TWELFTH CONVOCATION

Dr. Babasaheb Ambedkar Technological University
Lonere – 402 103 (Maharashtra)

Address by the Chief Guest

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Honourable Chancellor of the University, Dr. Ashok Ghatol, the Vice Chancellor, Members of the Executive Council, Members of the Academic Council, Faculty, Distinguished Guests, Ladies and Gentleman and most importantly, the graduating class of 2008,

It is a great privilege for me to speak at your twelfth Convocation. I am delighted to be a part of this joyous occasion. Congratulations, the Class of 2008, on completing an important milestone in your life journey.

I hope you have enjoyed your stay in this salubrious campus and imbibed the best that this institution can offer. An environment in a University is like the womb of a mother, secure, cloistered, and warm and being nourished continually. As you venture into the world outside, you will find it to be competitive, sometimes cold, and vulnerable and a place where you have to seek your intellectual nourishment. You will need all the qualities of the head and heart to survive in the world outside. I do hope each one of you find the destiny that you are seeking and make life joyful and fulfilling. To accomplish this goal, you will need apart from competence a set of principles. Whereas education in a University endows you with competence, principles are your moral compass to charter your journey into the great unknown. Human values such as integrity, honesty, compassion and civility are not taught in classrooms, but are learnt from parents, family, teachers, seers, role models and life's experiences. Armed with competence and principles you can face any challenge, confront any adversity, solve the most complex problems and ultimately come out a winner.

Science, Technology and Innovation: Some Perspectives

On this occasion I would like to share with you some of my perspectives on the role of Science, Technology and Innovation (STI) for the development of India. Robert Solow in the early fifties reasoned that scientific and technical knowledge was a prerequisite for economic development. A decade ago, the *World Bank* in its *World Development Report for 1998* contended that scientific knowledge was one of the most important "global public goods" and asserted that scientific knowledge produces economic and social benefits. Today it is widely acknowledged that science and technology produces essential underpinnings for economic

growth as well as the intellectual ground from which to address educational, environmental, health and other critical needs of the society.

Science and technology has played a critical role in human development launching the industrial revolution in the eighteenth century, transforming transportation systems in the nineteenth century and spurring the rapid advances in information and communication technology as well as new materials in the twentieth century. Today, more than ever, public and policy makers are looking to the community of scientists and technologists to address more complex problems that face humanity. These include global warming, energy security, access to quality water and food, affordable health care and conservation of biodiversity.

In spite of above, a linear model of science leading to technology which results in societal benefits is too simple to be true. In reality, evolution of technology occurs through a tortuous path, beginning from the creation of knowledge or assembly of existing knowledge, the recognition of its application to a public good, the spirit of entrepreneurship leading ultimately to the creation of the goods. A strong foundation in science and technology may be a necessary but certainly not a sufficient condition for economic growth and development.

It is also worth noting that while science and/or technology may be created in one part of the world, its exploitation often occurs in another part of the world. It thus becomes clear that any society which nurtures scientific curiosity and creativity can become an innovation leader, developing the ability to use pre-existing knowledge and transforming it into useful products which can benefit society.

Innovation, thus, becomes the inevitable third pillar to science and technology. The quality of being innovative can be applied to either individual singly or to a group of individuals in an organization or even collectively to an entire population of a country. We speak of high degree of innovation of Japan, Korea and Taiwan in the post War era. Singapore, Israel and Ireland have emerged as innovative nations more recently. It is obvious that the size of the country or its GDP is not necessarily related to how innovative a nation is. Thus, scientific temper, technological prowess and a spirit of innovation are the key attributes that a society must possess if it has to bring the power of science and technology to bear on the problems of its society.

I wish to briefly digress to discuss the definition of innovation. Innovation has become a cliché today, a word often used with little understanding. It is the subject of many treatises and much discussion. Though we all recognize an innovation when we see one and can often trace societal benefits and commercial success to their innovative origin, the essence of the underlying process remains enigmatic. Innovation, according to Peter Drucker, is the means by which a person creates new wealth producing resources or endows existing resources with enhanced potential for creating wealth. All things new are not necessarily innovations and all things innovative do not necessarily constitute technological innovation. An essential element that must be present in a society or in an organization for innovations to occur is a deep, broad and continuously refreshed reservoir of scientific knowledge. Knowledge pool is a requisite but not necessarily a pre-requisite for any particular innovation. A linear picture of orderly succession of increasingly applied tasks strung together in a bridge from pure knowledge to the market is as mythical as it is appealing in its simplicity. The reservoir of knowledge interacts with the users and providers in an apparently random and

less sequential manner. This characteristic is what makes innovation more complex than a mere scientific observation or discovery. Science, by very nature, is based on deductive logic. It is built on systematic experiments and observations leading to hypothesis which when adequately subjected to verification become a discovery. Innovation is far more chaotic with no preordained casual relationship between knowledge produced and its ultimate applications.

Whereas a University can teach an organized body of knowledge such as science and technology, it hardly introduces students to the complex process of innovation. Innovation cannot be taught. It can be leant only by practice, by being part of an organization or society which inculcates, appreciates and rewards the culture of innovation.

Innovation does not thrive in a vacuum. It needs an environment which encourages risk taking and is failure tolerant. Innovation requires an ecosystem wherein through a collaborative process multiple elements of knowledge are combined to offer a coherent solution to a problem. In the absence of such an ecosystem value creation out of innovation is well impossible. Innovation is not just creative endeavour; it is a discipline. It is about creating a perspective within which ordinary people can create something extraordinary.

Science Technology and Innovation: The India Story

There is little doubt that India has arrived on the world stage, as a strong and fast growing economy ready to make its mark and helps transform the world economic order. The economic development is propelled by a productive economy, a young workforce and surging domestic demands driven by an aspiring class. The world has taken notice of India's appetite for technology and innovation. It straddles the entire economic pyramid, rural and urban, young and old as well as the rich and poor. The middle class is set to grow from 50 to 500 million and carry a discretionary spending power of US $ 1.5 trillion over the next fifteen years. By 2020, India will have close to 350-400 million people below the age of 35 who will drive the largest consumer revolution of our times. As of today, there are over seven million science, technology and engineering students in India – an incredible 30 % of the same student population globally. With such staggering figures we can hardly say that we do not possess the necessary human capital to become a hub for innovations.

The geography of science, technology and innovation too is seeing a shift to the emerging economies of Asia such as India and China. However, it must be recognized that the foundations of this growth story goes back to India's independence in 1947. India's rich tradition in science and technology which dates back to 4500 years before now became dormant during the five hundred years of domination by alien forces. Immediately after independence, our founding fathers wisely invested in several institutions of higher learning as well as institutions devoted to research in such diverse areas as atomic energy, space, agriculture, medicine and public health, atmospheric and environmental sciences, oceanography, geology and geophysics, aeronautics and aerospace, chemistry , physics and engineering.

In succeeding decades, Indian science, technology and innovation delivered spectacular successes, namely, the Green Revolution (agriculture), the White Revolution (milk), the Blue Revolution (space exploration), the Brown Revolution (underground atomic explosions) and

more recently the Grey Revolution (information and communication technologies). The journey of Chandrayan to the Moon in November 2008 is symbolic of the maturity that Indian science and technology has gained in a short period of sixty years.

The science and technology landscape of India is in the midst of a major change. For the first time since 1970, India is establishing a large number of institutions of higher learning and research. Public investment in S&T has been increased to Rs. 73,304 crores in the period 2007-12, up from Rs.25, 300 crores in the previous plan period. Links between science and technology on the one hand and manufacturing and economy on the other are increasingly becoming stronger. Technology has, for the first time, entered the centre stage in the national agenda. S&T linkages with socio economic and industrial sectors are also becoming a reality.

Nevertheless, growth of Indian science and technology has not kept pace with the rate of developments in other countries. Competitiveness of India in science measured in terms of publications in papers in journals covered by Science Citation Index does not match the inherent strength of the country. In 2006, India published 38,000 papers (ranked 10th in the world) compared to 340,000 papers from USA and 166,000 papers from China (ranked 1st and 2nd). Investment of India in science and technology as a percentage of GDP (about 1%) is not growing as fast as necessary. India has a paltry 157 researchers for every million people compared to 633 in China, 4526 in USA, 5085 in Japan and 7431 in Finland.

So what are the significant challenges for India if it has to become a power to reckon with in science, technology and innovation? Firstly, we need to attract more young people to careers in science and technology. There is a need to couple more strongly R&D with applications. R&D investments by industries have to increase. Newer models for public private partnerships for commercialization of academic research have to be evolved. Rejuvenation of research in university sector is necessary along with the ability of the research infrastructure to absorb and utilize resources. Share of University sector in R&D has decreased from 50% to 15% during the last 25 years. This trend has to be reversed. The country must judiciously invest into science, technology and innovation infrastructure with a view to attract talent to science, rejuvenating university research and enhancing accountability to the National agenda. To this end, the Department of Science and Technology has recently launched an ambitious programme to attract young talent to science and technology. This programme will cover over one million children in the age group of 1017 (catch them young), providing scholarships to about 10,000 students in the age group of 17-22 to pursue education in science and technology, an additional 1000 scholarships for students in the age group 22-32 desirous of pursuing a Ph D degree with assured career opportunity in research. This programme is aimed at enhancing the number of individuals pursuing a career in research and innovation in science and technology in India.

The future is indeed bright for professionals who wish to pursue science and technology as a career. With both public and private investments increasing exponentially, rewarding careers await those who pursue higher education in science and technology. What India needs more than ever are individuals who can discover, create and innovate. We cannot be mere back office for the rest of the world. Young Indians have to be opportunity seekers and not problem solvers. Opportunity seekers are the ones who will change the world. They create new possibilities.

Sir C.V Raman said and I quote, Indian mind is not inferior; what we lack is courage and the spirit of adventure. If that indomitable spirit were to arise nothing can hold us from achieving our rightful destiny unquote.

My young friends, this destiny is in your hands and minds. Go forth and seize it. Catch the trade winds in your sails. Explore, Dream, Discover and Innovate.

Jai Hind