India's Defence Public Sector Undertakings: A Performance Analysis

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India has established eight Defence Public Sector Undertakings (DPSUs) whose responsibility is to provide the Armed Forces state-of-the-art equipments and at the same time enhance country's self-reliance in defence production. However the performance of these Undertakings is not up to the mark, resulting in import of arms worth billions of dollars every year. A deeper insight into DPSUs' production profile reveals that most of them are over-dependent on external sources for the production needs, and have a very low labour productivity level, negligible export, and a low R&D base. What the DPSUs need to do is to overcome these aspects and in turn make India truly self-reliant in defence production.

Introduction

India has eight Defence Public Sector Undertakings (DPSUs) under the control of Department of Defence Production, Ministry of Defence (MoD). These Undertakings together with 39 Defence Ordnance Factories (OFs) form the backbone of India's defence production, and are responsible for making India self-sufficient in defence production. However, unlike the OFs which mostly cater to the low-technology defence items, the DPSUs cater to the "strategic requirements" of the Armed Forces. The items produced by DPSUS ranges from "aircrafts to helicopters, warships, submarines, heavy vehicles and earth movers, missiles, electronic devices and components, alloys and special purpose steel."[1] In terms of value of production, DPSUs account for more than 65 per cent of the total industrial output of all defence public sector enterprises, including Ordnance Factories. Over the years, the Undertakings have grown both in size and as well as in their portfolio of items. However, the growth of DPSUs in terms of range and depth of production has not corroborated with the requirements of the Armed forces. This is evident from huge arms import by India. This in turn raises the question on the capability and efficiency of DPSUs in meeting the Armed Forces' requirements.

The paper makes an attempt to evaluate the performance of DPSUs over the last decade or so. In particular, the papers examines the role of DPSUs in the context of India's aim of self-reliance in defence production; DPSUs' performance on account of value addition, indigenisation and exports.

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Defence Public Sector Undertakings: An Overview

The eight DPSUs that India has established over the years are: (1) Hindustan Aeronautics Limited (HAL), (2) Bharat Electronics Limited (BEL), (3) Bharat Earth Movers Limited (BEML), (4) Bharat Dynamics limited (BDL), (5) Mishra Dhatu Limited (MIDHANI), (6) Goa Shipyard Limited (GSL), (7) Garden Reach Shipyards and Engineers Limited (GRSE), and (8) Mazagoan Dock limited (MDL). Among these, HAL is the largest DPSU, accounting for nearly half of DPSUs' production in 2006-07. Formed in 1964 by merger of Hindustan Aircraft Limited and Aeronautics India Limited, it has over the years evolved into a large aeronautics complex organised along four Complexes – Bangalore Complex, MiG Complex, Accessories Complex and Design Complex. The company's primary area of activity is to design, manufacture and overhaul fighters, trainers, helicopters, transport aircraft, engines, avionics and system equipments. By 2005-06, the company has produced around 3400 aircraft, 3600 aero engines, and overhauled 8320 aircraft and 27,803 engines. At present it is involved in nine major projects related to design and development and manufacturing. Design Projects include Intermediate Jet Trainer, Light Combat Aircraft, ALH Weapon System Integration, Light Combat Helicopter and Aircraft Upgrades (Jaguar, Sea Harrier); and manufacturing Projects include SU-30 MKI aircraft, Jaguar single seater, Advances Light Helicopter and Dornier 228.[2] In terms of value of production and total sales, the company has registered impressive growth rates. In the last 10 years (1997-98 to 2006-07), while the VoP has increased from Rs. 1838.12 crore to Rs. 9201.88 crore, sales has increased from Rs. 1869.93 crore to Rs. 7783.61 crore.[3] For the sustained performance, the Company was granted in June 2007 the "Navratna Status" by the Government of India.

BEL, established at Bangalore in 1954 by the Ministry of Defence, is the premier defence electronics company with nine production units and 31 manufacturing divisions across seven states. From the initial production, of Transceivers for Indian Army's radio communication equipment,[4] the organisation has evolved to have 350 products to its credits,[5] including high-tech products such as radars, sonars, communication equipment, electronics warfare equipment, opto electronics, tank electronics, and components, among others. BEL is one of the Public Sector Enterprises that has been recognised for its "path-breaking innovations and new products" in recent time. The Company won the SCOPE (Standing Conference of Public Enterprises) for the products developed such as "Battlefield Surveillance System, Artillery Combat Command & Control System, ATM-based Integrated Ship-borne Data Network, Frequency Hopping Radios, Secured Hand-held VHF/UHF Radios and Upgraded Electronic Voting Machine."[6] Recently, the company handed over three-dimensional multifunction medium range surveillance radar 'Rohini', to the Indian Air Force (IAF).[7] While defence forces remain the prime customers of BEL, others such as para-military organisations (Border Security Force, Assam Rifles, and Central Industrial Force) and civilian

customers (BSNL, AAI, ECI) also use its product. In 2006-07, BEL generated 24 per cent of its total business from the civilian sector, up from 14 per cent in the previous year.[8] Between 1999-2000 and 2003-04, BEL's defence sales accounted for nearly 75 per cent.

BEML, which came into being in 1964, commenced its operation nearly one year later, with productions of rail coaches and assembly of space parts at its Bangalore unit. The company with three product segments – Mining & Construction Equipment, Defence Equipment & Aggregates and Railway Rolling Stock, caters to the core needs of the industry (mining, irrigation, steel, cement, power plants, infrastructure, etc), defence services (trucks, diesel engines, and earth movers), and Railways. The defence sector, however, contributes much less to total sales, compared to its civilian business.[9] In 2005-06, defence segment accounted for 32 per cent of total turnover.[10]

BDL was carved out of Defence Research and Development Organisation (DRDO) and establishment as a separate DPSU in 1970.[11] It builds strategic and tactical missiles and allied equipments, either under the license or technologies supplied by the DRDO. Its license-manufactured products include Milan (France) and Konkurs (Russia) anti-tank guided missiles (ATGM). The company got into prominence with the launch of India's Integrated Guided Missile Programme (IGMP), in early 1980s.[12] Under the programme, BDL was the production agency. It has so far supplied to the Indian armed forces both the land and naval versions of Prithvi missiles (150 km and 250 km); and Agni I & II (700 Km and more than 2000 km).[13] In addition to above, BDL is also involved in a number of other DRDO projects, such as K-15 (submarine launched ballistic missile, SLBM) and ASTRA beyond visual air-to-air missile.[14]

Among the three shipbuilders under MoD, MDL is the largest one, in terms of product range, value of production, and number of employees.[15] The company was mainly a ship repair yard when it taken over by the government of India from private owners in 1960.[16] Since then it has expanded its activities to shipbuilding, ship repair and construction of offshore platforms. Its present capacity is to build warships upto 6,500 tonne displacement and merchant ships upto 27,000 DWT. In defence sector it specialises in design, construction and support of naval ships such as destroyers, frigates, missiles boats, offshore patrol vessels and submarines. Till late 2008, MDL has made 196 ships and is currently making a total of 14 ships, including 3 frigates, three destroyers and six submarines for the Indian Navy.[17] It is the only shipyard in the country and among few companies in the world to build a submarine.[18] In civilian sector it supplies cargo and passenger ships, supply vessels, and various types of small crafts. In the export sector, the Company has bagged an order for design, construction and supply of Multipurpose Support Vessels (MSVs) from a Singapore based company.[19] The company's order book includes, inter alia, three P-17 class stealth frigates and three P15A destroyers for the Indian Navy. The combined projected cost for these projects is nearly Rs. 20, 000 crore.[20]

GRSE was taken over by the government of India in 1960[21] to develop a second line of shipbuilding facility. It is the only shipbuilder in India and among few in the world, to have its own engineering and engine manufacturing division. The company's products include frigates, ASW and missile corvettes, Landing Ship Tanks, fast patrol vessels, survey vessels, etc for the navy and coast guard.

GSL, established in 1957 under the name of "Estaleiros Navais De Goa", is the largest enterprise on the West Coast of India, employing about 1600 people.[22] So far it has built and delivered 181 ships to navy, coast guard and private sector. The product range of GSL include 105 meter (m) advance offshore patrol vessels, 90m offshore patrol vessels, 50m fast patrol vessels, missile boats, etc. The company has not performed consistently over the years, showing high fluctuations in its turnovers. The company also performs poorly in exporting its products. Recent data shows the company in last over a decade has been succeeded in bagged export orders for supply of three Harbour Tugs to Royal Navy of Oman.[23] The company also relies heavily on the private sector for the construction of ships. In the defence sector, the private industry is involved upto 90 per cent for construction activities.[24]

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MIDHANI was incorporated as a PSU in 1973 to achieve self-reliance in areas of special steels, superalloys, titanium alloys which form the core needs not only of the defence but of space and atomic energy programmes. In the defence sector, MIDHANI is responsible for indigenisation of technologies and products to support programmes such as T-72 and MBT Arjun, Kaveri engines (of LCA), Advanced Technology Vessels, MiG, etc. In 2006-07, Defence and Space sector accounted for 75 per cent of its total suppliers.[25]

Self-Reliance in Defence Production: The Role of DPSUs

The necessity of establishing DPSUs was to meet advanced weapons and equipments required by the armed forces, and work towards the goal of self-reliance in defence production.[26] In fact, these aspects have repeatedly been stated by the Ministry of Defence in its various annual reports. The Annual Report of 1980-81 of the MoD has even gone to extent of stating complete self-reliance in defence production and eliminations of technology imports within next 10 to 15 years.[27] In other words, India, by 1995, would have achieved total self-reliance in defence production with no import of technology from overseas. Though the above objective looks ambitious, the question is as to what extent these have been fulfilled.

Self reliance was defined as the percentage share of indigenous content in the total expenditure on procurement in a given year. By this definition, self-reliance, which was 30 per cent in 1992-93, was planned to go upto 70 per cent by 2005. However, at the end of 2005, the index barely moved upward from the 1992-93 level.[28] This shows the failure of domestic efforts by both OFs and DPSUs to provide required armaments to the Armed Forces, which in turn led to increased imports from external sources.

The DPSUs are the major providers of advanced systems to defence forces and are largely responsible for India's poor achievements in self-reliance. From the budgetary perspective the poor contributions of DPSUs are also reflected in their decreasing share in India's capital acquisition budget, which nearly accounts for 80 per cent of India's capital expenditure. As the table below shows the share of DPSUs has decreased from as high as 61 per cent in 1999-2000 to low 29 per cent in 2004-05.

Table-1
Defence Sales, Capital Acquisition and Share of DPSUs in Capital Acquisitions

Year	Value of Defence Sales by DPSUs (Rs. Cr)[29]	India's Capital Acquisition (Rs. Cr)	Share of DPSUs in Capital Acquisition (%)
1998-99	3874	8663	45
1999-00	6276	10219	61
2000-01	5365	10502	38
2001-02	5552	14430	38
2002-03	6152	12939	48
2003-04	6925	14584	47
2004-05	7874	27209	29
2005-06	69116	25491	36
2006-07	11095	26900	41

Sources: Annual reports of DPSUs (various years); and Report of the Standing Committee on Defence

As regards eliminations of arms imports or technologies associated thereof, India on the contrary is heavily dependent on foreign suppliers. According to SIPRI (Stockholm International Peace Research Institute) Arms Transfer Database, India's arms imports in real terms totalled nearly US $18 billion between 1995 and 2007, with Russian contribution accounting for more than 70 per cent.[30] Moreover, between 1999 and 2006, India, according to a 2007 US Congressional Research Service (CRS) Report, topped the list of arms importers among the developing countries, with agreements over US $22 billion[31] (the 2008 Report puts the figure at US$ 31.9 billion for the period

2000-2007[32]). On an annual basis, India's defence import is to the tune of $5-6 billion.[33] The weapons and systems that Indian has imported and or negotiated, more importantly, fall in the domains of the DPSUs activities. A select list of arms imports along with supplier and the domain of DPSUs is placed below. The above are the indication of collective failure of DPSUs to provide required systems to the Armed Forces.

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Table-2
Select Arms Acquisition and Domain of DPSUs

Designation (Classification)	Supplier	Domain of DPSU
Su-30 (FGA)*	Russia	HAL
Scorpene (SSK)*	France	MDL
C-130J-30(Transport aircraft)	US	USHAL
INS Jalaswa (AALS)	US	MDL/GRSE/GSL
Derby (BVRAAM)	ISRAEL	IBDL
Ajit Hawk*	UK	HAL

*: These items are also licence-produced by respective DPSUs
Sources: Military Balance 2008, MoD Press Releases, and Media Reports

Performance of DPSUs

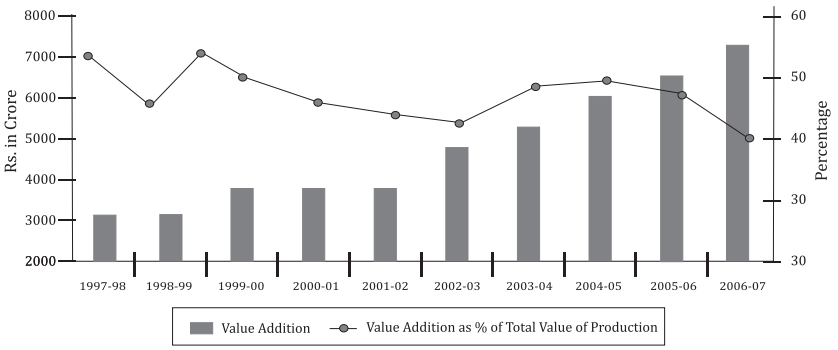
The DPSUs in India are under the control of MoD, and are largely the production agencies to produce items mostly assigned to them, some times on a nomination basis. In this context their performance evaluation is bit difficult. Nonetheless, the attempt here is made to evaluate the performance on the basis of three parameters: value addition, export performance and labour productivity.

Little Value Addition & High Dependence on External Sources

The value addition (VA) of all DPSUs as a percentage of their total value of

production (VoP) has in last 10 years decreased from high of 51 per cent to low of 38 per cent, notwithstanding the fact that the combined VoP of DPSUs has witnessed a near continuous growth over the same period (Figure-1).

Figure-1
Value of Addition and its percentage Share in Total Value of Production



Source: Figure prepared by author based on data from individual Annual Reports of DPSUs

Though the eight DPSUs have increased their total value of production, their dependence on external sources for production requirements, have also increased significantly. The dependence on external sources could be the one reason behind the progressively deceasing value addition by the DPSUs. HAL, the biggest DPSU, is a case in point. Its value addition in the past decade has increased by more than two-and-a-half times from Rs. 1166.13 crore in 1997-98 to 3221.48 in 2006-07.[34] However, its VA as percentage of VoP has decreased from 68 per cent in 1999-2000 to 35 per cent in 2006-07. It is to be noted that HAL in the meantime is involved in the manufacturing of Su-30 MKI[35] and Jaguar aircrafts, Light Combat Aircraft (LCA), Dornier-228, and Advanced Light Helicopter (ALH) among other high-value items.[36]

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The dependence on external sources is across the DPSUs, from the biggest one (HAL) to the smallest one, i.e., MIDHANI.[37] It is to be noted that the DPSUs are the production agencies, the technologies are either provided by external agencies or by the DRDO. For instance, HAL produces Su-30, AJT-Hawk etc under licence from Russia and the UK, respectively. For production of these items along with its other activities, the company's dependence on raw materials, components and spare parts, and capital goods is to the extent of 74 per cent, of which import content

is about 80-90 per cent. In last two years (2005-06 and 2006-07) its value of imports totalled Rs. 4,753 crore and Rs. 6,715 crore, which are nearly 73 and 80 per cent of its total cost of VoP, respectively.[38] Compared to HAL, BEL's dependence on external sources is far less. In the last two years, the foreign exchange outgo was to the extent of 36-37 per cent of its total value of production.

Unlike HAL, few other DPSUs do provide the break up, in value terms, of import and indigenous content. Some of them however provide volume of foreign exchange outgo in each financial year. The foreign exchange outgoes are mostly on account "of import of production requirements", as is the clear case with BDL.[39] The foreign exchange outgo of BDL in 2007-08 was Rs. 287.74 crore, of which 99.9 per cent (Rs.287.45 crore) was for import of production materials.[40] This represents nearly 57 per cent of total VOP in 2007-08.

The above high dependence on external sources for production requirements run contrary to many DPSUs' idea of achieving greater self-reliance and "substantial cost reduction through indigenisation."[41] More importantly, resorting to import route is not due to the "economic reasons rather due to the lack of commitment for indigenisation".[42]

The high dependence on external sources could be due to several factors, one being the little in-house R&D efforts by the DPSUs. A Review of expenditures in 2006-07 by DPSUs reveals that the Undertakings spend around four percent of their turnovers and five per cent of their annual sales on R&D. However, dedicated R&D efforts are not across the DPSUs; half of eight Undertakings do not spend anything on R&D (see Table- 3).

Table-3
DPSUs' R&D Expenditure and its Percentage in Value of Production and Value of Sales, 2006-07

DPSU	R&D Expenditure Rs in Cr.	Value of Pruduction (Rs. In Cr)	R&D as % of VoP	Value of sales (Rs. In Cr.)	R&D as % of value of sales
HAL	637.79	9201.88	6.9	7783.61	8.2
BEL	140.34	4012.75	3.5	3952.69	3.6
BMEL	18.05	2590.75	0.7	2601.79	0.7
MDL	.....	1872.24	.....	18.68	.....
GRSE	.....	641.66	.....	713.79	.....
GSL	.....	267.07	.....	152.79	.....
BDL	.....	385.84	.....	433.51	.....
MIDHANI	2.2	223.88	0.1	192.49	1.1
TOTAL	798.38	19196.07	4.2	15849.31	5.0

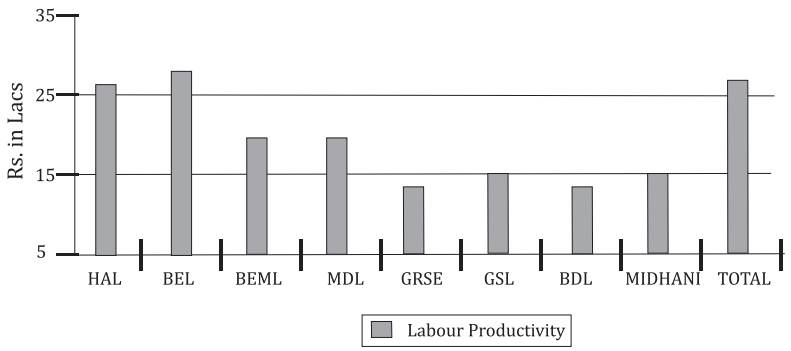
Source: Data compiled by author from individual Annual Reports of DPSUs

As the table above shows, HAL and BEL are two companies with noticeable R&D efforts. HAL, which spends the highest percentage of its production or sales values, is however, dependence much of its production requirements on others.

Low Labour Productivity

DPSUs in general suffer from low productivity compared to their counterparts in the global defence industry. The top five arms producing companies in the world together have an average labour productivity of $0.3 million;[43] where as the eight DPSUs' combined productivity is less than $0.06 million.

Figure-2
Labour Productivity of Individual and all DPSUs, 2006-07



Source: Figure prepared by author from data obtained from individual Annual Reports of DPSUs

Meagre Exports

Among the DPSUs, three – HAL, BEML and BEL – have been successful in entering into defence exports, though the volume of exports can be termed meagre in comparison to global standard. HAL is so far is biggest exporter among DPSUs, accounting for nearly 64 per cent of total exports in 2006-07. In value terms, HAL's exports have grown from Rs. 103.89 crores in 2002-03 to Rs. 341 crores in 2007-08.[44] During 2006-07, HAL booked export orders worth Rs. 501.10 crore. As per the perspective plan of the company, the export target is to reach Rs. 500 crore by 2011-12. The areas in which HAL has established its foothold in international market include aero-structures – supplied to Boeing of USA and Aerospatiale, France – and "spares and services for a variety of military and civil aircraft, engine, equipment, spares and devices." In addition, HAL has been successful in terms of entering export market in the area of Computer Aided Design (CAD) Modelling and Services. HAL's biggest achievement in exports perhaps came in 2008, when it won two bids worth over US $ 70 million from Ecuador and Turkey for supply of Advanced Light

Helicopters, Dhruv.[45] The order with Ecuador was worth US $ 50.7 million. According to a MoD Press Release, HAL won the bid "amidst strong competition" from other established international players and its bid was "about 32 per cent lower than the second lowest bid."[46]

BEL's exports have increased from Rs. 48.12 crores in 2002-03 to Rs 57.1 crores in 2007-08.[47] BEL has exported to countries such as USA, Israel, Indonesia, Ireland, Honduras and Surinam. During 2007-08, the Company bagged a "high value" export order worth US $ 9.0 million from Honduras. As on 1st April, 2008, the Company has an export order book of US $ 19.68 million.[48] BEL-manufactured items that have been exported in last two years include, among others, Satellite Radios (to US), Satellite Communication equipment (to Nigeria), HF Radios (to Suriname), Vacuum Interrupter Tubes and Magnetrons (to various countries)[49], data display unit and accessories, Small Arms Training Simulator, Radar Warning Receiver for MIG 29 fighter upgrade programme, Non Eye Safe and Eye Safe Laser Range Finder, Radar spares, X-Ray parts, and Small Signal Devices, Power Devices.[50]

BEML has the unique distinction of exporting to more than 50 counties, including UK, South Africa, and in Middle East.[51] In 2006-07 it made inroads for the first time in countries such as Indonesia, China, Thailand, Oman, Saudi Arabia, Zimbabwe, Sudan and Myanmar.[52] In last 10 years, BEML's exports have exceeded Rs.1, 093 crores, including Rs.200.62 crores in 2007-08.[53] The product of the Company has been found greater acceptance in few counties like Syria and Tunisia, which have placed repeat orders on the Company.[54]

The overall performance of DPSUs on account of exports is not so satisfactory, especially in comparison to global defence majors. In 2006, the estimated international arms trade was in excess of US $ 45.6 billion.[55] DPSUs' total exports in 2006-07 amounted to Rs. 422.71 crores. This along with exports of Ordnance Factories' Rs. 13.08 crores[56] stands at approximately at US$97 million.[57] As mentioned earlier, among the DPSUs, only three have exports of any significance. But their exports as percentage of VoP and total sales (see Table) are below international standard. For instance, Lockheed Martin, the biggest defence company in the world in terms of defence revenues in 2007[58], generated over 16 per cent of its total revenue through exports.[59]

The low export base of DPSU can be ascribed to a number of factors, such as quality of product offered, marketing strategy, among others.

The low export base of DPSU can be ascribed to a number of factors, such as quality of product offered, marketing strategy, among others. As far as the latter is concerned, DPSUs, especially the shipyards are way behind. Goa Shipyard

Table-4
Export Performance of DPSUs, 2006-07[60]

DPSU	Exports Rs in Cr.	Share in VoP (%)	Share in toatal sales(%)
HAL	270.51	2.94	3.48
BEL	41.41	1.03	1.05
BMEL	110.73	4,27	4.26
MDL	.....	.....	.....
GRSE	.....	.....	.....
GSL	.....	.....	.....
BDL	0.06	0.02	0.01
MIDHANI	.....	.....	.....
TOTAL	422.71	2.20	2.70

Note: -- = No export in 2006-07
Source: Data compiled by author from individual Annual Reports of DPSUs

Limited (GSL), which has made no exports between 1999-00 and 2006-07, is a clear example. Though the shipyard's export offers to at least nine counties[61] were "considered favourably" the offers could not be materialised "for want of financial assistance" required by the importing countries. MDL also face similar situation while promoting its ships in international market.

Conclusion

The value of production across the DPSUs has no doubt increased over the past decade or so. However, the Undertakings have not been able to arms the defence forces, resulting in huge arms imports, to the tune of over US $ 5-6 billion per year. The failure of DPSUs in producing systems required by the Armed Forces defeats the self-reliance objective set out by the government a long time ago.

Though the volume of production by DPSUs has increased over the years, the value addition by them has progressively decreased. This in turn indicates larger the production value lower the value addition. A deeper insight into companies' production profile reveals that most of DPSUs are over-dependent on external sources for raw material, components and spare parts, and capital goods for the production requirements. The over dependency is not costly, but raises the fundamental question of strategic importance of some of DPSUs.

The export performance of DPSUs taken together is below the three per cent of total value of production or total value of sales. On the other hand, the global defence majors generate as much as 10-15 per cent of their revenue from exports. Some of the DPSUs do not have any exports despite several efforts. The low export base contradicts the cost-effectiveness of the some of the companies like HAL which has been able to successfully compete against

established international players to export its items. What India needs is an aggressive export policy, backed by favourable incentives to some importing counties who find Indian products attractive but turn their back due to lack of availability of any cheap credit.

Notes:

1. Government of India, "Antony cautions Defence PSUs against over-dependence on Imports", Ministry of Defence Press Release, November 07, 2008.
2. 17th Report of the Standing Committee on Defence (2006-07), 14th Lok Sabha, Ministry of Defence, "In-depth study and critical review of Hindustan Aeronautics Limited (HAL)", Lok Sabha Secretariat, New Delhi.
3. Hindustan Aeronautics Limited, Annual Report 2006-07, pp.2-3.
4. 9th Report of the Standing Committee on Defence (2005-06), 14th Lok Sabha, Ministry of Defence, "Defence Public Sector Undertakings", Lok Sabha Secretariat, New Delhi, p.17.
5. Government of India, Ministry of Defence, press Information Bureau, "BEL Pays 60% Interim Dividend" Press Release, August 06, 2008.
6. Government of India, Press Information Bureau, "BEL bags SCOPE award for R&D and innovation" MoD Press Release, November 21, 2008.
7. Government of India, Ministry of Defence, press Information Bureau, "BEL Hands over State of the art 'Rohini' Radar to IAF", Press Release, August 06, 2008.
8. Bharat Electronics, Annual Report 2006-07, p.26.
9. In 2005-06, 32 per cent of total turnover of Rs.2205.84 came from defence sector. See, Bharat Earth Movers Limited, Annual Report 2005-06, p. 17.
10. BEML, Annual Report, 2005-06, p.17.
11. Amiya Kumar Ghosh, India's defence budget and expenditure management in a wider context, (New Delhi: Lancer Publishers, 1996), p.331.
12. The IGMDP, sanctioned in 1983, encompasses five missile systems: Prithvi (150 & 250 km range surface-to-surface), Akash (25 km surface-to-air), Trishul (surface-to-air), Nag (fire &forget anti-tank). The later is technology demonstrator. For detailed description of the Programme, see 14th Report of the Standing Committee on Defence (2006-07) of 14th Lok Sabha, "Defence Research and Development Organisation (DRDO", Lok Sabha Secretariat, New Delhi, pp.58-65.
13. Government of India, Ministry of Defence, Annual Report 2007-08, pp.80-81.
14. Government of India, Ministry of Defence, Annual Report 2007-08, p.81.
15. In 2005-06, value of production of GRSE exceeded that of MDL.
16. Amiya Kumar Ghosh, India's defence budget and expenditure management in a wider context, (New Delhi: Lancer Publishers, 1996), p.331.
17. Government of India, Press Information Bureau, Ministry of Defence, "Antony asks defence shipyards to be counted among the global best three; Defence shipyards pay Rs. 105 crores as dividend", October 10, 2008.
18. Government of India, Ministry of Defence, Annual Report 2007-08, p.62.
19. Ibid.
20. 29th Report of the Standing Committee on Defence (2007-08) of 14th Lok Sabha, Ministry of Defence, Demands for Grants (2008-09), Lok Sabha Secretariat, New Delhi, p.52.
21. Government of India, Ministry of Defence, Annual Report 2007-08, p.64.
22. Official website of Goa Shipyard Limited, http://www.goashipyard.co.in/html/frames.htm (accessed on September 20, 2008).
23. Official website of Goa Shipyard Limited, http://www.goashipyard.co.in/html/frames.htm (accessed on September 20, 2008).
24. 9th Report of the Standing Committee on Defence (2005-06), 14th Lok Sabha, Ministry of Defence, "Defence Public Sector Undertakings", Lok Sabha Secretariat, New Delhi, p.44.
25. Mishra Dhatu Nigam Limited, 33rd Annual Report 2006-07, p.5.
26. Amiya Kumar Ghosh, India's defence budget and expenditure management in a wider context, (New Delhi: Lancer Publishers, 1996), p.331.
27. Government of India, Ministry of Defence, Annual Report 1980-81, p.33.

28. 14th Report of the Standing Committee on Defence (2006-07), 14th Lok Sabha, Ministry of Defence, Defence Research and Development Organisation (DRDO), p.3.
29. Defence sales are extrapolated by assuming that 30 % of total turnover of DPSUs are for civilian purpose. The MoD has stopped providing composition of sales to defence and civil sectors from 1997-98 onwards. The last figures available suggest nearly 70 per cent of DPSUs' total turnovers are for defence sector.
30. "Figures are SIPRI Trend Indicator Values (TIVs) expressed in US$ m. at constant (1990) prices". For details see http://www.sipri.org/ (accessed on September 22, 2008).
31. Richard F. Grimmett, "Conventional Arms Transfers to Developing Nations, 1999-2006", CRS Report for Congress, p.56 and 67.
32. Richard F. Grimmett, "Conventional Arms Transfers to Developing Nations, 2000-2007", CRS Report for Congress, p.43.
33. See Concept Note of National Seminar on Defence Offsets, at http://www.idsa.in/SeminaronDefenceOffsets081008.htm (accessed on November 10, 2008).
34. Data extrapolated from HAL's Annual Report 2006-07.
35. Sukhoi sales account nearly 40 per cent of HAL's total sales. Interview with anonymous.
36. Hindustan Aeronautics Limited, Annual Report 2006-07, p.6.
37. The comparison is in relation to value of production of DPSUs.
38. This is not to say that all the imported items are consumed in the same year. Rather it shows the dependence of HAL on foreign sources to maintain its production line.
39. See Bharat Dynamics Limited, 38th Annual Report 2007-08, p. 18.
40. See Bharat Dynamics Limited, 38th Annual Report 2007-08, p. 18.
41. See Bharat Electronics, Annual Report 2006-07, p.26; In 2006-07, HAL claims to have indigenized 3500 items. The year before, the company claimed to have indigenized state-of-the-art Adour Engine
42. Anonymous interview
43. Figure calculated from Table 6A.2. "The SIPRI top 100 arms-producing companies in the world excluding China, 2006", See SIPRI Yearbook 2008: Armaments Disarmament and International Security
44. See 9th Report of the Standing Committee on Defence (2005-06), 14th Lok Sabha, Ministry of Defence, "Defence Public Sector Undertakings", Lok Sabha Secretariat, New Delhi, p.13; and MoD Press Release, "Antony asks HAL to keep pace with changing times", November 06, 2008.
45. Manu Pubby, "India bags $20 mn helicopter contract", The Indian Express, November 24, 2008.
46. Government of India, Press Information Bureau, Ministry of Defence, "HAL bags order form Ecuador", June 26, 2008.
47. See 9th Report of Standing Committee on Defence (2005-06), p.22; and Bharat Electronics, Annual Report 2007-08, p.20.
48. Bharat Electronics, Annual Report 2007-08, p.11.
49. Bharat Electronics, Annual Report 2006-07, p.8.
50. Bharat Electronics, Annual Report 2007-08, p.11.
51. Official website of BEML Limited, at http://www.bemlindia.com/documents/Financials/Annual%20Report/0708.pdf (accessed on November 24, 2008.)
52. Ibid
53. See official website of BEML Limited at http://www.bemlindia.com/index.php (accessed on November 24, 2008).
54. See 9th Report of Standing Committee on Defence (2005-06), p.30.
55. The figure excludes exports from a number of countries, including China. See SIPRI Yearbook 2008: Armaments, Disarmament, and International Security (Oxford University Press: New York), 2008, p.295.
56. The export figure for Ordnance Factories is for 2005-06. See Ordnance Factory Board, Annual Report 2005-06, p.15.
57. The conversion rate between US Dollars and INR is based on US$ 1 = Rs. 45.00.
58. See Top 100 defence companies at http://www.defensenews.com/index.php (accessed on November 24, 2008).
59. Export percentage figure for Lockheed Martin is estimated from Lockheed Martin Corporation, Annual Report 2007, p. 94.
60. HAL, AR-2006-07, p.3; BEL, AR 2006-07, p. 19; BEML, AR 2006-07, p.1; BDL AR 2006-07, p.15;
61. The nine countries are Sri Lanka, Mauritius, Mozambique, Tanzania, Maldives, Indonesia and Kenya.