EXPANDING HORIZONS IN HIGHER AND TECHNICAL EDUCATION TO ADOPT NEW VISIONS OF NEW WORLD A CHALLENGE

By

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Today success in the global market place means creating and applying new knowledge- which is to say new technology- faster than one's competitors. World winners will be those who develop talent, technologies, techniques and tools so advanced that there is no competition.

ABSTRACT

Which government does not want to generate hi - tech employment, high pay international jobs, spur industrial growth, and make education globally competitive? Then it must install research parks, incubators, Patent & IPR to facilitate commercial exploitation of sunrise technologies. Industries world over are seen flocking round the advanced knowledge centers to obtain brand new ideas for global competitiveness. Role of higher education has emerged central to industrial and economic development. Association with industry, venture capital firms, international agencies who succeeded in this cause is essential.

The paper prescribes "dream big" for universities and colleges. They should aim at technology generation, technology diffusion, which is achieving high significance in enabling a nation to win. The paper emphasizes adoption of new organizational inventions like Research Park, which when implemented will contribute to India's international competitiveness. The institutions should have now to look beyond the traditional lines of teaching and learning and adapt to corporate development, and help industry to win. They should have to restructure themselves to become fountain heads of new knowledge and new technology. They should deserve the status of "Light House" for industry. People demand world class education. How can this be done? Synergy between industry and academics in this cause is vital. Parks have enhanced the scholarship of universities. They jointly can give economic and political stability to India. Will industry- institute interaction become a national priority? The paper recommends reforms in the light of experience elsewhere in the world.

Keywords: Research Park, Technology Incubator, Technology Transfer, Well Springs of New Knowledge, Corporate Development, Governance and Leadership, Innovation Centre, Intellectual Strength, Patent & IPR, Orbit, Light House, Compatible, Entrepreneurship.

INTRODUCTION

World experience tells us that now the economic development is technology driven. The limiting factor for growth and prosperity of a nation is not oil, nor land, nor minerals but the scientific and technological capability of people. Industrialized nations by virtue of technological superiority are found capturing the world market and emerging as epicenter of interdependent world. Industrialized nations through knowledge especially of emerging technologies are amassing wealth. 80% of world's wealth is possessed by G-8 countries. World Bank observed that wealth is flowing today from developing to developed countries because of level difference in technology. Besides, advanced nations yield economic and political powers. Solow the Nobel Laureate observed that the GNP of USA doubled between 1909 and 1949, and that 85% of the growth was attributable to technology change (1).

Those nations, organizations and individuals exploiting the latest technology are likely to win-others may work hard, may have essential resources to draw on, but will lag behind without technological capability and adaptability.

1. Scientific infrastructure "Research Park" and its relevance to India

True that India is late starter in engineering and technology and so it lagged behind. However, after independence it has made a laudable progress. But, it has yet to go a long way. It is today distinctly a technology follower. The technology development plans of most of the companies in India are propelled by foreign collaborators. Universities and academic institutions are too weak in research, and innovation. They have remained reflection centers teaching that knowledge which comes to them from abroad. They do not have "well springs" of new knowledge. Besides, they have remained away from industry. There are systems and procedures for import of technology, but there are no systems developed for technology generation and transmission from institutions within the country to industry.

Industry Institute Partnership world over, is observed to be critical to success. The World proven model of Silicon Valley was initiated by Prof. Terman of Stanford University. Research Triangle Park in North Carolina was initiated by Prof. Luther Hodge of Duke University. MARS innovation district in Toronto, is evolved in partnership with Toronto University. This model for technological and industrial development has been adopted now in many east- west countries. The role of government in so doing has been central. The universities and other higher education institutes in the respective regions have undoubtedly been the leaders of this change. The underlying principle given by Prof. Terman being that-

" Industry so as to remain competitive globally needs access to first class research in universities. So also the first class researchers in universities need access to industry so as to commercialize their research findings." (2)

Thousands of Research Parks are now installed in Japan, Taiwan, China, U.K and elsewhere in the world. They are found to provide a high class infrastructure in the vicinity of higher education institutes where qualified scientists, engineers and entrepreneurs can professionally grow. Research Parks have come to be known as the maternity homes for safe birth of hi- tech industries. It provides a fertile ground for the creation of New Technology Based Firms [NTBF]. It has proved to be effective in tapping the valuable resource of new knowledge for the growth of professions and productivity. It is an engine of development reducing lead time between invention and commercialization, giving new direction to human civilization. India so far has been trying to catch up technology race from behind rather than riding the crest. If it adopts research park scheme it will be able to ride. It will move new knowledge and new technology continually to economy like blood supply to our body. The economy will thereby have more knowledge/technology intensive business. India must recognize the role of new technologies and universities responsible for generating them. Research scientists and engineers if attracted to good infrastructure of research parks they will not migrate to other countries. New industries will keep coming around Universities (3).

Where do Indian institutions stand in technology generation and diffusion? How many engineering colleges and universities offering education at graduate and research levels have corporate development as a vision & mission to carry out technology transfer to industry? Department of S & T Government of India has installed twelve parks in universities. They are doing very well. But they are too few for a big country. Doing research is good. But what use if it is not exploited commercially? Many institutions have now reached a stage where establishment of innovative endeavors like Research Park, technology incubator, patent & IPR center, entrepreneurship development center can prove immensely useful to them, to industry as well as to students passing out of these institutions. It is now not enough to produce just engineers and technologists but it is essential to produce leaders in technology, and leaders in industry. To win in world economy it is now necessary to produce technology pioneers, for which innovative infrastructure

like research parks are absolutely necessary. Education charged with the spirit of discovery and innovation alone can move a nation forward. Future belongs to those who understand this. The purpose of this article is therefore to prescribe innovation, creativity and commercial exploitation of research which are the present day deficiencies of Indian economy. This will necessitate installing units as stated above as integral components of institutions. Industries, venture capital companies and institutes must come together to set up such parks. The "Stand Alone" policies of industry and education must be done away with. This is today's Guru Mantra.

2. Reforms needed to Create Future

Knowledge is power. It changes lives of people. It converts a liability in to an asset. The world, due to rapid advances in science and technology, is changing fast. Change is accelerated by globalization, privatization, and liberalization. Survival of fittest in competitive world is tending to become the law. People have to cope with high velocity environment on local and global planes. Institutes of technical education, under these stormy changes, have not to perform the way they performed in the past. They have to depart from old style to enable the people to assimilate emerging, technological advances and use them so as to win jobs and earn income in competition at world level. They have to facilitate increase in scientific and technological capability of people. It is they who produce scientific and research personnel to do discoveries. Institutes must have to be adaptive, constantly changing, and using world class strategies. Courses, curriculum and methods of teaching must have to change with times. Their visions and missions, policies and practices, systems and procedures must have now to be constantly changing to fulfill local as well as global needs. World experience says Institutes ought to provide economic stimulus for regional development. Even political development of nations depends on capacity of institutions in what they teach (4).

Where do the Indian institutes stand in world list? They are far too low, like India in Olympics. They are progressing. Yet thousands of students are going for higher education abroad, to be humiliated? Why? The education in India is yet not aligned to the needs of globalization. No longer well being of a nation and its future destiny are constrained by its geography, population, natural resources. Knowledge especially of science and technology has become the prime mover (5). Science and technology represent the new driving force. Economic prosperity, energy supplies, manufacturing capacity, health, public safety, military security, political stability and environmental quality all these and more will depend on knowledge owned and possessed by the people, women and men in the community. Scientific knowledge with usage does not deplete but multiplies. This is the unique beauty of knowledge resource. India will be strengthened by learning to compete in S & T in this flat world.

2.1 Education must be compatible to globalization (6.)

Technical education ought to be qualitative and cost competitive not only by local standards but by international. Many opportunities and challenges are arising in the areas of research, innovation, manufacturing, sales etc on global plane. The borders of education are expanding ocean like. How to prepare people to make most of them? Do the policy makers have to be outward looking? Do they have to take in to account the global dynamics in respect of technology, industry, economics etc? Yes, certainly they have to. It is essential, without which design of system will be imperfect. People can harvest opportunities ably only if they are well aware of what is on horizon and how to prepare in advance? They can make most of the situation if they are educated and technically trained and not without it. On the whole to win in world economy technical education must have to be compatible to globalization.

Education must be world class to enable people to win in interdependent world (7). People are ready to pay for in terms of time, effort, and money. But Universities and colleges in India are not able to give. Why? This needs examination in depth. Their frame of work is old, out dated, primitive, and dysfunctional. They lack in creation of new knowledge, discoveries, and creative endeavors which are now the integral components of modern institutes elsewhere in the world. They lack in

organizational capability. They lack in global visions and missions. That is why Indian institutes do not stand high in world list, and thousands of students every year go abroad. From experience elsewhere in the world, it can be said that higher education has to be necessarily coupled with research and innovation. Multifaceted research facilities like, technology incubation, patent & IPR, start ups entrepreneurship, Research Park have become now the integral components. They are observed to have a deeper impact on quality of education. Quality in Institutes is now critical and related to improving economic and political security of India. Do we realize this?

2.2 Institutions must now change their orbit(8).

They must jump up to creating hi- tech enterprises, hi-tech world class entrepreneurs, producing not just engineers but more of M.Tech and Ph.Ds. Institutes must take active hand in corporate development, by virtue of research become a "light house" for industry. The center of gravity of operations must have to shift from UG to advanced education like PG, Ph.D and post doctoral. This is what National Knowledge Commission 2006-2007 has recommended. Without them India can not hope to become a super power, and achieve its declared dream. Without research, innovation, technology transfer Indian institutes may keep on producing engineers but they will be just followers and not leaders. They will not be able to create new India which people dream. Will India create a brand name in innovation? Without it India will lag behind in brain race.

Attempts for reforms are being made in India through Technical Education quality improvement program [TEQIP]. Techniques of industrial management like Total quality Management [TQM] are being implemented. Leaders in industry are being appointed as chairman and members of board of governors. These efforts are good but not enough. Hi-breeding by way of transnational collaboration is necessary. Role of academicians in reformation is crucial. The authors say leadership skills on the part of academicians to establish and run institutes in world class manner need urgently to be developed. It is ultimately the academicians alone who can change the scene in institutes. First class professors need to be recruited and deputed to world best institutes and enabled to grow to the international standard. Professors and researchers need to be respected more. Science and Technology need to be accorded more budgets, comparable to those in developed countries. The establishment of new institutions like new universities, new IITs, IIMs, as declared by government has to be designed and implemented not in a routine manner but in a world class manner. These institutes must be designed with the involvement of world best professors, regardless from which country they come. We did this in IITs and so they shine.

2.3 Education must be Enterprising, (9) oriented to producing Entrepreneurs like Narayan Murthy, Bill Gates

An institute exists basically for two purposes. First, it exists to educate people, to make them more competent to do jobs using the state of art technology. Secondly it exists to conduct research, innovation and use their findings in various vocations and professions. The purpose of education is to instill knowledge in those who undergo education. The purpose of research is to discover to create new knowledge, new theories, new technologies etc. so as to raise human civilization to greater heights. Institutes are also expected to train professionals to do professional practices more efficiently, to do consultation, technology transfer, assist students in career planning and contribute to broader social agenda among other things. They must promote entrepreneurship.

The role models of students should have to shift to becoming world best entrepreneurs. But these are not the things; they were expected to do in the past. These are now the new additions in their roles. Modern institutions unlike in the past have now to target to build a learning society consisting of learning organizations and continuously learning individuals. They have to play different roles in a variety of ways. All institutes however may not do all that. They may choose to do what fits in their visions and missions, and fits in their respective resource availability.

Education should reach to Excellence which comes through research and innovation Institutes which engage themselves simultaneously both in research and teaching are found to show excellence and hence are preferred by scholars. It is this kind of institution which tends to excel in competition and attains the world class status. People want world class education. But where do we find world class education? It is available in only a few institutions like IITs. Many universities and colleges are not able to give. Students are going abroad by spending huge sums of money. According to one estimate the total drain on foreign exchange, every year is equivalent to the cost of establishment of 20 IITs. The purpose of education in changing global context must therefore be understood by people who matter most to bring about changes. Only those who realize this win.

Teaching and research ought to go together (10). An investment of rupee one in research in an educational institute does double duty. Firstly, it produces research output in the form of new knowledge, new technology, contributing to human civilization. It enhances economic competitiveness. The students at younger age are more agile and productive in research. Catch them young, becomes possible. Secondly, it results in elevating the educational standard of students and thereby quick dissipation of the findings of research to society, making it competitive. It is thus giving double profit. Research funding in an education institute is adding greatly to human capital making them innovative life long. Developed nations follow this strategy and hence they are found to be more progressive. India should therefore learn to invest with priority in research in institutes of technical education. There is lot of potential lying idle in youths in these institutes. Will India succeed to utilize it, remains to be seen?

2.4 Research subsidizes education, and education subsidizes research (11)

A modern institute is a place where teachers simultaneously do research, and where researchers do teaching. It is observed that in these institutions teachers teach the latest and researchers discover unknown faster and better. The new sunrise knowledge, which they discover, flows automatically to class rooms. They tend to teach tomorrow's knowledge today. They remain ahead of time. Professors conduct research with the help of students at a cheaper cost and in lesser time. Students acquire research and an innovation skill which they use life long, is the prime gain. It is the best economic proposal for any nation. Teaching and research are thus found to be complementary to each other. Hence they must go together. Students learn to cultivate habit to dream high and possess tenacity to fulfill the dream. In the absence of research in an educational institution professors tend to teach sunset technologies i.e. yesterdays knowledge today, throwing the new generation behind time.

This however does not mean that teaching institutions and teaching professors are not necessary. They also have a place in society. There are jobs which do not require research skills. Working knowledge is required to handle in marketing, purchase and manufacturing. They are quite large in number. Teaching institutions do important job of providing people for them. Such institutions and professors in them however need continuous updating. They must have to undergo retraining at the hands of researching professors.

Nations with higher knowledge level are found economically more secure. Emphasis on technical education in developing countries to elevate technology level therefore achieves high importance.

Are researching professors passionate to teach? Students ought to learn not only the known knowledge and known professional practices but learn to discover unknown. They ought to elevate professional practices constantly to newer heights. The professors and students rightly form a wider community of close knit researchers; build a team to become think tanks for the society. Thus an institution fulfils both teaching and research functions in a most efficient manner. It is this intimate connection-the idea that professors bring cutting edge knowledge and expertise to the class room that makes the institution relevant and purposeful. Institutions which are involved in only teaching remain teaching shops teaching "parrot like" that which is obsolete, irrelevant and comes to them

from other researchers mostly in foreign. They have therefore no first hand experience and hence lack force in teaching. Researching professors are found highly passionate to test and teach new knowledge to students. Institutions are thus the testing grounds, of forthcoming technologies and generations.

Teaching and research have no force without being tied together. There is a school of thought that those who pay more attention to research tend to neglect teaching. They believe students are put to disadvantage. However, this is a myth. How much time a professor should devote to research and how much to teaching is an art. This has to be left to the judgment of individual professor. It is observed on the whole that students prefer to have instruction at the hands of researching professors. All world class institutions excel simply because professors in them are research oriented. They have excellent bond with students. They function in an autonomous manner. In such institutions there is always a tension between teaching and research. The tension is like the tension in rope of a bow only on account of which arrow moves forward with force. Education gets force on account of this tension.

2.5 Modern Institutes should be multifaceted (12)

Technical education institutes have no longer to be simple. They have to be reformed much beyond class room teaching and learning. They have to be necessarily multifaceted complex organizations in part driven by technology and, in part mirroring other organizations in the world. Increasingly, they have to cater to peoples demands such as research skills i.e. generation of new knowledge, technology innovation, patenting & IPR, life long education, technology incubation, technology transfer, entrepreneurship, start up companies, venture capital etc It is these aspects whose presence in campus is adding to institute's reputation. They create and add tremendous value in learning environment. Students at UG, PG, and doctoral levels get thereby inspired to dream high, learn even that which is beyond curriculum and learn to be innovative and creative to take paths not trodden by their predecessors. Research, patent & IPR, entrepreneurship etc enable to get more value out of investments in an institution. They increase the financial rate of return. Institutes become more viable. They succeed in attracting more and more funds.

The paper emphasizes the urgent need to establish on priority basis the units like Research Park-Technology Incubator-Patent & IPR Center-Entrepreneurship Development Center, Technology Transfer Center, Venture Capital Fund, Innovation center etc on the campus. This is to set a tone of discovery, innovation, creativity, spin-offs, new technology based firms, create technology pioneers etc, in economy. With out this the paper argues that India, inspite of its potential will lag behind.

Attracting best talent in P G, Ph.D matters. a nation cannot win economic war with only soldiers like B.Tech degree holders. Captains and Generals with M.Tech, Ph.D degree are needed. In India not many scholars however are found to be attracted to post graduation and doctorate courses. Why? An analysis will indicate that due to poor infrastructure and poor knowledge availability at institutes, value addition being made through these courses is less than the value addition made by working in industry. Besides, the students have also to forego the salary income. The institutions are deficient in respect of multifaceted activities. Many students in competition prefer to go to universities abroad. Indian institutes to that extent are losing talent, and hence lagging behind. They need to be made attractive enough in comparison with their counterparts abroad. Also they must have to offer what industry can not in terms of research, innovation etc. Without innovation infrastructure, institutes will not be able to produce captains needed to win in world economy. Achievement oriented missions in Indian institutes need urgently to be practically built on big scale. Capability building is a big challenge to reach to world class standards. Institutes ought to be empowered with autonomy to do all that and to award degrees of B.Tech, M.Tech, and Ph.D.

Number of Ph.Ds awarded by an institution has become a differentiating factor of one nation from the other. It is now the critical measure for economic development. By virtue of this they alone tend to become a "light house" for

industry and to bring prosperity to the nation. The purpose of an institution thus goes far beyond and extends to nation building and building humanity. Many institutions in the world attract scholars from any where and everywhere in the world. This is the strategy worth emulation.

Do we give research grant to professors at the time of appointment? (13) If yes, it will attract better talent in professorship to increase university value. Education is not necessarily synonymous with teaching. One can acquire knowledge by reading, researching, experimenting, discussions, etc. Being taught in a class room is only one way of learning. Similarly new knowledge can be developed through the simple act of thinking like Gautama Buddha. An institute is one place in society where inquisitive minds assemble to brainstorm, leading to breakthroughs yielding enormous benefits to society. It is a place where a student motivated by questions like why and how can find answers. An institute to be excellent has necessarily thus to be multifaceted. It must grant funds for research right at the time of appointment. Many institutions in the world are doing and this is the best way to become world class.

2.6 Should Institutions be autonomous and transnational in character?

Yes, without which they will not be able to bring about changes. The mandate to an institution is to preserve, discover and carry knowledge from one generation to the next. This mandate can not be fulfilled without financial resources and grant of autonomy. It is for the Government to allocate adequate funds out of public exchequer, yet grant autonomy i.e. liberty to think and liberty to act and not intervene in its internal matters. It is obviously because Government is least qualified in academics, it can not steer the direction and hence it should not interfere. Public private partnerships are being evolved to make most of knowledge and financial resources available in any society for the cause of technical education. Transnational partnerships for both research and education are also growing. They must grow so as to tap and bring together good work being done every where and any where in the world. Experience tells us that transnational research linkages are vital to effective teaching. It creates favorable environment for achieving excellence. Nations are prosperous where institutions are autonomous and transnational in character, multifaceted and free to conduct teaching and research in a multiple way. Institutes should keep control of their destiny in their own hands; hence they should necessarily be autonomous. If control goes elsewhere it will then not be able to do justice to its vision and mission(14).

3. Make Governance and Leadership fit for new visions

Improving governance and leadership of institutions so as to install Research Park is essential. The old style of working and thinking does not suit. Bringing corporate principles of management in academic institutions is a trend. It is good but not enough.

How does an Institute differ from an industry? Can industrial management practices work well in academics?

Management of a small institute worth the name is much more difficult than management of a big factory, so said pundit Jawaharlal Nehru in 1959 on the occasion of laying the foundation stone of IIT Mumbai.

Institutes are meant to produce leaders, leaders for the nation and leaders for the world. This is what American universities are doing. Many leaders in many countries have received education in USA. Today's leaders were students yesterday. Some of the students of today are going to be the leaders of tomorrow. An institute deals with human beings who create future engineers to run factories. An industry on the other hand deals with machines and materials for profit. They produce goods and services, which is much different from producing leaders. An institute attempts to unfold the capabilities lying dormant within the students. Professors are research scientists working for a much broader aim like developing human civilization. Factory managers on the other hand are in service of factory management. Industries do processing on non living materials. There is thus a vast difference between the two. Skills needed in factory management and institution management is much different (15).

3.1 Management strategies need modifications to fit new visions

Factory methods and strategies for improvement like TQM do not apply as they are to academic institutions. They need to be modified so as to suit and achieve the humanistic and scientific excellence of an institute. The spirit of academics should not be lost while implementing TQM. The quality of education leading to excellence does not have external referent like in industry. In globalization links between the institutions with the government of nation state are weakening although they provide funds. Links are strengthened with bodies which work for humanity. Institutes are more in the service of humanity in general. Personnel from industry who are associated with academic institutions in their management should have to bear theory of education in mind.

The strategies employed for successful working of a factory therefore do not necessarily apply to all activities in an institution. Institutes are not for profit like factories. That is why they are registered not under companies act but under charitable trusts and society's act. However, of late institutes for profit are on horizon. They are under debate and discussion.

There is a school of thought that institutes must remain institutes and industries must remain industries. Each has a separate reason to exist. There are some common purposes for which they may have to come closer. Industries need to have a continuous flow of competent manpower, new knowledge and new technology so as to remain competitive globally. It is the institutions which are legitimately meant to supply. Industries have R & D cells. All the research which the industry needs can not however be done all alone by itself. Some research of fundamental nature for public good has to be necessarily done in institutes. Professors need freedom to think and freedom to act much more than in industry. They do research not alone in private interest but also in public interest. They need more mobility and sharing of research experience across the world. To be a successful leader in industry is one thing. To be a successful leader in an academic institution is quite another. The skills needed, knowledge and mind set needed for each is much different , however there are commonalities.

Industries can not do all the long range research they need to be competitive by themselves. They essentially need support of universities to illustrate.

The invention of Geographical positioning system [GPS] was initiated in Cambridge University by a UG student, under the guidance of his professor. This invention today is found to have a high impact in automobile sector. The impact came after a period of 50 years. Universities do not take a short range view like an industry. Return on investment in academics is not immediately apparent. Economic analysis indicates that the returns from research to the institute are about 20%, to the nation 50%, and much greater to global society. The impact of research done in institute is on a much larger plane from which many industries world over draw benefits. This is not the case in isolation but there are innumerable cases of them. Larger public interest has to be kept in view in coming of industry and institute together. Industries are benefitted most by conducting research in universities. They must cash on research in universities and support them financially.

Conclusion

Waves of technology are sweeping the world. Now is time for India to dream big and take a jump start in creation of new technology. This requires creation of hi-tech enterprises, technology and business incubators, entrepreneurship, research parks, Patent & IPR, Venture Capital Fund, Continuing education Centers, etc. Enterprising institutes have a deeper impact on improving the quality of education making it more relevant and purposeful. Scope of PG, doctoral and post doctoral courses must be widened. Institutes ought to expand and look beyond conventional horizons to what their counterparts else where in the world are doing.

Indian universities and colleges must have to study the strategies, visions and missions adopted by world best. Internationalization should become the trend. Can we create world class centers of excellence? This will decide India's future.

The Indian economy can flourish only if there is a culture

within the country which is favorable to innovation and technology transfer. Is finance for innovation available? The priority given to S & T in national budget, although increasing, is still far from adequate. Research, education, and industry are isolated from each other, which constrain their growth. Venture capital is not available for innovation in universities and there is a fear for failure. How many patents are obtained every year by each university/college? How many NTBFs are born in university? How many pioneer technologies are developed? These are the pertinent questions now to be asked.

India dreams to become a technology power in the world which could be made possible by adopting world best policies and practices and not without them. The sermons of National Knowledge commission must forthwith be heard and implemented.

Institutions must be governed, managed and maintained by following world proven academic principles. Permitting mobility of professors and establishing transnational collaborations between the institutions is essential. Professors should be enabled to rise to international standard for which suitable schemes must be designed.

The success in international competition depends now on turning intellectual strength in to marketable commodities".

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