Technology assessment..
An essentially political process

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Accidents like the Union Carbide disaster in Bhopal, India, underline the need technology assessment in developing countries, as well as in the industrialized ones. Many difficulties are involved in this relatively new activity, and technology assessment is not a magic formular that will prevent all adverse consequences of the applications science and technology. Nor does it apply only to multinational corporations. Dr. Standke discusses this thorny problem and concludes that the best that can be expected for technology assessment is that it may help people to rethink their own value systems revealing the costs of the options available to them.

In August 1979, delegations from practically all countries of the world gathered Vienna under United Nations auspices to discuss every conceive aspect of science and technology and its impact on development. The 1979 conference differed from predecessor in February 1963[l], held in Geneva. The Vienna conference was essentially a governmental meeting. That is to say, it set out to achieve—and indeed it succeeded achieving—a diplomatically negotiated result known as the 'Vienna Programme'

publicity is profoundly misleading. Developed and developing countries both remain more than ever preoccupied with the complexity of all matters connected with science and technology, but a certain disillusionment about the viability of collective solutions seems to be widespread. Confronted with immediate crisis situations, individual countries tend to react like individual human beings when searching for *ad hoc* self-preservation solutions. Yet on all sides there is a growing feeling that science and technology is somehow the major instrument for bringing about the desired economic' and social change needed to master the present world crisis.

Which is the right technology?

The old question about the right technology has, therefore, lost nothing of its importance. The answers are as confusing as ever. Which technology is 'appropriate'? A new school of thought attempts to optimize the parameters by which a prospective technology is to be judged. An 'optimum technology' is accordingly that which

(1) is directed towards the highest possible human goals;
(2) uses mineral and energy resources most efficiently and preserves or enhances the environment;
(3) preserves or enhances 'good work' for the maximum number of human beings;
(4) uses the very best scientific and technical information and combines them with the wisdom and highest values of the culture[3].

The assessment of science and technology calls indeed for much more than simply the Development of institutionalized techniques and programmes.

for development in Bangalore, the then Secretary of the Department 01 in Technology of the Government of India, M. G. K. Menon rightly observed seminar faced a possible conflict because the term 'technology' in technical assessment is based upon a European value system and the 'assessment' will naturally, on the value system of the assessors*.

Another important aspect of the cultural dimension of technology is highly Nichols in an essay on the role of foreign policy in science and technology issue 1980s: 'For developing countries we cannot demonstrate convincingly what varied immediate impacts of technical change during the process of modernization even less well can we predict the more long-range cultural changes in "development"'[5].

Since technology—in any event the large-scale technologies that characterize industries of the industrialized countries—is a product of the developed count not surprising that the movement of technology assessment has had its origin the same industrialized countries. In these countries, concern has rapidly mo recent years over society's seeming inability to channel technological developing directions that sufficiently respect the broad range of human needs. Further belief is now held in large segments of society that the continuation of technological trends would pose grave dangers for the future of man, and in the ill-considered exploitation of technology has already contributed to son most urgent contemporary problems.

Even among those who readily concede that technological advance has whole, been a great boon to mankind, there has emerged a certain amount of skill towards proposals and projects that, in an earlier time, might have been made in human progress which is

responsible for his own destiny, and a sense of critical responsibility thus has gained ground.

The Apollo Space Programme of President Kennedy was perhaps the last large-scale scientific-technological achievement supported by almost unreserved general public acceptance. Things have rapidly changed since.

The alienation of those who feel excluded from power in an increasingly technical civilization has led to an identity crisis among many people in Western industrialized countries. The high degree of depersonalization caused by modern large-scale technologies—refineries, power plants, nuclear reactors, chemical plants—but also the complexity of modern public administration, leaves man in no position to understand and rationalize what is happening. A deep mistrust of technology and hostility to industry in general, is often the result.

The aforementioned study of the US National Academy of Sciences summarized and attempted to answer these anti-technology criticisms, which indeed rapidly became a general criticism of Western capitalistic life-styles as a whole:

> Some who share these general misgivings tend to make modern technology the scapegoat of all our social ills. They perceive technology as having become an end in itself, subjecting man to its demands rather than serving human needs. They regard it as inherently destructive to personal freedom and fear that it will make the world totally uninhabitable or at least rob it of all hope and beauty. This wholly pessimistic attitude rests, of course, upon a vast oversimplification—as does the converse notion that technology is a universal solvent that, having liberated western man from the bondage of poverty and disease, need only be applied vigorously to assure global prosperity and universal

the previous instance (re goals) we touch on problems of perception. Differ individuals with different backgrounds, education, levels of intelligence, experiences, expectations and values look at the world differently. This lead: different opinions on the best approach to solving a problem. This also applies to those who analyze problems. It is therefore difficult, if not impossible, to have objective analysis. *Thirdly,* there are limits of time and budget. This means I we cannot have "complete" information on which to base a decision. There dilemma here! Even if there were no restrictions on time and resources, human mind could not absorb all the information gathered. There is also added risk that the world would have changed while the problem was studied. The trick is to know when enough is enough and what information collect. This, of course, depends on perception which is value loaded. Thus a st is influenced by the analyst's perceptions. *Fourthly,* it is difficult to anticipate consequences of the application of a technology on society because we have imperfect knowledge of the processes at work in society. There is possibly b(knowledge of natural and physical processes than there is knowledge psychological and sociological processes but. on the whole, the complexity o interactions in society can invalidate social impact studies. The problem is fur complicated by the fact that the world cannot be treated as a science experiment—we change the world as we walk in it. *Fifthly,* decision-makers act on information they can comprehend. This means that most analyses ha[1] be distilled and the salient features extracted. This can therefore only b approximation of an analysis which is itself only an approximation of re; Combining this with all the other pressures on decision-makers one wonders in an increasingly

bounding CT groups. Names like Ralph Nader stand symbolically for a whole new school of thought.

One of the possible reasons for the striking difference between scientists on the one hand and technologists on the other, may be the fact that the former are usually either government-employed or belong to academia at large, and therefore enjoy a different status of intellectual freedom as compared to their colleagues who work in industry, which has its own set of rules concerning intellectual property.

On a world scale, public opinion on the interaction between technology, natural resources and the environment was shaken by the first reports to the Club of Rome, by the United Nations Conference on the Environment in Stockholm in 1972, by the Interfutures Study of the OECD. the report on Europe + 30 by the European Economic Commission, by the Report *Global 2000* commissioned by President Carter, and others.

Spectacular disasters and political action

These studies obtained massive media support and were, so-to-speak, evidenced by a number of spectacular disasters: the closing of the Three-Mile Island nuclear power plant in the United States; the pollution of the beaches in Brittany in 1978 after the breaking up of the oil tanker *Amoco Cadiz;* the forced closing down of a chemical plant in Hamburg: the effect of acid rain on the forests in FR Germany and other European countries. Yet despite this, no country other than the United States has institutionalized an Office of Technology Assessment. In the European countries., technology assessment activities have been outside the legislature, either in governmental agencies or in universities.

The themes concerning the interaction between technology and the environment attracting a large segment of the population and particularly of young people other hand, governments have a mandate to protect the economic basis countries. They are therefore faced with an almost insoluble conflict bet\ demands of their technology-based industry, which is the backbone of employees industrialized countries, and the ever-growing social costs of these same technically. They prefer not to interfere beyond the demands of mainly safety-oriented achieve regulations.

In the Western industrialized countries, both the production and the utilization of technological innovations are largely matters for decisions by relatively automatically subsystems of society, such as the economic system and the science governmental control being exercised mainly through such[1] indirect mea incentives, disincentives and selective promotion. It is for this reason that the assessment has been primarily seen as an activity that should be carried authorities with little or no vested interests in the issue, i.e. by government parliament. Technology assessments undertaken by the private sector tend somewhat different goals and criteria than those carried out by governing institutions, as shown in table 1. The results are therefore almost opposite ' assessment is commissioned by industry and when commissioned by public authority.

Table 1. Comparison of private and public sector technology assessment.

Industrial	**Governmental**
	Objectives

Government authorities, on the other hand, face the question: given the uncertainties, is action justifiable? In many cases, the available evidence is inadequate, and it may be impractical to wait until more comes along. (Indeed, given the complexities of the environmental system and the difficulties of assessing exposure it may be years, if ever, before incontrovertible proof of harm of a product o«* process becomes available.)

Technology assessment techniques are perhaps best established in industry. The likelihood of an industrial accident and the consequences in terms of fatalities and casualties are amenable to quantification; more importantly perhaps the exercise of carrying out the technology assessment helps to identify any potential weaknesses both in processes and in emergency routines.

But risks are associated not only with industrial accidents: there are also risks associated with products in everyday use and with materials discharged as waste. What is the likelihood that a particular pesticide is responsible for damage to wildlife? Or that contamination of an industrial development site will give rise to health effects? To what extent are car exhaust emissions responsible for acid rain?

In spite of the international dimension of science and technology, the formalized assessment of science and technology has remained almost exclusively a national effort reflecting primarily the interests of the country directly involved. Corporations operating world-wide have always attempted to exploit as far as possible the comparative advantages stemming from both the differences in factor costs—i.e. the existence of cheap and abundant supplies of labour, energy and raw materials, etc. that exist between countries—and the differences in legislative, fiscal and regulative procedures.

Could these catastrophes have been avoided if a proper technology assessment which had been carried out prior to the investment decision?

The tragedy of Bhopal

It is particularly the tragedy of Bhopal that has suddenly highlighted for dev countries the enormous risks involved in their massive and mostly uncoordinated importation of large-scale technology. Technology transfer is taking place in a of forms. The acquisition of technology from and through multinational corporation is only one, although one of the most efficient ways to import technology.

Even the most critical observer cannot deny that private direct investment t the multinational corporation is unique in providing from a single source a practical critical industrial inputs: capital technology, managerial skills and other required for production and distribution. Nevertheless, greater awareness in years of the far-reaching implications of the operations of multinational corporation has brought about a series of dramatic changes in government attitudes.

Among the many topics of the continuing and often heated debate on the multinational companies within North-South relations, the issue of plant and] safety seems to have been almost overlooked. It would be to take too narrow however, to confine the problem of technology safety only to the involve] multinational corporations based in industrialized countries. The fast-growing of multinational corporations with headquarters in developing countries, the

facilities for basic petrochemical products (urea, methanol, ethylene, ammonia, etc.) to recently-built chemical complexes in Saudi Arabia (Jubail), Kuwait and Indonesia[12]. However economically or politically relevant the reasons for these industrial relocations, it is correct to say that 'the net result is that potentially hazardous production processes are being shifted to countries which are often less aggressive in their efforts to protect the health of workers or where these efforts are constantly thwarted under the pressures of unemployment (and the rewards of a viable export enterprise)'.

In general, it is fair to say that national and multinational corporations alike have made efforts to respond positively to the pressures of citizens' movements, to the fast-changing, more critical attitudes of the public towards the role of science and technology in society and, of course, to the more severe governmental regulations on all issues concerning problems caused by science and technology.

The responsibilities of industry

There is an increasing readiness in industry to cover social and environmental issues as part of annual corporate reporting. There is also a growing awareness that the responsibility of industry cannot be limited to the safety of operational facilities, to production processes and to the products themselves, but that it should be extended to the disposal of hazardous waste. In the chemical industry, for example, it is recognized that the major dangers no longer involve only production facilities but also improperly stored poisonous residues. Today, more and more, expenditures for safety measures are

Not panacea, but a complex process of thoughts.

It appears from all available experience in developed countries that tech assessment is not a magic formula that will prevent all possible negative consec of the applications of science and technology. It is rather a very complex *t* process that calls for the permanent interaction, of a number of social and p supportive systems:

(1) An educated public that can manifest itself against strong interest gr
(2) A parliamentary system that can carry through legislative and reg measures to orient technology issues to harmonize with the hum ecological environment.
(3) A governmental system sufficiently sensitive to public demands and de well as to economic and technological necessities mainly conditioner employment situation.

Technology choices ultimately they are political ones

Recognizing the enormous difficulties industrialized countries have in dealing i negative effects of their old, established technological infrastructure, one can as gigantic task developing countries face in their struggle to bring into harmony needs and those of the future. Technology choices are ultimately political technology assessments that must take this basic principle into account.

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8. D. NELKIN, The social responsibility of scientists, in H. I. Fusfeld (Ed.) Science and technology policy: perspectives for the 1980s, *Annals of the New York Academy of Sciences,* Vol. 334,1979, p. 176. See also: M. DERKES and V. THIENEN, Science Court—'cin Ausweg aus der KriseT, *Wirtschaft und Wissenschaft,* No. 4, 1977, G. ROELLECKE, Wissenschaft im Kreuzvcrhor, *Wirtschaft und Wissenschaft,* No. 3,1978. OECD, *Technology on Trial, Public Participation in Decision-Making Related to Science and Technology,* Paris, 1979.
9. V. T. COATES and T. FABIAN, Technology assessment in Europe and Japan, *Technological Forecasting and Social Change,* No. 22, 1982, pp. 343-361.
10. United Nations, Office for Science and Technology, Technology Assessment for Develop ment, op. cit. Unesco, Technology Assessment: Review and Implications for Developing Countries, *Science Policy Studies and Documents,* No. 61, 1984.
11. K. M. KHAN, Third World multinationals: new actors in the international economy, *D+C Development and Cooperation,* No. 1, January/February 1985, p. 12-13.
12. J. LEMPFRIERE. Le développement des échanges commerciaux contre pays du tiers-monde.
    Le Monde diplomatique. May 1985, pp. 33-53.
13. E. GARTNER, Bhopal and the consequences, op. cit, p. 6. D. NELSON, Fact bank can prevent more disasters, D + C *Development and Cooperation,* No. 2, March/April 1985, p. 7.
14. The International Register of Potentially Toxic Chemicals in Geneva, set up by the United Nations Environment Programme (UNEP). cf. D. NELSON, Fart bank can prevent more disasters, D+C *Development and Cooperation,* op. cit.
15. H. BROOKS, Technology assessment as a process. *International Social Science Journal,* Vol. XXV, No. 3, 1973, p. 247. ,