

**CONFERENCE OF EXECUTIVE
HEADS**

Adelaide , Australia, 11th April, 2006

“Innovation and the University System”

by

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1. INTRODUCTION

Science and Technology are the drivers of growth in an economy. But measures of progress in Science and Technology have many dimensions. Publications in reputed journals is a measure of basic research, which should be globally competitive. Basic research is a cultural necessity in any civilized country, which should allow the highest intellects to work on fundamental problems of their choice. All other research and development should be related to the needs of industry, to the requirements of what the country considers as critical technologies, and for the benefit of society. The measure of progress in applied research and technology

Plenary 2, “University Futures”: New Roles, New Rules, New Forms, Association of Commonwealth Universities Conference of Executive Heads, 11th April, 2006

development related to the needs of industry is in patents – not just the number of patents but the right kind of patents which creates wealth for the company and the country – and in innovations which are converted into useful and marketable products. The critical technologies for India, arrived at after a technology foresight analysis, include strategic technologies – nuclear, space and defence-related; advanced manufacturing and process technologies; knowledge-intensive technologies like information technology, bio-technology and nanotechnology – and a convergence of these technologies like bioinformatics and nano-biotechnology; and technologies needed for small and medium enterprises and technologies related to rural development.

2. CREATIVITY AND INNOVATION

Knowledge is people. It is obvious, but not often understood, that science is done by individual scientists – though they may often work in large teams like in experimental high energy physics – and that technology is developed by individual technologists – though they may often work in large teams like in nuclear reactor design. So it is important for a country to retain the most talented young people in science in scientific careers and those who show high potential for applied research in technology development.

The country has the responsibility to make such careers attractive. And the universities have the responsibility to maximize the talent in such young people. As A.N. Whitehead has said: “Youth has imagination, Age has experience. The purpose of University education is to transfer knowledge without destroying creativity.”

Creativity is needed for innovation. And innovation is likely to drive the world economy in the coming decades. Global innovation leadership in select areas would be the aim of all countries. The larger countries, including India, would seek innovation leadership across the board, in all science and technology areas. It must, however, be recognised that innovation goes beyond science and technology.

3. ACADEMIA – INDUSTRY INTERACTION

There is need to enhance in India the interaction between the national laboratories and universities on the one hand (for convenience, I shall use the term ‘academia’ to include both) and the industry on the other. It is accepted that Universities and research laboratories are good in research and generally poor in development. Industry is good in delivery and again poor in development. So there is a need to develop interfaces between the University System and the Industry. The Technology Information Forecasting and Assessment Council

(TIFAC) of the Department of Science and Technology is one such interface. The Core Advisory Group for Automotive Research (CAR) set by my office, is another successful interface. Here I must mention that such interfaces are likely to be successful for industry sectors which are booming and, therefore, are keen on Research & Development; the automotive sector is booming in India now. Seeing the success of CAR, other sectors like the machine tool industry have approached us to establish similar interface structures.

TIFAC does this through colleges and Universities in the proximity of Small and Medium Enterprise clusters in some specific technology areas. There is a pedagogic component leading to Bachelor's and Master's Degrees and short-term courses for technicians as well as for specialists and also a research and development component. There is considerable flexibility in establishing more than two dozen Centres of Relevance and Excellence (COREs) in colleges cross the country in areas ranging from fireworks safety and environmental engineering to rapid prototyping and network engineering. This very successful model of academia-industry-government interaction is being expanded.

4. RURAL TECHNOLOGY DELIVERY

The Rural Technology Action Group (RuTAG), also nucleated by my office, has been planned to occupy a special niche in rural technology delivery. All scientists in India I know of want to do something for rural development. But active scientists – active in their own field – are not the best people for grassroots intervention. Fortunately, in India, there are scientists who, for their own personal or emotional reasons, have started to live in rural areas and have started voluntary organizations which have implemented many technology solutions up to a point. RuTAG takes them beyond that by networking them with Universities and national laboratories. RuTAG has made small beginnings but has already been successful in areas like technology delivery for improving rural processed foods and in bringing isotope hydrology techniques for determining ground water connectivity in hilly regions. RuTAG also works with governmental organizations.

5. THE NEED FOR 'COHERENT SYNERGY'

The Science & Technology efforts of a country have many components – human resource development, research & development with prioritization, academia-industry interaction, international cooperation and so on. Each effort requires synergy among the concerned parties. Each such

synergetic effort gives the nation a momentum for development. But momentum is a vector. If you want rapid national development, there must be coherence, involving phase relationship and space-time synchronization, among all the efforts! Synergy in every effort and coherence among all the efforts. This is what I call 'Coherent Synergy', a phrase I coined a few years back in the Science & Technology context. Here, as you see, human resource development- the responsibility of the University system - has to play a very important part.

If a country wants rapid national development, it must introduce 'Coherent synergy' in its science & technology efforts, it must have technology foresight to make the right technology choices at any point of time in a national perspective and it must have a robust innovation ecosystem. In all these, I see new roles for the Universities.