CONVOCATION ADDRESS
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A FIVE POINT NEW MILLENNIUM —
INDIAN AGENDA

I deem it a great privilege and an honour to have been invited to deliver the Convocation Address today. The IITs are recognised as world class centres of excellence today and IIT-Delhi is most certainly the jewel in the crown of these set of institutions. Its high rank and prestige among Asian institutions as well as in the world that has been recognised in recent times has made every Indian proud. The alumni of IIT have contributed not only national development, but have brought prestige and honour to India through their innovative spirit, their creativity and entrepreneurship, so ably demonstrated throughout the world. The young graduates coming out today will join this proud brand of IIT alumni. You will have the responsibility to lay the foundation for the new India of the next millennium. I want to congratulate you not only on your achievements but also for the great opportunity that you have in the future to contribute to nation building as we enter the next millennium.

We are awaiting the dawn of the next millennium with anticipation and excitement. But let us look back a little bit. One finds that the Indian gains in the post-independence period are sizeable. We have functioned as a nation in spite of the cultural, social, political, economic and religious diversities. We are a unique nation with unity in diversity and diversity in unity. We have built a vibrant democracy, an independent judiciary, and a diversified and widespread industry. We lacked economic or military clout, yet we contributed significantly to the establishment of an equitable world order.

In spite of all that we have achieved, several formidable challenges remain: exploding population, widespread poverty, illiteracy, squalor, ruptures & cleavages based on region, religion, language and gender threatening the social fabric, urban congestion, wounded ecosystems, critical power and energy situation. Almost as many Indians are below the poverty line and illiterate as the entire population of India in 1950. Another dimension to the challenge has been added by globalization in terms of both economy and geopolitics. Never before in the history of mankind, did a country with democratic dispensation had to feed so many poor and teach so many illiterates and also simultaneously compete with the most advanced countries for a place under the sun. We enter the next millennium, therefore, with a great challenge ahead of us.

In order to meet this challenge and build the new India of our dreams, we will have to create a major national agenda for action. I wish to propose today a simple five point agenda for your consideration. This would be tantamount to launching a second freedom movement with an agenda on -

- Child centred education;
- Woman centered family;
- Human centred development;
- Knowledge centred society;
- Innovation centred India.

Let me elaborate on this new millennium national agenda now.

Child Centred Education

There are deep worries about the way we are building up our ‘Y generation’, namely, the young people, who are expected to build the foundation of the new India.
There is an all round crisis in education. Let me just focus though on science education as an example. The way science is taught in our schools will eventually determine as to whether or not we will have a society which is capable of developing and absorbing technology creatively as well as giving a scientific foundation to our cultural, political and economic fabric. Over the last few decades, we find that our education system has become textbook and curriculum centred and not child centred and there is a great danger ahead of us that the products of our schools will be unable to cope up with the challenges of the next century.

We have to mould the school science education to the mode of ‘learning by discovery’ and ‘learning by doing’ in contrast to the prevailing ‘learning by rote’ method. The child has to become an active participant in the process of learning science through field studies, experiments, observation, recording, analysis and discussions. The prevailing discipline-centred approach must change to a child-centred approach. Rather than memorising the products of science, the child needs to understand and appreciate the beautiful process of science; then only will it develop a scientific temper. The curricula must relate closely to science and technology experiences of everyday life. But equally importantly, we must take into account all the factors that effect the teaching process in the classroom and tackle all of them in an integrated manner. This would involve teacher training, innovative kits to do experiments with, school administration, extra curricular inputs, etc. An examination system that probes not merely the accumulated information in the brain of a child but knowledge, innovation and creativity will have to be introduced.

Modern information technology will allow unlimited opportunities to move education to home. It will mould and build the child by creating an interactive environment that will help us approach the goal of child centred education. We must seize these opportunities here and now.

**Woman Centred Society**

Early this year, I had the privilege of receiving the JRD Tata Corporate leadership award at the hands of the Hon’ble Vice-President of India and he had something inspiring to say that evening to the leading captains of the corporate world and the members of the All India Management Association. He said “The best symbol of female values that has been created by nature is in the form of ‘mother’. Mother is ‘creativity’ and ‘innovation’ personified in solving human problems in the family. She represents excellence, morality, equality not in material terms but as a living cultural symbol practicing these values. Out of all management experiences in business, industry, public service and society, mother is the best manager nature has created. In our intense search for roots of culture, we have arrived at the formulation of ‘human face’ for social, economic, political and technology management. The word ‘human face’ is vague and diffused. The rightful word to strive for is ‘mother face’, which represents the best in everything that nature has produced and society has experienced. Mother’s instinct has sustained Mother India. It is more specific than the word culture itself.

The growing alienation between man and society, which modern-day management practices have to contend with, may find its solution in the management practices which derives strength from the way mother manages her family in small and big ways i.e. Mother Culture!”

These are very poignant and very persuasive thoughts indeed. They bring us back to the stark realization that we have lost somewhere on the way the essence of
not only the "mother culture", as the Hon'ble Vice-President put it, but also the concept of woman centred family. The sharp gender inequalities on one hand and continuing female infanticide on the other hand are pointers to this reality.

The UN had adopted 1994 as the year of the family with an emphasis that the family is the smallest democracy at the heart of the society. But on the other hand the Human Development Report 1993 had said, "No country treats its women as well as its men". There is a paradox here, which we must resolve. A woman centred family will be one, where the woman will be respected, she will be made aware of her duties and rights, she will be made confident and independent, where she will be allowed the full expression of her potential, thereby empowering her to become a dynamic partner in the building of new India of our dreams.

There are several fundamentals, which need revisiting. For instance, marriage may be an important institution for the furtherance of family and society. But forcing a girl into early marriage against her wishes, denying her freedom to marry outside the caste, compelling her to continue to live in matrimony with an undeserving partner, even denying her the right to re-marry – all these constitute oppression in the present day India which need change. The state has brought forth several pieces of legislation to curb these forms of oppression – Child Marriage Restraint Act, the Age of Marriage Act, the Special Marriage Act, the Medical Termination of Pregnancy Act, the Widow Remarriage Act. However, the women have not benefited from the rights and privileges conferred on them by these Acts. These acts will have to become acts of faith. But this is possible only when the mindset of our strongly patriarchal society changes fundamentally.

The new technological developments have the potential to impact the lives of the women enormously. We have seen how the access of women to higher education has become easy. The same flexibilities are available for working too. The emerging IT connectivity offers the women the freedom to work from home and at hours that suit them. Home and office have ceased to be contrary pulls.

Similarly, the advances in life sciences have placed in the hands of women opportunities that were unheard of earlier. A passing reference to the reality of surrogate motherhood through in vitro fertilisation would suffice as it takes the cause of woman's independence a mighty leap further and expands her choices in life. However, technology is a double edged weapon and if not well used, its advance can hurt the cause of women. For instance, today the advance of technology is enabling the determination of the sex of a child during pregnancy. However, I was stunned to hear recently about some statistics of the number of pregnancy terminations. These terminations in the case of a female child far exceeded that of a male child – and this was not in a village but in a metropolitan city. What kind of India will we create if such practices persist?

We must seize the opportunities to create technologies that will suit women. These exist in their creative participation in agriculture linked activities, micro-propagation, plant tissue culture, computer software, disease surveillance, health care systems, A focus on developing and enhancing a woman's entrepreneurial skills and giving her economic freedom will restore her to the rightful place in the family and the society.

Human Centred Development

More than half a century ago, Albert Einstein suggested "we shall require a new manner of thinking, if mankind
is to survive. This new thinking is particularly important if we have to resolve the tension between two irreconcilable trends, namely, demographic projections that the world population will reach 10 to 12 billion by the year 2050; and scientific estimates that the Earth's long-term sustainable carrying capacity at an adequate standard of living may not be much greater than 2 to 3 billion. A minor fraction of world's people consume a disproportionate amount of natural resources. Unsustainable lifestyles on the part of a few and unacceptable poverty on the part of many is going to create a crisis of unbelievable dimensions and we can resolve it only by taking recourse to 'human centred development'.

We cannot have plans of economic development where the human is a bystander. In the new human centred development, the balance of five Es, namely ecology, environment, economics, equity and ethics will have to be achieved. Mere economic development with disregard to equity and ethics will take us nowhere; just as economic development disregarding ecology and environment will be fatal. May be we should look at the issue of equity again. We often talk about equity — which is based on subsidy. But this is not sustainable. The world ‘equity’ must be substituted with ‘dignity’. This can come only through the process of self-employment, which alone can bring self-empowerment. The new engineers and technologists can contribute to making this happen.

It is time that we look at our approach of top-down planning, which has met with mixed success. Participation of local institutions through new technology will need emphasis. Promoting a job-lead economic growth strategy based on pro-nature, pro-poor, and pro-woman orientation to development of technology and its dissemination will need a new impetus. New models to create new micro-enterprises, which are able to add value and generate employment and income will be needed. If the processes of production, trade and consumption have to be localised in these models then developing innovative scale-insensitive technologies, which are still economically viable, will pose new intellectual challenges. My chemical engineering friends, who are graduating today have learned the scaling up of processes. They will also have to learn scaling down of processes. Economies of scale will have two dimensions in a vast country like India. The world size industrial plants will give our industrial houses a global ranking and a global competitive advantage on one hand — but a new economy of scale, which integrates local raw materials and innovative blend of human experience, skills and technologies will provide succour to those who have been deprived and unchallenged so far. Our engineers have remained isolated from these challenges — we need to turn our innovative energies on such challenges, which will be at once demanding and fulfilling — fulfilling because they have a direct bearing on human centred development.

**Knowledge Centred Societies**

Only those nations will survive in the next millennium, who build knowledge centred societies; the others will vanish into oblivion. If the Indian society has to become a knowledge centred society, then it is important that every Indian becomes a knowledge worker, be it a farmer, a rural woman, a mediaman, an artisan and so on.

Let us develop this concept further. A farmer can be a knowledge worker, provided he understands the soil that he is sowing his seeds in, he understands the why and how of the micro nutrient and pesticide addition that he makes, he lives in an information village, where he has the benefits of short and medium range weather forecasting to plan his farming activity and so on.
Innovative experiments for creating such knowledge workers are already on the anvil. For instance, M.S. Swaminathan Research Foundation is creating new knowledge systems in the villages around Pondicherry with its goal of the empowerment of rural women, men and children with information relating to ecologically sound agriculture, economic access and utilisation. Computer-aided information systems are operated in local languages, farmers are being trained to maintain soil health cards to monitor the impact of farming systems on the physical, chemical and microbiological components of soil fertility and so on. Every constituent of the village is thus becoming a knowledge worker.

We need Indian customers to be knowledge workers. They will change the market dynamics dramatically. We take great pride in the white revolution that took place in India. But let us remember those early days, when some producers began diluting the milk and customers could not determine its quality before buying it. It was empowering the customers with knowledge with simple lactometers that put emphasis on quality, and that led to the qualitative and quantitative growth of milk production. Knowledge can get encoded implicitly in the products. For instance, insistence on ecolabeling is nothing other than insistence on the customer being empowered with knowledge about the environmental and ecological impact of the products he is buying and using.

Enlightened citizens, who are knowledge workers will not be guided by misinformation fed by the vested interest groups. They will not stop projects that lead to economic development, but they will stop those, which lead to destruction. They will not burn fields, where modern biotechnological experiments are being conducted with genetically engineered crops, since as sensible knowledge workers, they will try to first understand the core issues before getting into such acts.

In a knowledge society, the knowledge workers will perform different tasks. Some of them will generate knowledge, some will acquire knowledge, some will absorb knowledge and some will communicate knowledge. Absorbing knowledge will involve ensuring universal basic education, creating opportunities for lifelong learning, supporting tertiary education in science and technology, etc. For building true knowledge societies, extending education to girls and other disadvantaged groups will be crucial.

True knowledge societies of tomorrow will make a creative use of modern information and communications technology. Access to information and knowledge will therefore assume a different dimension altogether. The cost of transmitting information and knowledge has plummeted by several hundred folds in the last twenty years and will continue to do so. This will mean that the poor will have an access to information as much as the rich have it. This is a good news for India.

In building the Indian knowledge society, we will have worry about two domains of knowledge. We have commonly focussed on S&T based knowledge. It pertains to a specific form of knowledge domain, which is established through the rigorous methodology of science. In its rigorous form, such a scientific methodology includes observation, verification, repeatability, hypothesis-making, theorization and a formal and universally valid structure based on a minimum set of universal laws or principles.

But there is another domain of knowledge, which has remained unacknowledged. Many societies in the developing world have nurtured and refined systems
of knowledge of their own, relating to such diverse domains as geology, ecology, botany, agriculture, physiology and health. We are now seeing the emergence of terms such as 'parallel', indigenous', 'traditional' and 'civilizational' knowledge systems. Such knowledge systems are also expressions of other approaches to the acquisition and production of knowledge. They were, as yet, neglected by modern science, as the pharmaceutical industry has realized. Indigenous knowledge systems must be sustained through active support to the societies that are keepers of this knowledge, their ways of life, their languages; their social organization and the environments in which they live.

There is a clear need for systematic and in-depth analysis of the parallelism of insights between indigenous and civilizational knowledge systems, on the one hand, and certain areas of modern science concerned with fundamental aspects, on the other. In particular, a strong linkage between the indigenous knowledge holders and scientists is needed to explore the relationship between different knowledge systems. In building the new knowledge centred societies, we will have to be alive to these issues.

Innovation Centred India

Knowledge without innovation is of no value. It is through the process of innovation that knowledge is converted into wealth and social good. Innovative nations lead the world today. When one looks at India, one feels that centuries of subjugation have perhaps undermined our capacity for innovation and creativity, which has got to be revived. We cannot allow the 'I' in India to stand for imitation and inhibition, it must stand for innovation. This requires 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 creativity and the innovative spirit needs to be made into a national movement today, in the same spirit and on the same scale as marked our freedom struggle.

The innovation process will have both forward linkages and backward linkages. The forward linkages will involve technology innovation and production chain, with the consequent process of diffusion representing a further forward linkage. For India, equally important is the backward linkage in the innovation chain, which pertains to literacy, science education, public awareness, the mass media and the use of innovation in science itself to further these.

When it comes to technology innovation, there are three types of technology innovations that stand out. Firstly, there is a large system innovation (such as a man on the moon mission), incremental innovation (such as development of an improved fax machine) and finally radical breakthroughs (such as an accidental breakthrough leading to the antibiotic industry). These invariably take place in formal systems of innovation, namely universities, individual inventors, industrial R&D laboratories, etc. Often not recognised is the technology innovation that takes place in an informal system of innovation, be it by artisans, farmers and so on; the grass root innovators.

India has done well in many large system innovations, be they the green revolution, the white revolution, our innovations in our programs in space, defence, atomic energy and so on. The interesting feature of the latter innovations is that they have survived, succeeded and delivered in spite of the technology denial regimes. In fact in some cases, the innovation movement has been boosted due to a denial regime.
Whereas India will build on these great successes, it is fostering the innovative spirit of an individual technopreneur that will need a great thrust, and such technopreneurs exist in cities, in villages, in homes and in streets. In particular, we will need a special focus on community knowledge and community innovation. To encourage communities, it is necessary to scout, support, spawn and scale up the green grass root innovation. It will generate employment on one hand and it will use natural resources sustainably through linking of innovation, enterprise and investment. One will need new innovative models of development, employment generation and conservation of natural resources.

Such movements are beginning to take place. One needs to build more organisations like Gujarat Grassroots Innovation Augmentation Network (GIAN). GIAN has attempted to set up venture capital fund for small innovation providing for its linkage with R&D and scaling it up into viable enterprise. The recent effort by DSIR and DST to set up a Technopreneurs Promotion Programme is also noteworthy, since it provides the much needed financial support for the first time for individual innovators, be it an artisan, a farmer, or a school boy. Setting up of the National Innovation Fund, recently announced by our Hon'ble Finance Minister in his budget speech, is another step in the right direction, since it will help create a national register of innovation of these grass root innovators and will also help the process of taking these innovations further to the market place.

We will have to build new institutions, who will look at innovation in a non-static way. For example, India has a number of outstanding schools of management. Whereas they do an excellent job of providing graduates in management of business, finance, marketing, etc., there is no thrust on technology management – more importantly on knowledge management, and most importantly, on innovation management. What is so special about innovation management? Let me explain.

There is a conflict between the standard management practices and good innovation management practices. Standard management practices are based on avoiding conflict, whereas innovators are bound to create conflict. The process of innovation brings in spontaneity and exceptionality. Standard management practice is based on how well a job has been done. Innovation leads to things that have never been done before. What kind of management do we need to have then, if that job has not been done before at all? Innovation management is not based on turn around strategy. It is based on turn around thinking.

In the new innovative India, innovators will convert inspiration into solutions and ideas into products that will be world class. But such innovators will have to be nurtured and supported by understanding the real dynamics of the process of innovation. True innovators are those who refuse to preserve status quo. Their incentives are personal and emotional. They are not institutional and financial. They enjoy the fun of creation, the admiration received from them by their peers, and the excitement and glory of taking part in a total process of creation.

Tomorrow's industries will be knowledge industries. For a cash poor country like India, the emergence of knowledge industry is a great news. But to harness the full potential of these new knowledge industries, we will need a fundamental change in the management structures. Around the world, top management is always the grand strategist and decides on the allocation of resources, and the lower management merely implements and administrates the strategy. For sustaining innovation, the new management will create
only an overarching purpose and an environment in which the people have the freedom to deliver. This means the emphasis will shift to defining the purpose of the organisation, setting the right process and getting the right people and empowering them to deliver. The shift is from the rigid strategy-structure-systems model to the purpose-process-people model in the new innovation strategy. To lead such organisations, we would also need new leaders who will innovate, promote innovation, who will dare, who will set stretched goals, and who will risk. There is a definition of an innovator. It says that innovator is one, who does not know that it cannot be done. We will require leaders who will instil this spirit in everyone.

I have emphasised so far on S&T based innovations but the concept of innovation is a much wider one. It is particularly important to recognise the need of social innovation. Innovation in India’s social and economic institutions, in the system of their governance is as crucial as innovation in the products and production processes of its economy. We must also recognise that innovation cannot arise by itself; it is generated and sustained through the efforts of its people. The Government needs to create an environment, in which innovation flourishes. Otherwise the innovators will either play safe and not innovate, or they will leave to become a part of other innovative societies, which encourage innovation, as India has seen to its dismay; since a lot of its young sons and daughters have left, not due to the lure of the physical income alone, but because of the psychic income that they gain in those innovative societies. We must reverse this process with speed and urgency.

India was a leader in innovation several centuries ago. These innovative contributions ranged from the decimal place value counting system using nine digits and the zero to the highly developed holistic philosophy and practice of Ayurveda, which was so different from the approach of western medicine. Many developments in mathematics, which bear the names of westerns today, took place in India. We had great innovations in astronomy, chemistry, metallurgy, sophisticated aspects of grammar, linguistics and logic as a part of philosophy. There is another definition of an innovator; he is one who sees what everyone else sees but thinks of what no one else thinks. The India that I am speaking about thought ahead of the rest of the world. Can we not bring the spirit of that glorious innovative India back? Indeed we have an opportunity to start the resurgence of an innovative India today. This will not only entail building new social, legal and economic structures that support innovation, but also making a national symbol of ‘I’ in ‘India’ to stand for ‘Innovation’. The ‘I’ in IIT will then stand for innovation, ‘I’ in industry will stand for innovation and ‘I’ in every individual will stand for innovation. It is this innovation centred India that will lead the world and not follow it.

Finally

Let me sum up by recalling the five point new millennium Indian agenda that I propose we launch in the year 2000. It is simply –

- Child centred education;
- Woman centered family;
- Human centred development;
- Knowledge centred society;
- Innovation centred India.

This agenda links the child, the woman, the human, the society and the nation. It focuses on equity, or dignity if you like, with growth. It emphasises bringing back the values and culture for which this country was so famous. Almost all conceivable programmes
become a subset of this agenda. For example the burning problem of population growth will be addressed meaningfully only when we build a woman centred family, with education to the female child being its essential fulcrum. Our environmental agenda is subsumed in the human centred development. Building a globally competitive Indian industry will automatically follow when we get the fundamentals of knowledge and innovation centric approaches right. These five Mantras could be the guideposts for the future.

Let us take a pledge. When we move out of the portals of this great institute today, we will take this new millennium Indian agenda with us and we will commit to it. And we will do so because we believe that it is then and then alone that we can build the new India of our dreams, which will finally occupy its rightful place in the comity of nations. This will happen as the dawn of the next millennium will turn into a morning and what a glorious morning it would be for India.

Thank you.