

## Engineering Education in Nepal: Prospects and Challenges in the new Environment

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Globalization Work: The Role of Consultants

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### **1. INTRODUCTION**

#### **1.1 The Country**

Situated between India in the South and Tibetan autonomous region of China in the North, Nepal lies between 26<sup>0</sup>22-30<sup>0</sup>27 North latitudes and 80<sup>0</sup>4- 80<sup>0</sup>12 East longitude covering a total area of 147, 181 sq.km. Altitude of the country varies between 70m in the South (Kechana) to 18,848m in the North (Everest).

Inhabited by 8% of the population, Himalayan Region occupies 37% of land area, Mountainous region occupies 49% of land area with 47% population and Terai occupies 14% land area with 45% population. Immense pressure of population in the Terai is therefore eminent.

Economy is based on traditional agriculture with lots of scope for modernization. Economic growth remains 3% to 4% with population growth of about 2.3 %. Overall consumer price index rising very fast, Nepal expects rapid economic growth by making the changed political system a vehicle which does not seem to be possible.

On the other hand the country is blessed with steeply varying altitude where by different climatic zone can be reached in short distance. Different cash crops can be produced all the season at various locations to suit the climate. Richness in biodiversity is also the blessings of this different climatic zone.

Similarly many deep georges, river valleys and some mountain peaks offer high speeds wind almost 16 hours a day suggesting high potential of wind energy. The country experiences bright sunshine more than 10 hours every day for over 250 days in a year- thus suggesting large potential of solar energy. The country is also blessed with over 4000 rivers and rivulets flowing from North to South with guestimated potential of 83,000 mw of electricity.

There are huge deposits of semi precious stones and useful rocks and minerals, lime stone being the most significant.

#### **1.2 The Education System**

Guided by vedic philosophy, this part of the Indian Subcontinent enjoyed institutional learning through Gurukul from 500 B.C. But modern education

started only from 1853 AD by establishing Durbar High School for the education of ruling dynasty-the Ranas. Almost 16% children of school going age never go to any school. Students dropout rate in the rural part is alarming. Only about 8% of the students admitted at the primary level complete higher secondary education.

Present school system is a 4 tier one with 0-5 years as primary level, 6-8 years as lower secondary level, 9-10 years as secondary level and 11-12 higher secondary level. After completing higher secondary, students go to universities for a generally 4 years Bachelor level education in three main streams- Humanities, Management and Technology which includes Engineering and others like food technology.

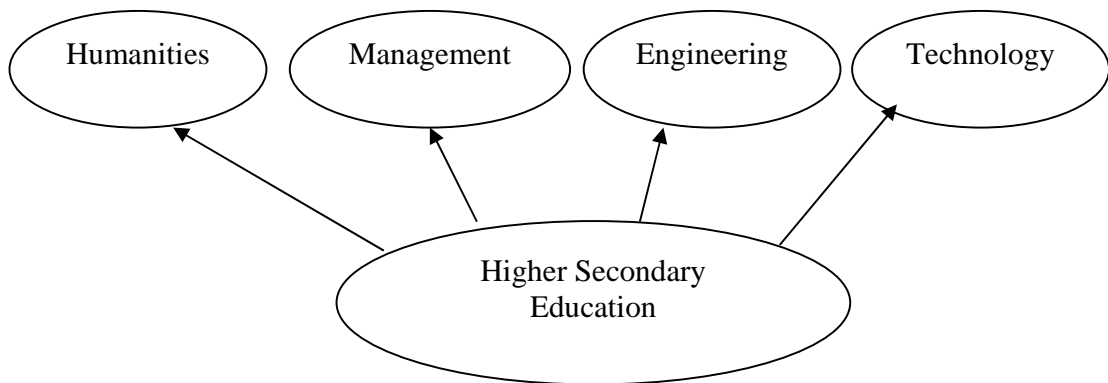


Fig.2: Higher Education Scenario

The then Prime Minister Junga Bahadur Rana started Department of Education in the year 1858 showing government concern to institutionalize education in the country. Sanskrit school was started in 1874 to give education to Gurukhalak-the Bahuns. It was only in the year 1885 that common people were given access to Durbar School. Spread of education was then rapid.

Today, education awareness is increasing all over the country. University education has gone to the private sector and the community. Government is focusing on school level education. Table below shows status of education in the country.

Table 1: Status of Education in Nepal

S.N	Level of Education	Number of Schools	Public%	Students Enrolment	Girls%	Number of Teachers	Females Teacher%
1	Primary	27,525	77.3	4,502,697	47.4	101,483	30
2	Lower Secondary	8,471	67.8	1,374,796	45.7	25,962	16.3
3.	Secondary	5,039	62.3	587,177	45.7	20,232	8.6
4.	Higher Secondary	1,018	52.6	364,404	43.3	-	-
5	University Education	520	16.2	141,636	32.7	-	-

Source: Ministry of Education and Sports 2007

### 1.3 History of Technical Education

Institutional technical education started in the year 1930 when a trade school was established to impart skills to the students. Basic Engineering education started in the year 1942. Nepal Engineering School was established in 1951 and 2 years overseer's program (after class 10) was started from year 1954. The first batch of overseers graduated in the year 1961. The present Institute of Engineering was organized under TU by combing the Engineering School at Pulchowk and Technical Training School at Thapathali in the year 1972.

Higher technical education started in the year 1978 with intake of 22 students in bachelor of Civil Engineering. Expansion of Engineering Education was very fast after the establishment of Nepal Engineering College in the year 1994. Master's level education started in the year 1988 at IoE. It was made more accessible with the start of master's level education at Nepal Engineering College in the year 1999. Ph.D. level education and research in Engineering started with first graduate obtaining a Ph.D. degree in Engineering in the year 2007.

## 2. PRESENT STATUS OF ENGINEERING EDUCATION

### 2.1 Institution and GoN Expenditure

Engineering education is being imparted through 30 colleges including 8 in the public sector. The country offered BE in Civil Engineering only in the year 1990. Currently 15 programs are offered in Engineering disciplines including Civil, Electrical, Mechanical, Electronics, Computer, Rural, Bio Medical, Geometrics, Environmental, Agricultural. Industrial, Software, Information Technology, Communication and Architecture. Currently three are 6 universities and 3 deemed to be universities out of which 4 offer these Engineering programs through their constituent campuses and/or affiliated colleges. Table below shows the universities in Nepal

Table 2: Universities in Nepal

S.N	Name of Institution	Year Established	Remark
1.	Tribhuvan University	1959	Offers Engineering Programs
2.	Nepal Sanskrit University	1986	
3.	Kathmandu University	1992	Offers Engineering Programs
4.	Purwanchal University	1995	Offers Engineering Programs
5.	Pokhara University	1997	Offers Engineering Programs
6.	B.P. Koirala Institute of Health Sciences	1998	Deemed to be University
7.	National Academy of Medical Sciences (Bir Hospital)	2002	Deemed to be University

8.	Lumbini University	Boudha	2005	Planned for Buddhism Studies
9.	Patan Hospital		2008	Deemed to be University

Through the ministerial speeches and also some programs, GoN seems to be serious on higher Engineering education. But figures show that it is not in the priority of GoN.

Table 3: Spending on Higher Education

Fiscal year	Budget for Education Sector %	Budget for Higher Education, % of 2	Budget for Engineering Education, % of 3
1	2	3	4
1999-2000	13.2	15.8	0.31
2001-2002	14.1	11.9	0.21
2003-2004	15.25	9.79	0.12

Source: Pahari (2008:43)

## 2.2 Enrolment Capacity and Student's Preference

The number of student's enrolment in Engineering education is increasing remarkably in the last decade because of the participation of private sector. The first batch enrolled at IoE in the year 1978 was only 22. Enrolment capacity in the year 1993 was only 96 students per year in Civil Engineering. Nepal Engineering College added 60 in Civil Engineering in the year 1994. With the establishment of other private Engineering colleges this number grew very fast. Table 4 shows enrolment capacity in Engineering programs under various universities.

Table 4: Enrolment Capacity Under Various Universities

University	Engineering Colleges			Students Enrolment Capacity
	Constituent	Affiliated		
Tribhuvan University	4	7	11	1638
Purwanchal University	1	8	9	1078
Pokhara University	0	9	9	1522
Kathmandu University	1	0	1	179
<b>Total</b>	<b>6</b>	<b>24</b>	<b>30</b>	<b>4417</b>

Source : Nepal Engineering Council (2007)

Engineering education has spread over 9 districts of Nepal covering Morang in the East to Dhangadi in the West. Out of the 30 existing colleges, 12 are located outside Kathmandu Valley.

The number of students enrolment in various disciplines fluctuates remarkably. In the year 2002 to 2006 there was a great demand for enrolment in Computer

Engineering and Electronics and Communication Engineering. This now has shifted to Civil Engineering. Table below shows the estimate of students enrolment in various disciplines in the Year 2007. This is based on author's experience at Nepal Engineering College.

Table 5 : Estimates of Students Enrolled in Various Disciplines.

S.N	Program of Studies	Students Enrolment
1	Civil Engineering	1670
2	Electrical Engineering	310
3	Mechanical Engineering	100
4	Electronics and electrical Engineering	100
5	Electronics and Communication Engineering	1050
6	Computer Engineering	700
7	Architecture	200
8	Other branch of Engineering	287
<b>Total</b>		<b>4417</b>

Other branch of Engineering include Industrial, Agriculture, Geometrics etc.

Students also prefer new subjects like Bio Medical Engineering and Geomatics. Interview of some students reveal that many students are looking for newer subjects like Nanotechnology, Surface Engineering etc. which are not available in the country.

### 2.3 Cost of Education

Nepal Engineering Council is the regulating authority for Engineering Colleges in the country. It has its norms and standards related to physical and academic infrastructures which colleges are obliged to fulfill. This commits lots of resources. Therefore Engineering education is slightly costlier than other Humanities or Management education.

An estimate indicated that average cost of Engineering Education for 4 years duration is about Rs. 0.6 m. This could be slightly lowered by increasing efficiency. This cost for IOE, Pulchowk Campus, a government college, is estimated to be Rs. 4.0 m. If only direct cost per student is accounted, it is Rs. 0.35 m in private colleges and Rs. 1.0 m at Pulchowk Campus.

When compared with the cost of medical education (MBBS) which is about NRs 2.0 m in average, the cost of Engineering education is moderate and affordable.

### 2.4. Quality Aspects

Quality of Engineering education is often debated. The quality is monitored by the affiliating university both by evaluating college infrastructures and the students

performance. Similarly NEC monitors the quality regularly to confirm if Engineering colleges maintain their norms and standards. Therefore maintaining quality is not a problem.

However some researchers argue that quality of Engineering education is low (Pahari:44). This has not been substantiated by any research work. The author strongly disagrees such comment on quality of Engineering education in Nepal on the following ground.

1. Graduates go to job market and get trained within 6 months to be fit in the respective job. It is their knowledge and skill gained in education that makes them learn trade specific requirement so fast – e.g. design of a high rise building.
2. About 50 % students go to job market in Middle East countries, India, Australia, and the world over. They are doing excellently well in the job market.
3. About 25 % graduates go for higher studies in countries including Australia, USA, UK and Singapore. Almost all of them complete the higher studies with honorable grade points which are at par with the students of any other country in the world.

Therefore quality of Engineering education in general is excellent. But there is a need for constant monitoring for its maintenance.

### **3. EMPLOYMENT OPPORTUNITIES AND FUTURE PROSPECTS.**

#### **3.1 Need of the Country:**

The country is in the process of re-building many of its infrastructures including creating new ones. Addressing Millennium Development Goal (MDG) is a Herculean task unless adequate infrastructures are created. Large number of Engineering manpower is required to achieve planned development. Table 6 shows plan for creating infrastructures by the year 2020.

Table 6 : Plan for Infrastructure Development

<b>S.N</b>	<b>Infrastructures</b>	<b>Status as of 2005</b>	<b>Plan for 2020</b>
1	Safe drinking water supply	60 % of population	100 % of population
2	Hydropower Installation	600 M W	10, 000 M W
3	Airport International Airport Regional	1 6	3 15
4	Telephone	0.3/100 Persons	10/100 Persons
5	Irrigation	1.2 m. Ha	2.5 m. Ha
6	Roads	18,000 KM	50,000 KM

If evaluated as of date, lot of effects has to be put in to meet the plan of 2020.

Rural roads and other infrastructures are being built through local effort. They do not reflect on the above plan. It is estimated that over 30,000 km rural roads are built by local effort. They require about 4000-5000 bridges if these roads are to be made serviceable throughout the year. Similarly local communication network has to be developed with the

help of satellite and internet technology. Many villages are now connected by this technology. All of these require many more technically trained manpower. An employment opportunity is also seen in the new type of industries which are emerging in the recent past.

It is estimated that about 39,000 additional Engineers shall be required by the year 2020 to be employed in these emerging industries. Table below shows the detail of possible employment.

Tables 7: Employment in the New Sector

S.No.	Sector Identified	Employment by 2020
1	Defence industry	500
2	Communication Technologies (Telephone/ TV/ Radio/ Printing/ Media)	4,000
3	Packaging	1,500
4	Service Industries (consulting, education)	10,000
5	Processing industry	4,000
6	Construction Material	2,500
7	Housing Development	5,000
8	Knowledge Industry	12,000
<b>Total</b>		<b>39,500</b>

**Source: Bhattarai (2006)**

Major area of employment shall be service industry, predominantly consulting industry. Therefore the new graduates in all the branches of Engineering must be prepared so that they can provide their services to the industry.

### 3.2 Opportunities Abroad

As in the country, Engineers are in short supply all over the world. It has been difficult to retain young professionals in the country. No specific research has been done in this area but it is estimated that about 1000 Engineering graduates are getting employment opportunity in the third countries with about equal number in India.

Currently Civil Engineering graduates are in great demand in India, Gulf Countries, Malaysia and Australia. Similarly Communication Engineers are getting better opportunities in the developed countries. Average rate of retention of young graduates at *nec* is about 2 years. Therefore it may be concluded that there are opportunities out side for Nepalese graduates to work.

### 3.3 Prospects to Link with Consulting Industry

This is not the new area for discussion. Often it is debated that Engineering curriculum has been very theoretical. The practical work that the students do at the laboratory are also theoretical. Therefore they need hands on experience or the industrial experience in the real job situation. This is true to a large extent. The curriculum of Engineering is so compact that they do not find time for a break for hands on experience. On the other hand Architecture curriculum is of 10 semesters (5 years) duration with a semester (6 months) dedicated to practical work. After completing their program, Architects are found to be

more easily adaptive in the industry as compared to the Engineers. Similar arrangement – extending the duration by one semester is being discussed in the academic sector. The consulting companies are serving the students as their laboratories and industry is getting cheap labour – in case of Architecture. Engineering students are being sent to the industry for short inspection visit or for demonstration. Some modalities could be developed to make even these short visits more useful to the students as well as to the industries. This needs to be worked out in detail. The following may be the possibilities.

1. Students make industries week end working place or part time working place.
2. Industries involve students for lower level technical work like survey, data collection and assisting in design work.
3. Industry experts share their knowledge and experience with the students to make them understand practical aspect.
4. Industry and Institution interact more frequently about curriculum development, curriculum implementation, evaluation system, possibilities for hands on experience and so on.

#### **4. PROSPECTS AND CHALLENGES OF ENGINEERING EDUCATION.**

##### **4.1 Prospects**

**Location:** Nepal is situated between 2 large population and rapidly growing economic. Geopolitical situation of the country is the most important prospects for Nepalese Engineering education sector. Recognition by the concerned regulating body of a country on reciprocating basis is needed for the students to travel for education.

**Climate:** Hilly part of Nepal enjoys moderate climate all year round. This offers very good educational environment. Also most part do not need air condition or heating for 8-10 months in a year. This climatic advantage makes the cost of education cheaper by saving on energy. This can be exploited as an important opportunity.

**Language:** Ability to speak English is another prospect for Engineering education. All the Engineering courses are delivered in English language. This makes education in Nepal universal. Any one seeking higher Engineering studies in English medium can come and join colleges in Nepal.

**Low cost of education:** It may be taken as another important prospect for Engineering Education. As discussed under sub chapter 2.3 cost of Engineering education is about US \$ 5000 for 4 years plus living cost of about \$ 10,000 for 4 years. This is very cheap by any standard. This cost advantage must be exploited to a maximum.

**Availability of Manpower:** Qualified manpower available in the region is another prospect. It is true that retaining these manpower has been difficult . But I guess, it is the economics. Manpower who are qualified and have teaching ability with proficiency in

English language is important. It should be taken as one of the prospects for Engineering education

**Quality Improvement:** Continuous improvement in quality is another important prospect for Engineering education. Indirect together with direct and hard competition with the domestic market has forced the colleges to enhance the quality of their infrastructure both physical and academic. This quest for quality although forced by competition will be beneficial to the colleges.

#### 4.2 Challenges Ahead.

**Lack of policies:** It has been a major challenge as for any other sector in the country. The Colleges are unclear about affiliation procedures, registration requirements, fee fixation principle, monitoring and evaluation process – who to be involved, scholarship requirements, taxation, free quotas, etc. The industry which has invested over Rs 2 billion is confused for not clear policies and non transparent method of decision making by the authorities.

**Indiferenceness of Public Sector:** The Engineering education sector can not invest on researches. Therefore it is fair for them to expect assistance from government institutions. If research grants are given to students more meaningful research can be done at the Master's level and Ph.D. level. This is not being done. Similarly starting new and more expensive programs like Nano Technology are expected from public institutions. A common resource centre may be established by the public sector for the use of all Engineering colleges. Similarly quality enhancement program must also be supported by the public sector. Public Sector resource commitment must be made for Master level and Ph.D. level studies. Making policies, rules and regulations, evaluating the existing colleges, grading their standard, communicating with public etc. are also expected from the public sector.

**Over Politicization:** It is another severe challenge to all the sector but especially to education sector. Politicians try to convince us that all the problem are solved through politics. Eat politics, drink politics, if sick – take politics pill, if feel cold, wrap politics is the situation. The staff, the teachers, the students all are politically divided and always eager to fight the other political group at any cost. A semester can hardly offer 90 working days. Most of the time of education manager is spent on solving inter group or intra group political conflict in the college. Growth planning, quality enhancement, monitoring of the process etc. are left behind.

**Low level of Education:** General level of education in the country is low. Only 80% of the children of school going age are admitted in the schools and about 8% of these admitted complete 12 grade in the school. Number of students completing higher studies or University education is much lower. This overall poor education scenario is not conducive for the growth of Engineering education in the country.

**Competition:** Competition in the local market has become very fierce. Further cut in the cost of education in various names like "bumper prizes", "buy one get one free" do not help. Meeting the quality shall be a major challenge. Competition with the foreign

players has started. But direct competition shall take place after the country enters WTO regime shortly. Big players from the region and also from far continents shall open their franchise. Probably it will be harder if preparations are not made from now on.

## **5. CONCLUSION**

Higher level Engineering education although started in 1978 has taken today's shape after the start of Nepal Engineering College in the year 1994. Enrollment capacity has increased from 96 to 4400. Single program in-Civil Engineering has expanded to 15 different ones. Hi- quality graduates are being produced and supplied to both national and international market. Their output in the industry and also in the academic institutions is found compatible with any other graduates.

There are enough opportunities of these graduates to be employed within the country- if the country has will to develop. They also have enough market all over the world. Consulting industry and all other industries in general can cooperate with Engineering Colleges to enhance the quality of graduates and also get benefit of perennial work force in the colleges.

There are large prospects for the growth and development of Engineering education in the country. There are many challenges as well. With the entry of Nepal into WTO regime, there will be direct competition with the world players. Nepalese players must compete with them. For making globalization work in Engineering education in the country, all the Engineering Colleges must enhance their quality in terms of teaching, evaluation, research and management efficiency.

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