

# **ECONOMIC AND SOCIOLOGICAL ISSUES OF THE TRANSITION TO COMPUTER BASED ENGINEERING EDUCATION**

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## **ABSTRACT**

It is proposed to raise the debate on Engineering and Technical Education at the global economic level and to examine some of the issues facing developing and poorer countries in managing and improving the quality of engineering education in their countries, especially in the context of internet and IT culture.

After the fall of the Berlin Wall, the world is now divided in two realigned blocks: one of developed (rich or advanced) countries which have a social security safety net for their population and another of developing (or poor) countries which have no such luxuries for their population.

For the general public in the developing countries, any engineering or technical degree/diploma is a passport to lifelong wellbeing of an individual and his/her extended family. Therefore, the demand for such qualifications is very high and it is almost a rat race amongst school leavers to get into engineering/technical colleges.

In view of this booming demand, there are hundreds of privately funded engineering/technical colleges in countries like Philippines, India, Thailand, etc., besides state funded ones. It is extremely difficult to ensure good quality in this mushrooming scenario.

There are also many very small poorly resourced developing countries where there is only one engineering school and/or two-three technical colleges. Products of these schools/colleges work only in their own country and education globalization have little or no meaning for them.

Besides highlighting the aforementioned general issues, the Paper also presents a few case studies on problems of accreditation and quality assessment in larger developing countries like India and the Philippines. The Paper also discusses the effects of *commercialization on the quality of education and social impacts of IT revolution on educational processes.*

## 1. INTRODUCTION

During the dawn of this new millennium, it is appropriate to take stock of what has been achieved worldwide in the areas of engineering education against the backdrop of expanding knowledge and high speed communication through information technology revolution.

This presentation seeks to raise the debate on engineering and internet education at the global economic, sociological and psychological level and examine some of the issues facing developing and developed countries in organizing, managing and improving the quality of these programs in their countries.

The paper also discusses the effect of these issues towards quality and marketability of engineering education programs by analyzing the following points:

- economic blocks:
- funding and quality in the developed world:
- funding and quality in developing regions:
- commercialization and globalization of

education:

- continuing engineering education:
- computer vs traditional teaching.

## 2. ECONOMIC BLOCKS

Before we discuss the nitty-gritty of relationships between funding problems, engineering and internet education, it is necessary to clarify what we mean by developed and developing countries. World Bank (WB) does not classify countries.

However, it classifies world economies into three categories: low, middle and high income economies based on Gross National Product (GNP). Low and middle income economies are sometimes referred to as developing economies [1]. Rankings based on Human Development Index (HDI) calculated by the United Nations Development Programme (UNDP) are much more complex. Life expectancy, literacy, Gross Domestic Product, etc. are considered in these calculations [2]. UNDP categorises countries under high, medium and low human development. At the end of the HDI Table, it further classifies countries as developing, Eastern Europe and the CIS and OECD [2]. Because of different criteria used by these two organizations, there is always some confusion as to which countries are

developed or developing. For example, Israel, Kuwait, Singapore and UAE are ranked as high income economies by WB but are considered as developing countries by UNDP-HDI or regarded as developing by their authorities.

I have developed a very simple classification of countries based on presence or otherwise of total social security for the whole population of a country. According to this criterion, after the collapse of communism in most parts of the world, there are now two realigned economic blocks (3):

- The Developed Block consisting of those rich/advanced countries where the government provides Total Social Security (SS Net or Welfare) Support System for its population. This block consists of about 20 countries located in North America, Australia, New Zealand and re-latively well-off countries of Western Europe.
- The Developing Block consists of those countries where there is no or almost no SS Net, i.e., when a person has never been employed, the government does not provide the basic human survival needs in terms of food and shelter. In these countries, unemployed people have the immense problem of providing for themselves, and their families, food and shelter which is their first priority. In this situation, people care the least about the other non-essential esoteric issues like quality of life, environment, ethics and even quality of education.

This Block consists of all remaining countries in Africa, Asia, Latin America, Central and Eastern parts of Europe, numbering over 200.

How these economic realities affect education in general and engineering /internet education in particular are discussed in the following sections.

### **3. FUNDING AND QUALITY IN THE DEVELOPED WORLD**

In advanced/rich countries, most of the educational funding (primary, secondary, tertiary, etc.) is provided by the respective government and is largely based on number of students. Exception to this general scenario is the USA, where most of the world-famous Universities and Centres of Learning were established by and are still funded by private individuals and collective pool of endowment funds, such as Harvard, Stanford, etc.

However, during the last few years, governments in even these rich countries, especially in Australia, New Zealand and the U.K., have decreased education funding and are forcing the Universities and Engineering Schools to seek private or fee-based funding to augment their resources. In European countries, Universities and Engineering Schools are still very well funded by their governments. The quality of the education provided in these countries is very good and is monitored mainly by professional bodies, which are generally free of governmental or political interference.

#### 4. FUNDING AND QUALITY IN DEVELOPING COUNTRIES

For the general public in the developing countries, any engineering or technical degree or diploma certificate is a passport to lifelong well-being for an individual and his/her extended family. Therefore, the demand for such qualifications is very high and it is almost a rat race amongst school graduates to get into engineering/technical colleges. These people will leave no stone unturned to gain entry and pass these courses. Because the problems of funding and quality are different in larger countries than those in smaller countries, it is proposed to divide developing countries into two groups:

- Large countries having population of more than 10 million.
- Small countries having population of less than 10 million.

##### 4.1 Large Countries

Universities and education institutions in these countries were initially established (in some countries about 600 years ago) by their governments or by colonial administration and government funding continued for the education sector till about the 1980s. After the collapse of communism and the emergence of market-driven economies in many countries of Central and Eastern Europe as well as Asia (e.g., India, Philippines and Indonesia), private sector educational funding is gaining ground [4].

In view of the aforesaid booming demand, there are hundreds of privately funded Engineering/Technical Colleges in countries like Philippines, India, Thailand, etc., besides the usual state-funded ones. These private colleges are run as business entities and are largely fee based. As there are now so many of these private Technical /Engineering Colleges, a bit of market-drive competition is coming to play. Those who can maintain good quality of education are attracting better students and can also demand higher fees. In the present age of internet and computers, private colleges or institutions offering good quality information technology education are doing extremely well and will continue to survive in the new millennium as long as this cyber boom continues.

It is extremely difficult to ensure good quality in this mushrooming high demand scenario. Educational quality of most of the central government funded universities and institutions, e.g., in India, is still very good but many other state or provincial government owned universities and institutions are not in very good shape. Amongst the privately run colleges and institutions, as mentioned above, the market is deciding as to which entity is good or bad. Quality in all educational institutions in these countries is usually monitored by government operated bodies, which are open to political influence and many times their decisions are not objective. Thus, the problems of accreditation and quality assessment is extremely difficult and complex in large developing

countries such as India, Philippines, Indonesia, Thailand, etc.

Because of India's very large population, the demand for engineering/IT degrees is very large but the entry places are still limited which ensures a good filtering and selection process and therefore quality is automatically maintained. Due to this fairly good quality product, Indian IT professionals are in great demand in USA, U.K., Europe, Arab and Southeast Asian countries. Education in the tightly controlled economy of China is till largely state funded with practically little or no role for private sector educational involvement. Quality in all engineering and technical colleges is also largely undefined and is monitored by state controlled bodies.

Some African countries have also started to establish private colleges and universities. Presently, there are a few private universities in Kenya. Quality is also monitored by state appointed entities in these countries.

#### 4.2 Small countries

Small developing countries can also be divided into two categories: poor and rich ones. There are many poor small countries scattered around the world but there are also a few very rich small countries like Arab countries, Brunei, etc.

In small/poorly resourced developing countries, there is only one engineering school and/or two or three technical colleges. Products of these institutions work only in their own country and educational globalization has little or no

meaning for them. For example, in a country like Papua New Guinea[5], there is only one degree granting Engineering School in a Technical University. There are 5-6 Technical Colleges which produce Diploma, Associate Diploma and Trade Certificate qualified students in technical areas. All are largely funded by the government, and funding is being reduced every year due to budget constraints.

However, during the last ten years, a number of private business colleges have propped up, which offer courses in Business, Accounting and Computing courses. Such courses require minimum laboratory facilities. The situation is similar in other smaller countries like Fiji, Costa Rica, etc.

Quality and accreditation has little or no meaning in these small countries, where the number of engineering/technical colleges offering technical education is extremely limited and it is difficult to compare one from the other. The quality is driven mainly by the market forces and employers decide as to which student is bad or good. The name of the college or institution has very little relationship to quality, because of the monopoly of these colleges in their own field of operation.

Cash rich small countries like UAE, Kuwait, Bahrain, Brunei, Singapore, etc. are concerned about quality but it is usually monitored by government appointed bodies, which are subject to political and other non-academic influences.

## 5.COMMERCIALIZATION AND GLOBALIZATION OF EDUCATION

As governments around the world cut back in formal education funding, commercial and private entities will take a greater role in educational business.

Education is slowly becoming a Service Industry similar to Banking, Insurance, Travel etc., (6). Recent examples of aggressive education marketing are those mounted by Australian and British universities in countries like Singapore, India, Malaysia, etc. There are many conferences, workshops and educational trade shows being organized by respective embassies, consortia of universities and specialized educational export companies.

Australia now earns about US\$4 billion per year from its education export and attracts a large number of full-fee paying students, mostly from Asian countries.

Many universities in developed countries continuously look over their balance sheets and try to maximize their incomes through admitting larger number of fee-paying foreign students.

However, the advanced countries of Europe, whose medium of instruction is in languages other than English, are falling behind in this world trade in education.

European Universities and Engineering Schools do very little marketing and promotion in the well funded regions of South East and Far East Asia, and in Arab countries.

Maintaining education quality in this free-for all scenario will become extremely complex as we move along from state controlled quality monitors to objectively minded professional quality monitors.

Professional bodies and institutions like the Institutions of Engineers or Accountants or Lawyers will pay more dominant role in enforcing quality in both government-run and privately-funded educational entities.

In the ultimate analysis, when the economies become totally market driven, survival of the fittest and best will automatically ensure good quality both nationally and internationally.

## 6. CONTINUING ENGINEERING EDUCATION

Life long education, learning and re-learning, educating and re-educating are the integral parts of an engineer. An engineer has to keep himself abreast of new and exciting developments taking place around himself by the constant push of the society to improve the quality of life and to reach dizzy heights of modernization and very high levels of technological advancements. Continuing education is available to an engineer in two main forms (7): Informal and Formal.

Informal Continuing Education Systems consist of mass media sources like TV, newspapers, magazines and reports.

Workplace discussions of ways to improve the work culture, work practice, modernization of equipment and improved quality control techniques are also informal CEEs.

Engineer constantly learns through his environment at home and at his work place.

Formal Continuing Education Systems

usually consist of attending specific subject related conferences and short courses. It entails considerable amount of financial resources either by the candidate himself or by the organization which employs him.

Most of the formal continuing engineering education programs in developing countries are sustained by companies and government organizations, who have money to sponsor their employees to attend these courses. Therefore, there are hardly any private takers for the non-formal learning/educational media.

The demand for award (degree or diploma) courses and programs is very high in developing countries but there is very little demand for continuing education or lifelong learning or short courses because these courses do not bring any immediate monetary value to the learner.

However, the demand for those programs which have market niche like English learning and Computer/Information technology is very high because of more job opportunities.

Professional institutions and universities organize most of the conferences and short courses. Specialised agencies and private companies organize short courses and conferences but these are very expensive and are on specific engineering topics.

Most popular short courses for engineers in non-English speaking countries of our region like Malaysia, Indonesia, Thailand Vietnam, Korea, Japan and China are English language courses which range from the intensive 2-week to more relaxed one year courses.

Lack of funds and institutional support remains a major problem for the engineers to be exposed regularly to the continuing education programme. Private companies employing engineers are reluctant to sponsor these engineers for the conference and short courses unless the government gives them some tax concession for the expenditure to be tax deductible and tax reduction through a training levy.

Developed countries provide such tax deductions and therefore continuing education programs are popular in these countries. Developing countries should also provide tax breaks to encourage continuing education programs. There is also a need for more institutional support for these activities. Perhaps some of the financial institutions like Asian Development Bank or other agencies should provide travel bursaries to encourage these activities.

## **7. COMPUTER VS TRADITIONAL TEACHING**

In developed (rich) countries, there is an increasing trend to move towards Virtual Universities and distance learning via computer and internet, and although the attempts are being made to create virtual universities in Africa and Asia, reach and appeal of these types of educational media is still very limited in the developing world.

In many developing countries, majority of the parents and/or students have problems of paying school/college fees of even US\$30 per year and they have no

means even to provide tables/chairs for home study. In such a scenario, it is almost a waste of time and effort on the part of educational administrators and managers to talk about computer/distance learning, virtual universities, etc.

In rich countries, people can sit in front of their own personal computers whole day and go for parties and clubs/pubs in the evening to socialize but in poor countries of our world there are no substitutes to normal classroom physical teaching. Only this type of teaching-for degree courses or CEE gives the opportunity to interact with each other amongst the class group because they have no resources firstly to buy computers and secondly to socialize or interact after hours.

Education is a great integrator of diverse communities and ethnic groups in any country. Social and physical interaction is as important as knowledge transmission in the global education process. For a country like India, with different religions, languages and social customs, education provides a great unifying force and it is doubtful whether computer based teaching without classrooms can supply this essential element of education process[8].

## 8. CONCLUSIONS

The following points emerge from above analysis:

- Export of all types of good quality education will become an important

component of the economies of advanced/rich countries like Australia, New Zealand, the U.K. and Canada and possibly Europe.

- Privatisation, commercialization and marketing of education, especially business, commerce, and information technology based education will increasingly play a dominant role in the developing countries.
- Quality management in developing countries will also move away from government monitors to professional monitors, as is now the case in developed countries.
- Quality in the developing countries in the long run will be determined by the market forces. Good quality educational entities will attract better students and will also be able to charge higher fees.
- CEE programs are increasing the mobility of people between developed and developing countries.
- Virtual universities/distance learning based on computer/internet will have limited appeal in developing world unless economies of these countries become richer.
- Developing countries should think of giving tax concession to educational activities to encourage companies and organizations to send their engineers to attend such programs.



- Funding agencies like World Bank, ADB, and other agencies should provide more funds to encourage the

people to attend these conferences and short courses.

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