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# Technology Transfer into LDCs

by Rolf Sutter, Hamburg \*

**Multinational enterprises play an important role in the transfer of technology into LDCs. The following article examines the various aspects of the transfer of technology and the attitude of multinational enterprises towards such transfers.**

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The countries of the Third World possess hardly any technologies of their own beyond the needs of their traditional economies. Of the three million odd patents registered throughout the world only some 20,000 i.e. about 0.7 p.c. are owned by enterprises or persons resident in LDCs<sup>1</sup>. In view of the fact that only 2 p.c. of all research and development is being carried out in LDCs<sup>2</sup> this markedly one-sided dependence on industrial countries is hardly likely to change in the near future. This dependence imposes a heavy financial burden on the LDCs: in 1968 they had to spend no less than US\$ 1.5 bn on the acquisition of patents, licences, processing techniques, trade marks and technical advice<sup>3</sup>. (Assuming a growth rate of 20 p.c. per annum these expenditures should increase towards the end of the seventies to \$ 9 bn). This sum spent is equivalent to 56 p.c. of today's total direct investments (including reinvested profits) received from abroad or 2½ times as much as they spend themselves on research and development. In view of these heavy burdens the problem of how best to procure the needed technology<sup>4</sup> is of paramount importance.

The important part played by multinational companies as suppliers of technological know-how results firstly from the vast store of modern technologies possessed by them. As far as industrial research and development is concerned it is they who are in the vanguard. In 1966 American industrial undertakings alone spent no less than \$ 14,656 bn on research and development<sup>5</sup>. Of

this \$ 7,598 bn, or 52 p.c. of the total was on account of multinational companies and this share is likely to rise still further. Estimates for 1970 are in the neighbourhood of 55 p.c. By 1966 the share of the multinational companies in most lines of business had already risen to more than 80 p.c. It is therefore clear that the multinational companies control in large measure the present and future technologies.

## Conditions of Technology Transfers

Another important aspect of the transfer of technologies are the particular conditions under which it takes place. Technologies which are liable to be overtaken by further developments within the foreseeable future and technologies possessed by smaller firms without the necessary finance to invest abroad on their own account can, as a rule, be acquired and imported by the LDCs by contractual agreement. On the other hand, modern technologies in the possession of multinational concerns are preferentially transferred by way of direct investments<sup>6</sup>. The enterprises thus keep control over the technologies and their monopoly position as providers of the particular type of technical know-how. In addition the value of the technology should, as a rule, be greater to the enterprise as investor than to a potential licence holder in the country in which the investment is to be made. That country possesses neither economically and technically skilled personnel in adequate numbers nor research and development facilities. Such personnel and facilities are essential to carry out successfully the transfer of technologies primarily designed for use in industrial countries, which cannot be done without considerable adaptations to the vastly different conditions prevailing in the Third World.

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<sup>1</sup> cf. Surendra J. Patel: The Technological Dependence of Developing Countries. In: The Journal of Modern African Studies, vol. 12 (1974), No. 1, p. 12.

<sup>2</sup> cf. Christopher Freeman: Comment on Keith Pavitt: The Multinational Enterprise and the Transfer of Technology. In: John H. Dunning (Publishers): The Multinational Enterprise, London 1971, p. 87.

<sup>3</sup> cf. Surendra J. Patel *ibid.*, pp. 9 et seq.

<sup>4</sup> We define Technology as comprising product design, production technique and managerial know-how. For more details about the problem of defining the concept of technology see also OECD: Choice and Adaptation of Technology in Developing Countries. An Overview of Major Policy Issues, Paris 1974, pp. 21 et seq.

<sup>5</sup> cf. Committee on Finance, United States Senate: Implications of Multinational Firms for World Trade and Investment and for U.S. Trade and Labor, Washington 1973 (Study of the U.S.-Tariff Commission), p. 582.

<sup>6</sup> cf. Grant L. Reuber: Private Foreign Investment in Development, Oxford 1973, pp. 190 et seq.

In the case of technology transfers via direct investments, which are primarily effected by the large international enterprises<sup>7</sup>, the provider of technology is responsible for solving these problems, for it is his capital which is at stake. For this reason the companies concerned transfer not only technical know-how but the whole technological package which is essential for the successful transfer and utilisation of the project. This package comprises:

☐ The selection and provision of the appropriate production technique and production programme.

☐ In addition the investing concern has to make available for the project suitable personnel to supervise on the spot the necessary installations. If necessary additional personnel has to be trained. The project is backed by the entire organisational set-up of the multinational enterprises.

Apart from its complexity a special feature of this type of transaction is the close link between the investment projects and all the other branches of the multinational concern. These links make sure that a technology transfer does not turn out to be an isolated action but as an integral part of an on-going process. This, of course, applies to the sphere of production, but in an even larger measure to the firm's comprehensive organisational know-how — a constantly growing asset which only the firm itself is able to pass on<sup>8</sup>.

### Diverging Interests

The multinational companies are therefore well placed not only as potential suppliers of new technologies but they have at the same time at their disposal the required mechanisms to transfer such technologies. That their activities have in recent years been increasingly subject to criticism is due to a fundamental conflict between different objectives.

The developing countries are interested in seeing that the imported technologies meet specific criteria which are of special importance to the process of development:

☐ They must meet consumer requirements, be commensurate with the size of the markets, be within the limits of the available resources and in step with the country's industrial developments. In view of the indigenous unemployment priority is given to making the project as labour-intensive as possible.

☐ At the same time the technology transfer is intended to make a contribution to the training of

native labour, while spreading the know-how beyond the subsidiary of the multinational concern.

☐ Lastly it is hoped that the imported technology will initiate in these countries native technological incentives and development processes. In this way the importing country would become more adaptable and able to choose other means of importing technologies, thus reducing the one-sided dependence on industrialised countries.

As far as the multinational companies are concerned direct investments by way of technology transfers are but one aspect of investment policy and governed by consideration of profit. In actual fact, in the case of multinational companies with their world-wide interests and operations, their aiming at the increase or maximisation of profits is subjected to a whole complex of objectives. It is these objectives as well as the realities of the actual negotiations between enterprise and LDC which ultimately determine the concrete decisions regarding the investment project and the kind and size of the technology transfer required. In the following it is proposed therefore to examine in greater detail the different aspects of technology transfers *seriatim* as well as the *modus operandi* of these transactions.

### Technological Adaptations

Nearly all multinational companies are resident in industrial countries. It is therefore the conditions prevailing in these countries which determine not only their production but also their research and development of new technologies. The policies of these companies are therefore influenced by such considerations as the size of the markets they may expect for their products in their own and other industrial countries and that size is in turn largely dependent on the availability of labour and capital<sup>9</sup>. A questionnaire submitted to American multinational concerns about the kind of their investment projects and the extent to which the transferred technological projects had to be adapted showed the following revealing results<sup>10</sup>.

In the case of 57 out of 78 projects the production and processing technologies were transferred in their original form; in 19 cases adaptations had to be made. Export-oriented investment projects required the fewest changes, whereas projects needing the opening up of new markets and those

<sup>7</sup> cf. P. P. Gabriel: *The International Transfer of International Skills. Management Contracts in Less Developed Countries*, Boston 1967, pp. 60 et seq.

<sup>8</sup> cf. St. Hymer: *The Efficiency (Contradictions) of Multinational Corporations*. In: *American Economic Review*, vol. 60 (1970), No. 2 p. 451.

<sup>10</sup> cf. Grant L. Reuber, *ibid.*, pp. 194 et seq.

initiated by governments involved relatively more technological adaptations.

These differences are implied in the reasons given by the firms for the adaptations they considered necessary. The narrowness of the markets was most frequently given as the reason. Other reasons were: requirements of the local market such as peculiar characteristics of home demand, problems of quality concerning raw materials and preliminary products and last but not least government rules and regulations. By contrast conditions on the labour market, that is to say low wages and the scarcity of qualified indigenous workers, play a relatively minor role. This applies also to export-oriented investment projects which is all the more surprising in view of the fact that transfers of production are frequently motivated by the high pay load in industrial countries. It has to be borne in mind however that the firms are most careful in selecting such product lines for transfer which are able to make use of already existing technological skills, and this puts them into a position of profiting from the low wages in the LDCs. Thus the production of goods is moved, for which — as Vernon points out in his theory of the "Product Cycle"<sup>11</sup> — fully developed and extensively standardised technologies are available and which in comparison with the other production lines of the enterprise are relatively labour-intensive.

Apart from this type of adaptation, the multinational organisations show little inclination to carry out any technical changes in favour of rendering the production process more labour-intensive, notwithstanding the fact that because of the decrease in the size of the production unit in some spheres, which as a rule conditions in LDCs necessitate, substitution of machinery by manpower would appear to be attainable without resulting loss of efficiency<sup>12</sup>. An enquiry among American firms operating in Mexico and the Philippines revealed that about half of them, after their past experiences, would in future not apply the same technologies in erecting new factories. Yet even then these changes would not entail any appreciable shift in the needed ratio of capital to labour<sup>13</sup>.

### Spreading Management Know-how

Technology can be transferred in two basic forms: firstly by physical means such as machines, books, documents, etc., and secondly through persons who dispose of special skills and knowledge.

<sup>11</sup> cf. Raymond Vernon: *International Investment and International Trade in the Product Cycle*. In: *Quarterly Journal of Economics*, vol. LXX (1966), No. 2 pp. 190 et seq.

<sup>12</sup> cf. Walter A. Chudson: *The International Transfer of Commercial Technology to Developing Countries*, UNITAR Research Reports, No. 13, New York 1971, p. 32.

Owing to the scarcity of skilled managers and technicians — a common feature in LDCs — the transfer of trained personnel is of special importance for these countries.

Particularly in the initial and early stages of a project, the capital-investing concern usually sends skilled personnel from industrial countries (in most cases nationals of the country's headquarters), but they also try to recruit suitable local labour to train them either at home or abroad. The developing countries attach particular importance to the training of their own nationals for it is in their interest that the technical and managerial skills required for the project do not remain the exclusive domain of the small number of people originally sent to set up the project, but that native workers are systematically trained to become skilled labour, technicians and management personnel<sup>14</sup>.

There is no doubt that the record of multinational concerns in the training of native labour is good. For example Japanese firms investing in projects in South-East Asia trained, in the period from August 1954 to March 1969, 3,471 native personnel<sup>15</sup>. In 1957 American firms with subsidiaries in Latin America employed 1,076 US citizens in the processing industry<sup>16</sup>. By 1966 this figure had risen to 1,701, but their number in relation to the total labour force employed had dropped from 0.6 p.c. to 0.4 p.c. The drop was even more marked for clerical and technical staff, the proportion of which to local employees decreased from 7.2 p.c. to 4.4 p.c.

The trend is no doubt caused to some extent by local laws, but the main reason for the decline of imported labour would seem to be that imported personnel is much more expensive than locally recruited staff with equal qualifications, and the fact that local qualified staff is at all available is largely due to the efforts of the enterprises<sup>17</sup>.

Furthermore, a comparison between 14 US subsidiaries in the Philippines and in Mexico with similar indigenous enterprises shows that the US

<sup>13</sup> cf. R. Hal Mason: *The Transfer of Technology and the Factor Proportions Problem: The Philippines and Mexico*, UNITAR Research Reports, No. 10, p. 52.

<sup>14</sup> According to Baranson the lack of qualifications of local labour in the mechanical engineering industry significantly limits the possibilities of substituting manpower for machine power. This is the reason why foreign firms choose at times production methods which are even more capital-intensive than those applied in industrial countries. Increased training facilities would therefore widen the scope of substitutions. cf. Jack Baranson: *International Transfer of Automotive Technology to Developing Countries*, UNITAR Research Reports, No. 8, New York 1971, p. 24.

<sup>15</sup> cf. Terumoto Ozawa: *Transfer of Technology from Japan to Developing Countries*, UNITAR Research Reports, No. 7, New York 1971, p. 34.

<sup>16</sup> cf. R. Hal Mason: *The Multinational Firm and The Cost of Technology to Developing Countries*. In: *California Management Review*, vol. XV (1973), No. 4, p. 12.

<sup>17</sup> cf. L. Reuber, *ibid.*, p. 202.

subsidiaries spend five times as much on the training of their staff as their local competitors.<sup>18</sup> Nevertheless the proportion of imported staff to the whole work force is nearly twice as high as in the comparable local firms. No data are available on the relative positions occupied by the foreign staff and the kind of training offered to local staff, but there is reason to believe that more of the imported personnel are employed in the higher echelons of the multinational firms. Hence the numerous complaints by developing countries which see themselves excluded from the real decision-making and the know-how that this implies<sup>19</sup>.

### Transfer of Research and Development

While research and development are largely in the hands of multinational companies, the LDCs' capacities in these spheres are minimal. It would therefore be possible for the multinational companies to help the LDCs in their efforts to create research and development institutions of their own. The transfer of research facilities from the developed to the developing countries would be especially useful in that new technological processes could be elaborated in the physical and social conditions in which they are ultimately to operate. Moreover if local scientists are trained and then employed and cooperation is established with local research institutions much preliminary work can be done which will speed up the research programme.

An enquiry into the research policies of American multinational enterprises in regard to the choice of location for their research and development activities shows the extent to which they transfer these

activities to foreign countries and how far these transfers have actually brought about a strengthening of the technological potential of the receiving countries. The enquiry reveals that as far as direct investments by the United States in LDCs are concerned — and these account after all for 30 p.c. of the total US foreign investments — practically no transfers of research and development activities have in fact taken place<sup>20</sup> in connection with these investments:

□ Of the \$ 8,124 mn used by US based companies in 1966 for research and development no more than \$ 526 mn or roughly 6 p.c. was spent abroad (corresponding expenditures for 1970 are estimated at \$ 770 mn, i.e. some 7–8 p.c. appeared to have been spent abroad)<sup>21</sup>. Only in a few branches could a higher proportion be observed.

□ The \$ 526 mn spent abroad in 1966 went primarily to industrial countries<sup>22</sup>; Canada's share was 27 p.c., Great Britain's 25 p.c., the Federal Republic's 20 p.c. and France's 8 p.c. Most of the remaining 20 p.c. or \$ 105 mn were employed mainly in Australia, Belgium, Italy and the Netherlands.

Total expenditure by US based multinational companies on research and development in LDCs during 1966 amounted to no more than \$ 50 mn. (Assuming that regional distribution has remained constant this figure of \$ 50 mn should have increased to something like \$ 70 mn by 1970). This is less than 10 p.c. of the total expenditure spent on research and development abroad and only some 0.5 p.c. of the total amounts spent by these companies on research and development.

<sup>18</sup> cf. R. Hal Mason: *The Multinational Firm and The Cost of Technology to Developing Countries*, *ibid.*, p. 12.

<sup>19</sup> cf. Kritik an Japans ausländischen Produktionsbasen (Critical Comments about Japan's Foreign Production Bases). In: *Nachrichten für Aussenhandel* (Foreign Trade News), No. 136 of 17. 7. 1973, p. 1; also Walter A. Hudson, *ibid.*, p. 46.

<sup>20</sup> cf. Sabine v. Saldern: *Internationaler Vergleich der Direktinvestitionen wichtiger Industrieländer* (International Comparison between Direct Investments of Important Industrial Countries), HWWA-Report No. 15, Hamburg 1973, p. 26.

<sup>21</sup> cf. Committee on Finance, United States Senate, *ibid.*, p. 581.

<sup>22</sup> cf. *ibid.*, p. 583.

Horst Rinne

## Tabellen zur Finanzmathematik

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There are several different reasons why research and development activities tend to be centralised in the industrial countries. First of all the production of multinational companies is geared to a high degree to the market requirement of industrial countries. Apart from this the researchers operating in industrialised countries can avail themselves of the services of highly developed firms outside their own concerns and particularly of the countries' basic research institutions. Moreover the fact that the researchers work in close proximity to management enables them to work more efficiently. For all these reasons it is quite natural that most of the research work should be concentrated at or near headquarters<sup>23</sup>. If transfers do take place priority is as a rule given to other industrial countries.

There is moreover evidence provided by studies on US-multinationals that all basic research initiated by them is centralised in the USA. The few research stations located abroad are mainly concerned with certain development tasks, such as the adaptation of American machinery to conditions abroad or to the adaptation of consumer goods to local taste<sup>24</sup>. But these minor changes hardly bring any technological benefits to the LDCs.

#### **Possibilities of Integrating Multinationals**

It is clear from the foregoing that multinational companies do transfer a great deal of modern technology into the Third World. Yet, because of the diverging interests between developed and developing countries the transfer as it is carried out at present is by no means ideal from the point of view of the receiving countries.

If one compares subsidiaries abroad with local enterprises a more favourable view is indicated. It becomes evident that local firms set aside much less money for the purposes of training as well as research and development. Even if local firms take out licences they do not necessarily employ more labour-intensive adapted technologies. Local enterprises even if they do not have access to the most modern technologies, employ virtually the same capital-intensive technologies as the subsidiaries of the multinationals.<sup>25</sup>

For this reason and in view of the dominating position of the multinationals as providers of technologies, LDCs would be no better off if they decided to do without this instrument of technology trans-

fer. Future policy must, therefore, be to make technology transfers by multinationals more effective from the point of the technological development of the receiving countries. That this is possible is evident from the experience with certain companies which — in contrast to the general trend — have decided to work out special technologies with an eye to requirements of developing countries<sup>26</sup>. Without going into the motives of the companies in greater detail it may be said it requires purposefully directed economico-political measures on the part of the LDCs to achieve such results on a broad front.

For one thing, to start such a policy some direct measures relating to multinationals are required. Such measures may be taken in connection with the granting of permission to carry through foreign investment projects; for another they may take the form of incentives in the fields of taxation, foreign trade or the transfer of foreign exchange. It depends in every case on what the particular LDC's government expects of the multinational company and what conditions it wishes to impose on it or what favours it is prepared to grant it in exchange for the company's contribution to research and development, to vocational training, to the development of new industries and to the integration of the company's own output into the economy.

In view of the relatively weak negotiating position of the LDCs such conditions will not always prove acceptable and incentives to be effective are very expensive. Before impositions are laid upon the investing multinational company an overall national development plan must exist which coordinates the country's own efforts in the field of research and development as well as its vocational training programme in the public and private sectors. This is as much an essential precondition as the efforts to obtain on an international level more favourable terms for the planned technology transfer.<sup>27</sup> The stronger the LDC's own technological base and the greater its choice between would-be technological exporters the stronger its negotiating position and the greater the hopes of effectively integrating the multinational enterprises in the country's technological development.

<sup>23</sup> cf. Michael G. Duerr, R & D in the Multinational Company, The Conference Board, Managing International Business, No. 8, New York 1970, pp. 2 et seq.

<sup>24</sup> cf. Committee on Finance, United States Senate, *ibid.*, p. 585.

<sup>25</sup> cf. R. Hal Mason: The Transfer of Technology and the Factor Proportions Problem: The Philippines and Mexico, *ibid.*

<sup>26</sup> The Netherlands Philips-concern with its Centre for the Developing and Testing of Average Technologies at Utrecht is particularly worth mentioning. See also A. Wieberdinck: Das Philips-Zentrum für Entwicklung und Erprobung mittlerer Technologien in Utrecht (The Philips Centre for the Developing and Testing of Average Technologies at Utrecht). In: J. Baranson, V. Hönes, K. W. Menck, M. R. Schams, A. Wieberdinck: Technologietransfer. Ausgewählte Beiträge (Transfer of Technology. Selected Contributions), HWWA-Report No. 20, Hamburg 1973, pp. 41–55. For further examples see also OECD: Choice and Adaptation of Technology in Developing Countries, *ibid.*, p. 43 et seq.

<sup>27</sup> cf. UN, Department of Economic and Social Affairs: Transfer of Operative Technology of the Enterprise Level, S/CEA 151, New York 1972, p. 15 et seq., and the United Nations Conference on Trade and Development: Transfer of Technology, Report by the UNCTAD Secretariat, TD/106, Santiago 1972, p. 19 et seq.