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TECHNOLOGY, ECONOMY AND POLITY

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TECHNOLOGY, ECONOMY AND POLITY

I am very grateful to Shri D. U. Kapur and Professor B. Nag for inviting me to address your convocation. Your institute is a great national centre of higher learning and research. The IITs attract the best and the brightest of our students. I deem it a great honour therefore to deliver the convocation address here today.

I should first like to congratulate all those scholars who, after diligent pursuit of their studies and research, have earned their degrees and diplomas. The IITs are associated with the pursuit of excellence combined with deep professional commitment. It is only on the basis of an abiding faith and commitment to the pursuit of excellence in all walks of life that we as a nation can prosper in this harsh competitive world. You are the privileged heirs to a proud legacy. I trust that you will see it as your duty to prove worthy of this inheritance.

India's economic structure has been greatly diversified since independence. Our scientists and technologists have been pace setters in this process of structural change. The entire country can take pride in the achievements of our agricultural scientists and their magnificent contribution to India's drive for self-sufficiency in food. Their colleagues in the fields of nuclear energy and space sciences have worked hard within a very difficult international environment to build up our national capabilities in these frontier technologies. Scientists and technologists involved in the exploration and development of hydrocarbons have similarly rendered outstanding services to our country. Because of the dedicated work of all these pioneers, a broad-based economy is now in position to offer rewarding opportunities to our educated youth.

This year we are celebrating the centenary of the birth of Jawaharlal Nehru. Thanks to his vision and foresight, our development plans have always recognized the vital role of science and technology in the social and economic transformation of our country. Our universities and institutes of national importance now annually produce 250,000 persons trained in scientific and technological fields. National expenditure on science and technology, including industrial research and development, is now close to 1 per cent of our GNP.

Nevertheless, it has to be recognized that the battle for technological maturity and self-reliant development is far from being over. Because of the unprecedented explosion in scientific and technological knowledge in the developed countries, the technological and economic distance between the rich and poor countries is widening rather than becoming narrower. Developments in new frontier technologies, particularly telecommunications, microelectronics, lasers, fibre optics, biotechnology and new materials, are ushering in a new industrial revolution. Its impact on the productivity, social organization, wealth and power of nations may be as profound as that of the steam engine, electrification and the internal combustion engine in earlier generations.

The exploitation of modern scientific knowledge and technological advances is now the main source of economic growth in the developed countries. The new technologies have far-reaching implications for the comparative advantage of countries in the international competition for global markets. Developing countries cannot stand aside while this new industrial revolution sweeps the industrialized world. Clearly, there is no alternative for the Third World but to adopt a viable strategy of technological leapfrog if its development options are to be widened progressively.

It is to the credit of our planners and those responsible for the formulation of India's science and

technology policies that they have grasped the far-reaching implications of the technological developments which are now on the horizon. The Seventh Five-Year Plan has witnessed some highly encouraging trends in the development of national capabilities in the new frontier technologies. However, the full utilization of the economic potential of the new technologies is not merely a function of technical capabilities, essential as they are. The outcome depends a great deal on the proper articulation of the complex linkages that exist between the management of technology, the economy and the wider polity. It is to the elaboration of these linkages that I propose to devote the rest of my address.

An effective strategy for the management of technical change must be based on a careful analysis of the country's social and economic objectives and the various resource constraints it faces. From a long-term perspective, a country like India, suffering from an acute scarcity of land and natural resources on a per capita basis, must give high priority to the development of technologies which can overcome these resource constraints. Degradation of land and water resources constitutes a major threat to the sustainability of the growth process in several parts of our country. Science and technology have a major role to play in meeting this threat. In particular, in the planning of science and technology, special attention has to be paid to raising the productivity of dry land agriculture.

Demand for **commercial energy** is likely to increase rapidly in the **process** of development. Commercial energy is highly capital-intensive, and our dependence on imports for meeting our requirements of hydrocarbons is quite considerable. Technologies designed to conserve energy and those like solar energy which are based on the use of renewable resources must, therefore, receive priority attention.

The limited natural resource base of the country also implies that we will have to rely on international trade much more in the future to meet our requirements of hydrocarbons and other scarce raw materials. We cannot finance these imports without a dynamic export sector. It is only through a competitive manufacturing base that we can build up an expanding export sector. Exporting in the globalized economy of the modern information age will require adequate access to new information technologies, new micro-electronic devices for quality control, an updated system of design and engineering capabilities as well as a modern infrastructure of telecommunications, banking and other financial services.

Flexible manufacturing systems or clusters of computerised numerical control machines are transforming production processes in the world. They save on labour and other inputs, and inventory and warehousing costs, and facilitate the production of multiple, highly custom-tailored, small batches of products on the same set of equipment. As a

result, these technologies threaten to erode the competitive advantage of developing countries even in such traditional labour-intensive industries as textiles. Our export strategies must take all this into account.

Clearly, we have no alternative but to participate in the new technological race. This is a costly business. Countries like the U.S.A. and Japan spend annually over 2.5 per cent of their GNP on research and development. Given the size of their GNP, these countries therefore have massive resources for the generation of new technologies, products and processes. Even though we cannot compete with these countries, we must be prepared to raise our spending on research and development to at least 2 per cent of our GNP.

To derive maximum benefit from the limited resources we can spare for research and development, it is essential to have a firm grasp of national priorities. Technological upgrading, must not imply a slavish imitation of the consumption patterns of the advanced industrial countries. The real challenge is to develop national capabilities in the new frontier technologies with the primary emphasis on meeting the basic human needs of our people. The process of technological leapfrog has to be both highly innovative as well as highly selective. Viable strategies have to be evolved to realise the very considerable potential of new technologies - particularly biotechnology, renewable decentralized energy systems and communications

technologies - in promoting non capital intensive, participatory and decentralised development.

All this can be accomplished only on the basis of a holistic view of the process of social and technological change. In view of the sweeping impact of new technologies, it is highly important that an integrated national perspective is evolved, delineating sectors, stages and processes which should receive priority attention in the process of technological upgradation. In the absence of such an approach, there is a real danger that new technologies may be used simply to modernize the consumption of a small privileged minority rather than as an instrument of promoting a people-centred process of social and economic change.

The quest for technological self-reliance and an internationally competitive economic structure is vitally linked to the quality of our labour force. In this context, the role of the educational system is critical. The educational system needs to be revamped so as to ensure that our work force is capable of meeting the skill needs of an economy increasingly based on science and technology. The time has come when we should resolve firmly that the constitutional requirement of universal elementary education for our children will be made a living reality before the year 2000. The task is formidable but any delay in its accomplishment will create further difficulties.

Simultaneously, adequate attention has also to be paid to the quality of teaching of science and mathematics in our secondary schools and universities. Despite large-scale quantitative expansion, the quality of science education in the country must be a cause for concern. As a recent publication of the Indian National Science Academy has pointed out:

"It is clear that since independence, in spite of the quantitative increase of science and of science graduates, quality has been a victim; a large, improved science base has, however, been established. Sometimes under the banner of equality and democracy, circumstances operate powerfully against the development of excellence. Therefore, one of our foremost concerns should be to protect, encourage and enhance the quality of work and thought which will raise the average level of science and produce leaders of excellence who can contribute to national endeavours".<sup>1/</sup>

It is therefore necessary that planners, the University Grants Commission and all those concerned with the management of education and scientific and technological research should

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<sup>1/</sup> Indian National Science Academy, Issues in Higher Education in Science, 1985.

face up squarely to **the challenge of** technological leapfrog. Clearly, there will be **need** for larger resources. But there is an equally urgent need to review the efficiency and effectiveness of existing structures for the management of science and technology.

The government's strong commitment and practical support are indispensable, but this should not lead to excessive bureaucratization of scientific and technological research. In particular, we have to ensure that our research institutions provide an environment conducive to the pursuit of excellence and creativity. We do need specialized institutes for technology development but their management strategies must have built-in safeguards to promote and nurse creativity. We must also ensure that the institutional structure of research and development is sufficiently sensitive to the needs of the productive system. The establishment of appropriate linkages between our research institutes and the world of industry and commerce has been a subject matter of considerable discussion and debate in our country. However, a stable viable pattern in this regard has yet to emerge.

Over time, all our leading enterprises must also devote adequate resources to research and development. To the extent research and development is paid for by industry, it will lead to enhanced accountability and cost effectiveness of outlays on research.

The role of universities in basic research is quite fundamental. However, I have a feeling that in our planning of science and technology the needs of universities do not receive as much attention as they deserve. There has also been a tendency to spread the available resources much too thinly so that their impact gets diluted. The inherited management structures of our universities are also not conducive to promoting a culture of creativity and excellence. There ought to be a national debate on the extent to which the structure, functioning and funding of our university system and its linkages with the rest of the society are in line with the basic national requirements.

Economic policies have an equally important role to play in the process of technological transformation. In an age of rapid technological change, the inducement to invest in new processes and products is greatly affected by the prospects for reasonable price stability and the stance of fiscal policies. A stable macro-economic environment ensures that higher productivity rather than speculative gains becomes the major determinant of corporate fortunes.

In aggregate terms, a rapidly expanding economy provides the most favourable environment for the absorption, adaptation and assimilation of new technologies. In this context, the Planning Commission's decision to aim at an

average annual growth rate of 6 per cent in the Eighth Plan is to be welcomed. However, the savings and balance of payments implications of this target need to be carefully spelled out. The improvement in the growth rate of the economy in the 1980s has not been accompanied by an increase in the domestic savings rate. In fact, compared to the late 1970s, there has been retrogression in the 1980s. I suspect that our premature drift into consumerism of the type prevailing in post industrial societies of the West has weakened the inducement to save in the private sector. In the public sector, the tendency to rely excessively on borrowings, both domestic and foreign, has led to inadequate attention being paid to the more fundamental tasks of restructuring tax administration, proper expenditure control and streamlining of management of public sector enterprises. These tasks will require much more systematic attention if the growth objectives of the Eighth Plan are to be realized.

Of course, all the investments do not have to be financed domestically. However, in view of the high real rates of interest prevailing in international capital markets and the low productivity of investment in our economy, heavy reliance on foreign borrowing can be highly risky and can saddle the economy with an unsustainable debt burden. Measures to improve the productivity of investment - both public and private - must precede any large-scale recourse to foreign loans. Indeed, in

some cases, it might be preferable to rely on foreign direct investment than foreign loan obligations. In this context, we ought to pay much more attention to strengthening our relations with Japan, which has attained high technological maturity and is also looking for profitable avenues to deploy its surplus savings.

At the same time, our industrial and trade policies must help to create a competitive environment in which producers have a built-in incentive to innovate, reduce costs and improve the quality of their products. Given the present foreign exchange situation, widespread import liberalization is not feasible. Nevertheless, it is necessary to remove all policy induced obstacles to enhanced domestic competition. Industrial licensing and restrictions on capacity expansion have outlived their utility except for the limited objective of influencing industrial location. Taking into account the very substantial economies of scale which characterize modern industrial processes, Indian firms must be encouraged to grow to an economic size.

Simultaneously, it must be recognised that attempts to prop up patently inefficient firms at all costs is counterproductive. The stimulus of competition cannot be made effective in a regime where entry into an industry is freely allowed but exit is not permissible. Of course, workers

engaged in sunset industries should not be made to bear the cost of technical progress. They are entitled to social safety nets in the form of unemployment insurance and retraining facilities to enable them to cope with the problems of technological upgradation. The system of industrial relations needs to be revamped so as to promote a proper appreciation of problems involved in the management of technical change and an equitable distribution of costs and benefits thereof.

Finally, the climate for technological upgradation and innovation cannot be divorced from the overall management of our polity and society. It is only in an atmosphere conducive to a free flow of information and new ideas that creativity can flourish. Excessive bureaucratization of science and technology and of economic processes is being recognized as a barrier to creativity in all planned economies. But creativity also requires a political and economic framework which upholds the rule of law and minimizes the scope for arbitrary decision-making. We need stable, well-functioning institutions to induce entrepreneurs to take a long view. Our polity must provide space for a scientific and technological culture. We have to evolve a political culture which recognises that the public sector managers need maximum possible functional autonomy if they are to discharge their functions with reasonable efficiency and to be held accountable for their actions. Mainstream national thinking has to show adequate

appreciation both of the creative role of enterprise, as well as of the importance of social consciousness and concern for the needs of the underprivileged.

Competitive politics is the stuff which invigorates a democracy but it must not be allowed to weaken the basic value system on which our republic was founded. Politics is sometimes described as the art of the possible. But in a poor country what is often considered possible is clearly not enough. We cannot be satisfied with the status quo. We need a creative politics which expands the boundaries of the possible. We need a politics which enables built-in tensions and conflicts in our economy and polity to be resolved, reconciled or arbitrated and not exploited for narrow partisan ends.

We have to be grateful to the founding fathers of our republic for giving us a political framework based on democracy, respect for fundamental human rights and the rule of law. We have deliberately chosen the difficult path of ushering in a social and economic revolution in the framework of an open society and polity. We can take pride in our achievements since independence. But we can hardly be complacent. There are visible strains in the functioning of our polity.