

Towards a Knowledge Society: Its relevance in the 21st Century

By

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It is a great honour for me to be delivering the 39th convocation address in this remarkable institution that has contributed richly not only to economic development in India but has also helped to raise this country's flag high in several developed countries in the world particularly in the USA. I myself began my career as an engineer, but from that initial experience have drifted into other areas which have taken me to exciting fields of human endeavour. However, I do realize that the power of precision thinking that the engineering profession provides the human mind with remain an important asset in any field that one ventures into after a basic engineering education. I owe a great deal to my undergraduate education as an engineer and the intensive practical training I received as part of that curriculum.

Institutions like IIT Delhi have today a much more significant role in defining future actions and initiatives that human society is likely to take than has been the case in the past. This is because I believe human society has before it a set of

complex choices that would require an unprecedented level of knowledge to avoid any regrets that we may have in the future if we ignore the relevance of intellectual activity and output. While policies and decisions both at the international and national levels would naturally involve clear assessment of socio-economic and political realities, the sharpest definition of choices will come basically as a result of work to be undertaken in the scientific and technical fields. Even more than this fact is the reality that solutions to some of the gravest problems facing us will come from the development and dissemination of technological choices. I would like to illustrate this observation with examples from two areas that I am aware of. Firstly, let me refer to the problem of depletion of the ozone layer that scientists reached conclusive evidence on during the 1980's. The enormous harm that thinning and depletion of stratospheric ozone could cause to human life and human well-being were accepted by most scientists and decision makers in developed and developing countries, and within a short period of time the multilateral system under the United Nations was able to come up with an effective means to begin reversing the damage that had taken place. But this became possible only with the rapid development of substitutes to a range of chemicals which were causing this problem, namely chlorofluorocarbons (CFCs). The Montreal Protocol has clearly been an effective instrument for first halting the damage to the earth's ozone layer and then beginning to reverse the harm that has taken place by mandating a move towards substitutes to restore a balance over time. Overall, this has been a remarkable example of success involving all the governments and people of the world, which if it had not occurred could have caused untold loss in terms of human morbidity

and mortality quite apart from harmful effects on agriculture and several other economic activities. This whole experience reflects the triumph of knowledge in changing human activity drastically for the benefit of all living species on this planet.

An even more daunting challenge that faces the world today and solutions to which would require worldwide mobilization of knowledge is the problem of climate change. Significantly this problem has been acknowledged and understood by a growing number of people across the globe largely because scientific knowledge related to both natural as well as human induced climate change has expanded substantially, largely as the result of 20 years of work carried out by thousands of scientists under the banner of the Intergovernmental Panel on Climate Change (IPCC). This body was established in 1988 as a result of a resolution by the UN General Assembly. The year 1988 was a period when a severe drought and high temperatures led to much greater focus on the question of human induced climate change in North America. The concerns that arose as a result were certainly instrumental in the creation of the IPCC, because the feeling among the leadership of most countries and those who are responsible for shaping public opinion worldwide was that credible and objective scientific efforts were required to unravel the scientific basis of climate change and its impacts. Since then four assessment reports have been produced by the IPCC as well as several special reports, which quite apart from the scientific content and findings that they contained have received considerable acclaim for their

usefulness and credibility, largely because of the process by which the IPCC functions.

At the start of an assessment cycle in the IPCC a scoping meeting is carried out involving several dozens of experts drawn from all over the world to come up with the outline and scope of the proposed assessment. Governments and other organizations are then invited to propose authors for the report, who are selected by the IPCC Bureau on the basis of their scientific work and professional credentials. As an example it can be mentioned that the Fourth Assessment Report of the IPCC which was completed in the year 2007 had altogether around 450 scientists and experts from all over the world who actually wrote the report. In addition, there were approximately 800 contributing authors who are invited to submit written material in areas of known scientific expertise that they possess. Drafts that are written up are peer-reviewed at every stage, and every single comment that is received is clearly logged, and the authors go through them carefully to accept or reject what is submitted by the reviewers as comments. The action taken on each comment is carefully recorded and is available on the website of the IPCC. As a body, the decisions of the IPCC are taken by consensus, involving all the governments of the world. Finally, when a Summary for Policymakers is prepared for each report it has to be accepted literally word by word by all the governments of the world, who are members of the IPCC. This is an extremely rigorous process, which can be time consuming since, in keeping with the mode of operation of the IPCC, every text has to be accepted and approved by consensus. The entire IPCC process and the

procedures are rigorous and thorough, characterized by overwhelming openness and transparency, which certainly contributes to the credibility of the Panel's output.

A valid question that can be asked would be on why the IPCC as a scientific body should have any impact on global or national decision making at all? The answer lies in the fact that climate change is now one of the biggest threats facing human society and all forms of life on this planet. The Fourth Assessment Report of the IPCC which was completed in 2007 has come up with some extremely important findings which require action at all levels across the globe. For instance, it has been found that the warming of the climate system is unequivocal. In other words based on observations extending over several decades, it can now be stated conclusively that the climate system of the earth is changing. What is equally significant is the fact that average Northern Hemisphere temperatures during the second half of the 20th century were very likely higher than during any other 50 year period in the last 500 years and likely the highest in at least the past 1300 years. But changes in temperature and climate are not characterized by smooth, linear increases in temperature. There are several other aspects of climate change, which result in negative impacts on established patterns of economic growth and welfare. For instance, heatwaves have become more frequent over most land areas. An example of this can be seen from the experience in Europe during the year 2003, when almost 35000 deaths took place, mostly in and around the city of Paris. Also significant is the fact that more intense and longer droughts have been observed over wider areas since the 1970s. In Africa in

particular about 25% of the population already experiences high water stress. The frequency of heavy precipitation events has also increased over most land areas. An example of such events can be seen from what happened in 2005 in the city of Mumbai, when the entire city was paralyzed, and several persons actually lost their lives on account of flooding and accumulation of water.

The IPCC Fourth Assessment Report dealt with several aspects of climate change including the serious impacts that are likely to take place in the future. The range of temperature increase projected for the end of the 21st century is quite large, simply because scenarios of economic growth and development as well as changes in technology, patterns of trade and investments etc. can vary substantially. However, two important figures were provided in the findings of this report, which focus on a best estimate of 1.8°C at the lower end of future projections and 4°C at the upper end of the scenarios assessed. It would be relevant to mention that average temperature increase during the 20th century was around 0.74°C. This combined with even the lower end projection of 1.8°C can be quite serious, because resulting from such a change several existing serious conditions would get exacerbated through the impacts of climate change that would occur. These would include more frequent and severe heatwaves, serious impacts on agricultural yields, scarcity of water, damage to ecosystems and a series of health effects both on account of more frequent and more severe extreme events as well as an increase in vector-borne diseases. For large numbers of people living in low-lying coastal areas and the small island states, sea level rise would present a grave threat. It is, therefore, in the interests of human

society to do everything feasible to prevent some of these harmful impacts which would get progressively worse if we do not curb the use of fossil fuels.

There is need for the world to embark on a path of stringent mitigation of emissions of greenhouse gases. Fortunately, this would not be a costly approach because the IPCC has examined a range of measures that could be adopted, and found the costs to be extremely feasible. For instance, if one of the paths of mitigation identified by the IPCC were to be pursued, the total cost to society worldwide would be less than 3% of the GDP in the year 2030. This is clearly not a high price to pay, because in real terms all this would mean is that the level of prosperity that the world would have reached in 2030 would at worst be delayed by a few months or a year at the most. Such an approach would be extremely vital, because it can then avoid and prevent some of the most harmful impacts that are likely to occur if no action were taken. There are at the same time several co-benefits associated with mitigation. These include higher levels of energy security, lower levels of air pollution and, therefore, enhanced health benefits as well as the possibility of a substantial increase in employment, particularly if centralized systems of energy production give way to decentralized and distributed technologies for energy, particularly in the rural areas of the developing world. In other words, a large number of mitigation measures can be described as win-win opportunities, because not only would there be substantial benefits to society that would accrue but these would perhaps also help to address the imbalance that exists currently between developed countries which are getting richer and large sections of the developing world who can hardly meet

their basic needs as a result of lack of economic development. Technology and new knowledge would be a major driver towards achieving a more equitable pattern of development.

The reality is, as we have seen from apparent shifts in decision-making based on public awareness in the case of climate change, that knowledge would drive many critical decisions in the future, particularly as they relate to serious societal issues and a detailed assessment of consequences which may not appear manifest at this stage. The scientific assessment of climate change clearly illustrates this point, because when in the middle of the 19th century Britain embarked on a phase of industrialization, few people knew anyway what the implications of rapidly growing use of fossil fuels would turn out to be. There were certainly some voices and scientific concerns highlighting the problem of continuing use of fossil fuels which it was predicted would lead to climate change and global warming. One outstanding scientist who worked on this subject over a hundred years ago and actually received the Nobel Prize in Chemistry was Svante Arrhenius who highlighted the danger of reliance on fossil fuels and the associated threat of climate change. For almost a century thereafter leaders of countries and those who shape public opinion ignored this scientific warning, till the IPCC was established providing a credible institutional base for understanding the complexities of climate change.

It is true that several human activities today are likely to result in negative consequences. It is efficient and prudent for us to fully grasp their consequences

today before we embark on them rather than try to correct the situation when the damage has already been done and the situation has gone out of hand. I foresee the role of knowledge in society assuming dominance and effectiveness beyond anything we have seen in the past. This, of course, will also impose a huge responsibility on those who are in the business of creating knowledge, because they would now have to be much more accountable to society than their predecessors were required to be in the past. It is institutions like IIT Delhi that will have to show the way not only in terms of influencing society and its decisions through a rigorous interpretation of scientific and technological phenomena being experienced in the world, but by also creating technological solutions that go far beyond what is available today. The pace of knowledge is growing rapidly and ideas as well as technological solutions would get obsolete soon after they are created. It is, therefore, vitally important for knowledge workers and knowledge institutions to keep renewing what they know, so that the danger of obsolescence does not overtake them. Institutions like IIT-Delhi would need to enhance their research activity substantially not only to keep at the frontiers of knowledge but also to make it available for commercialization and practical application. Society expects this of you as the torchbearers of modern technological education in India & a reservoir of knowledge. May you all succeed and shine in your mission.