The Technology Transfer Paradigm: A Critique

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Abstract

In this paper we examine certain central themes common to literature on technology transfer such as technological independence, appropriateness of technology and completeness of technology transfer. It is claimed that these and associated concepts form a coherent paradigm. The critique is based on contextual and historical analysis. Towards the end the paper deals with the central role of transnational corporation in transfer of technology.

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Key Words: Technology transfer, technological dependence, appropriate and complete technology transfer, the role of transnational enterprise

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Paradigm: "[in the philosophy of science] a generally accepted model of how ideas relate to one another, forming a conceptual framework within which scientific research is carried out." ENCARTA

"Technology transfer is a contradiction in terms like military intelligence or perhaps nuclear safety." (Darton 1986, p. 248)

"…`technology' is not an artefact that may be taken off the shelf and applied to the process of production in an automatic fashion. On the contrary… `technology' can only really be understood in an evolutionary sense, constantly changing as a result of both the operation of its own dynamic in specific circumstances, and of contextual conditions." (Clark 1985, p. 190)

Introduction

The literature on technology transfer reveals certain common themes and elements that may be characterised as a paradigm. There are at least three main themes that can be identified as follows:

1) Technological dependence versus independence
2) Appropriate versus inappropriate technology
3) Complete versus incomplete technology transfer

There are other related issues as well. For instance the use of word `transfer' instead of trade or acquisition implies that the movement of technology across national borders is or should be subject to different rules and laws compared to movement of goods and services. More specifically it implies that it is primarily the duty or the job of governments to initiate technology acquisition from abroad. Thus it is a reflection of the mood in development literature after WWII, which broadly speaking was pro government intervention and economic planning. The independence movement in many ex-colonies enhanced this mood for a blind faith in state intervention and planning. For instance, as we shall see below, the debate on appropriateness of imported technology assumed that without government intervention, technology `transferred' by TNCs will be inappropriate. We shall discuss all these elements below.

Technological Dependence and Independence

One of the main themes of technology transfer paradigm (TTP) concerns technological dependence and independence. There are several issues here. First is the concept itself and its empirical possibility. Another relates to the process of going from a state of dependence to independence. The definition of technological independence itself is problematic, as it contains the possibility that a country may be at a low level of technological development or at a high level. It may imply the possibility that such a country, if it wishes to develop its technology further, can do so without any technological imports from abroad. Implicitly this means the country has a well developed R&D infrastructure and innovation capability. As we shall see both the empirical possibility and conceptual desirability of such a state is very doubtful. First we shall see how the authors sympathetic to the idea try to define the concept.

Inspired by the emerging neo-Marxist and dependency theories of development UNCTAD (1975) defines technological dependence as a condition in which a country (1) has a low level of innovative activity as measured by the number of patents owned in the country, (2) lacks high-level skills needed to make technological choices and (3) lacks low-level skill needed to operate machinery. These are reasonable characteristics of a country at a low level of economic and technological development. The reason why this condition is called technological `dependence' is not made clear, although references are made to the cost of imported technologies, especially when it involves transnational corporations (TNC) [pp. 265-271]. In order to get a better idea of this issue we return to Frances Stewart, a prominent expert on the issue who approaches the concept first by defining its opposite, i.e. technological dependence:
"Technological dependence arises where the major source of a country's technology comes from abroad. Most advanced nations specialise and trade in technology, so many advanced nations could, in this sense, be described as technologically dependent…" (Stewart 1978, p. 116)

So far we have learnt that technological dependence is undesirable in spite of the fact that some advanced countries may be described as dependent. The question: is there any technologically independent country? The answer: not really.
"Countries which are heavy importers and exporters of technology like most advanced countries are clearly in some sense dependent on foreign technology just as they are on foreign goods…" (Ibid, p. 118)

The author continues further by characterising the above situation as interdependence. Thus dependence is defined as one-way interdependence. The question is: can we easily find any country that is a net exporter of technology, as we would a country with a positive balance of trade?

This assumes that it is possible for each country to achieve technological independence. While historically there are precedents of technological independence (e.g. Britain in the 19^{th} century and to a limited extent USA, Japan and the former Soviet Union) the paradigm is clearly based on closed economy assumptions. If we look at any of the above cases it is clear that none of them achieved technological independence in the long run.

It is possible to conceive of successful technology transfer and technological independence in particular sectors of the economy where the forward and backward linkages are weak or in the service sector where domestic suppliers are easy to organise. But when we consider a complex product such as a car, that uses thousands of parts, it is almost impossible to conceive of complete technological independence.

We believe that most traditional technological transfer models which assume a linear stage scheme from introduction to diffusion and absorption (see, for instance UNCTC 1988) are based on closed-economy assumption. This may have been suitable in 19^{th} century and early 20^{th} century. However, the post-World War II period has experienced greater globalisation in world economy. Further, these models are based on a narrow definition of technology (i.e. process technology). If we relax these definitions and assumptions, the traditional models fail to explain technology transfer.

If we relax these assumptions and assume open economies and a broader definition of technology, new avenues are opened up. For instance, under open economy assumption a country with a system of flexible exchange rates may find it difficult to attract FDI in all sectors of the economy as TNC's may prefer to change outsourcing of raw materials and sub-assemblies to countries with devalued exchange rates.

These models may be a fair description of the technological transfer process in 19^{th} and early 20^{th} century. For instance, USA, Germany, Russia and Japan began industrialisation in the second half of the 19^{th} century. They all relied on import substitution (IS) strategy using tariffs as protective measures.

In the 20th century the prime examples of IS has been the former Soviet Union, Brazil, India, Iran and Nigeria. The former Soviet Union used the licensing method to transfer technology. It is clear from the ideological perspective of the Soviet Union that technology should be transferred with a view to economic independence from the imperialist west. For Japan a similar perspective existed as Japan since the Maiji Restoration in the 1870's was desperate to stay independent and avoid colonisation by the west. China's attempt at economic independence in the 1950's shadowed the Soviet experience.

To a lesser extent Japan also used licensing (Stewart, 1978). This method of technology transfer is suitable in a number of sectors of the economy where brand names, trademarks and ultimately quality control are not essential. These sectors include engineering industries (and in general capital goods sector) and those consumer goods industries that at early stage of development of a country where the object is to meet 'basic needs', do not depend on brand loyalty, product differentiation etc. e.g. textiles, hygiene goods such as soaps. Thus technology could be transferred in the second half of the 19th century and the first half of the 20th century through licensing.

The post-war period presents a different picture altogether. In this period, both in the North and South we witnessed rising per-capita incomes, consumerism and rising expectations as well as changing lifestyles associated with the rise of sub-cultures as well as social movements (civil rights, Women's Liberation).

Consumer products, product differentiation, quality, etc. in the context of rising per-capita incomes and increasing competition (Auerbach, 1988) made licensing a less attractive route for technology transfer.

Thus licensing that essentially led to some kind of technological independence (through complete transfer of technologies) became less relevant as the emerging industries in the South had to cater to more sophisticated customers in an increasingly competitive world economy.

In the post-war period we witness an increased role in technology transfer for FDI, joint ventures, franchising, management contracts and turnkey projects.

Thus, compared with the late 19^{th} century and early 20^{th} century methods of technology transfer, we are faced today with a multitude of methods. These methods are based on factors ranging from consumer loyalty to brands to the complexity of technical know-how. A recent study of technology transfer in car industry in Egypt (Taha 2002) shows how this industry from the end of World War II to the present has moved from a strategy of complete (process) technology transfer to a more market and export oriented strategy that may not require complete process technology transfer.

Appropriate and Inappropriate Technology

Appropriate/inappropriate embraces three basic interrelated elements:

1) Appropriateness in relation to factor endowment of the host country, e.g. capital intensive technology not suitable for labour abundant countries.

2) `Right'/`wrong' products (consumption technology), e.g. luxury products as opposed to mass consumption goods (UNCTAD 1975, pp. 271- 274)

3) Regional/sectoral impact: e.g. urban versus rural (intermediate technology) (Schumacher 1973, Clark 1985)

A further point often discussed in this connection is the cost of imported technologies, particularly if TNCs are the transfer agents. We will now concentrate on the three points above and reserve the discussion of TNC for a later section.

Schumacher was the first person to raise the question of appropriate or intermediate technology in his seminal work **Small Is Beautiful** (Schumacher 1973). Although intended as a work targeted at Less Developed Countries (LDCs) it became an icon of the 1960's counter cultures, i.e. it was interpreted as an alternative organisational principle as opposed to corporations, large multinational corporations, even bureaucracies.

The basic motif in Schumacher's book was the contrast between modern technology (used mostly in western industrialised countries) and ancient technologies still in use in LDCs, particularly in rural areas but also in small-scale urban industry.

Figure 1 contrasts the two technologies. As opposed to these two kinds of technologies, Schumacher suggests an intermediate technology (IT) that would raise productivity at lower costs (compared to advance technology), use local resources, skills, labour pools and that, further, would be easy to operate, maintain etc.

Thus the idea of intermediate technology seemed suited to conditions in many LDCs, where there are abundant labour resources, low skill levels, low productivity, lower educational levels, low levels of capital formation etc. The idea was to raise productivity levels, thus income, with minimum cost in terms of imported capital, raw materials, skilled labour etc. Although Schumacher's ideas were ignored by most development economists when they appeared first in the 1970's, they gradually came to be taken seriously partly due to the following circumstances:

1) The general disillusionment with state-led large scale Import-Substitution-Industrialisation (ISI) strategy of economic development, which produced a fairly high growth rate (e.g. Brazil) but at the expense of high unemployment rates and worsening income distribution. This led to the rise of Basic Needs Approach.
2) The rise of Newly Industrialised Countries in South East Asia where high growth rates were accompanied by a more equitable income distribution and higher employment levels.
3) 'Urban Bias', a policy adopted by many LDC's, which systematically gives priority to the urban sector compared to the rural (Lipton 1977).

As the ideas of IT were becoming more and more appreciated a major criticism from the Marxist camp came from Arghiri Emmanuel (1982). He basically dismissed the idea on the grounds that IT adoption is equivalent to denial of advanced technology to LDCs.

Figure 1: Advanced and Backward Technologies

	ADVANCED TECHNOLOGY	**BACKWARD TECHNOLOGY**
THE NATURE	**Complex**	**Simple**
EQUIPMENT	**Machinery**	**Tools**
MAINTENANCE OPERATION	**Complicated**	**Easy**
SKILL LEVEL	**Highly Skilled or Specialised**	**Skilled, not necessarily specialised**
FACTOR-INTENSITY	**Fairly Capital Intensive**	**Labour Intensive**
RAW MATERIALS	**Local, but largely imported**	**Mostly local**
PRODUCTIVITY	**High**	**Low**
COST	**Expensive**	**Cheap**

Both the total embracing of IT and its total rejection is false for the following reasons:

1) The idea of intermediate technology is both industry specific and stage of development specific. There are certain industries and sectors of LDCs that may benefit from IT, e.g. the rural sector or the small-scale industry in urban areas. However, other industries may require large scale as a matter of efficiency and productivity as many fields of manufacturing exhibit economies of scale. Also countries at a certain stage of development, e.g. low income, predominantly agricultural societies, can benefit tremendously from IT. When this stage is passed modern technology may become appropriate as higher growth rates in income per head make large scale production possible through market (demand) creation.
2) Schumacher's ideas represent a broad generalisation of the condition in LDCs in the 1950's and 1960's, which no longer holds true. The fact is that several countries in LDCs industrialised very rapidly with minimum of urban bias (India and China are prime examples).

3) Total rejection of IT is based on technological and economic determinism. This approach tries to idealise modern technology with total disregard to normal conditions in which technology is applied (Shamsavari 1991).

Now we offer a more developed critique of appropriate-inappropriate dimension of the TRP.

1) As far as the factor endowment aspect of the debate is concerned one can claim that the experience of TNC in low income countries show that adaptation of developed country technology to low wage economies has not been a problem e.g. American company operations in Mexico as far back as 1950s. If we focus on profit-seeking organisations such as TNCs it is clear that lack of attention to factor endowment issue, e.g. more abundant labour in LDCs will cost these companies dearly if they rely on capital intensive technology. Also historical studies of technology transfer from Britain to the US in 19^{th}. Century show that initiating companies, American or British, adapted imported technology to American factor endowment, e.g. greater availability of wood and waterways (rivers) [Rosenberg 1976].
2) Labour-intensive methods are not necessarily appropriate for LDC as they may require hiring expensive, highly skilled supervisory labour power. This point raises issues about the usefulness of factor intensity concept (a standard tool in economists' toolbox) without further refinements, e.g. differences in types and grades of labour as well as capital.
3) Wrong product concept, apart from representing a `patronising' frame of mind among DC and LDC intellectuals, is misleading for a number of reasons. A luxury or in fact any consumer durable may encourage work in order to earn enough income to buy the product. If the product is also technically sophisticated, e.g. a car, it may add to skills pool in the form of car mechanics.
4) Sectoral impact, rural-urban in particular, is significant in the light of Schumacher's view on technology and society, which one can only admire. The realities of Third World industrialisation show that an initial period of `inappropriate' technology may be necessary before appropriate technology becomes both desirable and possible. Example: rising environmental awareness in China after considerable `dirty' industrialisation (environmental Kuznets U-curve).

Complete versus Incomplete Technology Transfer

Both the definition of technology and technological transfer are problematic. We have dealt with the first in Shamsavari et al. (2002), where we contrasted the narrow and broad definitions of technology. Here we will deal with the problematic nature of technology transfer.

According to one authority on the subject, the difficulty of defining technology transfer arises from the issue of completeness of technology transfer.

> At the one end, technology transfer may simply be the movement of technology from one location to another or from one use to another, or a combination of the two (Smith, 1980). On the other end, technology transfer must be "nothing less than the transfer of the capacity to understand and develop the introduced technology," (Komoda, 1986 as quoted by Chen 1996, p. 182.)

Chen follows the above by pointing out that based on Komoda's views, technology transfer cannot be complete unless it is completely adopted and absorbed without outside assistance, i.e. until the transferee is able to operate and maintain the process independently and furthermore can 'improve, extend and develop the technology originally transferred'. He continues by stating that 'Technology transfer is not just acquiring of knowledge in production, but also building up of a nation's technological capabilities. The difficulties of defining technology transfer arise largely from the fact that technology is knowledge, not a product. The transfer process and mechanism are necessarily difficult to define operationally.' (Chen, ibid, p. 182)

It is not clear from the above what Chen's position is about complete and incomplete technology.

The traditional literature on technology transfer (Stewart 1978, Adikibi 1984, UNCTC 1988, Souder 1990) defines the latter as a process which goes through three stages of introduction, adoption and absorption. It is not often clear whether or not this scheme is supposed to apply to a few sectors of the economy or the entire economy. Complete technology transfer to one or a few sectors, as opposed to complete technology transfer to the entire economy, are two entirely separate issues.

It is possible and may be desirable to transfer technology completely in a few sectors of the economy. The obvious candidate sectors would be those that rely on locally available factors of production and may be low-tech, e.g. textiles, construction sector, building materials, detergents, timber and wood, paper, steel, food, beverage and tobacco, etc. The possibility of transfer of technology in these sectors is based on the low level of technology and availability of local factors of production, e.g. land, mineral deposits and labour. In more high-tech sectors such as household durables and cars, technology transfer is both possible and desirable. It is possible as many MNC are happy to grant turnkey contracts (CKD) to host countries. It is desirable as many LDCs will benefit from saving in foreign exchange and some degree of employment and education of the labour force. This stage of technology transfer in the IS strategy has been referred to as the easy phase of IS by Hirshman (1968). The second and more difficult phase requires development of supplier industries (Hirshman, 1968). As many supplier industries require a minimum size to operate efficiently (MES), a size which depends on the extent of the domestic market, the second phase may not be feasible in a great number of small developing countries. Thus for a large number of LDCs, particularly the least developed countries (LLDC's) that number between 50-60 countries, including island, land-locked, sparsely-populated countries located in sub-Saharan Africa, Central America and the Pacific Ocean), the second phase of IS (corresponding to adoption-absorption stages of technology transfer) may not be a feasible option.

Thus, complete technology transfer in a few sectors of the economy may or may not be possible due to factors such as the size of the economy, economies of scale, etc. When we consider complete technology transfer to the whole economy the issue becomes problematic.

The possibility of such complete technology transfer is not only dependent upon the size of the economy and its stage of development but also on the constraints relating to the nature of technology and its availability to transfer. Another factor is the sector specificity of technology.

In certain manufacturing sectors, e.g. simple household durables such as vacuum cleaners or in certain chemical industries, the raw materials and parts used are small and limited. In these sectors it is easy to achieve complete technology transfer, especially if the raw materials are locally available (e.g. the petrochemical industry in oil producing countries).

In other sectors where the final product either requires a great number of parts, components and subassemblies (car) or the parts used are very high-tech (PCs) complete technology transfer is either inconceivable or very difficult.

The nature of technology in the 19th century and the first half of the 20th century made it easier to transfer as it involved largely process technology, which could be transferred through licensing agreements. These technologies did not involve product differentiation, brands, quality control, management technologies etc. They were largely non-propriety technologies. It also involved sectors such as capital goods, business to business transactions in which advertising, brand loyalty etc, play an insignificant role compared to quality and technical specification. The reason that the US, Germany and Japan in the late 19th century were successful in technology transfer had to do with building up the basic industries such as steel and shipbuilding.

The possibility of technology transfer in the 19th century and early 20th century in certain countries with large internal markets and in the capital goods sector were rooted in the nature of technologies transferred, the originators of technology transfer, which were large organisations that engaged in licensing agreements as the only way to maximise returns on their investment in the context of world economic conditions that favoured autarky. Apart from the fact that post-war developments favour greater trade liberalisation, etc. it is hard to conceive of complete technology transfer either in certain sectors or in the whole economy, in view of modern trends in technological change.

How is it possible to transfer technology completely when the technology is rapidly changing? In the rapidly changing technologies in the world today complete technological transfer is neither feasible nor desirable. It is not feasible due to the speed of change. It is not desirable due to the fact that many LDCs may be left out if they insist on non-propriety technology transfer.

Technology transfer involves transfer of knowledge at five levels of technology, product, process, marketing, finance and quality (UNCTC 1988, Shamsavari, et.al, 2002). The emphasis of traditional technology transfer models was largely on process technology. This was justified as the nature of technologies and the mode of their transfer, especially before World War II, involved strictly process technological know-how at the expense of other aspects.

Complete technology transfer may be desirable and possible in **some** sectors of any national economy, but such transfer to an entire economy is neither possible nor desirable. It is impossible, because of the Alice-in-Wonderland effect: In order to stay at the same spot you have to run very fast, i.e. technology is a constantly evolving and expanding, this being particularly true at the present time.

It is also impossible because depending on the size of the economy, certain sectors may not be economical to expand, e.g. car production, because of economies of scale. Even if this was possible it would not be desirable because it implies (by its nature) a closed economy (Shamsavari and Taha 2005).

Technology Transfer in Historical Perspective

If we look at technology transfer from a historical perspective a number of significant factors emerges:

1) Technology transfer historically has been from sector to sector, company to company, within the sector as well as country to country.
2) Stages and mechanisms of transmission have varied widely from industry to industry and in stages of economic development.

3) In certain industries transfer of technology is intimately bound up with the nature of technology itself.
4) A most common form of transfer these days is between supplier and customer in industrial markets.

The following cases and examples should help to demonstrate the above-mentioned points:
Textile industry in Europe in 17-19th centuries: technology transfer occurred between many countries (UK, France, Germany, Holland) largely through migration of skilled labour (Jeremy 1991).

In many industries, technology transfer from Europe to US in 19th. century, involved firm to firm transmission and adaptation to domestic factor endowment took place as a matter of course in response to market mechanisms (Rosenberg 1976).

Unlike the case of textile technology that was transmitted through migration of a large number of artisans, technology transfer in iron and steel industry required a smaller number of highly educated engineers (Jeremy 1991).

The rise of a number of industries beginning in mid to late 19th century led to technologies whose appropriate scales of operation by their nature were truly global, e.g. electricity generation, hence the urgent need to come up with an internationally accepted unit of measurement (Teich 1989).

In communication and transportation industries it does not make much sense to talk about technology transfer, as transfer is part and parcel of the industry itself (one cannot make a call to another country without the technology to receive it having been already installed at the destination):

“The nature of early telegraph technology contributed to its transfer as well. Though some of the early entrepreneurs, notably Morse, initially sought to keep knowledge about their systems secret, the necessity of hiring literate operators who either possessed or could easily learn the necessary electrical knowledge to keep the systems running made it difficult to keep knowledge of the technology proprietary." (Jeremy 1991, p. 113)

The nature and mechanisms of technology transfer have changed throughout history. We can distinguish four historical stages: pre-industrial, early Industrialisation, high Industrialisation and post-industrial (See Fig. 2).

In the pre-industrial stage agriculture is the main sector, where technology transfer is largely through informal education; in non-agricultural activities it may involve copying and translation of texts and some migration.

During early industrialisation technology is simple, raw materials local, needs mass and basic (e.g. textiles, hygiene goods, paper, food processing and construction). In this stage process and product technology are dominant. Technology transfer takes place through imports of machinery and labour.

Figure 2: Technology Levels and Transfer in Historical Perspective

	Level of Technology/Sectors	**Type of technology**	**Methodology of production**	**Mechanism of Technology Transfer**
Pre-industrial	**Simple: Agriculture, Handicrafts, some Project**	**Product**	**Craft**	**Informal Education, Labour Migration**
Early Industrialisation	**Low: Textile, Hygiene, Construction, Food, Paper**	**Process, Product, some Management**	**Batch, some Mass**	**Machinery Import, Show how, non-Education**
Late Industrialisation	**Medium: Iron & Steel, Energy, Railways**	**Product, Process, Management**	**Large Batch, Mass**	**License,**
Post-industrial	**High: IT, Bio Technology Nanotechnology**	**Product, Brand Management, Quality**	**Lean, Mass**	**License, FDI, Joint Venture**

In the high industrial phase we see the advent of high technology and machine based production at large scale (e.g. iron and steel, oil and gas, assembly of machine tools, consumer durables, automotive industry). Product (esp. brand) and quality control technologies dominate. Technology transfer takes place through licenses, machinery supply contracts, turnkey and management contracts. Import of parts and raw material is common and know how and show how plus some FDI begin to acquire considerable importance. We observe growing importance of both foreign trade and investment.

Post-industrial stage involves very high technology, brand management, quality control, marketing and R&D (e.g. IT, bio-technology, nanotechnology, also modular production of sophisticated consumer products such as cars). Technology transfer takes place through some licensing, FDI and joint ventures. We see a much greater internationalisation of production and trade involving globally- integrated production and distribution.

When we consider North-South process of technology transfer in 20th century we can identify three historical models of technology transfer as follows:

These models can be distinguished by certain factors, i.e. the geographical area, the route or mechanism of technology transfer, the extent of state intervention, trade strategy and policies of the host country.

1. The Soviet (East-European) Model: This was used initially by the former Soviet Union (SU). But it was copied in Eastern Europe and India and China after WWII. It aimed at Import Substitution (IS) with primary channel of transfer being licensing agreements (e.g. production of Lada cars under license with Fiat). As the SU was not a market economy tariff was not used as an instrument of protection of domestic industry. State intervention was supreme.

2. The Brazilian (Latin American) model: This model also aimed at import substitution but relied heavily on wholly-owned FDI (e.g. American Ford company investments in the 1950-60s). Trade policies included tariff, quota

and tax-subsidy incentives. Thus the role of state was important but private sector also played a significant role especially in supplier industries.

3. The Korean (Asian) Model: This was a complete departure from the above two in that both the aims and routes of technology transfer were different. It aimed at export promotion (EP) and used joint-ventures with Japanese and American TNCs. The extent of state intervention was lower than LA model, while private sector played a major role. Trade policies included mostly tariff and subsidies.

See Fig. 3 for a summary of the above.

Figure 3: Historical Models of Technology Transfer in 20th Century

	Means of Transfer	Role of Government	Export-oriented	Regions
Soviet Model	**License**	**Total**	**Zero**	**SU, Eastern Europe**
Latin American Model	**FDI**	**Large to Medium**	**Small to Medium**	**Brazil and Mexico**
Asian Model	**Joint venture**	**Medium**	**Large**	**Japan, S. Korea**

The Central Role of FDI in Technology Transfer

FDI has often been considered as a major vehicle of technology transfer because of its packaged (bundled) nature. This is true, but the role of TNC in technology transfer may involve other factors that are more important especially in the light of above critical discussion of the paradigm:

Through the necessity of adaptation of some or all of the technology transfer package the TNC, as if by an invisible hand', delivers innovation and R&D to the host economy. TNCs may also be encouraged to form partnerships, joint venture and alliances with domestic firms in the host country or enter into linkages with national supplier companies, thus acceleration transfer of technology (Shamsavari 2005).

Furthermore, TNCs may transfer technology from their affiliates abroad back to the home country operations. This is reverse technology transfer and is a hallmark of globally integrated production (complex) as opposed to multi-domestic (simple, stand-alone) model.

> "International business can be thought of as a package, combining resources to produce goods and/or services. With international business, by definition, knowledge is diffused within an organisation. And…typically the knowledge flows have stemmed from parent onwards. However, as international business has evolved there came to be a two-way street, where the parent obtained knowledge from an existing affiliate or a newly acquired one." (Wilkins 2005, p. 141)

In this context it is also interesting to contrast the latest view of UNCTAD (2000) compared to the one mentioned above (UNCTAD 1975). According to the former, FDI is not the most expensive form of technology transfer, but the least costly:

> "FDI may be a more expensive mode of transfer than externalised modes (e.g. licensing)…, the latest and most valuable technologies, however, are not available on license… and FDI can provide an effective means of updating technologies quickly, which is important for countries that lack the ability to improve and innovate on imported technologies. Taking these factors into account, FDI may often prove to be the cheapest long-term means of technology transfer." (UNCTAD 2000, p. 173)

It is interesting to observe that we have come a long way since the heyday of dependency theory, as the issue of TNC and cost of transfer associated with it is now definitively resolved in favour of the latter.

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