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India's Ordnance Factories: A Performance Analysis

*Laxman Kumar Behera**

The ordnance factory organisation has grown over the years and now consists of 39 factories with two more being set up. The organisation, which dates back to the eighteenth century, has however not been able to rise up to the expectation of its prime customer. The paper argues that for the organisation to be able function more efficiently, its management needs to be corporatised, as suggested by many, particularly the Kelkar Committee. At the same time, the organisation has to assume higher responsibility with respect to R&D investment, execution of contracts, quality assurance and exports, in order to remain competent in its area of functioning.

Introduction

India has established 39 ordnance factories (OFs), apart from two more that are being presently set up. Together they form the largest and oldest departmentally run industrial organisation and are responsible for manufacturing of, *inter alia*, arms, ammunitions, armoured vehicles and ordnance stores required by defence forces, paramilitary forces, civil police, other government departments, and also for civil customers and exports. However, the organisation as a whole has repeatedly come under attack for below-expected performance for several reasons. The article analyses the performance of the ordnance factories in key areas such as range and depth of production; efficiency in execution of orders; and pricing and quality of products; and exports. The article nonetheless starts with a brief background of the origin and growth of ordnance factories and their management.

Origin and Growth of Ordnance Factories

The origin of the OFs dates back to pre-colonial period. To further the economic interests and enhance the political holding in India, the then British rulers considered some low-end defence production as a vital element. In 1775, the British authorities accepted the establishment of Board of Ordnance at Fort

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William, Kolkata, marking the beginning of Army Ordnance in India. Although the first ordnance factory, Gun Powder Factory, was established in 1787 at Ishapore, it is the Gun Carriage Agency (present known as Gun & Shell Factory), set up in 1801 at Cossipore, which made first production by any ordnance factory in India. Since then the number of factories has increased over the years. However, the focus of expansion in independent India took place after the 1962 war with China. The war with China, and subsequent desire of self-reliance in defence production, led to establishment of 16 new factories between 1963 and 1995, compared to five factories that were set up during 1949–62 (the British rulers had established 18 factories pre-1944). These 39 factories are in operation at 24 different locations. The fortieth factory is being set up in Nalanda, Bihar, for production of bi-modular charges, and the forty-first at Korwa, Uttar Pradesh, for the production of new generation carbines.

Management of Ordnance Factories

The management of the OFs can be divided into three categories. At the apex level is the Department of Defence Production (DDP) of the Ministry of Defence (MoD), which is the administrative head of the organisation. As a controlling authority, the DDP takes the major decisions with regard to the OFs' vendor development, product improvement/development and commercial interests.¹ At the middle level lies the Ordnance Factory Board (OFB), which was set up in 1979 in pursuance of the recommendations of the Rajadhyaksha Committee set up by the MoD. Under the 1979 reorganisation, OFB is headed by a director general who is also the chairman of the board. He is supported by nine other members of additional director general rank. Of these, five members head each an operating division consisting of a group of factories. The operating divisions are: (i) Ammunition and Explosives (A&E)—10 factories; (ii) Weapons, Vehicles and Equipments (WV&E)—10 factories; (iii) Materials and Components (M&C)—nine factories; (iv) Armoured Vehicle (AV)—five factories; and (v) Ordnance Equipment Group of Factories—five factories. The remaining four are responsible for staff functions: (i) personnel; (ii) finance; (iii) planning and material management; and (v) projects and engineering and technical services.

The OFB performs the executive functions, including laying down policies and procedures on the functioning of the factories, monitoring receipts of orders from buyers and determining annual target for production. It also controls the overall budget of the organisation.² At the lowest level lie the factories which are normally headed by a general manger or senior general manager, who is responsible for day-to-day functioning of the factory under him.

The above structure of management has, however, not allowed the centuries-old organisation to graduate into an independent organisation, and grow on its own. Since the MoD is responsible for major policy decisions, which are often tardy and sometimes politically motivated, the autonomy of the OFB in running the organisation is reduced to obeying MoD's decisions. It is to be noted that compared to the ordnance factories, the Defence Public Sector Undertakings (DPSUs) are more autonomous, with powers to form joint ventures and strategic alliances, invest in modernisation projects, undertake research and development (R&D) projects and collaborate with foreign partners for technological know-how.³ These powers allow the DPSUs to look for opportunity, tap the potential market and grow on its own. In the case of OFB, since these powers are vested with the MoD, the organisation is constrained to have its own independent outlook.

Similarly, unlike the DPSUs whose board of directors are collectively responsible for the functioning of factories under them, the OFs are not board managed. The OFB's responsibility is merely restricted to giving policy directions to its factories, while the factories are more or less independent in their functioning⁴ without being fully accountable to the board or its chairman. This has led to degeneration of management at the factories level, which is amply evident from the recent audit report of the Comptroller and Auditor General (CAG), which highlights highly inefficient procurement and other related activities, without being monitored by the board or its chairman.⁵

To address the stated deficiency in the management of OFs, various government-appointed committees and oversight agencies have suggested that the factories should be corporatised. The rationale behind the idea of corporatisation is to allow greater autonomy to the organisation to run its own affairs while, at the same time, be accountable for its performance. The Kelkar Committee constituted by the government had, in particular, recommended that "all ordnance factories should be corporatized under single corporation under the leadership of competitive management."⁶ The CAG, in its recommendation, also says that "the factories and the OF secretariat should be Board managed...similar to a Board of a company."⁷ However, the government has not so far been able to implement this vital recommendation, apparently because of the strong opposition from the labour unions associated with the factories.

Range and Depth of Ordnance Factories' Production

Since the establishment of the first factory, the OF organisation has grown into a vast industrial empire, with a product range consisting of nearly 1,000 principal items, including tanks, infantry combat vehicles (ICVs), artillery guns, rocket launchers, among others (Table 1). These products are produced across the factories divided into five product/technology-based operating divisions, as mentioned earlier. In 2010–11, OFs' total production and value of sales were estimated at Rs 14,884.27 crore and Rs 8,397.10 crore, respectively.⁸

Although, the OFs have a wide range of products, it is not enough to meet the requirements of the armed forces, forcing the government to resort to direct import from others. According to the Stockholm International Peace Research Institute (SIPRI), a Stockholm-based think tank, India, between 1980 and 2008, imported artillery and armoured vehicles valued over \$10 billion (at constant 1990 prices). These imports are from various countries such as Israel (towed gun and mortar); Italy (naval gun); Union of Soviet Socialist Republics (USSR)/Russia (naval gun, towed gun, surface-to-surface missile [SSM] launcher and multiple rocket launcher [MRL], Mobile Air Defence (AD) system, tank, armoured personnel carrier [APC], *infantry fighting vehicle* [IFV]); Sweden (towed gun); Poland (armoured recovery vehicle [ARV]); Slovakia (ARV); South Africa (APC/ Internal Security Vehicle [ISV]); and the United Kingdom (UK) (Airborne Early Warning [AEW]).⁹

In addition to direct imports, some of the items are also licence produced or assembled from semi-knocked down units (SKDs) and completely knocked down units (CKDs), based on technical assistance from the importing countries. For instance, OFs' production of tanks (of T-72 and T-90 origins) and IFV, *Sarath*, are based on Russian technology. It is also believed that some of the ammunitions produced by the OFs are based on Russian technical assistance. Besides Russia, OFs also have/had technical cooperation with others such as the UK for production of *Vijayanta* tanks and with Poland for ARVs. It is noteworthy that production by OFs through the routes of licence or SKD/CKDs is meant not only to provide the factories opportunity to utilise the existing capability and meet the operational requirements of the armed forces, but also to enable them to enhance India's self-reliance in defence production, by absorbing the technical know-how/why and production process. However, with regard to latter, the organisation has not been very successful, despite years of producing the same item. For instance, after nearly 25 years after the start of production of T-72 tanks, the ordnance factory is still dependent on Russia for certain vital components.

The void in the range and depth of OFs' production can be ascribed to lack of an advanced defence R&D base in India, and within the organisation in particular.¹⁰ Historically, the factories are not mandated to undertake any major R&D activities. They are, on the other hand, dependent on either foreign collaborators or the Defence Research and Development Organisation (DRDO) for core technology, product design and prototype development. As a consequence, the organisation, with poor infrastructure and low spending on R&D (amounting to a fraction of their total expenditure), has virtually disassociated from the complexities of R&D work, leading to problems in assimilating technologies and translating them into production. A member of the review committee which submitted its report in 2008 on *Redefining DRDO*, observes that those production agencies which have well-developed in-house R&D and are associated right from early stages of R&D are the ones with better production results, compared to those which have low in-house R&D and are dependent on detailed engineering drawings and documentations. He further points out that the ordnance factories do not have an institutional mechanism for interaction with the DRDO during the developmental phase, even when they are nominated as the designated production centres.¹¹ This has not only resulted in delays in production of items after the successful development of prototypes but also makes them perpetually dependent on DRDO for upgrades and product improvement—the activities which they should do themselves, based on their own production experience and the inputs from the users. The low R&D base has also sometimes hindered the factories from formulating well-crafted Transfer of Technology (ToT) documents for contracting with the foreign suppliers, observes a former secretary in the MoD.

Table 1 Product Range of Ordnance Factories

1	Weapon items	Small arms (rifles, pistols, carbines, machine guns); tank guns; ant-tank guns; field howitzers; artillery guns; mortars; air defence guns; and rocket launchers.
2	Ammunition items	Ammunitions for all the above weapon systems; rockets; missile warheads; mortar bombs: pyro-technique (smoke, illuminating, signal); grenades and bombs for air force; naval ammunition; propellant; and fuzes.
3	Armoured and transport vehicles	Tank T-72 <i>Ajeya</i> ; Tank T-90 <i>Bhishma</i> ; ICVs; armoured ambulance; bullet-proof and mine-proof vehicles; special transport vehicles; and variants. ¹²
4	Troop comfort items	Parachute for the army and air force; high altitude and combat clothing; tents of various types; uniforms and clothing items; and floats for light assault bridges.
5	Opto electronics	Optical instruments and opto-electronic devices/fire control instruments for armoured vehicles; and infantry and artillery systems.
6	Others	Special aluminium alloys for aviation and space industry; field cables, water bowser, etc.

Source: Parliamentary Standing Committee on Defence.

Execution of Orders

Timely execution of orders by the OFs is often a source of acrimony between the OFB and the armed forces. The armed forces officials say that the factories are “simply unable” to meet the production requirements, affecting their operational readiness. They further say that shortfall in OFs’ production is often behind the schedule, even after the target for production is lowered from the original requirements. A review of the execution of orders in last five years shows that the factories could meet only 64 per cent of the production targets mutually agreed with the armed forces, while the annual shortfalls range between 27 and 34 per cent. The shortfall is however large (to the extent of 43 per cent) when compared with respect to the original demands (Table 2).

Table 2 Delay in Execution of Orders

Year	No. of items for which demands existed	No. of items for which target fixed	No. of items manufactured as per target	% shortfall with regard to demands existed	% shortfall with regard to target fixed
2004-05	388	388	255	34	34
2005-06	352	352	257	27	27
2006-07	552	438	321	42	27
2007-08	628	507	360	43	29
2008-09	419	419	296	29	29
Total	2,339	2,104	1,489	36	29

Source: Reports of the Comptroller and Auditor General (CAG) of India, Union Government (Defence Services), Army and Ordnance Factories (relevant years).

According to one army official, the OFs have the tendency to inflate capabilities beyond their wherewithal in order to get increased number of orders from the armed forces. The factories' officials however maintain that shortfall is on account of factors remotely related to their production capabilities. They accuse the army in particular of late finalisation and placement of orders, resulting in delay in production planning. They also maintain that as the factories are the mere production agencies of the items as per the laid down specifications, the production schedule is often subject to external vagaries not in their control. The MoD also concurs with this argument. Replying to the Parliamentary Standing Committee on Defence, the MoD identified the following reasons for the delay:¹³

- late finalisation of annual target;
- delay in placement of covering indents;
- delay in issuing clearance of designs and other particulars from respective Authority Holding Sealed Particulars (AHSP) in case of new items;

- modification of designs for existing items;
- sudden increase in target by the indentors in the middle of the financial year;
- urgency shown by some indenter for some particular items with enhanced target, affecting the target of same items for other indentors; and
- unforeseen problem and delay in development for some items.

From the given list, it seems that some of the problems could be sorted out with close cooperation between the OFs and the armed forces. Presently, while the production programme of the OFs is initiated on the basis of the 2–3 years' forecasts by the armed forces, the actual production takes place after the placement of the firm indents, which are of annual basis. Since production could not be augmented in a short span of one year, the armed forces could consider giving firm orders for at least 2–3 years in advance. It would also be appropriate on the part of the armed forces to engage the OFB more proactively during the stage of the finalisation of services' long-term perspective plan (LTPP), especially the part which pertains to the factories. Some experts opine that the relevant portions of the LTPP must be shared with the OFs, so as to enable the latter in advance planning.

Pricing of OFB Products

The OFs operate on “no-loss, no-profit” basis. In other words, the products are supplied to the armed forces at a price, taking into account only the actual cost of production, which includes the costs of material and labour consumed and the overhead charges.¹⁴ However, this cost-plus mechanism of pricing is widely believed to be inefficient. The armed forces are vociferous in saying that OFB products are overpriced, affecting their budget and modernisation programmes. To keep the price under control, the finance division of the MoD has, since last few years, devised a system to determine and fix the price of major items supplied to the defence forces. The system is based on actual cost of production of last two years, cost estimates for the year of pricing and the projected cost for the next year. The system also provides for interaction among the OFB, users and the MoD's finance division, so as to enable them to arrive at acceptable price estimates of the products, after factoring in the cost elements and analysing the reasons for cost escalation. The advantage of the system lies in its in-built pressure on the

OFB to target for efficiencies once the prices are fixed in advance. If the final issue price deviates from the negotiated price, the OFB has to absorb the deviations. However, the new system is contingent upon the detailed costing and its timely reporting at the time of determination of price. According to a former secretary, Defence Finance, the mechanism, with all its intended merits, is constrained to work optimally because of delays in finalising and reporting the cost estimates at the time of price negotiations. This, along with absence of benchmarking against material procurement cost and the productivity gains over the years, renders the system of little use.

In addition to the above, there are two other factors that contribute to the high price of OFB products. The first one is related to efficiency in the usage of both labour and materials. Officials conversant with functioning of factories state that the organisation has a very high input usage rate, due to lack of process improvement and skill upgradation of labour force.

The second factor is related to "surge capacity" that the factories are mandated to carry in order to meet the increased supply requirements during the time of crisis. The surge capacity carries a minimum cost in terms of overhead charges. The only way the cost on this account could be reduced is through better utilisation of the labour, plants, machineries and the stores. Although the factories as a whole have been able to reduce percentage of overhead charges to total cost of production over the years (see Table 3), the reduction is hardly due to any efficiency gain, says one official in the Defence Accounts Department (DAD).¹⁵ The official further says that the reduction is largely due the sharp decline in labour force, necessitated by the government's policy of not filling up the vacant positions (total employment in the factories, between 1995-96 and 2008-09, has decreased by 37 per cent to 107,061). Besides, the reduction in overhead charges is not uniform across the group of factories, suggestive of absence of systematic efforts to curb the overhead charges.

Table 3 Overhead Charges in Ordnance Groups of Factories

Group of Factories	Average percentage of overhead to cost of production				
	1995-96	2000-01	2005-06	2007-08	2008-09
Materials and Components	47.67	49.84	45.89	41.53	42.61
Weapons, Vehicles and Equipment	44.83	39.67	32.80	33.12	37.26
Ammunitions and Explosives	23.08	19.69	22.48	20.06	24.73
Armoured Vehicles	36.29	38.18	20.22	24.63	20.23
Ordnance Equipment	24.22	28.20	28.45	32.03	34.06
Total Factories	34.84	31.84	28.52	28.38	29.97

Source: Reports of the Comptroller and Auditor General (CAG) of India, Union Government (Defence Services), Army and Ordnance Factories (relevant years).

Quality of OFB Products

In a reply to the lower house of the Parliament in 2007, the Minister of State for Defence Production reported a number of deficiencies in OFB products, including some batches of 5.56 mm INSAS rifle, 5.56 mm light machine gun, small arms and ammunitions, tank ammunitions and delay igniter. The minister further reported that affected items were segregated for investigation and corrective actions.¹⁶ Besides the Parliament, audit agencies have also reported deficiencies in OFB products. In 2005, the CAG observed that of the 47 items (test audited by the agency) of weapons, ammunition and heavy vehicles produced in the OFs, 18 items had quality problems.¹⁷ Recently also, the CAG talks of defective manufacturing of bombs and empty primers, leading to their rejection and loss of revenue.¹⁸ While

the oversight agencies have raised concerns from time to time, the armed forces are most vociferous with regard to the quality of OFB products. Army officials, both present and retired, who were interviewed told that most of the OF products are below mark, and often cause of loss of the lives of service personnel. Between 1999 and 2004, the army reported a total of 3,210 defects in OFB supplied products, of which more than 1,500 were related to weapons, ammunitions and armoured vehicles.¹⁹ There are instances where the army, being frustrated with consistent failures of some OFB products, has resorted to "expedient approach", by way of setting its own in-house repair facility.

While the defence companies worldwide are constantly under watch for the quality of their products, the OFB too is no exception. However, unlike most of other manufactures, the accountability of the product's quality does not lie entirely with the OFB. The Directorate General of Quality Assurance (DGQA), a body which functions under the administrative control of the DDP, is responsible for ensuring the quality of supplies from the factories.²⁰ However, the primary responsibility of DGQA in providing quality assurance has not been, as pointed out by several expert committees, commensurate with its role as second-party quality assurer.²¹ Rather the body is deeply engaged in the factories' production process, diluting the OFB's core responsibility for quality. Even the OFB officials have "conceded that the factories sometime became slack because of the knowledge that DGQA, in any case, was going to check the stores."²² To make the OFB directly responsible, the MoD, of late, has however asked them to move towards the process of self-certification, a norm widely practised globally. Though OFB has started self-certification of their products, the items, as of now, are restricted to low-tech items like clothing and general stores. At present, there is no time frame for covering the entire product range. The MoD, in consultation with the OFB, should lay down the precise time frame, by which all the items supplied, including those overhauled by them, would be self-certified.

Exports

Historically, exports by OFs had never been a primary focus. However, in a major policy change, the MoD has allowed OFB to venture into direct exports business since 1989. The intention of the policy decision was not solely revenue driven. Rather it was intended that the international exposure will make the factories quality and price conscious. At the same time, it was visualised that exports will allow the factories to take advantage of the spare capacity, which, in turn, would drive down the per unit cost of production. To provide a competitive edge in the

international market, the OFB was also instructed to resort to “strategic pricing”, covering full material costs and a part of labour and overheads costs.²³ Despite these initiatives, the exports have not really gone up over the years. At present, only a fraction of their sales come from exports. Besides, not all the factories are in the export business (Table 4).

Table 4 Export Performance of Ordnance Factories

Year	No of factories involved	Exports (Rs in crore)	Exports as % of total value of sales
1997-98	13	23.83	0.8
1998-99	13	13.46	0.3
1999-2000	11	6.19	0.1
2000-01	15	11.79	0.2
2001-02	15	35.32	0.6
2002-03	17	59.52	0.9
2003-04	16	103.00	1.6
2004-05	17	58.00	0.9
2005-06	11	14.66	0.2
2006-07	13	15.12	0.2
2007-08	10	27.44	0.4
2008-09	11	41.07	0.6

Sources: Authors database, based on various reports of the CAG of India, and annual reports of the MoD.

There are several factors behind OFB’s poor export performance, some of which are not in its direct control. For instance, the OFB’s exports are limited to only those countries which are not figured in the “negative list” as maintained by the Ministry of External Affairs. Similarly, the OFB can not export some of its high-value systems such as tanks, some ammunitions and IFVs because they are based on

foreign technology, and this requires permission from its overseas collaborator for selling to third parties. The export potential is further constrained due to some of OFB products' non-compatibility with North Atlantic Treaty Organisation (NATO) specifications.

The given factors notwithstanding, the present export level could not be termed satisfactory. The limiting factors, however genuine, are not peculiar to the OFs only; they also apply to the existing government-owned DPSUs. Measured in terms of the percentage of total sales, DPSUs such as Hindustan Aeronautics Ltd (HAL) and Bharat Electronics Ltd (BEL) have higher exports, in the range of 4–5 per cent, compared to less than 1 per cent for the OFB. Although the OFB of late has taken few measures—such as procedural simplification, hosting of an “international generic” website (www.ofbindia.com) and product demonstration in major arms exhibitions—they have not resulted in any significant dividend. The lack of enthusiasm of customers is primarily because of two factors. First, the international customers are not yet convinced about the competitiveness of OFB products, in terms of both quality and price. Second, the OFB has so far not taken a corporate approach in establishing a brand image for its product. Unless these aspects are taken care of, there is little hope of enhancing the export potential.

Conclusion

Since the establishment of the first factory in 1801, the ordnance factory organisation has grown into a large industrial house, presently consisting of 39 factories with two more in the pipeline. These factories, apart from producing a variety of items for armed forces and other customers, are also responsible for enhancing India's self-reliance in defence production. However, the organisation, despite its long presence and vast capability, has not performed to its full potential.

Presently, the OFs have little autonomy, in comparison to other defence public sector enterprises. The lack of autonomy has prevented the organisation from graduating into an independent production centre. Instead, the organisation continues to depend on the government orders on nomination basis for its sustenance. While the government has taken some initiatives like creating the OFB for the internal management of the factory, it has not proved effective because of the lack of powers vested in the board members. The government needs to put an effective management system in place by corporatising the OFB and giving it autonomy in its functioning. The board should also be made responsible for performance of factories under it.

Though the range of products produced by the factories is numerically on higher side, it is not enough to meet the diverse requirement of the armed forces, forcing the government to import many critical items worth billion of dollars. In addition, the factories production of many high-end products are based on licences or though CKD/SKD, suggesting the lack of in-house capability for such production. The dependency on external sources for its production is largely due to absence of in-house R&D. In view of this, there is a need to strengthen the in-house R&D facility of the OFs.

Execution of orders by the factories is sometimes hampered due to delay in finalisation of annual targets by the armed forces. Since the production capability of the factories can not be augmented in a short span to match the annual targets of the armed forces, the latter need to give firm orders of at least 2–3 years. In addition, the forces should also share their LTPPs with the factory board, so as to enable them draw long-term modernisation and production plan.

The OFs need to assume greater responsibility with regard to the price and quality of their products, so as to infuse greater confidence not only among the domestic consumers but also in the export market, which has so far not been taped successfully. The existing system for price negotiation between the government, OFB and the users needs to be strengthened though detailed and timely completing of the annual accounts and benchmarking the cost elements against a set of standard parameters such as material procurement cost and productivity gains, among others. At the same time, the factories need to bring greater efficiency in usage rates of both labour and materials. As regards quality, the factories should progressively move towards self-certification, while the DGQA could render its services as second-party quality assurer in letter and spirit.



Notes:

- 1 Standing Committee on Defence (2005–06), 14th Lok Sabha, Ministry of Defence, *Defence Ordnance Factories*, Seventh Report, New Delhi: Lok Sabha Secretariat 2005, p. 5.
- 2 *Procurement of Stores and Machinery in Ordnance Factories*, Report of the Comptroller and Auditor General (CAG) of India, Union Government (Defence Services), Ordnance Factories, No. 15 of 2010–11, p. 2.
- 3 See *Public Enterprises Survey 2009-10* (Vol. I), Ministry of Heavy Industry and Public Enterprises, Government of India, pp. 112–116.
- 4 The independent functioning of individual OFs is however limited to certain financial powers delegated to them.
- 5 *Procurement of Stores and Machinery in Ordnance Factories*, n. 2.

- 6 Standing Committee on Defence (2008–09), 14th Lok Sabha, *Indigenisation of Defence Production: Public–Private–Partnership*, 33rd Report, New Delhi: Lok Sabha Secretariat, 2008, p. 83.
- 7 Report of the Comptroller and Auditor General of India, Procurement of Stores and Machinery in Ordnance Factories, Union Government (Defence Services), Ordnance Factories, No 15 of 2010–11, p. xvii.
- 8 The value of production of OFs is inclusive of inter-factory demand (IFD) which is around 25 per cent of total production value. Ministry of Defence, Government of India, *Annual Report 2010–11*, p. 59; and N. Neihisal, “Outsourcing and Vendor Development in the Indian Ordnance Factories”, *Journal of Defence Studies*, Vol. 3, No. 3, July 2009, p. 82.
- 9 “SIPRI Arms Transfer Database”, available at <http://www.sipri.org/> (Accessed August 13, 2009). It is to be noted SIPRI uses Trend Indicator Value (TIV) for measuring trends in arms transfers. The TIV does not however reflect the financial value of arms transferred, leading to its critique by analysts. For a critique of TIV, see G. Balachandran, “International Arms Transfers: A Study”, in Jasjit Singh (ed.), *Conventional Arms Transfers*, New Delhi: Institute for Defence Studies and Analysis, 1995, pp. 48–59.
- 10 In 2006–07, OFs’ total R&D expenditure was Rs 10 crore, representing less than 0.6 per cent of their sales.
- 11 Interview with a member of the DRDO review committee (May 2009).
- 12 Standing Committee on Defence (2008–09), 14th Lok Sabha, *Indigenisation of Defence Production: Public–Private–Partnership*, 33rd Report, New Delhi: Lok Sabha Secretariat, 2008, p. 7.
- 13 Standing Committee on Defence (2005–06), n. 1, p. 40.
- 14 The overhead costs include those of the plants and machineries, and is divided into fixed and variable overheads.
- 15 Interview with an anonymous official of the Defence Accounts Department, Ministry of Defence, Government of India (May 2009).
- 16 Government of India, Lok Sabha, “Rejection of Indigenous Weapons by Armed Forces”. Unstarred Question No 2231 asked by Shri Ananth Kumar and answered on December 03, 2007 by Minister of State for Defence Production Rao Inderjit Singh.
- 17 *Performance Audit of the Directorate General of Quality Assurance: Quality Assurance of Armaments*, Report of the CAG of India for the year ended March 2004, Union Government (Defence Services), Army and Ordnance Factories, No. 18 of 2005, p. 15.
- 18 Primer, which comprises of body, plug, anvil, ball, magazine and adapter, is a critical item in the manufacture of ammunition. See Report of the CAG of India for the year ended March 2006, Union Government (Defence Services), Army and Ordnance Factories, No. 4 of 2007, pp. 36–38.
- 19 Report of the Comptroller and Auditor General of India, n. 17, , p. 18.
- 20 Functioning of DGQA under the DDP has been criticised as an “organisation infirmity”, as it impinges on former’s independence.
- 21 In 1980, Rajadhyaksha Committee had recommended that DGQA should restrict itself to final acceptance inspection and leave the intermediate inspection to the factory.
- 22 Report of the Comptroller and Auditor General of India, n. 17, p. 20.
- 23 Ordnance Factories Board, *Annual Report 2005–06*, p. 21.