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ARTICLES

Technology Transfer

Transfer of Technology in LDCs

by Professor Hans W. Singer, Brighton *

The author discusses the controversial problems connected with the transfer of highly sophisticated technologies to LDCs. In his opinion this transfer and adaptation of technologies is necessary and advantageous, but depends on the development of a national technological capacity of a developing country as a prerequisite.

The modern technology now existing and applied in the "modern" sector of the developing countries is a technology which, by and large, has been developed in the rich countries, by the rich countries and for the rich countries. It is designed to solve their problems by methods appropriate to their situation. The problems and appropriate methods for less developed countries (LDCs) are different. But practically no modern technology exists to suit their problems by appropriate methods. As we shall see, in the absence of an appropriate modern technology an empirical indigenous technology has developed in the non-modern ("traditional" or "informal") section of the developing countries. While this indigenous technology is by no means to be despised — on the contrary, it is one of the pillars of any rational employment strategy — it suffers from neglect, discrimination, harassment by the government and, above all, from lack of any systematic Research and Development (R & D) activities.¹

The concentration of modern technology in the rich countries is difficult to quantify. But for lack, at the present time, of a satisfactory measurement of the output of technological know-how, the distribution of inputs, or cost of producing technological know-how in the form of R & D expenditures are now increasingly accepted as substitute measures. By this standard, 98 p.c. of all R & D expenditures take place in rich countries. On a per capita basis, this is a grotesque disproportion of 100 : 1.

This rich-country technology is transferred to the developing countries in multiple forms: through trade, embodied in the products, specially machinery, of rich countries; through foreign investment, as part of a "package" deal involving capital,

management and technology; in "pure" form selling know-how against royalties, licence fees, etc.; through consulting services and the advice of experts sent under bilateral or multilateral technical assistance programmes; through the training of scientists and technologists of the developing countries, both inside and outside these countries, in this modern technology, etc.

What is the impact of this multiple transfer of "modern" (i.e. rich country) technology on the developing country? The technology, being a rich-country technology, reflects the resources endowment of a rich country, i.e. a relative abundance of capital and highlevel skills and a relative scarcity of sheer labour ("hands"). It also reflects the demand structure of a high-income market, sophisticated high-quality goods embodying the kind of gadgets appealing to a high-income clientèle anxious — and preconditioned — to novelty and differentiation (real and imaginary). In the case of agriculture for instance, it also reflects concentration on temperate zone products and conditions as well as the export products of developing countries sold to the rich countries, at the expense of tropical production for the needs of local and national consumers.

Labour-intensive Technologies Required

The LDCs have a rate of population increase, and hence of increase in the labour force, some 5–8 times higher than in rich countries (around 2.5 p.c. — 3.5 p.c. p.a. instead of 0.4 p.c. — 1 p.c. p.a.). They also have only a fraction, perhaps 5 to 10 p.c., of the resources that rich countries have for the capital component of financing new jobs. Putting these two ratios together, it is easy to see that the application of rich country technology without adaptation to the greater employment needs and the smaller resources of developing countries will result in a situation, in which the available re-

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¹ See Employment, Incomes and Equality, A Strategy for Increasing Productive Employment in Kenya. International Labour Organisation, Geneva, 1972. The author, jointly with Professor Richard Jolly, was the Chief of this Mission. See specially Chapter 13 on the informal sector.

sources will be sufficient only for the creation of a small modern sector, providing only a small fraction of the jobs required by a rapidly growing labour force. And this is precisely what we see happening in the great majority of the developing countries today.

The small capital-intensive modern sector provides few jobs, but has relatively high labour productivity, due to the relatively high capital/job ratio, and as a result forms an enclave of higher incomes, including higher wages. But no capital is left over for the rest of the economy, and those relying on jobs outside the limited modern sector have to make do with low-productivity employment in the traditional (mainly agricultural) and informal sectors, or without any employment at all. Both groups are effectively unemployed, if we define unemployment as the lack of productive employment, and "productive employment" being defined as employment yielding an income sufficient to place the earner and his family above a modest minimum subsistence "poverty" line. On a realistic definition of such a poverty line it will be found that in many developing countries some 25–30 p.c. of the labour force is unemployed. Perhaps half of these are without employment, the other half represent the "working poor"², whose employment is not sufficiently productive to bring them above the poverty line.

What is needed instead is a technology, which is "labour-intensive" enough to spread the comparatively small capital resources widely over the large number of new jobs, which have to be created, thus reducing the condition of dualism and widespread lack of productive employment or income earning opportunities. The word "labour-intensive" has been put in quotation marks because strictly speaking it is incorrect. The total amount of capital used is the same as before, determined by the total resources available to the economy to finance new jobs. Only now this amount of capital is more widely and evenly distributed over a large number of jobs. The individual jobs financed by the available capital have become more labour-intensive but the overall capital-intensity for the economy as a whole has remained the same. Unfortunately, such an "appropriate" or "intermediate" technology either does not exist, or no longer exists (having been submerged by the rich countries' technological "progress"), or if it exists does not have the normal (profit-oriented) transfer and information transmittal apparatus attached to it, which is needed to bring it into effective operation in the developing countries. This latter point is often true even regarding the *internal* transfer of technology within developing countries: an "appropriate" technology

practiced in the informal sector or traditional agriculture of LDCs may simply not be known to the planners and decision-makers in their shiny offices in the centre of the capital.

The Role of the Planners

The planners and decision-makers of developing countries also tend to prefer "modern" (i.e. rich-country capital-intensive) technology because — so they argue — is not development synonymous with modernisation? Is not "primitive" (i.e. non capital-intensive) technology a way of fobbing off the developing countries with something "second-best"? In this belief, they also do their best to encourage the import of capital-intensive technologies, even where they might be aware of the existence of less "modern" technologies. Yet this belief is based on a tragic confusion of means and ends. True, a "modern" capital-intensive technology is associated with high levels of development, but it is not the *cause* of development. It is more a product or symptom of high levels of development than a road to it. Once a country is capital-rich the "modern" technology becomes appropriate, indeed necessary, and the conditions for its optimum use and absorption are there. But if a country is capital-poor and underdeveloped, the "modern" technology is inappropriate and its adoption will result in set-backs to development, and specifically in a distorted and "enclave" pattern of growth with high and rising unemployment, in spite of its association, in many peoples' minds, with "development" and "wealth".

There are other factors, too, on the part of the LDCs themselves which favour the transfer of capital-intensive technologies. These range from the unequal income distribution — resulting in a demand pattern favouring "sophisticated" products — to artificial cheapness of capital through over-valuation of exchange rates, tax and tariff subsidies, investment allowances, etc., — while unskilled urban wages in the modern sector are allowed to rise to a multiple of earnings of comparable grades of labour in the agricultural, traditional and informal sectors. It is right to urge developing countries to revise their policies in these and related respects. But it remains true that the bulk of the forces making for the transfer of inappropriate technology reside in the rich countries, the multinational corporations headquartered there, the trade and aid rules largely devised by the rich countries and the existence of a one-sided international system in which the interests of the poorer countries do not receive an adequate weight.

But is it not wasteful to develop fresh knowledge and technology in the LDCs at great cost when such knowledge already exists? Can the existing

² The term used in the ILO employment mission report, Kenya, *Ibid.*

technology and knowledge not be adapted to the different needs of the developing countries? And can this not be done more cheaply than to develop a national or indigenous technology in the developing countries? The answer is that such questions are based on an entirely false choice between *either* developing national technological capacity or the effective import and adaptation of technology from the more advanced countries. The fact is that these two policies, far from being alternatives, must go hand in hand. The second policy, effective transfer and adaptation of technology, depends on the first, a national technological capacity. It is only where such capacity exists that a country can properly judge the relative merits and disadvantages of different technologies for the production of different types of commodities, or even be aware of their existence. The effective adaptation of imported technologies is directly dependent on national technology. Only on the basis of such national capacity can a developing country negotiate with any chance of reasonably fair results with multinational corporations and other foreign investors, with salesmen of equipment, with trading partners and aid donors, with patent holders and consultants. If any historical demonstration of this is needed, it would be amply provided by the case of Japan.

What happens today constitutes a vicious circle. The big multinational corporations set up branches and subsidiaries in developing countries in order to make additional sales and profits, and thus obtain a better pay-off on their costly and extensive R & D expenditure, which is not geared to the needs (marginal from the point of view of these big corporations) of the LDCs. From these profits and incomes derived from LDCs, new and even more advanced R & D is financed, which is virtually certain to make the prevailing technology even less appropriate to the needs of developing countries. It is an almost tragic spectacle to see the poorer countries of the world in this way contribute to their own destruction. Destruction may seem an excessively strong word to use, but one must think of destruction of employment opportunities for the rapidly rising labour force of these countries, and specifically the desperate plight of their younger people and school-leavers.

The creation of national technological capacity in the poorer countries is thus a necessity, even if it places heavy reliance upon the transfer and adaptation of imported technology. But it will be a very long and expensive business. Rich countries spend up to 3 p.c. of their large GNP on such R & D work, and the proportionate burden in poor countries would be even higher. Perhaps even more relevant, the training of the scientists and technologists needed, if they are to be provided on a national

basis, would take over a generation in many developing countries, for instance in Africa. (There are, of course, exceptions such as India, Brazil, and both Egypt and Israel.) Thus, the development of a "national" technological capacity will often require joint action and cooperation among LDCs on a regional or subregional basis, and above all, help and collaboration from the developed countries, whose technological monopoly is a fact of life and will remain so for many years to come.

UN Three-point Action Programme

The United Nations has drawn up a three-point action programme which could become the basis of concerted world-wide action³.

This involves action — in each case based on quantitative targets:

by the developing countries to raise their R & D expenditures (including the cost of a scientific and technological infrastructure) from 0.2 p.c. of their GNP to 1 p.c. by 1980;

for the developed countries to devote 5 p.c. of their total R & D expenditures to solving a series of specified priority problems and approaches of priority relevance to the developing countries⁴;

for the developed countries to devote a specified percentage of their aid or of their GNP (one-seventh of their current aid levels has been suggested) to assistance in the field of technology, raising the national technological capacity of the developing countries, specifically with the institutional and training infrastructure requirements.

This action plan could provide a firm foundation for the otherwise rather shadowy "International Development Strategy for the Second Development Decade". But unfortunately the rich countries have not so far made the firm commitments which would be necessary (in spite of some promising new approaches within OECD) — nor, one would suspect, have many of the LDCs yet realised the priority they should give now to taking the first step on what is bound to be the long road of acquiring technological capacity adequate to solve their own problems in their own way.

Code of Conduct for Multinationals

The United Nations has also taken steps recently to examine the impact of the transfer of technology through multinational corporations upon the developing countries. The ultimate aim is to draw up a code of conduct under which fairer and more

³ UN World Plan of Action for the Application of Science and Technology to Development. United Nations Publication, 1971.

⁴ Subsequently raised to 10 p.c. by the UN Economic and Social Council.

equitable bargains can be struck between the corporations and the developing countries. Essential key elements of such a fairer system would be: better and more widespread use of labour-intensive technology by the multinationals; more local R & D work and more work on adaptation of technology to local conditions; more use of local supplies and technical assistance to local suppliers to upgrade their technological capacity; more tax revenue to the developing countries which could be used to defray the cost of scientific and technological development; more local re-investment of profits, etc. The present bargaining position of the developing countries – quite apart from oil and other strategic materials – is by no means as weak as is often imagined, although once again more regional cooperation and better information and understanding are required. The example of the Andean Pact countries in Latin America shows the constructive opportunities which lie open to the developing countries in this area. The cooperation of such institutions as the World Bank and the OECD will be required to bring such efforts to fruition.

Similarly, present aid practices tying aid to the specific import requirements (usually capital equipment) have the same effect in biasing the technology transferred to developing countries in a capital-intensive direction. It should be noted that this issue is different from the problem of "tied aid" by which we usually mean aid tied to the equipment of the specific donor country. Even where aid is untied in that latter sense, the danger of technological distortion pointed out here will remain. What is needed is much more liberal use of aid for the financing of local expenditures – and more aid on a wider programme basis to finance employment creating programmes, such as rural development, rural public works and improvements in housing and marketing. There is also (as has been pointed out before) the need for more aid to assist directly in the building up of scientific and technological capacity in the developing countries. It would be important to make sure that the technological basis thus created is geared to the concrete and specific requirements of developing countries, rather than remain a marginal appendix to rich-country technology.

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