ASSESSING TECHNOLOGY

FOR TECHNOLOGICAL CHOICES

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Published in:
Technology Assessment for Development
United Nations, New York 1979

(The Director greeted the participants in the Seminar on behalf of the Secretary – General. He called attention to the appointment of Professor Menon as Secretary to the Department of Science and Technology of the Government of India and noted that he had been for many years a member of the United Nations Advisory Committee on the Application of Science and Technology to Development (ACAST). He then gave the following address.)

Technology assessment is a fairly new concept in industrialized countries. It has its origin in the continuing concern for the apparent inability of society to channel technological developments into directions that sufficiently respect the broad range of human needs.

It is often argued that the technology assessment movement is a visible reaction within the developed countries against an almost blind reliance on technological solutions to social, economic and political problems. Whether rightly or wrongly, the belief is now widely held that the continuation of certain technological trends would pose grave dangers for the future of man and indeed that the ill-considered exploitation of technology has already contributed to some of the most urgent of our contemporary problems: the spectre of thermonuclear destruction; the tensions of congested cities; the hazards of a polluted and despoiled biosphere; the expanding arsenal of techniques for the surveillance and manipulation of private thought and behaviour; the alienation of those who feel excluded from power in an increasingly technical civilization". (1)

Should one conclude from these observations that the technology assessment concept is relevant only to those "post-development" countries which are now seeking to control the undesirable and unforeseen consequences of technological application? I do not think so. On the contrary, it is even more crucial for countries with scarce resources that technologies be carefully assessed in terms of their efficient use of human and material resources and over-all implications for development. Furthermore, it is possible for these developing countries to profit avoiding the errors of others- if a proper assessment of such errors is conducted.

The theme of this meeting is thus a new one: Technology assessment for development". It adds the "development" dimension to device initiated for the purposes of developed countries. It is of symbolic importance that India was chosen as a host country for the first international meeting dealing with this topic in a developing country. As is well known, India has the third largest potential of the world in terms of the number of scientists and engineers. In most sectors, it

ranks among the top ten industrial nations using, in many instances, the most sophisticated technology available, while simultaneously propagating the large-scale utilization of Mahatma Ghandi's famous spinning wheel. India has some of the largest cities in the world, with all of their myriad and inherent problems, and it also has more than 550,000 villages, with their own traditions and standards. The local conditions of this multifaceted, great country provide one test case for determination whether or not "technology assessment for development" could be meaningful for developing countries in general. However, like technology itself, the kind and number of indicators utilized in the assessment methodology will vary; will need to be derived from the needs and conditions of the developing countries. When in 1972 the Congress of the United States established a formal office of technology assessment for the first time, Maurice Goldsmith raised this question of the relevance of technology assessment in an editorial for the journal *Science Policy*. Mr. Goldsmith felt that technology assessment was clearly significant for the advanced industrialized societies. However, for the developing countries, he suggested that special indicators would have to be built into the assessment models in order to take into account variables specific to the developing countries, including the need for growth technology regardless of some unintended consequences (2).

It is true that in spite of a number of attempts in various other countries (3), the formalized technology assessment function has largely remained "an American creation with American emphasis, looking at American problems" (Goldsmith). The fact that the United States has pioneered the concept of technology assessment explains also why at this Seminar the number of American experts is higher than the number of experts from any other single country. But since we are here to learn from each other, we shall find out soon that the basic idea behind technology assessment is relevant to any country, rich or poor, as long as it wishes to rationalize the complex process of applying technology to its development.

As Walter A. Hahn, the first President of the International Society for Technology Assessment once described it: "the simple idea <of technology assessment>--and it is hardly new—is to look before you leap. The complexity and novelty come from what is looked at, who is looking and the sophisticated techniques for improving one's vision"(4).

In essence, technology assessment can be regarded as an early warning and monitoring system. It should provide early indications of the probability of beneficial and adverse impacts of the applications of technology. Technology assessment, therefore, is clearly distinct from technological forecasting (5), which is expected to predict technological developments, and from technology planning (6), which defines a time frame how the desired technology will be generated. In other words, technology assessment should enable decision makers to identify the secondary or tertiary efforts of new technology rather than the primary (intended) efforts. The first order impacts are usually studied in detail in the planning stage. Technology assessment focuses on the question of what else may happen when technology is introduced. (7)

After these general remarks, it may be useful to introduce two of the many possible definitions of technology assessment. According to Joseph F. Coates, one of the protagonists of the movement "technology assessment is the

systematic study of the efforts on society that may occur when a technology is introduced, extended, or modified, with special emphasis on the impacts that are unintended, indirect, an delayed"(8).

Another formula is proposed by Arnstein and Christakis: "Technology assessment (TA) is a policy oriented activity, primarily concerned with society's management of technology and not the development or elaboration of technological alternatives. What distinguishes TA from systems analysis is its emphasis on the social consequences that are likely to be precipitated through the contemplated innovation and its emphasis on appropriate intervention by policy makers and decision makers"(9).

Both definitions accentuate the particular notion of technology assessment that is the interaction between "Technology" on the one side and "society" on the other. The societal dimension of technology, ignored for a long time, is highlighted in the titles of three of the major assessment publications: Hetman's "state of art" compilations entitled *Society and the Assessment of Technology* (10), Lawless' case history of forty-five technology assessments is entitled *Technology and Social Shock* (11) and a recent study prepared by the Organisation for Economic Co-operation and Development (OECD), reviewing the technology assessment experience in some member countries illustrated by 15 cases called *Social Assessment of Technology* (12).

In one of the most recent hearings of the United States Congress, undertaken "for the purpose of exploring what has happened to the concept of technology assessment"—during which a large number of cases was presented—it was appropriately said: "maybe we need a kind of assessment that looks at human value system and how it impacts technology rather than starts with technology" (13). It is from this juncture that we can see interrelation between the technology assessment concept and schools of thought that are advocating alternative development styles and seeking to achieve this goal, *inter alia,* through the introduction of "appropriate technology".

Since the concept of technology assessment—as indicated earlier—originated from widespread though ill-defined general disenchantment with the equally ill-defined notion of "quality of life" in Western industrialized countries (14), the United States has been hesitant to explore this concept for possible adoption to needs of development countries. Interest in the premises and in the methodology of the technology assessment concept has increased in the United Nations simultaneously with the rapidly increasing preoccupation of the States with the role of technology in the development process as such. Technology transfer, technology adoption, technology policy and technology planning have become central issues in the North-South debate. They are also prominent items on the agenda of the more recent North- South dialogue, which culminated in August of this year in the Buenos Aires Conference on Technical co-operation among Developing countries.

A. THE EXPERT GROUP ON TECHNOLOGY ASSESSMENT

In 1975, the Office for Science and Technology of the United Nations Secretariat called together an Expert Group to meet in New York to discuss the issue of technology assessment and its possible implications in the work of the United Nations (15). The Group put the main emphasis on the societal aspects of

technology assessment as an essential aid to decision making. The “societal assessment of technology” was seen as the systematic study of the range of consequences that result from technology-related actions taken by society. The process involves the identification and assessment of technological, economic, social, cultural, environmental and psychological aspects and it’s therefore a multidisciplinary activity.

As one might have expected, there was an animated discussion on the question of differences in the concept of technology assessment when applied in highly industrialized countries as against developing countries. An interesting distinction was formulated which reads more or less as follows: The highly industrialized countries are now interested in identifying evaluating and correcting the negative effects of the use of technologies. The developing countries would like to assess technology primarily to determine and maximize the positive effects of using the technologies to accelerate their development process. When referring to the group of developing countries, we have to be prudent, for obvious reasons, not to generalize. As there are significant differences within the group of developed countries, we have to bear in mind that equally significant differences exist among developing countries. During the meeting of the Expert Group it was recognized that the necessary social environmental and cultural appraisal would increase the complexity of the evaluation of developing projects. But the group held that applying technology assessment would invariably benefit the nation and would outweigh in value and long-term costs any other decisions based on the narrower, short-term context of cost/ benefit choice. A series of actions for the establishment of technology assessment mechanisms in a country was recommended.

It is of interest to this meeting to be reminded of the importance that the Expert Group attached to the need for involving the various interacting target groups of a given society to ensure the acceptance of technology assessment. Specifically, five constituencies were identified:

Political and administrative decision makers in Governments

Public financial institutions
Scientific and technological institutes
Production enterprises
The public

1. Political and administrative decision makers in Governments

The national decision makers are easy to identify, though it may be difficult to trace real trajectory of a specific decision-making process. The responsibilities of government agencies for technology policy are often defined in rather narrow operational terms and tend to resist major changes in existing structures or procedures. It is therefore of prime importance to introduce the concept of technology assessment both at the legislative and at the highest level.

2. Public financial institutions

These institutions constitute, particularly for developing countries, an extremely

Important constituency for technology assessment. These are organizations such

As agricultural and industrial development banks whose basic operations relate to the appraising and financing of development projects. Unfortunately however, these organizations tend to see themselves basically as banks operating in a market framework but under government ownership. This can pose problems in the incorporation of aspects which the economists, who tend largely to staff such organizations, have been trained to regard as “external” costs.

Government policy directives and norms, relating to define the criteria for investment-worthy projects can also impede fore these organisations the incorporation of the technology assessment approach, as such directives are themselves most often predicated on private cost / benefit perspectives. There seems to be an urgent need to bring about a dialogue between the top-officials in finance and planning ministries and the top management of public financial institutions, through which a broadening of the scope and character of project appraisal to encompass the technology assessment approach is legitimized and operational zed. This constituency could be a valuable source of advice in selecting problems and establishing priorities for technology assessment.

3. Scientific and technological institutions

This is the network of public or semi-public agencies and institutions which are called upon to perform particular missions on the basis of an organized research and development and design engineering effort (in the industrial sector) in order to generate new scientific knowledge and to adapt or develop new technologies. It can be expected that the involvement of these organizations can be secured more easily than that of operational public agencies and commercial enterprises. However, they often need considerable sensitization to non-technical considerations (so very important in technology assessment) and less emphasis on the deterministic approach to scientific and technological advance with which their professional training tends to imbue them.

4. Production enterprises

Obviously, these play a central role in technological development. They represent the basic source of information on both present and future trends in a given technological field and hence constitute a very influential constituency for technology assessment. They have been accustomed to apply the profit maximizing principle to their activities and to generate their own anticipations regarding a limited range of consequences. In developing countries, this applies, by and large, as much to production enterprises in the public sector. Under these circumstances, successful undertaking of technology assessment in areas involving production enterprises implies, and indeed may call for, government agencies, the technological community and the technology assessment specialists to be involved with the enterprise in considering how to maximize the societal returns from an investment decision.

It seems apparent that technology assessment should be included in the early stages of research, development and product management. Ideally, concern for social relevance of technology should be built into the criteria for selection of research and development projects, as well as for screening of results. However, such criteria presuppose a consensus on a certain maximum scale of values which is not easily in-

Corporate into the norms usually fixed for commercial activities.

Enterprises will also be involved in supplying information and, on occasion, the experts needed to conduct technology assessment. However, for obvious reasons, enterprises are likely to be reluctant to help governmental technology assessment institutions in assembling arguments which may decide against the acquisition and use of commercially attractive technologies even at some future date.

5. The Public

The public should and can play an important role in enhancing the demand for "participatory technology". More or less it shares a common belief in science and technological advance. Given its knowledge and overt attitude toward novelty, it also determines the acceptance of new goods. In the past, its reaction to the introduction of new products and technological processes was a fragmented and hardly coherent. In the last few years however, several movements- such as consumerism, environmental protection, defence of professional prerogatives, and action for local or regional development- have greatly strengthened public awareness of problems raised by application of new technologies. The public became conscious of its social power, potentially vested in groups of organized citizens, both for supporting or opposing new projects. This can be of major importance in influencing the market acceptance of new goods. IN questioning new lines of goods, groups of citizens can challenge the direction of a technological trend and consequently the wisdom of the proponents of a given technology. It is already clear, no matter how one tries to understand technology assessment in terms of society as a whole and the action needed to undertake it, whether by means of building up constituencies as proposed by the Expert Group, or by any other means that other experts or groups may propose, that we are dealing essentially with an issue of political interest.

The very need to define the problems for applying technology assessment in terms of the society is itself a political question. This is another aspect of the premise outlined earlier, namely, that technology assessment really is a question that can vary considerably not only from country to country, but from period to period within a country as political conditions change.

B.INSTITUIONAL ARRANGEMENTS FOR TECHNOLOGY ASSESSMENT

The experience of several countries, developed and developing, has been considered, and there is, obviously, no optimal structure for the instruction of technology assessment. Rather, as in any other aspect of development, each country itself has to find the optimum structure suited to its own context.

There are, however, some basic criteria that should be kept in mind in formulating such optimal structures. First, the entity undertaking technology assessment should be an integral part of the decision-making apparatus of the country. Second, the structures should have the operational autonomy for effective functioning. Third, technology assessment should be a distinct responsibility assigned to the special organ. Fourth, the organ should be able to exercise judgement on questions of a large-scale projects (which are often interagency in scope) as well as of a smaller projects which fall within the domain of a single governmental agency.

The danger is, and we are aware of it, that technology assessment may lead to

the formation of a bureaucracy superimposed on the decision-making machinery for almost all aspects of development projects in a country. Thus, if we are not careful, technology assessment may quickly turn into “technology arrestment”

Actions by developing countries and by highly industrialized countries

The Expert Group made a number a recommendations concerning what developing countries should do to institutionalize the process of the technology assessment. Their recommendations deal with institutional structures, training of human resources, designing and building information systems, and so on. There is also advice on the desirability of proceeding on an evolutionary basis in order to provide flexibility for the gradual integration of technology assessment into the planning machinery of the country.

Highly industrialized countries are called upon to review the formulation of their developing assistance projects, whether in agriculture, industry, health, transport etc., with a view to incorporating the multidisciplinary approach required by the societal assessment of technology. It is further emphasized that all these analyses should be undertaken in close association with the developing countries receiving the aid in order to take into account properly their societal conditions.

The report of this first United Nations Expert meeting on Technology Assessment for Development introduces well the underlying philosophy of this new field (16). It is a good starting point for the deliberations of this Seminar. Since there would be little point in attempting to debate, once again, the more or less generally accepted methodology of technology assessment, it is hoped that the participants in the Seminar will be able to exchange experience on the technology assessment approach among participants. This should help us to identify better the possibilities as well as the limitations and dangers of failure for the technology assessment. In order to achieve this, it is expected that the composition of the Seminar, which consists of both theoreticians and practitioners of technology assessment, will foster new insights for practical applications on a sector-by sector basis. Most important, however, will be the critical views from colleagues from so many developing countries, on how they evaluate technology assessment for the particular conditions in their own countries and their own sectors. For us, the United Nations and in the specialized agencies of the United Nations system, your advice on how, in your opinion, technology assessment could be used by the various organizations in order to improve the effectiveness of our work, is of particular value.

It is encouraging to note that Governments are apparently more and more accepting the concept of technology assessment. In order to prepare for the forthcoming United Nations Conference on Science and Technology for Development (Vienna, 20th -31st August 1979) all Member States have been invited to prepare their own national position papers, stating what they regard as crucial on this vast subject. A preliminary analysis of a large number of these national papers indicates that technology assessment is indeed of major concern to many countries. A few developing countries even recommended the establishment of a central office for technology assessment in the United Nations system to co-ordinate national and regional efforts aimed at assessing the social, economic, cultural, environmental and institutional impact of technology. A group

of countries also recommends the establishment of a sub regional organization for technology assessment.

The deliberations in Bangalore will help Governments and the members of the United Nations system to reach better understanding on the complexity of technology assessment concept. If an explicit linkage can be established between this concept and the wider concept of development, this Seminar will be an important milestone in this history of technology assessment.

(In closing his address, the Director expressed gratitude to the Department of Science and Technology of the Government of India which, as hosts of the Seminar, had assisted in its preparation; and to the Government of India and the National Foundation of the United States of America for financial support, particularly with regard to travelling fellowships which made possible the presence of participants from developing countries.)

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16) Report of the Expert Group on Technology Assessment, convened under the auspices of the Office for Science and Technology of the United Nations Secretariat, New York, 23-27 June 1975.

17) Details of these national and regional recommendations concerning technology Assessment is contained in annex I to this paper (brought up to date in April 1979).

18) The views of non-governmental organizations on the same issue are reproduced in annex II to this paper.