

Innovation As a Way of Life: Convocation Address delivered by Dr R. A. Mashelkar,
at Maharshi Dayanand University, Rohtak, Haryana on 10 April 2005

1. I consider it to be a great honour and a special privilege to have been invited to deliver the 12th Convocation Address of Maharshi Dayanand University. The products of this University have done the nation proud. There are enormous expectations from everyone about this University role in building the new India.
2. Let me begin by extending my wholehearted congratulations and my very best wishes to the young graduates. You are going to enter a new exciting world, which is changing rapidly. Indeed, you will see a sea-change in the economic, political and technological environment the world over. There are extraordinary opportunities for those, who are prepared to face the challenge of change. Indeed, only those of us will survive and succeed, who will be able to anticipate the change and also exploit the change. And those who do this will one day lead the change. We in India should have the ambition of leading the change and make things happen on our own terms. It is all of you, who will build the new India of our dreams in the 21st Century. This new India of our dreams should be an innovative India.
3. Everyone recognizes that twenty first century is the 'century of knowledge'. Nations, which have developed mastery in the production of knowledge, its dissemination, its conversion into wealth and social good, and its protection, have assumed a leadership position in the world today. But it must be recognized that knowledge without innovation is of no value. It is through the process of innovation alone that new knowledge can be created. It is also innovation alone, which converts knowledge into wealth and social good. In fact, innovation must become a way of our life. Why do I say this India was a leader in innovation several centuries ago? Indeed, since the Indus Valley Civilization of about 5000 years ago, innovation has been a part of the Indian culture and the basis of its civilization. Our innovations were diverse and pioneering. Indian civilization was characterized by scientific thought, capabilities and techniques, at levels far more advanced than others.

4. In spite of this great heritage and record of accomplishments, why did India fall behind in the ensuing centuries? When the scientific and industrial revolutions took place in the west a few hundred years ago, there was a period of stagnation in India. Lack of development over this period was a result of a hierarchical approach, irrational subjective thinking, and build up of superstitions and superficial ritualism. The earlier great traditions were allowed to decay. A highly feudalistic structure of society developed. It was in this state of its society that India came under the colonial domination. By and large, compared to other nations, inhibition and imitation in the society was evident during a substantial part of the twentieth century. We lost leadership position. This cannot continue into the twenty first century. We must regain this position with determined action.

5. We have now an opportunity to start the resurgence of an innovative India today. What do we need to do? We need to build new social, legal and economic structures that will support innovation. We need to make the symbol of 'I' in 'India' to stand for 'Innovation'. I am convinced that just as we had launched a freedom movement, which freed us from the stronghold of foreign powers, we must launch an 'Indian Innovation Movement' now, so that India can assume its rightful place in the comity of nations. And the time to do it is now, at the dawn of the new millennium.

6. The landscape of technology innovation in India is not static. It is continuously evolving. It has undergone a number of positive developments over the past decade. Let us reflect on some of these. There has been a paradigm shift that is reflected in a move from research as an end in itself to research coupled with technology development, with this linkage being increasingly driven by socio-economic needs. The perspective has also shifted from primarily a local or national focus to a global one, with the globalization of R&D being a major driving force. This has resulted in some major transitions: for example, the pharmaceutical sector that was based on formulations of imported drugs in the 1960s has slowly enhanced its innovative capabilities and is now gearing up to compete with the global players. Realizing the power of Indian intellect, we have seen more than 100 top companies from abroad set up their R&D centres here in India.

7. What are India's major strengths in technological innovation? On the human resource front, India has the largest pool of qualified engineers in the world, the 7th largest pool of R&D personnel, and a large cadre of expatriate scientists, technologists, and entrepreneurs,

who are increasingly returning to their home country. On the institutional front, India's assets include numerous institutions of higher learning as well as an impressive array of research centers and laboratories that focus on a large range of scientific and technical problems.

8. Our new innovative India will have to be built by concentrating on our youth, which represents the national strength, vitality and vigour. If properly moulded, the youth can become the champion of our culture, custodian of our national pride and a trustee of the freedom of the country. Our youth must imbibe the spirit of a true innovator. Innovators are those who do not know that it cannot be done. Innovators are also those who see what everyone else sees, but think of what no one else thinks. Innovators refuse *status quo*, they convert inspirations into solutions and ideas into products. Building such innovators will require an all-pervasive attitudinal change towards life and work – a shift from a culture of drift to a culture of dynamism, from a culture of idle prattle to a culture of thought and work, from diffidence to confidence, from despair to hope. Revival of Indian creativity and the innovative spirit needs to be made into a national movement today.

9. Academies must understand the route from *Saraswati* to *Lakshmi*. We must see an expression of entrepreneurship in a scientist and *vice versa*. Technology entrepreneurship will lead to creation of technopreneurs. While creation of high-technology start-ups has been dominated so far by information technology services and software, there is also activity in knowledge-intensive sectors such as biotechnology and IT-hardware. There is also an emergence of innovative models of entrepreneurship. The TeNeT group at IIT Madras, for example, has spun off – with faculty, student and alumni involvement – a series of firms that are engaged in a range of activities from IT product development to provision of technology-based services. Scientists from Indian Institute of Science have set up companies such as 'Strand Genomics'. The nanoscience group at National Chemical Laboratory has had a breakthrough on nanotechnology to make unique materials, which is leading to the formation of a company. We need to multiply such examples manifold in India.

10. How can we induce creative thinking amongst our young people? The young budding inventors can learn a lot from the legendary career of an inventor like Thomas Alva Edison. As we know, Edison was granted a record of 1,093 patents for inventions ranging from

light bulb, typewriter and electric pen to his phonograph and motion-picture camera. His work methods reveal that the real keys to unlocking creativity are an open-minded approach to learning and perseverance.

11. When Edison died in 1931, he left 3500 notebooks, which read like a turbulent brainstorm. It shows Edison's mind at work spanning most of his six-decade career. They offer fresh clues as to how Edison, who received virtually no formal education, could achieve such an astounding unrivalled record of inventiveness.
12. When an experiment failed, Edison would always ask what the failure revealed and would enthusiastically record what he had learnt. He had an enormous talent for appropriating ideas that may have failed in one instance and using them for something else. Whenever he succeeded with a new idea, he would review his notebooks to rethink ideas and inventions abandoned in the past in light of what was recently learnt. He would often jot down ideas others had come up with in other fields.
13. The lessons that we learn from Edison's life are simple. Challenge the assumptions continuously. Do not have a preset or prejudiced mind. Let the windows of your mind be always open. Second, patience and perseverance pays. Third, nothing is final. Strive for creating products that are better than the best. And displace your products yourself. Finally, you can learn more from your failures than you can from your successes. So do not be afraid to fail. Take risks. Indeed, risk taking must become a part of the national innovation policy.
14. Innovators are those, who do not know that it cannot be done. Indian history is full of such innovators. We need to highlight inspirational stories of such innovators, which illustrate the point that even in India, people, who have done 'out of the box thinking' have won and achieved hugely. Mr. Arun Shorie, when he was the Minister handling the Ministry of Personnel, Public Grievances and Pensions, had organized an inspirational series of talks on "ideas that have worked."
15. In this series, several people spoke. N.R. Narayana Murthy spoke of how by putting together Rs.10,000 and starting in his small 700 square feet apartment, he built Infosys. Its market capitalization, at one point of time, was more than Rs. 60,000 crores. Infosys has become a pride of the nation today. Mukesh Ambani of Reliance spoke about building the largest green field refinery complex at Jamnagar with an investment of five billion US

dollars in a record time of 36 months at a capital cost that was 50% lower than similar refineries and commissioning it in 3 months as against the international norms of 6 to 18 months. There were others like Dr. Kurien talking about our white revolution and making India a global leader in milk production in the world. E. Sreedharan spoke about building the 760 km Konkan Railway project in one of the most difficult terrains ever encountered in the history of railway construction by using the most sophisticated technology. Chandrababu Naidu spoke about his assuming the role of CEO of Andhra Pradesh. He has converted Hyderabad into Cyberabad within no time. It is a worldclass city today. Ratan Tata spoke about building the car 'Indica' by using 700 engineers, who had no experience of designing an automobile, and at a development cost, which was one tenth of the international cost. I myself spoke about transforming some of our national laboratories from the 'reverse engineering mode' or 'copying mode' to 'forward engineering mode'. CSIR today exports our knowledge even to leading multinationals in USA and Europe, whose budgets are bigger than India's R&D budgets. And there were others who spoke from different fields, whose ideas had worked right here in India. The simple message is that we can do it in India, in all fields, in all sectors.

16. Innovative India of the future must be compassionate. It should continuously look at the problems of the poor. Problems that affect millions of people every day not get solved through the use of existing scientific models? New innovative India or our dreams must carry that compassion so that the problems of the poor can be solved. We must harness the talent of the scientists so that value can be added to the local, indigenous ability.
17. For all this to happen, we must create a new value system, where problem solving for the poor and the disadvantaged becomes a national mission. Those who contribute to this mission must be made into the national heroes.
18. How can we change our mindset and value systems? Technologies developed by local artisans, craftsmen, potters, farmers, weavers, etc., are considered as traditional. These technologies are never included in the fabric of modern technology. How can we bring about this change. I tried an experiment in Pune during the Indian Science Congress in January 2000. As President of the Science Congress, I said let this Science Congress be 'knowledge congress'. Let it be 'people's congress'. We will show that we value people's knowledge. We had several grass root innovators participate in our science exhibition.

They demonstrated their technologies. None of them spoke English. We had a session, where they made a presentation on their technologies in local languages to around 2000 scientists. They stood on the same platform from which the Nobel Laureates spoke. I must say that they got a bigger applause than ever the Nobel Laureates. I believe the scientists, for the first time, realised the power of innovation that takes place in the field. They also saw the innovative and creative abilities of those, who were unadulterated by the modern day educational system. The realization must now turn to a respect and then to meaningful partnership.

19. National Innovation Foundation (NIF) is helping to build such respect and partnership. NIF recognizes the innovations by grass root innovators, by they farmers, slum dwellers, artisans, school dropouts and so on. NIF set up a national innovation competition five years ago. To begin with, in the first year, there were less than one thousand entries, which increased to fourteen thousand in the second year and in the third year it was more than 21,000. Hon'ble President Dr. A.P.J. Abdul Kalam gave away the prizes to the winners of second and third competition. Many of them were illiterate or semi-literates. The winners during the last year included an eight standard dropout, who developed a cardamom variety, which today has over 80% share of the market in Kerala. The winners included again an illiterate individual, who had developed a disease resistant pigeon pea variety, which became a big winner. These disadvantaged individuals had shown to us as to what they can do by working in laboratories of life by using their power of observation, analysis and synthesis. It is time that we sing a song for these heroes and salute this part of India, which is as vast as it is innovative. Others recognize them but we do not. Let me give an example.

20. What do global giants like General Electric and Motorola have in common with a humble tiffin delivery network comprising 3500 *dabbawallas*, who deliver 1.5 lakh lunch boxes to citizens in Mumbai each day? The *dabbawallas* have the six sigma rating or an efficiency rating of 99.999999, which means one error in one million transactions! This rating has been given to them by Forbes Global, the famous American Business Weekly. But we did not recognize them. Look at the innovation that these largely illiterate *dabbawallas* have done. Their secret lies in a coding system devised over the years. Each *dabba* is marked in an indelible ink with an alphanumeric code of about 10 characters. In terms of price and the reliability of delivery, say compared to a Federal Express System, *dabbawallas* remain

unbeatable. Their business models have become a class room study in some management institutes. By giving this one example, all that I am trying to convey is that the innovative potential of the people does not plummet to zero, when the people are illiterate or semi-literate. They necessarily have to innovate to survive and to succeed. Our challenge in India is to be truly 'inclusive' of all our population in the National Innovation Movement and not 'exclusive' to the privileged few.

21. I would like to end by emphasizing that the future of India can be built by remembering and practicing three things, which are encapsulated in the word 'TI'. Firstly, TI stands for 'Think India'. We must have India in our hearts and minds. As someone had said, India's response to WTO should be WTI, that is, 'We Think for India'. The second meaning of TI is 'Team India'. We all must work as a team, breathe as a team and strive forward as a team. TI also stands for 'Total Innovation'. This means making India truly innovative by changing its social, legal and economic structures. The most important pledge we should take today is that, we should make the national symbol in 'I' in 'India' stand for 'Innovation'. If we 'Think India', work with the spirit of 'Team India' and push forward the movement on 'Total Innovation', then I am confident that India will find its rightful place in the comity of nations, which is right at the top.