

ROLE OF TECHNOLOGICAL INSTITUTIONS IN TECHNOLOGY INNOVATIONS AND THEIR IMPACTS ON NATIONAL SECURITY

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Abstract

In the era of Knowledge intensive work environment, it is important to establish Knowledge Infrastructure in engineering institutions to foster technology innovations and technology incubation. The students of engineering in India are a reservoir of talent and have high innovative and creative abilities. The establishment of knowledge infrastructure shall unleash technology innovations in institutions of higher learning and shall help accelerate the growth of student companies thus, creating an enabling environment for techno-entrepreneurship. Technology innovations have a direct impact on ensuring national security. The paper outlines the focus areas of technology innovation which could be taken up in engineering institutions in India.

Key Words - *Technical Education, Technology Innovation, Knowledge Infrastructure, Knowledge Management.*

1.0 Introduction:

Emergence of India as a Knowledge Superpower in the recent years is now being well acknowledged around the globe. All this could be possible primarily because of significant growth of science and technology institutions established in the country during the last 4 decades, more so during the last 15 years, which have provided the much needed capacity for the development of human capital to propel the growth of knowledge industries both at home as well as abroad. India with its IISc, 7 IITs, 4 IIITs, 18 NITs and a good number of world-renowned engineering and technology institutions such as Delhi

College of Engineering, BITS Pilani, Anna University, Jadavpur University, Bengal Engineering College, now Bengal University of Science and Technology, Punjab Engineering College, Thapar Institute of Engineering and Technology, PSG College of Engineering and Technology, Coimbatore, etc. have enabled India to create a niche advancement in manpower development to meet the current demand of engineering manpower for the industries at home and abroad. Indian engineering graduates have found high acceptability in MNCs and in the industries and organizations in the developed countries. In fact, the world renowned

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IT organizations such as Microsoft, Intel, AMD, Oracle, CISCO and others have utilized the geniuses of Indian engineering graduates to propel technology innovations and product development. Further, R&D organizations and Research Centres set up in India both by Indian and foreign companies continue to attract engineering and technology graduates from Indian institutions. This goes to demonstrate that India has emerged as a major hub for human capital to propel technology innovations in the knowledge intensive industries. In the strategic defense sector, Indian engineers have already demonstrated their capabilities of technical innovations which have enabled India to attain near self-sufficiency for its strategic defense programmes.

2.0 Engineering in the Knowledge Age:

In the present era where knowledge reigns supreme, it is important to recognize that the development of a country is propelled by the power of scientific and technological innovations and is driven by the growth of knowledge intensive industrial environment. In this context, the focus on technology innovation, product innovation and process improvement leading to improved energy efficiency and reduction in environment impact has assumed a much greater importance. Further, the power of connectivity unleashed by modern networked systems of communication has further created the enabling environment to accelerate product innovations by significantly cutting down the technology and product cycle. New horizons of design engineering based on life cycle assessment basis of

design have enabled the growth of an integral approach to design for manufacturing, design for environment, design for maintainability, and design for recycle and reuse. These developments on the design fronts when coupled with the advances in the manufacturing systems such as e-manufacturing and concurrent engineering have enabled to compress the total product cycle to unprecedented levels of human imaginations. Rapid pace of innovations leading to the development of new, smart and intelligent materials are bound to accelerate the pace of technology and product innovations in the coming years.

India with its vast technical education system can respond to this growing demand for technology and product innovation. As is visible from the developments during the past couple of years, the knowledge industries around the world are making India a destination for outsourcing the knowledge services including R&D, software development and IT-enabled services. More recently, the emergence of Knowledge Process Outsourcing, KPOs, has resulted into the growth of KPOs in India. This is a highly welcome development for India's technical education system. The emergence of KPOs is further strengthened by the establishment of design centres and research and development centres by leading MNCs for the development of new technology and innovated products. Many leading IT companies are setting up their product development centres in the country. As such it is absolutely essential that the technology innovation and product development becomes one of the major focus areas in the

technical institutions and universities in the country.

3.0 India's Technical Education System:

There are approximate 1500 colleges of engineering around the country enrolling today approximately 4 lacs students at undergraduate level. The primary focus of engineering and technology institutions, except the IITs and a few selected PG institutions, has been primarily to provide undergraduate studies in engineering and technology while the postgraduate studies and research have been limited to 26203 candidates in 268 AICTE approved institutions of engineering and technology in addition to 54167 candidates enrolled in MCA in 1012 institutions as per the Annual Report 2003-2004 of AICTE. The country thus, has created a technological education system which is largely focused around undergraduate education. The challenge at hand, therefore, is how to transform the engineering education system of India into a system of nurturing world-class quality in the human capital development along side with the development of intellectual and knowledge capital to support country's march on technology innovations to meet the requirement of rapidly changing technology and know-how for the knowledge intensive industrial development.

4.0 Knowledge Infrastructure in Engineering Institutions:

Creating Knowledge Infrastructure in engineering and technology institutions is a dire need at present if we have to transform Indian engineering education system to a system tuned to

technology and product innovation alongside with the development of world-class quality human capital. This requires creation of enabling environment and support infrastructure to harness the power of innovation and creativity of Indian engineering students and teaching faculty. Technological institutions are to be equipped with a Knowledge and Innovation Management Centre which besides providing necessary guidance should have technology incubators and a techno-entrepreneurship Park so that the brilliant ideas of the students and faculty could be provided the necessary support for their incubation into viable technology and innovated products. Currently this activity is at low pace in *Indian engineering institutions*.

5.0 Focus Areas for Technology Innovations:

The major areas of focus for technology innovations in the Indian context are related to:

1. **Providing energy security**-a significant increase in installed capacity, reduction in T&D losses, energy conservation devices and programs and technology break-through for making renewable energy economically viable Technology innovations can provide solutions to India's energy needs. India is expected to meet its demand of installed capacity of 3,50,000 MW by 2015. The current capacity is around 1,20,000 MW, largely from coal and gas fired plants.
2. **Environmental Sustainability** is yet another important area where technology innovations

could provide solutions to monumental problems of drinking water scarcity, waste disposal, treatment of industrial affluent and de-pollution of rivers and water bodies, the life line of India's human habitat.

3. **Information security** is yet another area where technology innovations shall play an important role. Communication revolution is already sweeping India with the power of wired and Wi-Fi systems. This will have a phenomenal impact on our infrastructure sector including transportation where IT-enabled Transportation System shall help improve congestion besides ensuring energy efficiency and reduction on pollution level. This could further be strengthened by technology innovations in the areas of photonics and nanotechnology.
4. **Health care** is an area where science and technology innovations could make good health care for all a reality. Tele medicine, diagnostics, innovated drug delivery systems, bio-sciences and genetic research is going to unfold hitherto un-imagined horizons supporting a healthy life affordable to a common man. The success in this area however will depend upon achieving energy security and environmental sustainability.
5. **Strategic defence** is an area where technology innovations provide a major fillip, whether it is the capability of surveillance or the fire power.

An integration of information technology, satellite communication, radar engineering, explosive engineering, chemical technology, material science and recently bio-science is involved in strategic defence programs. India can highly be benefited from the developments in these core areas of technology in which the country has already created an environment for technology innovations.

Conclusion

National security of a country in today's technology and knowledge intensive global environment can be best assured by nurturing and sustaining an environment of technology innovations in educational institutions, R&D organizations as well as on the work-floors of the industries and organizations. India could reap rich dividends, specially that its human capital has the capabilities to un-lease technological innovations which besides assuring higher levels of national prosperity will ensure higher levels of national security.

The present GDP growth of 7-8 percent has been achieved through a vibrant industry environment including the IT Sector. If we are able to provide uninterrupted supply of electric power to our industries and also to other sectors of economy, the GDP growth will jump to 10 percent and even more. Technology innovations can help achieving energy security by cutting down enormous waste of electricity in T & D losses, promoting engineering efficiency in electrical devices and systems as also new and viable energy fuels including non-conventional

sources. Similarly in the area of technical education leveraging advantage technology assisted by the power of technology innovations can help in significantly improving the quality of education and research. Same applies to health care and strategic defence.

India as a nation of highly enthusiastic youth so keenly motivated to engineering and technology education can unleash an era of technology innovation in the country by integrating Knowledge infrastructure in its existing engineering education system.

