

Menck, Karl-Wolfgang

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quality, adaptability to local conditions and price. It is perhaps a symptom of our time that Brazil, a country particularly generous to foreign investors, insists upon detailed screening—case by case—of the know-how purchases.

One may state without exaggeration that the country offering inspiration these days to the developing world in this respect is Japan that had long ago developed the art of choosing and buying foreign technology from alternative sources and at low prices. This does not mean that the developing countries lack awareness that Japanese policies and practices cannot be imitated elsewhere. Their aim is not to create obstacles to foreign investment and concentrate exclusively on the purchases of know-how, but to unravel—for negotiation purposes—the traditional pack-

age: foreign capital-technology-management.

There is no basis for a belief that the developing countries will abandon their present efforts to diminish the degree of technological dependence and to cut down the costs of imported know-how. What should be expected instead is an increase in the number of countries that will follow the road taken by Argentina, Brazil and India. Most probably, the main thrust of new policies will be directed towards elimination of all sorts of restrictive business practices that accompany the sales of technology under licensing agreements between foreign technology owners and domestic manufacturing firms. The main argument of the developing countries is that these practices, frequently embodied in licensing contracts, are not only illegal in the industrial countries themselves, but offer

insurmountable obstacles to the entry of the semi-developed nations into world trade in manufactures.

It would be very useful to the technology exporting countries to take note of the described changes in the attitude of many less developed nations towards the problems of science and technology transfer. Otherwise, serious and unnecessary conflicts may arise between both groups that would not serve the best interests of the parties concerned. In this particular field there is a great need for mutual understanding and for keeping all channels of communication open. It is an encouraging sign that World Intellectual Property Organization (WIPO), that represents a meeting place for technology producing and purchasing countries, shows growing awareness of the issues involved.

The Concept of Appropriate Technology

by Dr Karl-Wolfgang Menck, Hamburg *

At the end of the second development decade the industrial countries' technical aid is in the centre of severe criticism:

to some of the LDCs it has made technologies available that they were unable to apply because the necessary qualifications were missing;

to most LDCs technical aid has brought capital-intensive methods that ran contrary to the widespread under-employment;

finally, for many receiving countries technical aid proved

too costly because the methods made available to them necessitated imports from the industrial countries. For this purpose the LDCs have had to expend part of their already scarce foreign exchange.

In view of these reproaches, at least partly justified as they are, the concept of the technology transfer evolved. Particular methods and skills specifically geared on the aims and requirements of the receiving countries were to be made available to the receiving countries as appropriate or intermediate technology. In this connexion appropriate or intermediate technologies are tech-

nical methods in the widest sense which have yet to be discovered and provided for the countries of the Third World.

The development of appropriate technologies is possible either by down-grading technical methods of the industrial countries according to the receiving countries' aims and conditions or up-grading the methods known to, and applied in, receiving countries by way of supplementing them with technical capabilities of the industrial countries. Partly, methods and techniques so far only held on the record are being practically applied again. It is in any case important that ap-

* HWWA-Institut für Wirtschaftsforschung (The Hamburg Institute for International Economics).

propriate technologies are not "white elephants". Methods no longer remunerative or competitive in industrial countries should therefore not be exported to the LDCs¹. There have in the past been ample examples for this misunderstanding: the export of outdated German textile machines to countries of the Third World is no constructive contribution in the sense of development policy; such sort of equipment is labour-intensive but at the same time also prone to frequent and extensive repair. The supply of spareparts takes a long time and requires heavy foreign exchange expenditure². This sort of thing therefore helps the receiving country precious little.

It still remains to be clarified whether in individual cases certain raw materials should, when applying the principle of appropriate technology, in the receiving country be replaced by other more readily available materials. Experiments, such as using timber constructions instead of metal ones, have so far not resulted in cost saving unless people were willing to reduce simultaneously the lifespan and operational quality of the installation. From experiences of this nature, A. Banjo of the Economic Commission for Africa was among those who deduced that the utilisation of materials locally available in the LDCs, but mostly no longer used in the industrial countries, would have to be in concurrence with the development of new techniques for any specific purpose³. In this field, the know-

how of industrial countries may well play a vital role in the shape of experiences already gained, although the experiences in themselves are not what is meant by appropriate technologies⁴.

Labour-intensive Technologies

Apart from technical characteristics, appropriate technologies are determined by additional economic criteria which were also set out authoritatively during the discussion on technical aid⁵. All measures of this technology are, for instance, to be as labour-intensive as possible in order to lessen underemployment in the LDCs. The industrial countries have recognised and accepted this intention of the LDCs in their endeavours towards an appropriate technology⁶. But for the present, labour-intensive technologies pay homage only to the aim of lessening underemployment. But in spite of the nominally great differences between wages in industrial countries and those in the LDCs they have not in all cases contributed towards an increase of exports which, on the other hand, many LDCs strive at no less intensively.

The Criterion of Export Intensity

Mostly, the foreign exchange requirements have, as a result of labour-intensive appropriate technologies, been reduced only by means of tariff walls in order simultaneously with the measures of appropriate technolo-

gies to protect the goods produced under these measures. One has, however, not always also succeeded in shifting the demand onto the domestic production and creating the necessary markets for the new manufacturing methods. As the experiences of the Kumasi University in Ghana have taught, one of the reasons may well be that labour-intensive finishing methods in the textile industry, metal working and in the timber industry can simply not compete with mass-produced cheap articles imported from various industrial countries. Against these goods, the quantities manufactured according to LDC home-technologies are too insignificant for satisfying the total demand. Mostly also the prices are higher, and the qualities lower, than those of imported merchandise. Local manufacture and end-assembly are moreover in no position to solve the LDC's big problem of spareparts and thus fully to eliminate their dependence on imports even though domestic finishing processes are initially job-creating and the assembly, contrary to the finishing, is less knowledge-demanding and therefore more geared to the criteria of appropriate technology⁷.

Even the distinctly labour-intensive manufacture of electrical appliances and radio sets helps domestic sales rather than the export to world markets. In the latter, the companies applying appropriate technology meet with difficulties in asserting themselves against cheap mass products in spite of many protectionist measures⁸.

¹ See H. Dickinson's contribution to the discussion on Development and Dissemination of Appropriate Technologies in Rural Areas at the Meeting in Kumasi (Ghana), July 17 to 28, 1972.

² See K. H. Sohn, *Entwicklungshilfe, Theorie und Praxis der Deutschen Entwicklungshilfe* (Development Policy, Theory and Practice of the German Development Aid), Munich 1972, page 19.

³ See A. Banjo's contribution to the discussion on Development and Dissemination of Appropriate Technologies in Rural Areas at the Meeting in Kumasi (Ghana), July 17 to 28, 1972.

⁴ See also Intermediate technology work programme, Intermediate Technology Development Group, Annual Report 1970/71, page 9.

⁵ See D. Brücke, *Appropriate Technology: Die Anpassung der Technik an den Menschen* (The Adjustment of Technology for Man), in: *Entwicklung und Zusammenarbeit* (Development and Cooperation), 5/71, pp. 5-7.

⁶ See inter alia *Der Bundesminister für wirtschaftliche Zusammenarbeit* (The Federal Minister for Economic Cooperation): *The Transfer of Technology to Developing Countries - An Expanded Programme of the Federal Republic of Germany*, Bonn, July 14, 1971 (multiplied).

⁷ See Results of the Conference of Appropriate Technologies for Development Countries, Berlin, October 4-8, 1971, and the Conference on Development and Dissemination of Appropriate Technologies in Rural Areas, Kumasi (Ghana), July 17-18, 1972.

⁸ See Phillips' *Gloelampenfabrieken, Eindhoven* (Netherlands), *The Utrecht Pilot Plant*, H. v. d. Brink, *Neuentwicklung von situationskonformen Techniken*, at the Conference on Appropriate Technologies for Developing Countries, Berlin, October 4-8, 1971.

Finally, the criterion of the export intensity fails, in connexion with appropriate technologies, to be effective if these technologies are to benefit domestic craft and small firms. It is particularly this kind of enterprises for which advantages are expected from the spreading of appropriate technologies because it is intended that they survive which, however, depends in the long run on a better know-how as heretofore. But for the time being these undertakings produce for the local and national markets and may occasionally also sell their goods in neighbouring countries. But it is only seldom that they venture into the world markets. Finally, measures of the appropriate technologies can in the spheres of health welfare, house building and infra-structure influence a country's imports and exports only indirectly.

Problems of Spreading

The discussion on appropriate technologies is not merely occupied with the questions as to the aims pursued and on which criteria to judge the entire aspect. In view of the so far rather unfavourable results of the spreading of appropriate technology the general interest is concentrated on the problem as to who is going to be recipient of this form of development aid and how it will be possible to spread it.

On the receiving end of appropriate technologies shall, according to unanimous opinion, not merely be large international and national companies in the Third World but also small and medium-size ones occupied with handicraft and with agriculture. But particularly in those, one finds little inclination to venture into long-term productive investments⁹. The purchase of machines, appli-

ances and implements for the practical application of new technologies will in most cases be abstained from as long as there is no change in attitudes generally. Often the necessary investments will also not be made because of the expenditure exceeding the financial capacity of the recipient of appropriate technologies. The prospect of higher yields in the future cannot make present investments appear convincing because it is small and medium enterprises that are without a proper internal accounting system. Only this system will make the inter-relations of higher incomes as a result of an appropriate technology visible.

Obviously, subsidies and cheap credits could further the spread of the appropriate technology provided the purchase of machines and implements would be rendered easier for the investor as part and parcel of the application of appropriate technology. This aid is, however, not adequate because first of all many obstacles of a psychological nature can, when it comes to the transfer of technology, not be removed with money incentives only.

The strong influence of financial conditions on the success of measures for the preparing of appropriate technologies and the high cost connected with the development of these methods necessitate in any case also a financial participation within the sphere of development aid. Claims to this effect have already been made in the Pearson Report, and the plan for a world-wide promotion of science and technology also points at this aspect. Finally, the delegates to UNCTAD III at

⁹ See K. Schiller, *Zur Wachstumsproblematik der Entwicklungsländer (To the Growth Problems of the LDCs)*, in: *Entwicklungstheorie und Entwicklungspolitik*, D. Mackenroth, *Zum Gedächtnis von seinen Freunden und Schülern (To his memory by his friends and pupils)*, published by E. Boettcher, Tübingen 1964, pp. 202.

Santiago also incorporated this proposal in one of their resolutions¹⁰.

Aid Performance of the Industrial Countries

Over and above this, the donor countries are in a position to assist the receiving countries in their efforts towards an appropriate technology by placing their technical knowledge at the disposal of the latter. For most of the LDCs the industrial countries' know-how in the shape of patents and licences is most valuable. The international co-operation in the passing-on of technical knowledge must therefore also include the active co-assistance of companies in the industrial countries. They possess a significant part of the technical know-how which is apt to provide an important contribution for the modernisation and the production growth in the LDCs' industry.

It is, after all, also up to the LDCs themselves to further individually and among each other, and in their dealings with the industrial countries, the co-operation necessary for the development and spreading of appropriate technologies particularly in the decisive fields of the economy, technique and social sciences. With the best of intentions of the industrial nations, there can be no successful strategy for the appropriate technology and the transfer of technology without active co-assistance of these countries.

¹⁰ See *Partners in Development, Report of the Commission on International Development*, Chairman C. B. Pearson, London 4th edition, 1970, pp. 22 and 202. See also: *World Plan of Action for the Application of Science and Technology to Development* prepared by the Advisory Committee on the Application of Science and Technology to Development for the Second United Nations Development Decade, New York, 1971; R. H. Klingner, D. Seul, *World Plan of Action for the Application of Science and Technology*, comprehensive survey, Bochum, December 1971; A. Naini, A. Borrmann, H.-L. Dornbusch, *Analyse der Themen und Ergebnisse der Dritten Welt-handelskonferenz (Analysis of the Subjects and Results of the Third World Trade Conference)*, Hamburg 1972, pp. 161.