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The Role of Science and Technology in the New International Order

by Volker Rittberger, Geneva/Tübingen *

The United Nations Conference on Science and Technology for Development (UNCSTD) is to be held in Vienna, 20–31 August 1979. The present article arises from the author's work at the United Nations Institute for Training and Research (UNITAR) on the preparations for this conference.

Science and Technology or, sometimes, R(e-search) & D(evelopment) have become magic formulae in today's world: whenever social problems (in the broadest sense) arise which appear to be insoluble, by known and practiced methods, to established "problem solvers" the call for more scientific research and technological know how emerges. Expert committees are then set up, conferences and symposia convened, new R & D programmes initiated, and the role of science and technology as productive force of prime importance is once again emphasized. For contemporary established "problem solvers" their readiness to increase investments in R & D to solve a certain social problem, which has become too critical to remain ignored, serves to demonstrate that they are on top of the situation and responsive to the exigencies of their times – in short, that they are "modern" (and, therefore, legitimate) "problem solvers".

There is no question that science and technology can help solve social problems and have done so in the past. Yet, the real issue is whether or not the prominence attributed to science and technology by established "problem solvers" obscures the possibility that it may be the established "problem solvers" themselves who prevent or impede the solution of urgent social problems because the acceptance of certain solutions might entail consequences detrimental to their status and that of their clientele groups. Moreover, R & D efforts may be directed, as a result of public policy, toward false problems and/or toward the wrong solutions in order to forestall independent critical analysis and to avoid the public consideration of options the implementation of which would imply more or less far-reaching changes in the socio-economic and political structure of a given country (or group of countries).

Take, for example, the case of hunger and malnutrition. Undoubtedly, this constitutes a crucial social problem in many parts of the world. All relevant international statistics, incomplete and inaccurate as they may be in various details, agree that starvation continues to plague a very large proportion of people in developing countries and that there is little prospect for improvement over the next few years¹. The most prominent solution to which most established "problem solvers" have turned (including those from developing countries) is the call for more R & D in agriculture (and, of course, for an expansion of food aid). What happened, and still happens, is that more R & D in agriculture may lead to increased productivity without necessarily decreasing hunger and malnutrition. For increases in agricultural productivity help eradicate hunger and malnutrition only if the increased output is channelled toward satisfying domestic needs and if the needy can acquire the means to share in this increased output, i.e. if the discrepancy between real needs and effective demand is being significantly reduced. In fact, the problem of hunger and malnutrition is not primarily one of agricultural productivity and, therefore, of insufficient R & D inputs only as most established "problem solvers" like to see it, but one of a social structure inappropriate to solve the problem of hunger and malnutrition. Yet, it is the same social structure which guarantees the established "problem solvers" their hegemonic status. As a result, the serious consideration of agrarian reform has usually been given very low

* United Nations Institute for Training and Research / University of Tübingen. – The views expressed in this article are those of the author and do not necessarily reflect the official position of UNITAR. The article has benefited from comments on earlier drafts received from several colleagues, notably Johan Galtung, Ward Morehouse and Mary Pat Williams. Responsibility for the text, however, remains with the author.

¹ Cf. Folker Froebel, Juergen Heinrichs, Otto Kreye, *Die Armut des Volkes. Verelendung in den unterentwickelten Ländern (The poverty of the people. Pauperization in the underdeveloped countries)*, Reinbek b. Hamburg, Rowohlt, 1974, pp. 12 to 23 and passim.

priority by most established "problem solvers" in this area. The reasons for this are obvious in the case of big landowners — old as well as new, i.e. transnational corporations entering agrobusiness — and ruling groups in developing countries, the latter relying often on the former, to varying degrees, as an important support group. Moreover, part of this coalition working against serious consideration of agrarian reform are also the relevant scientific and technological communities in developed countries, because their expertise is geared primarily toward large-scale farming which is more capital and, therefore, more technology intensive than small-scale farming. However, to avoid any misunderstanding of the preceding critical assessment of the role of the scientific and technological communities it should be stressed that the improvement of small-scale farming may not be feasible without substantial R & D efforts either; yet, the R & D required here would be of a different kind ².

In summary, the points which this case may serve to pinpoint are:

□ Development is not just more (usually measured in aggregate terms) of certain goods and services. To be useful as a category of social science and praxis the concept of development requires a specification in terms of "who gets what", etc., as a result of marshalling scientific-

technological resources for solving critical social problems.

□ Science and technology in the singular may be misleading, for the concepts of science and technology are not identical across time and space. Dominant, i.e. widely accepted paradigms, methodologies and approaches may follow one another over time, but they may also coexist in space possessing equal validity within their respective socio-cultural environments ³.

Science and Technology in UN Conceptions

Science and technology also play a great role in documents (resolutions, declarations, programmes of action, etc.) of the UN system calling for a reshaping of the international system with a view toward improving the wellbeing of developing countries and of their poorer segments (people

² The preceding observations have been informed by several studies which seem to converge in their critical analysis of many past and contemporary policies to fight hunger and malnutrition. Rudolf Buntzel, *Umriss einer landwirtschaftlichen Entwicklungsstrategie fuer Afrika* (Outline of an agricultural development strategy for Africa), in: Alfred Schmidt (ed.), *Strategien gegen Unterentwicklung*, Frankfurt/M., Campus, 1976, pp. 199-214; Kurt Egger, Bernhard Glaeser, *Ideologiekritik der Gruenen Revolution* (Criticism of the ideology of the Green Revolution), in: *Technologie und Politik*, Vol. 1, Reinbek b. Hamburg, Rowohlt, 1975, pp. 135-155; Dieter Senghaas, *Weltwirtschaftsordnung und Entwicklungspolitik* (International Economic Order and development policy), Frankfurt/M., Suhrkamp, 1977, pp. 189-202.

³ This line of thought has been developed by Gilbert Rist in an unpublished paper "The New International Economic Order as a Belief System", Geneva, 1978, pp. 3-4.

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Klaus Matthies

TRANSNATIONALE UNTERNEHMEN IN MEXIKO

(Transnational Enterprises in Mexico)

In this study the effects of transnational enterprises on the structure of production and foreign trade, on employment, growth, balance of payments as well as research and development in Mexico are being analysed on the basis of the newest empirical data. A large part of this material could be obtained only by the author's own surveys. This investigation should contribute to debunking the frequently polemical discussion of transnational enterprises. (In German).

Large octavo, 185 pages, 1977, price paperbound DM 35,—

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and regions) in particular. The principal document for this special emphasis on science and technology as levers for accelerating the development process of developing countries has been the action programme of the General Assembly for the Second United Nations Development Decade⁴. Some of the central points in this document are:

- ☐ the expansion of the capability of developing countries to apply science and technology to development and to reduce the technological gap; (para 60)
- ☐ the increase, by developing countries, of their expenditure on research and development averaging 0.5 per cent of their GNP per annum; (para 61)
- ☐ the development of appropriate technologies for developing countries; (paras 61–63)
- ☐ the strengthening of international cooperation and assistance to promote science and technology in developing countries; (paras 62 and 63)
- ☐ the establishment of a programme for promoting the transfer of technology to developing countries; (para 64).

In 1975, the General Assembly resolution on "Development and International Economic Cooperation"⁵ devoted a full section to science and technology and reiterated its position that a series of measures need to be taken to foster the development of developing countries by strengthening their scientific and technological capabilities and by giving them more rapid and wider access to existing productive know how. In this resolution the General Assembly also decided that a United Nations Conference on Science and Technology for Development should be convened before the end of the decade.

Predominantly Instrumental View

Aside from this resolution, adopted during the 7th Special Session of the General Assembly, virtually all major global conferences organized by the UN and/or its Specialized Agencies have referred, in their final documents, to science and technology as important factors in the development process. In a study on such conferences during the 1970s, John Logsdon and Mary Allen discover the following trends pointing to areas of consensus about the nature and function of science and technology in the development process⁶:

- ☐ "an emphasis on creating the appropriate balance, for each member state, between the development of indigenous scientific and technological capabilities and access to the scientific and technological resources of other countries;

- ☐ a growing interest in technology described as "practical", "appropriate", or "intermediate" as a particular focus for United Nations activity;

- ☐ a constant concern with the migration of trained scientific and technical personnel away from their native countries;

- ☐ an emphasis on the roles developed countries should play on various scientific and technological issues by:

1. devoting more attention in developed country research and development programmes to problems of concern to developing countries;
2. providing access for developing countries on equitable terms to the scientific and technological resources of developed countries;
3. providing greater assistance, both on a bilateral basis and through multilateral institutions, to the developing countries in their attempts to develop indigenous scientific and technological capabilities;

- ☐ increasing emphasis on the importance of technical cooperation among developing countries;

- ☐ particular emphasis on research, training and information requirements related to achieving basic human needs."

From this brief summary of UN system statements on science and technology for development, there emerge the contours of a concept which takes a predominantly instrumental view of science and technology but without thoroughly examining the social prerequisites, conditions and consequences of relying on science and technology for solving development problems.

Alternative Models

The role of science and technology in the development process can be conceptualized, in summary fashion, in terms of three models: optimism – pessimism – realism. And one might ask which model most closely represents the prevailing view in UN concepts of a new international order and international development strategy⁷.

It is suggested that the model of scientific-technological optimism captures best the way in which UN documents perceive the relationship between

⁴ Cf. International Development Strategy. Action Programme of the General Assembly for the Second United Nations Development Decade. New York, United Nations, 1970, pp. 15-16.

⁵ General Assembly Resolution 3362 (S-VII) in GAOR, 7th Special Session, Supplement No. 1 (A/10301), sect. III.

⁶ John M. Logsdon and Mary M. Allen, Science and Technology in United Nations Conferences. A Report for the UN Office for Science and Technology. Washington, D.C., Graduate Programme in Science, Technology and Public Policy, George Washington University, January 1978, esp. pp. 7-8.

⁷ The concepts of technological optimism and pessimism are adapted from Thomas G. Weiss, Robert S. Jordan, The World Food Conference and Global Problem Solving, New York, Praeger, 1976, pp. 139-140.

science and technology, on the one hand, and the development process, on the other. This means that they proceed from the assumption that science and technology have played a crucial and, in general, beneficial role in the development of today's economically advanced countries and regions. Thus, they take the view that the fruits of applying science and technology to development hitherto enjoyed by a few countries only should be made available to all countries and regions of the world. To this end they propose a two-pronged approach to strengthen the scientific-technological capacities of developing countries and to transfer technologies to them as a means of fostering, above all, economic growth.

Quite obviously, the UN documents referred to above and the development strategy conceived by them have little, if anything, in common with the pessimist model of the role of science and technology in the development process. This pessimist model is informed by "a feeling that some of the problems of modern industrialized societies have not emerged in spite of modern technology but *because of* modern technology . . ." ⁸. It is interesting to note in this context that in developing countries this view appears to have little support among the national elites. Rather, "even where there is scepticism in the Third World about western societies enthusiasm for western science and technology nevertheless seems to prevail" ⁹. In summary, then, if scientific-technological pessimism regards scientific-technological change as a, or even the, source of many critical social problems rather than as a means to solve them, then this model stands in clear contradiction to what the prevailing UN conception of the role of science and technology in the development process is all about.

The Realistic Model

One might still wonder, however, whether this juxtaposition of the optimist and pessimist models is really helpful in critically assessing the concepts of the role of science and technology in the development process. It seems plausible to make the following assumptions forming the basis for another — realist — model:

- ☐ that science and technology play a pervasive role in social dynamics;
- ☐ that science and technology can help solve social problems and contribute to development;
- ☐ that the application of science and technology to the solving of social problems may entail unintended consequences which may be detrimental to development efforts; this occurs most often when the social implications of scientific and technological change have been neglected;

☐ and that science and technology can be, and have been, used for wasteful and destructive purposes.

The notion of the dialectical nature of scientific-technological change inherent in the realist model refers to the historical simultaneity of constructive and destructive qualities in man's labour and interaction. The critical aspect of this evolutionary process today is the need for a theoretically informed social praxis which successfully prevents the destructive qualities of scientific-technological change from dominating the constructive ones. Admittedly, these ideas will not be found in the UN documents on a new international order and international development strategy given the optimist ring pervading all of them. It appears, though, that in other connections — the issue area of disarmament may be cited as an example — the question of wasteful and destructive uses of science and technology has been dealt with in UN documents in a very explicit and critical way. For instance, the fact was criticized that a very large proportion of the world's scientific-technological resources (financial and human) is absorbed by military R & D work ¹⁰. Nevertheless, this cannot detract from the more general observation that UN documents dealing with issues of development do not project a coherent, realistic picture of the nature of scientific-technological change.

Scientific-Technological Dependence

The importance which the UN documents on the establishment of a new international order and on international development strategy attribute to science and technology as a problem solving mechanism should not be regarded as fulfilling an ideological function alone. There exists a very real basis for giving top priority to questions of mobilizing science and technology for development in the structure of international society, particularly as far as the distribution of resources (in the broadest sense) among and within nations is concerned. It is probably safe to state that the quest for a new international order imposed by the developing countries on many international and most UN policy-making processes arises from perceptions of gaps along a variety of dimensions relevant to development — and, of course, from the perception of possessing a modicum of political leverage toward the developed countries (and, in particular, the OECD countries).

One of the most serious of these gaps is certainly found in science and technology. Even though

⁸ Johan Galtung, *Towards a New International Technological Order?* Geneva, 1978, p. 2 (unpubl. ms.).

⁹ *Ibid.*, p. 3.

¹⁰ Cf. *The Arms Race and Development*. New York, United Nations, 1978, pp. 10-11 and *passim*.

we have not yet a fully satisfactory data base for determining exactly the distribution of the world's R & D resources, it is nevertheless possible to sketch a global picture without distorting the main trends. Jan Annerstedt¹¹ who has done pioneering work in the compilation of R & D data on a world-wide basis states that, as compared with the mid-1960s, "there are no substantial changes between developed and underdeveloped regions of the world, if you measure the financial resources and man-years invested in all countries. There is still a wide gap between developing countries and the rest of the world". His assessment of the situation as of 1973 is summarized in the following table.

**Estimated Global Distribution
of R & D Expenditures and R & D Manpower**

	R & D Expenditures	R & D Manpower
First World	58.5 %	52.3 %
Second World	39.2 %	35.7 %
Third World	2.3 %	12.0 %
World Total	ca. 109,000 mn US Dollar	4,900,000

Of course, one should not overlook the considerable variations in scientific-technological capabilities among developing as well as developed countries. It is not at all clear whether the distance between the least advanced developed countries and the more advanced developing countries is not smaller than the distance either between the more advanced and the least advanced developing countries or between the more advanced and the least advanced developed countries. Yet, on the average, developing countries do rely more heavily, if not exclusively, on externally created knowledge and skills feeding, more or less uncontrolled by them, into their educational systems and productive sectors.

Surendra Patel¹² has made an attempt to indicate the costs which developing countries incur as a result of their technological dependence. He distinguishes between direct, indirect and other costs. Patel considers it essential for a full understanding of the nature and extent of these costs that one acknowledges the monopolistic tendencies in the world market(s) for technologies providing the owners of technologies with a considerable bargaining edge over the buyers of technologies particularly in developing countries — an asymmetrical relationship strengthened by the already existing lack of adequately equipped and staffed institutions in the field of science and technology.

Direct costs have been estimated to amount to US\$ 1.5 bn in 1968 (usually in foreign convertible currency). This is equal to one third of the external debt servicing or to two and a half times the public expenditures on science and technol-

ogy of developing countries. Indirect costs are held to be many times higher than direct costs to which must be added other types of costs, in particular opportunity costs. "Rough estimates suggest that these costs amount to 2–4 per cent of the national income of developing countries, i.e. 6–12 billion US dollars. In comparison, the amounts spent by developing countries on R & D represent 1/10–1/20 of these costs (about 600 million US dollars)"¹³. Patel concludes that developing countries instead of bearing these costs, should — and could — devote more resources to the creation of indigenous scientific-technological capabilities.

Historical Processes

If this analysis seems tenable the following question arises immediately: Are the UN conceptions of a new international order and international development strategy grounded in a valid theory (or theories) of underdevelopment and dependence? For, without such a scientifically acceptable foundation, what chance do political efforts stand to accomplish anything in terms of achieving realistically defined goals and avoiding foreseeable pitfalls? — At this point, it must suffice to state that the emergence of scientific-technological dependence (and underdevelopment) is part of a more general historical process by which Europe and North America became the centres of the first truly global civilization. The reverse side of this process was represented by an increasing relative, sometimes even absolute, backwardness of most other regions of the world. Since the 16th and 17th centuries the world grew apart, the 20th century witnessing the wide gap described earlier. This historical process was caused and conditioned by a complex combination and interaction of endogenous and exogenous factors. Today, one of the most difficult analytical tasks consists in identifying not only the presently most potent dependence-generating endogenous and exogenous factors for a given country or region in the Third World but also their relative weight; for without such a thoroughgoing analysis there can only be a shaky basis for devising appropriate development strategies designed to reduce scientific-technological dependence. It may be considered an open question whether, and to what

¹¹ The following is taken from an abstract of the oral presentation by Jan Annerstedt at the seminar "Technology, Science and Development in the Changing International System" organized by the Research Policy Programme of the University of Lund, 31 May–2 June 1978. A more comprehensive presentation of data and an in-depth analysis by Annerstedt is to be expected soon.

¹² See Surendra Patel, *Der Preis der Abhängigkeit von der Technologie* (The price of dependence on technology), in: *Technologie und Politik*, Vol. 1, Reinbek b. Hamburg, Rowohlt, 1975, pp. 124–134; also from the same author: *The Technological Dependence of Developing Countries*, in *Technology and Development*, UNITAR News, Vol. 6, No. 4 (1974), pp. 23–25.

¹³ *Ibid.*, p. 133 (translation mine).

extent, the UN conceptions of a new international order and of international development strategy fully satisfy this requirement.

Development of Indigenous Capabilities

Given the general mix of dependence-generating factors one of the foremost goals of development strategy leading to a new international order consists in promoting indigenous scientific-technological capabilities both by mobilizing dormant or under-utilized domestic energies and by drawing on external assistance. However, since existing scientific-technological capabilities of developing countries vary greatly according to the level of socio-economic development already reached individually, this goal needs a great deal of specification to be of operational value in guiding policy for, and within, a given developing country or region.

On one extreme, the goal could be defined as creating viable scientific-technological infrastructures in the very poor countries. This would imply, above all, the setting-up of large-scale and differentiated education and training programmes for technicians, engineers and scientists (including social scientists), the initiation of bottom-up institution-building, and the fostering of R & D work oriented toward local (and locally defined) needs (which will almost certainly include "basic needs" but must not be restricted to them).

On the other extreme, the general goal of promoting indigenous scientific-technological capabilities could be operationalized by emphasizing *adaptation* and *reorientation* of the existing, relatively advanced scientific-technological institutions and capabilities to contribute to social and economic development which is not simply equated with growing per capita GNP. One important implication of such an operationalization would be the reshaping of national systems of higher learning and of academic research to bring them into closer contact with domestic agricultural and industrial production¹⁴.

This need for goal operationalization which also takes into account the differences between developing countries tends to be neglected by the UN conceptions of a new international order and of international development strategy. Thus, potentially controversial discussions, both at the international and the national level, about the substance of development goals to be served by indigenous scientific-technological capabilities are discouraged rather than encouraged. In line with this avoidance strategy, internationally agreed-

upon development targets tend to be defined in purely quantitative terms thereby ensuring compatibility with differing qualitative policy objectives. In sum, the goal of promoting indigenous scientific-technological capabilities in developing countries, unless specified and operationalized, indicates nothing about its real social and political meaning. It is this social and political meaning, however, which determines the development relevance of promoting scientific-technological capabilities, be they indigenous or not.

In addition to discouraging substantive controversies over development goals within the UN, the setting of development targets in quantitative terms also facilitates the achievement of spurious consensus between developing and developed countries. One reason is that this consensus does not carry binding force. More importantly, developed countries can easily agree on helping to strengthen the indigenous scientific-technological capabilities of developing countries as long as the achievement of this goal remains qualitatively undetermined and, thus, leaves them free to exert their influence on developing countries building up their scientific-technological infrastructures. Put differently, most developed countries will express their readiness to contribute to the strengthening of scientific-technological capabilities in developing countries particularly if this is to follow a pattern that is likely to suit their foreign economic interests and their own scientific-technological aspirations. If assistance from developed countries is sought by developing countries as well as some measure of independent scientific-technological development, then developing countries must engage developed countries in a substantive debate, reaching broad social strata, over goals and processes of development as a means of arriving at authentic consensus. Yet, this is a risky endeavour for any national leadership and, therefore, not to be expected on a broad scale: Nevertheless, the possibility for coalition formation, across the North-South divide, among internationally reformist regimes and movements deserves further exploration.

Ambivalences and Contradictions

To overcome technological dependence the UN conceptions of a new international order and of international development strategy also call for a rapid and massive increase in the transfer of technologies from developed to developing countries on more favourable terms. Even though certainly justified, in principle, as a way to counteract the effects of exogenous factors generating or maintaining technological dependence, transfer of technology is beset with ambivalences and loaded with seemingly inescapable contradictions.

¹⁴ This point has been stressed by Miguel S. Wionczek in his generally provocative article on the preparations for UNCSTD: Some Questions for the "World Jamboree", in: Bulletin of the Atomic Scientists, Vol. 30, No. 10 (1977), p. 30.

Criticizing the assumptions underlying the UN conceptions one position holds that, in general, transfer of technology will reproduce, at best, the existing dependency relationships while increasing the differentiation among, and the fragmentation within, developing countries. Galtung views indiscriminate transfer of technology "as a structural and cultural invasion; possibly of much larger significance than colonialism and neo-colonialism . . ."¹⁵ Less sweepingly, Dieter Ernst¹⁶ sees a relationship between increased technology transfer and a "new industrialization scenario" "which, superficially, may fulfil some of the expectations . . . in some recent declarations of the 'Group of 77', (but which) may in fact turn out to fulfil nearly all preconditions to increase significantly the technological dependence of these countries", i.e. "technological dependence on a qualitatively higher level". Thus, calling for an increase in transfer of technologies may well imply, objectively, agreeing to continued technological superiority of the developed countries. Given the importance of their comparative advantages in the field of R & D, developed countries — and the transnational corporations based there, in particular — will resist or try to thwart, any international action which might endanger their competitiveness in crucial world markets, i.e. those with a high or above average growth potential¹⁷.

However, it could also be argued that the competition among developed countries — and transnational corporations — for markets and investment opportunities, both in the extractive and manufacturing sectors, in the Third World provides developing countries with a bargaining power the full and determined use of which would allow them to pursue both goals of increased inflow of know how and of establishing or retaining control with regard to the appropriateness of imported technology. This argument could be thought of applying best to the major oil exporting and the so-called threshold countries in the Third World. For they appear to satisfy at least some of the conditions which lay the ground for "self reliance of judgement"¹⁸ and action in the selection of technologies including the question of importation. It should be noted here that this argument does not presuppose any international action by the UN or any other international organization. Rather, it refers to a "natural" process of change which political intervention can perhaps facilitate but not generate.

While these conflicting views of the possible and probable extent, nature and effects of increased transfer of technology cannot easily be reconciled — even though both of them have their merits — there remains the question of the relationship between promoting indigenous capabilities

and importation of technologies. Among transnational corporations surveyed by Business International¹⁹ none of them indicated that transfer of technology on their part was related to the promotion of indigenous technological capabilities in developing countries. Leading government spokesmen in developed countries, however, "believe that technology transfer . . . will contribute to meeting human needs and developing human capacities and to upward mobility through the growth of indigenous technical and managerial skills . . ."²⁰.

Strategic Recommendations

Contrary to these attitudes of indifference or of benevolence which seem to prevail in business and government circles of major industrialized countries a growing number of social scientists attempt to probe more deeply into the problem of how to deal with technology transfer while pursuing the goal of scientific-technological autonomy. Morehouse and Sigurdson²¹ seeing a "circle of continued dependence on foreign technology inhibiting the development of an autonomous capacity for technological change", propose that serious consideration be given to the debate on implementing two contradictory measures: (1) declaration of a 10-year moratorium on new transfer of technology from industrialized to developing countries; (2) removal of all constraints on technology transfers including patents and other restrictions on proprietary technology. Adopting a more differentiated approach Dieter Ernst²² suggests that the answer to the problem lies in a strategy of "selective technological delinking" after having identified, on the basis of a system-

¹⁵ Johan Galtung, *op. cit.*, p. 11.

¹⁶ Dieter Ernst, *Technological Dependence and Development Strategies*, Hamburg 1978, esp. pp. 3, 14 f. (unpubl. ms.).

¹⁷ See, in this connection, the difficulties to reach an agreement, between developed and developing countries within the framework of UNCTAD, on a Code of Conduct on Transfer of Technology, be it in the form of nonbinding "guidelines" or in that of a legally binding convention. On the most recent state of deliberations cf. Report of the Inter-Governmental Group of Experts on an International Code of Conduct on Transfer of Technology to the United Nations Conference on an International Code of Conduct on Transfer of Technology, Geneva, 13 July 1978 (TD/CODE TOT/1).

¹⁸ This phrase is borrowed from Ward Morehouse, *Science, Technology and the Global Equity Crisis*. New Directions for United States Policy. Muscatine, Iowa, Stanley Foundation, 1978 (Occasional Paper, 16.), p. 19.

¹⁹ Cf. Business International, *Transfer of Technology. A Survey of Corporate Reaction to a Proposed Code*, Geneva 1978, pp. 13-15 where the main reasons for transferring technologies, by transnational corporations, to developing countries are described. They are, not surprisingly, very mundane indeed.

²⁰ So, e.g. The Deputy to the Under-Secretary for Security Assistance, Science and Technology in the US Department of State, Joseph S. Nye, Jr., *Science and Technology. Technology Transfer Policies*, in: Department of State Bulletin Vol. 78, No. 2012 (1978), p. 40. — I owe this reference to my good colleague Dr. Beate Lindemann.

²¹ See Ward Morehouse and Jon Sigurdson, *Science and Technology and Poverty. Issues Underlying the 1979 UN Conference on Science and Technology for Development*, in: Bulletin of the Atomic Scientists, Vol. 30, No. 10 (1978), p. 26.

²² Cf. Dieter Ernst, *Strengthening the Technological Autonomy of Developing Countries — Some Controversial Hypotheses Concerning UNCSTD*, Hamburg 1978, p. 7 f. (unpubl. ms.).

matic review of branch- and product-specific patterns of technological dependence, the priority sectors for the implementation of this strategy.

In this connection he warns explicitly against such a strategy "applied indiscriminately to all/most sectors of the economy, (because it) would be bound to fail anyway"²³. Admittedly, these analyses and strategic recommendations concerning the relationship between transfer of technology and scientific-technological autonomy have not yet gone past the stage of substantive controversy. However, there can be little doubt as to the validity of many findings brought out in these critical analyses. Apparently, there is no reflection of this, as yet, in the UN conceptions of a new international order and of international development strategy.

Cooperation and Structural Asymmetries

International scientific-technological cooperation, be it bilaterally or multilaterally organized, has spread considerably over the last decades as shown in a book-length study by Jean Toussez some years ago²⁴. Yet the evidence suggests that the patterns of cooperation largely reflect, and may even tend to reproduce, the gap in scientific-technological capacities between developed and developing countries referred to above. In other words, cooperation among developed countries is not only more frequent than between developing and developed countries, let alone among developing countries themselves; it also appears that the results of such cooperation, i.e. among developed countries, are more equally shared.

In the UN conceptions of a new international order and of international development strategy considerable emphasis is placed upon increasing scientific-technological cooperation between developed and developing countries as well as among developing countries themselves — the latter being, at least in part, the subject of another special *ad-hoc* conference organized by the UN/UNDP: United Nations Conference on Technical Cooperation Among Developing Countries (TCDC), Buenos Aires, 30 August–12 September 1978²⁵. Again, we must not shy away from asking probing questions: How can we expect that these objectives will be met and, if met, that they will significantly reduce the scientific-technological dependence of developing countries?

If we accept a notion of cooperation which implies comparability of efforts, commonality of interests as well as a proportionate sharing of costs and benefits, then scientific-technological cooperation among developing countries might hold the greatest prospects for advancing their autonomy in the field of science and technology. However,

two obvious problems should not be overlooked. One results from the already mentioned fact that there exist wide discrepancies in scientific-technological capabilities among developing countries. In other words, structural asymmetries may stand in the way of successful cooperation here, too, though at a lower level. The other problem is related to the historically grown and still widely shared orientation of the scientific-technological communities in developing countries toward the developed countries, sometimes only toward the former colonial power. While it can be expected that this last-mentioned restrictive condition is more easily overcome in the foreseeable future, it is safe to predict that increases in scientific-technological cooperation among developing countries are likely to concentrate on the more advanced ones.

When calling for increases in the scientific-technological cooperation between developed and developing countries one should not lose sight of the danger that "cooperation" turns out to represent "old wine in new bottles", i.e. relationships of domination, paternalism and exploitation, if the preconditions for cooperation are not present. For, cooperation and the persistence of basic structural asymmetries must be considered as mutually exclusive. Therefore, if authentic scientific-technological cooperation is to be promoted one has to look for programmes and projects which are capable of satisfying the preconditions for cooperation. As an illustration, two possibilities come to mind: Firstly, one could focus on areas for scientific-technological cooperation in which developing countries have already reached a sufficient level of competence and expertise. Secondly, in other areas, cooperative programmes and projects would be linked to promotional schemes which provide for raising the level of competence of participating scientists and technologists in developing countries up to that of their partners from developed countries in the course of implementing the programme or project. Other types of cooperation properly speaking should and can be identified²⁶. However, if scientific-technological cooperation, particularly between developed and developing countries, is to contribute to development in the Third World, it will do little good to achieve more cooperation without paying much more attention to the social and political content of such cooperation.

²³ Dieter Ernst, *Technological Dependence and Development Strategies*, Hamburg 1978, p. 5 (unpubl. ms.).

²⁴ Jean Toussez, *La Coopération Scientifique Internationale*. Paris, Editions Techniques et Economiques, 1973.

²⁵ See Report of the Preparatory Committee for the United Nations Conference on Technical Cooperation Among Developing Countries, in GAOR, 32nd Session, Supplement No. 42 (A/32/42), Vols. I-II and Report of the Preparatory Committee for the United Nations Conference on Technical Cooperation Among Developing Countries on its Third Session, 25 May 1978, A/CONF.79/3.

²⁶ Cf., e.g. Johan Galtung, *op. cit.*, pp. 19 ff.