

2. STRATEGIES TO MAKE TECHNOLOGICAL UNIVERSITIES GLOBALLY COMPETITIVE

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Synopsis

Many technological universities have five star infrastructure, brilliant faculty and scholarly students, who do possess lot of advanced scientific knowledge needed most by national and global economy. They continuously generate new knowledge through research at PhD, PG, UG levels. Mechanism for transfer of knowledge from lab to land, in both the private and public universities in India, is however almost absent. Universities are insensitive to market demands. Government has perfected systems for import of technology, but it has not perfected systems for technology transfer from universities to industry. Feedback loop today is incomplete. As a result continuous feedback inputs to reform education are not provided, productivity of various professions and vocations on this account remain low. 25% people live in poverty; the rate of return on investment in universities, due mainly to lack of outreach, is far too low. Technological universities are expected to be industry oriented. They are expected to provide ever emerging technology to industry, to keep them globally competitive. But today their impact is far too less. What is the experience of western schools?

Many western schools, on the other hand, are having well defined and perfected knowledge transfer systems and procedures. They are not only educating students to keep them competitive lifelong but practically generating and marketing new technology/new knowledge and transferring their full scientific capacities to the benefit of society in their vicinity and all over the world. The outreach of technology universities and feedback, is far and wide. Thereby, they are enriching themselves and augmenting new ideas besides providing budget support for future growth. Technological Universities, large in number exist in US, Germany, Japan. By virtue of knowledge they have moved from periphery to the centre. They have become the drivers of economic and social prosperity. The visions & missions of Universities are dynamic, adaptive based on sharing experiences with people, at large.

The paper presents from experience in the world, new directions to the Indian technological universities so as to make them world class. They should not remain mere examination bodies, as they are today, producing soldiers fit to do lower end jobs in the army of multi nationals. Students have to be educated in what they like, and then they achieve excellence. Uniform standard does not facilitate excellence. Freedom to learn with necessary autonomy is the need of the hour. The paper presents in brief, the strategies to make technology universities competitive by world standards.

Key words: technology transfer, technological innovation, campus culture,

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Introduction

Does India need world class technological universities?

Can India do without them? Governments in the world have realised that no city, region or nation, can ever prosper fast and have sustained growth, without having world class institutions of higher & technical education. They are the main energy sources, brain power factories needed to bring India at par with developed world. Well educated citizenry in technology, is an essential condition for faster growth and prosperity. People's development is national development. They need to be educated, on priority, to the level they are capable for, in a best possible manner. It is the well educated men and women with imagination, capability and competency, who matter most for productive utilization of physical, financial and intellectual resources. Government is convinced **that to run its affairs ably at national and international levels it requires leaders, leaders in engineering, industry, and all other walks of life, having professional competency nothing less than world standard.** Where are such professionals nurtured? Seeds are sown within the four walls of class rooms. Mediocre institutes produce mediocre leaders. They in ultimate analysis are found to be more costly than the cost of their upgradation. So, it is advisable to spend with priority on modernization. Presence of world class institutions is reckoned to be a differentiating factor between developed and developing nations. Nations develop faster only when world class institutes are within the reach of people. **If India does not envision building world class technological universities with priority, then India is destined to lose in world brain race. India will then trail behind.**

World experience in technology universities:

Germany in 19th century, with the help of technical high schools, is the first country to capitalize on technology. In German language,

they were then known as, "Technische Hochschule". Now, they are upgraded to the level of, "Technical Universities". Today, there are more than 84 technical universities, to name a few Berlin Technical University, Stuttgart Technical University, Karlsruhe technical university, Aachen Technical University. The author has personally visited them and studied the organization, Technology Transfer & management style of them, under a UGC program. The technological advancement of Germany is attributed greatly to the successful working of technical universities.

USA has more than 100 technical & research universities; for example, Massachusetts Institute of Technology, California Institute of Technology, and Rochester Institute of Technology etc. The model of technical universities is now adopted in almost all countries in the world. Japan, Canada, Korea, China has many technical universities. Some universities may not have the word "technical" in their name, but essentially their character is technical.

On the campuses of these universities, what we notice is that research companies are flocking round them. Technology Incubators, Research Parks, Innovation Centres, Patent & IPR bureaus are distinctly visible. Venture Capital companies have opened offices in campuses in search of new technological ideas for commercialization. These universities are like magnets, which attract not only scholars but also industry, entrepreneurs, and VCF companies from across the world. Taiwan has set up a science town at Hsinchu with some 13000 researchers, in two universities, 6 national laboratories and around 150 companies specializing in electronics. Tsukuba Science city, near Tokyo is another example of technical University-Science park collaboration. Another feature of Japan is, that on the periphery of technical universities, there are several specialised research institutes/companies to absorb persons coming out of universities with new qualifications. Students get access in these

research labs and researchers get access in teaching to students, which make teaching, learning, research supportive to each other. Teaching, research and extension thus become more powerful by coupling with each other. This is achieved in Japan by locating research labs on the periphery of universities. Spin off of companies from universities is a common phenomenon, so also spin off of technologies. A foundation is set in MIT with facility of venture capital fund enabling professors and students to start new ventures, based on technologies they develop during the M Tech/PhD research effort. Every year as many as 20 to 30 new technology based firms [NTBF] are born in MIT. According to a study around 3000 companies owe their origin to MIT. This is not unique with MIT only. It is true of almost all universities in US, Canada, Australia and China. Universities have become maternity homes for safe birth of hi-tech companies.

On the basis of their successful working, it is recommended that establishing technical universities is the only way to build Indian industry, globally competitive. We envision starting technical universities, not only to award ME and PhD degrees but also to become light house for industry. We have to have technical university model like one in western world, otherwise, we will miss the bus or trail behind Hi-Tech industrial development. Hon Prime Minister Dr Manmohan Singh on January 3, 2012 in Indian Science Congress at Bhubaneswar said *"How long India should play the catch up game in science & technology?" This requires not only money but new approaches.*

How to Set Up

IITs were conceived as world class technological universities. From very beginning, world best professors in countries like Germany, UK, USA, Russia, were invited to shape them. They were mentored by foreign collaborators, over a period of 20-30 years. Programs like exchange of faculty, research partnership, global visions & missions, systems & procedures,

gave them international character and so they could shine in the world. Establishment of universities even in developed countries is normally done like this, under close supervision, of world best professors, some of them from within the country and some from foreign. They are appointed as mentors, as many as 15 to 20, one for each discipline. It is the mentors who accelerate creation of world class academic culture. Universities, right at birth, must be groomed to be fit for tomorrow. They should not be outdated or handicapped, right at birth. Currently, with a view to increase gross enrolment ratio, many new universities and colleges are being set up in India. Should they not adopt such innovative proven approaches? They must; otherwise, they are likely to be born handicapped, and removing handicap afterwards, is so difficult.

This article explains, in detail, how to go about. There is a thinking in some circles why collaborate with foreign universities, when IITs within are available? Are IITs not good enough to guide? Many new things like patenting and outreach have come up elsewhere in the world after IIT were set up. Good policies and practices for industrial development from elsewhere in the world, will have to be incorporated in newly coming technological universities. It is good to involve existing IITs, but wiser, to involve world best technical universities and remain in global network.

Envision creating imaginative technology leaders. Importance of technological academic institutions in today's knowledge driven society is very high. It is they, who are furthering human civilization to greater heights. It is the academicians who provide new knowledge, new theories, new technology and competent manpower to business and industry. They are supposed to provide not only knowledgeable but also ethical leaders to government, to the total economy and the world. Industry, society and government, in return, ought to provide adequate funds to academics, to make it grow. India can be richer only by use

of advanced technological knowledge. There is no other way. What kind of graduates institutions produce decide the future? If institutes produce mediocre engineers, future of India will be mediocre. If they produce world class leaders, future of India will be world class. Are Indian institutes aiming at producing leaders of global standard? Do we have a mechanism for building leadership in academic institutions like principals, vice chancellors? The well known saying goes, *"First we shape institutions, and then they shape us for generations"*. Do the key people in government attach proper value for upbringing of youths and provide adequate budget? Do they adopt world class strategies and provide better governance to enable youth to harvest global job opportunities?

Want to be globally competitive? Then India ought to have many technological universities, of world class standard. Students now demand world class education. They are ready to pay for it in terms of time, effort and money. But where do you find such institutions? IITs are very few. Thousands of students to obtain quality education are forced by circumstances to go abroad by spending huge sums of money. The number of students going abroad is increasing. Technological Universities and colleges in India, now, will have to be competitive by nothing less than world standard. Education has become a global subject. Foreign universities have come and many more are coming. They are attracting best of our talent and may soon dominate the Indian scene. Where do the Indian institutions stand in comparison? Let us humbly admit that Indian institutes are far too behind the world. Have we made a gap analysis between Indian institutes and their counterparts abroad? Why are our universities woefully unsuited to the quality demands of globalization? Why they are far too behind their counterparts in developed world? The intellectual potential of our men & women is far too good. **They have contributed immensely in American universities and made them forerunner. In India, similar people, fall too short because they are**

under poor governance, poor systems and procedures.

We need to make introspection, especially in the light of world proven policies and practices, and improve governance of technological universities. Do our institutions lack new visions of new world? The present method of governance which is under the "grip of government" although at one time served well, but today, it falls too short of requirement. It needs to be reformed, made flexible enough without any delay and made competitive in global context. How can the technological universities become autonomous in true sense? How can they become knowledge generators? How can they have effective and imaginative governing boards? This is a challenge before Indian academicians. How to face these challenges effectively? You will find answers, in this article. It essentially demands willingness to embrace change. The world under the forces of globalization is changing fast. Only those professors and institutions, who change to innovate and again innovate can educate the students on correct lines

Marketing is essential. Marketing is a usual practice in profit making companies. Companies earn money by selling their goods and services. In non profit organizations like universities and colleges, however, it is rare. Universities from developed countries have of late, opened marketing departments and are adopting strategies to sell education and knowledge, in international market. They have been organizing campaigns in India, so also in many other countries, to lure students. They, on campus, have been vigorously conducting scientific research, obtaining patents & IPR and selling technology brands to the whole world. Through technology transfer, they are contributing to human civilization. Thereby, they are earning money which is ploughed back to support institutional budget, and contributing to make education affordable. Technology transfer from knowledge organizations to industry to improve productivity, has become a major phenomenon.

It is considered as the key to industrial development and competitiveness. Technology generation, dissemination, patenting & IPR, are some of the current important issues before the nations.

Technology level of a nation is the key determinant of its economic and social well being. Therefore, efficient organization and management of technology generation and its effective transfer to community in any nation more so in India, is the need of the hour. Will the present technological universities pay adequate attention to these aspects? They create the future of India. Will India remain a technology follower or become technology leader, matters for future of children and grand children.

Performance of institutions, in isolation, ought to be discouraged. Fresh initiatives to integrate the working of universities, CSIR labs, colleges, industrial estates, chamber of commerce need to be introduced forthwith. Gone are the days when universities enjoyed sellers market. Then, they did not need, marketing. Now, transnational migration of students and high mobility in search of quality, has become common. Indian technological universities, now, have to deserve rank on national and global planes on their own merit. They face now competition with domestic and international, at their own door steps. Foreign universities are posing a threat to Indian higher education system. Indian universities will stand to gain from globalization only if they learn lessons from their counterparts, and quickly adapt to changing times. Otherwise, they may trail behind.

Universities, world over, are getting less and less budget from Government, and are expected to produce more. Expectations of students are soaring high. They aspire to make career on global plane. Universities are expected to perform far better than in the past, for which they are pressurised to increase outreach for welfare of community and generate revenue to support their own activities. Self finance universities and colleges are allowed by law.

Universities and colleges are assuming key role in global economic systems, where new technological knowledge and highly skilled people are perceived as critical inputs for economic and social development.

What our Technical Universities should be doing now?

Following observations are pertinent in this regard. They give a hint as to what our universities should be doing now and how they can stay fit and competitive in global market

Participation in Exhibition

A few years back I happened to visit Hannover Industrial Exhibition in Germany. There was a pavilion meant for universities and colleges. It was most crowded by visitors. Students and professors were explaining the new researches, emerging technologies, like patents and IPR to visitors. Universities had come from all over the world to display and sell their research and innovation output to global industrial community. Visitors came to this pavilion to know which of the new technologies are on horizon and would dominate their business operations tomorrow. Japanese companies in particular were far too ahead, remaining in touch from research stage till completion with the universities not only in Japan but also those in USA, UK, and Europe. It is this strategy which has enabled Japan to become industrial leader. Good universities are aggressive in tapping the industrial clientele world over. Participation in exhibition presenting new knowledge, new technology, and new theories to create new society is demanded of a modern Indian technological university.

What is the use of that research which, in spite of its potential, is not exploited commercially? Do our universities participate in industrial exhibitions? Do they have patents & IPR to sell like their counterparts abroad? Can we do this? We can, but we need to have a vision. In India, how many universities have so far obtained patents and marketed them. American universities obtain as many as 1000

patents each year, whereas Indian universities obtain less than 10, and they have no mechanism to market. Their use and application is, left to chance. Students do research for PhD, masters and under graduation. In the absence of marketing mechanism, the theses remain in library on cupboards. Commercial exploitation is not done, and hence quality of research remains mediocre, less useful and irrelevant, and in turn, the quality of education suffers. Full gains from research are not achieved. Many times papers are published in national and international journals, but patents on them are earned by foreigners. We need to make most of our capacities and outputs for which a well designed; well connected marketing and technology transfer department in a university is a must. Without that, we are losing benefits and shall continue importing technology from foreign.

Technology Transfer from university to industrial estate: Can a university propel industrial development? A major reason for the success of the US computer industry has been the development of a host of small firms in Silicon Valley and in Boston. These firms grew directly out of research in neighbouring universities. Professors have acted as consultants to these firms, new grads have provided the workforce, and research projects funded by government have provided ideas. The companies benefitted, so also the nation with new products, new jobs and new market strength. Chinese universities are not behind, so also Australian. Can the Indian technological universities not do this? You need a swimming pool to learn swimming, so you need a technology transfer department to learn and practice entrepreneurship.

New Agenda for Technological Universities A university by definition is a place where knowledge is generated. They should be technology generators, obtaining patents & IPR, and transferring them to industry. To make this happen, the technological universities should set up on campus Research parks, Incubation centres, patent & IPR centre, Innovation centres,

technology transfer centres, and marketing departments. This is what universities in foreign are doing. Why our technological universities cannot do?

Research Parks and Incubation centres:

It is the success of projects like Cornell's Centre for Advanced Technology that has led many universities all over the world to establish research parks and incubation centres on their campuses. In these parks, space is rented to small, developing companies-often headed by recent graduates- and the university provides facilities as well as scientific and business advice and support. The model is now adopted the world over. Research Parks are providing spring boards for students to swim ahead of all in creative activity.

Success in the international marketplace in the coming years will depend chiefly on the successful and swift application of new S & T to manufacturing and processes and products. And that in turn will depend on close and effective partnership between university, government and industry. Are these models worth adaption for Indian universities?

Foreign collaborators, thus far, have propelled Indian industrial growth. Can Indian universities not go nearer to industry and contribute?

Most of the companies have foreign collaborations. True that India is late starter in industry. Now enlightened industries are coming forward to join hands with universities to jointly conduct research and innovation. Department of Science and Industrial Research Government of India have started many schemes. It is good that they are recognizing their role and responsibility. They have to play a leading role in innovation and entrepreneurship. Foreign collaborators have so far been transferring technology to industry at high cost and with time lag, besides making us too dependent on them. Industry will be flocking round the technological universities if and only if they generate technologies.

Why India should Generate Technology?

Most of the time, it is the penultimate technology foreigners give us and then they keep secret with them, and so we cannot be competitive in world market. Now organizational innovations like technology parks, innovation centres, patent & IPR centres, technology incubators are being established in many universities and colleges. This is a good sign, necessary to produce Indian brands of technology. This accentuates the need and importance of effective marketing departments. How can the products be sold in international market without marketing department?

Characteristics of world class technological universities. On the campuses of universities like Madison, Cambridge, Edinburgh what we notice is that research companies are flocking round them. Venture capital companies have opened offices in campuses in search of new technological ideas for commercialization. Universities in developed countries have become like magnets which attract not only scholar students but also industry, VCF, and entrepreneurs, from across the world. They are globalizing their operations to meet the world needs in education and of technology. Students from many countries, so also industries from across the world are coming to their campuses and for which they are prideful. By virtue of strong research base they have become a source of latest technological knowledge in education and a source of new ideas enabling companies to win. This has become possible because of strategies of marketing.

Conclusions

From discussions above following conclusions emerge.

1. India desperately needs research based world class technological universities. They should not remain only as examination bodies. They are expected to provide each new generation top leaders with creative, inclusive, inquiring, engaged and

enabling mind. Brave new India of tomorrow is being created today in these temples of knowledge. Well being of people critically depends on reforms in technological universities. Who will make millions of citizens fit for living in modern world? Who will create world class leadership fit to run a big country, like India? It is the world class professors in them who produce excellent able leadership. Therefore they should be challenged, critically examined, and enabled to play an influential role in preserving traditional knowledge and rewriting the book of new knowledge.

2. Technology universities should show lead in industrial development. Technology clusters, innovation centres, research parks must be started in and around them. This will fire the imagination of young. IITs, NITs and state technology universities, whose present impact is far too low, should now emulate the models of western schools. Technical Education Quality Improvement Program [TEQIP] Government of India is aiming at this. Technological universities must make its fuller utilization. Universities must have to think out of box and enable industry to win.

3. What should be the next big thing for universities to do? Technological universities at this juncture of time must focus on Generation and Marketing of Intellectual, technological capability in to saleable goods and services. Public service, carried out chiefly through teaching, was the motive for the creation of the earliest universities and colleges. Even today teaching remains the core of the university's public service. But now in globalized world, trend of public service extends far beyond, to entrepreneurial activities like technology transfer, Research Park, Technology Innovation, and Patent & IPR etc.

4. Technological universities must be made responsive to world dynamics. It is the technological universities in US, Germany, Japan which have enabled them to capitalize on technology. World experience tells us that but for effective knowledge generation and

technology transfer with technology push matching with market pull; universities remain out of tune and isolated, as "Ivory Towers". They do not remain responsive to world dynamics in technology and hence do not effectively influence people's life as much as expected.

5. Restructuring and repositioning of Indian technological universities with respect to society and the world is needed.

The conventional wisdom of university system, with outdated visions & missions, systems & procedures, policies & practices need revision. Once it served well. But now in free world universities are expected to stand on their own merit and imagination. If innovation and creativity are to be given a boost, creation of research foundations for the purpose is must. Industries should have to show a lead.

6. Thus far, it is the foreign collaborators who have gone nearer to Indian industry and propelled their growth.

Indian universities remained away. Now is time that technical universities learn a lesson from foreign counterparts and play the role of "light House". They should present their research output, patents etc in industrial exhibitions.

7. Technological universities can accelerate Brain Gain.

Thousands of students are going abroad every year. They have been going from Gandhi, Nehru period. This is happening mainly because our universities are highly deficient in knowledge generation & knowledge transfer to industry and society at large. Indian Universities can stand high in world list if they generate and dissipate knowledge effectively.

If india does not create research based, world class technological universities, if industry does

not associate with them in this mission, the universities will be providing mediocre graduates far too low by international standard to run India's professional affairs at national and international levels. India will then tend to lag behind.

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