CHAPTER 18

Higher Education Model for Large Developing Economies

*Raghunath K. Shevgaonkar**

INTRODUCTION

Education is the key to socio-economic development and character building. Higher education plays an important role in knowledge and wealth creation. Historically, one can find a good correlation between the spread and quality of higher education and the economic development of a nation. Scientific, social and economic developments in developed nations can be primarily attributed to the robust higher education systems those nations developed over a long period of time. Many European universities have a tradition longer than a few hundred years, whereas in the developing nations the modern education system evolved only in the last 100 years. In countries like India and China, although there were world-renowned universities in pre-Christ era, in the intermediate period the higher education system deteriorated due to many social, economic, geographical and political reasons, and today these large nations suffer from inadequate higher education systems. Although more than half the world's population lives in these countries, their knowledge and wealth contribution to the world are relatively small. With the industrial revolution, the economic gap between the western world and the Asian countries further increased. Countries like India and China continued to work with traditional practices without paying due attention to the modern approach to knowledge and wealth generation. The same thing happened in the middle Asian, African and South American countries. As a result, a large part of the world remained deprived of economic development. Large nations like India and China aspire to be major players in the modern world. However, this can become possible only with establishing a proper and robust higher education system.

PRESENT STATUS OF HIGHER EDUCATION IN DEVELOPING COUNTRIES

According to the World Bank report published at the end of the last century, more than 80% of the world's population lives in developing countries as conventionally defined on the basis of per capita income. The developing world includes Africa, much of Asia, most of Latin America and large parts of the former Soviet Union. Although the developing nations exhibit wide economic, political, social and cultural diversity, the report discusses broad principles applicable to all the developing nations.

It is clear that in the 21st century wealth will not remain confined to factories and land, but will be distributed in the form of knowledge, skills and innovativeness of the people. The developed world has quickly reacted to the demands of the 21st century by redefining its educational priorities. However this could not happen for the developing countries. This is not because the challenges of the 21st century are not well understood by the developing countries, but they have many implementation issues due to their geographical, social and political conditions. One can therefore ask the following questions in the context of the developing countries: (i) what is the role of higher education in economic and social development? (ii) what are the major obstacles that Higher Education faces in developing nations? (iii) how can these obstacles be overcome?

These questions might appear trivial since the role of higher education in economic and social development is abundantly clear. However, in reality, during the last three to four decades the focus in developing countries has been mostly on primary and not tertiary education. (China, however, has provided more thrust for higher education in last decade.) Higher Education has remained under-funded by governments and consequently Higher Education institutions are politicized and poorly regulated. There is therefore a need to concentrate on Higher Education in developing nations. The report also points out that the modern Higher Education system has not remained limited to extending help in raising living standards and alleviating poverty, but has been forced to confront expansion, differentiation and a knowledge revolution. In recent times there has been a shift from class to mass in the Higher Education system in developing countries. More and more children are completing secondary education and are aspiring to get university degrees. Consequently the old institutions have grown in size to become mega-universities. Similarly a variety of new specialized institutions emerged in developing countries as compared to a small member of homogeneous universities that existed 50 years ago. The major impact of this quick expansion is the deterioration in the quality of Higher Education. Since major expansion is taking place in the private education sector, there is a need to explore what the private sector can and cannot deliver. For example, the private sector is mostly interested in professional schools and not in traditional uni-

versity subjects. Government then should establish a mechanism for guaranteeing quality and for nurturing areas in which the private sector is unlikely to invest, like fundamental research, humanities and social sciences, liberal arts etc.

The internet transformed the outlook and the functioning of the world. More knowledge became accessible and those who got the skills to use it became powerful. The knowledge revolution therefore requires a new type of education. Higher Education should create intellectuals who are flexible and keep learning life long. In the present context Higher Education therefore becomes extremely important for the developing world. It is amply clear that although Higher Education alone cannot guarantee rapid economic growth, no sustained progress is possible without it.

The success of higher education lies in high-quality faculty, high-quality and committed students, and adequate resources. Developing nations primarily lack the first and the last of the three. By and large there are well prepared and committed pre-university student populations, but unfortunately there is an acute shortage of qualified faculty, and resources are meager. Faculty financial packages are the least attractive and therefore university faculty is the last option exercised by bright researchers. Due to the low paying capacity of the population in developing countries, revenue generation from tuition is negligibly small and Higher Education needs almost full financial support from the Government. Since the Government's priority in the developing countries is primary and secondary education, the developing countries spend far less on higher education than the developed countries on each student. It may however be pointed out that in developing countries individuals actually spend a higher proportion of their income than that in the developed world on higher education.

In addition to low financial resources, the developing countries suffer from poor governance.

Another important aspect of Higher Education in developing countries is insufficient scientific capacity. Academia in these countries also lacks strong linkages with industries. This pushes developing countries further behind the industrial nations in terms of their science and technology achievements, and widens global inequality. The key question for policy-makers in developing countries is what is the priority for science and technology education from a resource-allocation viewpoint? The answer widely varies from country to country. India and other Asian countries have provided proper thrust for science and technology education and have started playing a major role in development of software and manufacturing.

HIGHER EDUCATION IN INDIA – ISSUES & CHALLENGES

In India barring a few, most of the universities were established after independence from the British rule i.e., in the last 60 years (Note: At the time of inde-

pendence there were only 30 universities in India). After independence (Colonial rule) in 1947, the visionary leadership of India put a thrust on technology education to make the Nation self-reliant and economically strong. A central regulatory body, the University Grants Commission (UGC), was established to define a higher education path for the country. A large number of state universities were established across the country to develop qualified manpower in all disciplines of science, engineering and technology, and humanities and social sciences (see Table I). The universities were primarily based on the British model with affiliated colleges that were physically isolated from the main university campuses. Although initially the universities were supposed to handle both undergraduates and postgraduates, slowly, the undergraduate teaching was shifted to the affiliated colleges and the university campuses predominantly became postgraduate. However, academic control, including the conduct of examinations, even for undergraduates, remained with the universities. The university functions got divided into two parts, postgraduate teaching and research, and the conduct of examination of the undergraduate students admitted in the affiliated colleges. Part of the university became an examination conducting board. Due to democratic processes involving the affiliated colleges, the functioning of university became sluggish and the quality of education deteriorated. Today a medium-size state university has 200-300 affiliated colleges with typical enrolment of 200,000 to 300,000 students. At large universities like Delhi, Mumbai, Pune, Kolkata, the number of affiliated colleges is as high as 500-600 and student enrolment more than half a million each. In the last 60 years the number of state-funded universities increased to about 300 and an equal number of privately funded universities have come into existence in last two decades.

Just after independence, as mentioned earlier, a few technological universities known as Indian Institutes of Technology (IIT) were established to meet the technological needs of the country by a special Act of parliament. These institutions were primarily based on the American Higher Education model and did not follow the affiliated college system. The institutions were single campus institutions with a good mix of undergraduate and postgraduate education and research.

To start with there were five IITs primarily located in different zones of the country i.e., Kharagpur (East), Bombay (West), Madras (South), Kanpur (North) and Delhi (North). Since that was the beginning of technical education in India, the Government of India encouraged mentorship from different industrialized nations for different IITs. Consequently, except IIT Kharagpur, all IITs received mentorship from the advanced nations — IIT Bombay was mentored by the USSR, IIT Madras was mentored by Germany, IIT Kanpur was mentored by the U.S. and IIT Delhi was mentored by the U.K. The mentorship not only provided financial and technical assistance, but imparted the

Table 1: Universities in India (2011)*

Institutes of National Importance	70
Central Universities	44
State Public Universities	302
Deemed to be Universities	132
Private Universities	146
Total Universities	694

*There were only 30 universities in India in 1950

educational ethos of the respective countries. This indeed resulted in some cultural differences between different IITs. However, over time all the IITs more or less converged to the American model of education. IITs provided a strong thrust on fundamentals and analytical skills, and produced graduates of international quality. IIT became a brand synonymous with quality in technical education. The number of IITs practically remained the same for almost 50 years. However, considering the need, the number tripled in the last decade. Today there are 16 IITs in India, including the original five.

In addition to IITs which were primarily technology institutions, a large number of central universities based on the American models were also established across the country. These universities are single campus universities covering all disciplines in science and humanities with a good mix of undergraduates and postgraduates. Jawaharlal Nehru University (JNU) at Delhi may be a good example of this.

To insure quality in higher education, the Government of India set up a National Assessment and Accreditation Council (NAAC) and a star rating criteria evolved over time. The star rating is based on overall performance in terms of NAAC score on a four-point scale, citation of research articles, patents filed etc. Although accreditation is not mandatory in India, good universities voluntarily obtain NAAC certification every five years. The institutions of national importance are exempted from the NAAC certification. Table II gives the number of universities for different star ratings.

While the modern university system was getting established in the country in the middle of the last century, the Government of India established a large number of research laboratories for area-specific fundamental and applied research under the banner of Council of Scientific and Industrial Research (CSIR). The mandate of these laboratories was to carry out research of national need without getting involved into teaching. As a result the research slowly moved from universities to these laboratories, research funds to the universities decreased and university research dwindled. Most of the state universities became teaching-centric examination bodies with less focus on research.

This model was in contrast to the western model where primary cutting-edge research is done in the university.

Table 2: Star Ranking of Indian Universities (214 Accredited Universities)

Star Rating	NAAC Score	Scopus Citations	Patents filed	Number of Universities
*****	>3.6	>6500	>500	24
****	3.2 – 3.6	3000 – 6500	>50	50
***	3.0 – 3.2	1000 – 3000	10 – 50	52
**	2.5 – 3.0	500 – 1000	1 – 9	44
*	2.0 – 2.5	100 – 500	–	44

The major disadvantage of this model was that the university students were deprived of exposure to cutting-edge research and their motivation to opt for research as a profession decreased. Due to improper exposure of the excitements in research, research became the last option for university graduates. This consequently resulted in a shortage of quality, research-oriented faculty in the universities.

In short, in the last 60 years, the Indian university system has undergone a massive expansion (See Table I). In addition to the state-funded universities, a large number of privately funded universities were also established in recent years. Today there are more than 650 universities in India, enrolling more than 10 million students, with about 1.5 million students in engineering and technology.

In spite of the massive expansion of the university system in India, the higher education gross enrolment ratio (GER) in India is just about 18%. When compared with other developing and developed countries, this GER is far below the satisfactory level (See Figure 1). For Asian countries this number is about 24% and in developed nations this number exceeds 70%. With the current number of higher education institutions, the GER in India will decrease in the next one to two decades because demographically India will become younger in the next few decades. It is therefore clear that even to catch up with Asian countries, the Higher Education system in India has to double within the next decade, and has to expand manifold within the next 30 years to become comparable to that of the developed nations.

India needs massive expansion and investment in research universities also (refer Figure 2 and Figure 3 for relative data). Today there is one research university for every 3 million population, whereas there is typically one university for every million population in the developed countries (see Table III). Research funding which is less than 0.5% of the GDP needs to be substantially enhanced as developed countries spend more than 2% of their GDP in research. Industrial investment in R&D also needs a transformational change.

Figure 3: Gross Enrolment Ratio for the Developed and Developing Nations [Ref. World Development Indicators 2012]

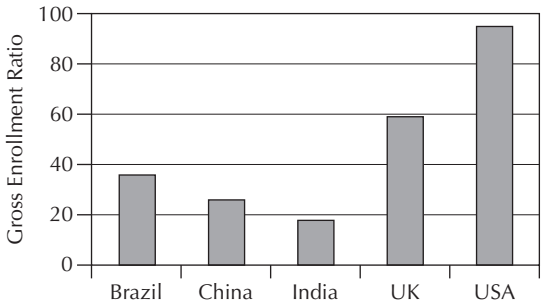


Figure 4: Number of Researchers

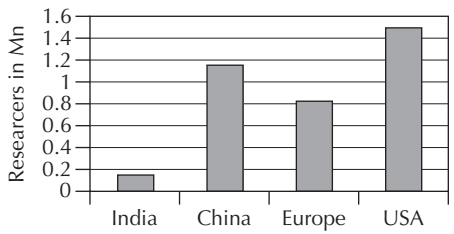


Figure 5: National R&D Investment

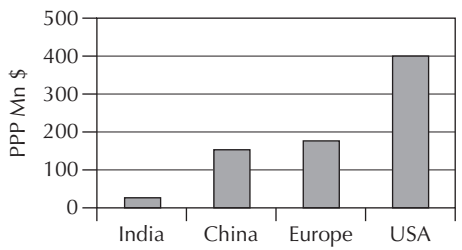


Table 3: Indian Universities and Population

Total Population in India	1.2 Billion
One University for	1.7 Million
Total PhD Awarding Universities	416
One Research University for	1 Million in Developed Countries
One Research University for	3 Million in India

HIGHER EDUCATION MODEL FOR INDIA

India's Education system has to undergo a massive transformation in the years to come, and the process has already begun. Education has been declared a high priority sector by the Indian Government and the funding has been enhanced manifold. However, mere enhancement of funds is not adequate to create a top-quality higher education system. Funds can create infrastructure and laboratories, but the creation of quality faculty is a long-drawn process. The major difficulty that India's Higher Education system faces today is an acute shortage of quality faculty. Today India produces about 10,000 to 15,000 PhDs per year, including about 2,000 in Engineering and Technology. This output is just about 25-30% of the national need. Due to a shortage of quality faculty, undergraduate education also suffers and the employability of graduates diminishes. The Indian Education System is therefore in a most challenging situation. It needs rapid expansion without compromising the quality of education.

To fill the gap of quality faculty, India has done a commendable job in using technology for teaching. To start with, e-learning technology has been used in engineering education. On an initiative of the Ministry of Human Resource Development, under the National Project on Technology Enhanced Learning (NPTEL) the entire engineering curriculum in all disciplines has been developed in web and video lecture format. There are more than 600 courses that have classroom video content created by the best faculty available in the country (mostly from IITs). This content is made available to anyone and everyone across the country free of cost. A high bandwidth National Knowledge Network (NKN), which connects all the educational institutions, has been commissioned for dissemination of the e-content. In addition, efforts are made to reach masses outside the Institute premises through the mobile communication network. India has an excellent mobile network with 80% penetration; with low-cost mobile handsets and tablets, it is possible to take quality e-content to a large number of students. In India, therefore, e-learning (MOOC) has been playing an important role in handling the problem of the shortage of quality faculty. Indeed this may not be a permanent solution, but is an excellent interim choice.

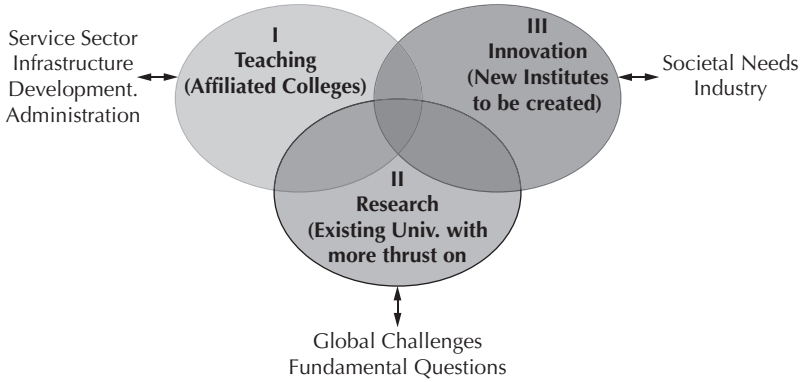
Being the largest democracy in the world and a prospective major player in the global economy in the years to come, India's Higher Education system needs to deliver on three counts, namely skilled manpower, high-quality research and innovation. The three outcomes need conceptually different institutional set-ups. There may be some overlap between some or all of them, but a university or a Higher Education Institute needs to define its objectives clearly. Considering the scale at which the system has to work, it is difficult for an institute to perform equally well in all the outcomes. Even within an

institute, it is difficult to find talent that has excellence in all three. Generally it is believed that research, innovation and teaching support each other. However, if the scale of operation is massive, as is the case in large, developing economies like India, institutions with three distinct priorities are a more effective model. The existing university system, with some modifications, will be more appropriate in the Indian context, instead of adopting the American university model. The model symbolically is shown in Figure 3. The model suggests three overlapping segments — teaching, research and innovation, and a university can choose relative proportions of them.

Teaching: The first segment that primarily focuses on teaching undergraduates can include all the affiliated colleges. An examination board can be created to efficiently conduct the examinations for the large student base. Teaching can be through the face-to-face mode or through a quality electronic mode. MOOCs may be used for imparting subject knowledge. Students can be empowered to define their course structure within some broad guidelines. Skills-based education can be made mandatory to make the graduate more employable. National agencies can assess the requirement of the specific skill sectors like administration, service sector, infrastructure development etc., and can dynamically upgrade the undergraduate curriculum. Although it is not mandatory, looking at the capability, a select class of students can be encouraged to interact with segments II and III. Faculty for this segment need not be PhDs since their primary responsibility would be quality teaching. However, they should have ample opportunities to overlap with the other two segments for enriching their knowledge. There should also be regular refresher programs for the teachers for updating subject knowledge. The performance of this segment should be assessed on the basis of the number of students graduated, their performance in competitive examinations and their placement.

Research: Research should remain primarily the responsibility of the state. Universities should focus on research and research-oriented teaching. Self-learning should become a regular practice instead of normal classroom teaching. E-content can be used for self-learning. Ample funds should be provided to the universities for doing research that is globally competitive. The faculty of this segment should address fundamental issues and grand challenges. The output of this segment should be measured in terms of funds attracted for research, and peer-reviewed journal and conference publications, articles, books etc. The faculty and students of this segment may interact with other two segments with a clear understanding that their primary responsibility is quality research. National agencies may define thrust areas of research from time to time, and the faculty of this segment should be able to align themselves with national priorities. In short, the faculty of this segment should be able to work with a free mind within broad research guidelines decided by the state.

Figure 6: Higher Education Model for Large Developing Countries



Innovation: Innovation is the key word today. An innovation improves some aspect of human life. A good innovation enhances the benefit to cost ratio where the benefit could be in terms of comfort of life, monetary return, human safety etc., and the cost could be in terms of money or resources, physical effort, etc. Innovation requires out-of-the-box thinking, an ecosystem and different training needed for product development. Not every researcher in the university may have the temperament and passion to convert his/her ideas into a usable product. Innovation also needs a good feel for societal requirements. For innovation, new universities or institutions need to be set up with mostly postgraduate education. Since industry generally has a good feel for the market and community needs, its linkage with this segment is very crucial. Assessing societal needs, industry can project problems to academia and the academician can work with a specific focus on a problem. Academia should work on concept-proving and the prototyping of an innovative idea, and the ecosystem should take the idea to the user in the final product form. The innovation university therefore should have a technology-transfer unit and a science and technology park. The technology-transfer unit should help an innovator to incubate a company or to establish a link with a prospective industry. The unit should also conduct regular programs about how to create innovation. The unit also should help in patent filing and IP protection. The output of the faculty from this segment should be measured in terms of patents and their monetization potential. The faculty from this segment of universities should not be assessed on the basis of publishable research. Since generally a good product needs input from multiple disciplines, the system should facilitate multi- and inter-disciplinary research cutting across various branches of science, engineering and the social sciences, including the law. The curriculum should not be straitjacketed and should be decided by the faculty depending upon the broad topic in which an innovation is expected. This approach is the opposite

of what a research university would normally follow where, first, all courses would be taught and then the research problem would be defined. The courses should be in small modules with a more practical orientation and open thinking. This segment may have linkages with the other two segments.

Innovation universities are practically nonexistent in India today. However realizing the importance of innovation in the 21st century, the Indian Government has established a National innovation council to promote innovative research. The University Grants Commission also has initiated schemes to establish innovation clusters in the existing universities with substantial funding over next five-year plan. The primary objective is to help develop innovative products that are India-centric. India-centric means a product which meets the needs of masses and which is inclusive, low-cost and sustainable. Since India is a multilingual, multi-caste, multi-religion system, innovation should cut across the boundaries of language, caste and religion. India therefore needs to develop its own educational framework since the model from the developed nations may not be suitable for Indian conditions.

It is therefore clear that a unique combination of teaching, research and innovation for university may not meet the needs of all societies. A variety of universities with different weightages given to the three segments, teaching, research and innovation, are needed in India. At present, since the thrust is on capacity-building, a large number of teaching-focused universities need to be created. However, as the country becomes more developed, the weightage for research must be enhanced. The education model proposed here is dynamic in nature and can be tuned to the requirements of individual nations. Considering the huge population, limited resources and complex society of India, there is a great potential for innovation. Also innovation created by and for India will be affordable to a majority of the global population that resides in developing nations.

SUMMARY

In this paper the challenges of higher education in the developing countries which account for more than 80% of the world's population have been investigated. Developing countries like India, China and some of the Latin American nations that aspire to be major players in the 21st century have provided thrust for higher education in the last two decades. However, there is still a long way to achieve the desired GER and the research capability. The Indian education system has been presented as a test case. A dynamic education model for large countries like India has been proposed. It is believed that the model will help in enhancing GER, research and innovation in the large developing countries, and will help in narrowing the gap between the developing and the developed world.

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