

ISIS SOUTH-SOUTH SERIES

THE QUEST FOR TECHNOLOGY TRANSFER

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Introduction

TECHNOLOGY, as embodied in capital goods, services of human capital, industrial blueprints and documents, is extremely vital for development. It is an essential input for all economic activities and is needed particularly by an economy wishing to industrialise, as in the case of most developing countries since the early fifties. As industrial output becomes an increasingly important component in the national product and as productivity becomes a significant source of economic growth, technological change is transformed from a minor factor governing productivity advance to its most significant one. However, in view of existing structural, institutional and technological constraints, any path to technological self-reliance in a developing country is a difficult one to tread.

Considering that technology is constantly changing, developing countries must upgrade their organisational capability to minimise these constraints. However, the transfer of industrial technology often generates its own dynamics within the socio-economic structures of developing countries, not only in terms of costs of acquiring technology but, more importantly, in creating a dependent economic structure which is perpetuated by numerous domestic constraints.

Given that industrial countries are in the lead in almost all aspects of science and technological development and that they generally dominate research and development (R&D) activities in terms of financial allocations and manpower skills, North-South trade in technology has always originated from the former. Correspondingly, technology trade among developing countries is minimal. With a small industrial base and be-

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cause of the lack of industrial R&D and highly skilled manpower, the costs of technology generation within any developing country are prohibitive. In order to obtain some benefits from the technological progress being achieved, many developing countries have opted for the import of technology. This is a less expensive and speedy means of forming a basis for their industrialisation and perhaps for the generation of indigenous technology.

Given the above, this paper will, firstly, examine technology transfer from the global perspective and some of the relevant issues within this global context. This will be followed by a broad analysis of the problems and constraints within which all developing countries have to operate to acquire technology and to expand domestic technological capability. This paper will also examine the extent of technological co-operation, as reflected in trading patterns among the developing countries and argue for the need to expand South-South trade. Finally, the prospects and policy implications as regards South-South co-operation will be discussed.

Global perspective

Despite the on-going integration of the world economy, as shown by the growth of world trade and by direct foreign investments between countries, trade between developing countries is relatively weak, reflecting the lack of complementarities among them. On the other hand, their trade with industrial countries tends to be more dominant, influencing to a greater extent many of the economic structures that have developed within developing countries. The developing countries, for example, are extremely dependent on the industrial economies for their export revenues and their need for capital equipment and intermediate goods, the embodiments of technology transfer itself.

Table 1 shows that, for 1965, the destination of

developing country exports was significantly dependent on demand patterns in the industrial countries where, on average, 56-69 per cent of their total exports went. On the other hand, the share of trade between developing countries was, on average, slightly less than 30 per cent. However, there has been an observable change in the pattern of their exports such that, in 1983, the proportion that went to the industrial countries dropped for the three groups of developing countries. The proportion, however, was still high for the middle and upper-middle developing countries.

The proportion that went to other developing countries also increased marginally for all the three groups. In comparison, the industrial countries have maintained a high proportion of their total exports among themselves, with only around 24 per cent going to the developing countries in 1983. The structure of merchandise exports (see Table 2) shows that developing countries' export earnings are still highly dependent on primary resources and commodities, comprising 50-58 per cent of total exports in 1982. The dependency ratio on primary exports has, however, declined quite substantially since 1965.

In terms of manufactured exports, the middle and upper-income groups have exhibited some progress during the 1965-82 period during which the shares of manufacturing exports increased from 17-42 per cent and from 20-49 per cent respectively. Unlike these two groups, which have diversified their export capability into machinery and transport equipment and other manufactures, the low-income countries are relatively dependent on the export of textiles and clothing which, in 1982, comprised 18 per cent of their total exports.

Third World dependence on industrial countries for manufactured exports, however, is not as high as in the case of total merchandise exports. Table 3 shows that the three groups of developing countries have brought down their proportion of manufactured exports to the industrial countries during the two years indicated. In 1982, slightly less than half of their total manufac-

tured exports were absorbed by the industrial countries, while the proportion that went to other developing countries had increased quite remarkably, particularly for the upper-middle income countries which include the Asian newly-industrialising countries (NICs). A high proportion of manufactured exports from the high-income oil exporters also went to other developing countries during the 1965-83 period. These trends in the trade of manufactures among developing countries, given the encouragement to expand, are certainly promising in the context of future South-South co-operation.

The current needs of developing countries for capital equipment from the industrial countries reflect the increasing desire of the former to industrialise. Moreover, increasing resource allocation for industrial development has been a planning norm since the early sixties. This is coupled with the belief that importing technology from the industrial countries is the obvious means to achieve industrial take-off. This process is also made possible by the increasing internationalisation of capital that simultaneously increases the need for industrial country technology.

The imports of machinery (including transport equipment) by developing countries are a good indicator of their technological dependence on the industrial countries. Table 4 shows that such imports are a major component of total imports of developing countries, especially the middle and upper-middle income economies, averaging around 30 per cent of total imports for both 1965 and 1982. (If other manufactures are included, the percentage rises to around 60 per cent). It is only in the low-income countries that the share has decreased from 32 per cent in 1965 to 20 per cent in 1982, and this drop has been translated into a substantial increase in the share of fuel imports from 5 per cent in 1965 to 18 per cent in 1982.

If such trading relationships take place between parties of unequal strength in respect of science and technological achievements, the consequence would be

the creation of dependent structures within the developing countries as reflected in most matters concerning North-South relationships. Since these imports are principally from the industrial countries, the state of dependence could be perpetuated unless developing countries themselves can successfully reverse this trend, either individually or collectively.

Trade links between countries are generally followed by inter-country flow of investments, especially between open market economies. And since direct foreign investment (DFI) flows are invariably associated with technology transfer, it is equally important to examine these flows among all countries. Table 5 indicates that between 1965-83, on average, about 75 per cent of DFI is concentrated in the industrial countries, reaching the maximum annual average of US\$31.3 billion during the 1980-83 period. The remainder has gone mainly to a few developing countries, predominantly those in the higher income brackets in Asia and Latin America -- Brazil and Mexico among the Latin American countries and Hong Kong, Malaysia and Singapore in Asia. Singapore, in particular, accounted for almost 50 per cent of total Asian receipts of DFI in recent years.

The share of DFI flows into developing countries indicate an increasing trend, rising from 18 per cent during the 1965-69 period to 27 per cent of the total during 1980-83, with an average annual flow of US\$13.4 billion. Brazil has, in fact, received more DFI than any other developing country. According to the World Bank, in 1983, the stock of DFI in Brazil totalled almost US\$22.3 billion, of which almost 75 per cent is in manufacturing. Mexico, the next largest recipient, has only half this amount.

The United Nations Centre on Transnational Corporations (UNCTC) estimates that of the DFI flows (which increased from US\$13.2 billion in 1970 to US\$42.2 billion in 1980), only about 20 per cent went to the developing countries. Of this, about 56 per cent went to Latin America while the Asian and Pacific developing region received around 18-27 per cent between 1971-78.

Being unevenly distributed, the DFI is concentrated in six countries which together absorbed about 50-75 per cent of all investments during the late seventies. These include Hong Kong, Malaysia, Singapore, Argentina, Brazil and Mexico (United Nations, 1985; p.5).

In contrast, the flow of DFI among developing countries has been relatively small. The substantial Opec oil surpluses (resulting from oil price increases during the 1973-74 and 1979-80 periods), which could have assisted the low-income developing countries, have not been fully utilised to the latter's advantage. This is not surprising since the high-income oil exporters themselves have to import industrial technologies from the industrial countries, while their capacity to assist other developing countries is extremely marginal in this respect. It is estimated that 40 per cent of the cumulative Opec surpluses went to the United States and Britain, while most of the remainder went to other industrial countries including France, West Germany, Japan and Switzerland, where there are efficient financial markets (World Bank, 1985; p.89).

In view of the dependence on imported technology and the generally keen competition among developing countries to attract DFI, the direct and indirect costs of acquiring technology, as these countries step up their industrialisation programmes, have become more prohibitive. This is increasingly linked to the commercialisation of technology that tends to inhibit the free communication of knowledge and the dominance of multinational companies (MNCs) in the dissemination of technical knowhow.

As successful technology transfer is conditional upon the existence of appropriate channels and a co-ordinated framework of international trading relations, industrial country MNCs tend to become more oligopolistic since they have the capacity to assess individual country technology requirements and the organisational ability to channel resources as appropriate to their interests. At the same time, their interests do coincide with their need to control the diffusion and ex-

exploitation of their technology as part of their global strategy.

As the production of technology is costly and risky, needing large-scale operations and highly skilled manpower, the entry of new competitors is restricted, particularly for developing countries. Thus, only a few large companies, more often than not MNCs of the industrial countries, can invest extensively in R&D, particularly in relatively advanced and sophisticated technology. More importantly, in the context of developing countries, a substantial proportion of technology transfer is within and amongst the MNCs. This is also associated with the concentration of world trade among the industrial countries and the fact that MNCs generally look to those that have similar technological capability as partners in technology exchange.

Problems and constraints

There are basically three groups of developing countries: the low-income countries, the middle-income countries and the high-income oil exporters. Their GNP per capita (in 1983) ranges from an average of US\$260 for the low-income countries (including China and India) to US\$1,310 for the middle-income countries (such as Brazil, Argentina and the Asian newly-industrialising countries) and US\$12,370 for the high-income oil exporters. Manufacturing is still relatively insignificant in each of their respective GDPs, amounting to an average of 14 per cent for the low-income countries in 1983, 21 per cent for the middle-income countries and only 6 per cent for the high-income oil exporters.

Given that developing countries are a heterogeneous group in terms of economic development as well as historical and cultural backgrounds, there is a diversity in their technological capability. The strength, or rather the weakness, of their technological base is also a reflection of very specific relationships that each developing country has developed with industrial

countries, either on a bilateral or multilateral basis. The relatively industrialised countries (mainly the NICs like South Korea, Singapore, Hong Kong and Taiwan) have the ability to make independent technological choices. This has been acquired during the last two decades and it gives them the capacity to adapt technology and, to a more limited extent, to be innovative in new production techniques and product lines.

It is instructive to note that the four NICs mentioned above placed substantial emphasis on export-led growth such that the share of manufacturing exports (including textiles and clothing, machinery transport equipment, and other manufactures) in their total merchandise exports increased from about 60 per cent in 1965 to about 81 per cent in 1982. South Korea achieved the largest increase -- from 59 per cent in 1965 to 92 per cent in 1982. With the exception of the South Korea (which had a population of 40 million in 1983), these NICs have relatively small populations and as such, their industrial expansion has been based substantively on export orientation, which provided them with the impetus to compete in international markets. Their export performance compares favourably with other upper-middle income countries whose total average share in manufactured exports increased from 20 per cent in 1965 to 49 per cent in 1982.

The relative success of the NICs in expanding their export base in manufactures is also a reflection of their capacity to employ industrial strategies that were conducive to export expansion during a period (the sixties and seventies) when the world economy was relatively buoyant. However, the prospects of strong demand from the industrial countries and hence the rapid growth of manufactured exports and high commodity prices seem to have diminished considerably during the 1980s. This will be a dominant constraint in the next few years. It will subsequently affect the industrialisation programmes of many developing countries and the expansion of their technological capability. This calls for an appraisal of existing development strategies in

many of these countries.

A broad development strategy that a country adopts will substantially influence its economic structures and, in our context, its technological options. The consumption patterns of many developing countries today are quite similar to those of the industrial countries. At the same time, the developing countries' trade is directed, in the main, towards industrial economies. These two factors, together, will influence the main mode of technology absorption in the modern industrial sector. This modern sector, as opposed to the traditional or small-scale sector, generally exhibits traits that are a delayed duplication of the production techniques and product-mix of the industrial countries.

Some modifications of technology is clearly possible even in this situation, especially when a domestic technological base has been developed, as in the case of the upper-middle income developing countries. But modifications are largely a matter of time-lags in adopting the latest industrial technology, with perhaps the introduction of more labour-intensive ancillary activities and changes rendered necessary by differences in the market size. In this respect, Bagchi aptly concludes:

The history and structure of Third World economies inhibit the widespread use and development of appropriate technologies, that is, technologies that generate employment and incomes for the poor people and can supply them with the necessities of food, clothing, medical treatment, housing and education. Different sectors of a typical Third World economy are currently linked more with the capitalist system than with one another. (Bagchi, 1982; pp, 247-48)

In some of the developing countries, particularly in the NICs, there may exist a potential to create new technology although, in general, this is very difficult

to achieve. Moreover, this ability is affected by the varied ways developing countries acquire technology and develop indigenous ones, reflecting differences in national policies to suit domestic conditions (like sectoral composition, absorptive capacity and the role of the public and private sectors in industrial development).

Policies and policy objectives thus vary with the stage of economic development, particularly with technological and administrative capacities of each country. Policies may relate to improving the terms of technology transfer, the selection of imported technology, reducing the element of 'packaging' in imported technology so as to secure greater independence in terms of decision-making and creating a register of technology transfer. There are also policies to promote domestic technology development.

In most developing countries, emphasis has generally been placed on policies to regulate the terms. Such policies, however, seem to be insufficient to promote indigenous technological capability. Countries which have a potential in this area need an active policy to promote domestic technological change. Such a policy should include positive promotional measures such as the provision of R&D institutions or infrastructure, subsidies and tax incentives, education and government procurement policies and a selective policy towards the import of industrial country technology. A selective policy involves discriminating such imports in those areas where indigenous potential exists. This is done by encouraging the import of technology which is likely to generate domestic learning and innovation and is complementary with local efforts, and restricting imports that are competitive with domestic capacity.

An industrialising country, in response to these challenges, will generally adopt industrial strategies that, according to their own perceptions, would be best suited to their socio-economic structures and needs. It is also in this sense that co-operation between developing countries or even within regional groupings of

developing nations tends to be minimal as each country's development objectives are very different from those of other countries or their neighbours. In this respect, Goetz concludes:

The weakness of proposals for South-South co-operation so far has been based on the concept of an aggregate, mythical South. The constraints to greater South-South co-operation build up in the South itself because of entrenched interests of dominant economic groups and traditions that connect it with the North economically, politically and intellectually. (Goetz, 1981)

From case studies on technological development of several developing countries including Colombia, India, Kenya, Mexico, Tanzania and Thailand, Bhalla observes that although some of the more industrialised countries have R&D institutions, these institutions are relatively weak since domestic science and technology are very rarely related to local production conditions. They tend to cater to the needs of a very small clientele of modern industry, while little effort is being made to harness the forces of science and technology for the traditional or small-scale sector (Bhalla, 1975; pp. 309-323).

Yet it is precisely the latter kind of employment that generates innovations that are primarily needed to improve living standards of the whole population. Measures to address the 'technological dualism' between the large and small-scale sectors must accord higher proportions of R&D resources to institutions mainly concerned with the small-scale industries. But in the pursuit of rapid industrialisation and because of the need to encourage the inflow of foreign investment, many developing countries tend to neglect the latter, although it is recognised that an effective industrial strategy must also emphasise the linkage development between the small-scale industries and their larger

counterparts.

These circumstances have an important impact on the possibilities for future South-South co-operation in the area of technological development. The varied nature of these policies makes it all the more difficult for the developing countries to co-operate in these matters and reduce their capacity to act collectively. This is not unlike the competition that prevails among developing countries to attract FDI by giving the best terms. Thus, according to Harrison:

There is the split between the newly-industrialising countries, the commodity producers, and the poorest countries who have practically nothing to sell. Each group has an interest in maximising Western concessions in the sphere that will help it most -- trade, commodities and aid respectively. Most of the industrialising countries might actually prefer cheaper commodities. (Harrison, 1980; p.339)

The emergence of the NICs, particularly in the Asian region, has added another dimension to the issue of technology transfer. The case of South Korea in this respect is extremely important, given the fact that it has achieved substantial industrial progress during the last two decades, during which its manufacturing share in GDP has increased from 18 per cent in 1965 to 27 per cent in 1983.

The role of Korean MNCs, which has assumed prominence since the early seventies, has been hailed as a development that could mitigate some of the problems associated with technology transfer through industrial country MNCs. The MNCs from the NICs could specialise in transferring manufacturing processes of products which are at the tail end of the 'product cycle', that is, standardised goods requiring relatively simple technology. Moreover, through their own experience, such MNCs could have adapted industrial country technologies to accommodate domestic requirements and tech-

nological capability which are relatively similar to those prevailing in the developing countries. They might also have scaled down plant size with the aim of producing for smaller markets that are also more appropriate for developing countries.

While the emergence of these MNCs has given rise to a great deal of expectations as they could provide an answer to the problems experienced by other developing countries (they also provide a challenge to the near monopolistic position of industrial country MNCs), a study by Escap/UNCTC concludes that Asian Third World MNCs play a more complementary role rather than competitive one vis-a-vis industrial country MNCs. In fact, most of the competition with respect to these MNCs occurs either among themselves or between them and local manufacturers in the host countries. They are generally concentrated in industries that are labour-intensive, where the technology used is relatively unsophisticated and standardised, where product differentiation is less important than price differentiation, and where products are domestic-market oriented, particularly textiles, food processing and construction (United Nations, 1985; p.159).

The MNCs of the NICs have often behaved in the same manner as industrial country MNCs and have even replicated some of the problems associated with investments from the industrial countries. For instance, the flow of DFI between the industrial countries and developing countries is lopsided, with the former actively investing in the latter. A similar disequilibrium exists between the NICs and the less industrialised countries. Hong Kong, India, South Korea and Singapore, for example, invest in the less industrialised countries of the Asian region but there is not much of an investment flow in the opposite direction.

The problems of economic domination and inequality, characteristic of North-South relationships are also observable among the developing countries themselves. Developing country MNCs, therefore, differ from the industrial country MNCs more in terms of the competi-