

ADDRESS BY PRESIDENT

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Hon'ble minister, engineers,

One of the greatest assets of a nation is the ability of her technologists to discover new areas of industrial development and technological services which generate resources and employment. Technologists of several nations have shown such ability to bring about industrial development and employment opportunities. Japanese, Russian, Dutch, Swedish and Italian technologists have shown their ability to hold their own against those of other nations in skill and expertise. It is not enough, however, to have these skills and abilities unless these are effectively demonstrated. It is in this demonstration of their expertise through their enterprise that Japanese, Dutch, Swedish and Italian technologists have made an impact in the entrepreneurial climate of these countries. It is not the capitalist or the industrial magnates that have been the spearhead of the new enterprises but the technologists, the entrepreneur and the banker,

We face in our country a crisis in entrepreneurship and technology getting together which is a serious handicap to rapid industrialisation and modernisation of our country. It is not difficult to think of adding more steel mills or hydroelectric generation when the resources for doing so are adequate. These do not represent entrepreneurship but only an extension of existing trends of activity and thought. A far more difficult and yet worth while exercise is to analyse the profitability as well as employment potentials of various kinds of industries. A detailed analysis of employment potential per unit of investment in various areas/endeavours is a study which has not been carried out so far by anybody. I have also not come across any study by technologists or professional societies of new areas of enterprise, their feasibility in India, their costs, employment potential and their value to the economy. In the situation that we face and are increasingly likely to face this type of task will become extremely important. The Japanese made an intensive study of the possible employment potential when they went into the completely new area of solid-state devices and equipment. Their activities were initiated by fairly detailed investigation almost 20 years ago. It was, necessarily highly speculative and yet because it was taken up jointly by highly competent people of different professions that the possibilities and potentials of new industries were understood. The result of such studies led to the highly successful and very diversified electronic industry as well as the highly precise optical and camera industry in Japan. A similar task was taken and gave rise to the small but highly competitive auto industry in Italy.

Our nation has been facing for some time problems of low economic growth and investments in very conventional areas. The State cannot easily make very diversified investments particularly in a mixed economy situation such as ours. The State can and should restrict itself to the infra-structure and basic investments, such as transport or basic materials. The

technologist and the entrepreneur has the responsibility to go into as many diverse industries as his competence arouse so that the maximum use is made of the potential created. This leads to the production of greater wealth and also gives an opportunity to the technologists to add maximally to the value of materials he is using through his technological expertise.

Because of the heavy investments made initially and the time lag that is taken for training of personnel, we went through a phase of shortage of technological personnel. Obviously, this could not last for a long time unless the rate of expansion of the economy was matched with the increase of technical personnel. Due to wars and draughts, investment fell below past levels and created problems of absorption of technical personnel. Now while the economy is showing signs of recovery, the production of technical personnel is going on almost as previously which means that there is going to be a gap for some time between jobs available and the numbers of technical personnel. There are only two possible ways to solve this problem. One of them is increase our investments to massive proportions. Apart from not having the resources to do so, there are other obvious problems. There is a second way, that of examining very very carefully the areas open to new enterprises due to new technologies in the context of personnel and natural resources of the country.

There are various problems of choice involved, including the sale of investments, the risks, the rate of change of technology which make the selection of new enterprises for investment a fairly sophisticated exercise. There is in addition a problem which we have not taken sufficiently into consideration in the past. The problem is to calculate the investment required per professional technologist in the various new technologies. For example, in a steel mill the investment is usually a few lakhs, say 5 or 6 lakhs for employment of one trained metallurgist or engineer. In areas such as the electronics industry, the investment may be one twentieth of that or less for employing an electronics or communication engineer. However, to discover what ratio of investment to technical employment these new areas of enterprise may have and to decide which would be the correct choice for new enterprises, requires knowledge, skill, and judgment to high degree of sophistication. For example, one must be able not only to be aware of but have relevant information necessary to understand the problems that require solution, the ability to understand the information that is available and to use and manipulate that information. Such entrepreneurial abilities cannot be expected from bankers or even capitalists. We can only expect such sophisticated ability to analyse and judge by technologists and entrepreneurs acting in concert. Finally, to execute such an enterprise requires the ability to create the necessary climate in the country through a scientific and technical leadership of professional societies which will lead to the formulation of enterprises in the right directions which means engineers and technologists have to be extremely competent. Their initial education must be thorough and this must be followed up by courses, seminars, symposia and discussions of your profession at society to continually upgrade the abilities of your membership.

Professional societies, such as the Association of Engineers have the advantage of being a professional society which is closely connected both with the present organisational structure of industry both in the public and in the private sectors, and also a variety of expertise and information available. Some of this information may not have been collected or made avail-

able in a meaningful way but the necessary information is there, I am sure. In addition, your society has the advantage of experience of the resources and the needs which properly analysed, assessed and codified again provides valuable guidance about the directions in which future enterprise can be directed. I would also like to raise the question in this forum that whether professional societies such as yours can play a significant role in encouraging, guiding and catalysing entrepreneurship. As we have seen, it happens in some of the other countries of the world. I can see a large number of difficulties, such as possible conflicts with the vested interests but none of them seem to me to be insuperable. On the other hand, I can see the large amount of skill, knowledge and experience gathered in this hall which no small scale industries service institute of the State Government can provide. One of the interesting developments in the United States was the various petrochemicals established through cracking certain fractions of the petroleum crude. Many of the products so produced had no immediate use until the American Society of Chemical Engineers began to study the various possibilities of the products and suggest various uses for a large variety of industries. These suggestions and help, that the American Society of Chemical Engineers was able to give were taken up not only by many of the members but a large number of entrepreneurs from outside.

The professional association like yours will have to make a three pronged attack in order to encourage and nurture entrepreneurship. These three links are the industry- the professional technologist or engineer and education. You are the link ; your weakness weakens the link between industry and education. And your strength strengthens both. Your strength is in your professional competence and entrepreneurial abilities. I have had occasion to attend meetings of the Institute of Electronic Engineers in the United States. I found every meeting as well as corridors full of entrepreneurs and engineers. I have also noticed the pains that the members of the Institute took to encourage, inform and assist these entrepreneurs in various ways. I also found members themselves take initiative as entrepreneurs, As regards industry, professional associations like yours should make a detailed review of the consultancy services in the country and all available resources in this regard should be pooled together. The consultancy organisations directly or through the professional associations should keep the Government and the users informed about the scope of their activities, the degree of self-sufficiency achieved in any particular field of engineering and the technical know-how available in the country so that the industry do not look to the foreign countries in this regard. The professional associations should also advise the industry to apply new technologies with a view to diversify the products, improve the quality of products and enter new lines of production so as not only to satisfy the internal demand but also enter more into external markets. As regards the engineer, the associations should function as guidance and advisory bureaux. They should not only guide the engineers as to the openings available for them but should also work for bringing in them a change in outlook, attitude and approach so that they no longer look to cosy jobs in Government and private industries. They should be encouraged to become entrepreneurs to take up new industry. Govt. and the financial institutions may also have to help them in this regard. These professional associations should also take up in collaboration with the industry and educational institutions steps to modify and improve the curricula, syllabus, training, etc. for engineering education

so as to match supply and demand to the extent possible. They will have to keep themselves fully armed with facts and figures regarding the manpower projections. It is these constructive and developmental tasks which will increase the utility and importance of engineering associations rather than trade union activities. This will require a lot of rethinking and enterprise on the part of those who man these associations so that they inculcate in their members the spirit of dynamism and enterprise. It is essential for the association leaders to be adoptive and innovative, themselves agent of change if they and their institutions are to survive. They can take advantage of developing countries in opening new vistas for the engineers, entrepreneurs and managers. This alone can help in solving the employment problem of engineers and also remodelling and revitalising the industrial sector.

Entrepreneurship in the present space era is no longer confined to combining land, labour and capital into new production activities. It brings the fourth component of new technology into the classic equation. Modern entrepreneurship needs a knowledge, even, a close contact with technology to anticipate future requirements of society, sometimes even creating them. A successful entrepreneur needs a new creative imaginative combination of technology and resources. In many instances the classical resources of land, labour and capital are relatively less important and critical resource often turns out to be professional competence, skill in organisation, and ability to command the respect of talented and professionally trained people and finally ability to act quickly. Organisations as well as individuals with entrepreneurial skills and foresight regarding the developing needs of society must develop. The development associations and professional society such as yours have, to my way of thinking, has an important role to play. Essential ingredients that entrepreneurs must possess are professional competence, outlook and ability to assemble and assess large amounts of information quickly. Powerful new tools of analysis will tremendously increase the range of entrepreneur's ability to handle large amounts of information and give substance to his imagination. These again are or should be closely related to the outlook of members of a society such as yours. The ordinary entrepreneur has one advantage that the engineer or technologist going into entrepreneurship does not have the advantage of bank and credit support for his activities. Partly this is due to the bank's lack of knowledge and skill in the matter of deciding the viability of technological ideas and partly from his lack of assurance regarding the credit worthiness of a new group of individuals whose credit worthiness is really assessed on technical competence and personal integrity rather than on physical assets.

Modern scientific research and technological development has created a seeming dilemma for industry. Innovation is constantly followed by obsolescence and innovation must be ahead of the race or be devoured. The dual challenges for new knowledge and restricted resource call for an increased emphasis on developing substitutes and new methods. Neither Govt. nor engineers can afford to attach the problems of the seventies with the attitudes of the fifties. Countries like U. S. A, and Russia are moving from a society based on natural resources to one based on human knowledge and skills.

You are perhaps aware that the last year was one of our most successful years in the history of our export trade. The success stories of the export trade of many countries are built on the foundations of dynamic new technologies. The Japanese succeeded in exporting

electronic goods, petrochemical plants, ships, cameras and optical goods. Japanese today build some of the world's largest and most modern ships while the ship builders in Europe are struggling hard to survive. We cannot predict the gains of our export trade on drives and promotions alone. While that is necessary, sustaining the growth of our export trade will primarily depend on our technological and innovative excellence. Export incentives cannot be effective without technological excellence and entrepreneurship on a broad front of our productive effort. Export incentives by themselves cannot add up to a grand strategy of export. Advanced manufacturing techniques, development of new and diverse products, skills of our labour, rational wage and price structures to keep our manufacturing costs competitive are all important factors of any viable export strategy. Organisational ability and technological leadership will be needed in a large measure to keep abreast of new developments and new techniques. New technologies will find a responsive investment climate if our engineers are enterprising enough to take up, as in many other nations, their sponsorship and their promotion. This has not happened in any significant manner in your country so far. I hope however that it will from now on, as more and more engineers and technologists enter industry through building up a variety of new enterprises, manufacturing new products and creating new services.

Perhaps a major deficiency of our engineers is their very traditional education and training which has changed very little in content or approach in the last forty years, particularly in the traditional civil, mechanical and electrical engineering courses. There is lack of developmental and innovative experience in their teaching and training. Of course it goes deeper and conditions are not better in the early years of their general education. The new thrusts of the industrialised nations indicate a shift from being entirely production oriented. There is a great deal of stress on ideas. Industry and education must plan together to produce the raw material needed--the engineers with knowledge and imagination and a spirit of enterprise so that they are able to direct technological progress for economic development and betterment of the nation. The educational institutions clearly have a role in aiding the individual in the development of knowledge, skills, motivation and attitudes which characterises the adaptive and innovative spirit. The task of education for enterprise management will be to provide the climate in which men of rare imagination are nurtured and their full abilities are brought to bear. The professional associations can also render valuable help in this regard. I would like to mention that the Engineering Advisory Council, United States, made a remarkable research in depth in preparing an Engineering Master Plan Study for the University of California in September 1965. The study and its projections were made in an effort to visualise the years upto 2000 in order to help, define a university curriculum able to produce engineers and scientists capable of facing the challenges of that time. Can our professional society of engineers accept challenges of this sort and give a direction to the education of a new type of engineer trained with skill, experienced in actual operations of industry and motivated by a drive to build new paths ?

The other important reason for the lack of enterprise in our engineers has been the soft job opportunity situation of the past thirty years. To take up developmental jobs or

build up one's own enterprise needs a lot of self-confidence, particularly as it is going to be a new enterprise, on the part of our engineers. A new mental attitude of accepting calculated risks needs to develop. Unemployed engineers are considered a problem in our country today. It is a challenge for the entire profession to do some thinking and give a leadership in the creation of an atmosphere in which calculated risks are worth taking for producing a host of new products and services. The new sources of credit and loans have made their task easier today and they are not left entirely to the mercy of the big capitalists. I am sure the Professional Associations like yours will give serious thought to some of these emerging problems and will spearhead movement to turn young engineers and technologists into promising and forward looking entrepreneurs.