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Factors Affecting The Quality Of Engineering Education In Nepal

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ABSTRACT

Higher Engineering Education in Nepal was started only in 1978. With the liberal policy of the Government of Nepal, many private engineering colleges were established after 1994 and recently there are altogether 43. In almost all college of Nepal, the result of the board semester examinations is deteriorating. This research paper aims to analyze different factors that are affecting the deterioration of the quality of engineering education which is being reflected through poor results in board examination and the insufficient performance of the engineering products in professional practices in different organizations. For this purpose, different literature in regards to the quality assurance of engineering education was collected as a secondary data and reviewed from one side, and from the other, as a primary data, different colleges were visited and conducted informal meeting with concerned persons and collected views about the quality deterioration. Based on the above mentioned activities result/discussion and recommendations is prepared in this research paper.

KEYWORDS

Universities, Colleges, Engineering, Education, Norms & Standards, Quality, Assurance, Deterioration, Globalization,

1. INTRODUCTION

Higher Engineering Education is new for Nepal. It was started only in 1978. Still in Nepal, substantial numbers of the engineers practicing in different sectors of the country are the product of different countries of the world. Institute of Engineering (IOE) under Tribhuvan University (TU), for the first time, has started BE in civil engineering courses with an intake capacity of 24 students only in 1978. But this program could not get continuity in next two years. Since 1981, IOE is running BE courses regularly in different branches.

Privatization and open market economy has been popular in the international arena since the last few decades and Nepal has not been exception to it. The government of Nepal, particularly, after the dawn of democracy in 1990, has given major priority to the privatization. Consequently many private institutions in educational sector have come into existence. But in higher engineering education, the first private engineering college, Nepal Engineering College (nec) in an affiliation with Tribhuvan University was started in 1994. In the same year, the Katmandu University (KU) also started Bachelor's degree course in engineering. In 1998, two more private engineering colleges in an affiliation with TU namely Kantipur Engineering College and Katmandu Engineering College had started their operation. In 1999, Pokhara Engineering College had started to run BE course in an affiliation with Pokhara University. Acme Engineering College affiliated to Purbanchal University was started in 2000.

No doubt, any education must be of good quality. The quality of engineering education must be even more due to many of the reasons. Engineering profession is very responsible one. They directly involved in infrastructure development. Minor mistake in designing and construction of infrastructure may cause great disaster in the society. Globalization has changed the role; responsibility, scope and scale of today's engineers. Today an engineer must have sufficient knowledge in scientific and mathematical fundamentals, engineering principles and

design together with global outlook and the broader skills to work in society inside the country and abroad. And so, the quality of engineering education is challenged to prepare a technically competent graduate, as it has done traditionally, and to add several dimensions of broadening within a period of the study.

As the engineering has become a more global profession; issues of quality assurance of engineering education have been amplified. Employers inside the country or abroad want to be assured that the engineering graduates must perform high quality outputs in the field with protective of the health, safety and welfare of its citizens.

In response to the changing nature of engineering practice, and its globalization, engineering institutions have changed their teaching style to the students. In the classroom, the emphasis is given to the learning, where student centered active learning is seen as the goal instead of only teaching in past. The use of modern technologies like computers and multimedia projectors has given positive impacts on the delivery of education and increase the interactions between students and faculty, which has enhanced the learning process. Besides, the curriculum of engineering in most of the countries has been upgraded by adding the subjects like teamwork and communication skills, business and entrepreneurship elements, international dimensions, sustainable development, etc.

In regards to the quality of engineering education in Nepal, diverse comments from employers and universities are being found about the performance of the graduates during informal talk with them. Besides, the result of the board examinations of different universities is deteriorating each year. Different factors, that are affecting the deterioration of the quality of engineering education which is being reflected through poor results in board examination and the insufficient performance of the engineering products in professional practices in different organizations are tried to analyze in this research paper. The Norms and Standards adopted by different countries like UK, EU countries, India, China and USA to assure the quality of engineering education is reviewed and compared with the Norms and Standards adopted by the concerning bodies of Nepal.

2. LITERATURE REVIEW

In Nepal, Nepal Engineering Council (NEC) and the concerning universities are responsible to provide approval to run the engineering colleges and monitoring and evaluation of these colleges. For this, they have their own Norms and Standard, but almost similar. The Norms and Standard of the NEC was thoroughly reviewed. Similarly, different research papers prepared by different scholars, books and technical journals about the quality assurance and factors affecting quality of engineering education and steps taken to enhance the quality of education by different colleges was collected and reviewed. Some of them are given below

In the year 1999 through Nepal Engineering Council Act-1998, NEC is vested with the formulation of norms and standards, monitoring and evaluation, and ensuring co-coordinated and integrated development of engineering education in Nepal. Some of the functions of Nepal Engineering Council to ensure maintenance of standards are:

- To lay down norms and standards for courses, curricula, physical and instructional facilities, staff pattern, staff qualifications, quality instruction and examinations;
- To grant approval for starting new technical institutions and for introduction of new courses or programs in consultation with the agencies concerned;
- To take all necessary steps to prevent commercialization of technical education;
- To set-up a National Board of Accreditation to periodically conduct evaluation of technical institutions or programs on the basis of guidelines, norms and standards specified by it and to make recommendations to it or to the affiliating universities regarding recognition or de-recognition of the institutions or the programs.

Accordingly, NEC has developed and approved the norms and standard to run engineering colleges. The major objective of the Norms and standard is to have basic guideline to monitor and evaluate engineering institutions to maintain quality of engineering education compatible to the international standard.

The salient features of an engineering college with an annual intake capacity of 300 students are mentioned in the norms and standard of the Nepal Engineering Council and based on these features; the engineering colleges are being monitored.

Similarly the Norms and Standard has also identified the weightage of different indicators, which are as follow:

Table 1: Weightage of indicators

S.N.	Description of infrastructure	Weighted
1	Lands and building space	15%
2	Laboratory equipments	20%
3	Library books and journals	15%
4	Permanent faculty	25%
5	Administrative staff	5%
6	Faculty development program	10%
7	Furniture	5.5%
8	Other: health, sports, canteen	4.5%
Total		100%

Source: Nepal Engineering Council (1999)

In India, All India Council for Technical Education (AICTE) is responsible to provide approval to run engineering program in deferent discipline. The Norms and standard to provide approval to run the institutions and to regulate the approved institutions is developed by AICTE. Following given are the highlights of the Norms and Standard developed by AICTE (for an intake capacity of 60 students per discipline) to provide approval to the engineering institutions:

1. Land requirement: 2.5 Acre
2. Built up Area of the institutions are based on the carpet areas of following room:
    - Class room: 66 sqm
    - Tutorial Room: 33 sqm
    - Laboratory: 66 sqm
    - Workshop: 200sqm
    - Computer center: 150sqm
    - Drawing Hall: 132sqm
    - Library/Reading Room: 400sqm
    - Seminar Hall: 132sqm
    - Sufficient administrative Area
    - Sufficient areas for amenities
3. Books and Journals:
4. Lab Equipments
5. Faculty requirement
6. Faculty cadre and qualification

The Accreditation Board for Engineering and Technology (ABET) has been responsible for the assurance of quality in engineering education in the United States from 1932,. Over the past decade, ABET has been engaged in a major reform to encourage curricular innovation and to improve the accreditation process, while continuing to assure the quality of engineering education at some 300 institutions process has resulted in new criteria for the evaluation of engineering programs, *Engineering Criteria 2000 (EC2000).* This new approach replaces previous guidelines and criteria that had become increasingly lengthy and prescriptive over the years, and were often seen as a constraint on curricular innovation.

As per ABET, to be a quality education, engineering programs must demonstrate that their graduates have:

- An ability to apply knowledge of mathematics, science, and engineering
- An ability to design and conduct experiments, as well as to analyze and interpret data
- An ability to design a system, component , or process to meet desired needs
- An ability to function on multi-disciplinary teams
- An ability to identify, formulate, and solve engineering problems
- An understanding of professional and ethical responsibility
- An ability to communicate effectively
- The broad education necessary to understand the impact of engineering solutions in a global and societal context
- A recognition of the need for, and an ability to engage in life-long learning
- A knowledge of contemporary issues
- An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.

Similarly, EC2000 also has briefly stated requirements for student quality, faculty qualifications, facilities, and institutional support.

With support from the European Commission under the Socrates II Thematic Network program, the Enhancing Engineering Education in Europe (E4) project is pursuing following five areas:

1. Employability through innovative curricula
2. Quality assessment and transparency for enhanced mobility and trans-European recognition
3. Engineering professional development for Europe
4. Enhancing the European dimension
5. Innovative learning and teaching methods

In the quality assessment activity, the following objectives are being pursued:

- Establish lists of 'qualification attributes' for engineering graduates, distinguished by branches (specialties)

and types

- Identify methodologies of quality control for study courses
- Adopt methodologies of quality assessment of achieved competencies
- Promote pilot projects on 'qualification attributes' (competencies) lists and on quality assurance and assessment
- Collect and highlight examples of good practice
- Comparison of loading of similar named courses in leading universities

In the innovative learning and teaching methods activity, following given are the aims and objectives:

- Institutional support required for innovative teaching and learning methods
- Role of information and communications technology in the new learning environment
- Facilitation of open distance learning in higher engineering education
- Adopt teaching and learning attitudes to support modern networked university
- New learning technologies and methods in support of learning through design, projects and team work
- Multidisciplinary methods to encourage self-direction and an entrepreneurial spirit

Thematic Network E4 was initiated in 2001, and completed its work in 2004. Some 112 institutions from all 15 EU member states have been involved on the program, with central administration provided by the University of Florence.

Professor Pahari, Bharat (2008) mentions that the quality of engineering education in Nepal is low. But the Professor Bhattarai, Deepak (2010) disagree the comment on quality of engineering education in Nepal mentioned in the thesis of Professor Pahari (2008). Professor Bhattarai further comments and says that this has not been substantiated by any research work in the thesis of Professor Pahari. The Professor Bhattarai in his paper gives three major evident, which proof the quality of engineering education is excellent in Nepal, but realizes that there are a lot of challenges, which if not managed, will deteriorate the quality of engineering education in future.

Journal IDEAS No. 17 was published with financial support of the Federation of Lebanese Engineers with partial subvention from the World Federation of Engineering Organizations in December 2011. In this issue, a paper written by Prof. Wlodzimierz Miszalski, from Polish Federation of Engineering Associations, Warsaw, Poland, in title "Improving Quality of Engineering Education, the Role of Future World University" was published and this paper describes different approaches to estimation quality of engineering education as outcomes, potential, process and hybrid approach of Technology. He in his paper describes the importance of quality of engineering education from the mobility point of view. There are different approaches to describe the quality. At least three basic approaches are given by him to define the quality of education:

- Education program outcomes approach,
- Education potential approach,
- Education process approach

The **outcomes approach** is the most popular one. In general it consists in description of the required capabilities of graduates from engineering education programs.

The **potential approach** emphasizes qualifications and prestige of faculty staff, modernity of laboratory equipment, standard of educational infrastructure - as the components of engineering education quality

The **process approach** consists in evaluation: structure, organization and length of teaching and learning processes, curriculum, syllabus, sequence and length of particular courses and topics.

3. METHODS

The method adopted is based on primary and secondary data. As a primary data, different colleges were visited and conducted informal meeting with relevant and concerning persons of the colleges. As a secondary data relevant appropriate documents were collected from the colleges in Nepal and related documents, research papers and articles were downloaded from different website and analyzed thoroughly.

In Nepal, there are six universities, which are providing engineering education through eight constituents and 43 affiliated colleges. In almost all colleges, the result of the board semester examinations is deteriorating. All together five colleges (two constituent and three affiliated) of four universities given below was randomly selected:

1. Institute of Engineering, Pulchok Campus, constituents college of Tribubhan University (TU)
2. School of Engineering, Constituents College of Kathmandu University (KU).
3. Kantipur Engineering College, affiliated college of TU
4. Acme Engineering College, affiliated college of Purbanchal University (PU)
5. Nepal Engineering College, affiliated college of Pokhara University (PKU)

During the visit, an informal meeting was conducted with management persons, faculty members and the students of the above mentioned colleges to get their views about the factors affecting the quality of engineering education and is documented in separate heading (Result/Discussion) of this paper.

As a secondary data, relevant documents of the selected colleges were collected and thoroughly reviewed what measures have taken for the quality assurance of engineering educations. The Norms and standards to assure the quality of engineering education developed by Nepal Engineering Council and four universities (TU, KU, PU, PKU was reviewed and compared with the Norms and standards developed by other relevant bodies of USA, UK, European Union, India and China for the quality assurance of engineering education. The syllabus of engineering followed by different countries will also be downloaded and compared with the syllabus adopted in Nepal. Based on these activities, the results are derived and discussed in separate heading of this paper.

4. RESULT/DISCUSSION

The Engineering profession in Nepal is treated as one of the prestigious profession because of the potential effects of its work in the society. It covers everything from buildings, roads, dams, bridges, airports and railways to industries, computers, software, aircrafts and satellites. Its works cover the entire spectrum of the nation, from the most affluent and urban to the most backward. Engineers have been commanding high respect in the society. So the demand of engineering study is substantially increasing. Hence, to meet the increasing demand of the engineering education, private engineering colleges were established. With the establishment of these colleges, access in engineering education has been increased substantially, but at the same time the quality of education seems deteriorating. With the review of documents and discussion with relevant persons of different engineering colleges, the following factors that are deteriorating the quality of engineering education is found and is summarized below:

4.1 Infrastructure of all colleges is not sufficient:

The colleges do not have sufficient carpet areas required for class room, Tutorial room, Laboratory, Workshop etc as per international standard. The number of books in Library, Lab equipments is also in minimum level. The insufficiency of the colleges' infrastructure compatible with international standard is causing poor teaching and learning environment in the colleges resulting to the quality deterioration.

4.2 Funding Problem:

A big amount of the money for complex development, laboratories and library establishment, furnishing and others is required to establish, operate and sustain engineering college. The major source of the funding for constituents colleges is the donation from the government, which seems not sufficient. In case of affiliated (private) engineering colleges the major source of funding is either equity and students' fee or debt. The management of this big amount only from equity i.e. share amount from the promoters is almost impossible. It is very necessary to manage debt amount from different financial institutions. There is no any system within the policy of the government to subsidize in interest rate prioritizing different sectors. From very ancient to modern, an education is taken as basic needs like food, shelter, and other economic needs. So the government should give major priority for the development of education sectors in the country. Accordingly, the government must provide different support to the private educational institutions including the system of provision of soft loan to these institutions. But there is no any systems of providing loan in subsidize interest rate, rather, the educational institutions are enforced to pay high interest rate.

4.3 Faculty Problem:

The teaching profession in our country is still not a mostly wanted profession of the engineers. Most of the engineers come to this profession as there is no any other job for them. After having one or two years of teaching experience either they go for further study or to other governmental organization. Therefore there is problem of the experienced, fully committed and consistent faculty in engineering colleges. There is great problem of retention of faculty and with the frequent turnover of the teaching faculties; the quality of engineering education is going down.

4.4 Syllabus are not timely updated:

The syllabus should be updated as per the innovation of new technology. In the syllabus there are still few some subjects, which are already outdated. Some subjects, which are very useful during professional practice, are not being integrated in the syllabus, due to the time constraints. As engineering is an applied science, some duration in the syllabus has to be provided for internship, which is lagging.

4.5 Academic Calendar Management Problem:

With the increase of private engineering colleges, the access in engineering education has been increased, but in same time, the colleges are enforced to admit lower grade students. The teaching hours allocated in the curriculum is not sufficient for those kind of students and additional classes are required to manage for them. But the duration of the semester is only 15 weeks and within this time frame a lot of disturbance is being experienced. Similarly a lot of time goes in the management of the internal, final semester and back paper examinations. The total weeks available for two semesters are only 52 weeks. About eight weeks requires conducting two final semester examination and four weeks for the preparation to the examination. About four weeks require for back paper examination. Four weeks is necessary to conduct internal assessment (two assessments in each two semesters and one week require for one assessment). At least four weeks are necessary for the vacation in a year (Most of the colleges are providing four weeks' vacation during Dasain to Tihar). Almost two weeks require conducting extracurricular activities. So practically the course designed for 15 weeks is required to accomplish within 12 weeks. So it is always necessary to add more classes to cover the course and in result students will be overloaded, which is expressed as poor result in final semester examination.

4.6 Students Problem:

The discipline of the students almost in all colleges is declining. There is a problem of group class bunk. Students do not study regularly and labors during examination only. There is high absenteeism of the students in the class. Students give

less attention in the class. The students are not eager for self study, deny to go to the library to read reference books/journals and depend only in the class note. The negligence of the students on their regular study is causing the bad result in board examinations.

5. CONCLUSION/RECOMMENDATIONS

Higher Engineering Education in Nepal is still young. It has a history of about 30 years. Due to the lack of sufficient experiences, it is not progressing as per expectations. To develop engineering education at par of the international level and enhance the quality of education additional efforts from all sectors has to be done. The government of Nepal should take lead responsibility to enhance the quality of engineering education. For this adequate budget has to be allocated for the universities and constituents colleges. Similarly, loan to the affiliated colleges to be provided in with subsidize interest rate. Nepal engineering Council and concerning universities should update their Norms and Standard for the monitoring and evaluation of the colleges. Both the organizations should monitor the colleges, and based on the findings of the monitoring grading of the colleges has to be done and publish the grading of all colleges.

Engineering colleges from another side should develop separate quality enhancement plan of engineering education and implement accordingly. The college management should upgrade the physical infrastructure, laboratories and library of the colleges. It seems the teaching faculties are under paid in the colleges. So the college management requires analyzing the causes behind the fast turnover of the teaching faculty and developing and implementing faculty retention plan.

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