Transfer of Technology in Indian Defence Manufacture - Elements and Challenges

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Abstract
It is a well-documented fact that Technology is a wealth creator of the nation. Civilisations have been built on technology and have vanished when they lagged in technology. Transfer of Technology (ToT) provides the ability to a nation to meet its particular need in a cheaper, faster and easier method than developing the product from the scratch. The process of obtaining ToT from a foreign OEM starts with the Fully Formed (FF) equipment, followed by Semi Knocked Down (SKD) kits and then Completely Knocked Down kits (CKD) and finally Licensed Manufacture (LM). There are many impediments in ToT, like protection of Intellectual Property Rights, affordability of nation to buy niche technology, Gap in technological ability between transferor and transferee and policy implementations. Though Defence Procurement Policy (DPP) stipulates, asking for technical information of all upgrades in the entire life cycle of the product to be provided at no additional cost is not easily acceptable to an Original Equipment Manufacturer (OEM). The Armed Forces need the latest technology, better than the adversary, to fight a war, as soon as possible. Whereas, design and developing a technology requires large time frames. Government of India and MoD is trying to encourage ToT by giving fillip to Joint Ventures and industry friendly Offset rules. Various government initiatives and factors like better ranking in ease of doing business, faster growth of Indian economy, inflow of FDI in defence manufacture, skilling the human resources, cultural shift in production standards, policy stability, protection of IPR, and a national policy of ToT, probably under the newly formed Chief of Defence Staff (CDS) may herald a new chapter in Indian Defence Equipment manufacture.

Keywords: Transfer of technology (ToT), DPSU, MSME, DPP, DPrP, Joint Ventures.

Introduction
It is well documented fact that Technology is a wealth creator for the nation (Boskin and Lawrence 1992). Civilisations have been built on technology and have vanished when they lagged in technology. Off late, Technology, (like mobiles, laptops) is directly linked to standards of living of the citizens of a country. Armed Forces with better technology have not only defended sovereignty of their country but also have expanded their reach and sphere of influence.

Transfer of Technology (ToT) is movement of innovations, ideas, knowledge, and techniques from one organization or country to another through assistance, investment, licensing, trade, or training. In Indian defence equipment manufacturing, ToT is recognised as a key factor in achieving the self-reliance. Several measures, policies and manuals have been issued including DPrP (Defence Production Policy), DPP (Defence Procurement Procedure) and Make in India initiatives. Still, there is lot more to be achieved in Transfer of Technology and indigenisation in Defence equipment manufacturing.

Transfer of Technology – Key Elements
ToT provides the ability to a nation to meet its particular need in a cheaper, faster and easier method than developing the product from the scratch. The production system of recipient nation due to ToT gets exposed to the global standards and practices which will have a spiralling effect on productions. The new skill sets acquired through ToT would have a cascading effect which must logically improve industrial growth and economic development of a nation creating more jobs. ToT can aid the indigenous technology development at DRDO labs and set standards to local production in DPSUs and MSMEs. The biggest advantage as seen by armed forces is its quick availability of cutting-edge technology to improve its war waging ability. R&D labs can be benefitted by becoming aware of global standards and global design requirement. Manufacturing agencies are exposed to global practices and matured technologies.

The need for Technology Transfer was always felt by Indian thinkers and policy makers. Historically, what was known as a Licensed Production in DPSUs was considered the best way to obtain cutting edge technologies to India. The Fully Formed (FF) equipment is the first step in obtaining the initial consignment of the equipment. Once the Indian users were accustomed to operation and maintenance of the equipment, Semi Knocked Down (SKD) kits were the obvious extension, where assembling of major parts were carried out on the Indian soil. The third step was to obtain Completely Knocked Down kits (CKD) with smaller parts assembled with OEM setting up assembly lines and training

the local workers. Licensed Manufacture (LM) is the earlier avatar of ToT although most niche technology/proprietary parts were still provided by OEM. Mig 21 production at HAL Nashik HAL division was one such attempt. Such LM had its own set of issues – like quality and delays in production at DPSUs and Ordnance Factories.

Impediments in ToT

ToT in manufacture and ToT in Repair and Overhaul are the two types of ToT that need to be separately dealt with. Overhauls, also being extremely technical in nature, wherein an aircraft or equipment is dis-assembled and re-assembled – requires a complete handholding by OEM and provision of right type of test equipment and jigs to carry out the task (Desouza 2019). Some of the key issues identified as impediments in ToT are:-

1. Intellectual Property Rights concerns of the OEM.
2. Gap in technological ability –for transferee to absorb the technology.
3. Trust Factor between the nation/OEM of transferor to transferee.
4. ToT typically tends to be more costly than the Commercial off the shelf purchase.
5. Availability of skilled workforce in transferee country. The advantage of low labour cost is neutralised by low productivity of unskilled workers.
6. Extremely demanding terms and conditions from the transferor.
7. Exorbitant costs.
8. Niche technology is never transferred by OEM.
9. Apprehension that transfer will dilute their brand and damage the competitiveness.
10. Readiness of Indian MSMEs to absorb both in skill and capital investment.
11. Capital investment and FDI.
12. Gap between policy initiatives and its implementation on ground zero.

Self-Reliance

Self-reliance can be described as equipping of armed forces to match India's adversaries with a range of weapons and equipment either foreign or indigenous maintain them to their full operational effectiveness and should be confident of spares and ammunition support under all conditions (K Subrahmanyam, 6th Kirloskar Memorial Lecture). K Subrahmanyam had observed that self-sufficiency is the in-house production of everything that is needed by the Armed Forces, a state which he considered as impractical for a developing nation possessing limited resources. Self-reliance review committee headed by Dr Kalm in 1992 (Behra, 2013) defined a self-reliance index (SRI) as percentage share of indigenous content in the total procurement expenditure suggested the objective of achieving an SRI of 70 percent over a ten-year period ending in 2005. The Kelkar committee had pointed out that there is a need to go beyond import substitution to involve capability enhance and development, increasing know-whys of design and system integration.

World as a Global Factory

The world is increasingly becoming a global factory. Each of the part or sub part is produced in different geographical locations but integrated at a Company's main assembly plant. HAL has been the single-source producer of overwing exit doors for a global product of Boeing 757 planes. Gripen aircraft is produced by Sweden, sourcing assemblies from different countries. India needs to develop a niche technology wherein the product/assembly is best in the world. The bargaining power for ToT or for a possible Joint Venture, not only comes from what we can buy with money but also with what we can produce with our technology. If we specialise in a particular niche field like metallurgy, software or payloads – countries/OEMs would look forward to tie up with Indian firms. A small country like Israel has many EU countries looking upto them for technical tie ups and Joint Ventures. A country like South Korea, which initially benefitted from ToT - now has a global edge on mobile phone manufacturing and is considered a major player in ship building industry.

DPP and DPrP Concerns on ToT

Substantive self-reliance in design, development and manufacturing in defencesector, in as early time frame as possible is envisaged in Defence Production Policy (DPrP). Defence Procurement Procedure (DPP) stipulates that the comprehensive ToT pertaining to critical technologies as per the specified range, depth and scope of critical technologies must be obtained. Full or a complete ToT is a tough thing to negotiate and implement with any OEM, although DPP mentions comprehensive ToT as a requirement. The process of defence procurement is time consuming and technology can always move ahead by the time an order is actually placed after long procedures. This lacuna has been somewhat addressed by the Enhanced Performance parameters of DPP which allows a bidder to offer newer technology at the time of delivery. DPP has come out with a list of critical technologies and also has specified Indigenous content in each of the category. However, the proprietary items that gives a system an edge over the competition is typically - closely guarded by OEM. OEMs will not be keen

to part with such proprietary technology probably till it reaches end of its shelf life.

The cost of ToT will depend on the recipient countries technology absorption capabilities. Asking for technical information of all upgrades in the entire life cycle of the product to be provided at no additional cost (DPP) could be a tall order to ask from any OEM. At best, OEM would like to provide minor modifications or a software update but expecting an OEM to provide it free of cost is a hard thing to bargain. One of the possible ways to ensure a good deal is to get into an agreement with an OEM (or government of a country) who have in past have actually helped in transferring the technology to India. Once there is a history and trust between countries, it should lead to defence deals with a real and transparent technology transfer.

Budget and Time Frames

The Armed Forces always need the latest and the best of military equipment what global market can offer – after all they are there to win wars. When a new technology props up, DRDO and Indian R&D organisations, starts catching up and by the time a product reaches production stage, the technology may not be all that state of the art as time lines involved are too large in Indian scenario. Budget is a constraint for a developing economy like ours to pump in large resources on R&D and sustain it for a long time. The strict time lines to produce a final output/equipment don't really work in R&D environment and at the same breath we must mention that the armed forces need to be current in technology with their war waging inventory. A country which lacks industrial base and a culture of R&D - will always be in the catching up mode. A technology will only get transferred when there is sufficient financial compensation to do so- for the OEM. Even if a country transfers a technology, the recipient nation must have the will and infrastructure to harness the content and take up further development on its own. The success stories of ISRO, LCA and Indian automobile industry can be template for ToT and indigenous R&D.

For a good technology absorption, the Indian defence industries should have abilities to assemble, test, manufacture (in part or full) and later even to design and develop. The industries need to have the potential to learn the processes quickly, infuse capital and even upgrade in a defined time frame. The flow of designs from R&D organisations to development and then to manufacturing lines, is a time-consuming process involving many agencies. On author's interaction with MSMEs, it was revealed that the biggest constraint in MSMEs is the capital budget. Unless there is a guarantee on orders (economy of scales) and sustainability in orders, no sensible businessman would invest money in absorbing new technology. Manufacturing units cannot place orders unless the equipment is proven and accepted by the user and quality assurance agencies. Such chicken/egg first equations can only be solved by huge investments by the government and it has to be in DPSUs.

Reverse Engineering

The history of military Technology, in the end, is the history of innovation, counter-innovation, and further innovation. The increase in complexity of defence equipment has made the imitation and replication of the performance of state-of-the-art weapon systems harder— in spite of globalization and advances in communications (Gilli 2019). On one hand, the increase in complexity has significantly raised the entry barriers for the production of advanced weapon systems - countries must now possess an extremely advanced industrial, scientific and technological base in weapons production before they can copy foreign military technology. On the other hand, the knowledge to design develops, and produce advanced weapon systems is less likely to diffuse, unless it is done the legal way.

If imitation was easy, without ToT, why one would invest time and money at all? One could argue that through reverse engineering, industrial espionage or cyber espionage, an imitating country could skip the design and development stages and manufacture a foreign weapon system using its existing industrial base. This argument ignores a key constraint - the increase in complexity has also made manufacturing processes more specific and possibly unique. Because of the requirements that military platforms need to meet, today's production processes must achieve stringent levels of precision that are alien to most industries. So Indian context, Reverse Engineering is not an option and legal ToT by paying upfront is the right way to move ahead.

Joint Ventures

Joint Venture, as in the case of Brahmos missile system, are independent entity formed from the contribution of two or more agencies or companies to achieve the common goal. The companies typically bring together complementary technologies and also contribute a joint funding. Although the JV seems to be the perfect recipe for a ToT, it has its own set of issues. (De' Souza 2019). We as a country must first possess a niche technology that a JV aspirant is interested in. The fifth generation fighter aircraft (FGFA) development through Perspective Multi-role Fighter (PMF) which was conceived as a JV, is yet to really take any shape and it appears that it will only be revisited later once Su-57 aircraft is fully operational at Russia (Economic Times,

2018). This project considered both the countries, India and Russia as co-developers and India was also was to have equal rights over the technology. One of the biggest advantage of a JV is that the developer of a technology has greater control over it. It leads to joint Intellectual Property Rights (IPR) and a shared international market space, though the technology cannot be exploited and exported with the freedom that pure indigenous technology (Ravindran, 2009).

Outright purchase of a niche technology is a very expensive proposition as transferor would be keen on recovering the complete cost of R&D and development from the transferee. JV can work out to be an ideal solution when there is a trust and a vision for a very long engagement between two companies backed by the unequivocal clarity by the two governments. The department for promotion of industry and internal trade (DPIIT) and the defence ministry are in talks to ease many conditions to encourage foreign investors to set up shop in India. One more round of liberalisation is expected to raise the limit for automatic clearance to 74% along with relaxation in other conditions (ET Oct 2019).

Offsets

Offset is one another option to get Modern Technology. The desired result in economy boost and ToT has not really taken off and even the inked offset clauses have barely managed 20% of the target of 11.2 Bn expected by the Industry experts(ET Jan 2019).Offsets, though introduced in 2005 as a policy, are probably yet to mature to see actual modern/niche technology landing into Indian shores. The recent Rafael deal and the controversy surrounding the offset clauses has probably made decision makers to be extra cautious in dealing with it, which might further delay the offset processes. But certainly, offsets, in terms of technology transfer can create wealth and jobs in Indian market though critical technologies may never come through this route.

Human Resources

Human resource as a tool to acquire new Technology is a concept which really needs a National HR policy. China had sent large number of students abroad, especially to US to gain skills necessary for the country's economic and social development. We, as a country need to match salaries and living standards of western countries, to attract any talent back to India. One head or one expert hired cannot bring about the big change required to get the global practices in defence equipment manufacture. Only an inter-governmental understanding to receive a set of experts to build, operate and equip a defence manufacturer from scratch to full-fledged manufacturing ability– as a policy - could help, which is difficult to implement. Despite having Technical Institutes of International repute like IITs and NITs, the ToT from University to manufacturing is yet to mature in India. Universities can only take up small projects but real design and development can happen only with focussed leadership at R&D institutes, raised specifically for it. We must look at co-locating R&D and manufacturing units together.

Democracy as a Factor

The vibrant democracy of India comes with its own set of advantages and disadvantages. The biggest advantage is that many Western countries, who have the '*know hows'* of the niche technology, see India as a natural ally due to impressive track record of the country, as a democratic nation. The flip side is that, there could be different approach to foreign policy by successive governments. The government of the day will always be very cautious about the defence procurements considering the scandal history of the past and ability of opposition to swing public opinion based on procurement including government to government deals. Unlike a unified command and control structure of China, where National policy on indigenous equipment manufacture can easily be evolved and implemented, the decision making in India has to be slow as it has to go through checks and balances of a democratic set up.

Conclusion

We as a nation, need to evolve a ToT policy which will withstand test of time. Mutual trust in political leadership cutting across the parties becomes a key factor, especially on issues concerned with National Security. Once there is ToT policy, and a trust factor established with a foreign country/firm, then ToT should happen willingly and smoothly as long as commercial aspects are taken care of. Irrespective of the government of the day, money of investing OEM should be safe, economy of scale for profit making should be guaranteed besides safeguarding Intellectual Property Rights. The two countries can ink a Government to Government visionary deal with a long-time frame of say 30 to 60 years for ToT and setting up defence equipment manufacturing through DPSU and MSMEs. The strategic partnership route of DPP appears to be based on these thoughts and lines. Proposed procurement of 114 Fighter Aircrafts, considering its size (18 Bn $ appx) and impact, may kick start a new beginning in Indian defence industry if we can obtain a true ToT and manufacturing facility for global standard fighter aircrafts. A public private

partnership, wherein government brings in policy and initial capital and established business houses bring in their management and work culture could be an option to increase Indigenous content in defence equipment manufacture.

Various factors like better ranking in ease of doing business, faster growth of Indian economy, inflow of FDI in defence manufacture, skilling the human resources, cultural shift in quality consciousness and production standards, political stability, policy stability, protection of IPR, stricter and efficient patent laws implementation, harnessing the global standard institutes of IITs for Research, cultural shift in working ethos of DRDO, DPSU and MSMEs and a national policy of ToT, probably under the newly formed CDS may herald a new chapter in Indian Defence Equipment manufacture.

Source of Funding
None.

Conflict of Interest
None.

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How to cite: Srinath TM. Transfer of Technology in Indian Defence Manufacture - Elements and Challenges. *J Manag Res Anal*. 2020;7(1):6-10.