6. TECHNICAL EDUCATION FOR KNOWLEDGE SOCIETY

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Abstract

A new educational paradigm is just beginning to emerge particularly in technical education, but is gathering momentum in a variety of settings. In facing the fast changing environment, many policy makers and educators get confused with uncertainties and ambiguities and lose their direction in the rapid globalization. Traditionally, technical education system views the infrastructure of technical professionals in terms of engineers, polytechnic diploma holders, technicians, vocational workers etc. There is an urgent need for a comprehensive framework for understanding the impacts of rapid developments and advancing implications for reforms and innovation in education particularly in technical education.

This paper discusses the case for creating a new technical university affiliating all the engineering colleges in the state. Creation of such university will address a number of important problems faced by the higher education system in India. This university should also attract scholars from around the world and ability to compete with and be ranked among the very best in the world. This paper also highlights technical educational opportunity with respect to knowledge society.

1. Introduction

In the emerging knowledge society of the 21st century, higher education has become the most important tool of development and the universities have become the real hub of knowledge generation. It is realised that in the 20 th century, when the world marched ahead into prosperity riding the waves of science and technology, technical education met many challenges and provided huge opportunities to move faster. Technology is a growing part of any society today. It has become the focus of educators worldwide. Increasing economic globalization is transforming the very nature of the engineering profession. While the 19th century was marked by the transportation revolution, the 20th century was marked by the communication revoultion. A whole range of tele-communication media namely videoconferencing, audio-graphics, virutal classroom and world world web are available to the content delivery.

Demand for higher education in decades ahead will grow exponentially and technical education will change in profound ways and will be driven by market forces. Students will face challenges in leadership and teamwork abilities as the diversity of cultures they experienced from their international peers and mentors. Overcoming these challenges is not an easy task and will take significant time and resources. The engineer of 2020 will need to

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learn much new technical information and techniques and be conversant with and embrace a whole realm of new technologies, but some old problems are not going to go away. The demands made on education and the challenges that education faces today are many and diverse. The conventional system was not designed to meet these new demands. It has become inadequate. A new system is needed and technical university, as an entity, is emerging on the scene, gradually over a decade.

The strength of Science and Technology workforce in India is the third largest in the world, being 5.5 million in 2007 (MHRD, 2007). We are aware that in S & T, knowledge doubles in less than five years. Even if we take it as five years, knowledge will multiply sixty four-fold in the thirty year period of one's career. If this is agreed to, we have to provide opportunities for several hundred thousand persons every year for updating their knowledge and skills. Under the Constitution of India, until 1976 education was an exclusive responsibility of the state governments. The central governement had only a very limited role to play and that too confined to univeristy education and the responsibility assigned was coordination and determination of standards. In 1977, through an amendment to the Constitution, education was made the joint responsibility of the central and the state governments. According to an assessment made by the Committee for Review of the National Policy on Education, the expenditure on education was about 4.2 percent of the GNP in 1989-90. The coordination and cooperation between the Union and the States is brought about in the field of education through the Central Advisory Board of Education (CABE).

The explosion of knowledge in the second-half of the century gone by has brought about an environment that is totally new in human history. Knowledge today is a resource and is no longer for its own sake but predominantly is for development. Throughout history, engineering has been driven to meet the human need for food, water, shelter, health, communications, defence, energy and even the provision of entertainment and information. The great challenges of the future await engineering need for clean water, energy, food and security. Their solution will in all likelihood, not be limited to just one country, (Seeram Ramakrishna, 2007)

2. Growth and Development of Engineering Education

Prior to independence, the growth of institutions of higher education in India was very slow and diversification in areas of studies was very limited. After independence, the number of institutions has increased significantly. During the last two decades, some states of India, Karnataka, Maharastra and Tamilnadu in particular have witnessed a significant intitiative by private enterprise in higher education, (Kulandaiswamy, V.C., 2002). The recent private initiatives have been predominantly confined to technical and professional education, particularly, Engineering, Medicine and Business Administration for which there is a continuously increasing social demand. While this trend seems to be irresistible, monitoring mechanisms need to be put in place. The growth in the number of tertiary level institutions and students, based on GOI data are detailed in Table-1.

At this stage, when our higher education system consists of 504 university level institutions and about 26,000 colleges, there are many nagging concerns about its role and performance. Many of our reputed universities and colleges have lost their pre-eminent positions. Only a few manage to maintain their status and dignity in an environment of complex socio-economic pressures and worldwide changes in approaches to the educational processes. The growth of Indian higher education has been phenomenal as could be seen in Table-2. However, there is not a single university in India that is ranked among the top 100 universities around the world.

Table -1 Number of Higher Education Institutions

Year	Central Universities	State Universities	Deemed to be Universities	Private Universities	Institute of National Importance	Total
1950	3	24	-	-	-	27
1960	4	41	2	-	2	49
1970	5	79	9	-	9	102
1980	7	105	11	-	9	132
1990	10	137	29	-	9	185
2005	18	205	95	7	18	343
2009	40	243	130	53	38	504

Source: CABE Report 2005

Table - 2: Growth of Indian Higher Education

Year	Universities*	Colleges	Enrolment (In millions)
1947 - 48	20	496	0.2
1950 - 51	28	578	0.28
1960 - 61	45	1819	0.6
1970 - 71	93	3277	2.0
1980 - 81	123	4738	2.08
1990 - 91	164	5748	4.4
2000 - 01	266	11146	8.8
2007 - 08	442	18627	11.5
2009 - 10	504	25951	13.6

Source: UGC.,* Includes all types of Universities

2.1 Establishment of New Engineering Institutions

Higher education covers post-secondary education (after class 12) with four levels of qualifications; Bachelors', Masters', Pre-Doctoral (M.Phil), and Doctoral (Ph.D.). Engineering education became a main attraction after 1990 when India became a major contributor to the global IT industry revolution. After the 1980s many state governments encouraged the idea of self-financed professional colleges where state government does not provide financial support but facilitates the setting up of such institutions by providing land and other infrastructural support at subsidized rates. This idea was well received by states in Southern and Western parts of India where four states (Tamil Nadu, Karnataka, Andhra Pradesh and Maharashtra) have more than 50 percent of total engineering colleges in India. The overall participation rate in Indian higher education is 11.7. Professional education is 13 percent of the student (higher education) population. The

growth in the number of technical institutions and students, based on GOI data are detailed in Table-3. Density of these institutions is more in urban and semi-urban areas.

The Indian Institutes of Technology provide one example of beneficial crossovers from the international to a national science community. Five institutes were established in the early 1950s as "Institutions of National Importance," modelled explicitly after the best examples of technical higher education from Germany, Russia, the United Kingdom, and the United States. Throughout the 1960s each of the institutes was heavily funded by a different country, and staffed by top-ranking faculty from both India and the funding country. Today the Indian Institutes of Technology enjoy not only national, but also international, prominence in several technical fields, operating successfully as Indian rather than as international institutions.

In 2009-10 several measures were taken to implement the Government's vision of providing increased access with equality and excellence. The setting up of new Indian Institutes of Technology (IITs), Indian Institutes of Management (IIMs), Indian Institutes of Science Education & Research (IISERs), assisting the State Governments in setting up new polytechnics and the initiation of the process for setting up of Indian Institutes of Information Technology (IIITs) and National Institutes of Technology (NITs) are steps in this direction.

Table 3: Technical Institutions and Intake for the academic year 2009 -2010 (As on 30 Jun e 2009)

S.No	Programme	Degree		Diploma	
		NOI*	Intake	NOI*	Intake
1	Engineering and Technology	2,872	10,71,896	1659	4,71,006
2	Architecture	106	4,133	-	-
3	MCA	1,169	78,293	-	-
4	Pharmacy	1,080	68,537	575	32,181
5	Applied Arts and Crafts	12	935	4	480
6	MBA	1,565	1,35,893	-	-
7	PGDM	375	43,668	-	-
8	Hotel Management	93	6,387	86	4,490
	Total	7,272	14,09,742	2324	5,08,157
	Grand Total			**Institutions**	9,596
				Intake	19,17,899

**Number of Institutions: source: MHRD Annual Report 2009-10*

3. Challenges

Our objective in higher education is not only to promote equality and social justice, but also to provide the right kind of work ethos, professional expertise and leadership in all walks of life. An important aspect of the National Policy on Education is to ensure the protective discrimination for a large number of sections of society through reservation of seats in higher education, special access to colleges and universities.

The large and rapid expansion of higher technical education, combined with widespread non formal education particulalry in the IT sector, has brought in substantial investments. Regional imbalance and disparities among institutions in different regions are disturbing. The quality of engineering education has suffered a lot on account of a severe dearth of faculty. The failure rate in several engineering colleges is high and a large number of those graduates are not readily employable. Other factors are inadequare research practices in institutions, weak innovation capability, outdated teaching-learning process, ever changing admission policy, political interference, lack of leadership and poor academic administration. Added to this is the fact that while there is an explosion of knowledge taking place every second, syllabi, even in the best of our universities, take years to change.

The challenges that confront higher education in India are clear. It needs a massive expansion of opportunities for higher education, to 1500 universities nationwide, that would enable India to attain a gross enrolment ratio of at least 15 per cent by 2015. The present support for higher education, at 0.7 per cent of GDP, is simply not adequate. In fact, over the past decade, in real terms, there has been a significant decline in the resources allocated for higher education, in the aggregate as also per student. Government support for higher education should be at least 1.5 per cent, if not 2 per cent of GDP, from a total of 6 per cent of GDP for education, (National Knowledge Commission, 2007). NKC recommends the creation of 50 National Universities that can provide education of the highest standard. The present regulatory system in higher education is flawed in some important respects. The need is for smaller universities which are responsive to change and easier to manage, and these should be created.

Higher education is continuing to expand, mostly in an unplanned manner, without even minimum levels of checks and balances. Many universities are burdened with unmanageable number of affiliated colleges. Nobel Laureate Prof. Amrtya Sen expressed this concern when he said that *"University education in India is in a state of crisis. It is not a crisis of lack of resources. It is deterioration in quality. The quality would vary from one university to another. However, the minimum levels of quality should be observed"*. The new regime under WTO where competence is the fundamental principle of success in international operations has made it abundantly clear that the country should exploit its excellent potential in higher education and training facilities and prepare itself to export the Indian brand of education to foreign countries.

4. Reforms in Higher Education

The proportion of enrolment in university in science and engineering versus humanities and social sciences could be viewed as another index of the "quality" of human capital at the level of higher education. The underlying assumption here is that scientists and engineers are likely to contribute more to economic growth than are social scientists and students of humanity because of the increasing importance of technological innovation and adaptation in the development process. Murphy, Shleifer, and Vishny (1991) show that countries with a high proportion of scientific graduates have higher growth rates than countries where most graduates come from the humanities. When countries invest in human capital through education, there is the potential for generating benefits to society that go beyond those acquired by the individuals involved. Available evidence suggests that education is associated with lower fertility rates, healthier and better educated children, and stronger national identity. Measuring the quality of education is illusive, and can only be approximated by using different indicators.

Power and Panda (1995) noted that *"an insitution of high quality is one that effectively and efficiently meets its stated purposes or mission and takes into account the client stated as well as implicit needs"*. Quality should be regarded as developmental, a never ending

process, as it is related to excellence and encourages learners for deep learning. However, in view of the need to promote mobility and taking into account the increasing globalization and keeping in view that education is assuming an industrial character, and becoming marketable, quality assessment is becoming important. The management of a university system is increasingly becoming more complex and not precisely defined to follow any grammer book. Regulation and creativity seem to be conflicting factors and there from stems the difficulty. Any discussion on accountability raises rebellion and the ultimate casualty is quality. As the situation is obtained now, there are only a few islands of excellence in the country and mediocrity pervades, (Kulandaiswamy, V.C., 2002).

The highest-ranked universities are the ones that make significant contributions to the advancement of knowledge through research, teach with the most innovative curricula and pedagogical methods under the most conducive circumstances, make research an integral component of undergraduate teaching, and produce graduates who stand out because of their success in intensely competitive arenas during their education and after graduation. Thus the traditonal scope of engineers has been broadened considerably to encompass the service sector, where engineers now contribute significantly to its overall growth.

4.1 Government Initiatives

The Central Government is in the process of undertaking reforms and restructuring of the Higher Education sector in pursuance of the recommendations of the Committee to advise on the Renovation and Rejuvenation of Higher Education. National Knowledge Commission (2006) Report on higher education supports a strong reform agenda through public investment. The draft legislation on the establishment of the National Commission for Higher Education and Research (NCHER) as approved by the Task Force is placed for consultations in the public domain for obtaining feedback and suggestions from all stakeholders.

The report talks about the concept of a university as a place where research and teaching become two important pillars of the creation of knowledge and should go together. It should provide practical training to the people that should be based on new knowledge and in response to social and personal needs. Most importantly, university should allow for the diverse growth of knowledge and should not lead to fragmentation of knowledge. It is, therefore, recommended that normally, no single discipline or specialized university should be created. There is also an idea that undergraduate programs should be restructured to enable students to have opportunities to access all curricular areas with fair degree of mobility.

4.2 Technical University

University is a unique institution engaged in exploring, generating conserving and transmitting the knowledge. The recommendations of the Yash Pal Committee and the National Knowledge Commission emanated from a realization that fragmentation of various fields of knowledge in higher education has been to the detriment of growth of inter-disciplinary subjects. Fragmentation of higher education has created boundaries embodying the development of newly emerging fields of knowledge at the boundaries of existing disciplines. Universities across the nation and in different regions should provide a variety of programmes for the purpose of developing varied man-power for the new and emerging realities of the region and the country, (CABE, 2005). In this context, the following critical questions need to be answered to guide the quest toward establishing a new technical university.

- Why does the state need a technical university?
- What is the economic rationale and the expected added value compared with the contribution of existing engineering

institutions?

- What is the vision for this new technical university?
- What would be the investment and recurrent costs of a technical university?
- What will be the relationship and articulation between the new technical university and existing tertiary education institutions?
- What are the governance arrangements that must be put in place to facilitate this transformation?
- What level of autonomy and forms of accountability will be appropriate?
- What will be the government's role in this process?
- How can the institution build the best leadership team?
- What are the vision and mission statements and what are the specific goals that the university is seeking to achieve?
- In what niche will it pursue excellence in teaching and research?
- Should the university be set up in partnership with a foreign institution?
- How will success be measured?
- What monitoring systems, outcome indicators, and accountability mechanisms will be used?

Instead of making a major change in the existing system and establishing a new technical university for the entire state, each university should be given freedom to bring in innovation in their academic programmes. More emphasis should be given for all types of research. State of the art Science Parks, Incubators, Innovation Centres, Specialised Research Academies, Patent and Licensing, Technology parks, Entrepreneurship Training Centres etc should be established based on the regional requirements. Well established and high quality technical institutions may be granted deemed to be university status and the procedures for the same should be simplified. This would be an important step towards expanding the number of autonomous technical institutions with focus on quality and excellence.

5. Suggestions

1. Higher education is no longer a luxury. However, it is essential to national social and economic development. High quality human capital should be developed in high quality education systems, with tertiary education providing the advanced skills that command a premium in today's workplace.
2. Governments need to develop a new role as supervisors, rather than directors, of higher education. They should concentrate on establishing the parameters within which success can be achieved, while allowing specific solutions to emerge from the creativity of higher education professionals.
3. The industries belonging to a specific discipline or related disciplines shall be encouraged to establish state of the art Research and Training Centers to develop the necessary specialized man power.
4. Strong quality control measures to assure performance above an acceptable benchmark is essential for the institutions
5. Higher education should be developed as an infrastructure for social and economic growth of the country.
6. There is a strong need for developing institutional linkages between research organization, industry and higher education institutions. Specific steps should be taken to ensure that such initiatives contribute to the development of higher, professional and technical education as is done in other countries.

6. Conclusion

One of the most important objectives of education is to churn out knowledgeable individuals who will contribute to the society actively, find gainful employment and develop a positive attitude towards life. Education is also the mode through which culture is transmitted and transformed; social functions and status

are reproduced and created. Higher education particularly technical education system should be dynamic, especially in the modern world where social change itself has become so rapid.

Technical education institutions should be encouraged and facilitated to put in place institutional mechanisms and infrastructure and facilities for attracting international students and to enter into collaborative arrangements with their counterparts abroad. There is a strong need for developing effective synergies between research in the universities and their application in and utilization by the industry to the mutual advantage of both the systems. Likewise industry should be persuaded to establish useful linkages with the universities to seek solutions of problems faced by the industry.

Technical education and research are the essential components of culture, socio-economic and environmentally sustainable development of individuals, community and nations. The technical education system needs to be fully integrated with industry and research and development institutions which should pave a way for continuous innovations in the system to gear it to market forces.

References

- *Governance of Technical Education in India: Key Issues, Principles and Case Studies* (2010). Eds. Andreas Blom and Jannette Cheong, World Bank, USA.
- Higher Education in Developing Countries: *Peril and Promise;* The Task force on higher education and society, (2000), The International Bank for Reconstruction and Development / The World Bank, USA
- Kulandaiswamy, V.C., 2002, *Education for Knowledge Era – Open and Flexible Learning*, New Delhi, Kogan Page
- Murphy, Shleifer, and Vishny, (1991), "The Allocation of Talent: Implication for Growth." Journal of Economics (106) 2: 503 –530.
- National Knowledge Commission, (2007), Compilation of Recommendations on Education.
- Power and Panda(1995), 'Accreditation as a means of quality assurance in higher education', in Powar, K.B. and Panda, S.K. (eds) *Higher Education in India – In search of quality*, New Delhi: AIU Press.
- Report of the Central Advisory Board of Education (CABE) (2005), *Committee On Autonomy of Higher Education Institutions,* Ministry of Human Resource Development, Department of Secondary and Higher Education, Government of India, New Delhi, June, 2005
- Report on *Higher Education in India: Issues, Concerns and New Directions*, UGC, New Delhi, 2003
- Seeram Ramakrishna, (2007), 'The expanding world of engineers', Think, The Sunday Times, 5, August 2007.
- Unesco, (1991), Education for All: Purpose and Context. Round Table Themes 1, World Conference on EFA, Jomtien, Thailand.

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