

# Technology Inflows: Issues, Challenges and Methodology

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The defence offset policy mandates the foreign suppliers to plough back a minimum of 30 per cent of the contractual value of projects worth Rs. 300 crores or above to the domestic defence industry. The offset route is intended to strengthen the domestic defence industrial base through a combination of technology transfer, investment in R&D and in production facilities, besides export business generation. From the national view point, the offset aims self-reliance and indigenous capability enhancement in the vital defence sector involving advanced technology.

The real success of technology absorption projects and technology enhancement schemes has always been a subject matter of debate between the administrators and technologists. Our experience of serial license – production agreements - reveals the yawning gap between certain types of licensed manufacture and development of indigenous capability. Hence while finalizing offset contracts, apart from the commercial angle, it is very important to ensure that the requirements of short and medium term goals of developing indigenous capability and know how are ensured.

This paper attempts to highlight the “Technology Inflows” as emerging from the implementation of offsets as well as “Challenges” foreseen in such implementations and suggested “Methodologies” for its effectiveness. This paper primarily deals with technology concerning Defence Electronics as the applicability in other sectors may need suitable adaptation.

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## Technology Inflow Routes

Over the period, some of the important commonly accessed routes for technology inflow through offsets to the recipient countries are following:

### (a) Co-development and Co-production

Co-development and co-production is seen as a very effective mechanism in state of the art technology induction and absorption. In joint development programs, the access to technology that individually the partnering companies / countries could not have developed is realized at substantially less cost and time. The joint development also ensures that the part of production work along with the jobs it creates is ensured to the Indian partner also.

By this process, the companies / countries will become partners at specific contribution levels. There are financial benefits connected with the contribution, the primary benefit being the access to advanced technology and an advanced product. Further, it provides the Indian vendors with the necessary skill sets through their contribution in the joint program.

Joint Intellectual Property (IP) rights and shared international market space should be part of the negotiated contract thereby providing international exposure and a fair share of the resultant revenues to the Indian firms.

### (b) Sub-contracting / Contract Manufacturing

Sub-contracting / contract manufacturing occurs when a foreign vendor procures defence-related components, subsystems or products for export from industries in countries where the vendor has to meet offset obligations.

In the short timeframe sub-contracting / contract manufacturing is an effective mechanism in bringing the technology. This could, however, get limited to fabrication, assembly and related services. The sub-contracting can either be through 'Build to Print' or "Build to Spec."

- ***Build to Print:*** The foreign vendor provides the complete documentation package to the (Indian) defence industry. The documentation package could include manufacturing drawings, Quality requirements, Test methods, Acceptance / Rejection criteria, etc. The Indian industry executes the task based on user-supplied data, being able to source / manufacture the parts, assemble and test the sub-assemblies / product before they are delivered. The design issues, if any, is an essential responsibility of the supplier while Indian industry could share the responsibility for design verification, especially while implementing modifications to the original documents.
- ***Build to Spec:*** The foreign supplier provides the detailed Technical Specification, Quality requirements, etc. to the (Indian) vendor who undertakes the design, development, manufacture and supply of the product. This method may also go through the phases of development of prototypes, user trials and evaluation, etc. as applicable to the product or sub-assembly.

During contract negotiation stage the IP related issues are to be resolved so as to avoid legal problems later.

### (c) Joint Ventures

The technology inflows can be affected through establishment of Joint Ventures (JVs). However, the investment level remains a critical factor affecting the success of a Joint Venture. In a Joint Venture with foreign equity participation restricted to 26 per cent, the OEMs, since they guard their IP, may inhibit / hesitate the collaborating partners to bring in cutting-

edge technology. There are instances where the JVs have become non-functional due to technology obsolescence, with the foreign partner limiting his investments and continue up gradation to his technology.

#### (d) Licensed Production

The transfer of technology (ToT) to a local defence industry capable of absorbing the technology, if implemented in true spirit, where both the supplier and the recipient are competent organizations, the local industry will be able to further develop the technology and this result in leapfrog on the existing technology lag. However, it has been experienced / seen that the absorption of technology and later its enhancements are often critical issues in its implementation.

From the seller's viewpoint, he would be throwing away his competitive advantage if he transfers all of the technology related to the product being sold. Further, from seller's perspective, he would be giving away know how to a partner who may later become his competitor. The seller therefore, may estimate the opportunity cost excessively causing avoidable increase in ToT costs. Also, precise verification of technology cost is difficult due to non-availability of sufficient details.

Invariably, the depth of technology being transferred becomes selective at the hands of seller. The proprietary items included by the seller in the TOT contract results in buyer being dependent on the seller. The buyer is unable to leverage the ToT. There are always gaps between the needs / expectations of the buyer and the offer from the seller.

While these aspects are primarily applicable to hardware related programs, the issues become further complicated where there is substantial software content also. Generally, the executable codes of software are transferred to the buyer who will be able to copy the same for implementation in another

module. The 'know why' is not normally part of the transfer without which the buyer can not carry out any enhancement /modification of the product for its uninterrupted usage or even marginal up-gradations to overcome obsolescence related issues during its service life.

#### (e) Maintenance ToT and Training

Long-term customer support activities have become mandatory. The training of local industrial partners and user agencies in maintenance of the system through applicable level of technology transfer ensures effective and committed maintenance support. The establishment of Maintenance Repair and Overhaul (MRO) Facility on partnership basis is an option to achieve this objective. By this the local defence industry acquires the technology and offers maintenance support to the user agency on a long-term basis. Establishment of training facilities like flight simulators and user-training centers by the foreign vendor in partnership with local defence industry will adequately meet this requirement. It will also be necessary to stock and maintain adequate quantity of spare parts for meeting D-level maintenance requirements.

#### Issues and Challenges associated with Technology Transfer

While the technology inflows may be through various means as explained, there are many issues and challenges foreseen in respect of our goal of achieving self-reliance and becoming leading technology house through technology transfer. Some of the critical issues related to technology transfer are the following:

##### *Relevance and Depth*

The vendor may offer transfer of technology not directly related to the product or system being procured. Hence, the offers from foreign vendors

need very careful and in-depth scrutiny to ensure that the technology being offered is relevant to defence applications both current and futuristic. Also, the depth of technology being offered for local manufacture for the systems / products is crucial to the development of local industry. The practice of holding back critical technologies by the *vendors calling them proprietary and necessitating continuous dependence on them for local manufacture of products need to be addressed during contract negotiations.*

Today the products and sub-systems are very software intensive. The software has become a component in most of the sub-systems. The know-how transfer should essentially address this even if the processes and procedures for its implementation are considered to be tedious.

In the present day context, where outsourcing of product development activities including design of sub systems, accessories, etc. are in common practice, we must critically assess the foreign supplier's actual possession of technology and his capability to transfer it. We need to evaluate the suppliers in this regard at a much greater depth during the process of selection.

### *International status*

The technology on offer should be assessed for its current position in the international market and its capability of remaining current for the period of its intended application by the user agency. This will help us avoid the pitfalls of giving credit to sub-standard or obsolete offers for technology transfer.

### *Capability of Indian Industry*

The capability of the local industry to absorb the technology being transferred is a critical factor. Indian Defence Industry with strong R&D base and Defence R&D establishments are certainly capable of absorbing

and translating the critical technology into products and systems needed by defence. For example, Bharat Electronics Limited (BEL) spends approximately 5 per cent of its annual sales turnover on Research and Development, with more than 1200 qualified engineers working on R&D projects. Assimilating technology in a related area and building further on it, poses no hurdles to BEL. There are other capable Indian defence industries also and along with OFB and the DRDO labs, the indigenous capability for technology absorption is indisputable.

However, this critical aspect of the Indian industry could face a technical challenge in future endeavours where the absorption of imported technology is carried out within specified time-frames and applied either directly for new products or in related areas for diverse product ranges.

It should be noted, however, that mere substitution of proprietary components with indigenous ones would take us only a limited distance forward in areas of improving existing products. The emphasis should be on internalizing the capabilities in such a way that new and diversified products can be developed in-house by leveraging the transferred foreign technology.

### *Industrial Returns*

Apart from the most important aspect of meeting the vital defence needs for which the technology is imported in the first place, the technology on offer must necessarily bring in industrial returns either from domestic market or from international market or from both and therefore should be assessed for this potential.

### *License Issues*

Frequently, it is found that the technology concerned is subject to approval of the foreign government and hence obtaining latest technology becomes difficult. In many areas of cutting-edge technologies, foreign suppliers do

not part with their technologies citing patents, IPRs etc., or may fix enormous prices for the same. Even in cases where the supplier is willing to sell the technology for a price, the governments in question do not permit the same under their respective export control regime. A very expensive and extensive licensing procedure, which is a very time consuming, has to be gone through in order for the product / technology to be exported. Finally, there are certain products / technologies that are barred for exports to certain third world countries and certain organizations.

### *Determination of Multiplier Factor*

Since Technology transfer becomes a key component of the Offset agreement, suitable multiplier factors may need to be worked out, if required, to promote and encourage the foreign supplier who is willing to transfer the necessary technology. The negotiated value of the technology is often based on the foreign supplier's prior investment in research and development, the market value of the technology or the cost of developing the technology in India. Multipliers should be applicable only for very critical technology and that too if transferred totally so that Indian industries can further develop on them.

### *Technology Valuation: Issues and Methodologies*

Valuation of technology is highly complex and extremely difficult and at times may appear to be subjective. This is in fact the greatest challenge in the whole process of technology transfer. However, technology valuation is a critical component of the technology transfer process and it is essential that this is carried out in as accurate and transparent manner as possible.

Offset agreements and contracts meet various requirements of the governmental agency entering into the contract with the foreign supplier. If government intends to use the offset value through direct offsets like manufacturing and/or technology transfers in the purchased product area, then the value of the offset is worked out based on the value of the costs of

manufacturing, value of the technology that is to be transferred, etc.

Based on the availability of infrastructure for product manufacture, support and future utility of such infrastructures, decisions could be made for offset value considerations. The multiplier issue can also be addressed based on such factors. As far as transfer of technology is concerned, the offset value can be arrived at only after complete analysis of the value of the technology.

Hence it becomes imperative to carry out a complete analysis of the value of technology involved in the transaction. In this regard, the technology valuation should consider the following aspects:

- *Details of technology and its applications:* In today's industry, technology used for a given product serves as at least a guideline for numerous other products thus paving the way for increased scope of products and services. Also many technologies have a dual-use application and thus many defence technologies also contribute to the civil sector.
- *Expected impact of technology in terms of profits:* It is becoming increasingly difficult to manufacture products with older technologies due to obsolescence of parts and processes leading to considerable erosion in profits caused by increased costs of manufacture and subsequent maintenance. Hence, the impact of latest technology in terms of ease of production and maintenance is realized through increased profits of operation.

These two factors have a significant impact on the importance of the efforts spent on technology valuation.

As regards information to technology and its applications are concerned some relevant questions to be asked are:

- Is it basic research leading to a new product or replacement of an existing product?  
Costs of technology for totally new products need to be evaluated against replacing the existing products of older designs / technology as this could pave the way for newer system designs.
- How does it benchmark with respect to other researchers and competitors?  
Frequently, the new technology is attempted by several companies in the same industry and the specifications on offer need to be critically evaluated before finalizing agreements.

The impact of technology can be assessed by examining the following aspects:

- *Technology impact* in terms of incremental improvement versus breakthrough invention. The costs of products and services based on incremental improvements in the available technologies are frequently found to be higher than that incurred for breakthrough technologies which may cost higher up-front but proves cost effective later on.
- *Potential market size*. Products directly based on imported technologies could have broader market base than local markets. When products are developed in-house after imbibing the technology that is comparable to international levels, the products become eligible for international markets. Also in case of dual-use technologies, the civilian products could have a much wider market in India itself.
- *Competitive advantage* which can be translated into profits. When local contractors become eligible for international markets and thus derive competitive advantage over other vendors, this translates into definite profits due to the lower manufacturing costs in India.

Some of the major factors to be considered in valuing technology are as follows:

- *Availability, acceptability of alternate technologies.* Issues related to licensing by foreign governments sometimes force Indian industries to opt for alternate technologies that are more readily available. This becomes an issue not only that of availability of technology but also that of acceptability due to the standards of products limited by available alternate technologies.
- *Quality of IP.* Some of the cutting edge technologies are protected by Intellectual Property Rights. The number of such IPR controls and Patents can form another basis for valuing technology that is offered.
- *Useful life of technology.* The point of introduction of the new technology in the industry will determine the useful life of the technology. For example, if a given product based on slightly older technology has already met most of the market requirements, and if the cost of upgrade / replacement of all the existing products are far higher than the cost benefits due to the new technology, then the life of the technology is limited to that of the remaining market. These three factors define the competitive advantage offered by the technology. Competitive advantage generally comes in three major types, lower operating costs, generation of a new product and generation of related products and services.
- *Stage of Product Development* The product can be in any of the known and defined stages of development such as, Research (prove the concept), Development (reduce the concept to practice), Application testing (product performance), Pilot product and Commercial production.

Overall system designs are influenced by available technologies at the time of product conceptualization. In cases where system designs have already progressed based on available technologies and new technology is sought to be introduced for a part of the system that may or may not be possible to integrate at a late stage, this becomes a factor for consideration. In such a situation the new technology may not prove useful.

- *Maturity level* Again given a product's life cycle, the product's maturity level plays a part in decision-making. Introduction of a new technology in a product nearing the end of its life cycle may not be useful.
- *Market status* Sometimes the market may not be ready for a particular technology. Introduction of the technology at such a stage may prove to be un-economical. These factors are indicative of the strength / size of the unmet market need, the competitive situation and the cost situation (manufacturing, operating & capital).

## Methods of Valuation of Technology

The commonly adopted major methods of valuing technology are the following:

*Cost.* Value of technology based on the cost to create it: The cost approach is one of the methods of valuation. Based on the valuation principles, the offset value is worked out using the suggested value from the supplier and peer review value from a panel of experts. Using the suggested value from the seller, the real value is evaluated by a panel of technology experts from relevant institutes and defence firms with the use of proven tools. Economic factors such as budget reduction, economic spill-over, and

technical usefulness factors, technical factors such as technical level, technical importance and technical difficulty factors and defence strength factors such as urgency of technology, defence contribution, and defence needs are considered in the process of evaluation. This has the advantage that it is a very simple and easily understood concept. However, it suffers from the disadvantages of the fact that, the cost may bear little relationship with potential benefits of intellectual assets, it is difficult to make accurate cost estimates and that the opportunity cost is not considered.

*Market.* Cost of ownership of similar technology through recent transactions: This method has the advantage that it is simple and is based on actual transaction data. But the disadvantages are that the transaction data are limited since transactions are infrequent and most often not public. Also the characteristics of previous transactions could be unique and hence difficult to compare with the present transaction.

*Income.* Value of Technology as the present worth of projected economic benefits. The income-based valuation is the most accepted practice as it captures the value in use of the technology. The advantages of this method of valuation are being: (i) It is based on economic benefits derived from owning / using the technology; (ii) It reflects full effects of risks including obsolescence associated with the technology. However, the valuation is subjective as it is based on anticipation of future income.

The optimum value of a technology transferred (in / out) is a fair percentage of the cash flow generated by the competitive advantage of the technology (sold / purchased). The market thumb rule is that 25 per cent of the expected profits from the business arising out of the technology should go to the licensor for contributing the technology. Balance 75 per cent of the profits go towards manufacturing, marketing etc. It may also be viewed that at the time of product introduction, 50 per cent of the risk still remains and therefore 25 per cent reflects a 50:50 sharing of market risk. It should

be borne in mind that the use of industry standards can work well if the basis for the development of these standards is well known to both parties negotiating the contract and are applicable to the specific situation. Rational licensees / purchasers of technology are unlikely to pay money or put money in to a venture with out a belief in future cash flow.

## Conclusion

The business opportunities arising out of the mandatory offset provisions in the defence import contracts provide ample scope for the Indian Defence Industries to get state of the art technology and if effectively absorbed by us, in due course, we can progress substantially towards achieving self reliance in indigenous design and manufacture of defence products. Through careful analysis and assessment during the selection process of technology on offer and through proper and effective monitoring of offset contract implementation we can reach this goal of self reliance along with significant enhancement in technology capability as well as its spin off effects in associated industrial and research sectors of the national economy. 