

## INDIA: EMERGING KNOWLEDGE SUPER POWER

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### Introduction

In the most competitive world, never before there has been such a race among nations to become a “Powerful Nation”. I am of the opinion that to become a powerful nation we need to have economic power, military power and knowledge power. Today we are the eleventh fast growing and vibrant economies in the world. The whole world is watching us. Our military power is getting stronger day by day because of motivated professional forces, weapon technologies they possess and development of home grown defence technologies. Before I proceed to knowledge power, I want to take you back to industrial era (1865 to 1960) when industrial revolution took place. India could not take a lead role in the industrial revolution and missed the opportunity. Industrial revolution was followed by the information era, which has been witnessed by most of the audience in the hall. India took lead and made tangible impact and drew the global attention. Presently we are in the knowledge era. What is knowledge era? It is step beyond information.

### Global Production

I may refer the 19<sup>th</sup> February 2005 dedicated issue of New Scientist. Its cover page reads “India: the next knowledge super power”. It is indeed a moment of pride. It started when the news began to appear in the international media suggesting that India was “stealing” jobs from the wealthy nations – not industrial jobs, like those who had migrated to South-East Asia, but the white – collar jobs of well-educated people. Today

we know that the trickle of jobs turned into a flood. India is now the back office of many banks, a magnet for labour -intensive, often tedious programming, and the customer services voice of everything from British Airways to Microsoft. In reality, the changes in India have been more profound than this suggests.

### Beginning of Knowledge Revolution

Over the past five years alone, more than 100 IT and science – based firms have located R&D labs in India. These are not of drudge jobs; high – tech companies are coming to India to find innovators whose ideas will take the world by storm. Their recruits are young graduates, straight from Indian universities and elite technology institutes, or expats who are streaming back because they see India as the place to be – better than Europe and USA. The knowledge revolution has begun. It is the West which has started realizing not only the present strength of India but also its futuristic projections of growth. It places a greater responsibility on our scientists and academia.

### Glorious Past of India as Knowledge Repository

India was once upon a time the repository of knowledge, giving it to the world through Vedas, Upanishads, Ayurveda, the great epics and a great center of learning like Nalanda in the fourth century in Chandragupt Maurya period when Fahaiun came to India and Vikramshila in 7<sup>th</sup> Century during Harsha vardhan period when Huansen came to India for higher learning. It is worth recalling the Sangam age, the glorious literary period of Tamil Nadu renaissance. India is marching ahead to occupy the leadership position in the knowledge Era once again emerging as a knowledge superpower thereby completing the circle.

### Knowledge Grid

The impact of IT industry has been enormous in 1999 when the IT industry has contributed only 0.3% of India's GDP while in 2004 it increased to 1.3%. I would like to reiterate the concept enunciated by His excellency Dr APJ Abdul Kalam on "Knowledge

Grid” which emphasises the need for networking and connectivity of the knowledge centers, i.e. Universities, IITs, NITs and R&D Centers through electronic connectivity using IT which is one of our core competence and broadband telecommunication. This will help to share the knowledge and expertise even to the remote place and rural areas thereby enabling the students sitting in a remote village of Tamil Nadu to avail the benefit of the lecture of a Professor of IIT Khargpur on-line. I would like to illustrate this concept using a successful model, which emerged from the State of Tamilnadu. A student Mr Ashok Jhunjhunwala of Indian Institute of Technology in Chennai had developed a low cost technology that can connect the places at a very low cost. Village Pinjavakkam is one of 93 places in the area that are part of his most successful project so far. Mr. Jhunjhunwala has connected these sites to the Internet via a system he developed and called corDECT, which exploits essentially the same digital technology that connects a domestic cordless phone to its base station.

### University – Cradle of New Knowledge

Universities are the hub of dynamic and creative young minds when synergised with experienced faculty should act as a seeding and breeding ground for new innovative ideas and technologies thereby leading to advancement of science and development of home grown technologies. I would appeal to the university faculty to lay emphasis in research on specific goal oriented research topics, which are relevant to national needs and some time specific to the region. One need not be enamored of undertaking only blue-sky research but also take up low tech R&D leading to products required in high volume.

### Clarion Call

I give a clarion call to the young doctoral and postdoctoral students to involve themselves in nation building by generating creative knowledge that should help in realizing the mission of the nation to become the knowledge super power. You my younger friends have the profound ability to create, immense energy to work much

longer which need to be harnessed. The time has come to inculcate the new approach of public-private partnership in higher education and R&D. Industries and corporate can adopt the university and then they can mentor and monitor them to make them a center of excellence. We should facilitate our universities reach to the pinnacle of excellence thereby attracting the faculty and the students from other parts of the globe.

### India – a Promising Knowledge Economy

What's good for one science based industry may be good for others as well. India has a thriving pharmaceutical industry base, which is restructuring itself to take on the world and biotechnology is also taking off. The attitude is growing that science cannot be an exclusively intellectual pursuit, but must be relevant to economic and social needs of the society. The hope among some senior scientists and officials is that India can short cut the established path of industrial development and move straight to a knowledge economy.

### Need for Path Breaking Research

Bringing research round to a more commercial way of thinking is not the only issue that academia must face up to. Another cultural problem according to some scientists is that too often institutions have an ethos of playing safe. Researchers who devise and test daring theories are criticized if they fail, discouraging the kind of path-breaking research that India needs. The responsibility lies with the senior faculty to ignite and nurture the fertile creative mind so that the time taken from mind-to-market gets reduced.

### Adequate Funding for Universities

There is a widespread view that the entire university system needs an overhaul. India awards about 5000 Ph.Ds in science every year, it should be producing 25,000. There are funding problems, which impede running of some universities, particularly those run by state governments. In response, central government has decided to select

30 universities, give them extra money, and mentor and monitor them to create a series of elite institutions.

### Science as an Attractive Career

But such changes will be futile if students choose not to opt science as their career. In recent years, increasing numbers have chosen to opt for IT Profession and management because these are more lucrative. IT and outsourcing has improved the economy and quality of life of people, but has had a negative effect on science, It is presumed that as science based companies grow, and demand for young professionals increases, salaries will rise and more students will opt for science. The synchronization is required between quality of science education and emerging futuristic needs.

The knowledge revolution is already percolating down the ranks of India's middle class. One of the critical issues facing India is the gulf between the academic world and industry. The concept that scientific ideas lead to technology and from there to wealth generation is not yet widely accepted. This stems in large measure from the attitudes prevalent before 1991. Before economic liberalization, competition between Indian companies was tame and so they were under no pressure to come up with new ideas, nor did academia promote their ideas to industry.

### IPR-Related Issues

India's attitudes to IPR issues are the product of that mindset. The country has no tradition of commercialization of knowledge, and only recently have institutions and academia started spinning off companies and filing patents in earnest. Most applications filed in India still come from foreign companies. Until recently, the country did not recognize international patent rules, which perhaps hampered interactions with foreign companies in much more commercial terms. I think the patents filed in India was very less because industry was not interested. To cite an example, DRDO used to file about a dozen patents in a year, a decade back whereas the number has now grown to 150 per year and the case is similar in CSIR also. The other aspect of patenting

is that the western countries were smart to file patents on the Indian traditional knowledge. We need to be vigilant and careful about such well known episodes like that of Neem and Turmeric.

### Knowledge Security

Knowledge is believed to get doubled every five years. India is predicted to become knowledge superpower (New Scientist Feb. 2005). At that time India would be one of the largest custodian of knowledge. It shall be our concern to manage, share and harness knowledge. While sharing we must ensure knowledge security by IPR protection, information security and strict regulations.

These problems must be solved if India is to capitalize on its recent gains, and there are hopeful signs that Indian science is improving in the global scheme of things. Its share of the highly cited publications has been growing, but it is starting from a very low base. The government spends only \$6 billion a year on research and it still has only fewer scientists among total population than China or South Korea.

### DRDO Role

Defence Research & Development Organisation (DRDO) during the last three decades has developed a strong knowledge base in critical defence technologies leading to the indigenous development of Missiles, Main Battle Tank, Light Combat Aircraft, Radars, Sonars, Torpedoes, and Life Support Systems for the soldiers. These endeavours are primarily aimed to meet the military hardware requirements of the Nation while providing the spin-off benefits to the society at large.

DRDO has been able to network the knowledge base available in the Universities and other academic Institutions through the formal mechanisms of interaction. We have Research Boards, Societies and extra-mural funding support for R&D in the Universities, which has paid rich dividends in our mission for achieving considerable level of self-reliance in critical defence technologies for the Nation. DRDO proposes to establish its R&D Centres in the Universities located in five different zones of the

country. Two have already been established: one on High Energy Materials at the University of Hyderabad and the other on Life Sciences in Bharathiar University, Coimbatore. Three more Centres are being planned. Triangular partnership among R&D Institutions, Academia and Industries is essential for faster knowledge generation. I am glad to note the Tamil Nadu Government has taken very important initiatives in this direction as seen from Industries and R&D Institutions establishing the Centres of Excellence and Technology parks in the universities of Tamil Nadu

### Home Grown Technologies

We have also been able to interface industries in our R&D ventures in developing sub-systems, devices and components. In this process, the industrial base in the country gets strengthened. Some of the important spin-off technologies are related to automobile engineering, lubricants and paints, agro-food, pharmaceuticals and bio-medical instruments. We have geared up our research in the fields of NANO Technology, MEMS, Information Technology and Bio-technology with particular reference to its application for defence R&D. Thus DRDO is striving for making valuable contributions in the transformation of India as a 'Knowledge Power' to reckon with.

### Conclusion

The rewards for India of a thriving science-based economy could be huge. The investment bank Goldman Sachs estimates that if India gets everything right it will have the third largest economy in the world by 2050, after China and the US. India is not yet a knowledge superpower. But it stands on the threshold. I am more than confident that we shall once again be the knowledge superpower thereby making India a nation not only of ideas but of opportunities too.