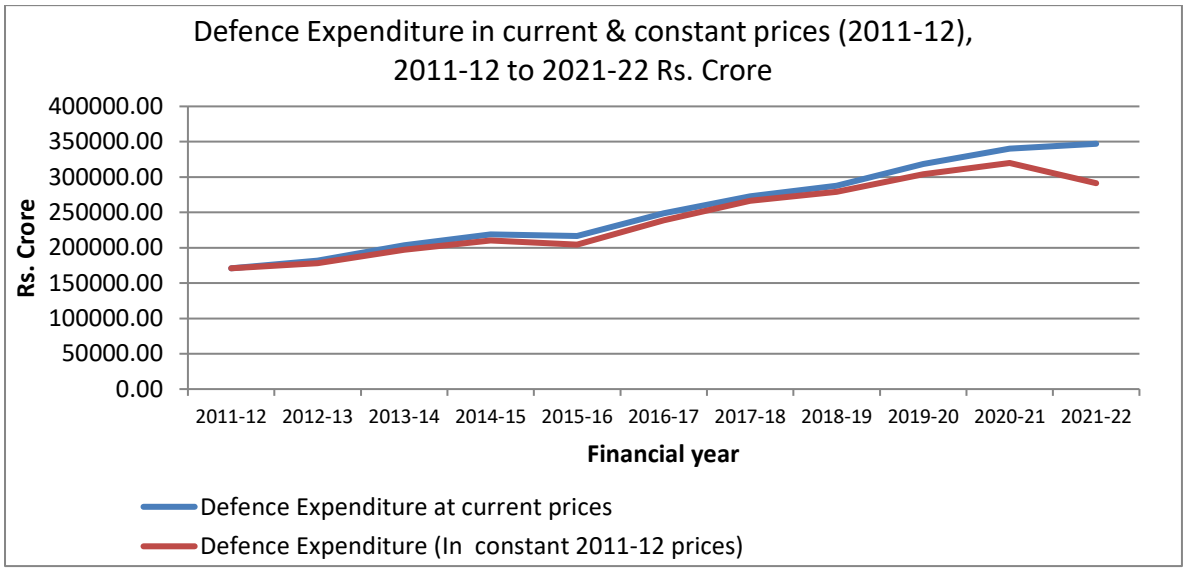
Figure 2: India-Defence Expenditure trends



Source: Same as Table No.1

Figure 2 reveals a consistent upward trend in defence expenditure over the observed period, starting from INR 15,426.48 crore in 1990-91 and reaching INR 451704 crore in 2021-22. This trend reflects the government's sustained commitment to strengthening national defence capabilities. The percentage of GDP allocated to defence expenditure fluctuates over the years, ranging from 1.47% in 2021-22 to 2.67% in 1999-2000. While there are fluctuations, the allocation generally remains within a range of 1.5% to 2.5%, indicating a consistent commitment to defence spending relative to the size of the economy. The proportion of defence expenditure relative to Centre Government Expenditure varies, with values ranging from 11.91% in 2021-22 to 16.35% in 2004-05. This suggests fluctuations in the priority placed on defence spending within the overall government budget over the years. The Gross Domestic Product (GDP) figures demonstrate a steady increase over the years, reflecting overall economic growth and development in India. The GDP has grown from INR 5, 35,534 crores in 1990-91 to INR 23,64,637 crore in 2021-22, indicating robust economic expansion. The analysis highlights the complex interplay between defence expenditure, economic growth, and fiscal management. While sustained defence spending reflects the government's commitment to national security, fluctuations in the allocation of resources relative to GDP and CGE may indicate shifting policy priorities or economic conditions.

Figure 3: Defence Expenditure in India: Current and Constant Prices (2011-12)



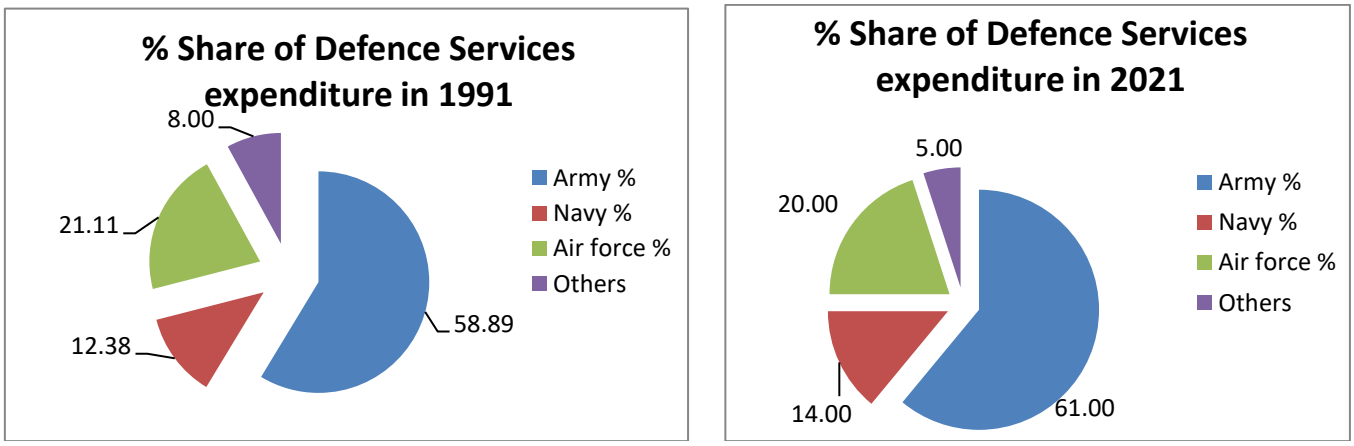
Source: Defence Service Estimates, Government of India, for relevant years, Economic Survey, Government of India, for relevant years, Defence Service Estimates, Government of India, for relevant years

Table 2: Defence Expenditure: Share of Army, Navy and Air Force (1990-91 to 2020-21) (In Crores)

Financial Year	Army	Navy	Air Force	Others	Grand Total	Army %	Navy %	Air force %
1990-91	9275.00	1949.98	3325.27	1199.75	15750.00	58.89	12.38	21.11
1995-96	15388.50	3797.48	6931.28	444.74	26562.00	57.93	14.30	26.09
2000-01	30649.67	7384.23	10610.73	977.35	49621.98	61.77	14.88	21.38
2005-06	39458.03	13966.99	21703.92	5420.04	80548.98	48.99	17.34	26.94
2010-11	78239.69	27119.20	38176.49	10581.33	154116.71	50.77	17.60	24.77
2015-16	114329.37	34866.73	52219.27	15257.96	216673.33	52.77	16.09	24.10
2016-17	142293.30	37133.65	53271.23	16011.81	248709.99	57.21	14.93	21.42
2017-18	154655.74	38833.63	62310.79	16759.73	272559.89	56.74	14.25	22.86
2018-19	154902.00	40420.00	64591.00	19392.00	279305.00	55.46	14.47	23.13
2019-20	171023.00	45368.00	68949.00	19956.00	305296.00	56.02	14.86	22.58
2020-21	179415.00	49623.00	73245.00	20770.00	323053.00	55.54	15.36	22.67
2021-22	275539.44	63238.56	90340	22585.20	451704	61.00	14.00	20

Source: Annual Report Ministry of Defence, Govt. of India for relevant years. Defence service estimates: Govt. of India for relevant years

Figure 4: Defence expenditure on Army, Navy and Air Force (1991 and 2021)



Source: Same as Table 2

Table 2 illustrates the allocation of defence expenditure across various branches and categories from the fiscal year 1990-91 to 2021-22. Over this period, there has been a discernible upward trend in total defence spending, starting at 15,750 crores in 1990-91 and reaching 4, 51,704 crores in 2021-22. The Army consistently commands the largest share of expenditure, followed by the Air Force and Navy. Figure 4 clearly shows that while the Army's percentage share has fluctuated, it has generally remained above 50%, peaking at 63.76% in 1999-00. The Navy and Air Force have seen steady growth in expenditure, indicating investments in naval and aerial capabilities. Despite fluctuations, the "Others" category remains relatively small compared to the main branches. Notably, there has been a significant increase in defence spending in recent years, particularly from 2019-20 to 2021-22, reflecting heightened allocations in defence budgets. In 2021-22, the Army's share is 61%, the Navy's at 14%, the Air Force's at 20%, and the "Others" category at 5%. This analysis provides valuable insights into defence expenditure allocation trends, informing future policy decisions and resource allocation.

Trend Analysis of DPSUs

The country boasts a substantial industrial base with a long history of defence production, *i.e.*17 Defence Public Sector Undertakings (DPSUs), including 7 newly established ones as of October 2021[1]through the corporatisation of the former 41 Ordnance Factories under the Ordnance Factory Board, operating under the administrative control of the Ministry of Defence.[15] Today, DRDO is a network of around 41 laboratories and 05 DRDO Young Scientist Laboratories (DYSLs) which are deeply engaged in developing defence technologies covering various disciplines, like aeronautics, armaments, electronics, combat vehicles, engineering systems, instrumentation, missiles, advanced computing and simulation, etc. are on hand and significant achievements have already been made in several such technologies.[16]

Table 3: Trend Analysis of DPSUs **(**value of production from 1990-91 - 2021-22)

	1990/91	2000/01	2010/11	2020/21	2021/22	CAGR
HAL	895	2603	16451	20044	23769	11%
BEL	700	1788	5521	13947	15044	10%
BDL	120	219	911	2043	2902	11%
BEML Limited	779	1343	3769	3556	3993	5%
MIDHANI	47	114	485	712	1014	10%
MDL	309	712	2611	4042	5733	10%
GRSE	187	491	1053	1133	1748	7%
GSL	68	190	990	827	704	8%
OFB	25109	5522	15390	22389	16998	-1.25%
Total	3104	12981	47181	46303	54907	10%

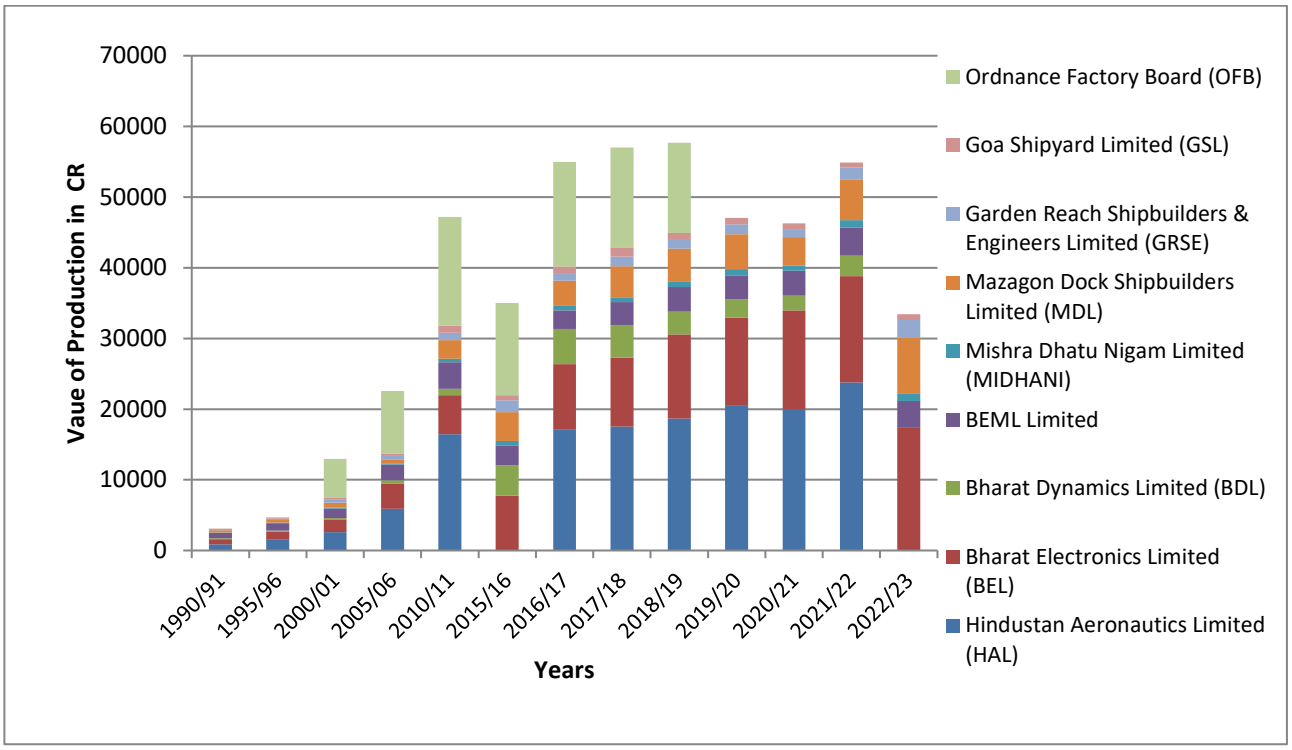
Source: IDSA database,Annual Report, Ministry of Defence, Govt. of India, for relevant years.
Annual report Ordinance factories & DPSUs, for relevant years.

[1]**a.** Advanced Weapons and Equipment India (AWE) Limited, Armoured Vehicles Nigam Limited (AVANI), Gliders India Limited (GIL)India Optel Limited (IOL), India Optel Limited (IOL)Troop Comforts Limited (TCL)**, Yantra** India Limited (YIL)

Note:
1. OFB is the Ordinance Factories Board.
2. DPSU is the Defence Public Sector Unit.
3. CAGR is calculated asCAGR = (Ending Value / Starting Value) ^(1 / Number of Years) – 1. Multiply the result by 100 to express the CAGR as a percentage.

Value of production refers to the financial value of items produced in a year and is different from sales. In some years, the industry especially shipyards doesn't provide sales figures as they are less the value of production.DPSUs and ordnance factories were established over time to assume the responsibility of designing and integrating defence weaponry and equipment under the Department of Defence Production.Among the 16 DPSUs, Hindustan Aeronautics Limited (HAL) stands out as the largest, consistently leading in production value compared to other defence public sector units in India. The compounded annual growth rate of 11% was high for both HAL and BDL followed by BEL, MIDHANI, and MDL with 10% CAGR.

Figure 5: Value of Production in OFB and DPSUs (1990-91 to 2021-22)



Source: Same as Table 3

Figure 5 shows that overall, there's a clear increasing trend in the value of production for most companies over the years, reflecting growth in the defence sector. Hindustan Aeronautics Limited (HAL) consistently appears as one of the highest producers throughout the years, indicating its significant role in the aerospace industry. Bharat Electronics Limited (BEL) and Bharat Dynamics Limited (BDL) also show consistent growth, highlighting their importance in defence electronics and missile systems respectively. Other companies like Mazagon Dock Shipbuilders Limited (MDL) and Garden Reach Shipbuilders & Engineers (GRSE) show fluctuations, possibly due to the nature of shipbuilding contracts and market demand. OFB's production value is significant and generally shows an increasing trend, suggesting its crucial role in supplying arms, ammunition, and equipment to the Indian armed forces. There are notable periods of rapid growth across companies, particularly in the late 2000s and early 2010s, which could be attributed to increased defence spending, modernization initiatives, or government policies promoting indigenous production. The years following 2014 also show significant growth for some companies, likely influenced by initiatives such as Make in India and efforts to boost domestic defence manufacturing capabilities.

Table 5: DPSUs select indicators (2020-21)

Company	Year of Incorporation	Revenue (INR billion) @	No. of Employees	R&D Expenditure (INR Bn)	Exports ($INR Mn)	Major Production	Defence Sales (%)	Civil Sales (%)
Hindustan Aeronautics Limited	1963	227.55	20,044	14.64	2175.6	Aircraft (LCA Tejas, Dhruv, LUH, LCH), helicopters, aero-structures, engines, avionics and systems	85%	15%
Bharat Electronics Limited	1954	140.64	9,172	8.87	3728.4	Radar systems, communication systems, electronic warfare systems, missile electronics and subsystems, naval systems	75%	25%
Bharat Dynamics Limited	1970	19.14	2,812	0.53	781.2	Missiles (anti-tank, air defence, surface-to-air, guided bombs), rocket systems, underwater weapons	90%	10%
BEML Limited	1964	35.57	6,053	0.71	282.4	Earth moving equipment, construction equipment, tank transporters, armored mine protected vehicles	80%	20%
Mishra Dhatu Nigam Limited	1972	8.13	763	0.3	194.2	Specialty metals and alloys (titanium, nickel, beryllium, zirconium), super alloys, special steels	50%	50%
Mazagon Dock Shipbuilders Limited	1960	40.48	5,989	0.85	0	Warships (frigates, corvettes, fast attack craft, patrol vessels), offshore patrol vessels, landing craft and auxiliary vessels, commercial ships	65%	35%
Garden Reach Shipbuilders & Engineers Limited	1960	11.41	1,900	0.12	874.9	Warships (destroyers, stealth frigates, submarines), offshore platforms	70%	30%
Goa Shipyard Limited	1955	8.60	1,389	0.1	3.3	Offshore patrol vessels, fast attack craft, landing craft and auxiliary vessels, commercial ships	60%	40%
Ordnance Factory Board	1801	223.89	80,000	2.04	6880	Ammunition (small arms, artillery shells, bombs, grenades, rockets, mortars, fuses, propellants, explosives)	95%	5%
Hindustan Shipyard Limited	1952	3.93	827	0	4.88	Cargo liners, bulk carriers, passenger vessels, offshore platform vessels, inshore platform vessels, survey vessel,		
New DPSUs	2021	170$	77199*	0.91#	946.1	Ammunition and explosives, Vehicles, Weapons and equipment, Troop comfort items, Military-grade components and ancillary products, Opto-electronics items, Parachutes		

Source: IDSA Annual Report, Ministry of Defence, Govt. of India, for relevant years, Annual report Ordinance factories & DPSUs, for relevant years

Notes:
Revenue from Operations (net) 0,
* As of Jan 2021,
# As of 2018-19,
$ Projected target

Table 5 presents a comprehensive overview of various Indian defence public sector undertakings (DPSUs) and their key operational metrics, encompassing revenue, employee strength, research and development (R&D) expenditure, exports, major production areas, and the distribution of defence and civil sales percentages. Notably, manufacturing entities within the public sector have traditionally shown limited enthusiasm towards innovation. Except for HAL and BEL, other production agencies allocate minimal funds towards research and development (R&D). Consequently, the responsibility for defence research predominantly falls on the Defence Research and Development Organization (DRDO).

Among the notable entities listed, Hindustan Aeronautics Limited (HAL) emerges as a significant player, with a substantial revenue of INR 227.55 billion and a workforce of 20,044 employees. HAL's robust R&D expenditure of INR 14.64 billion underscores its commitment to innovation, contributing to its diverse portfolio encompassing aircraft, helicopters, aerostructures, engines, and avionics. Notably, HAL exhibits a strong focus on defence sales, constituting 85% of its revenue, with the remaining 15% attributed to civil sales. HAL Exports gas turbines, spare parts, avionics and software for various fighter aircraft, transport aircraft and helicopters. DPSUs are also exporting defence equipment from India.Bharat Electronics Limited (BEL) also commands attention, boasting revenue of INR 140.64 billion and a workforce of 9,172 employees. With an R&D expenditure of INR 8.87 billion, BEL specializes in radar systems, communication systems, electronic warfare systems, and missile electronics. The company allocates 75% of its revenue to defence sales, while 25% caters to civil sales. Similarly, Bharat Dynamics Limited (BDL) operates in the realm of missiles and rocket systems, generating revenue of INR 19.14 billion and employing 2,812 individuals. BDL's strong focus on defence is evident, with 90% of its revenue stemming from defence sales. The Ordnance Factory Board (OFB), with a rich history dating back to 1801, boasts significant revenue of INR 223.89 billion, supported by an extensive workforce of 80,000 employees. OFB specializes in ammunition production, with defence sales accounting for a substantial 95% of its revenue. The significant move towards corporatization, initially proposed in 2005, aims to enhance efficiency, autonomy, and innovation in defence production, aligning with its broader national security objectives and global aspirations as a net security provider within Defence Public Sector Undertakings (DPSUs). By transitioning into corporate entities, the new DPSUs gain the freedom to operate with a profit motive and are held accountable for their performance. The recent conversion of ordnance factories into new DPSUs underscores a strategic alignment with different specializations, ranging from ammunition and explosives, vehicles, weapons, troop comfort items, military-grade components, and optoelectronic items.

Moreover, the table introduces New DPSUs, established in 2021, with a workforce of 77,199 individuals. DPSUs continue to play a pivotal role in India's defence production landscape. Additionally, various other public sector undertakings (PSUs) and government-sponsored joint ventures contribute to defence production and quality monitoring. Notably, entities like Cochin Shipyard Limited have played a significant role in constructing India's indigenous aircraft carrier, reflecting the diverse capabilities within the PSU ecosystem.[17] Overall, the data underscores the critical role played by Indian DPSUs in the defence sector, with a strong emphasis on indigenous production, innovation, and a significant contribution to the country's defence capabilities. Additionally, the allocation of resources towards R&D highlights the sector's commitment to technological advancement and self-reliance in defence manufacturing.The pivotal role of ordnance factories in catering to the needs of the Indian army is evident, with the army accounting for 80% of the total output in 2017-18. Notably, several defence public sector undertakings (DPSUs), including Hindustan Aeronautics Limited (HAL), Bharat Electronics Limited (BEL), and Mazagon Dock Shipbuilders Limited (MDL), are listed on the stock exchange, underscoring their corporate status and market presence. Moreover, the listing of DPSUs on stock exchanges serves the purpose of enhancing corporate governance and fostering greater accountability within these entities. In a global context, Indian defence DPSUs such as HAL, BEL, and MDL have made notable strides, featuring in the list of top 100 arms-producing companies according to a report released by SIPRI in 2022. Despite ranking 41st, 63rd, and 89th respectively, with significant arms sales figures, these entities collectively represented a mere 1% of the global arms sales of $597 billion, highlighting the dominance of US and Chinese companies in the arms market.[18] The current incapacity of the public sector to fulfil the escalating needs of the Indian armed forces has led to reliance on external suppliers. Notably, not all sales made by the public sector are directed towards defence purposes; a significant portion is allocated to non-defence clients and exports. For instance, in the fiscal year 2021-22, approximately 22% of BEL's sales turnover, the second-largest defence company in India, originated from non-defence segments.[19] Similarly, around 15% of the Ordnance Factory Board's total sales value was attributed to clients outside the Indian armed forces. The import dependency of the Indian public sector is exemplified by HAL, India's largest defence company. As per reports presented to the Indian parliament, HAL has achieved an indigenous content exceeding 50% across most platforms it currently manufactures, indicating a notable level of self-reliance.[20] However, there remains a crucial need for the indigenization of materials, an area where HAL's capacity falls short. In another domain, the Indian public sector has demonstrated significant strides in indigenization, particularly in warship construction. Domestic shipyards have attained an impressive 80% indigenization level in the latest iterations of destroyers and frigates. Furthermore, the maiden aircraft carrier INS Vikrant, constructed by CSL, boasts an indigenization level of 76%.[21]

Defence exports & Recent Policy initiatives

The significance of the domestic defence industrial base (DIB) was accentuated during the Kargil War of 1991 when India faced challenges due to its reliance on external arms assistance. The Vajpayee government played a crucial role in liberalizing the defence industry in 2001, subsequently opening it up to private enterprises. This move paved the way for a surge in defence exports from India. Emphasizing the importance of indigenous development for achieving battlefield superiority, Prime Minister Narendra Modi reiterated the need for domestic innovation and manufacturing capabilities. The government's Make in India and

Atmanirbhar Bharat initiatives have been central to fostering industrial growth and self-reliance, with a focus on job creation in the defence sector. Currently, India's 100 defence companies are exporting defence products to over 85 friendly foreign countries across Africa, South Asia, Southeast Asia, and West Asia, showcasing the nation's growing prowess in designing, developing, and manufacturing defence solutions for the global market. [22] While India remains the largest importer of arms globally, its emergence as a significant exporter signifies a crucial development towards achieving strategic autonomy and self-reliance in the defence sector. On April 1st, 2023, Prime Minister Narendra Modi praised the upsurge in defence exports, attributing it to India's talent and enthusiasm for the Make in India initiative.[23] The Government also lauded this achievement, expressing confidence in the continued exponential growth of defence exports. The increase in defence exports is primarily a result of enhanced collaboration with the private sector. The Ministry of Defence has undertaken important steps to facilitate and encourage exports. The Export Promotional cell in the Department of Defence Production has been created for this purpose. India achieved considerable growth in exporting defence equipment from 2015 to 20. India's Defence exports grew from around Rs 2000cr to Rs 9000cr [24] Exports of globally competitive Indian defence products will no doubt help economies of scale and spur qualitative improvement in indigenous defence production. Defence export earnings can contribute to financing portions of the state's defence spending and supporting research and development in the sector, all without detracting from other key developmental initiatives. This is particularly significant for a nation like India, which allocates significant funds to welfare programs and subsidies.

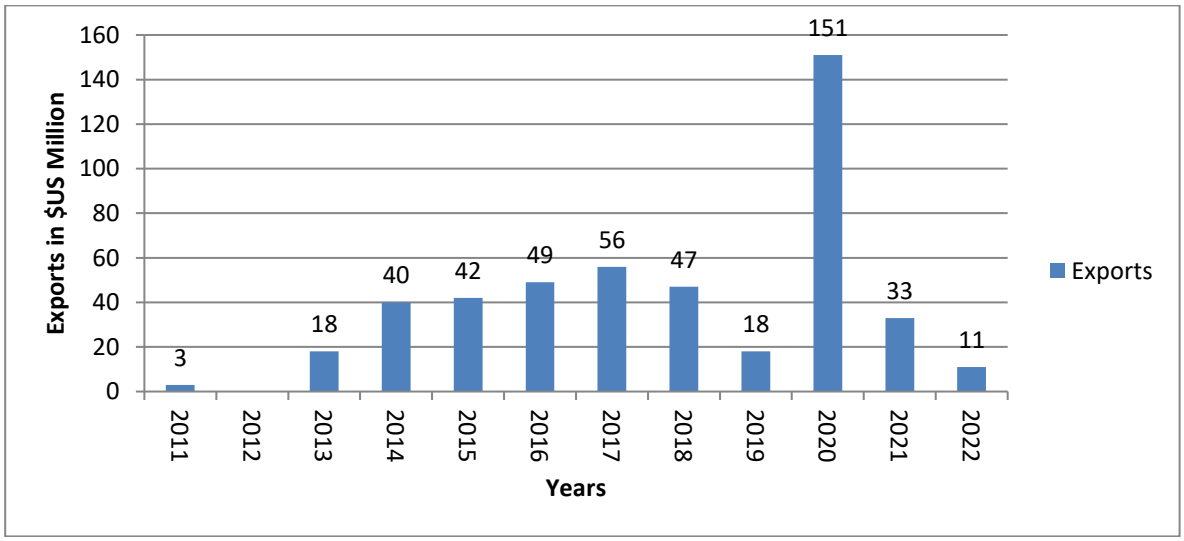
Table 6

	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	Total
Afghanistan						12	3							15
Armenia												32		32
Bangladesh											0			0
Maldives	5			5							3			12
Mauritius					28		26	19				1	4	77
Mozambique										15				15
Myanmar				6		27	12			3	148			196
Namibia		1			2									3
Nepal		3			5									7
Seychelles				7	6		8		10					30
Sri Lanka								37	37				7	81
Suriname						3								3
Total	5	3		18	40	42	49	56	47	18	151	33	11	471

Source: SIPRI Arms Transfers Database downloaded on 25th Feb 2024.

Note:
1. Figures are SIPRI trend indicator values expressed in millions
2. Figures may not add up due to conventions of rounding.
3. '0' indicates that the values of deliveries are less than 0.5million
4. details: http://www.sipri.org/databases/armstransfers/sources-and-methods/

Figure 6: Indian Defence Exports



Source: Stockholm International Peace Research Institute (SIPRI)

India's Defence exports (Figure 6) are in stark contrast to its imports. There has been a gradual increase in export revenue from INR 686 crore in 2013 to an all-time high of INR 16000 crore in 2023.[25] This 23-fold increase reflects India's progress in the global defence manufacturing sector. In Southeast Asia over 50% of India's total arms exports went to Myanmar. [26] The major arms that Myanmar bought from India include remote-controlled air defence systems, Artillery guns, bulletproof jackets and helmets and military ships. In addition to policy reforms, the government serves as an enabler and supporter, providing opportunities for self-reliance in defence manufacturing. Initiatives include facilitating defence R&D in the private sector through DRDO collaborations, licensing agreements for technology transfer, access to patents and test facilities, and funding support. Strategic alliances with private enterprises are aimed at fortifying major defence initiatives, facilitating their evolution into globally recognized entities. The government's procurement preferences, which prioritize 'Buy Indian', 'Buy and Make (Indian)', and 'Buy (Indian)' approaches over direct imports, empower domestic industries, including Micro, Small, and Medium Enterprises (MSMEs), thereby enhancing self-sufficiency and fostering job creation.[27] The Indian government is actively supporting startups and encouraging their involvement in the aerospace and defence industries. Referring to MSMEs as 'emerging stars' in these sectors, the Defence Ministry anticipates their numbers will increase twofold to 16,000 by 2026 as they become more integrated into international supply chains.[28] Initiatives such as iDEX are geared towards involving start-ups in addressing challenges within the defence and aerospace domains. Moreover, the government has liberalized foreign equity caps, facilitating increased investment in the defence and aerospace sectors. FDI worth Rs 5077 crore has been reported by companies operating in the defence sector. The FDI limit in the defence sector was enhanced in 2020 by up to 74% through the automatic route and up to 100% by the government route.[29]

Additionally, the government aims to increase the aerospace industry's size twofold to INR 60,000 crore by 2024, positioning India as a pivotal supplier of aerospace components.[30] A strategic plan for artificial intelligence in national security endeavours to create 25 AI products by 2024, positioning India as a notable contributor to defence capabilities.[31] Besides insufficient progress in achieving Indigenous capabilities, Defence Public Sector Undertakings (DPSUs) demonstrate inefficiencies across various metrics including exports, labour productivity, and innovation.[32] Notably, manufacturing entities within the public sector have traditionally shown limited enthusiasm towards innovation. Measures have been unveiled to facilitate a reduction in import reliance within the public sector, with the Prime Minister setting a target of reducing it by INR 150 billion by 2025.

Simultaneously, the involvement of the private sector in defence research and development (R&D) is gradually expanding, propelled by governmental policy initiatives. To stimulate R&D activities among industry startups and academic institutions, the Ministry of Defence has introduced three schemes: Innovation for Defence Excellence (iDEX), Technology Development Fund (TDF), and the Make category. [33] These initiatives have begun to yield results at a moderate level. Encouraged by the success of iDEX, the government has introduced an enhanced funding version called iDEX Prime, with a funding support of INR 100 million.[34] Recognizing the pivotal role of the private sector, the government has earmarked a distinct budget for procurement. In 2023, out of the total capital procurement budget of INR 845.98 billion from domestic sources, INR 211.49 billion (25%) has been specifically allocated to the private sector.[35] In a significant move aimed at bolstering indigenous defence production and reducing imports, the Ministry of Defence announced four lists comprising a total of 411 service items and three lists comprising 3,738 items from Defence Public Sector Undertakings (DPSUs) for positive indigenization.[36] These lists impose an embargo on the import of these items beyond specified timelines, extending up to 2025.

CONCLUSION

The study revealed a consistent upward trend in defence expenditure over the observed period, starting from INR 15,426.48 crore in 1990-91 and reaching INR 45,1704 crore in 2021-22. This trend reflects the government's sustained commitment to strengthening national defence capabilities. The contention among some critics is that defence spending diverts crucial resources from other areas, with such expenditure often being considered, at best, a necessary burden. Nevertheless, the modernization of the military—in terms of equipment, structures, and institutions—is essential for national security [37]. This paper revealed that from 1990 to 2022, India's defence budget as a percentage of GDP averaged 1.5% to 2.5%, subsequently dipping to 1.47% in 2022. Despite a decrease in GDP percentage terms, defence spending remains a significant portion of the central government's total expenditure, claiming nearly one-seventh. The debate around defence budgets has seen arguments positing that a minimum of 3% of GDP should be allocated to defence to establish India as a global force in the future. It is asserted that military strength is a key indicator of a nation's power, not just for warfare but also as a deterrent, necessitating increased defence funding moving forward. Regarding the distribution of resources among the military branches, the army has traditionally received the lion's share of the defence budget, with the air force and Navy following. However, the past two decades have seen a reallocation, with the army's proportion decreasing and the Navy and Air Force receiving increased funding. This budgetary shift indicates a strategic transition from a predominantly land-based focus to an enhanced emphasis on air and naval capabilities. The data reveals a pronounced upward trend in production values across numerous firms, signifying an expansion within the defence industry. Hindustan Aeronautics Limited (HAL) stands out for its sustained high output, affirming its pivotal

position in the aerospace sector. However, it is observed that public sector enterprises generally exhibit a restrained approach to innovation. Apart from HAL and Bharat Electronics Limited (BEL), which are exceptions, there is a tendency among other production entities to invest only a nominal portion of their budget in research and development (R&D). This places the onus of defence-related research largely on the shoulders of the Defence Research and Development Organization (DRDO), which spearheads the R&D efforts in this domain. The study observes a notable surge in defence exports from India, with figures soaring from INR 686 crore in the fiscal year 2013-14 to INR 16,000 crore over ten years. Despite this increase, India is not ranked among the top 20 defence exporters worldwide, underscoring a significant disparity in manufacturing and export capabilities compared to leading nations such as the USA, France, Russia, and China. [38] India continues to be the world's foremost defence importer, highlighting its considerable challenges in balancing and expanding its defence sector. India possesses capable DPSUs that can set benchmarks for the private sector in the production of defence goods, leveraging significant investments already made in specialized domains. Resources such as facilities, expertise and personnel developed by DPSUs through public funding should be maximized to enhance the nation's self-reliance and export potential in defence procurement. The Indian government is prioritizing innovative approaches to bolster the country's defence and security through initiatives like "Innovation for Defence Excellence" (iDEX), providing startups with opportunities to engage with the defence sector and develop novel technological solutions in the years ahead. The decision to involve the private sector in defence, seen as a means to secure capital and enhance production, is underscored. Efforts should be undertaken to make sectors like aerospace and electronics globally competitive and to make defence industrialization a driving force for economic development. There is a need to explore options to minimize
state investment while encouraging private and foreign portfolio collaborations between domestic and international defence companies to bring in technology, expertise, and investments. Government should allocate resources for R&D to enhance indigenous capabilities, innovation, and product development. Invest in skill development programs to ensure a skilled workforce capable of meeting the industry's demands. Streamline regulations to facilitate ease of doing business while ensuring compliance with international standards and security protocols. The government should enhance infrastructure for manufacturing, testing, and logistics to support the growth of the defence industry. The government should develop strategies to promote defence exports by aligning with international quality standards and participating in global defence exhibitions. The Government needs to create a defence Export Promotion Zone Agency (DEPA) to coordinate defence exports. India needs to push the exports of sophisticated weapons platforms and systems. Ensure consistent policy support, financial incentives, and a stable taxation regime to attract investments and promote growth. It should encourage technology transfer agreements with foreign partners to enhance capabilities and reduce dependency on imports. Strengthen cyber security measures to safeguard sensitive defence technologies and data. Promote sustainable practices in manufacturing processes and materials to align with global standards and reduce environmental impact. Develop a long-term strategic vision for the defence industry, considering geopolitical dynamics and emerging technologies. Establish mechanisms to monitor progress, assess the effectiveness of policies, and make necessary adjustments to achieve targets. Remember to engage stakeholders, including government agencies, industry experts, and academia, in the planning and execution of the blueprint for achieving a USD 5 trillion economy.

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