

Since the appearance of the Draft of the New Technology Policy—1993, there have been many scientists, engineers, technologists and industrialists who have expressed strong views for and against the document. We publish below the 'Technology Policy Statement 1983' and 'The Draft Paper for a New Technology Policy', as also one of the comments we received on the document. We invite our readers to send in their comments so that there could be a free and fair exchange of views on the important step government hopes to take.

Editor

Technology policy statement—1983

Preamble

Political freedom must lead to economic independence and the alleviation of the burden of poverty. We have regarded science and technology as the basis of economic progress. As a result of three decades of planning, and the Scientific Policy Resolution of 1958, we now have a strong agricultural and industrial base and a scientific manpower impressive in quality, numbers and range of skills. Given clear-cut objectives and the necessary support, our science has shown its capacity to solve problems.

The frontiers of knowledge are being extended at incredible speed, opening up wholly new areas and introducing new concepts. Technological advances are influencing life-styles as well as societal expectations.

The use and development of technology must relate to the people's aspirations. Our own immediate needs in India are the attainment of technological self-reliance, a swift and tangible improvement in the conditions of the weakest sections of the population and the speedy development of backward regions. India is known for its diversity. Technology must suit local needs and to make an impact on the lives of ordinary citizens, must give constant thought to even small improvements which could make better and more cost-effective use of existing materials and methods of work. Our development must be based on our own culture and personality. Our future depends on our ability to resist the imposition of technology which is obsolete or unrelated to our specific requirements and of policies which tie us to systems which serve the purposes of others rather than our own, and on our success in dealing with vested interests in our organizations: governmental, economic, social and even intellectual, which bind us to outmoded systems and institutions.

Technology must be viewed in the broadest sense, covering the agricultu-

ral and the services sectors along with the obvious manufacturing sector. The latter stretches over a wide spectrum ranging from village, small-scale and cottage industries (often based on traditional skills) to medium, heavy and sophisticated industries. Our philosophy of a mixed economy involves the operation of the private, public and joint sectors, including those with foreign equity participation.

Our directives must clearly define systems for the choice of technology, taking into account economic, social and cultural factors along with technical considerations; indigenous development and support to technology, and utilization of such technology; acquisition of technology through import and its subsequent absorption, adaptation and upgradation; ensuring competitiveness at international levels in all necessary areas; and establishing links between the various elements concerned with generation of technology, its transformation into economically utilizable form, the sector responsible for production (which is the user of such technology), financial institutions concerned with the resources needed for these activities, and the promotional and regulating arms of the Government.

This Technology Policy Statement is in response to the need for guidelines to cover this wide-ranging and complex set of inter-related areas. Keeping in mind the capital-scarce character of a developing economy it aims at ensuring that our available natural endowments, especially human resources, are optimally utilized for a continuing increase in the well-being of all sections of our people.

We seek technological advancement not for prestige or aggrandisement but to solve our multifarious problems and to be able to safeguard our independence and our unity. Our modernization, far from diminishing the enormous diversity of our regional traditions should help to enrich them and to make the ancient wisdom of our nation more meaningful

to our people.

Our task is gigantic and calls for close co-ordination between the different departments of the Central and State Governments and also of those concerned, at all levels, with any sector of economic, scientific or technological activity, and not least, the understanding and involvement of the entire Indian people. We look particularly to young people to bring a scientific attitude of mind to bear on all our problems.

2. Aims and objectives

2.1 Aims

The basic objectives of the Technology Policy will be the development of indigenous technology and efficient absorption and adaptation of imported technology appropriate to national priorities and resources. Its aims are to:

(a) attain technological competence and self-reliance, to reduce vulnerability, particularly in strategic and critical areas, making the maximum use of indigenous resources;

(b) provide the maximum gainful and satisfying employment to all strata of society, with emphasis on the employment of women and weaker sections of society;

(c) use traditional skills and capabilities, making them commercially competitive;

(d) ensure the correct mix between mass production technologies and production by the masses;

(e) ensure maximum development with minimum capital outlay;

(f) identify obsolescence of technology in use and arrange for modernization of both equipment and technology;

(g) develop technologies which are internationally competitive, particularly those with export potential;

(h) improve production speedily through greater efficiency and fuller utilization of existing capabilities, and

enhance the quality and reliability of performance and output;

(i) reduce demands on energy, particularly energy from non-renewable sources;

(j) ensure harmony with the environment, preserve the ecological balance and improve the quality of the habitat; and

(k) recycle waste material and make full utilization of by-products.

2.2 Self-reliance

In a country of India's size and endowments, self-reliance is inescapable and must be at the very heart of technological development. We must aim at major technological breakthroughs in the shortest possible time for the development of indigenous technology appropriate to national priorities and resources. For this, the role of different agencies will be identified, responsibilities assigned and the necessary linkages established.

2.3 Strengthening the technology base

Research and development, together with science and technology education and training of a high order, will be accorded pride of place. The base of science and technology consists of trained and skilled manpower at various levels, covering a wide range of disciplines, and an appropriate institutional, legal and fiscal infrastructure. Consolidation of the existing scientific base and selective strengthening of thrust areas in it are essential. Special attention will be given to the promotion and strengthening of the technology base in newly emerging and frontier areas such as information and materials sciences, electronics and bio-technology. Education and training to upgrade skills are also of utmost importance. Basic research and the building of centres of excellence will be encouraged.

Skills and skilled workers will be accorded special recognition. The quality and efficiency of the technology generation and delivery systems will be continuously monitored and upgraded. All of this calls for substantial financial investments and also strengthening of the linkages between various sectors (educational institutions, R&D establishments,

industry and governmental machinery).

3. Priorities

3.1 Need for perspective planning

The time scales involved in the generation of technology are long, even with imported elements. Therefore, relevant technologies in all areas of priority, particularly where large investments are to be made, should be clearly identified well in advance. The cost and time element involved in the import of technology and indigenous development will be given consideration. Components which could be assigned to the various institutions which are capable of developing them or which could be built up for such activities will be identified. Ministries concerned with large investments and production activities in areas such as food, health and energy will be provided with appropriate technical support through suitably structured S&T groups.

3.2 Employment

Human resources constitute our richest endowment. Conditions will be created for the fullest expression and utilization of scientific talent. Measures will be taken for the identification and diffusion of technologies that can progressively reduce the incidence of poverty and unemployment, and of regional inequalities. The application of science and technology for the improvement of standards of living of those engaged in traditional activities will be promoted, particularly household technologies. Technologies relevant to the cottage, village and small industries sector will be upgraded. In the decentralized sector labour must be diversified and all steps taken to reduce drudgery. In all sectors, the potential impact on employment will be an important criterion in the choice of technology.

3.3 Energy

Energy constitutes an expensive and sometimes scarce input. Therefore, the energy requirements both of a direct and indirect nature for each product and each production activity and the associated technology employed will be

analysed. Measures will be devised to avoid wastage or non-optimal use of energy. Fiscal measures as necessary will be introduced to ensure these. Research and development in the energy sector will aim at improving the efficiency of its production, distribution and utilization, as well as improvement of efficiency in processes and equipment.

3.4 Efficiency and productivity

Technologies already employed will be evaluated on a continuing basis to realize maximum benefits in terms of increased production and lower costs, specially in the public sector enterprises. Every effort should be made to utilize by-products and wherever possible to recycle waste materials, especially those from urban areas. Programmes to make use of easily available and less costly materials will be supported.

3.5 Environment

Development should not upset the ecological balance for short as well as long-term considerations. Poorly planned efforts to achieve apparently rapid development, ignoring the long-term effect of many technologies on the environment, have resulted in serious ecological damage. It is, therefore, essential to analyse the environmental impact of the application of each technology. Due regard will be given to the preservation and enhancement of the environment in the choice of technologies. Measures to improve environmental hygiene will be evolved.

3.6 Some specific areas

In technology development special emphasis will be focused on food, health, housing, energy and industry. In particular, stress will be laid on:

- agriculture including dry-land farming;
- optimum use of water resources, increased production of pulses and oilseeds;
- provision of drinking water in rural areas, improvement of nutrition, rapid reduction in the incidence of blindness, eradication of the major communicable diseases (such as leprosy and tuberculosis), and population stabilization;

- low-cost housing;
- development and use of renewable non-conventional sources of energy; and
- industrial development.

4. Indigenous technology

4.1 Importance of technology development

Fullest support will be given to the development of indigenous technology to achieve technological self-reliance and reduce the dependence on foreign inputs, particularly in critical and vulnerable areas and in high value-added items in which the domestic base is strong. Strengthening and diversifying the domestic technology base are necessary to reduce imports and to expand exports for which international competitiveness must be ensured.

4.2 Inventions

The spirit of innovation and invention is the driving force behind all technological change. We must awaken our science and technology to the exciting challenges of our times, provide incentives to encourage inventors, and direct their efforts to areas of special importance. The system of rewards and incentives will be strengthened for inventions, innovations and technological breakthroughs and their utilization. The fullest opportunity will be provided to make use of inventions.

4.3 Enhancing traditional skills and capabilities

Traditional skills and capabilities will need to be upgraded and enhanced, using knowledge and techniques generated by advances in science and technology. Technologies which will result in low-cost production and in products marketable close to the point of manufacture, particularly in the rural sector, will be promoted. Support will be given to technologies which reduce pressure on items in short supply and utilize improved local materials and methods. Government will give preference to products of such technologies in its own purchases. The adoption of technologies that can promote decentralized produc-

tion will be helped through the support to design, marketing, quality control and other services.

4.4 Ensuring timely availability

The time cycle from scientific research to utilization is a long one. Hence the need to initiate action well in advance to identify and ensure timely availability and delivery of new technologies. Encouragement and support (fiscal, commercial and administrative) will be given to the production and user organizations to be associated with and participate in technology development efforts at appropriate stages.

4.5 Upgradation to prevent obsolescence

Technology is constantly on the move. The base of indigenous technology should be capable of utilizing worldwide advances and adapting them to local needs. The creation and strengthening of institutional structures for keeping track of international developments will receive urgent attention.

A strong central group will be constituted to undertake technology forecast and technology assessment studies and will *inter alia* draw up programmes of purposeful research. Arrangements will be made to provide high-level scientific advice in major sectors of the economy. Where big investments are involved or a large volume of production is envisaged, it will be incumbent on the Ministry or agency concerned to provide a technology forecast covering its requirements over a ten-year or longer period and evolve a strategy for development based on priorities.

4.6 Increasing the demand for indigenous technology

Our country has already invested significant amounts in setting up research and development facilities as well as design consultancy and engineering capabilities. The technological potential inherent in this system of interlinked capabilities must be fully utilized, and in turn provide a fillip for further development from within the system. Incentives will, therefore, be provided to users of indigenously developed technology, and

for products and processes resulting for such use.

4.7 Preferential treatment

In view of the cost of technology development and the time necessary for successful marketing of a new or improved product, indigenously developed items are invariably at a disadvantage compared with imported products or those based on imported technologies and brand names. Support must therefore be provided through fiscal and other measures, for a limited period, in favour of products made through indigenously developed technologies, care being taken to ensure quality.

4.8 Fiscal incentives

Suitable financial mechanisms will be established to facilitate investment on pilot plants, process demonstration units and prototype development in order to enable rapid commercial exploitation of technologies developed in laboratories. Linkages between scientific and technological institutions and development banks will be strengthened. Gaps in technology will be identified and suitable corrective measures taken with adequate allocation of resources. Fiscal incentives will be provided in particular to: promote inventions; increase the use of indigenously developed technology; enhance in-house Research and Development in industry; and efforts directed to absorb and adapt imported technology.

4.9 Design engineering

Capabilities in design engineering are essential for the translation of know-how to commercial production. This is particularly important in areas relating to: agricultural production; agro-industries; metallurgical, chemical and petrochemical processes; machine tools; industrial machinery and capital goods; as well as for the construction and erection of entire plants. Building up and enhancing these capabilities will have a catalytic beneficial impact on the utilization of indigenous efforts that have resulted in product and process know-how. Existing design engineering capabilities will be strengthened and up-

graded, and interaction encouraged between design engineering organizations, academic and research institutions and industry. Wherever gaps exist, design engineering capabilities will be developed and nurtured.

4.10 Engineering consultancy

Engineering consultancy is a vital area for ensuring speedy technological and industrial development. It ensures the appropriate utilization of indigenous materials, plant and machinery. Engineering consultancy provides an essential link between R&D institutions and industry, and thus promotes effective transfer of technology. Capability for total systems engineering, process development and project management should be developed with collaboration if required. Wherever capability exists, utilization of Indian consultancy engineering organizations will be promoted. Even where foreign technical collaboration or consultancy is considered unavoidable, association of designated Indian consulting engineering organizations would be preferred. Indigenous engineering consultancy, in both private and public sectors, will be promoted on a sound professional basis in the context of the overall national perspective of technological self-reliance.

4.11 In-house R&D

In-house R&D units in industry provide a desirable and essential interface between efforts within the national laboratories and the educational sector as well as production in industry. Appropriate incentives will be given to the setting up of R&D units in industry and for industry including those on a cooperative basis. Enterprises will be encouraged to set up R&D units of a size to permit the accomplishment of major technological tasks.

5. Technology acquisition

5.1 Mix of indigenous and imported technology

A policy directed towards technological self-reliance does not imply technological self-sufficiency. The criterion must be

national interest. Government policy will be directed towards reducing technological dependence in key areas.

Advantage should be taken of technological developments elsewhere. This can also be achieved through well-defined collaborative arrangements in research and development.

At any given point of time, there will be a mix of indigenous and imported technology. However, technology acquisition from outside shall not be at the expense of national interest. Indigenous initiative must receive due recognition and support.

In the acquisition of technology, consideration will be given to the choice and sources of technology, alternative means of acquiring it, its role in meeting a major felt need, selection and relevance of the products, costs, and related conditions. A National Register on Foreign Collaboration will be developed to provide analytical inputs at various stages of technological acquisition.

5.2 Principles of acquisition and technology assessment

Where the need to import technology is established, every effort should be made to ensure that it is of the highest level, consistent with requirements and resources. The technology import will be so planned as to have effective transfer of basic knowledge (know-why) and to facilitate further advancement.

Where the import of technology is contemplated, the level to which technology has been developed, or is in current use, within the country, shall be first evaluated. Lists of technologies that have been adequately developed to the extent that import is unnecessary will be prepared and periodically updated; in such areas no import of technology would normally be permitted; and the onus will be on the seeker of foreign technology, be it industry or a user Ministry, to demonstrate to the satisfaction of the approval authority that import is necessary.

Technology assessment systems will be reviewed. A technology assessment mechanism consisting of competent groups will render advice in all cases of technology import relating to highly sophisticated technology, large investments and national security. Aspects of

employment, energy, efficiency and environment will be kept in view.

The basic principles governing the acquisition of technology will be:

(a) Import of technology, and foreign investment in this regard, will continue to be permitted only on a selective basis where: need has been established; technology does not exist within the country; the time taken to generate the technology indigenously would delay the achievement of development targets.

(b) Government may, from time to time, identify and notify such areas of high national priority, in respect of which procedures would be simplified further to ensure timely acquisition of the required technology.

(c) There shall be a firm commitment for absorption, adaptation and subsequent development of imported know-how through adequate investment in Research and Development to which importers of technology will be expected to contribute.

5.3 Unpackaging

Technology to fulfil a particular need consists of many components. It is necessary to develop capability to break down the total package of technology required for a purpose into components, some of which may be readily available or could be indigenously developed, and others that will need to be imported. Norms and guidelines for such unpackaging will be evolved.

5.4 Absorption of technology

There shall be a commitment to ensure an adequate scale of investment in R&D for the absorption, adaptation and, wherever possible, improvement on and generation of new technology, making fullest use of overall national capabilities. Only thus can self-reliance be ensured and a technology generation process established firmly. Appropriate mechanisms will be evolved at the stage of technology assessment to ensure the absorption of imported technology.

5.5 Technological information

The availability of an efficient system of collection and analysis of relevant tech-

nological information, including cost and other economic aspects, is a prerequisite for the appropriate choice of technologies. This will considerably enhance the possibility of obtaining favourable terms and conditions in acquisition of technology. Such a technology information base will be established.

6. Technology transfer

6.1 Diffusion

Special efforts need to be made for the diffusion of technology in use to all beneficiaries who can employ them optimally. Appropriate measures shall be evolved to facilitate technology diffusion, including: horizontal transfer technological support for ancillaries from large units; technology inputs to small units; and upgradation of traditional skills and capabilities.

6.2 International competitiveness and technology exports

It is necessary to maintain international competitiveness in products, services and technologies that have export

potential. Conditions for the marketing of indigenous technology and of products based on it will be improved. It is important in all such cases to conform to the highest international standards.

6.3 Technical cooperation among developing countries

A concerted effort will be made to participate fully in technical cooperation among developing countries. Encouragement will be provided for participation in technology development programmes with other developing countries which can contribute to mutual national development.

6.4 Protection: legislative framework

Development of technology calls for large investments and often involves considerable risk. Encouragement will be given to obtaining necessary protection in all cases of indigenous technology development. A mechanism will be set up to ensure that national interests arising from the generating of technology are fully protected internationally in terms of industrial property rights.

7. Implementation

The success of the Technology Policy and the speed with which the various facets of the policy are implemented will depend to a considerable extent on a system for efficient monitoring, review and guidance and a scheme of incentives and disincentives.

Government will evolve instruments for the implementation of this Technology Policy and spell out in detail guidelines for Ministries and agencies of Government as well as for industries and entrepreneurs.

Success in implementation demands a conscious integrated approach covering technology assessment, development, acquisition, absorption, utilization and diffusion, and connected aspects of financing, based on overall national interests, priorities and the attainment of the most challenging technological goals.

Above all, the entire population must be imbued with self-confidence and pride in national capacity.

Indian Science and Technology must unlock the creative potential of our people and help in building the India of our dreams.

The Draft Paper for a New Technology Policy — 1993

1. Preamble

This Technology Policy Statement of 1993 has been designed to further strengthen the Indian economy and to assist the nation in fulfilling its role in the global economic environment with confidence and a sense of urgency.

The nation's commitment to the use of science and technology as key instruments for national development has been articulated in the Scientific Policy Resolution of 1958. The present policy is aimed at giving a renewed sense of purpose to indigenous technology for its accelerated development and use in the context of the Industrial Policy Statement of 1991 and keeping in view the need to adhere to international quality systems as well as preserve the environment.

2. Technology and society

In order to enable large sections of our society to derive the benefits from science and technology, this policy is directed to:

- achieve a greater spread in the use of technological developments;
- ensure accessibility of technological devices to all segments of the society with a special emphasis on remote and rural communities in order to improve their quality of life;
- enhance infrastructural facilities;
- upgrade traditional skills and reduce drudgery keeping in view the special needs of women and the weaker sections of society; and
- encourage industries for enhancing human skills to upgrade existing techno-

logies to comparable international levels as well as to attain such levels for newer and emerging technologies.

3. Technology and environment

To facilitate optimal utilization of the finite natural resources for ensuring a sustainable benefit stream for a better quality of life, it is essential that the technology conversion process must be made as efficient as possible. This will provide a much higher output of the productive goods and services from the same material inputs and consequently reduce wastage which results in pollutants in the gaseous, liquid or solid form. This policy, therefore, aims at:

- adoption, adaptation and promotion of state-of-the-art technologies for waste