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TECHNOLOGY TRANSFER: NORTH-SOUTH OR SOUTH-SOUTH?

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ABSTRACT

It is widely recognized that technology transfer plays a key role in economic and industrial development and that the effective transfer of technology can enable developing countries, especially the Least Developed Countries (LDCs) to utilize their natural and human resources more efficiently. This paper investigates the modes of technology transfer from multinational corporations (MNCs) to developing countries. However, most of the MNCs have their parent companies in the developed North, raising questions on the actual absorptive and diffusion capacity of these technologies in the developing world. This paper explores whether South-South technology transfer could offer a more efficient option to technology transfer given that Southern countries, in many cases, share similar environmental, cultural and social conditions by looking at China's Kpatawee rice project in Liberia.

Key words: *Technology, Technology Transfer, Absorptive capacity, Technology Diffusion, Multinational Corporations.*

Introduction

In the contemporary world, it is not only the conventional economic resources like land; labor and capital which are important to facilitate economic growth of a nation, but also these resources are to be rationally used for productive purposes through 'technology.' The developing and developed nations acknowledge that technology plays an important role in economic growth and enhancing the living standards of the countries.

The word technology has different definitions in different schools of thought, given that the meaning of the word technology has itself been changed over the years. Technology can be juxtaposed with words like growth, development and industrialization. However, the word technology can be defined in simple words like explained in the oxford dictionary as 'machinery and devices developed from scientific knowledge,' but it can also be defined in complex sentence structures and have a different meaning for itself. Schon defined technology as 'a tool or technique, any product or process, any physical equipment or method of doing or making, by which human capability is extended.' In their definitions of technology, some authors stress the importance of knowledge and skills. Technology is also defined as systematic application of scientific or other organized knowledge to practical tasks (Galbraith, 1967). While other authors see it as a knowledge which is applied exclusively to the production and creation of goods. According to Merrill, technology is body of skills, knowledge and procedures, used for making, using and doing valuable things. According to the Organization for Economic Co-operation and Development (OECD) technology refers to the state of knowledge concerning ways of converting resources into outputs (OECD Directorate, 2001). Technology is also a set of disciplines, approaches, processes, techniques and tools used to make tangible products (Barquin, 1981). Dosi defined technology as a set of segments of knowledge, which contains direct practical and theoretical know-how, procedures, experiences of success and emphasizes that technology does not only contain hardware but it is also encompasses the technical knowledge and skills of participants of an organization. From these definitions, it can be observed that they reveal one or more precise features of technology like its type (machinery or know-how) or subject (used for improving productivity).

Technology is an important means by which countries obtain developmental progress along with higher standards of living. When going through an array of literature about 'technology' I deduced that, technology involves many elements like engineering, organizational know-how, social, economic and managerial factors. According to George Kozmetsky, there are five essential features of technology which relate to its nature and its materialistic nature in the contemporary economy: technology is a constantly replenish able national resource; technology generates wealth which is the key to economic, social and political power; technology is a prime factor in domestic productivity and international competitiveness; technology is the driver of new alliances among business, government and academia; technology requires new managerial philosophy and practice. From these five features provided by Kozmetsky, it can be deduced that the environment along with the system of social values within which technologies are to be used, demand a particular kind of organization, management and communication (Cohen, 2004). This means that, it is crucial that the managerial aspects of technology, like the organizational philosophy and practice are to be developed in concert with the process of technology transfer, because technology is a set of specialized knowledge applied to achieving a practical purpose.

Concepts and definitions in technology transfer

The acknowledgement of ‘technology transfer’ as an important factor in the economic and industrial growth of a nation is to be considered. The transfer of technology from developed countries to Least Developed Countries (LDCs) would enable them to increase their efficiency and productivity levels while also keeping them at an advantage to build technological capabilities by importing and adopting foreign technology. Technology transfer has brought in high-productivity techniques and encouraged technical changes in LDCs. Initially, technology transfer has been defined as the process where in the technology is moved from one physical or geographic location to another for the purpose of application towards an end product. This transfer can occur domestically (from one sector too another; from one firm to another), or across national boundaries – which is seen as international technology transfer. Technology transfer also includes the acquisition of inventive activity, which means that, technology transfer does not only include transfer of machinery or physical equipment but ‘knowledge’ can also be transferred through training and education (Cohen, 2004). In this era of globalization, technology transfer could be a solution for the problem of dispersed resources of capital, human resources which are spread globally.

Technology transfer is vital process which requires adequate infrastructure (R&D capacity, scientific research foundations), skilled human resource for its effective transfer. The two important components of technology transfer include: the appropriate acquisition of technology and widespread diffusion (Kathuria, 2000). In the process of technology transfer, in order to choose the appropriate technology, resource endowments are of crucial importance, also, acquisition is not only a necessary condition, a good condition of technology transfer is the ‘absorption’ of the technology, which would entail domestic firms to have their own R&D programs, domestic research centers, universities with good technical skills and human resources. Only if these two components are addressed, there will be an increase in productivity and efficiency. A simple definition of technology ‘absorption’ in a commercial context is defined as the acquisition, development, assimilation and utilization of technological knowledge and capability by a firm from an external source, which occurs between transferring and receiving entities. Technology absorbed without changing parameters of acquired technology is called ‘technology adoption’ while on the other hand, technology absorbed by changing certain parameters of acquired technology is called ‘technology adaptation.’ These technologies may require careful evaluation to assess their compatibility and safety with respect to local conditions. On the other hand, technology diffusion is the spread of applications/usage of new technology and its related products, services or processes from one nation to another; from one entity to another; from one industry to another; technology diffusion is the study of how, why and at what rate new ideas and technology spread across the economy (United Nations Conference on Trade and Development, 2010).

Multinational Corporations and technology transfer: a North-South cooperation?

Technology transfer can also happen through: transfer of goods, licensing, foreign direct investment and movement of people. The transfer of goods can bring about new idea, innovations when traded internationally by diffusing their knowledge over and across borders. Because the goods traded, also transfer the technology embodied in them (for example, trading of capital goods). However, this knowledge transmission requires local firms to reverse engineer the product, if they want to gain through this channel of technology transfer. However, reverse engineering

requires skilled labor to do so and the absorptive capacity of the country (UNCTAD, 2004).. A second way of technology transfer can take place through FDI, which is one of the most contested channel of technology transfer, because it comes with investment, managerial know-how and spill over's. However, the success of FDI in a developing country depends on its responsiveness of that country, through its economic and policy capacities and capabilities. Technology spill over's through FDI are noticeable in the demonstration effects (when local firms acquire knowledge or technology from foreign firms through imitation or reverse engineering) (Patel, 2007). On the other hand, licensing also provides a means of international technology transfer, however, a licensee, when acquiring the product will look into the issues of the potential and size of the market for the product, the licensee's confidence in human capital and services which would allow for the adaptation to the licensed product and bring it to the market. On the other hand, the licensor would want to achieve a royalty. Licensing as a technology transfer would rely on the research and technological skills and the availability of development support for adaptation and learning (Patel, 2007). Labor turnover is another important means of technology transfer and technology diffusion. Through this means, technology transfer occurs when formers MNC employees are employed by local enterprises or establish their own firms i.e. through physical movement of people in the local economy as the value addition of MNC employee is higher when he works for the local firms instead of foreign firms (UNCTAD, 2004).

Now it is crucial to ask the question of who owns the technology. Most of the world's modern technology is owned, produced and controlled by Multinational Corporations (MNCs). This brings to the definition of technology transfer according to Fransman – which is 'a process whereby knowledge relating to the transfer of inputs into outputs is acquired by entities within a country, from sources outside that country.' Transfer refers to the flow of technology, in the form of tools, procedures, know-how and information usually through an international agency, from an advanced country or a Multinational Corporation (MNCs) to developing countries. The MNCs play a major role in this field of technology transfer; it is to be acknowledged that, MNCs are the primary agents of technology transfer and it is greatly facilitated by the operations of MNCs. These MNC's use two important means – foreign direct investment and licensing - in order to play a direct role in technology transfer. Given that MNCs can also use other channels like trade fairs, scientific exchange of people, where their role is not only implicit; Fransman states that, even if MNCs do not play a direct role in diffusion of technology, their indirect role is adequate enough to bring about international technology transfer of diffusion through FDI.

However, there are two important concerns in the process of international technology transfer (Hoekman, Maskus and Saggi, 2005):

1. The imperfections and asymmetries in the market for technology, as technology are owned by few large firms only.
2. The monopolistic advantages of MNCs, as they have substantial market power resulting from lead time and Intellectual Property Rights (IPR).

These two concerns have led to the weak bargaining power of the host countries, in turn, resulting in huge transaction costs for acquiring technology and reduced technology transfer. The costs and benefits of technology transfer are then not being internalized by the participants. The only way by which the technology transfer recipient countries can benefit is through uncompensated spillovers – where technological and managerial know-how information will be diffused into the

economy and the technology provider – like the MNCs – cannot extract the economic value associated with the uncompensated spillovers. However, it should be noted that, the import of technology by local firms will reduce their efforts on R&D – because it is costly and in order to remain competitive, the local firms import technology instead of investing in their own R&D. When inappropriate technology is transferred, it does not create any capabilities. Through technology transfer – the technological flow is through – flow of managerial know how, flow of capital goods, engineering, flow of skills for operations, flow of knowledge and expertise for producing and managing the technical change (Patel, 2007).

Implications in South-South technology transfer: case study of China's Kpatawee Rice Project.

Given that most of the MNCs are established in the developed world, the arguments presented above could trigger a concern of – the international technology transfer happening through the MNCs in the developed north to the developing south – have been facing many concerns mentioned above and depict rather a north-south cooperation/technology transfer. Take for example, the concern of the inappropriate technology transfer not creating any capabilities – this may still happen even if technology flows from South-to-South.

The case study of China's Kpatawee Rice project in Liberia depicts how the technology which is transferred from China to Liberia has failed to generate enough capabilities. The People's Republic of China has developed a state-owned rice seed plantation called – Kpatawee Farm – in rural Liberia, during 1978-89, drawing from its past experiences of around 20 rice projects in different African countries. The similarities in rice-growing techniques of China and Liberia are (Brautigam, 1993):

- Irrigable land is limited by hilly topography.
- Both countries relied heavily on seasonal rainfall
- In both the countries, drought affects even gravity and pump irrigation.

Given these similarities, the countries also differ in two key areas of rice growing environment: China is a densely populated country and has low labor costs while labor in Liberia is limited in relation to land, which makes the labor costs comparatively high. Liberia does not have any irrigation infrastructure along with undeveloped marketing and input delivery system. But in China has these ingredients since centuries.

China's technical choices in their Liberian agricultural assistance projects were choices based on China's own domestic rural experiences – constructing effective irrigation systems near water source and rain-fed systems, agricultural mechanization, improved seeds and management patterns. However, Kpelle farmers who lived close to Kpatawee valley and continued to farm its hills using slash techniques, the Chinese methods of near irrigated rice paddies, cultivation patterns have appeared as alien transfers to these Kpelle farmers, having to do little with their style of Liberian farming. They watched the Chinese struggle with the valley and they themselves suffered with the hills (Brautigam, 1993).

Given this scenario, the local farmers had little connection with Kpatawee and vice versa. Liberia's Rural Development Institute which is post-secondary training center was located near Kpatawee

but no RDI student has worked as a trainee in this farm. The technical constraints in Liberia on agricultural production were – the relation between land and labor. The green revolution technologies like high-yielding techniques were developed in Asia in context to the local conditions of increasing scarce land and abundant inputs like labor. But this is not the case with Africa; here the resource scarcity is labor and not land. In the context of Liberia, the technical change which was important was to increase labor productivity, but instead the Chinese over employed the farms and failed to develop techniques which would have allowed for continuous cropping on highland. On the other hand, the irrigated area was also very small to overcome the losses incurred in the highlands, given that the Chinese focused on yields per unit of land and did not give an estimated costs involved in the production to the Liberian government.¹

From this case study, even South-South cooperation of technology transfer has major concerns and cannot happen without problems. Without taking into account the existing needs and capabilities of the recipient country, the technical cooperation from South-South may give rise to unforeseen difficulties. In this case, the cost of technology transfer was neither on China who was transferring it nor on Liberia which was receiving it, but it is the cultural distance between these two countries. Technology transfer is more successful in countries which have similar cultural attitudes, the implications of cultural distance in international technology transfer increases if the technology is moved from product orientated technology to process oriented or person oriented technological places (Kedia and Bhagat, 1988).

In short, technology transfer to developing countries – be in North-South transfer through MNCs or South to South transfer, one has to consider the issues concerning the developing countries such as: the type of needs of the recipient country, the requirements of appropriate technologies to meet those needs, the current available expertise of capacity building which is needed for the effective transfer in the recipient country and also to consider the factors which affect adoption and adaptation of the imported technology. Such issues may be trimmed down if technology transfer could take place from same environment like from South to South instead of north to south, but however, each has the difficulties of its own.

In the process of technology transfer, there is the supplier of technology and recipient. The supplier of technology transfers the item through a certain channel – licensing, FDI, goods and services, movement of people – in order for this transfer to be successful, it is important to know the supplier's needs skills and knowledge along with the absorptive capacity of the receiver. The obstacles for the successful transfer as mentioned is that individuals in different nation, organizations work differently as they have their own way of doing things. It is important to make sure the supplier and the receiver should be willing and able to work a way for an effective manner of technology transfer.

Conclusion

¹ *Source:* Brautigam, D. (1993). South-south technology transfer: The case of China's Kpatawee rice project in Liberia. *World Development*, [online] 21(12), pp.1989-2001. Available at: https://deborahbrautigam.files.wordpress.com/2014/02/brautigam_1993.pdf [Accessed 5 Apr. 2017].

In order to transfer appropriate technology to the developing nations, there are need for appropriate policies which are to be framed keeping in mind the level of development of the countries. These policies should consider the human capital and R&D of their country and ensure increase access to available technology while reducing the costs of acquiring and absorbing existing technologies. These policies should also encourage domestic innovation and ascertain that technology transfer should enhance the capabilities of local firms. Given that technology does not only consist of hardware equipment like machinery, but also has software ways of production and the transfer of knowledge, it is to be noted that this transfer process is complex in itself because neither transferring technology nor the technology is itself a constant. The case study provided of the Chinese rice farm in Liberia depicts that the transferring of Chinese technologies and developing model of a state farm did not work at all for Liberia. From this, it is important to learn that the recipient's environment is different and has to be acknowledged before transferring technology.

The issues of the developing countries can be met through the same environment technology transfer from South-South, given that technical cooperation is a significant component of South-South development cooperation. The south countries should share and replicate each others' experiences in finding solutions and at the same time cater to their specific needs and circumstances. It can be undertaken through knowledge and experience sharing, training and technology transfer and the governments of developing countries play an important role to establish and strengthen effective agreements to encourage and maintain co-operation between public institutions' in their own countries and those in other developing countries, in order to promote closer technical cooperation (Patel, 2007).

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