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It is a pleasure and an honour to have been asked to deliver the Convocation Address at this University. I would like to offer, at the outset, my greetings and good wishes to the staff and students of this young University. What awaits to be done in education in our country in the years to come is going to be of more profound significance than what has been achieved or attempted in the past two decades of planned development. The challenge that faces the universities as indeed of all educational institutions is thus immense.

Our society is changing rapidly. It will change whether we wish it or not, for change has become a natural phenomenon in the modern world. For us this is nothing new because we have experienced stormy periods in our long history. Adherence to certain fundamental values has helped us to weather these storms and maintain an essential continuity in our way of life. The latest challenge that our nation has to face is twofold. The more tangible it is on (the economic front, connected with the problems of fighting hunger, disease, illiteracy and unemployment for the large masses of our people. The other is on an intellectual plane, connected with changes in thought and action that advances in science and technology imply. These two challenges are not unrelated to each other. Concern for the weak and a striving towards egalitarianism have been our cherished ideals from time immemorial. Our philosophy has moreover encouraged a keen spirit of enquiry and a deep passion for truth. This after all epitomises the spirit of scientific enquiry. When science as knowledge flows into technology as power, it gives us the means by which we can better ourselves not only materially but even spiritually. Centuries of technological progress have helped to usher in a new era and a new civilization in human history. We are no doubt late-comers on this stage of scientific advance and technological progress. But is our mental make-up and our spiritual heritage a stumbling block in our journey towards higher levels of scientific knowledge and technological excellence

Far from it. Those acquainted with the versatility and many-sidedness of our heritage are not only convinced that the scientific spirit will find a hospitable climate in the Indian tradition. They also firmly believe that India might yet show the world how to understand and assimilate the formidable forces that science has placed in our hands. I would like to quote the late Jawaharlal Nehru on this subject from his 'The Discovery of India.

“ Science has dominated the Western world and everyone there pays tribute to it, and yet the West is still far from having developed the real temper of science. It has still to bring the spirit and the flesh into creative harmony In India in many obvious ways we have a greater distance to travel. And yet there may be fewer major obstructions on our way, for the essential basis of Indian thought for ages past, though not its later manifestations, fits in with the scientific temper and approach, as well as with internationalism. It is based on a fearless search for truth, on the solidarity of man, even on the divinity of everything living, and on the free and co-operative development of the individual, and the species, ever to greater freedom and higher stages of human growth.

It is in this sense that I am strongly of the view that unlike in the West, science will have no opposition from philosophy or religion in our country, provided we go about the job of propagating modernism with imagination and with an abiding sense of our rich national heritage. It is in this light that I would like the major tasks before us in the field of economic development, educational policy and scientific research to be approached. In short, there has to be an harmonious blending of the twin tasks of education, viz., character- building and skill-formation in our educational programmes at all levels.

II

Dadekar and Rath in a recent study attempted a quantification of the nature and dimensions of poverty in our country. Even without this quantification, the reality of it was there, making its grim presence felt at every turn in our life and posing a

continual challenge to our conscience and to our competence. But this quantification was in itself valuable, as it served to pin-point the scope and the contours of this problem, from which we can derive the order of effort required to tackle it effectively.

Ever since we attained political independence we have attempted a multi-pronged attack on our economic backwardness. We have invested heavily in building up irrigation projects, in power stations and in new industrial establishments. We have attempted moreover to spread education, to impart higher technical skills, to promote research and generally to increase efficiency. One often tends to undervalue what has been achieved during these two decades of development. If only to put the picture right, let us not forget that we have during this period stepped up production of foodgrains from 55 million tonnes to 105 million tonnes, increased power output from 2.3 million K. W. to 18 million K. W., increased industrial production more than 3 times, with pig iron production going up from 2 million tonnes to 7 million tonnes, cement from 5 million tonnes to 18 million tonnes and petroleum production from 3 million tonnes to 20 million tonnes. One can add to this list and it will be quite impressive judged by any standards. Yet, there is an overall feeling of inadequacy and dissatisfaction with what has been achieved. It is essential that we try and understand this feeling in its full perspective while planning the strategy for the future.

This dissatisfaction, in my view, can be traced to two main factors. Firstly, while in absolute terms the availability of these goods and services has increased quite significantly during the 1950s and the 1960s, our needs have gone up more than proportionately in the meanwhile under the pressure of a growing population and with rising money incomes. Secondly, part of this disenchantment is also to be put down to the fact that those classes of people who were especially in need of improvement in their standards of living were not always specifically taken care of by programmes tailored to their benefit. Progressive income tax rates, the estate duty, the ceilings on land property and restrictions on accumulation of additional assets by monopoly houses have been among the major instruments we have adopted for levelling down the pattern of income distribution in the country. The effort in the other direction for levelling up those categories falling in the bottom one or two

deciles in the income scale have had but limited impact so far.

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III

It is this realisation and the anxiety to rectify the situation before it becomes too late for our goal of orderly transformation of our economy and our society that led to the formulation of the programme of a direct attack on poverty. This approach calls for the opening up of employment and income-earning opportunities to the economically most depressed regions and classes of people. For a democratically governed country, weighed down with age-old poverty and beset with a massive population pressure, this poses a challenge of the first order.

How does one achieve this goal ? Are there any magic solutions or simple remedies ? The answer is no. There are no tricks that can quickly and painlessly pull us out of the rut. The goal can be achieved only by increasing production and by making sure that what we produce is what is needed by the masses (and not just by the elite) and is available to them at prices that are within their reach. This implies in turn that these people should have some income of their own. The programme cannot be developed on the basis of continued charity under government auspices. Idleness is incompatible with growth or prosperity.

How does one provide a satisfying job and an adequate income to this class of people ? We are having in mind here the landless labourer, the small tenant, the unemployed artisan, and the so called 'menials' Gandhiji's 'Harijans' in the villages. In the towns we have in mind the slumdweller, the rickshaw-puller, the casual servant and that class of floating population that has no specific skills and no fixed earnings.

What we wish to do in the first phase of this battle is twofold. First, provide them with some material means of production. This can take the form of a piece of land, an agricultural implement, equipment for a cottage industry, a building tool, and the like. Secondly, make sure that with what ever tool or other facility is available, its productivity is maximised for the user.

The next question then is how does one push up levels of productivity? Our

cultivators have traditionally used their plough on their land, getting crop-yields which have been but a fraction of what is prevalent in countries like Japan or the United States. What is the key to higher yield from land ? Similarly, how does one improve productivity for the carpenter, the cobbler, the charkha spinner, or the building artisan ? In other words, how does one improve or upgrade technology ?

It is in this sense that I feel that technology holds the fundamental clue for economic progress. Even a country like Japan with a limited land area and other natural resources has been able to achieve a very high standard of living because of its accent on technological excellence. This explains its ability to import raw material from abroad, make finished products and export them to other countries, sometimes to the very same country which supplied it the raw material in the first instance. It is happening to us today in our relation with Japan. We export iron ore to Japan and import considerable finished steel. The answer is again basically the difference in technological capability between the two countries.

We in this country are fortunate to have a large land area with generally good soil, a variety of agro-climatic conditions in which we can grow practically any crop we choose. In regard to industrial raw materials, we do not quite know the extent of our reserves. But the inventory that we do know of is quite impressive. If today we are not able to utilise the resources available to us effectively, we should put it down once again to our technological backwardness. Take, for instance, the protein requirements of our population. There is unanimity among experts on the grave effects-physical and mental-on children owing to protein-calorie malnutrition at the critical age, say up to the 6th year in their growth cycle. A few years back, I happened to head a United Nations Panel to study this question in regard to all the developing countries and to propose a plan of action. We recommended a package of measures, including the setting up of an international fund for this purpose. Unfortunately concrete follow-up action on the recommendations of this Panel has been slow and unsatisfactory the world over. The point I would however like to make here is that with practically unlimited ocean resources and with vast potential for increasing milk yields and for achieving higher production levels in

pulses, we have not been able to launch a programme of adequate magnitude to meet protein deficiencies of the millions of our children. Why ? Not because we lack the 'resources ' in the real sense of the term; but because we have not yet bent our energies to solving the technological problems of collecting, processing and distri-buting the resources we have in an efficient and economic manner. This I cite as another example of the price we pay for technological inadequacy in an area of crucial national importance.

For long it used to be said that our ignorant and illiterate masses are not quite capable of mastering modern technology and of modifying their economic activities to meet its rigorous requirements in a rapidly changing world. Our early planners themselves perhaps had some doubts on this score. But the experience of wheat cultivation since 1965 has shown how misplaced these misgivings were and how unwarranted the assumptions proved to be in regard to the alleged inabilities of our farmers to adapt to changes. The speed with which farmers were willing to discard their traditional seeds and methods of cultivation and to take to the new set of practices was truly remarkable. This experiment has demonstrated that what is needed for achieving higher production is a clear-cut technological improvement, matched by a package of necessary inputs and backed by a well-organised extension agency.

Nor is this the only example we have before us. Take the dairy industry in the Kaira or Mehsana area of Gujarat. The whole tract has been transformed and the people of the locality have achieved a level of prosperity which was perhaps unthinkable two decades ago. Thanks to imaginative leadership, the farmers have organised themselves into cooperative societies for production, processing and distribution of milk and milk-products. 'Amul' has become a by-word not only in this country; it has established its reputation abroad. Giant multi-national Corporations in this field, established much earlier in this country, have been put in their places by the emergence of this mass-based organisation, whose productivity was sharpened by new technological and managerial inputs.

If this view of the process of economic development is accepted, it follows that

we need to organise ourselves quickly and systematically for a better technological performance in all areas that matter in our national life. There are two aspects to such a policy. One is promotion of research and development designed to improve productivity, to reduce waste and evolve processes that are suitable to our conditions. The other is more purposive education and training for spreading new knowledge and improved techniques to those who need them most for increasing productivity. This is the link that I envisage between education, research and production.

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I am sure some of you at least would have heard of the National Committee on Science and Technology that was set up about two years back to prepare a Science and Technology Plan for our country. This Committee is composed of about a dozen scientists and technologists of proven ability, with the Minister for the newly created Department of Science and Technology as the Chairman. During the two years of its existence, the Committee has involved nearly 1,800 scientists at the working level to review the level of technological competence in each major sector of the national economy, and to identify concrete programmes of research and development to improve this capability. As part of this exercise the Committee has identified the institution or the agency that can best handle each one of these projects and has also estimated the requirements of men and materials for implementing them.

The Committee, you might recall, published an Approach Paper to Science and Technology Plan earlier this year, setting out its basic philosophy in regard to science planning, the areas of prime national importance. It also drew attention to the major policy and organisational issues that will be critical for the successful implementation of any Plan. This paper was discussed at a series of Seminars held in different parts of the country. Based on the views expressed and the suggestions made at these Seminars, we have just completed the draft outline of the first comprehensive Science and Technology Plan for the country, as the counterpart, and the reinforcing instrument, of the 5th Five Year Plan of national development for the period 1974 to 1979. The allocations proposed for each sector are now under detailed discussions with the

Planning Commission. We hope to publish the Draft Plan document shortly and based on the comments it evokes we would draw up the final Plan for publication by March 1974.

I would like to take this opportunity to refer very briefly to what the approach of this Committee has been on the question of education, manpower research and its link to the productive apparatus. The importance of this relationship needs no special elaboration. Various scholars have commented on it in writings relating to economic development. Many of them have drawn attention to an imbalance in the pattern of education in the developing countries between the humanities and the arts on the one hand, and scientific and technical disciplines on the other. As regards technical education, a common criticism relates to the lack of practical orientation both in the curriculum and in the methods of teaching. Here is what that distinguished Jamaican economist, Sir Arthur Lewis had to say on the subject.

“ Most of the jobs which graduates in the humanities fill - in administration, commerce or teaching - could be done equally well by engineers or scientists; but what engineers and scientists do cannot be done equally well by humanities graduates. Hence, in framing higher education policies there is no point in counting how many engineers or scientists the economy needs, with a view to keeping their numbers down; financial stringency may force strict control over the numbers admitted into faculties of humanities, law or commerce; but maximum encouragement should be given to students who desire to enter faculties of science, engineering, agriculture or medicine.”

On the question of a lack of practical bias in even technical education in many developing countries, Gunnar Myrdal in his ‘Asian Drama’ observed as follows :

“While a Western student of engineering is more likely than not to seek practical experience as a worker in a factory or at a construction site during his vocations, such an idea would seldom occur to a South Asian student. After a Western engineer obtains his degree and takes a steady job, he is prepared to use his hands and even get them soiled if necessary, but a south Asian engineer often prefers to stand beside his machine when something goes wrong, and give orders to inferiors.”

Recognising these lacunae, the National Committee has felt that the main objectives in educational planning should be as follows :-

- i) providing a steady stream of skilled manpower for the various sectors of importance;
- ii) attempting adequate employment opportunities for the existing stock as well as the future addition to the stock, of scientists, engineer and other technical personnel;
- iii) re-structuring existing programmes of education, as well as re-structuring the institutions themselves in order to make education more purposeful and establish better liaison between education, research and the production units;
- iv) attempting a wider diffusion of good quality science education to as large a body of students as possible, with particular attention to the requirements of students in and from the rural areas ;
- v) Providing a broad science base at all levels of education and including the illiterate in our society;
- vi) making our educational institutions more active participants in our training and research effort;
- vii) improving the conditions of work of our teachers, scientists, engineers and other professionals;
- viii) achieving a better matching between what we train in our educational institutions and what we employ in our manufacturing establishments' and
- ix) creating an appetite for excellence in science and technology among the younger generation.

This is a formidable list indeed; but there is no getting away from these hard tasks. An immediate step will be to upgrade existing standards of teaching, training and research. In regard to engineering education, for instance, an important test to apply in evaluating its efficiency is how far it assists in industrial development. Do the students get the right kind of training as part of their education, or are they being given specialised knowledge in areas that are of no direct significance to our economy? A major lacuna so far in regard to identifying areas and projects in which additional inputs can be expected concrete results will have been removed with the publication of the Science and Technology Plan. The areas of importance indicated in the Plan, no less than the specific programmes

outlined therein, can provide the framework of action not only for national research laboratories, but to institutions of higher training all over the country. It is this practical orientation to which we attach the highest importance in higher education, particularly in technical education. It is in this sense that we should regard investment in technical education as investment in any other project or scheme, with a balancing of costs and the benefits. Higher technical education of really good standard is far too expensive for us to indulge in the luxury of imparting it in a haphazard fashion, without clear-cut and time bound national goals, to whomsoever happen to be admitted to these institutions.

Nor is education at middle or lower level to be looked upon as of less importance. Even a cursory look at the pattern of education in socialistic countries, particularly in the Soviet Union, reveals the enormous importance that is attached to the training of the mind and the imparting of the skills among the very young. The range of middle level technical manpower available to us already covers fairly wide ground. The training imparted in the polytechnics is, however, not sufficiently partial. One or two areas such as instruments and electronics also require special attention at this level as these are areas with immense potential for application in the years to come

There is another facet to this link between industry, research and training. It is the involvement of the industry itself in the formulation and execution of programmes of research by national laboratories and institutes of higher learning. We have already initiated the practice of sandwich courses and apprenticeships in collaboration with industry. More attention is needed in stimulating involvement of industrial units in our reliance on foreign sources for technology either for processes or equipment. We are separately looking into possible incentives to industry (whether in the public sector or in the private sector) for this purpose we are hopeful that enlightened self-interest on the part of industry, together with the proposed incentives would help to give a significant push towards better technological performance through constant research and development on the part of every major industry in the country.

I have not touched upon equally important areas of research in which educational institutions can make significant contribution such as health, family planning, water supply and communications. The general point I wish to make is however quite clear. There has to be an attack at every point where our technological competence is below par, as manifest in undue external dependence or low productivity. Without tackling this problem of technological backwardness, we

can find no lasting solution to the problems of scarcity, unemployment or rising prices.

VI

To the young students graduating from this institution on this occasions, I would like to offer my greetings and my very good wishes. I hope they will secure opportunities for work that are satisfying to themselves and significant to the country at large. But even as you acquire the skills of your trade, let not the awareness of social responsibility be dimmed. Nearly seventy five years back Swami Vivekananda warned of the dangers to our society from the emergence of mentally immature products of a distorted educational system. He referred to such specimens as “moustached babies”, as persons who grow up physically but not mentally or spiritually. Let not our freedom and democracy, won with the sacrifice of so many, be allowed to degenerate and disintegrate, through a deficiency in our educational ideals. Jawaharlal Nehru used to emphasise this while calling upon the young to prepare themselves to shoulder new responsibilities,

I would like to end this address with a quotation from him :

“ My generation is a passing one and soon we shall hand over the bright torch of India, which embodies her great and eternal spirit, to younger hands and stronger arms. May they hold it aloft, undimmed and untarnished, so that its light reaches every home and bring faith and courage and well-being to our masses.”

Thank you.