

Enhancing Competitiveness through Technology Upgradation

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The accomplishment of Technology Transfer would enable MSMEs to realize some or all of their objectives leading to an overall enhancement of economic performance and competitiveness. In the current era, it is imperative to enable an increasing number of MSMEs to realize technology upgradation through Technology Transfer, for the benefit of the sector as much as for Indian economy

Micro, Small and Medium Enterprises (MSMEs) have a strategic appeal globally to policy makers in view of their magnitude in terms of number of enterprises, and contribution in terms of employment, production and exports, among others. They promote inclusive and sustainable economic growth, generate employment, encourage sustainable industrialization, foster innovation, and reduce income inequalities (OECD, 2017). In the current globalized world, it is imperative to enable MSMEs to adapt and thrive in a more open environment and participate more actively in the digital transformation, to boost economic growth and deliver a more inclusive globalization (OECD, 2017).

Among firms of different sizes, MSMEs have unique constraints in managing to achieve technology development for their growth. MSME entrepreneurs have relatively inadequate ability to manage technology as a strategic weapon as they have limited human resources and weak financial standing. All these are constraints for MSMEs to achieve technology development internally (Buratti and Penco, 2001). Therefore, MSMEs rely more often on external

technologies as part of their technology development strategy. This holds good for industrialized as well as industrializing countries.

In the global economy, India occupies a unique status in view of its long standing policy for the promotion of MSMEs since its independence in 1947. The general merits as well as constraints observed in the international context are applicable to Indian MSMEs as well. MSMEs contribute significantly to the Indian economy. In 2015/16, the sector comprised more than 51 million enterprises, employed more than 117 million persons and accounted for more than Rs.8492 billion worth of exports (at current prices); produced about Rs.18100 billion worth of output (at constant prices in 2012/13) (RBI, 2017). In 2014/15, MSMEs accounted for 30.74 per cent of the Gross Domestic Product (GDP); of which, manufacturing sector MSMEs accounted for 6.11 per cent of the GDP, and services sector MSMEs accounted for 24.63 per cent of the GDP (Ministry of MSMEs, 2017). Thus, MSME sector has grown to be one of the important pillars of Indian economy.

But, in spite of their varied merits and sustained contribution, MSMEs,

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particularly in the unorganized sector, show weaknesses in technology development and innovation (National Commission for Enterprises in the unorganized sector, 2009). This introduces opportunities for public intervention aimed at sustaining technology development in MSMEs, especially through Technology Transfer processes. The MSME sector in India, with some exceptions, is characterized by low technology levels, which acts as a handicap in the emerging global market (Bala Subrahmanya, 2014). In fact, advanced manufacturing technology is critical for a firm's long term success and growth (Scannell, et.al., 2012). But given their scale of operations, it is difficult for Indian MSMEs not only to invest in Research and Development (R&D) activities but even to acquire advanced manufacturing technologies available in the market, on their own, due to high costs (Government of India, 2010).

In the light of the above discussion, it is appropriate to examine what are the different options of technology upgradation for MSMEs. Why is Technology Transfer a better option for MSMEs? What are the objectives, sources, channels and achievements which prompt MSMEs to go for Technology Transfer? What kind of public policy support is extended to Indian MSMEs to overcome their technological obsolescence? These issues are thrown light in this article.

Technology Transfer: Meaning and Importance

In the narrowest definition, technology includes patentable blueprints, plans, mechanisms, formulae, and the like (Enos, 1989), and transfer can be limited to the new use of such technology either within a particular firm or by a host country firm after contractual exchange with a foreign firm or organization (Smith, 1980). Technology can perhaps be better defined as the knowledge whereby economic efficiency can be improved. Hence, it includes not only



the "hard," possibly patentable, aspects of production, like the specifications of goods and the mechanistic details of their manufacture, but also the "soft" aspects of business processes, such as organization, marketing, and other types of managerial knowledge and skills (Stewart 1977).

Technology Transfer is an alternative to internal technology development. Therefore, the decision to develop technology and innovative capabilities internally or acquire them via external means is a central component of any technology strategy (Zahra, et al, 1994). It applies to corporate ventures as much as to MSMEs (Zahra, 1996). Koc and Ceylan (2007) emphasized on the finding that most enterprises in developing countries preferred external sourcing since most of the technologies they use are outside their resource capabilities. Limited resources, expertise and time are the factors that push many firms to acquire technology from a source external to the firm rather than developing it in-house (Stock and Tatikonda, 2004). The process of acquiring technology from external sources can be achieved through what is commonly known as "Technology Transfer". In its most general meaning, "Technology Transfer" is seen as every process that aims at transferring technological know-how from a donor such as a university, a research centre or R&D

department of firms to a recipient – firms which may either directly use or co-develop the technology (Kim, 1990).

Given the above, "technology" can be defined to include knowledge or ideas as well as physical products and "transfer" is the movement of technology via some type of channel: from person/institution/firm to MSMEs. Thus, Technology Transfer is fundamentally the application of knowledge associated with a new physical hardware used by an MSME as machinery equipment in the production process for generating product/service which is quantitatively as well as qualitatively superior to what it was producing earlier.

Transfer: Objectives, Achievements

The long run competitive position of most individual firms depends on how well they learn to manage and increase their technological asset bases (Lanctot and Swan (2000). The objective of a technology strategy is to guide the firm in acquiring, developing and applying technology for a competitive advantage. A firm's options range from 'high technological risk decision' to develop the needed technology internally, to 'low technology risk decision' to acquire a fully functioning technology from another firm. It is the high cost of conducting internal R&D that has resulted in a growing trend

towards acquiring new technologies by some other means (Noori, 1990). In general, it is argued that the decision to purchase a fully functioning and a widely used product technology from another firm could result in a superior product quality (Lanctot and Swan, 2000).

MSMEs, particularly in industrializing countries, go for acquiring external technologies to overcome their technological obsolescence. This is because they are not able to cope with the technological changes that occur in the international market. This is the outcome of negligible or nil R&D orientation and if at all, incremental technological innovations. This, in turn, is due to resource constraints relating to technical knowledge, expertise, skills, and finance. Therefore, policy support for technology up-gradation and modernization is invariably extended in various forms to MSMEs (Romijn, 2001).

There are various sources through which MSMEs can acquire external technologies. Some of them are as follows (Daim and Kocaogh, 2008):

- ❖ Sponsoring a research in a University,
- ❖ Supporting employees' education and thereby assess candidate technologies,
- ❖ Making use of an external R&D centre,
- ❖ Employing consultants to help them assess the new technologies available in the market,
- ❖ Going for licensing, one of the widely utilized methods of technology acquisition,
- ❖ Using technical meetings, technical journals and trade shows for assessing alternative technologies,
- ❖ Purchasing existing technology either through the vendor/supplier or from any commercial channel.

The various forms of Technology



Transfer can be broadly grouped under (i) vertical Technology Transfer and (ii) horizontal Technology Transfer. Vertical Technology Transfer occurs when information is transmitted from basic research to applied research, from applied research to development, and from development to production. Such transfers occur in both directions. And the form of information changes as it moves along this dimension. But horizontal Technology Transfer occurs when technology used in one place, organization or context is transferred and used in another place, organization and context (Enos, 1989). Horizontal Technology Transfer is found to be common among MSMEs.

While the transfer of machinery and equipment is, in most cases, a necessary first step, what is more important is the transfer of information and skills to the employees of the technology receiving firm, which constitutes the second step. The second step is more important because if the technology acquiring firm has to effectively use the transferred technology, acquisition of necessary information and skills related to the use of the new technology is essential and critical. The personal aspect as against the locational aspect of Technology Transfer covers technology-specific skills and know-how from the lowest level of operators, right up to exclusive technical personnel comprising scientists and engineers.

But an important pre-condition for this second step is the absorptive capacity of employees in the recipient firms (Bischoff, 2001). Therefore, MSMEs with a better absorptive capacity will be able to adapt externally acquired technology efficiently and successfully.

The channels and achievements of Technology Transfer would depend on the source of technology chosen by a firm. Transfer of technologies from the non-commercial to the private sector is increasingly regarded as playing a significant role in tech start-ups, growth of existing businesses, and new job creation (Parker and Zilberman, 1993; Proctor, 1993). The majority of empirical literature describes the process of Technology Transfer as:

- (i) Transfer from universities to private enterprises (Parker and Zilberman, 1993; Proctor, 1993),
- (ii) Transfer from government promoted labs/support agencies to private enterprises (Cole, 1992), and
- (iii) Transfer between and within private enterprises (Chakrabarti, et al, 1993; Palaniswami and Bishop, 1993).

In the global context, contractual mode in Technology Transfers is the relevant and the dominant one for

MSMEs (Venanzi, 1996). However, how effective is this Technology Transfer would depend on various factors, the most important of them all being the involvement of the partners. The gap between the degrees of motivational involvement of the two partners significantly influences both their contractual power and the performance of the transfer. Another aspect connected to the motivational involvement of the transferring firm is the level of completeness of the transferred technology, in terms of quality of the knowledge and experiences transferred.

Technology Transfer channels are of particular importance to MSMEs with little in-house resources and experience to explore the potential of new technologies (Brychan, 2001). MSMEs usually lack awareness about the value of Technology Transfer, sources of technology, they are diffident about enabling services, and therefore rely on co-operation with others. Two basic mechanisms available to MSMEs are technology exchange (technology passed from one MSME to another) and technology exploitation (technology transferred to an MSME from an external source). For MSMEs involved in Technology Transfer networks, key mechanisms include information transfer (newsletters and databases), Technology Transfer (R&D audits), skills transfer (training) and specialist support (financial guidance).

The Technology transfer performance of MSMEs will be influenced by a variety of institutional factors which include in-house technical personnel, access to external sources of knowledge (firms and research institutions), the political, legal and administrative environment and the organization of knowledge transfer. However, not all aspects of the institutional setting which surrounds business firms in the field of Technology Transfer are of the same importance for their performance. It generally varies to a large extent

between different countries and industries to a considerable degree.

As far as achievements of Technology Transfer are concerned, (i) increase in number of new products, (ii) shortened product development cycle (iii) increase in productivity due to cost reduction, and (iv) sales increase, are the commonly observed major outcomes (Daim and Kacaoglu, 2008). The empirical studies have brought out a significant and positive relationship between external technology acquisition and firm performance, depending on the degree of internal R&D efforts (Tasi and Wang, 2008). More recently, this has been substantiated in the Indian context with respect to Bangalore based engineering industry MSMEs. Technology Transfers, along with necessary firm-level innovation capability and firm-level competitiveness building, have contributed to the enhancement of their economic performance. Therefore, to accomplish successful Technology Transfers and higher economic performance, MSMEs must have some internal "techno-economic" strength within, as a pre-requisite (Bala Subrahmanya, 2015).

In the light of the above discussion, considering the policy support extended to MSMEs for technology upgradation, a conceptual framework is proposed linking objectives, sources, channels and possible achievements (as given in Figure 1).

Technology Transfer and MSMEs: A Conceptual Framework

Technology development is of paramount importance for Indian MSMEs, if they have to remain competitive in the domestic market and penetrate the international market steadily. This assumes significance because technological obsolescence has been one of the most severe problems identified with the Indian MSME sector time and again. That is why technology development has been considered the foremost factor for

enhancing the global competitiveness of the Indian SME sector (Ministry of MSMEs, 2011; TIFAC, 2017).

Objectives of Technology Transfer: Technology Transfer offers various benefits to MSMEs. In general, Indian MSMEs lack technical expertise needed to develop technology internally through R&D, they lack financial strength to incur expenditure and bear the risk and uncertainties of R&D for technology development; and internal technology development process may consume a long period of time, sometimes involving inordinate delays. Therefore, MSMEs would prefer Technology Transfer to save on time and money, and overcome deficiencies of sufficient in-house technical expertise, to achieve technology upgradation. In some cases, MSMEs which would like to exploit scale economies or scope economies or even to enter the international market might go for Technology Transfer.

Sources and Channels of Technology Transfer: MSMEs have multiple sources for technology upgradation through Technology Transfer, such as:

- (i) Technology information and Technology assistance are provided by means of a Technology Bank maintained by the Development Commission for Micro, Small and Medium Enterprises in the Ministry of MSMEs, Government of India (DCMSMEs, 2017).
- (ii) A university or an engineering institution (such as IITs/NITs/IISc or other engineering colleges), can provide lab developed technologies to MSMEs through contract research or which emerged out of their basic research. TIFAC-MSME Programme facilitates such interactions (TIFAC, 2017).
- (iii) An R&D establishment promoted by the government such as a Technology Research

- Centre (TRC), which can enable a MSME to source and acquire a technology either locally or from abroad.
- (iv) National Research Development Corporation (NRDC) which commercializes technologies, developed in Council for Scientific & Industrial Research (CSIR) labs located across the country, primarily helps MSMEs in Technology Transfer.
 - (v) Cluster Development Programme of National Manufacturing Competitiveness Programme (NMCP) (DCMSMEs, 2014).
 - (vi) A large enterprise (it could be a domestic private enterprise, a public sector enterprise or a Multinational Corporation) with which MSMEs have sub-contracting relationships. To facilitate MSMEs to produce high-quality parts and components, the former will provide technical information, assistance and core technology to the latter.
 - (vii) A professional technical consultant (registered with Department of Scientific and Industrial Research (DSIR), Government of India) might help

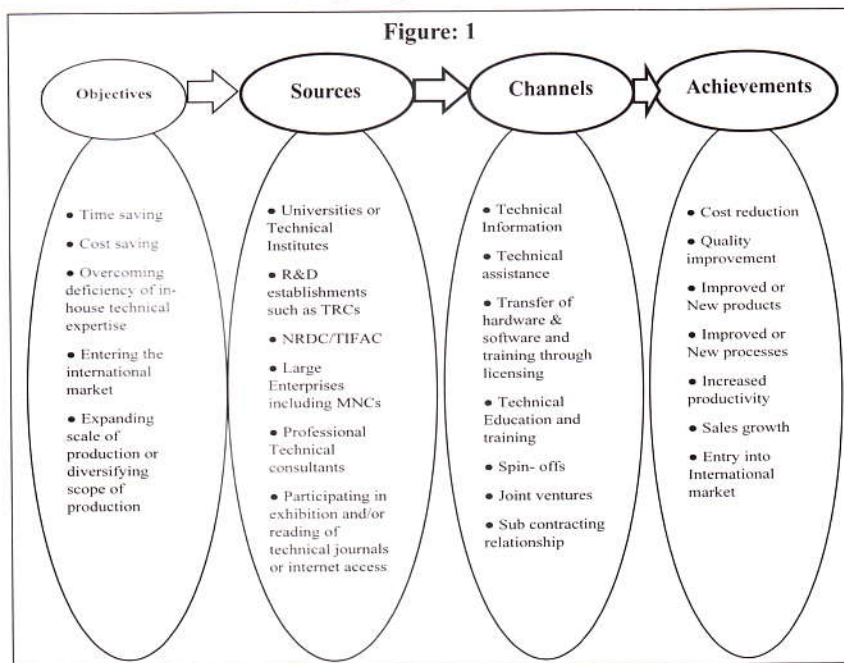
- (viii) Sponsor technical education and training of personnel in higher education and research institutes within the country for developing in-house technology expertise and thereby assess and access appropriate external technologies.
- (ix) Participation in technology exhibitions, technology conferences and reading of technical journals and internet access for knowing sources and channels of available external technologies.
- (x) Technology licensing: It is a contractual arrangement in which the licensor's patents, trademarks, service marks, copyrights, trade secrets, or other intellectual property may be sold or made available to a licensee for compensation that is negotiated in advance between the parties. This compensation, or royalties, may be a lump sum royalty, a running royalty (royalty that is based on volume of production), or a combination of both. All of the above from (i)

- (xi) Outright purchase of an existing technology from a vendor/supplier or any commercial channel. APCTT (a New Delhi based UN organization) periodically facilitates Technology Transfer among MSMEs in the Asia-Pacific region, through periodic events, support mechanisms and capacity building programmes (APCTT, 2017).
- (xii) India SME Technology Services Limited provides a platform where Micro, Small and Medium Enterprises (MSMEs) can tap opportunities at the global level for new and emerging technology or establish business collaboration (ISTSL, 2017).

Achievements of Technology Transfer: MSMEs generally are able to accomplish multiple outcomes through Technology Transfer. Some of them are:

- ❖ Increase in productivity.
- ❖ Reduction in costs.
- ❖ Expansion of scale of production (Scale economies).
- ❖ Diversified product range (Scope economies).
- ❖ New product development.
- ❖ New design products.
- ❖ Better quality of products.
- ❖ Penetration of international markets.
- ❖ Increase in sales and market share.

To conclude, technology upgradation (through diverse sources and channels of Technology Transfer) is desired by MSMEs to achieve multiple objectives such as overcoming technological obsolescence, scale/scope expansion, and/or entering the international market. To achieve technology upgradation, MSMEs go for Technology Transfer by scouting for alternative sources. Once a certain



source is identified, the channel of Technology Transfer is finalized and pursued. The accomplishment of Technology Transfer would enable MSMEs to realize some or all of their objectives leading to an overall enhancement of economic performance and competitiveness. In the current era, it is imperative to enable an increasing number of MSMEs to realize technology upgradation through Technology Transfer, for the benefit of the sector as much as for Indian economy.

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