REFORM STRATEGIES FOR QUALITY OF ENGINEERING HIGHER EDUCATION IN NEPAL

Bharat Raj Pahari

A Thesis

Submitted to

School of Education

Kathmandu University

in partial fulfilment of the requirement for the degree of

Doctor of Philosophy in Education

Presented on August 20, 2008

Convocation on September 17, 2008

AN ABSTRACT OF THE THESIS OF

Bharat Raj Pahari for the degree of *Doctor of Philosophy in Education* presented on August 20, 2008. Title: *Reform Strategies for Quality of Engineering Higher Education in Nepal.*

Abstract Approved___________________________ ___________________________

Prof. Mana Prasad Wagley, PhD	Prof. Tanka Nath Sharma, PhD
Thesis Guide	Thesis Guide

Recent literatures on engineering education have described the need of reform in engineering higher education in Nepal and this has become an essential agenda for the development of the country. In order to identify the policy options and programs for reform in engineering higher education in Nepal, it was essential to examine; the existing level of competency of graduating engineers, the existing pertinent issues influencing quality of engineering education and also to explore the strategies to resolve those pertinent issues. Sufficient emphasis was found in the literatures that much of the world economy, now and in the days to come, rests on the technology and its application in the society. This, eventually, connotes the inevitability of enhanced knowledge and skills of the engineers.

The purpose of this study was to explore and analyze the current issues associated with the quality of engineering higher education and recommending the future strategies for reforming engineering higher education in Nepal. For this, survey instruments were developed that consisted three parts; professional competency, issues and strategies. The pilot test was undertaken and it was validated by a panel of experts. The survey instruments were distributed in August 2007 to stratified sample and data collection continued till the end of February, 2008.

The findings revealed the main parameters representing competencies requirements for entry level engineering professional practice and they were grouped into four categories: basic knowledge and skill; specific professional capacity; understanding society and social phenomena and; management and leadership. It was found that the graduating engineers have satisfactory level of competencies, however, requires further improvements to cope with the complexities emerging in the engineering practice.

The findings also explored the pertinent issues influencing the quality of engineering higher education and were grouped into nine categories, namely; financing, faculties and their role, equity and access, management and institutional barriers, students and their activities, socio-cultural imperatives, infrastructures, curriculum and assessment system and, job market. Additional issues, such as; politicization, absence of research and development and, inconsistency in policy issues were generated from the open ended responses.

The study also identified reform strategies to resolve emerged issues so as to achieve quality in the engineering higher education. Prominent strategies explored from the study were: concrete planning for human resources (faculties and staffs) development and appropriate investment for technology along with the tangible plan for generation of fund, policies and programs for the access of capable and competent students and for encouragement in the academic and professional skills, periodic review and updating of curriculum based on market needs and prevailing technology, visionary leadership in academic institutions and accountability and transparency in management along with the understanding of society and de-politicization in the institution, encouragement of experimental learning opportunities (on-the-job learning) etc.

Bharat Raj Pahari

DECLARATION

I hereby declare that this thesis has not been submitted for candidature for any other degree in any university. To the best of my knowledge and belief, this thesis contains no material previously published by any other person except where due acknowledgement has been made.

Date: August 20, 2008

____
Bharat Raj Pahari, Degree Candidate

DEDICATION

This study is dedicated

to

all committed

for the cause of prosperity of Nepalese people.

A Thesis on *Doctor of Philosophy in Education* has been submitted by *Bharat Raj Pahari* and presented on August 20, 2008.

APPROVED

Date: August 20, 2008

Prof. Mana Prasad Wagley, PhD
Thesis Guide and Dean of School of Education

Date: August 20, 2008

Prof. Tanka Nath Sharma, PhD
Thesis Guide

Date: August 20, 2008

Prof. Kedar Nath Shrestha, PhD
Member, Research Committee

Date: August 20, 2008

Prof. Shreeram Lamichhane, PhD
Member, Research Committee

Date: August 20, 2008

Prof. Bhola Thapa, PhD
External

I understand that my thesis will become part of Kathmandu university library. My signature below authorizes release of my thesis to any reader upon request for scholarly purpose.

Date: August 20, 2008

Bharat Raj Pahari

ACKNOWLEDGEMENTS

As I near the end of my research journey, it was with great pleasure and satisfaction that I look back on the wider horizon of work and immense opportunities it has offered. This journey has brought me into contact with many people from different dimensions, who have guided, inspired and challenged me in my professional growth. For this, I am thankful.

I was indeed overwhelmed to have Professor Dr. Mana Prasad Wagley and Professor Dr. Tanka Nath Sharma as my thesis guides.

It was a great opportunity for me to have Professor Dr. Mana Prasad Wagley, Dean in School of Education, Kathmandu university, as a guide. He was my true teacher and inspirator for this research. His constant support, guidance, critiques helped me throughout the research. The immense experiences of Prof. Wagley provided insight on the fundamental issues of this research. Prof. Wagley has given me right direction and taught me a great deal about research during this study. For this, I am forever indebted.

It was a privilege to have Professor Dr. Tanka Nath Sharma, Head of Department in School of Education, Kathmandu university, as my thesis guide. His constant support, encouragement, suggestions and his high standards helped me throughout the course of this study. Prof. Sharma's vast experiences and understanding of technical education provided the focus and impetus for the completion of this thesis. Prof. Sharma has taught me a great deal about research, reflection and academic writing. For this, I am truly grateful.

To the faculties, students, policy makers and employers, who willingly participated in this research and shared their thoughts and experiences, I am forever thankful. My thanks are due to my colleagues; in the workplace, in the IOE, for their moral support and for sharing moments of anxiety and joys.

I consider myself fortunate to have the support, patient and love of my family. My sincere thanks are due to my wife-Shova for constant support, encouragement and taking care of everything during my data collection and writing of the thesis. My children, Pragya, Pratik and Pritee for their support and for understanding why their papa has been so busy these last few years. Last few months were indeed terrible and I was vigorously working for the final writing of this thesis. My time in the working room will be fondly remembered.

And finally I would like to express my gratitude to my colleague Mr. Nagendra Bahadur Amatya, the statistician, for handling and supporting me in painstaking work of data treatment and processing by the application of SPSS software. I am also thankful for the contributions of Mr. Megh Raj Dangal for APA style and Associate Prof. Raj Kumar Yadav of Institute of Engineering for proof-reading of this thesis.

____

Bharat Raj Pahari, Author

Date: August 20, 2008

TABLE OF CONTENTS

LIST OF TABLES

Tables

LIST OF FIGURES

ABBREVIATIONS AND ACRONYMS

AAST	Australian Academy of Science and Technology
ABET	American Board of Engineering and Technology
ADB	Asian Development Bank
ANOVA	Analysis of Variance
ASCE	American Society of Civil Engineers
BE	Bachelor level in Engineering
BOK	Body of Knowledge
BPKIHS	Bisheswar Prasad Koirala Institute of Health Sciences
CBS	Central Bureau of Statistics, Nepal
CIJ	Journals in Education
EMF	Engineers' Mobility Forum
ERIC	Education Resource Information Centre
FCAN	Federation of Contractors' Association of Nepal
FDI	Foreign Direct Investment
FEISCA	Federation of Engineering Institutions in South and Central Asia
GDP	Gross Domestic Product
GNI	Gross National Income
HEC	High Level Education Commission
ICIMOD	International Centre for Integrated Mountain Development
INGO	International Non-Governmental Organizations
IOE	Institute Of Engineering
Km	Kilometres
KU	Kathmandu University

ME	Master Degree in Engineering
MOE	Ministry of Education and Sports
MSc	Master of Science in Engineering
NAMS	National Academy of Medical Sciences
NEA	Nepal Engineers' Association
NEC	Nepal Engineering Council
NESP	National Education System Plan
NGO	Non-Governmental Organizations
NPC	National Planning Commission, Nepal
NSET	National Society for Earthquake Technology in Nepal
PhD	Doctor of Philosophy
PoKU	Pokhara University
PU	Purwanchal University
R & D	Research and Development
RIE	Resources in Education
SAARC	South Asian Association for Regional Cooperation
SCAEF	Society for Consulting Architectural and Engineering Firms
SPSS	Statistical Package for the Social Sciences
TU	Tribhuvan University
UGC	University Grant Commission
UNESCO	United Nation Education and Scientific Cooperation Organization
WA	Washington Accord
WB	World Bank
WCST	World Conference of Science and Technology
WFEO	World Federation of Engineering Organisations

CHAPTER I

INTRODUCTION

Nature of Study

The higher education in Nepal, incepted during Vedic period as Gurukul and subsequently developed in the course of time, is at present being disseminated from different universities through their constituent and affiliated colleges. Many colleges have been established in different disciplines having affiliation with one of those universities. The state of condition of the universities and the colleges is different. Tribhuvan university is too large to manage the students, programmes and the administration. Sanskrit university is hardly functioning with the government financing. Kathmandu university seems to be satisfied with its own endeavours and the outputs. Purwanchal and Pokhara universities are largely running with the strength of affiliated colleges. They are sustaining from giving affiliation to private colleges and government assistance. Lumbini Bauddha university is still in the course of developing its infrastructure. Besides, BP Koirala institute of health science in Dharan and national academy of medical sciences in Bir Hospital are also functioning in the capacity of universities.

Higher education policy in Nepal is still conventional and it is following the same track of generation and transmission of ideology and selecting and formation of elites. As an elite's constituency, education in Nepal is more idealistic and less practical. But, in the course of time the paradigm has changed; education is becoming a means of survival-the basic need of people. However, the content and delivery is as conservative as before. The products, though enthusiastic and energetic, do not demonstrate the capacity they deserve (Khati, 2003).

In the similar way, the engineering higher education is developing in Nepal. The curriculum, management and the delivery are conventional. As a mater of fact, engineering education not only develops a technologically literate society, but also gives direction to the national development process of the country (Paudel, 2006). Engineering education is an integrated, experience-based instructional program designed to prepare a population that is knowledgeable about technology-its evolution, systems, techniques, utilization, ethical considerations, and social and cultural significance (Education Standards & Practices Board [ESPB], 2004).

Looking to the education statistics of Nepal, the data indicate that the numbers of students in higher education is below 1.22 percent of total population in Nepal (University Grant Commission [UGC], 2004). According to the population census of 2001, 58 per cent of the economically active population is illiterate. This indicates that most of the workforce is unskilled. The numbers of students in the higher education (university) in 2002/2003 was 165379 (Central Bureau of Statistics [CBS], 2003 & UGC, 2004), which is about 0.714 percent of the population. The annual enrolment of students in engineering higher education was only 2014 in 2003 (UGC, 2004), which is only 1.22 percent of the students population in higher education.

Table 1

Education Statistics

Total population of the country	23151423
Nos. of students in higher education (2002/2003)	165379
percent of students in higher education of total population	0.714
Annual Student enrolment in engg higher education (B.E.) 2003	2014
percent of Students enrolment in engineering higher education	1.22

Source: (CBS, 2003 & UGC, 2004)

The technical school established in 1930 was the embryo of engineering higher education in Nepal. Engineering higher education begin in 1978 after the start of Bachelor level (B.E.) in Civil Engineering in Institute of Engineering, Pulchowk Campus. It was after the adoption of bill of multi-university from the parliament in 1994, there was a momentum in engineering higher education and numbers of engineering colleges emerged in private sectors to deliver engineering higher education. Nepal Engineering College was first of this kind to be established in 1994. Kathmandu university also launched its engineering program in 1994. There are, at present, 31 engineering colleges running engineering higher education courses in multi-dimensional engineering discipline (Nepal Engineering Council [NEC], 2007). Among them 24 colleges are affiliated colleges with different universities and seven colleges are the constituent colleges of Universities.

Despite the production of human resource from higher education, more specifically engineering higher education, Nepal remained one of the least developed countries of the world and almost all economic indicators indicate Nepal as a country under poverty. Among 22.7 million people of the country 85.8 per cent of the people live in the rural areas. According to the census 2001, the growth rate of population is

2.25 per cent per annum. The unemployed rate is 5.1 per cent of the economically active population (of ten years and above). The literacy rate for the year 2001 is 53.7 per cent (CBS, 2003). Nepal with a per capita income of only US $ 237 per annum (The World Bank, 2003) is one of the poorest countries in the world. Relatively low and declining rates of economic growth through 2000s, together with high rates of population growth have combined to reduce the growth of per capita income to the lowest in the region.

Table 2

Social Indicators of SAARC Countries

Country	GNI per capita($) (2000)	GDP per capita growth (2000)	Life Expectancy (2000)	Poverty percent of population below poverty line (2000)
Bhutan	590	3.4	62	-
Bangladesh	370	3.0	61	35.6
India	450	4.1	63	35
Nepal	237	2.4	59	42
Pakistan	440	1.2	63	34
Sri Lanka	850	3.9	73	25

Source: (CBS, 2003)

Some social and economic indicators indicate the burning scenario of the country. Nepal per capita income is the lowest among the SAARC (South Asian Association of Regional Co-operation) countries ($237). The social status is even more miserable standing on the lowest life expectancy (59 years) and highest poverty level (42 percent) (CBS, 2003).

To be more precise, poverty is widespread in Nepal. Almost half of the population is below the poverty line. In spite of improvements in basic social and economic infrastructures, Nepal still lags behind other south Asian countries in most areas of social and economic development. One of the causes, as well as consequences, of income poverty is the very small amount of assets and capital held by most households (National Planning Commission [NPC], 2007).

As a matter of fact, Education is widely accepted as a leading instrument for promoting economic growth. Stressfully, higher education can lead to economic growth through both private and public channels. The private benefits for individuals are well established and include better employment prospects, higher salaries and great ability to save and invest. These benefits may results in better health and improved quality of life, thus setting off a virtuous spiral in which life expectancy improvements enable individuals to work more productively over a longer time further boosting lifetime earnings (Bloom, 2005).

More over, technology advances are transforming the world at an astonishing rate. Developments in computing and communications, in particular, are helping to accelerate these changes. Organizations in even the most advanced economies struggle to keep up, while developing countries face serious threats, as well as some new opportunities. Therefore educationists are coming in a consensus that governments should accord the highest priority to improving engineering education at all levels (World Conference on Science & Technology [WCST], 1999) and should work closely in this endeavour with the private sector and civil society. The emphasis is now on the engineering higher education.

So far talking about the engineering higher education in Nepal, it is found that there is the gap between the needs of the quality engineering education and the performance of the engineering graduates (Pahari, 2006). In the course of time, there has been a dire need of effective and competent high skilled human resources in Nepal and for this; a clear and comprehensive engineering higher education policy appears to be must. In developing viable reform policy in engineering higher education, it is essential to identify the issues influencing the quality of engineering education and workable future strategies to resolve those issues should be developed. In order to address those issues, it is important that there be a consensus among policy makers, educators and employers to clarify reform policy for the quality engineering higher education programs. The reforms, therefore, should address the pertinent issues in the engineering education. Reforms may be undertaken both at macro (in the policy level) and micro level (within university) to bring about sector-wide changes (Joshi, 2004).

Purpose of Study

The purpose of this study is to supplement the body of knowledge on the quality of engineering higher education in Nepal. More specifically, this research analysed and explored the current issues of engineering higher education in Nepal and recommended policy strategies to address these issues for reforming engineering higher education in Nepal.

Problem Statement

What are the issues affecting the quality of engineering higher education in Nepal and what policy strategies should be adopted to address these issues?

Objectives of Study

1. To analyse the existing and desired level of competency of graduates of engineering higher education in Nepal with respect to established international norms and standards.
2. To identify pertinent issues associated with quality of engineering higher education in Nepal.
3. To explore strategies in resolving issues associated with quality in order to reform engineering higher education in Nepal.
4. To recommend pertinent policy strategies for reforming engineering higher education in Nepal.

Specific Research Questions

Based on the statement of the problems in the engineering education, some pertinent questions have been formulated as the basis of the research.

This research has attempted to find answers to following representative questions;

1. To the observation of respondent groups, what is the existing and desired level of competence of graduates on quality of engineering higher education in Nepal?
2. Is there a significant difference between the values of level of competence of graduates on quality of engineering higher education in Nepal in the observation of respondent groups?
3. What are the issues influencing quality of engineering higher education in Nepal in the observation of respondent groups?
4. Is there a significant difference between the issues influencing quality of engineering higher education in Nepal as identifies by the respondent groups?

5. What are the strategies in resolving these issues influencing quality in order to reform engineering higher education in Nepal?
6. Is there a significant difference between the observations of respondent groups on the strategies for reforming engineering higher education in Nepal?

Hypothesis

Based on the research questions, following hypothesis were formulated and tested. There is no significant difference between the mean values of respondent groups concerning level of competence of graduates of engineering higher education in Nepal.

There is no significant difference between the mean values of respondent groups concerning the influence of prevailing issues on quality of engineering higher education in Nepal.

There is no significant difference between the mean values of respondent groups concerning strategies for reforming engineering higher education in Nepal.

Significance of Study

Recent studies and reports have emphasised on the importance of reforms in education, more precisely; in the engineering higher education in Nepal (Joshi, 2004; Bhattarai, 2002; Khati, 2003; Pahari, 2003 & IOE, 2005), but the important point is to bring change into the competency of the engineering graduates to the level of set international standards.

Over the past two decades, the engineering higher education system in Nepal has successfully concentrated on production of engineers and on developing infrastructures for engineering higher education. The first batch of engineers enrolled were 22 in Institute of Engineering and passed numbers were 17 in 1983 and this has increased to about 2014 in 2003 (IOE, 2005 &UGC, 2004) annual intake from 28 engineering colleges so far. However, there are the voices from policy makers, employers and faculties that the existing level of graduating engineers from Nepal are not meeting the standard demanded by the market (Shrestha, 2006). In the course of time, pressure has been intensified to respond this in prevailing education system. This has developed concern over the equity, quality and competence in engineering higher education.

The globalisation has been widespread now. Nepal has also entered into the world trade organisation. The effect of globalisation is now appearing in Nepal. The quality and competence are the prime issues now. Unless, Nepalese engineers prove to be capable and competence in the global market, the situation is going to be much harder for them now and after (Paudel, 2006).

The world is expanding to a global village. A country can not survive in a closed boundary as before. The education, more precisely the engineering higher education, should be able to load individual a depth knowledge and skill that makes people capable and competent to cope with confronting issues. The accreditation Board for Engineering and Technology has prescribed 11 outcomes essential as a body of knowledge (ASCE, 2004). These are the basis for the entry in the global market. The outcomes of Nepalese Engineering Colleges are found to be not meeting these standards (Suwal, 2006).

Taking an example of civil engineering, the total engineers required in 2003/04, 2004/05, 2005/06, 2006/07 are 16500, 19100, 22100, 25700, and 29400 respectively (Vaid,1999). As against this demand projection, the supply projection is 5600, 6609, 7645, 8711, 9811 respectively (NEA, 2003 & UGC, 2004). This is the evidence for the substantial deficiency of civil engineers in the country. Among the total numbers of engineers, around 70 percent are from civil engineering in 2003/04 and this number is declining in the subsequent years. Nepal engineers' association source (NEA, 2006) said that there are about 15838 engineers from all disciplines and by the end of this year this number would reach 20363.

Table 3

Scenario of Civil Engineers

	2002/03	2003/04	2004/05	2005/06	2006/07
Projection of demand of civil engineers	16500	19100	22100	25700	29400
Projection of civil Engineers in the rate produced in 2001 (NEA/UGC)	5600	6609	7645	8711	9811
Deficiency of civil engineers	10900	12491	14455	16989	19589

Source: (Vaid,1999; NEA, 2007 & UGC, 2004)

It is envisaged that around 20 percent of the engineers produced are abroad for job or higher career opportunities. Despite establishment of numbers of Engineering Colleges, there is an acute shortage of engineering human resource in the country. However, there are the cases that substantial numbers of engineering graduates are being unemployed or underemployed (NEA, 2003).

Numbers of issues are appearing on the surface regarding the quality of engineering higher education. Education, being the basic need now, should reflect the dynamics of the society. It should develop confidence and capacity of the pupil. This depends on; what should be taught and learned, how it should be taught and learned, and who should teach and learn (American Society of Civil Engineers [ASCE], 2004).

Engineering education in Nepal is in cross road in this issue. Often, questions arise on the methodology of delivery of lectures and in the selection and deputation of the faculties (Pahari, 2006).

While stating the entry of students in the engineering higher education, largely, the students entering are from elite society, having schooling from well established private schools. The students from general publics, having schooling from public schools, rarely enter in to engineering higher education. This is the same case with the marginalized area of the society. This deprivation is not only because of the income and caste but also from geographical location (Paudel, 2006).

Further to this, the issue of institutional management of engineering higher education is under discussion at present. The arguments are focused on the accountability and responsibility of the management. The present state of management of engineering education is centralised and authorities are heavily concentrated on single person. Taking the case of decentralisation of institute of engineering since 1995, IOE has been suffering dependency on the faculty recruitment and policy formulation. As a result of this, the quality of engineering education is under question (Paudel, 2006).

It is found that the need of policy reforms in engineering higher education was felt since very beginning. It was indeed the national education system plan in 1972 that gave concrete emphasis on the engineering higher education in Nepal after the establishment of Institute of engineering (IOE) under Tribhuvan University. The first batch of bachelor degree of civil engineering (B.E.) was enrolled in 1978 in IOE as three years diploma in civil engineering, which was later expanded into four years bachelor degree of civil engineering. In the course of working for academic excellence in engineering higher education, IOE-Strategic plan (2000) has set its mission as:

> The institute of engineering envisages through quality education in the frontier engineering areas of the new age and those of relevance to the nation and its citizen and through problem solving research and development in engineering as required by the developmental policies and programs of the country. (p.7)

The process of reform has been a part in IOE after the introduction of engineering education project in 1983 and effective from 1889 with the assistance of The World Bank and Swiss and Canadian government. This project was instrumental for the overall reform of the engineering education. This included the curriculum reform, infrastructure development, faculty development etc. the reform process was pronounced in 1986 with the introduction of fair admission system. Attempts were made to set the academic calendar with improvement in management and students discipline. Cost sharing reform was also introduced as an alternative for financing (Joshi, 2004).

As a part of growth and development of engineering education, the policy of privatization has been instrumental. Substantial efforts were found in the Kathmandu university in the area of engineering education. Establishing in 1994, the school of engineering of Kathmandu university has developed its strategic plan that states: "School of engineering develops creative leaders equipped with the quality knowledge and skills to solve the complex engineering problems as well as innovative technologies and intellectual properties as a contribution to the society" (KU-School of Engineering strategic plan, 2008, p.2).

It is obvious that the key stakeholders of engineering education, such as; policy makers, (administration and management), students and faculties, employers play a vital role to develop quality and relevance. Their views and observations are significant in the formulation of the strategies for reform in engineering higher education.

Since few years, the attention of the scholars, educators and other professionals has been drawn on the issues of engineering higher education in Nepal. Several discourses and deliberations were also taken place. Despite such studies and seminars, none of those identified issues were verified through a formal research process. Moreover, there were no such formal studies that have identified pertinent issues and formulated the strategies for reform in engineering higher education. In this context, a study like this that analyses the observation of policy makers, students, faculties and employers concerning the issues related to the quality of engineering higher education was significant.

In short, this research is of significant value not only for those who are directly involved in the engineering higher education, but also serve a base for further search and development. It is obvious that this study would prove to be valuable to other countries with similar socio-economic conditions and share common problems related with the quality and relevance of engineering higher education.

Limitation

Following conditions influential to the research work were independent to researcher;

1. Scope of research limited to experience, understanding & willingness of the respondents
2. Political unrest thus restrained in the transportation
3. Flexibility of academic calendar in different universities thus uncertainty in the exam of final year engineering students
4. Reluctant culture in giving responses to research
5. The study has covered only the product of engineering (B.E.) from the universities of Nepal.
6. The respondents were confined to; policy makers, faculties, employers and students.

Despite numbers of limitations, this research work was successfully completed within given time and within the statistical standards and norms.

Definition of Terms

These are the definitions of the terms used in this study.

Engineering Higher Education: Post certificate level (+2) education program leading to bachelor degree and above engineering education programs at the university level with the technical content mainly requiring skill and knowledge necessary for the standard application of scientific principles. Graduates from such programs are usually levelled as engineers.

Engineering Colleges: Specialised colleges designed with the technical contents mainly requiring skill and knowledge for the standard application of scientific principles.

Graduates or Program Completers: Participants in higher engineering education who have successfully completed the bachelor level and above engineering education program are levelled as graduates.

Students: Participants in all discipline of engineering higher education studying in the final year of bachelor level engineering education program are levelled as students.

Policy makers: For the purpose of this study, policy makers are those individuals who are directly or indirectly involved in the policy making of higher engineering education. Individuals, involved in the universities and colleges managements (vice-chancellors, Rectors, Registers, Deans, Principals/ campus-chiefs, Vice-Principals/ Assistant Campus Chiefs/ Department Chiefs etc); Senior Government Officials; Education Experts etc. are being considered as policy makers in this study.

Faculties: Professors/ Associate professors/ lecturers of the universities/ colleges/ departments delivering lecture classes, supervise and conduct laboratory tests, who are responsible to impart skill and knowledge necessary for the standard application of scientific principles are considered as faculties. They include representatives of university teachers' association.

Employers: For the purpose of this study, employers includes; government departments, consultants, industries, business enterprises, who are employing engineers produced from the universities and colleges from Nepal are considered as employers.

Education Expert: Educators, professionals and foreign experts in engineering education involved in the policy making, designing and implementation of quality engineering education in Nepal are considered as education expert.

Senior Government Officers: Secretaries, joint-secretaries, directors and experts in ministries responsible for education, engineering education, and the member of national planning commission responsible for engineering sector are considered as senior government officers.

Quality of Engineering Education: Quality of engineering education is the benchmark performance of the graduates in higher engineering education. This is objectively represented by the competency level of the engineering graduates freshly entering into the engineering professional practice. The quality is, therefore, the capacity of the engineering professional practicenor to cope with the confronting problems.

CHAPTER II

REVIEW OF RELATED LITERATURE

Introduction

The purpose of this study was to supplement the body of knowledge on the quality of engineering higher education in Nepal. More specifically, this research has analysed and explored the current issues of higher engineering education in Nepal and recommended policy strategies to be adopted to address these issues thus facilitating reform in the engineering higher education in Nepal.

Review of literature, in fact, had focused primarily to address the research questions. The organization of literature review was made from whole-to-part method. In this process, the scope was extended to higher education from engineering education in global and domestic horizon. The literatures related with developed and developing countries and focusing on Nepal were reviewed. The emphasis was also given on the historical development of engineering education, higher education and its essence, current status of engineering higher education etc. This review was focused mainly to explore and examine relevant information useful to address the quality of engineering education. Information concerning capacity and competency of the outcomes of the engineering higher education has also been examined during the review. The research conclusions and recommendations documented on competency of engineering graduates were also the part of review. The attempt was also made to go through the in-depth studies and reports on the literatures related with; importance of reforms in education, more precisely; in the engineering education in Nepal. The literatures on engineering higher education, in different countries, similar to the context of Nepal, were referred and taken as supplementary information in the review.

As the nature of this research, it demanded extensive reference of the related literature. However, there was a limitation of time and resources in Nepal. The other fact was that there were very few works done in the higher engineering education in Nepal. Despite this, substantial publications related to higher education were found from; World Bank, Asian Development Bank, UNESCO, Ministry of Education and Sports of Government of Nepal, National Planning Commission of Nepal, Engineering Organisations in different parts of the world, Education Resource Information centre (ERIC), Resources in Education (RIE), Current Index to Journals in Education (CIJ) etc. Efforts were made to have access in these literatures. During the literature review, it was found that the professional bodies in engineering have done substantial works on engineering education, such as; American society of civil Engineers (ASCE), World Federation of Engineering Organisations (WFEO), American Society of Engineering Education, Australian Society of Engineering education, Institution of Engineers, Engineers' mobility forum etc. Though not much, but, the libraries available in Kathmandu were source for important reference materials for this research. These libraries were; central library of TU, IOE library, KU library, ICIMOD library etc.

The internet was indeed another potential area to find related literatures. The descriptors for searching in the web have been used are "higher education," "higher engineering education," "engineering education and employment potentials," "higher education in developing countries," "higher education and economic development", "issues of engineering education", "strategies for reform in engineering education", "reform in engineering education", 21st century engineering education" etc. Besides this, the articles and working papers related with engineering education have been collected and downloaded.

The review of the literature was concentrated within the thematic areas. It dealt the state of higher education in the world and in Nepal. The effect of education, more precisely, engineering education in the society was another concern. The historical development of engineering education in Nepal and its current scenario was yet another part to be analysed. The issues, challenges and trends of engineering education were inseparable part while reviewing the literature. The research works done, if any, in area related to reforms in engineering education were also the integral part of this review. Attempt was made to find articles and working papers of education experts in the areas related with research questions. Substantial parts of the literatures were collected manually and others were extracted and downloaded from internet source.

In order to have extensive study on the matters related to research questions, wider horizon of the engineering education was captured. After going through the literatures, this study was framed in the order of; organization of review work, higher education and engineering higher education in Nepal, higher education for economic growth, issues challenges and trends, reform strategies, related research and conclusions.

While undergoing literature review, the academic, professional and commercialized publications were referred, such as; books, proceedings, journals, articles, periodicals, reports etc. The publications of some of the prominent publishers or organizations were highly valuable. Some of those organizations are; The World Bank, Asian Development Bank, UNESCO, American Society of Civil Engineers, American Society of Engineering Education, World Federation of Engineering Organization, Australian Academy of Science and Technology, American Board of Engineering and Technology, Ministry of Education and Sport Government of Nepal, Department of Education, National Planning Commission, University Grant Commission, Nepal Engineering Council, Nepal Engineers' Association, ICIMOD, Society of Consulting Architectural and Engineering Firms, Federation of Contractors' Association of Nepal, University publications etc.

Higher Education in Nepal

The higher education in Nepal, incepted during Vedic period as Gurukul and subsequently developed in the course of time. Modern higher education that began after the Tri-chandra college in 1918, is at present being disseminated from different universities through their constituent and affiliated colleges. Many colleges have been established with the delivery of diversified discipline and having affiliation with one of those universities. The state of condition of the universities and the colleges is different. Tribhuvan university is the largest one and expanding in the span of the country. It has the highest numbers of students, faculties, programs and staffs. Sanskrit university is running traditionally the subject matters in Sanskrit medium. This university is hardly functioning with the government financing. Kathmandu university, established from private sector and has established academic excellence. It seems to be satisfied with its' own endeavours and the outputs. Purwanchal and Pokhara universities are largely running with the strength of affiliated colleges. They are sustaining from giving affiliation to private colleges and government assistance. Lumbini Bauddha university is still in the course of developing its infrastructure. BPKIHS in Dharan is running satisfactorily and National academy of medical sciences is running in Bir hospital.

Higher education policy in Nepal is still conventional and it is following the same track of generation and transmission of ideology and selecting and formation of elites. As an elite's constituency, education in Nepal is more idealistic and less practical. But, in the course of time the paradigm has changed; education is becoming a means of survival-the basic need of people. However, the content and delivery is as conservative as before. The products, though enthusiastic and energetic, do not demonstrate the capacity they deserve (Khati, 2003).

In the course of time, the educationists are reaching in the opinion that along with the school education emphasis should be given to the higher education. Accepting higher education as one of the most important indicators of the advancement of a country in many regards, Nepal is initiating to prepare its graduates for position of leadership and responsibility in a rapidly and increasingly complex and competitive world (Khati, 2003).

Historical Development of Higher Education in Nepal

While talking about the higher education, it is equally important to observe its historical chronology of the pace of development. Nepalese society is rich culturally and socially. Its heritage dates back from the ancient Vedic period to today's age of science and technology. The civilisation has come-across many ups and downs. History has witnessed many Rishis and Munis (Scholars) delivering educational discourses. A glimpse of the historical perspective of higher education is the part of this script.

Higher Education in the Historical Period

Looking back to the history, the tradition of Gurukul (study of multi-disciplinary subjects), Rishikul, Devkul (study of theology), Rajkul (study of political science) and Pitrukul (study of history and anthropology) systems of education were prevailed in the Vedic time in Nepal (Government of Nepal Ministry of Education [HMG-MOE], 1971). There was access to education only for elites. The then policy of the education was generation and transmission of ideology and forming dominant elites in the society (Sharma, 2000). The great Universities of Takshashila, Nalanda and Vikramshila were the developed shapes of the Gurukuls. These Universities were the centres of education (HMG-MOE, 1971). The then education was more focused on the religious doctrines and imagined society in accordance to the prevailing religion. It was the age of idealism in education.

During Lichchhawi period, there was a tradition of taking education from Vikramshila in Bihar and Granden, Drepung and Shera in Tibet (High Level Education Commission [HEC], 1955). During Malla period, they were more focused in vocational education to the citizens. Their emphasis was to develop a means to increase the revenue (HMG-MOE, 1971). There was Arya Vidhyapith in Pokhara, Doti, Dingla of Nepal following the legacy of Gurukul, Rishikul, Devkul etc.(HEC, 1984).

Emergence of New System of Education in Nepal

Western education system was taking momentum in India in the ruling of the East India Company. Nepal also followed this new education system as a result of the British influence. The beginning of present higher education in Nepal dates back to 1918 when Tribhuvan-Chandra Intermediate College (present Tri-Chandra College) was established. After 10 years gap, in 1928, Royal Nepalese Ayurved School was established to offer higher education in Ayurved discipline in the country. In 1948, Sanskrit college was established (Sharma, 2000). In fact, these colleges were established as the influence of emerging education in India. Rana rulers were, almost in all cases, impulsive and reluctant on the dissemination of education to general public. Establishment of Tri-Chandra College was possible due to British pressure. Earlier, these colleges were affiliated with Patna university. Before this, people striving for higher education - especially the elites - largely used to go to Varanasi (HEC, 1984).

Momentum in Higher Education

After the popular movement of 1950, the autocratic Rana regime was displaced by democratic system. The democratic setting in the country brought momentum in the education. The first formal education policy of the country was drafted in 1954. Many private and community owned colleges were established. There were already 33 colleges during the establishment of Tribhuvan university in 1959. The higher education expanded with great momentum. People took initiative in opening new colleges. While introducing New Education System Plan in 1971, there were already 53 colleges and training centres in the country and they were brought under Tribhuvan university. All these colleges were spreading all over Nepal ranging from Terai to Hills and Valleys. The period from 1951 to 1971 was a remarkable period for the expansion of higher education in Nepal. In different time, education commissions were formed to address the prevailing educational issues.

The state of condition of the country was somehow turbulent during the period of 1950 to 1960. In the mean time, King Mahendra took over the power of state in 1960 and initiated the Panchayat system. This system, at the beginning, started to work with the comprehensive reforms in the education policy.

There was a great inconsistency in the policy and implementation and also administration did not follow the spirit of the policy. The academic calendar was not running smoothly. There were the extreme policy fluctuations. Moreover, higher education was not streamlined with the human resource planning of the country (Khati, 2003).

The discontentment of the student questioned on the prevailing education system and government formed the royal higher education commission in 1984 to look over the student's issues and entrusted the task of formulating new education policy. The recommendation of this commission can be taken as a landmark in the process of developing higher education. It emphasised on the education for country's modernization and development.

After the restoration of democracy in the country in 1991, there was the notion of remoulding education policy in democratic setting. Then government formed the national education commission in 1993 to work in this direction. This commission had put forward some of the crucial policies regarding higher education. The commission suggested the policy of multi-Universities in order to provide higher education to the qualified and talented people living in all region of the country. It also engraved the concept of University grant commission.

But, education policy did not take the proper direction as of expectation. Despite the policy, academic programmes in different faculties did not reflect the need of time and there was also the problem of streamlining the programs with the national development planning etc. Besides, other problems were also in substantial level, namely; the entry system, financial shortcomings, administrative and management shortcomings, visionary approach, curriculum and text books, resource management and privatization, research works, quality and quantity of students, middle and higher level education etc.

Present Structure of Higher Education

Higher education in Nepal is being disseminated from different universities through their constituent and affiliated colleges. After the recommendation of Royal Commission for Higher Education in1984, committee for higher education was formed to look after higher education in the ministry of education.

The concept of multi universities was on the surface after the establishment of Sanskrit university in 1986. But, this concept took momentum only after 1990. By now, there are few numbers of universities, namely; Tribhuvan university, Kathmandu university, Sanskrit university, Purwanchal university and Pokhara university. A new university (Lumbini Bauddha university) have been adopted from the ordinance in 2004; however, this is by now in the course of developing infrastructures and yet to function. Others institutions, such as; BP Koirala memorial institute of health sciences and national academy of medical sciences, Bir hospital are delivering and conferring academic degrees in higher education as well.

A new scenario of privatization was also emerged after 1990. Many colleges have been established in different disciplines having affiliation with one of those universities. The state of conditions of those universities and the colleges are different. TU is functioning in the span of the country with largest numbers of students, faculties, staffs and programmes. Sanskrit university is running with conventional Sanskrit education. Kathmandu university, the first university of its kind, established from private sector and set the image of delivering quality education in Nepal. Purwanchal and Pokhara universities have very limited academic programmes on their own. They are sustaining from giving affiliation to private colleges and part of government assistance.

Engineering Higher Education

Right from the beginning of the civilization, technology has been instrumental for the change. In the early days, the skill of hunting and the development of fire were engineering and later on this was developed in to the production of weapons, survey of the geography and construction of roads. In the early period, engineering was the part of military activities in exploring new ventures and developing civilization. In the course of time, this process developed into the modern complex technology. The life is becoming more and more dependent on the technology. This has made inevitable to develop a technologically literate society (Jones, 2006).

It is obvious that transformation of society is possible with knowledge and skill, more specifically, with the engineering knowledge and skill. At present, engineering higher education has become concern to every country.

At present, there are 31 engineering colleges including constituents and affiliated colleges under four universities; Tribhuvan university, Kathmandu university, Pokhara university and Purwanchal university, disseminating engineering higher education in Nepal (NEC, 2007).

Historical Development of Engineering Education in Nepal

Stacks of information are found in different religious doctrines on engineering education. Among them, Vastushastra is well known. There are different literature illustrating engineering fundamentals, some of them are; Vastupuran, Vasturatnakar, Vastusar, Vastumandan, Mayamatam, Manashar, Matsyapuran, Mahabharat, Prashadmandan, Shukraniti, Brihatsamhita etc. (Pandey, 2001). The Takshashila, Nalanda and other universities of the early periods were some evidences of delivering formal engineering education. However, all these treatise of the past are not the content of present day conventional engineering education (Sharma, 2000).

In the historical period, there was more informal technical education, transferring technology from generation to generation through experiences. The great legend Balabahu (Araniko) was the architect of the 13th century, well-known for establishing new history of pagoda architecture in China. Vocational education was very much popular in Kathmandu valley during Malla period as a tool to increase revenue. There was a special degree for citizens to learn some kind of skills and involve in production and business. Malla period was famous for handicraft. It was the golden period for all types of architectures. The kings from parts other than valley were also found to be cautious on the importance of technical works. This is illustrated in the decree of King Prithwi Malla of Sinja state in the west Nepal (Sharma, 2000).

During Rana dynasty (1846-1950) Mr. Bir Shamsher was found to be aware of the technical service for the development of the country. As a result of this, his son, Gehendra Shamsher, along with other 5 students were sent to Japan for higher technical study (Sharma, 2000). They were the pioneer engineers taking formal engineering degree in modern technical education in Nepal. However, the policy regarding technical education did not prevail.

Formal technical education started in 1930 (1987/11/19 B.S.) after the establishment of technical school in Kumari Chowk, Kathmandu. At the beginning, this school began the trade course on textile skill. In 1942 (1998/10/17 B.S.), engineering section was introduced in the school offering two years sub-overseer course for SLC graduates. This school was shifted to Tri-chandra campus in 1945 and renamed as engineering school in 1950. It was in 1958 that this school was accepted as a formal institution to deliver engineering education and once again renamed as Nepal Engineering Institute and it was shifted to Nepal Administrative Training Council complex, Jawalakhel at the beginning of 1958. By the end of same year 1958, it was taken to Ananda Niketan, Pulchowk. It offered overseer course in civil engineering and later on in 1971 offered electrical overseer course. In 1965, technical training institute was established in Thapathali under the assistance of German Government offering overseer course in mechanical and electrical engineering.

After the introduction of New Education System Plan in 1972 in the country, Institute of Engineering was formed under Tribhuvan University and both the Nepal Engineering Institute and Technical Training Institute were brought under Institute of Engineering. Nepal Engineering Institute was renamed as Pulchowk Campus and Technical Training Institute was renamed as Thapathali Campus. Later on, in 1984 and 1987 Purbanchal Campus in Dharan and Paschimanchal Campus in Pokhara were established respectively. Pulchowk campus started Bachelor level (B.E.) in Civil Engineering in 1978. Similarly, B.E. in Electrical and Electronics Engineering began in 1994, Architectural and Mechanical Engineering began in 1995, and Computer Engineering began in 1998 in Pulchowk campus. Paschimanchal campus of IOE in Pokhara started B.E. Civil Engineering in1999 and Electronics Engineering in 2005. Similarly, Purwanchal campus of IOE started B.E. in Agricultural Engineering in 2000 and Civil Engineering in 2004. Thapathali campus began B.E. in industrial engineering in 2005 and civil engineering in 2007 (IOE, 2007).

It was after the adoption of bill of multi-university from the parliament in 1994, there was a momentum to establish engineering colleges in private sectors. Nepal Engineering College was first of this kind to be established in 1994. Kathmandu university established in 1991 also began engineering program in 1994. Later on, Purwanchal university and Pokhara university have also launched engineering program. There are about 31 engineering colleges today running diploma, bachelor degree, master degree and Ph.D. courses in multi-dimensional Engineering discipline. Among them 24 colleges are affiliated with different Universities and seven colleges are the constituent colleges of universities. At present, engineering higher education is disseminated in 14 different engineering discipline, namely; civil, electrical, electronics and communication mechanical, computer, environmental, agriculture, architecture, electrical and electronics, electronics, biomedical, software, information technology, industrial etc (NEC, 2007).

Inception and Growth of Higher Engineering Education

The planned development of Nepal was incepted after the democratic change of 1949. National plans were formulated for the overall development of the country. The first national plan began in Nepal in 1956. The planned attempt of engineering human resource development was initiated in fifth plan under Colombo plan; as a result of this substantial numbers of engineers were produced. As a part of Karnali hydro power project large contingent of engineers were produced from Roorkee university that begin from 1980. However, the issue of engineering education was considered in the seventh plan by the introduction of engineering education project and formulating the plan for overall development of the infrastructures and faculties. The issue of human resource development was stressed in the 8th Plan statement:

"Capacity will be increased and quality education will be promoted to produce medium and high level manpower production within the country in agriculture, medicine, engineering and forestry through Tribhuvan university" (NPC, 1992, p28).

The first engineering education project under the assistance of World Bank, Swiss & Canada, though incepted in seventh plan was in the implementation in the eighth plan after 1986. It was instrumental to develop curriculum, faculties and establish infrastructures necessary for engineering higher education.

The ninth plan was more specific human resource development. This was included in the strategy and policy statement (NPC, 1997). The ninth plan emphasized on the formation of Nepal Engineering Council with the idea of regulating the engineering profession. The tenth plan illustrated the human resource development among its four strategies. It has also stated to prepare the policy to match the engineers' production and engineers' absorptive capacity for the development of the country. Tenth plan was more specific on maintaining and enforcing quality control measures of engineering colleges and of engineering education (NPC, 2002). It is envisaged that the human resource agenda is in the limelight since seventh plan. The issues of engineering education has found included in the three years interim plan (2008-2010) as well. According to which the process of preparatory works are underway for the establishment of engineering university, technical university and dimmed university. The World Bank at present is launching second higher education project under national three years interim plan. A component of this project is obviously the engineering education.

Henceforth, higher education is drawing the attention of the policy makers. The focus is naturally on engineering human resources. The reason behind this is that the activities that drive the industrial state and the activities that implement scientific advance are generally rooted in engineering.

In the course of time, attempts were made to revitalize the higher education of Nepal through different education commissions. In this process, new policy decisions were made regarding engineering education.

The education policy drafted by the first education commission formed in 1955 illustrated that the pace of development of the country may take momentum if the vocational education could be managed in a proper way (HEC, 1955). The commission had also emphasised on the compulsory vocational education in school and established a notion that selection of a vocational subject has to be a part of basic education.

National education system plan adopted in 1961 put forward the recommendation to change engineering school to engineering college under the Tribhuvan university (National Education Committee [EC], 1961). With this recommendation, government had accepted engineering as a formal education. Besides, it did not talk much about engineering education.

After a decade, the government thought to overhaul the prevailing education system. New education system project was launched in 1972. This system said on education, 'the country needs such education that makes people competent in any profession having high moral and serve the country (EC, 1972). It had also emphasized on the optional vocational subjects in the high school. As a result of this, vocational education was extensively applied in the school.

The discontentment of the student questioned on the prevailing education system and government formed the royal higher education commission in 1984 to look over the student's issues and entrusted the task of formulating new education policy. The recommendation of this commission can be taken as a landmark in the process of developing technical education. It had emphasised on the need of technical manpower for the development of the country. The four areas of technical education were identified, namely; Engineering, Agriculture and animal science, Forestry and Medicine (EC, 1984).

Regarding engineering education, the commission recommended; "Institute of Engineering should be established as a centre for producing quality engineering manpower and promoting and developing technology as required in the national development process"(EC,1984, p38).

The commission also talked about the planned system of engineering higher education. In addition to this, commission proposed the board of technical and vocational training and education to conduct trade course and training. This commission streamlined the technical education to the national policy as the basis of development.

After the restoration of democracy in the country in 1991, there was the notion of remoulding education policy in democratic setting and then government formed the national education commission in 1993 to work in this direction. This commission had put forward some of the crucial policies regarding engineering education. It emphasized on the promotion of informal and non-formal way of basic skill training in one way and in other way the medium and higher level trainings should be conducted in the vocational training schools (EC, 1993).

Once again, a high level national education commission was formed in 1998. This commission was entrusted to analyze the prevailing education system and suggest the rational and timely direction to education system. This commission had presented comprehensive vision regarding engineering education. The objectives were clearly spelled out and the infrastructure necessary for this were noticeably illustrated and also gave direction for establishing engineering University for the cause of national development. Special focus was given to enhance national technical capacity of the country through the production of the engineering human resource, development of appropriate technology and technical services (EC, 1998).

In the course of time, then government formed a 'high level executive committee for education' in 2001 with an intention of transparent and effective management of school education. This committee was focused on the school education in general and did not talk anything about the engineering education.

So far stating higher education in engineering, it was started in 1978/79 as Bachelor in Civil Engineering in Institute of Engineering. The enrolment was only 22 students in the first batch. The graduates produced from Nepalese colleges were limited in numbers (72 nos.) up to 1997. This number was increased after the establishment of private engineering colleges including engineering program of Kathmandu university from 1994. Total enrolment of students in the higher engineering education (B.E. Level) in the fiscal year 2003 was 2014 numbers (UGC, 2004). There has been tremendous increase in the numbers of students after the establishment of private colleges. The enrolment capacity of 31 numbers of engineering colleges accredited from Nepal engineering Council in 2007 was found to be 4417 (refer table 4). But, actual entry of the student was only about 70 percent of the enrolment capacity.

Table 4

Student Enrolment Capacity of Engineering Colleges

University	Engineering Colleges		Students enrolment capacity
	Constituents	Affiliated	
Tribhuvan University	4	7	1638
Purwanchal University	1	8	1078
Pokhara University	0	9	1522
Kathmandu University	2	0	179
Total	7	24	4417

Source: (NEC, 2007)

The scenario of students' pass/ fail rate is varying in different universities. In Tribhuvan university, the average fail rate in all eight semesters is found to be 33 percent to 47 percent the data of past two batch of graduation from IOE- 2004 and 2005, from both constituents and affiliated colleges respectively. This rate is slightly high in the first and second year and slightly low in the third and fourth year (IOE-exam, 2006). The average fail rate in Kathmandu university is found to be 14 percent to 36 percent in the past five years-2003-2007 (KU-exam, 2008).

The drop-out rate in the 2004 and 2005 batch from first year to fourth year was found to be 8 percent and 6 percent respectively (IOE-exam, 2006). This rate is 12 percent to 5 percent in Kathmandu university (KU-exam, 2008). The drop-out rate in Purwanchal and Pokhara universities are slightly higher. Students fail rate in constituent colleges of IOE is found to be slightly lower in compare to the affiliated colleges.

Higher Education for Economic Growth of the Country

The study of quality of higher education is related with its contribution in the economic growth of the country. Different experiences in different parts of the world were reviewed regarding contribution of education in the economic growth of the country.

Education is widely accepted as a leading instrument for promoting economic growth. To be more precise, higher education can lead to economic growth through both private and public channels. The private benefits for individuals are well established and include better employment prospects, higher salaries and great ability to save and invest. These benefits may results in better health and improved quality of life, thus setting off a virtuous spiral in which life expectancy improvements enable individuals to work more productively over a longer time further boosting lifetime earnings (Lin, 2004). Public benefits are less widely recognized, which explains many governments' neglect of tertiary schooling as a vehicle for public investment. But individual gains can also benefit society as a whole. Higher earnings for well-educated individuals raise tax revenues for governments and ease demands on state finances. They also translate into greater consumption, which benefits producers from all educational backgrounds (Lin, 2004).

However, it is a fact that almost in all developing countries; the higher education is in the least priority. The emphasis is more on the primary and secondary education. Visualizing the data, the enrolment ratios in south Asia are lowest in the world. Although, it was increased in the past 40 years from 4 percent in 1965 to 10 percent in 2004, there are rapid gains in other regions. Except Sub-Sahara region (5 percent in 2003), rest of the regions; East Asia & Pacific, Europe & Central Asia, Latin America & Caribbean, Middle East & North Africa and high income countries have enrolment ratio of 17 percent, 49 percent, 27 percent, 23 percent and 67 percent respectively (The World Bank, 2004). This is an evidence of growth of poverty in this region.

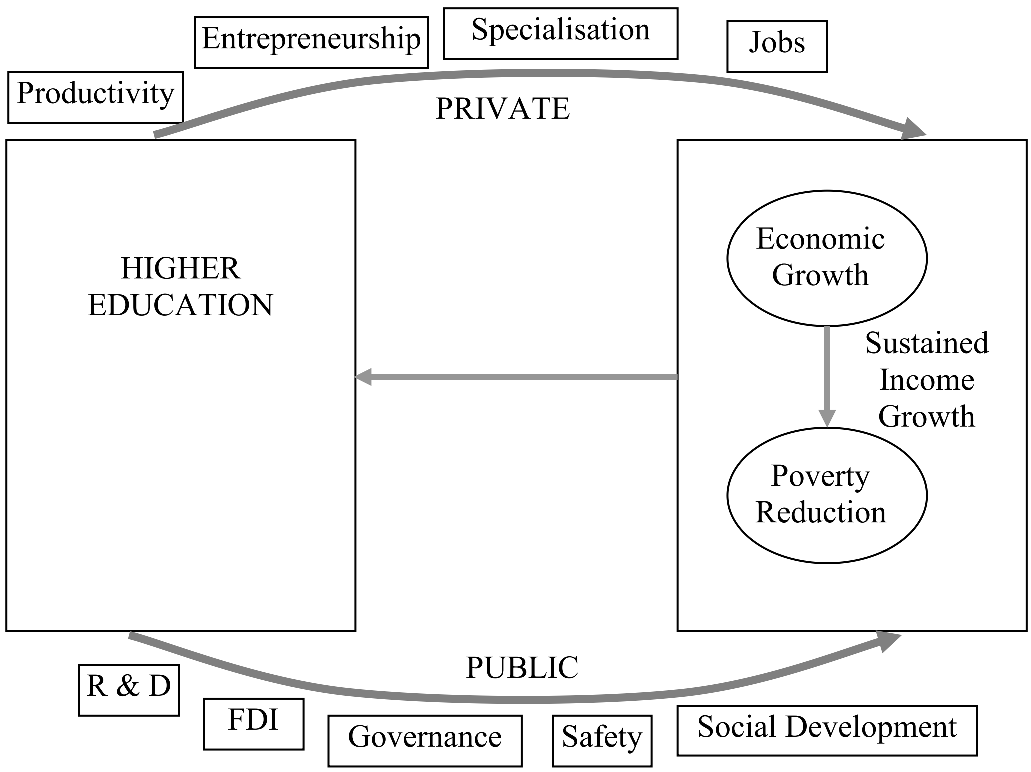
In contrast to this early view of giving less priority to higher education, recent evidence suggests that higher education is both a result and determinant of income, and can produce public and private benefits (Bloom, 2004). Higher education may create greater tax revenue, increase saving and investment and lead to more entrepreneurial and civic society. It can also improve a nation's health, contribute to reduce population growth, improve technology and strengthen governance.

Higher education, in fact, is building knowledge and skill. By now, the world is moving towards knowledge economy. Knowledge is concern with developing competent human resources and it is regarded as strong property at present. Thus, the paradigm on higher education has shifted to building knowledge and skill. It is therefore that different governments and donor agencies are changing their legislation giving due attention on higher education (Bloom, 2005). In a knowledge economy, tertiary education can help economies keep up or catch up with more technologically advanced societies. Higher education graduates are likely to be more aware of and better able to use new technologies. They are also more likely to develop new tools and skills themselves. Their knowledge can also improve the skills and understanding of non-graduate co-workers, while the greater confidence and know-how inculcated by advanced schooling may generate entrepreneurship, with positive effects on job creation (The World Bank, 2005).

Tertiary education can also have other benefits for economies. By producing well-trained teachers, it can enhance the quality of primary and secondary education systems and give secondary graduates greater opportunities for economic advancement. By training physicians and other health workers, it can improve a society's health, raising productivity at work. And by nurturing governance and leadership skills, it can provide countries with the talented individuals needed to establish a policy environment favourable to growth. Setting up robust and fair legal and political institutions and making them a part of a country's fabric, and developing a culture of job and business creation, for example, call for advanced knowledge and decision-making skills. Addressing environmental problems and improving security against internal and external threats also place a premium on the skills that advanced education is best placed to deliver (Lin, 2004).

Following framework suggests many possible routes through which higher education can benefits economics.

Figure 1. Conceptual framework of higher education



A series of studies are found as the evidences in support of higher education as the tool for economic growth (Pasacharopaulos, 2002; Bloom, 2004; Barro, 1995; Jenkins, 1995 & Lin, 2004). This includes higher productivity of the graduates than non graduates; positive correlation between higher education and entrepreneurship; positive correlation between higher education and governance indicators, such as, absence of corruption, rule of law, absence of ethnic tensions, bureaucratic quality etc.

While discussing on the contribution of higher education in the economic growth, the role of engineering higher education is more prominent. It is the fact that engineering has direct impacts on society and such impacts can be translated directly into economic growth. A well-developed engineering higher education sector is imperative for this. It allows countries to generate new engineering knowledge, to wisely select and implement existing technologies, and to effectively adapt them to local circumstances. To achieve these tasks, higher education in engineering extremely needs more investment and more efficient allocation of existing resources. This will require a formidable effort (Jones, 2004).

Technology advances are transforming the world at an astonishing rate. Developments in computing and communications, in particular, are helping to accelerate these changes. Organizations in even the most advanced economies struggle to keep up, while developing countries face serious threats, as well as some new opportunities. Therefore educationists are coming in a consensus that governments should accord the highest priority to improving engineering education at all levels (WCST, 1999) and should work closely in this endeavour with the private sector and civil society. The emphasis is now on the engineering higher education.

Technology has a good track record in generating and applying new knowledge to improve the human condition. It can justly claim to have made a positive difference to the lives of billions. High-yielding varieties of rice, sulfa drugs, powerful antibiotics, oral contraceptives, electricity, and cheap and durable plastics are just a few examples of engineering advances that have had an enormous, direct, and positive impact on living standards across the world (The World Bank, 2005).

The country and the people are recognized at present by the state of development and the prosperity of the people. Being one of the least developed countries of the world, Nepal is in the pressure for economic growth. Being one of the very important factors for economic growth, engineering higher education is in the key priority in developed countries. Other countries are also giving focus in engineering education by now.

Current Situation

While studying on the reform on the quality of engineering higher education in Nepal, it is obvious to study the current state of condition in the country and globally as well. Any theory, guidelines, directives or recommendations could be effectively enforced if they are compatible with the prevailing context. The local and the global context are imperative and should be duly considered. The socio-economic context of the country is basically decisive for the quality of engineering higher education.

Domestic Context

Socio-economic context. The state of condition of the Nepal is such that almost all social and economic indicators are poor. The substantial part of the population (85.8 percent) lives in the rural areas. The growth rate of population is 2.25 per cent per annum (CBS, 2001) which is high comparing other SAARC countries. The unemployed rate is 5.1 per cent of the economically active population (of ten years and above). The per capita income of Nepal is only US $ 237 per annum (The World Bank, 2002) is one of the poorest countries in the world and lowest in the SAARC region. The rate of economic growth through 2000s is relatively low and declining. Together with high rates of population growth, it has combined to reduce the growth of per capita income to the lowest in the region. The literacy rate for the year 2001 is 53.7 per cent (CBS, 2003). The maternal mortality rate is 415 per thousand people and infant mortality rate is 64 per 100000 people. This rate is highest in this region. The life expectancy is estimated to be 59 years and fertility rate is 4.1 per family. The other social indicators are still alarming. The population of 42 percent is below the poverty line. Similarly, literacy rate is just 46.3 percent of the population. The large segment of the population (53.7) is illiterate (CBS, 2003). Together with all these indicators, Nepalese society has been facing grave problems related to unemployment, discrimination, economic disparity, political crisis, ethical and moral degradation.

Agricultural sector has been main contributor to the Gross Domestic Product (GDP) in Nepal. After a decade of fairly robust growth, Nepal's real GDP growth became negative (-0.6 percent) in 2001/02, for the first time in nineteen years (NPC, 2003). Over 80 percent of the population still depends on agriculture as the primary source of income. However, people who are involved in agriculture are underutilised. Nepalese farmers are occupied in the field seasonally about two-third of the year.

Segments of the poor are hardcore poor barely eking out subsistence on fragile, vulnerable ecosystems; and large areas of the country lack even the most basic infrastructure. And there are wide variations in poverty levels based on rural-urban divide, geography, gender, and ethnic groups and occupational castes (NPC, 2003).

Poverty is deeper, more intense, and more severe in rural (as compared to urban) areas; and even more so in the hills and mountains and in the Western and Far Western regions. There are also clear; gender, ethnic and regional disparities. Other indicators of human poverty (as measured through key social indicators) also closely correspond with, and confirm this rural, gender, ethnic and regionally oriented poverty pattern. The analysis also shows a clear nexus among the key variables/determinants of poverty.

The level and intensity of poverty is closely linked to the pace and pattern of economic growth in urban and rural areas and economic/income generating opportunities associated with such growth. Rural poverty is worse, primarily, because agricultural growth – the primary source of income and employment generation in the rural economy – has stagnated in per capita terms over the past few decades. Even within rural areas, the poorer segments of the population have less access to fertile land, irrigation, modern inputs, credit, and marketing and road infrastructure. Similarly, a key determinant of the level and intensity of both income and human poverty is access (or the lack of it) to basic social and economic infrastructure. The rural areas are badly underserved in terms of quality and coverage of basic education, healthcare, drinking water, roads and access to other infrastructure and markets (NPC, 2003).

Poverty is also closely related to the degree of social, political and economic inclusion/ exclusion. Women and ethnic groups by and large are left out of the mainstream of development, because they lack voice, empowerment, representation and access to economic opportunities and resources. Similarly the remote districts and regions are further away from centres of power and influence and are the most neglected. Another key determinant, which cuts across and exacerbates the impact of these factors on the poverty pattern, is weak governance, which includes ineffective government, poor resource allocation, week implementation and service delivery performance, and corruption and leakages, among others (NPC, 2003).

The mind set of policy makers in Nepal is such that higher education is not in the priority. The budget in education is fluctuating from 12 percent to 15 percent of total budget, which is least in compare to other countries. The budget for higher education is ranging from 9 percent to 16 percent of education budget. Engineering education is yet in the shadow. The budget for engineering education is ranging from 0.12 to 0.30 percent of higher education budget (Lohani, 2004). The actual budget for engineering education is virtually negligible. Even the budget for education material is not provided by the government.

Table 5

Budget for Education

Fiscal Year	Budget for education sector (percent)	Budget for higher education (percent of 2)	Budget for engineering education (percent of 3)
1	2	3	4
1998/1999	12.50	09.50	0.16
1999/2000	13.20	15.80	0.31
2000/2001	12.82	16.30	0.22
2001/2002	14.10	11.90	0.21
2002/2003	15.00	10.20	0.30
2003/2004	15.25	9.79	0.12

Source: Ministry of Finance, 2005

Scenario of Higher Engineering Education

The general impressions collected from various stakeholders as well as from the management of engineering education shade light on different pertinent aspects.

The Nepalese society is changing and there is a sweeping change of paradigms of the society. People need skills and knowledge for their livelihood and society needs production for its prosperity. Since the formal development of engineering education, many attempts have been made. The engineering education system in Nepal is very young. Though its inception dates back to 1930, higher engineering education began only after 1978. Not surprisingly, part of the system have been well designed and are implemented effectively, others remain in embryonic stage and are only partially effective (Paudel, 2005). Over the past decade, there have been considerable quantitative achievements in terms of infrastructures, students and teachers in engineering colleges. More recently, efforts are underway in developing new curriculum, improvements in exam system, selection and training of teachers etc.(UGC, 2007).

In spite of these successes, the performance outcomes of the engineering education are found to be not satisfactory. Different issues are appearing on the surface. These issues are in terms of quality, competency, relevancy, accessibility etc. in engineering education.

Quality of engineering education is low. Engineering education is the youngest in Nepal compared with other areas. It was virtually after 90's that large numbers of Engineers are being produced, though the first contingent was produced in 1983. Despite large numbers of engineers, the development issue of the country is still unaddressed. The industries and service sectors have complaint to resolve the technical problems. Research and development is found almost absent in academic institutions and industries. Few researches taking place in some institutions are also not representing the need of society (Paudel, 2006).

Engineering education, in fact, builds ability to design a system, components or the process to meet desired needs. However, the products of the colleges are not reflecting this aspiration. A survey revealed that among the buildings in Kathmandu, only 7 percent are engineered, 50 percent are semi-engineered and 43 percent are non engineered (National Society for Earthquake Technology in Nepal [NSET], 2005). The semi-engineered buildings are made in consultation with masons and thesis guides having experiences in construction. These buildings are not designed and supervised by engineers. Therefore, these buildings may be considered as non-engineered. With these data, around 93 percent of the buildings in the country's capital are non-engineered. Engineering education has not being able to address this.

A modern society needs engineering education that could be a means of survival and prosperity and a basis of life long continuing education. The colleges need to begin the process by establishing applied mathematical and problem solving behaviour, scientific and technological methods of inquiry, communication skills, reasoned debate and consensus building, knowledge of technology etc. (Jones, 2006). Nepal's engineering colleges do not do these things well. An electronic engineer does not feel comfortable to work with repair and maintenance of electronic hardware. Similarly, a civil engineer does not feel comfortable to work with cement. Education is more like building status rather than capacity and confidence building. The consequence of this is the degradation of quality (Suwal, 2006).

There is significantly high fail rate in higher engineering. A case study of IOE revealed that the average fail rate in Bachelor level is more than 47 percent. This is alarming rate for engineering education. Surprisingly, there is also drop-out in IOE that is about 8 percent (IOE-Exam, 2006) and about 12 percent in KU (KU-exam, 2008). This scenario is similar with other Universities as well.

The system does not serve the labour market. Engineering education is valued both by individuals and governments for the way in which it equips people to cope with the world more effectively. This has many aspects including increase in self esteem, an improved ability to deal more effectively with confronting problems and increase capabilities which broaden the area of individual choice. In addition, engineering education makes individual more economically productive and consequently enjoying higher income with better jobs (Michel, 2006).

The demand of the industries and service sector are found not satisfied as they are not able to get desired work force. Since few years back, there is a flooding of Nepalese work force to go outside for the want of work. Almost all the labour force going outside is unskilled and their earning is very low. Had it been quality engineering education, skilled workforce could have remitted much higher amount of money by now. Engineering education system does not serve the labour market (The World Bank, 2001).

While, there is mismatching of engineering graduates and labour market. The knowledge and skill that graduates acquire in the colleges is not matching with the demand of the market. The curriculum, to the larger extent, does not reflect the demand of the market (Shrestha, 2006).

There are often the cases that shortages of engineers are in critical areas and they are in over supply in conventional areas.

Participation of students in engineering education is unequal across income and social groups. The access in the engineering education is relatively competitive. One has to cross entrance examination. The prevailing system is such that rich students are getting entry in the regular stream. This is true in both private and public institutions. This is due to the fact that rich students study in private schools offering better education and opportunities. Poor students study in the public schools with poor academic environment and less opportunities. They do not get opportunities to build their capacities. Even the potential students from marginalized community will not secure high marks in the entrance examination (Pahari, 2005). These students, in case successful in exam, will come into lower level and have to be admitted in full fee system in public institution (IOE).

The issue is not that an unprepared and unequipped poor should be given access, rather s/he should be given opportunities right from the pre-engineering level. The poor, studying in public school find almost impossible to cross the entrance exam. Further to this, the cost is out of their reach. Alternatives to address this financial problem are not available to students till yet (The World Bank, 2001).

There are marked differences in the performance of the students from geographical locations, income and social groups. The students from socially and economically poor and from remote geographical location have generally poor pre-engineering performances; the consequence of this is the poor performance in higher engineering as well. This has created disparity in the society.

The government investment and subsidy in engineering higher education is therefore inequitably distributed; largely going in the hands of the elites.

Economic benefit of the engineering education is not greater. There is ever going belief in the Nepalese society that technical sector opens wider avenues for opportunities for better jobs. Since few years back, engineering graduates are finding difficult to cover their household cost from their income. Often, engineers are not satisfied with income from their job. Fresh engineers are time and again found underemployed and also unemployed. The curriculum coverage is also questioned for not stimulating economy. Also, educational coverage does not yet appear to be at the level which is high enough for increasing economic returns to occur as behavioural changes become widespread (The World Bank, 2001). One more fascinating fact is that the investment in the engineering education, though not enough as per demand, is not serving higher economic benefits to the country.

Low level of ethics and morality of the graduates. It is found in a study of outcomes of engineering graduates that they have relatively weak sincerity and more self-centred attitude. The professionalism and ethical values are feeble within them. They are found more concern with money matters and pay less attention to professional, morals and ethics. Whenever, they found self benefits, they are prepared to sacrifice their collective interest (Pahari, 2005). The result is still depressing that engineering graduates have low level of creativeness and confidence.

Engineers pay less concern to social issues. It is often heard from the engineers that they are the technocrats and have less concern with social issues. As a consequence of this engineers are in isolation in the society. Even in the colleges, there is less attention on the subject- society and development. Whether, engineers pay attention or not, the social issue swifts away every one under its grip. Moreover, the end to take the benefit of the engineering achievements is society. As engineers do not deal in society, they shiver to face the problems in the market. They prefer to have a job as an obedient pupil and less as entrepreneur to take the challenge (Pahari, 2005).

Global Context

The technological revolution has confined the world to global village. However, North-South Technological gap is increasing day by day. Further research will be required to quantify the extent of this gap, but there is enough evidence to show that it is huge. Developed countries have set the priorities on the engineering education. They have a much higher share of their populations studying engineering education at the tertiary level, principally due to substantially greater enrolment rates. The numbers of students in engineering education are ever increasing every year. This rate is 3.8 numbers per 1000 population in compare to the 0.4 numbers in developing countries. Substantial part of the GDP in developed countries (about 2 percent) is spent in the research and development works, where developing countries are allocating only about 0.5 percent of the GDP. Contribution in the scientific work is significant in developed countries. Western Europe, North America, Japan, and the newly industrialized East Asian countries account for 84 percent of scientific articles published. These regions also provide more than 97 percent of all new patents registered in Europe and the United States (The World Bank, 2000). Many countries, such as; New Zealand, Australia, UK, USA, Canada etc, have proposed attractive schemes to the high skill manpower.

Distance, time, and geography are developing new meaning as a result of advances in information and computer technologies and the establishment of global partnerships and alliances that provide mechanisms for collaborations that cross disciplines, institutions, states, and countries. Future engineering graduates need to be educated to take a leadership role in shaping events to create a better future. The context has changed dramatically from what it was even a decade ago (Jamieson, 2007).

Global context has developed new scenario. The quality of engineering higher education depends on the global context. While undertaking reform activities in engineering education to achieve quality, global context exerts high pressure.

New Initiation and Competition. In the course of time, international policy communities are shifting their traditional policy and attitude towards higher education. In recent years, key organizations; such as, The World Bank, UNESCO, ADB and government of major donors have conceded that tertiary education may have a positive impact on country's economic development (Marcus, 2005).

Engineering has become a global enterprise, and engineering graduates today must be adequately prepared for practice in a global economy that stretches across traditional national and regional borders. Developing countries, where technical capacity building efforts result in an enhanced pool of well qualified engineering graduates should attract direct foreign investment within the country, as well as benefit from expanded local technical activity that leads to economic development. It is resulting two types of mobility – the attraction of engineering work across national borders, with the enhanced pool of engineers sought out by companies seeking cost effective technical expertise for their global operations; and the movement of engineers to localities where their talents are needed. Care must be taken to provide attractive and rewarding engineering positions in such developing countries so that the enhanced pool of engineers is attracted to remain there (Jones, 2006).

To successfully compete and be leaders in the future workplace, the engineering graduates must have a world-class engineering education, be equipped with the latest technical knowledge and tools, and have adequate understanding of the social, economic, and political issues that affect their work. Engineering graduates need to be significantly better prepared to deal with information retrieval, integrating knowledge, and synthesis. They must be able to take a holistic approach to problems involving complex and ambiguous systems and scenarios employing creative and critical thinking skills. In an increasingly global marketplace, the graduates are and will be expected to work on multinational teams, have a global perspective, and be culturally and linguistically literate. They must possess communication skills to interact effectively in the community and within the professional and political arenas. Today’s ethical issues will assume global proportions and engineering graduates must have the strong ethical foundation they will need to deal with issues involving equitable distribution of resources, by-products of design, proprietary information, sustainable development, environmental conservation, genetic engineering, and human cloning. They need to be familiar with legal and business aspects of engineering solutions and their social impact and have a foundation in best business practices and fundamentals of entrepreneurship (Katehi, 2004).

*Entrepreneurship and Connections with Industry. E*ntrepreneurship education programs for engineering students in the world have become familiar and the academic content refined. Now the movement has spread internationally, with programs being initiated in most parts of the world. Teaching students to consider alternatives to traditional employment is also now seen as an important part of economic recovery programs in less affluent countries. Many of these programs rely heavily on the use of mentors, and include the skills of entrepreneurship – using entrepreneurial skills within a company – creating early bonds between the practice of engineering and the industries that employ engineers. The connections between researchers and industry are increasingly being in demand and many academic institutions are giving efforts to establish relation with industries. More over, teaching entrepreneurship skills touches the core interest of many students desirous to study engineering in the first place, and may be another way to increase the attractiveness of the profession (Jones & Oerst, 2006).

Cross-Cultural Communication. The world is rapidly transitioning from one of nationally differentiated organizations and cultural identities to one increasingly characterized by transnational institutions and multicultural communities. Accelerated by dramatic technological advancements, this transformation is having a profound effect on national and international systems of commerce, education, and governance. This new world will require an even more sophisticated workforce to address a growing list of complex and interdependent global challenges, such as sustainability, security, and economic development. Engineers, whether working abroad or at home, play a critical role in addressing these and other global challenges (Marcus, 2005).

Propelled by the desire to improve one's life and helped along by technology, both the interconnectedness and interdependence have grown. This increasing integration of the world has enriched cross-cultural communication but also created new problems.

Information and Communication Revolution. The third dimension of change is the information and communication revolution. The advent of printing in the 15th century brought about the first radical transformation in the way knowledge is kept and shared by people. Today, technological innovations are revolutionizing again the capacity to store, transmit, access and use information. Rapid progress in electronics, telecommunications and satellite technologies, permitting high capacity data transmission at very low cost, has resulted in the quasi abolition of physical distance. Sixty years ago a phone call from New York to London cost the equivalent of US$300 per minute, today that same call costs only five cents per minute. In 1985, the cost of sending 45 million bits of information per second over one kilometer of optical fiber was close to 100 dollars; in 1997, it was possible to send 45,000 million bits per second at a cost of just 0.05 cents (Bond, 1997 & Salmi, 2000). For all practical purposes, there are no more logistical barriers to information access and communication among people, institutions and countries. Further to this, a portable hard-disc having capacity of storing data of 80 giga-bites is available in the market only for 70 dollars and a pen-drive of one giga-bite is available for seven dollars.

Outsourcing and the External Environment shaping Engineering Education. Off shoring of technical jobs, while still retaining its ability to provoke outrage, is now just as often seen as a permanent characteristic of the employment landscape in developed countries. With the expansion of the European Union in May 2004 to include ten lower-cost countries from the east, and Brussels promoting worker mobility, European engineers and technical people have more reason to be wary of threats to their employment coming from within. Evidence that off-shoring moves at quicksilver speeds is the fact that India, which only a few short years ago raised the spectre of off-shoring as a threat to technical jobs, now has fears that it might be losing its own competitive edge to China. Other external developments, which are impacting engineering education, include arguments about the future of the US space program, volatility in computer science employment, continued stagnation in math skills in US students, and the promises of nanotechnology (Jones & Oerst, 2006).

Engineers Mobility. Engineers Mobility is more and more becoming a key development factor. As the global market is open to everyone, one may find interesting job in any corners of the world and get a good salary and satisfying conditions of employment. This new context of Mobility in the form of professional competences and resources (like mobility of financial resources) is also crucial for any company or organisation which has to compete on a more “global” international market (Michel, 2006).

Mobility is often limited, in the professionals’ debates, to the physical mobility, that is to say to travelling, studying and working abroad. Of course, this geographical mobility is the most obvious facet. However, it is important also not to forget other dimensions of mobility; such as, professional or job mobility; social mobility; cultural mobility; trans-disciplinary mobility; methodological mobility and technological mobility (Michel, 2006).

Engineers have different facets of life. They may change the job in time and space. There may be good and exemplar experiences in the job and bitter experiences as well. The other part of the involvement may be the social organizations. It's obvious of such attachments as a member of the society (Marcus, 2005).

Mobility of graduate engineers in the wake of globalization is governed by the recognition of the basic academic qualification across national borders. Such recognition can be established, fostered and maintained through a mechanism of accreditation by an authorized National Accreditation Agency, which is different from the training institutions. The accrediting body should develop an international consensus for achieving substantial equivalence of the basic qualification among the various countries (Johnson & Daniel, 2006).

Certain desired attributes of a graduate engineer can be agreed upon, with a view to facilitate assessment of quality assurance and evaluation of the educational programme through accreditation. For example, the 'Criteria 2000' of the US Accreditation Board for Engineering and Technology (ABET) relies on an evaluation of the outcomes based on goal setting, continuous improvements and detailed assessment of the results of the engineering programmes (Jones, 2005). Essentially, the engineer should demonstrate adequate mastery of mathematics, basic sciences and engineering fundamentals; should be capable of analysing an engineering problem and evolving an efficient and cost-effective solution; and should be able to communicate effectively with a sense of professional and ethical responsibility in the social and global context.

Increasing Role of Integrated Engineering. The social side of engineering has been more prominent than in the past. Engineers are being portrayed, appropriately, as more responsive to basic human needs such as poverty reduction and hunger. They are seen as more responsive to environmental concerns, and sustainable development is a popular phrase in describing how current engineers approach the development of new projects to serve mankind. In addition, engineers in developed countries are assisting those in developing countries to build their indigenous technical capabilities in order to attract direct foreign investment, utilize foreign aid funds more effectively, and develop entrepreneurial small businesses – all with the aim of promoting economic development and eventual self-sufficiency for developing countries. Engineers are also heavily involved in converting the results of basic research and development into useful products and services to address the needs of society. Such international organizations as UNESCO and the World Federation of Engineering Organizations are pursuing integrated engineering in developing countries as a major approach to addressing their needs (National Academy of Science & Technology [NAS], 2006).

Privatization in Engineering Education. In many countries where the demand for engineering education has outpaced the ability of public institutions to meet it, private engineering education institutions are springing up and growing to meet market demands. In many cases, these private engineering education operations are meeting needs in market niches that are not well served by traditional public education – such as retraining needed by working professionals, or focused training in hot fields such as computer applications. Often the delivery of education and training by private purveyors utilizes distance education techniques – increasingly over the Internet rather than satellite or microwave delivery typical a decade or two ago. Distance education offerings are more and more available anytime, anywhere. They are becoming much more responsive to the desires of employed engineers and their employers, and tend to be market pulled instead of provider pushed (Jones & Oerst, 2006).

Education is the basic needs and the prerequisite for the development of the nation. Many researches proved that the development process of the country could be accelerated by the efforts of both public and private sector. Besides the government investment in education, the policy of harnessing stagnant resources available in the private sector in the education is widespread throughout the world. Almost every country is encouraging participation of private sector in the education. This is indeed a new context.

Quality Assurance. As globalization sweeps around the world, stimulating the flow of engineers and their services across national borders, accreditation and other forms of quality assurance have grown in importance. Some form of credentialing is often demanded before an engineer is allowed to move from one job market to another, or to offer services in another country from a home base. Formal accreditation is often the preferred form of quality assurance in such cases, and accreditation systems for engineering education are being established or strengthened in many parts of the world. Such high level pronouncements as the Bologna Declaration in Europe (Nyborg, 2004), and a similar recent declaration by the

Ministers of Science and Technology of the Organization of American States, have led to the rapid development of quality assurance mechanism within countries or regions (Thorn & Soo, 2006). There is also a strong movement toward mutual recognition agreements between such countries once local accreditation systems are in place – leading, for example, to the expansion of such cross-border educational equivalence pacts as the Washington Accord (Hay, 2006).

Issues in Engineering Education

As the world is shrinking to global village, the mobility of resources is apparent. This has accelerated the pace of economic growth of every country. In the course of time, technology has become a part of general living. Obviously, engineering education has become the concern. New issues are emerging and have to be addressed in order to give direction of development of the country. The study of engineering education is indeed meant by educating engineers with a global mindset to improve their global competency. The engineers should be exposed to and be able to grasp global technology, culture, communication and collaboration (Jones, 2005). There is a need for this to understand and address the emerging issues in engineering education.

Financing in Engineering Education

The education sector, similar to other sectors, is facing crisis as an effect of economy crisis of the developing countries. When adjusted for inflation, most government's budget for education has either declined or at best remained stagnant for a very long time. The result of this is that engineering education, which is financed mainly from government grants, has suffered all kinds of problems including those affecting the ability to assure quality and relevance of the programs. This situation is compounded by the population increases and the consequent increase in enrolment in secondary schools. The demand for places in engineering institutions, arising from these demographic changes has, also put severe pressure on the already inadequate facilities (Massaquoi, 2000).

Engineering education is a pre-requisite for the technological development of any nation. In other words, the productivity of any nation is an index of country's engineering educational system. With the declining resource allocation to universities, the budget for engineering education is expected to be adversely affected. Therefore, there is the need for an aggressive fund mobilization drive, by, charging cost-effective course fees, engaging in revenue-generating activities such as consultancy services, contract research, and creating conducive environment for external support (Audu, 2000).

The engineering education demands heavy investment in the infrastructures and teaching materials. There is largely the constraint of financial resources for the establishment and innovation of engineering education. This is severe in developing countries and even in the developed countries, financing is insufficient. The government is not supporting adequately. Taking an example of Institute of Engineering, since few years even the budget for teaching materials is not given by the government. Government is providing only the salary component of permanent status staffs and faculties (Paudel, 2006).

The issue is also the incomprehensive financial management in the universities. There exist traditional method of financing and accounts systems. The policy makers are not found considering the ideas of cost sharing and cost recovery in the engineering education. There are the policies of subsidy in education in different parts of the world. However, these policies of subsidy are not consistent. In one side the traditional financing system is creating burden on the budget and staff and on other side the financing for new technologies and related infrastructure in a sustainable way is yet burning issue. Government budget for universities, largely in developing countries, is not sufficient. The budget available for education is also not distributed sufficiently to the universities. Due to the availability of limited resources, the innovation in engineering education is not taking place. It is obvious that cross-disciplinary works exert strong influence in engineering education. But, funding support to such works is not available. The system is such that available human and other resources are not properly utilized (Bird, 2005).

Financial system in Institute of Engineering, only state financed institution, is under crisis. There is a serious issue of wastage of resources, such as; underutilization of infrastructure, frequent shift of academic calendar, overstaffing etc. There is a serious problem of new investment for supporting research and innovation and new educational technologies (Paudel, 2006). Despite the fact that the engineers are the demand of the industries, private sector investment in engineering education is not encouraging.

Faculties and Their Role

Faculty is important component for the quality of engineering education. The delivery of the faculty defines the competency of the graduates. However, there are grave issues regarding faculties. Especially in the developing countries, party-politicization is quite high and there is a intervention in the recruitment of the faculties.

While discussing on the issues of the faculties, teaching process and the methodology is other barrier. The conventional method ((explanatory-one-way traffic method, formal technique, monotonous & insensible, spoon feeding model, course completion oriented) has become the barrier to perceive subject matter objectively. The market is expecting dynamic and skilful engineers. For this, there is a need of research and analysis of the problem. However, the faculties are very seldom involving in such research works. They are doing only the conventional way of delivering lecture classes. The large numbers of faculties are not making themselves relevant and competent in the changing time.

In one side, the practice of faculties to the larger extent is found to be conventional and in other side, the competent and dynamic faculties are leaving institution for better professional opportunities. The professional satisfaction for faculties, such as; career building, financial benefits and social status, is eroding.

Despite the fact that engineering programs must demonstrate that the graduates have an understanding of professional and ethical responsibility so as to cope the market demand (American Board of Engineering and Technology [ABET], 2000), faculties are reluctant on the delivery of lectures on ethics in the engineering practice. Faculties are found indifference to the larger extent. Also, there prevails the belief that engineering faculties are not competent to teach ethics (Herkert, 1999). Engineering faculties are most comfortable with quantitative concepts, and often do not believe they are qualified to lead class discussions on ethics. Many engineering faculty do not think that they have the time in an already overcrowded syllabus to introduce discussions on professional ethics, or the time in their own schedules to prepare the necessary material. Findings from courses at Lamar University suggest that while undergraduate students may lack motivation to study ethics, they do have an interest in the social aspects of engineering that could be used to leverage an interest in ethics (Koehn, 1997).

For engineering institution to go forward, it is important to see the value proposition of the faculties- how they see their career in the college. This decides their delivery eventually deciding the quality of the education. For faculty, the stimulating factors are advancement of knowledge, research programs, career options, networks etc.

Equity and Access

According to the population census of 2001, 58 per cent of the economically active population is illiterate. This indicates that most of the workforce is unskilled. The numbers of students in the higher education (university) in 2002/2003 was 165379(CBS, 2003), which is about 0.714 percent of the population. The enrolment of students in higher engineering education is only 2014 in 2003 which is 1.22 percent of the students in higher education (UGC, 2004). The numbers of students from deprived community are far behind.

According to the population census 2001, upper castes constitute 35.4 percent of total economically active population. By major occupation, they dominate in professional/ technical (62.2 percent), legislative/ administrative (58.3 percent) and clerical (53.6 percent). On the reverse, Dalit who constitute 11.9 percent of economically active population have only a nominal representation in such occupations: 1.6 percent in professional/ technical, 1.3 percent in legislative/ administrative, 3.9 percent in clerical. Among those engaged in elementary occupation 36.1 percent are Janajati, 22.6 percent Dalit and 19.1 percent upper caste (Gurung, 2006).

Nepal has become to a greater extent an unequal society in which some people or community and geographical area have prospered while many other communities and districts have not. There is strong conceptual debate around the notions that exclusion either social, economic, political or geographical have been the main causes of unequal society. Exclusion results in poverty, unequal distribution of resources and development initiatives, and inability of certain community or geographical area to participate in socio-economic and political development processes (Shah, 2006).

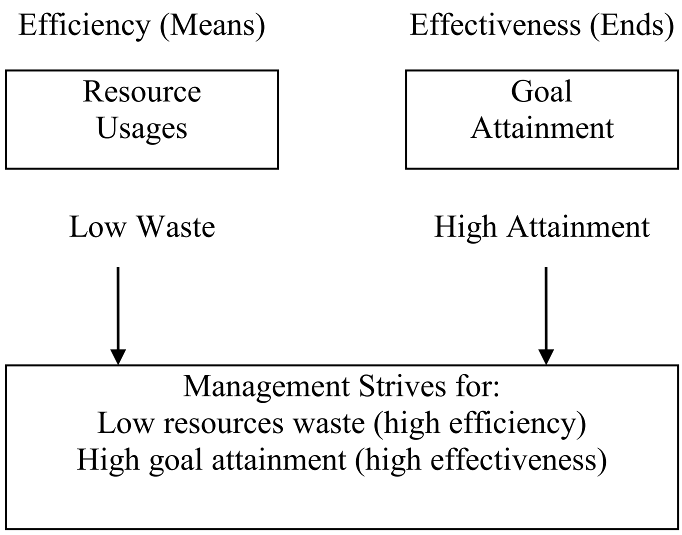
It is a catch-word now that we are all born equal and could live consistently with human rights and dignity. However, there is disparity in resource availability, social status, wealth, power and prestige to individuals. Almost all political and social organizations talk about the equality, but the practice is a bit different. So far taking the case of higher engineering education, there is overwhelming access to the elites only. There is traces of students from deprives community in engineering education. It is true that access in higher engineering education gives better opportunities to build the capacity and eventually employment potential of the individuals. This in-turn increases the living standard (Suwal, 2006).

Nepal as the patrimony of high caste has always remained reluctant to progressive measures on equality. The preamble of Nepal Constitution 1990 on social, economic, and political justice for all citizens has been constricted by lack of legal provisions. The State has been reluctant to enact comprehensive laws pertaining to social justice. Even in the case of a few initiatives, State commitment has remained cosmetic (Tamrakar, 2006).

Management and Institutional Barriers

Management is the attainment of organizational goal effectively and efficiently by coordinating people and their works. This gives the sense that the works has; to be planned, to be directed, to be supervised, to be controlled etc. For all these functions to be done, the people involved in the whole process should be managed. Therefore central thrust of the management is the effectiveness and efficiency.

Figure 2. Efficiency and effectiveness in management



The effectiveness is often describes by 'doing the right things'-that is, those work activities that will help the organization reach its goals. Similarly, efficiency refers to getting the most output from the least amount of inputs. This is better represented by the flow chart above (Robbins, 2003).

For every organization, attainment of the goals is very important. For this, every manager has to perform different functions. The most representative functions as defined for modern management are planning, organizing, leading and controlling.

Figure 3

Management functions

Planning	Organizing	Leading	Controlling	Lead to
Defining; goals, establishing strategy and developing tactics/sub-plans to coordinate activities	Determining; what needs to be done, how it will be done, and who is to do it	Directing and motivating all involved and resolving conflicts	Monitoring activities to ensure that they are accomplished as planned.	Achieving the organization’s stated purpose

Source: (Robbins, 2003, p.8)

The issues of higher engineering education are the problems of leadership and management in education. The visionary approach is possible only from rational management. The external and internal factors are responsible for the adverse effect ultimately affecting management (Shrestha, 2003).

The external factors do have substantial effect in the leadership. These factors are political, economical, social, technological, students' influences, donor intervention etc. In the moment, the country is facing crisis in all areas, there is acute problem in higher education in general and engineering education in specific. There is also unbelievable intervention of the donor. The consequence is that the programs are not in accordance with the national policies, rather are operated under donor's impulse. The influences of the students, in most cases, are also becoming instrument in violating the policies of higher education (Robbins, 2003).

Since the very beginning, there has been intervention of the state in the higher education. During Panchayat regime, there was a substantial intervention in curriculum and management. Even after the restoration of democracy, management is always under the influence of ruling parties. The functioning of the institution is influenced by the interest of political group (KC, 2005).

The internal factors are also equally responsible for manipulating the management. The management system under favouritism and nepotism can not function properly. During Panchayat regime, then *Anchaladish* were nominated as vice-chancellor in TU-only institution running higher education in the country. They were not honest on the plan and programme of the TU. The result was anarchy in the institution. Even after the restoration of democracy leadership followed the same legacy of recruiting party cadres in the institutions (KC, 2005).

In the absent of the policy, the private institutions are running under the impulse of the individuals. Almost all educational institutions in private sector do not have institutional set up. The management and decision making process is not institutional. The consequence of this is the chaos in the higher education leading to nowhere. This, in turn, has strong effect in the quality of leadership (Joshi, 2005).

The Institutions imparting engineering education include universities, industry and government. These institutions involve in different ways. Obviously, universities provide students with global opportunities which sometimes are funded by industry and government and also sometimes involve on-site industry experiences such as internships and projects to solve industry problems involving global issues such as supply chain management or involving global distributed teams. Such team may be from the students from different universities and colleges in which teams of students from each university join as one team working on an industry project as part of their capstone experience. Problem occurs in this case and causes barrier. This includes issues between institutes (inter-institutional barriers) and within an institute (intra-institutional barriers). Inter-institutional barriers can include multiple languages, time schedules that are off by several time zones, difficulty in communication both technically and personally and the cost and time to coordinate between institutions. This is especially true in universities in which joint courses or distributed teams require mentoring and other resources that can be expensive (Assford, 2006).

Furthermore, barriers within an institution are also common and include mis-perception of cost and time which means that the amount of expense and time commitment to produce competent engineer is typically much higher than administrators realize. Within a university, courses involving engineering education are usually counted the same in terms of faculty effort as regular courses. Also, within one institution, there can be inter-departmental issues as well. For example, in a university, especially in multi-disciplinary courses, requirements for student work can be vastly different among departments and can prevent students from participating. Culture within an institution can be a barrier. In an institution for example, a rigid work schedule can prevent distributed team members in distant time zones from having an opportunity for real-time communication (Assford, 2006).

Students and Their Activities

The globalization has opened the avenues of job in the global market. But, the issue of competency is very crucial. The market demands the quality engineers. Moreover, as the pace of technology development is accelerating, there is a high demand of knowledge and skill of technology in every spare of life. This has created great mobility of students. Students are moving from one country to others for the want of better quality education eventually better job too (Rahman, 2003).

Students as a dynamic and energetic force are influenced by the society and social phenomena. In the developing countries, they are largely influenced by the politics, which is not standing on the ethical ground. For students, the interest of their political group is coming in the forefront rather than institutional interest. Besides, vested interest of the student has also been the barrier in the smooth functioning of the institution (Katehi, 2004).

Students in engineering come from competitive examination. They are conscious on their performance. There is a need of motivation and counselling in the study and for their future career. There is a need for leadership and guidance in the academic performance to the students.

Globalization has created a condition that industrialist are forced to search human resource in the domestic market as it is cost effective in compare to the global market. It’s obvious that industry seeks the competent engineer. For students in engineering, their concern is the job opportunity. They look their education as the basis of career potential. Market is competitive and every student wants to develop capacity so that one can be saleable in the market. It's the value proposition of the student (Azim, 2002).

There are other issues regarding students. Competent engineering students are also found under financial pressure. Other students are found to be less concerned with the ethical and moral issues.

Socio-Cultural Imperatives

Engineering is fundamentally the service delivery to the society. This means the services necessary for the safety, comfort and economy for the people in order to live prosperous life. In this process the society changes. Therefore, the change of society from tribal stage to modern civilization is social transformation and the manifestation of engineering. Being the leader of the technology, engineer should be familiar with these phenomena of change. Change is not merely the material changes, but social and cultural change (Jamieson, 2007).

Engineering developed fundamentally as an integral part of conquering horizon of civilization. Its root exists in the military activities of invention, invasion and development of the country. Technology development is therefore the deliberate efforts of military manoeuvres. As a part of finding new ways of production there has been invention and reinvention of technology. This has eventually brought ease and comfort in the day to day life of the human being. Technology, as such, is not merely the intellectual entertainment rather it is the means for social change. It shapes the behaviour of the human being (ASCE, 2004).

Engineer stands as one of the most important force for the advancement of a country in many regards. The main reason for this is that a country prepares its engineering graduates for position of leadership and responsibility of development works in a rapidly and increasingly complex and competitive world. Therefore, Engineer should be able to respond in an effective manner to changing scenario and needs of the country and adopt more dynamic and flexible strategies for the operation of development works eventually leading to the prosperous society. It is obvious that simply having followed the past trends of Engineers' role and opportunities provided to them would not lead a country to achieve social and economic growth (NEA, 2005).

The relationship between Engineers and national development is of complementary type; one helps to other to grow. Development as such, is the quality of life in totality, including individual dignity, self-respect and self-command. These parameters are broadly exhibited by almost all developed societies (Deuja, 2003).

Engineers are the leader of technology. They invent and also apply technology into the social behaviour thus the society is modernised. Technology has social and economical implications and one has to understand this. An engineer being the leader should understand the society, its structure and social relations. Merely a technocrat can not give proper direction of any ventures as s/he can hardly understand the social phenomena (Edwardson, 2007).

Engineering knowledge and skill are for the people and country. Therefore, this is regarded as public property and it has social value. In this ground, engineering student should understand religion, culture, cross-cultural relations, ethical and gender issues. An engineer may find difficulty in delivery of service without social connection and community attachment. This obviously demands the integration of other discipline into the engineering (Gabriele, 2006).

Infrastructure Issues

Engineering education is the delivery of the knowledge and skill to the students. It is all about technology, its achievement and its delivery to the society. It demands laboratories along with the class rooms and library. Other infrastructures necessary for the allied services necessary in the institution also deserve importance for the quality engineering education (Jones, 2006).

The infrastructures necessary in the engineering education demand huge investment. Many institutions can not afford this. Therefore, government investment is required to establish these infrastructures. These infrastructures cover building, physical facilities, laboratories etc. Some of these infrastructures, such as laboratories, are critical and without which academic programs can not be run. It is important for their protection, maintenance and development (Paudel, 2006).

The problem of almost all engineering institutions is the repair and maintenance of infrastructures. It is obvious that huge infrastructures demand high maintenance budget. Moreover, upgrading and replacement of the tools and equipments is yet another part in engineering education. In the course of time functional aspects of the available infrastructures change and they need to be developed in the new way. In many countries, the public institutions delivering engineering education have the problem of proper inventory of physical facilities. It is obvious that in the absence of the records, the proper use of those infrastructures can not be imagined (Aryal, 2006).

The other part of the infrastructures is the incorporation of the current technologies. This includes upgrading of electrical, electronics and mechanical system. The upgrading of library and research facilities is other important part to be considered. This issue of infrastructure has direct impact on the quality of engineering education (Boda, 2006).

Curriculum and Assessment System

One of the important factors influencing quality of higher engineering education is the entry system of the students. The uniformity in the basis of entry eligibility in higher engineering education (B.E. Level) is under question. Some universities have physical group of plus two or intermediate level with percentage of 40-60 and others have opened the avenue for the biological group as well (Pahari, 2006).

The revision and upgrading of curriculum in the engineering colleges is tedious and time consuming process. The system for designing curriculum from all levels of management, departments to faculties, etc. do not function properly. The demand of the global and domestic market is shifting in the short span of time. But the content of the engineering education is not matching accordingly. There is a need for subject courses matched and harmonized (synchronized) with global courses and schedules. The problem, in most cases, is the breadth and depth of the course. There is a need for review of breadth and depth of subject coverage in the curriculum based on market needs (Paudel, 2006).

The text books are yet another shadow area. Faculties are not encouraged to produce text books and available books are not based on local source, skill, originality & Nepali culture & market conditions. As a result of this, books are expensive in one side and are not available in the market (Jones, 2006).

There are also the cases that the courses of engineering are not periodically evaluated. There is a lacking of systematic evaluation of; institutional performance; course prescribed; administrative practices; feedback system from lower to higher level and from students on course taught. The shortcoming is also prevails in the developing and enforcing national standards for engineering education (academic degree and engineering colleges). As an effect of globalization, the mobility of engineers is obvious, but the system of accreditation and confirming the courses in accordance with international standards is yet to be established. There is a need for conformity of standard of Nepalese graduates with standard abroad. The quality of knowledge and skill in conformity with ISO 9000 standards is very important to go to the global market. This has to be incorporated in the courses (Mcgrath, 2006).

Engineering is not one time study matter. It demands continuous upgrading and refreshment. The provision for continuing education and lifelong learning in engineering education is another part of curriculum. The quality of engineering education has been largely affected by the flexibility of academic calendar. The system of internal assessment as a tool of evaluating students is yet the matter to be reviewed. The examination system in many countries is clerical, tedious and pressure creating. As the technology is accelerating very fast the information and communication technology have to be incorporated in the engineering courses. Engineering education is basically learning by doing. The exposure of technical know-how, i.e., evolving in application of technologies, is lacking and this has to be encouraged (Fuchs, 2006).

Job Market and Its Reality

Engineering education is fundamentally the service delivery in to the society. It is not just gaining knowledge and skill for the status and prestige. Therefore, it should address the market demand; of industries; of service sectors etc. The engineering colleges are not paying attention in this fact. Industries are not encouraged to search for the manpower needed in the colleges. There is lack of collaboration between industry and academic institution for need based delivery and research. The condition is such that there is the lack of respond to new challenges posed by increasing liberalization economy in higher engineering education in Nepal (Paudel, 2006).

The world is becoming more and more competent and there is increased threat to quality higher engineering education by commercial organizations making product more commercialized. This has created a shortage of skilled human resource in some critical areas and over supply of engineering graduates in conventional areas (Jones, 2006).

Competition is increasing to the engineering colleges. In one side, there is global demand and in other side there are societal issues to be addressed. The performance of the colleges in this regard is very important. There is the lacking of private public partnerships for assessment of the academic performance of students and market response to their performances. Almost all engineering colleges still have conventional teaching methods (Polczynski, 2005). The system of on-the-job learning experiences (experimental learning opportunities) in engineering education is not practiced. Matching of engineering courses between academic programs and job market is another shortcoming in engineering education. The exchange of ideas and experiences is very important part in engineering education and this is lacking in this area. Responding market is possible by taking feedback from there (Hay, 2006). Engineering institutions are not giving attention in this area.

Challenges of Engineering Education

Higher engineering education is facing many challenges in country like Nepal. The data witnessed that in the past decades there has been rapid expansion of higher engineering education. The rapid expansion of the technology has brought great momentum in the growth of engineering institutions. As against single public institution delivering engineering education, there are, at present, 31 engineering colleges which include 24 private colleges and 7 constituent colleges (Suwal, 2006). The institutions are emerging into new forms and there has been increased importance of knowledge.

Engineering education clearly needs well designed academic programs and clear mission. Most important to its success, however, are the high quality faculty, committed and well-prepared students and sufficient resources. Besides, the role of management is getting more and more responsible in achieving the goals (Holm-Nielsen, 2001).

Decentralization and Autonomy in the Institution

Higher education institutions in developing countries are often severely influenced by different factors, and despite their best efforts, they lack the authority to make key academic, financial and personnel decisions. They can also be slow to devolve responsibility for decision making to constituent departments. This eventually leads to poor governance which dilutes their ability to spend what money they have (The

World Bank, 2000). This is valid in case of Nepal. Most of the academic institutions including engineering educational institution are running under the system of centralization. Public institution like IOE, despite decentralized from Tribhuvan University, is still under direct influence of central management (Paudel, 2006).

At present, IOE has got the partial autonomy under the decentralisation rules 1998. This rule allows IOE to manage the internal resources that it generates. However, IOE still requires to follow TU administrative and fiscal regulations and working procedures for the use of internal resources. The recruitment and dismissal of the faculty is also centralized. The scenario is such that TU administration has centralized academic, administrative and financial authorities even in the case of decentralization (Paudel, 2006). Other universities have also similar centralized system. Lack of academic decentralization has created serious setback to address the market demands. Campus chiefs are more accountable to central office and less to stakeholders. In some cases, there are different interpretations of decentralization rules in central and local authorities. In addition to this, management of public institution (IOE) is nominated by the executive body of TU with the government intervention. Key staff management functions are vested in the Central Administration. Despite the definite selection procedure, key positions in the management are, in most cases, found to be nominated from among the supporters of the ruling groups. This has created serious problems internally and externally (Aryal, 2006). Such management, in the most cases, is found weak in self-confidence and absent of team-building. They hardly face the confronting problems. More over, management runs under adhocism. Any valid issues are not treated properly. Harsh pressure is required to fulfil even the regular demands, such as; procurement of teacher or instruction materials. The management in engineering colleges is often under crisis. The regular meetings of committees and faculties do not take place. The faculties are to the large extent dissatisfied and humiliated. People in the management build pressure on them rather than consultation (Pahari, 2006).

Though, Private engineering institutions entertain more leverage in the executive part, are, by large, under the control of promoters. The management in private institution is decided by the promoters. As the promoters, in most cases, are non-academicians and non-professionals, they rarely understand the academic issues and their decisions are more impulsive. They are conducting centralised system. The decisions are made by board of directors in the institution having institutional set-up. Many of the private colleges lack institutional set-up and decisions are made by single person. It's a reality that not all the institutions have enough infrastructures, such as; class rooms, laboratories, library, meeting halls etc.(Suwal, 2006).

For academic institution, it is very important to have freedom in deciding academic programs and authority of administration and financial decisions. Institutional accountability is very important for teaching/learning process, quality of education, research and maintenance of academic calendar. For this, decentralization and autonomy is imperative (Aryal, 2006).

Incomprehensive Financing System

Many of the problems involving engineering higher education are rooted in lack of resources. In the past years, the donors and the government did not give priority to higher education. However, at present, higher education is in the agenda of most of the countries as a means for economic growth.

Nepal has allocated 15.2 percent of the budget in the education and 9.5 percent of this budget is further allocated to higher education. If certificate level is separated from higher education, this budget comes to be 6 percent only (MOE, 2006). In spite of declining amount of government budget in higher education in developing countries, people are spending higher proportion of their income in the higher education than the people in developed countries. This is evident with public spending for education growing more quickly than income or total government spending (The World Bank, 2000).

Engineering Education demands heavy investment. This is fundamentally for the laboratory and instruction materials. It is not just the delivery of lectures rather the demonstration and practice of the science. But, the return of this investment is also massive. This produces high skill human resources responsible for productivity and efficiency. Therefore, this is often treated as the state responsibility. However, the system of financing is imprecise in engineering education. State is reluctant and as a consequence of this IOE is not getting fund even for instruction materials and repair & maintenance works (Aryal, 2004). Government seems to be in confusion whether the investment is to be shared or recovered and by what means. The concept of cost sharing has been introduced in1996 as full fee system for sustaining regular program in IOE as a rescue from financial bottle-neck. Despite this full fee system the only means to cover recurrent cost, there is a need of further discussions on this policy (Joshi, 2002).

There is also a confusion of statistical data analysis regarding participation of income groups in the higher education. The World Bank review of Nepal's public expenditure indicates that more than 80 percent of the participants are from highest 20 percent income group. Any subsidy and benefits from this has been received by the elite group that is capable of cost sharing. This is the general scenario of higher education in Nepal (Nepal Living Standard Survey [NLSS], 2001). However, the attraction of cream students in engineering has questioned this data to the extent that those capable enough from other quintile are studying engineering education. The contradiction is on the study of high school and pre-engineering education in intermediate level of science and engineering. Those marginalised geographically and economically have little or no access in quality schools and colleges to build capacity for studying higher engineering (Pahari, 2003). Moreover, there is the absent of financial policy to build the capacity of lower income groups so as to increase their participation in the higher education.

Due to the fact that highest income group capable of sharing cost is taking benefits of higher education substantially, government has curtailed the budget from higher education. This has been reflected in the engineering education as well. The scenario is such that institute of engineering is not receiving budget even for educational materials except salary of the teachers and staffs (Paudel, 2006).

In Nepal, all public universities are highly dependent on government for their financial resources. For the case of Tribhuvan university, tuition fees are negligible and attempt to increase fee encounter major resistance. Introduction of full-fee-system in IOE is a major achievement to generate the resource from the student (Joshi, 2004). The scenario is such that the capital and operating budgets are poorly coordinated. There was heavy investment in infrastructure in IOE during engineering education project (1988-1998) funded by The World Bank. But, all these infrastructures are now left with no fund for repair and maintenance (Paudel, 2006). IOE is littered with deteriorating buildings. Many of the scientific equipments in the laboratories are out of order due to the absent of repair and maintenance. This has created a situation of 'use-it-or-lose-it' environment resulting overspending or misspend of resources. Resources for research and development are virtually not available.

Private colleges have similar fate but of different nature. Government has no policy on the soft loans to engineering colleges. There are no any other financial packages to address financial issues. As a consequence of this, promoters plan for short-term recovery of their investment. This naturally increases the cost of education. The sources of fund in the private colleges are promoters, banks and students. Promoters have normally token of initial shares and take the bank loan for investment in infrastructures necessary for engineering education. This loan is repaid from the student in the form of fee later on. As the bankers offer short-term loans in the most cases, the repayment instalment is usually much higher and as a consequence of this students have to pay higher fee. Colleges are more commercialized (Suwal, 2006).

Faculties for Quality in Engineering Education

A well qualified and highly motivated faculty is critical to the quality of engineering institutions. Nepalese engineering education is facing serious challenges on the recruitment and retaining of quality faculties. In addition to this, substantial numbers of faculties have graduate level training. This limits the level of knowledge imparted to students and restricts the students' ability to access existing knowledge and generate new ideas (Aryal , 2006).

Teaching methods are often outmoded. Rote learning is common, with instructors doing little more in the classroom than copying their notes on the blackboard. Such passive approaches have helped student to pass the exam but have very little creativity. There is a need of a more enlightened view of learning that emphasizes active intellectual engagement, participation and discovery rather than the passive absorption of facts (Kapu & Mehta, 2004).

Improving the quality of faculty is made more difficult by the ill-conceived incentive structures in Universities. Faculty pay is relatively low to that offered by alternate professional occupations. While pay disparities make it difficult to attract talented individuals, recruitment procedures are often found to hinder intellectual growth. Bureaucracy and corruption are common. Favouritism and patronage contribute to academic inbreeding that denies Universities the benefits of intellectual cross-fertilization (The World Bank, 2000).

Politicization in the engineering colleges has wider impact in the system. Political activities in an academic institution are obvious, while it helps to address injustices and promote democracy. In many instances, politicization has inappropriately disrupted campus life. The faculties are recruited under favouritism and patronage. Such persons take up positions as combative agents of rival political factions. The consequence of this is that most of the qualified and trained faculties are humiliated and discontent eventually find difficult to retain in the institution (Pahari, 2006).

Students and Their Problems: A New Challenge

Many students are found unprepared academically for their studies in higher engineering education. Pre-course in plus two level and diploma in engineering is such that students after completing these courses are still not well prepared for higher engineering course. Poor basic education is the root for inferior quality of engineering education (Shakya, 2005).

Engineering is the area for competitive students. The entry system is responsible for the choice of such students. The entrance systems of engineering in different Universities are different and questions are appearing on their reliability. Inferior students are getting entry and as a result of this, there is a high failure rate (Shakya, 2005).

The academic environment in almost all colleges is not conducive for study. Inadequate classrooms, library and laboratory facilities are some examples for this. Financial constraints are further aggravating the situation. The extra-curricular and co-curricular activities of students are not found directed to the professional and academic achievements (Khati, 2003).

Equity and Access in Engineering Education

There are large differences in enrolment rate in engineering education across geographical/ ecological areas and income levels. It is obvious that higher engineering education provides wider opportunities for better jobs, therefore economically wealthier family and family from urban and other accessible areas send their children for engineering education. Those who have their schooling in public school and intermediate from public colleges can not compete in the entrance exam (Joshi, 2002).

A large majority of students studying higher engineering are students from private boarding schools. Students from remote hills and terrain have very little access in engineering. This has contributed to the inequality in the society and this is still increasing in the course of time (Paudel, 2006).

Nepal is a country of multi-cultural and multi ethnical society. None of the castes and the ethnical groups is in the majority here. This signifies that the possibility of the ethnical conflict is virtually very less. However, political, social, economical and other interests of the individual and the group manipulate the human sentiments. As a result of this unrest takes place. Some times, it appears as harsh conflicts resulting heavy casualties and loss of life (Shah, 2006). This is one of the great challenges in engineering education.

Trends of Engineering Education

Domestic Trends of Engineering Education

Assessing the outcome performances of the graduates from engineering education over time is useful in understanding the quality of engineering education in Nepal.

The product of the engineering are found less competent to deal with confronting engineering problems (Bhattarai, 2002). Enrolment in higher education is increasing sharply as the students in pre-curse level (plus two and intermediate level) are growing with high numbers. The engineering graduates produced in the country during nineties were hardly 96, this number rose to 2625 in 2005 (CBS, 2003 & UGC, 2005). The demand of higher engineering education is further increasing. The failure rate in engineering is relatively high 47 percent in 2001 (IOE-exam, 2006). Further to this, engineering education has been the elite's constituency and differences exist across the geographical and income diversity. Several issues are appearing on the surface on management, faculty and students. These are the evidences that quality of engineering education is deteriorating.

For every country, the priority is to boost the development process and achieving prosperity of the people. For this, state formulates strategies and plans. The management of engineering education has to harmonise strategies and plan of education with the national strategies and plan. Obviously, these should be comprehensive internal management system, such as; administration of students entry, examination system, development of new curriculum etc. The system of continuous training and upgrading teaching skills for faculties is yet another part to assure quality of education. It is very important to link-up the engineering education with the labour market, otherwise, it becomes absolute. Present trend of engineering education is such that the quality is declining and it is not need based (Paudel, 2006).

Global Trend of Engineering Education

Globalisation. Globalization is the complex integration of capital, technology, and information across national boundaries in such a way as to create an increasingly integrated world market, with the direct consequence that more and more countries and firms have no choice but to compete in a global economy. Globalization may not be a new phenomenon. The conquest of America by the Spanish and Portuguese invaders at the end of the 15th century, the triangular cotton and slave trade in the 17th and 18th centuries, the construction of the trans-Atlantic telegraph cable in the 1860s, and the colonization of most of Asia and Africa until the middle of the 20th century were key factors of economic integration and determinants of economic growth on a global scale. But there has undoubtedly been an acceleration of the phenomenon in the past two decades as demonstrated by the increase in international trade and the growing interdependence of capital markets (Salmi, 2000).

Emphasizing globalization as an important economic trend does not imply a value judgment, either positive or negative. Many people see this evolution as a major source of opportunities, while critics decry the dangers of inter-dependency and high volatility, such as the risk of transferring financial crises from one country to the other. But globalization is happening, whether one approves of it or not, whether one likes it or not, and every country in the world, every firm, every working person is affected by it and is very likely a part of it (Azim, 2003).

The world, by now, is the global village and globalization has become the reality. The evidences are clearer for this. There is the fast communication from one corner to another of the world. One can travel in hours to the ends of the earths rather than months and years. Detail information on any subjects could be traced within short span of time (Whitwell, 2002). To define the globalisation, professor Diamond says:

we have globalisation on our table-A typical American meal might consists of chicken (of Southeast Asian origin) with corn (from Mexico) or potatoes (from Southern Andes), seasoned with papers (from India), accompanied by the piece of bread (from near Eastern Wheat) and butter (from Eastern Cattle), and washed down by the cup of coffee (from Ethiopia) (Diamond, 1989).

Globalisation is in effect since the period of colonisation. It has been more pronounced in the 20th century due to the fast pace of development. This has globalised the economy, society, industry and education (Rahman, 2003). There are positive and negative views on globalisation. It is not the case of supporting or opposing it. The rational view is to accept it as an emerging and powerful global reality and to formulate strategies to manage it to minimise the adverse effects and maximise the gains from it (Rahman, 2003).

It is true that so much of the world economy rests on the skills of the engineers. The safety, comfort and prosperity of the people rest on the endeavours of the engineers. The population is ever increasing and the economy and infrastructures necessary to support them is to be designed and constructed only by engineers. The limitation of a country is not going to be valid for professional like engineer. Wherever the problem confronts, engineer goes there and resolve it. Globalisation, eventually, have open the path for mobility of engineers from one country to another. For this, engineering education should be of good quality and relevant and understand real-time-problem across the globe (Whitwell, 2002). A new scenario has developed, such that engineer will need to understand how business is practiced in other countries and how engineering is practices there and also what societies expect from the products and services of other countries.

Due to the effect of the globalisation, the engineering institutions benefits greatly from connection with similar institutions. For engineers and scientists, the paucity of such contacts is often an impediment to their creativity and productivity. Globalisation has developed new trend to be addressed in the engineering education.

Emergence of Knowledge based Society. Knowledge accumulation has become one of the major factors in economic development and is increasingly at the core of the country's competitive advantage, which is itself determined by the ability to innovate in a continuous manner (Bloom, 2005).

The opportunity for growth in the world market have shifted to the knowledge intensive area where rich countries are in the centre and most of the poor nations are peripheral players in the knowledge economy (Rahman, 2003).

The technology is changing very fast. It was a time, not long back, of mechanization. Later on the industries came to transistors and chips. Now, paradigm shift is taking place to nano-technology. This has created a demand of human resources with ever growing knowledge. It is now evident that the demand on engineers is continuously changing and this will still be faster in the 21st century than any time before. An engineer with his/her static knowledge will not be able to cope up with this change. S/he will have to upgrade his knowledge and skill continuously so that s/he remains competitive in the new demand domain (Azim, 2003).

The last few decades have experienced colossal changes in the world. The land, factory and factory products were treated as the properties in the past. This has been changed by now. The 21st century is knowledge based century. The capital at present is knowledge rather than factory and factory products. The new paradigm of knowledge base in engineering is emerging. The knowledge domains of the conventional engineering fields are experiencing an ever increasing growth, resulting in knowledge explosion. Every engineering field has started to disintegrate into independent specialized knowledge domains. In the course of time independent fields integrated to give birth of new engineering professions. An engineer must be flexible enough to adjust with this ever-changing knowledge-based demand. His/her knowledge and skill domain should enable him/her to search for needed incremental knowledge and should be trained to think analytically (Azim, 2003).

The second dimension of change is the growing role of knowledge. Economic development is increasingly linked to a nation's ability to acquire and apply technical and socio-economic knowledge, and the process of globalization is accelerating this trend. Comparative advantages come less and less from abundant natural resources or cheaper labour, and more and more from technical innovations and the competitive use of knowledge. The proportion of goods with a medium-high and high level of technology content in international trade has gone from 33 percent in 1976 to 54 percent in 1996 (The World Bank, 1998). Today, economic growth is as much a process of knowledge accumulation as of capital accumulation. It is estimated that firms devote one-third of their investment to knowledge-based intangibles such as training, research and development, patents, licensing, design and marketing. In this context, economies of scope, derived from the ability to design and offer different products and services with the same technology, are becoming a powerful factor of expansion. In high-technology industries like electronics and telecommunications, economies of scope can be more of a driving force than traditional economies of scale (Banker, 1998). New types of companies, called producer services companies, have begun to prosper as providers of specialized knowledge, information and data supporting existing manufacturing firms. Experts see them as the principal source of created comparative advantage and high value added in advanced industrialized economies (Gibbons, 1998).

At the same time, there is a rapid acceleration in the rhythm of creation and dissemination of knowledge, which means that the life span of technologies and products gets progressively shorter and that obsolescence comes more quickly. In chemistry, for instance, there were 360,000 known substances in 1978. This number had doubled by 1988. By 1998, there were three times as many known substances (1,700,000). Almost 150,000 new “patent equivalents” were added to the Chemical Abstracts data base in 1998, compared to less than 10,000 a year in the late 1960s. Perhaps the best illustration of the short life time of new information and products comes from the computer industry, where the monopoly of the Intel micro processing chip has decreased spectacularly in duration with each new version. With its 386 microprocessor, Intel dominated the market for more than three years in the late 1980s. Ten years later its competitive edge lasted only three months with Pentium II. Even more dramatic, Pentium III was supplanted by AMD’s Athlon microprocessor after being on the market for only a few weeks (Holm-Nielsen, 2001).

In addition, in many fields the distance between basic science and technological application is narrowing or, in some cases, disappearing altogether. The implication is that pure and applied researches are not separate any longer. Molecular biology and computer science are two salient examples of this evolution (Lin, 2004).

Figure 4. Knowledge for economic growth (Holm-Nielsen, 2001. p. 36).

Knowledge Makes Difference between Poverty & Wealth

A World Bank study, which compared the economic evolution of republic of Korea and Ghana between 1958 and 1990 illustrated the significant difference made by knowledge based development strategy. The graph represents the prosperity of Korea from the knowledge base. Ghana remained in the same level of poverty. Distinction can be visualized between tangible factors and knowledge factors in the building of the wealth. The first includes the accumulation of physical capital and additional years of schooling in the labour force. The knowledge factor includes quality of education, strength of institutions, ease of communicating and disseminating technical information and management and organization skills (Holm-Nielsen, 2001).

Similar World Bank study revealed that in the past half century, South Korea has progressed from an input-driven to a knowledge-based economy. In 1960, agriculture and fishing accounted for 36 percent of GDP in the country, with service sector accounting 47 percent and manufacturing sector for 16 percent. By 2002 this has reversed. Service sector now accounted 63 percent of employment and agriculture and fishing for just 4 percent. With these changes came dramatic income growth from extremely low level in 1960 to the US$15,000 in 2002. Much of this growth has been driven by knowledge (The World Bank , 2005).

Further to this, engineers are expected to simultaneously possess broader capability and greater specialized technical competence than was required for previous generations. However, students of today study less credit hour than in the past in many Universities (ASCE, 2004). This is an evidence to review whether the requirements for core engineering knowledge has been attained or not, whether the sub-discipline of engineering are duly considered or not. The practice of engineering has become more and more complex technically than in the past. Many technical issues, resulting from decades of engineering research and technology driven changes in professional practice, have to be added in the curriculum (Jones, 2006).

There are many elements that govern the quality of engineering education. This ranges from knowledge, attitude and practice. The role of all stakeholders is other part responsible for the quality. All these factors may be grouped in to following three elements;

1. Contents that includes defining the term knowledge, skills and attitudes
2. The process and means that includes curricula, co-curricula and extra-curricula approaches, methodologies and techniques etc.
3. Faculties and student characteristics.

The skill is the capability and this can be reflected on the performance outcomes of the engineers or the graduates. These outcomes collectively prescribe the necessary depth and breadth of the knowledge, skills and attitudes of an individual aspiring to enter the practice of engineering at the professional level. The outcomes are the qualities to be demonstrated by the engineering graduates. American Board of Engineering and Technology (ABET) has prescribed following 11 outcomes to be demonstrated by engineering graduates (American Board for Engineering and Technology [ABET], 2000);

1. An ability to apply knowledge of mathematics, science and engineering.
2. An ability to design and conduct experiments, as well as analyze and interpret data.
3. An ability to design a system, component or process to meet desired needs.
4. An ability to function on multi-disciplinary teams.
5. An ability to identify, formulate and solve engineering problems.
6. An understanding of professional and ethical responsibility.
7. An ability to communicate effectively.
8. The broad education necessary to understand the impact of engineering solutions in a global and societal context.
9. A recognition of the need for, and an ability to engage in, life-long learning.

10. Knowledge of contemporary issues.

11. An ability to understand the techniques, skills, and modern engineering tools necessary for engineering practice.

Attitudes are an essential part of the body of knowledge. It reflects individual's values. By attitudes, one thinks and feels in response to a fact or situation. They may be positives or negatives. Some of the potential attitudes might be considered as skill, creativity and assertiveness. The knowledge and skills are frequently discussed by engineers but they are relative to the attitudes. Understanding of ethical and professional responsibility is the part of attitude issue. It is indeed true that certain attitudes empower individuals and increase the receptivity of team members, clients and other stakeholders to work with individuals and team. There are list of attitudes that are value driven and possibly conductive to effective professional practice of engineering. Some of these attitudes are; commitment, confidence, judgment, optimism, persistence, fairness, honesty, integrity, self esteem, tolerance, positiveness, sensitivity etc (ASCE, 2004).

As a matter of fact, engineering institutions should adopt the approach of understanding value and meaning of certain attitudes so that their graduates may be benefited in the practice. There is a distinct relation of attitudes with outcomes. The fact is that one demonstrating constructive attitudes will underscore the achievements of most of the outcomes. This is the process of knowledge building and this new paradigm of demand of knowledge on engineering profession has to be addresses in the engineering education (ASCE, 2004).

Fast Pace of Technology Development. Science and technology advances are transforming the world at an astonishing rate. Developments in computing and communications, in particular, are helping to accelerate these changes. Engineering has direct impacts on society and such impact can translate directly into economic growth. It is very important for every countries well-developed higher engineering education to generate new scientific knowledge, to wisely select and implement existing technologies and to effectively adapt them to local circumstances (The World Bank, 2000).

The wave of technology is reaching all facets of human civilization- agriculture, industry, service sector, communication etc. Every human activity is associated with technology. The trend is such that technologically illiterate person can not attain efficiency and productivity in the days to come. Engineering education is getting high value. Technology is for society, therefore, engineering education should prepare the graduates to be equipped with comprehensive knowledge in technology & science, and they will have to acquire practical skills for the protection of environment. Every engineer should, even at the initial stage of the design of technical equipment, try to achieve the most friendly impact on the environment of the devices when they operate as well as when they become morally and technically outdated. This new trend of technology-revolution has shaken even the well established organisations in different parts of the world. They are all changing towards the technology driven system. Engineering education has to address this scenario of technology (Michel, 2006).

Quality in Engineering Higher Education

Meaning of Quality

Defining the quality of engineering education is not easy. One needs to address various current related issues such as the introduction of ISO (International Organization for Standard) standards to education, the way to view; students and employers, the role of non-technical courses, the use of technology in the classroom and faculties and the performance of products of engineering education in the work place, in order to have a holistic view of quality of engineering education (Goetsch & Davis, 1998).

Defining quality in higher education has proved to be a challenging task. At the broadest level, education quality can be viewed as a set of elements that constitute the input, process and output of the education system, and provide services that completely satisfy both internal and external strategic constituencies by meeting their explicit and implicit expectations (Cheng & Tam, 1997).

The quality can be broken down into five different but related dimensions: quality as exceptional (e.g. high standards), quality as consistency (e.g. zero defects), quality as fitness for purpose (fitting customer specifications), quality as value for money, and quality as transformative (an ongoing process that includes empowerment and enhancement of the customer satisfaction) (Harvey & Knight, 1996). Based on the Oxford Dictionary, 'quality is degree, especially high degree, of goodness or worth'. The Webster's Dictionary defines it as 'grade of excellence'. There are also other definitions proposed by various researchers. Accordingly, quality has been understood as conformance to requirements, not as goodness (Crosby, 1986). It may also be understood as effectiveness in achieving institutional goals, meeting customers stated or implied needs, degree to which education prepares students to be personally effective and capable within the circumstances of their life and work (Green, 1994; Stephenson, 1992 & Harvey, 1992).

The concept of quality in engineering higher education is complex and dependent upon different stakeholder perspectives. The more appropriate concept of quality may be to benchmark performance in higher engineering education. This is objectively represented by the competency level of the engineering graduates freshly entering into the engineering professional practice. The quality is, therefore, the capacity of the engineering professional practicenor to cope with the confronting problems (ASCE, 2001).

Guiding Principles for the Quality of Engineering Education

While getting on to the quality and relevance of the engineering education, certain guiding themes or the principles have to be decided to give the proper direction. Followings may be these principles;

1. Orientation towards future
2. Broad interpretation of practice
3. Institutional flexibility

The world is ever facing new scenarios, such as; sea level rise, melting of snow from the mountains, decline in oil supplies, increased globalization, technology breakthroughs, higher population growth, increase in more conscious and demanding public etc. Tomorrow's possibilities are still developing to new horizon from these benchmarks. Engineering education should be able to address these challenges thus orienting towards the future (Borahan & Ziarati, 2002).

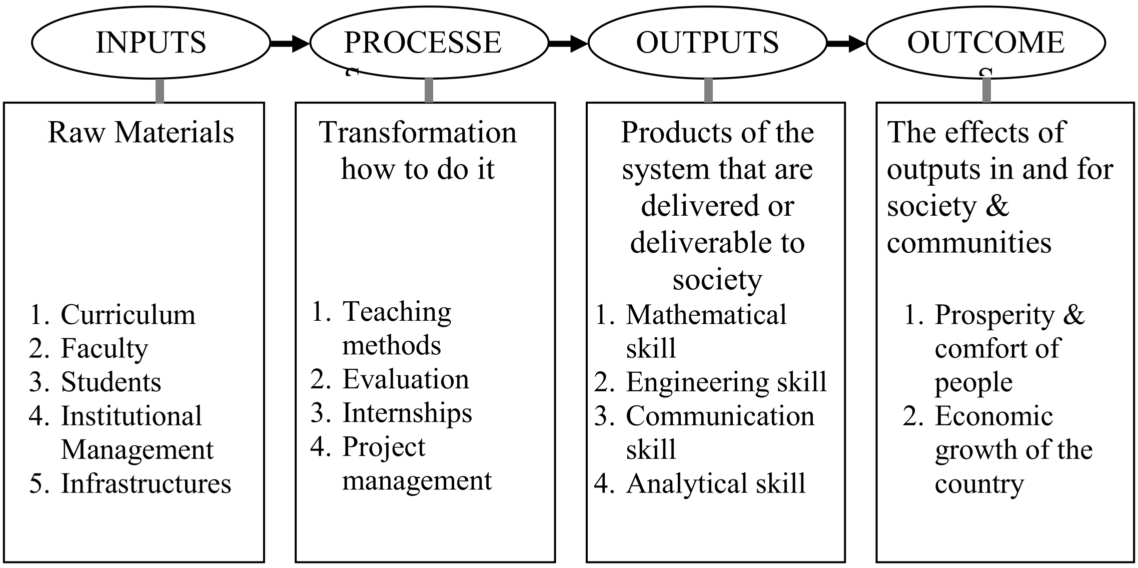
It is often heard that practicing engineers assume themselves as technocrats encircling around the science and technology. They are found to pay little concern on the society and societal phenomena. Therefore, the engineering practice has been understood to include planning, designing, implementation, research and development. It is time now to broaden the scope of engineering practice to the teaching, management, administration, construction and operation, economics, law, leadership etc. (Borahan & Ziarati, 2002).

It is obvious that to promote and maintain dynamism in engineering education and make it more qualitative, there must be a greater space for institutional flexibility in the implementation, such as; teaching methods, faculty education and experience, modernizing curricula, course contents, teaching and learning delivery and access systems, relative emphasis on technical depth etc. This flexibility respects and builds on each institutions better culture, traditions and strengths (Borahan & Ziarati, 2002).

The Quality Framework for Engineering Education

The sphere of engineering education contains certain elements that are responsible for its quality. The logical relationship of these elements may be represented into a framework. This framework in figure-5 gives holistic approach of quality.

Figure 5. The quality framework



The inputs, indeed, are the curriculum, faculties, students, institutional management and infrastructures. The efforts of these inputs produce different skills and these skills are basically responsible to enhance the capacity of the individual, this eventually leads to the prosperity of the people.

So far curriculum is concern; it should be relevant, updated and compatible with the objective condition of the country. The content of the curriculum is basically comprehensive knowledge, skill and attitudes. The knowledge, in fact, builds the competency level of the individuals. The other content is the skill and this is the capability that is reflected on the performance outcomes of the engineers or the graduates. Building attitude is also the part of curriculum. It reflects individual's values. By attitudes, one thinks and feels in response to a fact or situation. They may be positives or negatives. Some of the potential attitudes might be considered as skill, creativity and assertiveness. Understanding of ethical and professional responsibility is the part of attitude. The performance of the graduating engineers is to the foremost the content of the curriculum and this collectively prescribes the necessary depth and breadth of the knowledge, skills and attitudes of an individual aspiring to enter the practice of engineering at the professional level. As a matter of fact, engineering institutions should adopt the approach of understanding value and meaning of certain attitudes so that their graduates may be benefited in the practice. There is a distinct relation of attitudes with outcomes. The fact is that one demonstrating constructive attitudes will underscore the achievements of most of the outcomes (ABET, 2001).

The faculty is the heart of any educational program. The role of teacher is always being very crucial and this would be even more important in the future. The quality of engineering education is very much dependent on the faculties and their delivery. For this, attention should be given to these pertinent questions. Who should be the faculties, as individuals and collectively? What will enable them to be successful in facilitating the accomplishment of quality? What are the characteristics required of educators to aid them in motivating and guiding students to the mastery of knowledge and skills? (Australian Academy of Science & Technology [AAST], 2003).

The delivery and the interaction of the teacher in the class and with the students have strong influences in shaping future engineers in their profession. Therefore, the faculties should exhibits some special characteristics, such as; a scholar, an effective teacher, an experienced professional and a positive role model (ASCE, 2001).

Scholar is high regarded in Nepalese culture. It is the state of having highest level of knowledge or the expert in the subject. Scholar is an academic leader enhancing continuously the horizon of knowledge and understanding. The knowledge, in fact, can be acquired through research, synthesis, practice and teaching. The scholar should perform corresponding functions of discovery, integration application and teaching to achieve personal and institutional missions and goals. Therefore, broadening of scholarship has great implications for maintaining quality. It is appreciative to establish the system of rewarding professors who are acting with positive attitude and developing scholarship (ASCE, 2001).

Faculties must be effective teachers. A well learned scholar may not be effective in delivering lectures. Effective teaching is a challenging job requiring expertise in the topic to be taught. It covers effective two-ways communication with students; ability to promote clear, complex and complete understanding; an awareness of learning styles and ability to relate with students in ways both positive and inspirational etc. The appropriate teaching, education and training are critical to enhance the effectiveness of faculty in creating excitement for learning. The effective teacher's skill comes from creating intellectual excitement in and interpersonal rapport with the students in a variety of classroom settings. Intellectual excitement is apparent from a teacher's technical expertise, organization, clarity of communication, engaging presentation and enthusiasm (ASCE, 2001).

While talking on the quality of engineering education, students are very important component to demonstrate the quality. Students are responsible for their own education and development. For success in engineering, each student should give emphasis in good study habits; co-operations with instructors, learning factual materials, thinking and logic, attentive and open-minded etc (Williams, 1946).

Student is not a vessel, so that one may keep on filling knowledge in it, is rather a growing and expanding organism to be guided and trained for his/her growth. Engineering students must develop a habit of learning, like eating, breathing etc. Confusions are often encountered that students should only be book-worm and faculty and management assumes the relation as master and subservient. This is wrong. Student should be enthusiastic to know the art, culture, politics, economy etc (Jones, 2006).

Engineering students must exhibit certain characters to demonstrate competency, such as:

1. Striving for engineering knowledge, skill and attitude along with the supportive approach to the faculty and department
2. Committed to the excellence in the education at all time
3. Understanding that they are developing as managers and leaders
4. Must value diverse perspective on culture and society

5. Understanding the fact that engineers are continuously shaping the world to new horizon
6. Understanding to uphold the vitality of engineering
7. Understanding engineering as life long learning

It is true that students are much more likely to meet their responsibilities, obligations and expectations and are much more likely to achieve success and significance, if they are informed about, attracted to and excited by engineering's unique or special characteristics (Brookes, 2003).

The other component governing quality is the process and the means of engineering education. It covers teaching methods, evaluation process, internships and project management skills. The scope of process of engineering education ranges from performing curricular, co-curricular and extra-curricular activities. Curricular activities deal with the hardcore subjects and co-curricular activities are internships, on-the-job-training, summer/winter para-professional employment etc. These activities build the horizon of knowledge and skills to new level. The extra-curricular activities are the games, social activities, political interactions etc. These activities build the qualities, such as; leadership, team working, project management, communication etc. (Pounder, 1999).

Teaching methods are often considered foremost for the quality of engineering education. As the growth of technology appears with vibrant pace, efficient and effective methods and techniques emerge to be applied in to the practice giving better delivery. Teaching is related with teachers and students. The effective teacher's skill comes from creating intellectual excitement in and interpersonal rapport with the students in a variety of classroom settings. Intellectual excitement is apparent from a teacher's technical expertise, organization, clarity of communication, engaging presentation and enthusiasm (Brookes, 2003).

There are different models suggested by different scholars for quality outcomes. The structural organization of the lecture is based on learning objectives appropriate to subject matters and varied to appeal to different learning style. Engaging presentation is another type of delivery of lecture. This includes clear written and verbal communication with high degree of contact with student including physical models and demonstrations (ASCE, 2004).

Positive rapport with student includes frequent assessment of students in the classroom and also out-of-class homework and project works with the use of appropriate techniques is widely used teaching methods in engineering education (ASCE, 2004).

Reform Strategies

Central Discussions

Reform indeed is the instrument to address the emerging issues of the subject matters. The concern of this research is the reform to achieve quality of engineering higher education in Nepal. While talking about the reform, the fundamentals of reform procedures should be considered.

In order to spell out the reform procedure, the root of the prevailing education system in Asia may give impetus. Built on the tradition of the British system from the 19th century, the educational programs purport to train students for employment in the public services, and therefore do not provide any training in entrepreneurship, marketing, or other skills that would be more relevant (Boston, 2005). The paradigm of the education has changed and reform process should address new paradigm.

Reform is fundamentally the change in the state of condition. Higher education is an instrument for this. However, before moving to work for change, it is useful to put forward a clear vision of what the reform process seeks to achieve, and to articulate a set of explicit goals that might actualize that vision. Such a set of goals might include the elements which focus on the quality of those who go into the universities, what happens inside universities, and what is produced by universities. The fact is that the very best students in the country should be assured the very best education in the country on the basis of merit and irrespective on financial constraints.

In addition to this, all universities should be able to meet minimum defined standards of faculty quality, procedural reliability, and fiscal solvency. Also the centres of higher education should be recognized by individuals and institutions as producing students and research of a demonstrably and reliably high quality (Holm-Nielsen, 2001).

After considerable discussion and debate, the Nepalese academia have suggested reform in the higher education and has set out a vision for this that aims to transform Nepalese institutions into world-class seats of learning and advancement of knowledge, in order to create a modern, progressive, tolerant and prosperous society that values the dignity of labour, craftsmanship, spirit of inquiry, critical thinking, and public duty. This is consistent with the range of opinions that have continued to inform such issues in both academic and popular media (Khaniya, 2004).

The reform in higher education is concerned with the economic growth of the country. The notion of reform is therefore linked with the knowledge economy. In the emerging ‘knowledge economy’, nations that fail at creating a decent learning environment will lag behind, and may end up becoming virtual colonies of those that do succeed in this regard. The report of Task force for Higher Education in Pakistan puts the matter of knowledge economy very well:

The world economy is changing as knowledge supplants physical capital as the source of present (and future) wealth…. As knowledge becomes more important, so does higher education…. The quality of knowledge generated within higher education institutions, and its accessibility to the wider economy, is becoming increasingly critical to national competitiveness…. This poses a serious challenge to the developing world…. Quite simply, many developing countries will need to work much harder just to maintain their position, let alone to catch up (Govt-Pak, 2006, pp. 42-46).

While, there have been many attempts at engineering higher educational reform in the past, they have all suffered dearly from being ad-hoc and selective; limited by their very own vision, scope and application. The problems at hand require a process that is both strategic and systemic. Rather than drawing up long lists of ‘good’ things that could be done and then hope that ‘some’ of them would be implemented, it is important that a minimum ‘critical’ set of tasks be identified and all of them be implemented. The key challenge is to mobilize the political, financial and administrative support for the changes proposed. It should be quite clear that without such support the best of ideas – including those presented here – will necessarily flounder (Joshi, 2002).

Reform Process

In order to go through reforms, it is also useful to identify a set of guiding courses that can escort while sifting through all that can be done and search for that which is most important to do. The courses, such as; building on the strength, understanding the reality, focusing on basic principles, learning from others, undertaking evaluation and monitoring process etc. (Schwarzman, 2002).

Despite all the ailments that the system of engineering higher education suffers from, the fact remains that there are elements of the system that work fairly well. It is critical that these strengths, where they exist, be identified and built upon. Similarly, it is important to identify and nurture those cohorts within the system that can be the agents of positive change (Bales, 2006).

While many of the changes needed might seem intuitively obvious to the outside observer, there are powerful vested interests that either benefit from the status-quo or have grown too used-to-it. They are unlikely to let go without a fight. Such realities need to be understood, but worked around. The reform process must be strategic in its focus – saving its fights for things that are likely to provide the highest immediate benefit or trigger enduring systemic change (Kapu & Mehta, 2004).

Past attempts at engineering higher education reform in different parts of the world have often spent more effort in trying to identify and invest in growth areas with future potential rather than concentrate on laying the foundation of a strong ethic of inquiry and research. Such efforts have tended to be unsuccessful. It is far better to focus on the basic principles of good education and work on the assumption that a robust system of engineering higher education will itself gravitate toward emerging opportunities (Schwarzman, 2002).

It is extremely critical that a country learns from the experience of other countries and systems. However, it is even more important that any changes be rooted in the realities of particular country. For example, it is very important to understand *why* many countries have moved to a four-year Bachelor's degree, but there is no reason to do so simply because others have done so. Just because a certain thing has 'worked' elsewhere is no reason to assume that it will also work in other country; but understanding why it worked where it did is always of relevance (Splitt, 2003).

It is important to set up evaluation criteria and programs for any reform effort that is initiated. While it is understood that not everything can be measured quantitatively, it is vital that progress be monitored. This is important not only so that implementation can be kept on track but also because this is where the design learning will come from. Reform is not a once-off initiative; it is an ongoing process. Constant vigilance and evaluation for the purpose of learning and keeping the process on track is necessary (Wulf, 2002).

Design Principles for Reform

A reform process cannot be successful unless if it takes seriously the variety of obstacles that it is likely to confront. In particular, given Nepal's history of several well intended but unsuccessfully implemented reforms, it is important to maintain a focus on the implementation problem. With this view, it is important that the current reform initiative be based on a few practical considerations (Shrestha, 2000). Engineering Higher Education must be understood as a system and a critical set of reforms must all be implemented simultaneously; otherwise they are bound to fail. The strategic centres of the reform process are the universities—not government ministries, the task force, the university grants commission, or other national or provincial policy making institutions. In the absent of university-level commitment to reform, no national or provincial actions can produce results. Therefore reform should be directed to assist university administrations, faculties, and student bodies to put in place policies and practices that can transform these institutions into high-class centres of learning (Splitt, 2002).

A System Approach for Reform

The key feature for the reform of engineering higher education is the explicit adoption of a systems perspective. This means approaching the various institutions of; education, research, funding, communications and publication, management etc. not as a set of isolated structures but as an integrated system. Furthermore, within each institution, the different dimensions of activity—e.g., pedagogical, research, management, fiscal, and political—are all best seen as part of a coherent system rather than separate spheres (Mcginn, 2002).

The existing education system in third world, however weak and problematic, does serve the interests of a number of people, including some faculty members and university officials, a subset of students, political parties, and patronage politicians and bureaucrats. As such, even though the broader social and economic benefits that a reform program may promise, it will also impose costs on some who benefit from the existing arrangements. As such, the reform agenda is not a purely technical exercise, it is a social initiative. It involves building consensus, mobilizing gainers (mainly the student body and the more dynamic elements of the faculty) and compensating or persuading those who may fear from it. It involves taking risks and engaging in what is most appropriately called social entrepreneurship. Therefore, the most significant opposition to reform will come from the incentives that the overall system provides to the individuals who compose the system (Carnoy, 2002).

Related Research

Several researchers have worked stack of works on the higher education/ tertiary education in different parts of the world. They have identified different issues related with this in general and countries specific. Much of works have also been done on the engineering higher education in the world.

International agencies, such as, The World Bank, Asian Development Bank, UNESCO, WFEO, ASEE, ASCE, ABET etc. have done plenty of study on higher education and engineering higher education. The government and related organisations have also done related study on higher education in their respective countries.

The task force on higher education and society convened by The World Bank and UNESCO in 2000 have done a comprehensive work on 'Higher education in developing countries'. Based on research and intensive discussion and hearings conducted over a two years period, the task force concluded that, with out more and better higher education, developing countries will find it increasingly difficult to benefit from the global knowledge based economy (The World Bank, 2000).

Research work on 'Higher education and economic development in Africa' conducted by; Bloom, Canning and Chan of Harvard university and published on 2005 September 20, is another ample piece revealing wider spectrum of prevailing scenario and the future prospects of higher education in Africa. This research suggests that increasing tertiary education may be important in promoting faster technological catch-up and improving a country's ability to maximise its economic output (Bloom, 2005).

The World Bank research conducted in republic of Korea on 'Korea as a knowledge economy' is exclusive piece. This research has given two conclusions. The first conclusion is that higher education builds the knowledge which is very important for the economic growth of the country. The second conclusion gives strong emphasis on the engineering higher education which is responsible for the geometrical income growth of the country (The World Bank, 2005).

Besides, The World Bank has done plenty of research on higher education in many countries across continents. The reports of higher education in Bolivia, Ethiopia, Zambia, Brazil and Tunisia are some examples delivering comprehensive information on this agenda.

During past two or three decades, the attention of almost all countries and the donor agencies was not focused on higher education. This had revealed very perilous state in many developing countries. By the end of century and than onwards much works been done in different parts of the world (Barro & Sala-i-Martin, 1995; Jenkins, 1995; Pasacharopaulos & Patrinos, 2002; Bloom, Hartley & Rosovsky, 2004 & Lin, 2004) on the contribution of higher education in the economic growth of the country.

A study undertaken by The World Bank in Nepal on 'Nepal: Priorities and Strategies for Education reform' is outstanding reference in this area. This document has reviewed the outcomes of prevailing higher education in Nepal. Diagnosis of these outcomes is other part of this document. The conclusion of the report is also noteworthy. This has given emphasis on four areas, namely; equitable access, quality, institutional management and public finance (The World Bank, 2001). Though, the report does not speak on the engineering education, the analysis of the outcomes of the higher education resembles, to the larger extent, with the outcomes of the engineering education. Very recently, World Bank in Nepal has initiated project on the reforms in higher education in Nepal. A component of this is the reform in engineering education as well.

Asian Development Bank (ADB) has also contributed to development of higher education in Asian countries. Very recently in 2005, ADB has launched a project on technical education in Sri Lanka. This project is going to analyse the problems and opportunities of technical education. The impact and outcomes of prevailing technical education would also be assessed. Finally, rational conclusions and recommendations would be worked out in the project. It is assumed that this project may be a master piece for the neighbouring countries for the reform of their engineering education (Asian Development Bank [ADB], 2005).

The project report (2000) on 'education quality improvement project' in Laos developed by ADB is an important document on the quality of education. This is, indeed, a splendid reference material in this area (ADB, 2000).

The UNESCO is other responsible body looking after the education agenda in the world. It has done stacks of work in engineering higher education. A committee for engineering education under UNESCO has done piles of works on the quality of engineering education. Engineering professional bodies have also contributed on the development of engineering education. Among them, American Society of Civil Engineers (ASCE) has developed a document called 'body of knowledge for the 21st century: preparing the civil Engineer for the future'. This document speaks more on the engineering knowledge and its quality essential to be an engineer (ASCE, 2004). Moreover, American Society for Engineering Education has also done stacks of works in the reform agenda.

As a part of reform in engineering education in Nepal, substantial reforms are taking place in IOE. World Bank had published a document on 'Reforms at the Institute of Engineering'. This document has illustrated the two phased reforms undertaken in IOE (Joshi, 2004).

At the moment, a Ph.D. research is undergoing in KU, school of education on ' Outcomes of Mechanical Engineering Education in Nepal'. Er. G. R. Paudel is conducting this research as a regular student. This study is intended to analyse the gap between desired and actual level of abilities of mechanical engineers graduated from TU and KU, in Nepal with the purpose of expanding current body of knowledge on the quality of mechanical engineering education in Nepal. The major concern of this study is to discover the answer on the question 'how well the mechanical engineering education system is satisfying the needs of stakeholders'. It will identify the potential areas of improvement to produce mechanical engineers with uniform and higher academic standards to contribute in meeting the future needs in 21st Century (Paudel, 2005).

The wave of reforming higher education taking momentum in different corners of the world has stimulated the educators and academicians in Nepal. A part of it, the scholars in engineering higher education are continuously discussing on the reform agenda of engineering higher education to make it more relevant and competitive in the days to come. Different articles are appearing in the journals and newspapers. Seminars and workshops are taking place on different aspects of reforms; quality, performance outcomes, financing, management, examination systems etc.

However, the specific research on the 'reform strategies for quality of engineering education in Nepal' was not taking place to date so far. To the best of knowledge, research has not been made on this area. This research, therefore, was forwarded with the aim of analysis and exploration of current issues of engineering higher education in Nepal and sketch-out the recommendations for future policy strategies to be adopted to address these issues thus facilitating reform in the higher engineering education in Nepal.

To summarize the literature review …………

Human capital is the greatest natural resource of any country. A country can be prosperous if the capabilities of the people are improved and upgraded. Engineering higher education can be instrumental in improving and upgrading the capabilities of people.

Engineering higher education in Nepal, as in other countries, is considered to play major role in tertiary education. It creates new avenues in transforming society to a more prosperous state. This is done by generating new knowledge of engineering in the areas of national needs and priorities and also by producing high level professionals, such as; teachers for engineering schools and institutions, engineering professionals, engineer-managers, engineer-bureaucrats, engineer-policy makers, and others to serve the nation with international competence. Increasing demand of higher education in general and engineering education in particular has created necessity of reform in prevailing engineering higher education in Nepal.

In the last 15 years, the Government of Nepal have executed major engineering education projects (funded by The World Bank and the Asian Development Bank) designed to improve the country’s engineering education and training sector by improving the quality and relevance of engineering programs and increasing the accessibility, efficiency and effectiveness of education and training delivery systems. However, reform in this sector is still required to address the issues of; skills mismatch, youth unemployment, professional preparation of teachers, promoting equal access of women and marginalised communities to engineering higher education, inadequate participation of the private sector (industry) in engineering higher education and training etc.

The essence of reform is quality and relevance of engineering higher education. In order to set the train in the track for in-depth reform and renewal of engineering higher education, close partnership is essential amongst all stakeholders - national and institutional policy-makers, governments and parliaments, the media, teaching and related staff, researchers, students and their families, the world of work, community groups etc.

The challenges to engineering education are to address the prevailing trends of globalisation, knowledge society and changing technology. This has resulted continuous change in local and global economy thus administering structural changes. These changes demands new knowledge and skills requirements. An engineering graduate entering into the labour market require advance knowledge and skills which is different from those needed by past generations. Therefore, engineering education institutions are expected to modify, upgrade and update their programs in response to the changing economy and technology in order to prepare continuously productive members (engineers) of the society. For this engineering higher education system requires reforms.

In this review of literature, it is clear that experts view higher education in general and engineering higher education in particular as an investment in human capital to the extend that it contributes to the economic growth of the country and of course to the future earnings of graduates. Earnings and employment rates are indeed very important criteria for success of any engineering education program. It is obvious that engineering education programs improves job placement and job productivity of the graduates. For this, there should be the job places available in the market. The healthy economy and linkage of education with labour market is inevitable for job creation and increase the economic return of the programs.

The literature review established the fact that success of engineering higher education in Nepal for employment depends upon its quality and relevance in the market. It was revealed that market demand of engineering education should be reflected in the engineering education process in order to maximise the employment potential of the graduates (engineers).

The literature also suggested that to prepare engineering graduates for better productive life and self sufficiency, engineering education institutions should give due attention on followings:

1. Design their academic programs based on labour market demand;
2. Recruit and retain qualified and competent faculties for teaching and research;
3. Provide adequate facilities, equipment and teaching materials;
4. Establish reliable and consistent assessment and examination;
5. Involve business and industry in the planning, delivery and evaluation of programs;
6. Provide career guidance and placement support to students;
7. Encourage and assist students to become successful entrepreneurs;

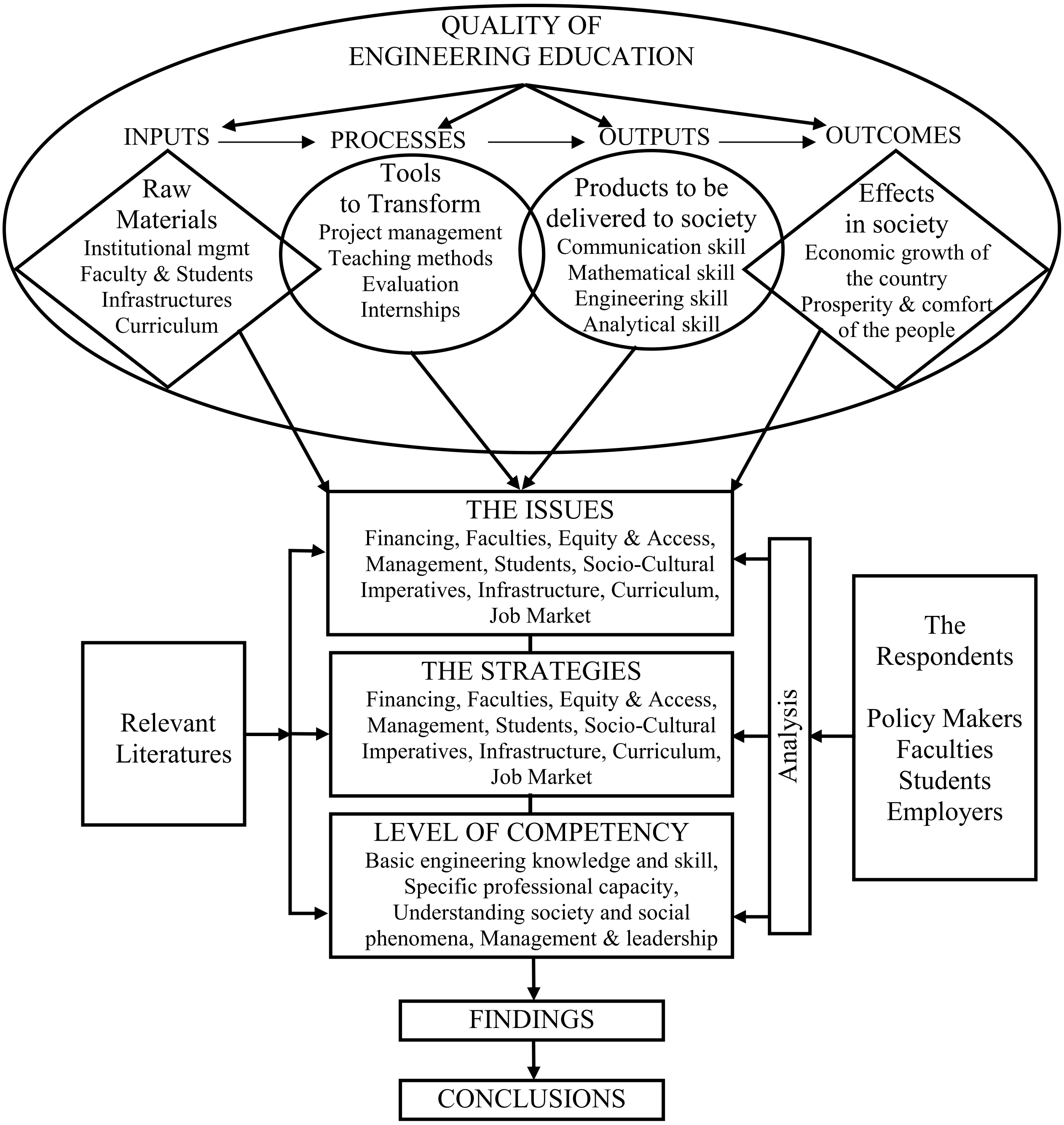
Theoretical Framework

This research is fundamentally focused on the quality of engineering higher education. A theoretical framework was developed to undertake this study. The focus of the study is naturally the quality of the engineering education. The framework was therefore sketched accordingly putting the quality agenda. The quality of engineering education should be understood by the outcomes- effects of engineering education in to the society. For this, the input and the processes are very important. Therefore, the elements of quality are in the heart of the study. It is quite natural that if the system is not delivering as of expectation the issues emerges. These issues were explored from the relevant literature. The strategies to resolve those issues were thought in the other parts to be extracted from the literature.

The quality of engineering education as such, is the level of competency of the products (e.g. engineers). The competency parameters as identified from the literature review were placed sequentially in the framework. These issues, strategies and competency parameters were thought to be tested in the present context (global & domestic) from the opinions of the respondents. These issues, strategies and competency parameters were thought for verification through analysis. It is obvious that the analysis would draw the findings. The conclusions were thought to be drawn from the findings. Following this description, figure 6 below clarifies the theoretical framework of this study. The Research tool was developed accordingly and data were collected.

After going through literature, this research has been organized following this theoretical framework;

Figure 6. Theoretical framework



CHAPTER III

METHODOLOGY

The purpose of this study was to supplement the body of knowledge on the quality of higher engineering education in Nepal. More specifically, this research analysed and explored the current issues of higher engineering education in Nepal and sketch-out the recommendations for future policy priorities and strategies to be adopted to address these issues thus facilitating reform in the higher engineering education in Nepal. This chapter described the research methodology, Subjects, instrumentation, data collection procedures and treatment of data.

Research Methods

The research methods adopted for this study is descriptive and analytical in nature. As indicated by Borg and Gall (1979), descriptive research determines and reports the way things are and answers questions concerning the current status of the subject of study. Borg & Gall further explained that questionnaires are commonly used to determine attitudes, opinions or perceptions of subjects in which the investigator is interested in study. The analytical research deals with the processing of data by statistical tools, such as; standard deviation, analysis of variance and other similar tools.

The independent variables investigated in the study are associated with the observations and experiences of Nepalese policy-makers, faculties, students and employers regarding issues and policy strategies affecting engineering higher education in Nepal. The dependent variables of the study are the issues and future policy strategies concerning quality of engineering higher education in Nepal. Survey questionnaires were used to collect the data for the study.

The conventional research method adopted in this research was as follows;

1. Population & Sampling
2. Instrumentation
    a. Questionnaire
    b. Variables: dependents & independent
    c. Likert five point rating scales
3. Test for Validity and Reliability of Instrument
4. Interview with Respondents
5. Data processing
6. Report writing

Description of the Subjects

Stakeholders' response is important to achieve quality of engineering higher education. Their observations and expectations are the guidelines to measure the performances and also to explore new directions.

Nepalese educational policy makers and employers are the principal sources of information for this study. Besides, Faculties and students are other important sources. After having vigorous analysis, it was decided that the scope of study is best represented by the responses and the opinions of the respondent groups: policy makers, employers, faculties and students.

Based on organisational affiliation and the occupational status, four major groups of respondents were identified.

1. Policy makers who are directly involved in the formulation of engineering policy of the country,

2. Faculties who are directly or indirectly involved in the teaching of engineering education and play significance role in policy implementation,
3. Students who are studying in the final year of bachelor level of different engineering disciplines,
4. Employers who can influence engineering education policy and play significance role in the employment to the engineering graduates,

The further description of these groups follows;

The group of policy makers is represented by authority of the universities and campuses, authority of Nnepal engineering council, authority in the ministry of education and sports looking after higher education. Authorities of the universities and campuses are also taken as the policy makers of engineering education and these include Dean and Assistant Deans in engineering institution, Campus-Chief and Assistant Campus-Chief, Principal and Vice-Principal, Head of Departments etc. There are, at present, four universities; Tribhuvan, Kathmandu, Purwanchal and Pokhara universities, delivering engineering education in Nepal. Among them, Tribhuvan university has four constituent engineering colleges; Kathmandu university has two constituent schools- school of science and engineering; Purwanchal university has one constituent college and Pokhara university does not have any constituent engineering college. There are about 24 affiliated colleges with these universities, among them, 7 in Tribhuvan university; 8 in Purwanchal university; 9 in Pokhara university. The authority in the Nepal Engineering Council includes Chairman, Vice-Chairman, Registrar and members. Authority in ministry includes, Joint Secretary and Under Secretary looking after higher education. The lists of these authorities have been collected from the respective offices.

The group of faculties is represented by the professors, associate professors and senior lecturers in the universities and colleges who are delivering engineering education. Priorities have been given to the permanent faculties in the colleges. The lists of such faculties were collected from respective engineering colleges from different universities.

The group of student is represented by the students studying in different discipline of engineering in bachelor level from different universities and colleges. The students in the final year of all discipline are taken as the representative students for this study. The lists of students were collected from respective colleges.

The group of employer is represented by Consultants and Government & company Departments. Though, engineers are employed in wider span of areas, this study is focused in the major sectors, namely; engineering consulting firms in private sector and government departments in public sector. Major government and company departments include Roads, Irrigation, Water supply and sewerage, Electricity authority, Nepal telecom etc. The lists of consultants were collected from society for consulting architectural and engineering firms, Nepal (SCAEF). The representatives from the departments were considered.

A complete list of subjects was prepared and grouped according to their professional or organisational affiliations. Based on the professional background or organisational affiliation, a list of subjects was prepared to ensure the uniform representation from each of the groups. A total of 1017 subjects were identified within the population framework of the study.

The sample was selected following probability sampling methods. Accordingly, the categories of population were defined in well defined strata. The process of selection of minimum size of samples was made referring different methods prescribed by different researchers (Kothari, 1997; Borg & Gall, 1979; Nachmias & Nachmias, 1996; Krejcie & Morgan, 1970; Wessa, 2007 & CRC, 2007).

While selecting the samples different literatures were followed. Among them followings are taken as the basis of sampling;

Consideration of Krejcie & Morgan Formula. Robert V. Krejcie from university of Minnesota and Daryle W. Morgan of Texas A & M university conducted comprehensive research in 1970 to determine sample size for research activities. They developed following formula to find the sample size for the research;

$s = X^2 * N * P (1- P) \div d^2 (N -1) + X^2 * P (1- P)$.

Where,

s = Required sample size,

X^2 = The table value of chi-square for 1 degree of freedom at the desired confidence level (3.841),

N = The population size,

P = The population proportion (assumed to be 0.50 since this would provide the maximum sample size),

d = The degree of accuracy expressed as a proportion (0.05).

They have developed a table and the graph with the help of above formula. Accordingly, the minimum size of the sample is 14 and as the population increases the sample size increases at a diminishing rate and remains relatively constant at slightly more than 380 cases.

Consideration of formula developed by Creative Research Centre. Creative research centre of United States has developed a formula to determine the sample size of research work after the vigorous research in 2006. The formula is as follows;

$SS = [z^2 * P * (1-P)] / C^2$

Where,

SS = Projected sample size,

Z = Confidence level taken as 95 percent and the value taken from the table is 1.96,

P = Probability of choice is 0.5,

C = Confidence interval taken as ± 5 percent (0.05),

The value of projected SS thus calculated is 384. This value is further used to find actual sample size as below;

Actual SS = [SS /{1+ (SS-1) / Pop}]

Where,

SS = 384 is projected sample size as derived from SS = [z^2 * P * (1-P)] / C^2

Pop = Population of the research,

Actual SS = [384 /{1+ (384-1) / Pop}]

This method calculates the minimum size of the sample as 16.

Consideration of free statistics software developed by Prof. Dr. Wessa. Professor Dr. P. Wessa from office for Research development and education, USA has developed free statistics software in 2007 to determine the sample size for the research works. This software can be found in the website http://www.wessa.net. The assumption in this software is such that; margin of error- 5 percent, confidence level 95 percent, response distribution 50 percent etc. The minimum size of sample from this method is 15.

The list of the population was collected from appropriate offices and attempt was made to reach to individual personally. However, the objective condition restraints to reach all the subjects. The respondent group were grouped to four categories; policy makers, faculties, students and employers.

Almost all methods indicated the minimum size of the sample on an average 15 numbers. Robert V. Krejcie and Daryle W. Morgan had developed formula to determine the minimum sample size. According to them, the minimum sample size that remained same as the population size was 14. This value was 15 by the formula of Prof. Wessa. The formula of creative research centre derived the minimum sample size to be 16.

The total subjects selected from all categories were 1017 and sample sizes calculated for this population from creative research centre, Krejcie & Morgan and statistical software from research development and education office were 279, 279, and 214 respectively.

Following these minimum size of the samples, sampling details are shown in the table 6 below.

Table 6

Research Sampling

Groups	Sub-group	Population	Distributed		Received	
			No	percent	No	Percent
	Nepal Engg Council	11	9	82	6	67
	MoES, Higher Education	2	2	100	2	100
Policy	Educationists	36	30	83	24	80
makers	(sum of samples)Total	49	41	84	32	78
	Tribhuban University	70	45	64	38	84
	Kathmandu University	10	7	70	7	100
	Purwanchal University	6	6	100	6	100
Faculties	Pokhara University	10	10	100	7	70
(Engg)	(sum of samples)Total	96	68	71	58	85
	Tribhuban University	305	120	39	106	88
	Kathmandu University	35	15	43	7	47
	Purwanchal University	235	37	16	5	14
	Pokhara University	215	30	14	5	17
Students	(sum of samples)Total	790	202	26	123	61
	Major Depts (Govt)	10	13	130	9	69
	Consultants	72	50	69	24	48
Employers	(sum of samples)Total	82	63	77	33	52
Total		1017	374	37	246	66

Educationist:dean/asst dean/cc/ ppl/acc/vp/hod/dhod- engg faculty

Faculty: prof/Associate prof/ Senior lecturer- preferably permanent engg faculty

Students: final year studentsIV/II in all discipline from TU,KU,PU, PokU

Employers:govt. dept/scaef

It is found in practice that minimum size of the sample is 30. Therefore, attempts were made to collect the sample to the minimum numbers of 30 from each respondent category. Accordingly, the numbers collected so far were; policy makers 32, faculties 58, students 123, employers 33. Therefore, total samples collected are 246.

This research has satisfied the minimum sample size as determined by statistical software as developed by Prof. Dr. P. Wessa from research development and education office, USA. The total questionnaires distributed to the subjects were 374 and among these respondents only 246 responded in this research.

Instrumentation

The survey instrument for this study is a blend of structured and open type questionnaire set. Development of the questionnaire was based on the review of literatures. The literature review included the topics: global context and status of engineering higher education; equity and access in engineering education; financing in engineering education; privatization in engineering education; mobility of engineers; global trends of engineering education; reform in engineering education in different countries; challenges of higher education; tertiary education; strategies of reform in engineering education; quality of engineering education; engineering education for sustainable development etc. Emphasis was given on the higher education and engineering higher education in Nepal and other developing countries. Review of Literature was also focused on performance outcomes of the graduates that influence their employment placement. Issues and trends of higher education and engineering higher education in Nepal and developing countries were also identified from the review of literature.

The theoretical framework for the development of the instrument was based on the reports from; (IOE-Strategic Plan, 2000; IOE, 2005; The World Bank, 2000; The World Bank, 2001. The World Bank, 2002; The World Bank, 2004; The World Bank, 2005; Paudel, 2006; Aryal, 2006; Joshi, 2004; Bloom, 2005; Lin, 2004; Ashford, 2006; Jones, 2004; Shrestha, 2006 & Jones & Reynolds, 2004) and also other national reports related with engineering higher education in Nepal.

Based on literature review and interactions with educationists and professors, questionnaires were developed. The questionnaires were verified and revised numbers of times before finalizing. This was done in consultation with members of research committee and professors in Kathmandu university, school of education.

The first part of the questionnaire was the introduction part. This part contained introductory information on research, demographic information of the respondents including organisational affiliation, educational background, gender, experiences and age. They were all reflected by eight questions.

The second part of the questionnaire was the main part. It contained different competency factors, issues influencing quality of engineering education, strategies related to engineering higher education in the form of Likert-type five point scales. In this scale, the respondents were asked to express their opinion by rating their degree of agreement or disagreement and also not applicable with each of the presented-statement. Respondent may select from 1-5 and 'N' selecting from strongly agree (5) to strongly disagree (1) and the statement which is not relevant as not applicable (N). This second part of the questionnaire consisted of three separate sub-divisions, namely; competencies required for entry level engineering professional practice (P), Issues influencing the quality of engineering education (I) and strategies for quality of engineering education (S). The first sub-division (P) had two column; existing competency level and desired competency level.

This sub-division (P) consisted of 30 pertinent statements on four groups of essential competency areas. This included; basic knowledge and skill, specific professional capacity, understanding society and societal phenomena and management & leadership. In these statements, attempts were made to identify the existing competency level of the fresh engineer and the desired competencies so far. The second and third sub-division consisted of only one column stating level of agreement. The sub-division-issues influencing the quality of engineering education (I) consisted of 99 pertinent statements on nine groups of crucial areas. These groups includes; financial, faculty, equity and access, management, students, socio-cultural issues, infrastructure, curriculum, job market etc. Each group consisted of nine to twenty statements. Similarly, the sub-division-strategies for quality of engineering education (S) consisted of 99 pertinent statements on nine groups of future policy strategies on engineering education. These groups includes; financial, faculty, equity and access, management, students, socio-cultural issues, infrastructure, curriculum, job market etc. Similar to the issues, each group on strategies consisted of nine to twenty statements. The statements in all sub-divisions were grouped into different categories as identified in the literature review.

The third part of the questionnaire was the open-ended questions. It was decided after the multiple discussions with the professors that some space should be spared to capture the independent opinion of the respondents. This part was designed to collect any other issues and strategies not included in the questionnaire. To avoid the ambiguity and mismatching of information, respondents were given opportunity to list only three issues influencing engineering higher education and other three strategies to resolve those issues.

Besides, instruction part was also incorporated that contained exhaustive instructions for respondents regarding the clear picture of process of filling the questionnaire. Although the research, to the larger extent, was conducted by researcher personally, some of the respondents were reached by e-mail and questionnaires were sent and received by e-mail. The instructions were mainly directed to respondents and those assisting in the research.

Validity and Reliability of Instrument

Validity of Instrument

The statements in the questionnaire were formulated from the conclusion of literature review. The content of the instrument was vigorously evaluated by multiple folds in association with thesis guide and other professors in School of Education & experts from outside. The statements were minutely scrutinized to make them represent research objectives. Serious attention was paid on deciding population and sample size. The instrument was developed taking the reference of, and tied with, national and international; parameters, standards and recommendations, on quality of engineering higher education. Literatures of; NEC, University norms, ABET, ASCE, WFEO norms, EMF, WA etc. were effectively referred. Raw findings were presented in seminars & opinions of experts were received. Findings were compared with literatures.

The confidence of accepting finding depends largely on the experiences. A part of it is the publication, such as; research findings, articles, seminar papers etc.

The credibility of the findings lies on the acceptance of the stakeholders. So far proving the external validity, the samples and the instruments were developed after the vigorous discussions and interactions with experts of the concerned area and also taken references of independent and established publications.

Reliability of Instrument

The clarity of texts and the contents of questionnaire were tested by pilot test: the Test-Retest method. Five experts were selected within the population. Experts were given the set of questionnaire & their responses were noted. After 15 days of interval, same set of questionnaire were given to same experts & their responses were noted. The level of significance of the opinions of experts on all statements was found to be above 0.05, suggesting difference of opinions to be not significant. Suggestions of experts were incorporated.

Before proceeding data collection procedures, clarity of texts and the contents of questionnaire were tested by pilot test: the Test-Retest method. Five experts were identified from the population framework of the study for pilot test. Pilot test was followed by interview procedure as describe by Krejcie & Morgan (1997) to increase the reliability of the instruments. At first, the draft questionnaires were given to the identified experts. The duly filled questionnaires were collected. The suggestions and feedback of those experts were incorporated in the analysis and verification of the questionnaire.

Again, after 15 days the second sets of same questionnaires were given to the same experts. The duly filled questionnaires were collected again and analyzed. The degree of consistency of the questionnaire was verified and it was found consistent in between the data from before-and-after set of questionnaire. Suggestions of experts were incorporated. Some suggestions for the improvement of clarity of instrument were incorporated. This final set of questionnaire was distributed to the respondents and asked to provide rating on each statement. Those experts who participated in the pilot test were not included in the actual research study.

Both sets of questionnaire were tabulated following SPSS program. The difference of opinion before (15 days) and after were tested with paired sample test (T-test). Each and every statement in different groups and categories were tested. The results of the paired sample test are given in the appendix iii. According to the paired sample test, the level of significance of the opinion of all experts before and after in the pilot test on all statements from competency area, issues and strategies was found to be above 0.05. This signified that the opinions of the experts before and after 15 days were not significantly different. It proved the reliability of the questionnaire.

Data Collection Procedure

The data collection is the important part and one has to reach to the respondents to collect their opinions. It is obvious that each respondent may seek authenticity of the research. Therefore, a letter from the school of education, Kathmandu university was written to the responding offices stating essence of research. Along with this, another letter from the researcher was produced soliciting individual respondents for their responses. This letter also stated the purpose of study, importance and good reasons for completing questionnaire and assurance of maintaining confidentiality of the responses.

Attempts were made to reach all subjects personally and receive the duly filled questionnaire. In some cases, it was not practical, questionnaire was sent with a self-addressed return envelope to concerning subjects. In some cases, follow up letters, e-mail and mobile-message were sent for earlier return of the questionnaires. There were also incidences to send second set of questionnaires to those who misplaced the questionnaire and were very late to respond. In order to ensure the higher return rate of questionnaires, the strategies adopted were telephone contacts, e-mail and personal contacts where ever possible. Despite vigorous attempts, data collection continued till the end of February, 2008. The total numbers of data collected till this date was 246 of 374 (66 percent). This research considered the sample size as calculated by the free statistical software developed by the office for research development and education. According to this, the calculated sample size was 214. It is assumed that the sample size of this research (246) proved to be representative as it slightly exceeded the calculated value (214).

Among the respondents, 90 percent (221) data collections were made by direct contact. Hard copy of the questionnaire was provided to 98 percent of respondents (241). Distribution of questionnaire to 2percent of respondents (5) was made by e-mail. Duly filled questionnaires were returned from 10 percent of respondents (24) by mail and persons. The follow up was done through personal contact, telephone, e-mail, mobile SMS service etc.

Treatment of Data

The responses to the survey questionnaires were tabulated according to the responding groups and research questions identified for the study. Separate coding system for each questionnaire was implemented for organized and systematic management of responses. The responses from each questionnaire were entered into a personal computer. A data file was prepared utilizing available Statistical Package for the Social Sciences (SPSS) software. The data entered into the computer was designed and analyzed by both descriptive and inferential statistical methods and then after the data were interpreted. The validity and reliability of the questionnaire were tested with paired sample test (T-test).

The major statistical methods used in the analysis were frequency distribution, percentage, means, standard deviation and analysis of variance (ANOVA), and others as required. All these statistical tools were used to identify: issues affecting quality of engineering higher education in Nepal; future policy strategies to resolve these issues affecting engineering higher education. In this research, there were four groups of respondents. The perceptions of different respondent groups regarding the issues of engineering higher education were compared. Analysis of variance (ANOVA) was used to compare variability in the perception in each of the issues and strategies. The significant mean differences among the groups were indicated by the significance level of the F-statistic. The level of significance (also known as the size of the rejection region or size of the critical region), traditionally denoted by Greek letter-α (alpha),was examined using one way ANOVA at a significance level of 5 percent (0.05). The Statistical Package for the Social Sciences (SPSS) was utilized for analysis of data. The following procedure was employed in analysis of data:

1. The mean score on desired and actual level of competence, satisfaction level and overall quality level was determined.
2. Standard deviation for each statement was calculated.
3. Overall mean and standard deviation was determined for each category.
4. Analysis of variance (ANOVA) was performed as required.

Table 7

Relationship of Research Questions and Survey Instruments

Objectives & Research questions	Questionnaire Categories & Items	Contents of statement	Methods to Collect Data	Statistical Tools applied
Examine existing & desired level of competence (RQ 1)	P-1 to P-4 Nos. 1-30	-Basic knowledge & skill -Specific professional capacity -Understanding society & social phenomena -Management & leadership	Questionnaire Interview Discussion	M, percent, SD
Analyze difference in values of level of competency Level (RQ 2),	P-1 to P-5 Nos. 1-42	Research Questions 1	Research Questions 1	ANOVA
Examine Existing issues influencing quality (RQ 3)	I-1 to I-9 Nos.1-99	financial, faculty, equity and access, management, students, socio-cultural issues, infrastructure, curriculum, job market	Questionnaire Interview Discussion	M, percent, SD
Analyze Significant Difference in issues (RQ 4)	I-1 to I-9 Nos.1-99	Research Questions 3	Research Questions 3	ANOVA
Examine strategies to resolve the issues influencing quality (RQ 5)	S-1 to S-9 Nos. 1-99	financial, faculty, equity and access, management, students, socio-cultural strategy, infrastructure, curriculum, job market	Questionnaire Interview Discussion	M, percent, SD
Analyze Significant Difference in strategies (RQ 6)	S-1 to S-9 Nos. 1- 99	Research Questions 5	Research Questions 5	ANOVA,

CHAPTER IV

ANALYSIS OF DATA

Introduction

This study primarily focused on identifying and analyzing current issues influencing the quality of engineering higher education in Nepal. In addition to this, identification and analysis of policy strategies to resolve identified issues were done in this study.

The engineering higher education is associated with wider sector and the issues are scattered. But, the source of information to the significant level were from Nepal engineering council, ministry of education and sports, universities and colleges, consultants, engineering departments, faculties in universities and colleges and engineering students. All the sources were related with engineering higher education and employers of engineers.

Respondent Information

The respondents selected for this study are basically from diversified sectors related with engineering. The respondent groups were decided from the conclusion derived after the literatures review and extensive discussions & interactions with expert. It was concluded that the policy makers: concerned authority in the ministry and the management in the engineering institution, are important respondent. The delivery of the faculties in the institution was thought other important component. Employers were assumed to be crucial part to judge the capability of graduating engineers. The students in the verge of graduation of bachelor degree in engineering were also selected other respondents.

Following table-8 shows breakdown of the respondents;

Table 8

Respondent Group Category and Response Rate

Respondents group	Contacted	Responded	Response percent
Policy Makers	41	32	78
Faculties	68	58	85
Students	202	123	61
Employers	63	33	52
Total	374	246	66

The data in the table-8 revealed that the responses from different respondent groups are different ranging from 52 to 85 percent. The participation of the faculties is highest (85 percent) and of employers is lowest (52 percent). The response rate of policy makers is also high. This reveals that the policy makers and faculties, the important stakeholders of engineering education, are more motivated with this study. Following different sampling methods, this percent of respondent participation serves as good representation for this kind of study.

The table-9 below represents demographic information of the respondents. This covers year of experiences, gender, education and age range of the respondents. The percentage of respondents-policy maker, faculty and employer, from ten years of experiences are found to be 66, 72 and 88 percent respectively. Among the respondents, there were 75 persons with more than 15 years of professional experiences. This is about 65 percent of the respondents other than students. About 15 percent of the respondents were experienced of less than 15 years. These data revealed that the respondents having more than 10 years of experiences are in the large majority excluding the students. This is an indicator of consistent data.

Out of the 246 respondents, only 15 (6.5 percent) numbers were female and 231 (93.5 percent) were male. Among the female, two numbers were faculties and 13 numbers were graduating students. Data revealed that there was very low representation of female. It is indeed the reflection of the society.

Following table-9 shows the demographic information of respondents;

Table 9

Demographic Information

Demographic Information	Respondent Groups					
	Students	Policy Maker	Faculty	Employer	Total	Percent
N	123 50 percent	32 13 percent	58 23.50 percent	33 13.50 percent	246	100
Year of experience						
0 yr	123	0	0	0	123	50
1 to 05 yrs	0	5	8	2	15	6
6 to 10 yrs	0	6	8	2	16	7
11 to 15 yrs	0	3	7	1	11	5
16 to 20 yrs	0	12	10	5	27	12
21 to 25 yrs	0	1	3	8	12	5
26 to 30 yrs	0	3	3	10	16	7
31 to 35 yrs	0	2	7	3	12	5
36 to 40 yrs	0	0	3	2	5	2
41 to 45 yrs	0	0	3	0	3	1
Gender						
Male	110	32	56	33	231	93.5
Female	13	0	2	0	15	6.5
Education						
Ph.D.	0	7	12	3	22	9.0
Master	0	23	40	17	80	32.5
Bachelor	123	2	6	13	144	58.5
Age Range						
20-25	123	0	0	0	123	50.0
26-30	0	1	1	3	5	2.0
31-35	0	1	1	6	10	4.0
36-40	0	1	3	6	12	4.9
41-45	0	5	7	3	17	6.9
46-50	0	19	27	6	52	21.3
51-55	0	4	10	8	22	8.9
56-60	0	1	3	1	5	2.0

The respondents of the study were from different academic level. Out of 246 respondents, there were 22 with PhD degree, 80 with master degree and 144 with bachelor degree. Among the respondents with bachelor degree, there were 123 graduating students. Excluding the students (123), the majority of the respondents had master or Ph.D. degree. This is an indicative of participation of qualifies respondents.

The students participated in this study were from age group ranging from 20 to 25. If the numbers of students are excluded, largest majority of other respondents were from 40 to 60 years of age. The policy maker, faculties and employers participated in this research and of the age more than 40 years are found to be 94, 96 and 73 percent respectively. The substantial parts of the respondents were from the age group above 40 years indicating passion and seriousness of the respondents.

Summary of Demographic Information. The respondents to the survey were largely from the dedicated professionals from engineering profession- faculties, policy makers and employers. Graduating students were other respondents. There were highly experienced professionals among the respondents except the students. The substantial numbers of respondents (more than 93 percent) were male. Among the respondents-faculties, employers and policy makers, almost all were above 40 years and highly educated having Master and Ph.D. degree in engineering. This information reveals the maturity, quality and representativeness of the respondents that justify the consistency of the data.

Research Question-1 Perception of Respondent Groups on Competency Parameters

The respondents were asked to rate 30 statements related to the professional competencies. These statements were grouped into four major categories.

The rating of the respondents for each statement on both existing and desired level of competency requirements is presented in the appendix-iv. In the table almost all respondents rated fair to good to the statement for the existing level of competency, whereas, they have rated higher level for the desired level of competency. The trends of rating on individual statements and the category were found similar.

There were four categories in the competency requirements. Those categories are; basic knowledge and skill, specific professional capacity, understanding society and social phenomena and management and leadership. The rating of the sum of the statements in the categories as derived by SPSS program is presented in the tables 10-13 below;

Table 10

Basic Knowledge and Skill

	Existing level		Desired level	
	Percent	Frequency	Percent	Frequency
NA	2	4	0	0
P	8	18	0	1
F	27	61	1	3
G	39	90	10	24
VG	20	45	44	101
E	5	11	44	101
Total	100	246	100	246

(NA=not applicable, P=poor, F=fair, G=good, VG=very good, E=excellent)

Above table 10 indicated the response rate of the respondents on existing and desired level of competency in basic knowledge and skill. This indicates that about 76 percent respondents (rating neutral and below) thought the existing level of basic knowledge and skill of the engineering graduates is not satisfactory.

Similarly, the table 10 showed that 88 percent of the respondents either desired to the very good level or to the excellent level of competency in basic knowledge and skill. This indicates that respondents highly considered basic knowledge and skill parameter. As the rating of desired level is very high in compare to the existing level, it indicated the necessity of improvement in this area.

Table 11

Specific Professional Capacity

	Existing level		Desired level	
	Percent	Frequency	Percent	Frequency
NA	3	6	0	0
P	13	31	1	2
F	33	75	2	4
G	35	79	9	21
VG	13	31	47	108
E	3	8	41	95
Total	100	246	100	246

(NA=not applicable, P=poor, F=fair, G=good, VG=very good, E=excellent)

Above table 11 indicated the response rates on existing and desired level in specific professional capacity. Data indicates that about 84 percent respondents think the existing level of specific professional capacity is unsatisfactory.

Similarly, in the table 11, respondents considered the specific professional capacity in professional areas as important component for the quality of engineering practice. Data showed that 88percent of the respondents either desired to the very good level or to the excellent level. As the rating of desired level is very high in compare to the existing level, it indicated the necessity of improvement in this area.

Table 12

Understanding Society and Social Phenomena

	Existing level		Desired level	
	Percent	Frequency	Percent	Frequency
NA	2	5	0	0
P	13	30	1	2
F	37	96	3	8
G	31	71	13	29
VG	13	29	45	110
E	4	9	38	92
Total	100	246	100	246

(NA=not applicable, P=poor, F=fair, G=good, VG=very good, E=excellent)

Above table 12 indicated the response rates on understanding society and social phenomena. Data indicated that about 83 percent respondents think the existing level of understanding society and social phenomena is unsatisfactory.

Similarly, above table 12 showed that respondents considered the capacity of understanding society and social phenomena in professional areas as important component for the quality of engineering practice. Data showed that 83 percent of the respondents either desired to the very good level or to the excellent level. As the rating of desired level is very high in compare to the existing level, it indicated the necessity of improvement in this area.

Table 13

Management and Leadership

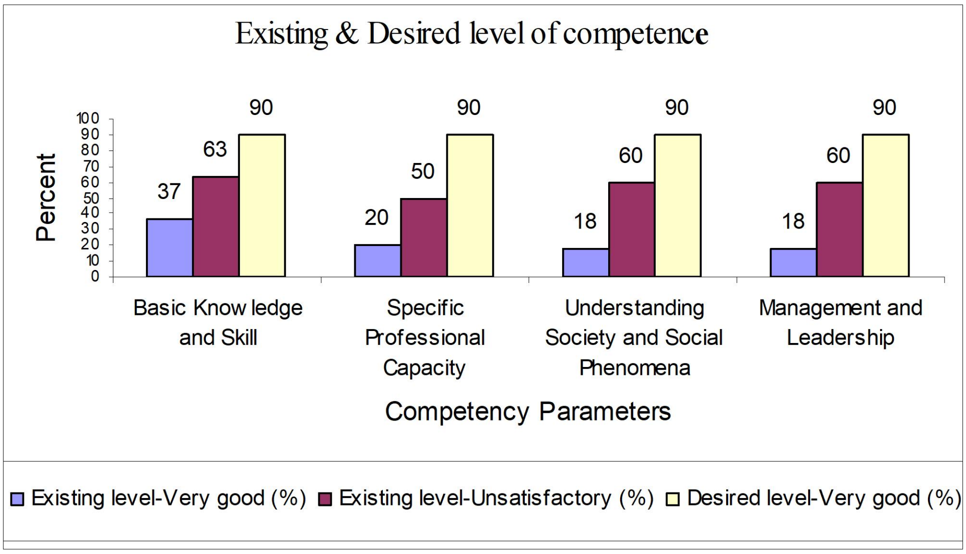
	Existing level		Desired level	
	Percent	Frequency	Percent	Frequency
NA	2	4	0	0
P	15	34	1	3
F	36	83	4	8
G	32	74	12	27
VG	11	26	46	105
E	4	9	38	87
Total	100	246	100	246

(NA=not applicable, P=poor, F=fair, G=good, VG=very good, E=excellent)

Above table 13 indicated the response rates on management and leadership. The data indicated that about 85 percent respondents think the existing level of management and leadership capacity is unsatisfactory.

Similarly, above table 13 showed that respondents considered the management and leadership in professional areas as important component for the quality of engineering practice. Data showed that 84 percent of the respondents either desired to the very good level or to the excellent level. As the rating of desired level is very high in compare to the existing level, it indicated the necessity of improvement in this area.

Figure 7. Existing and desired level of competence



The values of the above tables 10-13 were compared and presented in the figure-7. According to which respondents of 37, 20, 18 and 18 percent opined very good to the existing level for basic knowledge and skill, specific professional capacity, understanding society & social phenomena and management & leadership respectively. However, the respondents of 63, 50 60 and 60 percent rated unsatisfactory for those competency parameters respectively. Almost 90 percent respondents rated the desired level for competency parameters to the higher limit demanding the improvement in the existing level of capacity. The figure reveals that very small numbers of respondents opined the existing level of competency is in the satisfactory level and largest numbers responded in unsatisfactory and almost 90 percent desired to higher level of competency in all parameters. This indicates strong opinions for the improvement in the capacity of the graduating engineers.

To summarize the discussion concerning research question no 1, following essences are drawn;

There were 30 statements related to the professional competencies and were grouped into four major categories; basic knowledge and skill, specific professional capacity, understanding society and social phenomena, management & leadership etc. and the rating values for these categories came similar to the trend in the individual statements. Almost all respondents marked the existing level of graduating engineers in the unsatisfactory level; however, they desired higher level of competency than the existing level.

Research Question-2 Examination of Perception of Respondent Groups on Competency Parameters

To address this research question, analysis was done of mean values of responses. Following tables 14 and 15 give the detail picture of all categories of competency parameters;

Table 14

Existing Level of Competencies (Mean Values)

	Faculty	Student	Policy Maker	Employers
P-sum1- Basic knowledge and skill	26.27	30.05	26.75	25.85
P-sum2- Specific Professional Capacity	23.66	27.30	23.09	22.53
Psum-3- Understanding society & social phenomena	11.33	11.39	13.76	11.06
P-sum4- Management and Leadership	11.43	13.77	10.97	10.33

The table-14 showed the mean values of the responses. The mean values are slightly higher in the student group in compare to faculty, policy makers and employers. The values of employers are found to the lower side. The existing level of the graduating engineer on the competency parameters is higher in the perception of the students. Faculties and policy makers opined in the same range and the employers marked the capacity in the lower range. The mean values for P-sum1 are highest than after are the values for P-sum2 and the values for P-sum3 & P-sum4 are the lowest ones. This indicates that respondents' priority on the competency parameters. That means the social and management agenda are in the least priority to the stakeholders of engineering education.

Table 15

Desired Level of Competencies (Mean Values)

	Faculty	Student	Policy Maker	Employers
P-sum1	41.45	44.69	41.00	40.79
P-sum2	41.64	44.57	40.53	39.09
P-sum3	20.27	21.76	19.94	19.58
P-sum4	20.14	21.63	19.91	19.48

P-sum1- Basic knowledge and skill, P-sum2- Specific professional capacity

P-sum3- Understanding society and social phenomena,

P-sum4- Management and leadership

The table-15 presented the mean values of the responses. The mean values are slightly higher in the student group in compare to faculty, policy makers and employers. The values of employers are found to the lower side. The desired level of graduating engineer on the competency parameters is higher in the perception of the students.

Faculties and policy makers opined in the same range and the employers marked the capacity in the lower range. The trend of responses for existing and desired level is similar from all respondents. The responses are such that respondents strongly desired to increase the capacity of the graduating engineers.

The deviations in the mean values were further analyzed with the help of analysis of variance (ANOVA). This was used to determine if there are significant differences in the perceptions among the responding groups for 30 statements in four categories (refer appendix-ii) included in the questionnaire. The details of the ANOVA for 30 statements for existing level are included in the appendix-v. The level of significance of each statement and of categories was found through this analysis. Visualizing the each statement, the statements- related with basic knowledge and skill (p2, p7, p8, p9, p10) five statements, related with specific professional capacity (p12, p13, p14, p16, p17, p18, p19, p20) eight statements, related with understanding society & social phenomena (p21, p22, p23) three statements and related with management and leadership (p26, p27, p28, p29 and p30) five statements (refer appendix-v), were found to have significantly different perceptions of the respondents on existing level of competency.

The differences of perceptions were further analyzed with the help of Scheffe's multiple comparison tests and are included in the appendix-vi. It was found in the analysis that the difference of perceptions of other respondents was mainly with the students. Students rated themselves higher and faculties and employer rated in the lower range. Whereas, in the statements-p8, p9, p10, p13, p14, p18, p23, p29 and p30 (refer appendix-v), students deferred with employers. Again in the statements- p16, p19, p20, p21, p26 and p28 (refer appendix v), students deferred with policy makers, faculties and employers. The difference of opinions may be due to the fact that Youth reactions are normally optimistic & offending, engineering students are the creams in society and therefore reflected confidence while rating and employer, faculties and policy makers are defending in nature & seek verifications before rating.

Similarly, level of significance for all the statements on desired level of competency was tested. The detail of the analysis of variance is included in the appendix-vi. Visualizing each statement, the statement-p6, p7, p14, p20 and p29 (refer appendix vii) were found to have significantly different perceptions of the respondents on desired level of competency.

The differences of perceptions were further analyzed with the help of Scheffe's multiple comparison tests and are included in the appendix-vii. In the statement-p6, student deferred with policy makers and in the statements- p7, p20 and p29, the differences of opinions were not significant, whereas, in the statement- p14, the students deferred with employers.

There were four categories of statements representing different competency qualities of the graduating engineers. The sum of the values of each of those categories on existing and desired level of competency was tested by ANOVA. Among these categories, the first category-basic knowledge & skill and second category- specific professional capacity consist of ten statements in each category, the third category- understanding society and social phenomena and fourth category- management and leadership comprise of five statements in each category.

Table 16

ANOVA Table for Level of Significance for Existing Level of Competency

		Sum of Squares	df	Mean Square	F	Sig.
Basic Knowledge and skill	Between Groups	840.972	3	280.324	5.661	0.001
	Within Groups	10,992.497	242	49.516		
	Total	11,833.469	245			
Specific Professional Capacity	Between Groups	995.096	3	331.699	4.440	0.005
	Within Groups	16,586.519	242	74.714		
	Total	17,581.615	245			
Understanding society & social Phenomena	Between Groups	349.254	3	116.418	6.235	0.000
	Within Groups	4,145.135	242	18.672		
	Total	4,494.389	245			
Management and Leadership	Between Groups	449.949	3	149.983	7.707	0.000
	Within Groups	4,320.409	242	19.461		
	Total	4,770.358	245			

ANOVA table 16 has given the level of significance of the respondents on competency requirements for the entry level engineering professional practice. Table16 is for existing level of graduating engineers. Considering the level of significance by 5 percent, any group that has level of significance less than 0.05 is accepted as significant difference of opinion and needs for further Scheffe's multiple comparison tests. In the table, all the four groups- Basic Knowledge and Skill, Specific Professional Capacity, Specific Professional Capacity, Management and Leadership, have level of significance-0.001, 0.005, 0.000 and 0.000 respectively. Therefore, there is significant difference of opinions of respondents.

This significant difference in the opinion of the respondents has been analyzed by Scheffe's multiple comparison tests. This data is presented in the appendix vii.

Visualizing the Scheffe's table (appendix-vii), the differences of opinions are analyzed as follows;

In the first category-the existing level of basic knowledge and skill, there is significant difference of opinion between faculties and students and no difference of opinion between faculties, employers and policy makers. Difference of opinion of student is also with employers, but not with policy makers. This may be due to the fact that substantial numbers of responding students were from institute of engineering and their entry in the institution is highly competitive in compare to other universities and they have more confidence on the basic knowledge and skills. Whereas, the faculties and employer have objective judgement of the capacity of basic knowledge and skills as, one teaches and other involve student in to the job.

In the second category-existing level of specific professional capacity, there is significant difference of opinion between employer and students on specific professional capacity and no difference of opinion between faculties, employers and policy makers. This may be due to the fact that specific professional capacity of graduating engineer is primarily judged by employers in the work place and therefore employers have rated lower than student.

In the third category-existing level of understanding society and social phenomena, there is significant difference of opinion of students with faculties, employers and policy makers on understanding society and social phenomena. There is no difference of opinion between faculties, employers and policy makers. This may be due to the fact that students are found to be involved in the rights-activities in the recent past and they may have the opinions as if they have better understanding of social phenomena.

In the fourth category-existing level of management and leadership, there is significant difference of opinion of students with faculties, employers and policy makers on project management and leadership. There is no difference of opinion between faculties, employers and policy makers. This may be due to the fact that students are found to be involved in the rights-activities and extra-curricular activities during their study in the college and this may have built a confidence to students in management and leadership skills. However, the judgement of other respondents may be from their experience.

The summary of ANOVA for each of four categories comprising 30 statements regarding desired level of competencies is shown in the table below;

Table 17

ANOVA Table for Level of Significance for Desired Level of Competency

		Sum of Squares	df	Mean Square	F	Sig.
Basic knowledge and skill	Between Groups	714.442	3	238.147	8.140	0.000
	Within Groups	6,495.279	242	29.258		
	Total	7,209.721	245			
Specific Professional Capacity	Between Groups	1,005.954	3	335.318	10.071	0.000
	Within Groups	7,391.555	242	33.295		
	Total	8,397.509	245			
Understanding society & social Phenomena	Between Groups	181.560	3	60.520	5.597	0.001
	Within Groups	2,400.299	242	10.812		
	Total	2,581.858	245			
Management and Leadership	Between Groups	170.785	3	56.928	4.609	0.004
	Within Groups	2,741.852	242	12.351		
	Total	2,912.637	245			

Above ANOVA table 17 has given the level of significance of the statements of respondents on desired level of competency requirements for the entry level engineering professional practice. Considering the level of significance by 5 percent, any group that has level of significance more than 0.05 is accepted as significant difference of opinion and needs for further Scheffe's multiple comparison test. In the table 17 all the four groups- basic knowledge and skill, specific professional capacity, understanding society and social phenomena, have level of significance-0.000, 0.000, 0.001 and 0.004 respectively. Therefore, there is significant difference in the perception of respondents in all categories for desired level.

The significantly different perceptions for desired level were further analyzed by scheffe's range test of multiple comparisons. This data is presented in the appendix vii. Visualizing the Scheffe's table (appendix-vii), the differences of opinions are analyzed as follows;

In the first category-desired level of basic knowledge and skill, there is significant difference in the opinion of students with other respondents; faculties, policy makers and employers. This may be due to the fact that substantial numbers of responding students were from institute of engineering and their entry in the institution is highly competitive in compare to other universities and they have more confidence on the basic knowledge and skills and they are more enthusiastic and desired for more knowledge and skills. Whereas, the faculties and employer have objective judgment on the capacity of basic knowledge and skills as, one teaches and other judges engineers in work place.

In the second category-desired level of specific professional capacity, there is significant difference of opinion of students with faculties, employers and policy makers on specific professional capacity. There is no difference of opinion between faculties, employers and policy makers. This may be due to the fact that students' expectations are more. The employers, policy makers and faculties are continuously evaluating the capacity of the graduating engineers in the class or in the work place.

In the third category-desired level of understanding society and social phenomena, there is significant difference of opinion of students with employers and policy makers on understanding society and social phenomena. There is no difference of opinion between students and faculty and also between faculties, employers and policy makers. This may be due to the fact that the level of perception varies with the experience and the opinions of faculties, employers and policy makers are differing with students and within themselves more or less remaining in the same horizon.

In the fourth category-desired level of management and leadership, there is significant difference of opinion of students with employers on project management and leadership. There is no difference of opinion between faculties, employers and policy makers. This may be due to the fact that employer seek output for their survival and desire more project management and leadership skill with students.

Ranking of Competency Parameters. Analysis of variance for each of the 30 statements in four categories was calculated to determine whether there were statistically significant differences in the perceptions of respondents- faculty, student, policy maker and employer. Following the 5 point Likert rating, the ranks of responses above average (3) are marked in the high range. Those ranked on the good (3) level (the average) is marked as middle and those ranked below the average (3) are marked in low range. The ranking of the respondents on the statements concerning competency is included in the appendix-viii.

Most prominent Competency Parameters. Most prominent statements regarding competency parameters were found from the frequency table. Following the five point Likert rating, ranking was made in such a way that those statements with; not applicable, poor and fair (N, 1 & 2) were marked as low. Others with good level (3) were marked as middle and those statements with; very good and excellent levels (4 & 5) were marked as high level. The statements with middle marking were not included in the table as they do not influence the analysis. In the table, percent of frequencies are taken for the analysis.

The table was sorted on the basis of existing and desired level in the high and low marking.

Table 18

Basic Knowledge and Skill

Items	Existing		Desired	
	high	low	high	low
p1	22.2	27.4	88.3	2.6
p2	30.9	25.2	88.3	1.7
p3	17.8	40.9	85.2	1.7
p4	21.3	43.9	84.8	2.6
p5	37.4	28.7	90.4	0.9
p6	35.7	19.6	89.1	0.4
p7	24.8	36.1	90.0	1.3
p8	16.5	49.6	88.3	2.2
p9	17.8	43.9	86.1	2.6
p10	21.3	47.4	88.3	3.5

The table 18 illustrates the ranking of the respondents on existing and desired level of basic knowledge and skill. Among the total respondents, only 37 percent or less numbers of respondents agreed on the existing level of basic knowledge and skill of graduating engineers to be either very good or excellent, whereas, 67 percent opined the existing level either fair or poor.

Whereas, 85 percent and above respondents agreed the desired level of basic knowledge and skill of the graduating engineers to be in the level of either very good or excellent.

Table 19

Highest Marking on Basic Knowledge and Skill (Existing Level)

Items	Statements
p5	Communicate through electronic means;(e-mail, internet)
p6	Apply knowledge of mathematics, science and engineering
p2	Communicate through written documents
p7	Demonstrate full responsibility for own actions and decisions
p1	Communicate orally
p4	Communicate through graphical means
p10	Interpret data and prepare documents
P3	Present technical information using audiovisuals
P9	Design & conduct laboratory tests (experiments)
P8	Design & conduct research/ feasibility studies for specific projects

The table 19 illustrates the statements in category basic knowledge and skill in the order of highest marking on existing level of graduating engineers. This indicates that engineers have satisfactory level in communication skill through electronic means and poorest in the design and conducting of research studies for specific projects.

Table 20

Highest Marking on Basic Knowledge and Skill (Desired level)

Items	Statements
p5	Communicate through electronic means;(e-mail, internet)
p7	Demonstrate full responsibility for own actions and decisions
p6	Apply knowledge of mathematics, science and engineering
p1	Communicate orally
p2	Communicate through written documents
p8	Design & conduct research/ feasibility studies for specific projects
p10	Interpret data and prepare documents
p9	Design & conduct laboratory tests (experiments)
p3	Present technical information using audiovisuals
p4	Communicate through graphical means

The table 20 illustrates the statements in category basic knowledge and skill in the order of highest marking on desired level of graduating engineers. This indicates that engineers' capacity, though exists in satisfactory level, desired to have excellent communication skill through electronic means and ranked the lowest to the desired level in communication skill through graphical means.

Table 21

Specific Professional Capacity

Items	Existing		Desired	
	high	low	high	low
p11	14.3	47.8	83.9	3.0
p12	13.9	46.5	85.2	3.0
p13	17.8	49.1	85.7	3.0
p14	19.6	50.0	90.4	2.2
p15	19.6	49.1	90.0	2.2
p16	20.9	46.5	89.6	2.6
p17	16.5	54.3	88.3	4.8
p18	13.5	44.8	87.4	2.2
p19	12.2	50.0	90.4	2.6
p20	18.3	50.4	90.0	2.2

The table 21 illustrates the ranking of the respondents on existing and desired level of specific professional capacity. Among the total respondents, only 20 percent or less numbers of respondents agreed on the existing level of specific professional capacity of graduating engineers to be either very good or excellent, whereas, 80 percent opined the existing level either fair or poor.

Whereas, 85 percent and above respondents agreed the desired level of specific professional capacity of the graduating engineers to be in the level of either very good or excellent.

Table 22

Highest Marking on Specific Professional Capacity (Existing Level)

Items	Statements
P16	Understand & practice professional and ethical responsibility
P14	Identify, formulate, and solve engineering problems
P15	Use the techniques, skills, & modern tools necessary for engineering practice
P20	Evaluate the impact of engineering design in the society
P13	Analyze properties of engineering materials to be used in engineering design
P17	Practice the principles of sustainable development in engineering design
P11	Design a system, component, or process to meet desired requirements and needs
P12	Conduct and coordinate quality control and quality assurance procedures
P18	Produce effective documentation of the engineering design
P19	Practice the principles of sustainable development in engineering design

The table 22 illustrates the statements in category specific professional capacity in the order of highest marking on existing level of graduating engineers. This indicates that engineers have satisfactory level in understanding & practice professional and ethical responsibility and poorest in the practicing of the principles of sustainable development in engineering design.

Table 23

Highest Marking on Specific Professional Capacity (Desired Level)

Items	Statements
P14	Identify, formulate, and solve engineering problems
P19	Practice the principles of sustainable development in engineering design
P15	Use the techniques, skills, & modern tools necessary for engineering practice
P20	Evaluate the impact of engineering design in the society
P16	Understand & practice professional and ethical responsibility
P17	Practice the principles of sustainable development in engineering design
P18	Produce effective documentation of the engineering design
P13	Analyze properties of engineering materials to be used in engineering design
P12	Conduct and coordinate quality control and quality assurance procedures
P11	Design a system, component, or process to meet desired requirements and needs

The table 23 illustrates the statements in category specific professional capacity in the order of highest marking on desired level of graduating engineers. This indicates that engineers' capacity, though exists in satisfactory level, desired to have excellent skill in Identify, formulate, and solve engineering problems and ranked the lowest to the desired level to the skill of designing a system, component, or process to meet desired requirements and needs.

Table 24

Understanding Society and Social Phenomena

Items	Existing		Desired	
	high	low	high	low
p21	18.7	50.4	87.0	2.6
p22	17.8	52.2	87.4	2.6
p23	12.6	57.8	81.3	3.9
p24	15.7	53.9	79.6	4.8
p25	18.3	49.1	81.3	3.9

The table 24 illustrates the ranking of the respondents on existing and desired level of understanding society and social phenomena. Among the total respondents, only 18 percent or less numbers of respondents agreed on the existing level of understanding society and social phenomena of graduating engineers to be either very good or excellent, whereas, 82 percent opined the existing level either fair or poor.

Whereas, 79 percent and above respondents agreed the desired level of understanding society and social phenomena of the graduating engineers to be in the level of either very good or excellent.

Table 25

Highest Marking on Understanding Society & Social Phenomena (Existing Level)

Items	Statements
p21	Understand the impact of engineering solutions in a global and societal context
p25	Demonstrate understanding of democratic practices and community participation
p22	Analyze the impact of the engineering service on society
p24	Demonstrate understanding of democratic practices and community participation
p23	Demonstrate understanding of socio-cultural context of the country

The table 25 illustrates the statements in category understanding society and social phenomena in the order of highest marking on existing level of graduating engineers. This indicates that engineers have satisfactory level in understand the impact of engineering solutions in a global and societal context and poorest in demonstrating the understanding of socio-cultural context of the country.

Table 26

Highest Marking on Understanding Society and Social Phenomena (Desired Level)

Items	Statements
p22	Analyze the impact of the engineering service on society
p21	Understand the impact of engineering solutions in a global and societal context
p23	Demonstrate understanding of socio-cultural context of the country
p25	Demonstrate understanding of democratic practices and community participation
p24	Demonstrate understanding of democratic practices and community participation

The table 26 illustrates the statements in category understanding society and social phenomena in the order of highest marking on desired level of graduating engineers. This indicates that engineers' capacity, though exists in satisfactory level, desired to have excellent skill in analyzing the impact of the engineering service on society and ranked the lowest to the desired level to the skill of demonstrating the understanding of democratic practices and community participation.

Table 27

Management and Leadership

Items	Existing		Desired	
	high	low	high	low
p26	18.3	47.0	87.8	3.9
p27	14.3	51.7	85.7	3.9
p28	15.7	54.3	83.5	4.3
p29	12.6	54.8	81.3	4.8
p30	13.9	56.1	78.3	7.4

The table 27 illustrates the ranking of the respondents on existing and desired level of management and leadership. Among the total respondents, only 18 percent or less numbers of respondents agreed on the existing level of management and leadership of graduating engineers to be either very good or excellent, whereas, 82 percent opined the existing level either fair or poor.

Whereas, 78 percent and above respondents agreed the desired level of management and leadership of the graduating engineers to be in the level of either very good or excellent.

Table 28

Highest Marking on Management and Leadership (Existing Level)

Items	Statements
p26	Analyze economic and financial consequences of engineering projects
p28	Lead for system development & improvement by making projects technically sound & viable as a leader & as a member
p27	Coordinate smooth operation of the projects using basic principles of management
p30	Adhere with contextual issues governing management of projects
p29	Assess effectiveness of the projects in relation with established standard understanding interrelationship between society, technology and environment

The table 28 illustrates the statements in category management and leadership in the order of highest marking on existing level of graduating engineers. This indicates that engineers have satisfactory level in analyzing economic and financial consequences of engineering projects and poorest in assess effectiveness of the projects in relation with established standard understanding interrelationship between society, technology and environment.

Table 29

Highest Marking on Management and Leadership (Desired Level)

Items	Statements
p26	Analyze economic and financial consequences of engineering projects
p27	Coordinate smooth operation of the projects using basic principles of management
p28	Lead for system development & improvement by making projects technically sound & viable as a leader & as a member
p29	Assess effectiveness of the projects in relation with established standard understanding interrelationship between society, technology and environment
p30	Adhere with contextual issues governing management of projects

The table 29 illustrates the statements in category management and leadership in the order of highest marking on desired level of graduating engineers. This indicates that engineers' capacity, though exists in satisfactory level, desired to have excellent skill in analyzing economic and financial consequences of engineering projects and ranked the lowest to the desired level to the skill of adhering with contextual issues governing management of projects.

While selecting lowest ranking of the statements in the competency area, some interesting picture appeared on the surface. More than 50 percent respondents responded that present graduating engineers have low level of knowledge in understanding socio-cultural context of the country. They are also weak in project management and leadership and also weak in understanding sustainable development.

The most prominent statement in the desired level of competency of graduating engineer with high rating were taken as one third numbers of statements from above table. About 90 percent respondents had given highest priority for these statements. The first ranking statement is concerned with electronic communication capacity. The second and third statements are concerned with specific professional capacity. Among the high ranked statements five numbers are related with communication skill. This is an indicative that basic knowledge and skill, though exists in satisfactory level, need to be further developed.

Very insignificant numbers of respondents ranked on the lower side of the desired level of competency.

To summarise the discussion concerning research question 2, the following essences are drawn;

The mean values were analyzed to find the deviations in opinions among the respondents on competency parameters. The mean values of existing level were found smaller than desired level indicating emphasis of the respondents on the capacity improvement of the graduating engineers.

The rating of the students in the competency parameters were in the higher side for both existing and desired level compare to other respondents, but the trend was found similar. Though the trend was similar, there were significant differences in the opinions of students with other respondents. The rating of employer and policy makers were in close proximity and to the lower side than students and faculties for both existing and desired level.

The existing level of the graduating engineers was rated to the average range stating satisfactory level in almost all the statements related with competency parameters, whereas, the desired level of graduating engineers was rated very high. The respondents were expecting higher capacity in competency parameters.

Despite the fact that the respondents marked all the statements as highly considerable, the desired outstanding statements 20 percent from above have been marked as most prominent statements in all categories as follows;

The prominent statements in the category-basic knowledge and skills are communication through e-mail, internet etc., and demonstrate full responsibility for own actions and decisions.

The prominent statements in the category-specific professional capacity are identify, formulate, and solve engineering problems, and practicing the principles of sustainable development in engineering design.

The prominent statements in the category-Understanding Society & Social Phenomena is analyzing the impact of the engineering service on society and in category management and leadership is analyzing economic and financial consequences of engineering projects.

Research Question-3 Perceptions of Respondents on Key issues Influencing Quality of Engineering Education

The respondents were asked to rate 99 statements related to the issues influencing quality of engineering education. These issue statements were grouped into nine major categories. These categories were related to; financing in Engineering Education, Faculties and Their Role, Equity and Access, Management and Institutional Barriers, Students and Their Activities, Socio-Cultural Imperatives, Infrastructure Issues, Curriculum and Assessment System, Job Market and Its Reality.

The rating of the respondents for each statement on issues influencing quality of engineering higher education is presented in the appendix-ix. In the rating of the each statement, almost all respondents rated strongly agree or agree to the statement for the issues influencing quality of engineering education, whereas, very small numbers of respondent rated neutral or disagree for the issues statements (refer appendix-ix). The rating of the sum of the statements in the categories as derived by SPSS program is presented in the table-30 below;

Table 30

Rating of the Issues Influencing Quality of Engineering Education

Issues	NA	SD	D	ND	A	SA
Financial Issues (I-1)	1	1	4	15	43	36
Faculties Issues (I-2)	0	1	3	11	39	46
Equity and Access (I-3)	1	2	3	17	44	32
Management Issues (I-4)	0	1	2	10	44	44
Students Issues (I-5)	0	0	2	13	45	39
Socio-Cultural Issues (I-6)	1	1	3	13	45	38
Infrastructure Issues (I-7)	0	1	2	10	43	44
Curriculum Issues (I-8)	1	1	2	15	47	34
Job Market Issues (I-9)	0	1	3	13	46	37

NA=not applicable, SD=strongly disagree, D=disagree, ND=not disagree, A=agree, SA= strongly agree

This data showed the respondents perceptions concerning whether financial issues influences the quality of engineering education. The data indicated that respondents considered the financial issue a governing component for the quality of engineering education. Data showed that 79 percent of the respondents either strongly agreed or agreed the financial aspect as the major issue in influencing engineering education. Among the respondents, 15 percent were neutral in this issue and 4 percent respondents disagreed financing as an issue, 1 percent strongly disagreed and 1 percent opined as not applicable.

Respondents had divided opinions regarding faculties and their role as an issue influencing quality of engineering education. Among the respondents, 85 percent strongly agreed or agreed on the faculties and their role as an issue influencing quality of engineering education, whereas, 11 percent were neutral, 3 percent disagreed and 1 percent strongly disagreed on the issue.

The data showed the respondents perceptions concerning whether equity and access influences the quality of engineering education. The rating indicated that respondents considered the equity and access as a governing component for the quality of engineering education. Data showed that 76 percent of the respondents either strongly agreed or agreed the equity and access as the major issue in influencing engineering education. 17 percent of the respondents were neutral in this issue and 3 percent respondents disagreed, 2 percent strongly disagreed on the issue.

This data showed the respondents perceptions concerning whether management and institutional barrier influences the quality of engineering education. The data indicated that respondents considered the management and institutional barrier as a governing component for the quality of engineering education. Data showed that 88 percent of the respondents either strongly agreed or agreed the management and institutional barrier as the major issue in influencing engineering education. 10 percent of the respondents were neutral in this issue and 2 percent respondents disagreed, 1 percent strongly disagreed on the issue.

The table 30 showed the respondents perceptions concerning whether students and their activities influences the quality of engineering education. The data indicated that respondents considered the students and their activities as a governing component for the quality of engineering education. Data showed that 84 percent of the respondents either strongly agreed or agreed students and their activities as the major issue in influencing engineering education. 13 percent of the respondents were neutral in this issue and 2 percent respondents disagreed.

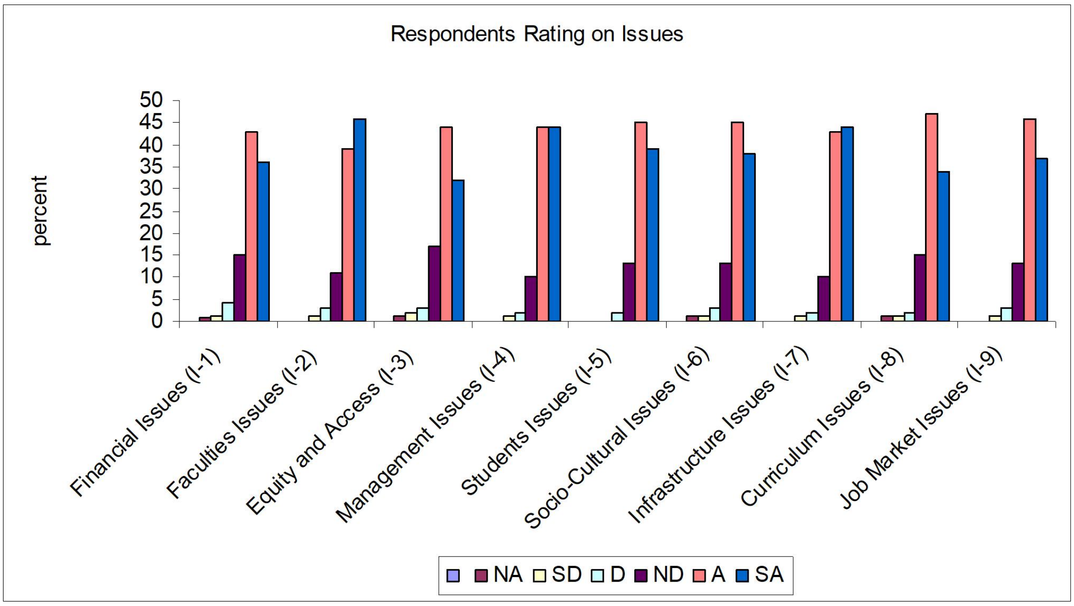
The data in the table 30 showed the respondents perceptions concerning whether socio-cultural imperatives influences the quality of engineering education. The data indicated that respondents considered the socio-cultural imperatives as a governing component for the quality of engineering education. Data showed that 83 percent of the respondents either strongly agreed or agreed the socio-cultural imperatives as the major issue in influencing engineering education. 13 percent of the respondents were neutral in this issue and 3 percent respondents disagreed, 1 percent strongly disagreed on the issue.

The table 30 showed the respondents perceptions concerning whether infrastructure (e.g. physical facilities, equipments, tools etc.) issue influences the quality of engineering education. The data indicated that respondents considered the infrastructure issue as a governing component for the quality of engineering education. Data showed that 87 percent of the respondents either strongly agreed or agreed the infrastructure issue as the major issue in influencing engineering education. 10 percent of the respondents were neutral in this issue and 2 percent respondents disagreed, 1 percent strongly disagreed on the issue.

The data presented in the table 30 showed the respondents perceptions concerning whether curriculum and assessment system influences the quality of engineering education. The data indicated that respondents considered the curriculum and assessment system as a governing component for the quality of engineering education. Data showed that 81 percent of the respondents either strongly agreed or agreed the curriculum and assessment system as the major issue in influencing engineering education. 15 percent of the respondents were neutral in this issue and 2 percent respondents disagreed, 1 percent strongly disagreed on the issue.

The rating in the table 30 showed the respondents perceptions concerning whether job-market issue influences the quality of engineering education. The data indicated that respondents considered the job-market issue as a governing component for the quality of engineering education. Data showed that 83 percent of the respondents either strongly agreed or agreed the job-market issue as the major issue in influencing engineering education. 13 percent of the respondents were neutral in this issue and 3 percent respondents disagreed, 1 percent strongly disagreed on the issue.

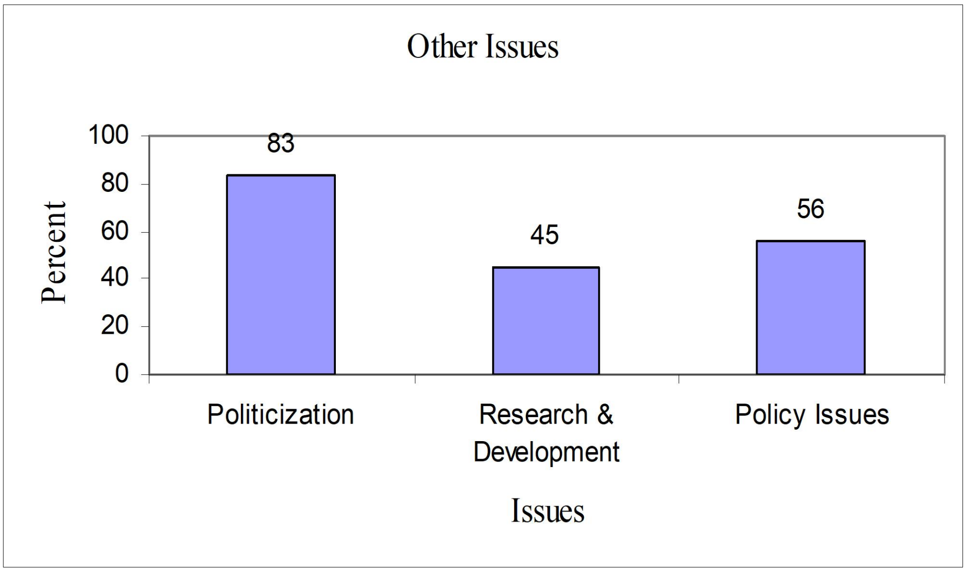
Figure 8. Respondents rating on issues



The rating of the respondents is illustrated in the histogram, such that those identified issues are overwhelmingly accepted by the respondents.

Other Issues. The respondents had also marked some of the issues in the space left for respondents' opinion in the open ended question part. All the respondents did not responded in this part. Initially 25 numbers of samples were manually noted and verified. The substantial majority of the responses (76 percent) indicated the other prominent issues as; politicization, research and development and policy issues. The ratings of these issues are illustrated in the figure-9.

Figure 9. Other issues influencing quality of engineering education



Large numbers of respondents (83 percent) responded that politicization has been the issue influencing quality of engineering education. They indicated that the students, faculties and staffs are all politicizing to satisfy their vested interest and quality is left in the second priority. Some of the respondents (45 percent) gave the opinion that absence of research and development in the engineering education is one of the issues for the degradation of the quality. Sufficient numbers of respondents (56 percent) gave the opinion that the policy issues are very much responsible for the quality of engineering education.

To summarise the discussion concerning research question 3, the following essences are drawn;

The respondents were asked to rate 99 statements related to the issues influencing quality of engineering education. These statements were grouped into nine major categories, namely; financing in Engineering Education, Faculties and Their Role, Equity and Access, Management and Institutional Barriers, Students and Their Activities, Socio-Cultural Imperatives, Infrastructure Issues, Curriculum and Assessment System, Job Market and Its Reality.

Almost all respondents rated strongly agree or agree to the statement for the issues influencing quality of engineering education, whereas, very small numbers of respondent rated neutral or disagree for the issues statements. Average rating on the categories was also very high (strongly agree or agree).

The respondents identified other issues influencing quality of engineering education, namely; politicization, research and development and policy issues. Among them, large numbers of respondents (83 percent) emphasized on politicization, 45 percent opined for research & development and 56 percent opined for policy issues.

Research Question-4 Examination of Perception of Respondent Groups on Issues

Is there a significant difference between the issues influencing quality of engineering education in Nepal as identifies by the respondent groups?

To address this research question, analysis was done of mean values of responses. The table 31 gives the detail picture of all categories of Issues influencing engineering education.

Table 31

Issues Influencing Quality of Engineering Education (Mean Values)

Issues	Faculty	Student	Policy Maker	Employers
I-1 Financing in Engineering Education	36.02	36.72	36.69	36.12
I-2 Faculties and Their Role	39.00	38.98	40.31	41.64
I-3 Equity and Access	35.68	35.53	35.97	36.94
I-4 Mgmt and Institutional Barriers	42.59	42.50	44.16	42.70
I-5 Students and Their Activities	45.80	46.98	45.22	45.73
I-6 Socio-Cultural Imperatives	41.67	41.19	40.94	42.67
I-7 Infrastructure Issues	47.24	47.04	46.66	46.73
I-8 Curriculum and Assessment System	82.20	84.20	82.38	82.27
I-9 Job Market and Its Reality	41.67	42.50	44.13	42.85

The table-31 presented the mean values of the responses. The mean values of the responses of all the respondents for financing issue are found similar, whereas, employers have rated marginally high to the faculties and their role. The policy makers have rated high to the management and institutional barrier. Students rated slightly higher in comparison to other respondents to the part of student and their activities. The employers rated more to others to socio-cultural side as an issue. The faculty and student rated slightly higher to infrastructure issues than policy makers and employers. Students emphasized more to the curriculum as an issue influencing quality. The policy makers marked more to the job-market issue influencing the quality.

The deviations in the mean values were further analyzed with the help of analysis of variance (ANOVA). This was used to determine if there are significant differences in the perceptions among the responding groups for 99 statements in nine categories (refer appendix-ii) included in the questionnaire. The details of the ANOVA for 99 statements for issues are included in the appendix-x. The level of significance of each statement and of categories was found through this analysis.

Visualizing the each statement in the ANOVA table included in the appendix-x, the perceptions of the respondents were not found significantly different.

As stated earlier, the issue statements were grouped in nine categories. Among them, financing, faculty and equity and access categories contained 9 statements, management, socio-cultural imperatives and job-market issue categories contained 10 statements, students and infrastructure categories contained 11 statements and curriculum and assessment system contained 20 statements (refer appendix-ii). The responses were further analysed in the categories as well.

The summary ANOVA for each of nine categories regarding level of agreements is shown in the table 32 below;

Table 32

ANOVA Table for Issues Influencing Engineering Higher Education

Issues		Sum of Squares	df	Mean Square	F	Sig.
i1_sum	Between Groups	33.092	3	11.031	0.553	0.646
	Within Groups	4,426.13	242	19.938		
i2_sum	Between Groups	58.883	3	19.628	1.085	0.356
	Within Groups	4,014.50	242	18.083		
i3_sum	Between Groups	37.851	3	12.617	0.498	0.684
	Within Groups	5,629.07	242	25.356		
i4_sum	Between Groups	72.952	3	24.317	1.049	0.372
	Within Groups	5,145.99	242	23.18		
i5_sum	Between Groups	118.849	3	39.616	1.417	0.239
	Within Groups	6,208.29	242	27.965		
i6_sum	Between Groups	62.014	3	20.671	0.671	0.571
	Within Groups	6,838.45	242	30.804		
i7_sum	Between Groups	38.735	3	12.912	0.42	0.739
	Within Groups	6,829.52	242	30.764		
i8_sum	Between Groups	203.176	3	67.725	0.692	0.558
	Within Groups	21,717.27	242	97.826		
i9_sum	Between Groups	96.715	3	32.238	0.963	0.411
	Within Groups	7,432.06	242	33.478		

Above ANOVA table-32 has given the issues influencing the quality of engineering education under nine categories. Considering the level of significance by 5 percent, any group that has level of significance less than 0.05 is accepted as significant difference of opinion and needs for further Scheffe's multiple comparison test. In the table, all the nine groups- I1, I2, I3, I4, I5, I6, I7, I8 and I9 have level of significance- 0.646, 0.356, 0.684, 0.372, 0.239, 0.571, 0.739, 0.558 and 0.411 respectively. Therefore, there exists no significant difference in the perception of respondents in all nine categories.

Ranking of Issues. Analysis of variance for each of the 99 issues statements in nine categories was calculated to determine whether there are statistically significant differences in the perceptions of respondents - faculty, student, policy maker and employer. Following the 5 point Likert rating, the ranks of responses (4 & 5) above average (3) are marked in the high range. Those ranked on the good (3) level (the average) is marked as middle and those ranked (NA,1 & 2)below the average (3) are marked in low range. The ranking of the respondents on the statements concerning issues is included in the appendix-xi.

Most Prominent Issues

Following the five point Likert rating, ranking was made in such a way that those statements with; not applicable, poor and fair (N, 1 & 2) were marked as low. Others with good level (3) were marked as middle and those statements with; very good and excellent levels (4 & 5) were marked as high level. The statements with middle marking were not included in the table as they do not influence the analysis. In the table, percentages of frequencies are taken for the analysis.

Most prominent Issue statements were found from the descriptive statistical analysis. Following table 33 gives picture of highest ranking of issue statements.

Table 33

Ranking of Financial Issue

	high	low
Items	F-percent	F-percent
I1	56.5	22.6
I2	90.9	2.6
I3	91.3	0.9
I4	89.6	0.9
I5	71.7	6.5
I6	55.2	5.2
I7	73.9	8.7
I8	78.7	5.7
I9	81.7	5.7

There were nine issue statements in financing issue. In the table 33, some of those issues were highly supported by respondents and others were not given priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent issues. Following this benchmark, four statements were found standing in this ranking in the financing category.

Those statements in highest priorities are as follows:

There is a need of more investment for supporting research and innovation and new educational technologies. There is a need for efficient utilization of available human, financial and material resources. There is a need of more investment for new educational technologies. There is a need for review of work-load of faculties and staffs of the engineering colleges to identify financial burden.

Table 34

Ranking of Faculties & Their Activities

	high	low
Items	Fr percent	Fr percent
I10	87.0	7.8
I11	90.0	3.0
I12	94.8	1.3
I13	91.3	0.9
I14	88.3	2.6
I15	84.8	3.9
I16	85.2	3.5
I17	93.9	0.9
I18	91.3	2.2

There were nine issue statements in issue of faculties and their role. Table 34 presented that almost all of those issues were highly supported by respondents. All the respondents had given high priority to the issue of faculties and their role. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent issues. Following this benchmark, all the statements have scored more than 80 percent. Among them, five of the statements scored more than 90 percent.

Those statements in highest priorities are as follows;

There is a need for dynamic teaching and research process in higher engineering education. There is a need for periodic meetings and discussions of faculties to maintain the quality standards. There is a need for joint research or design project within colleges and with other stakeholders (industries, employers etc). There is a need for developing and implementing long term planning of faculty development. There is a need for shift of teaching methodology from conventional (explanatory-one-way traffic method, formal technique, monotonous & insensible, spoon feeding model, course completion oriented) to interactive practice. There is a need for faculty development and retention programs (career path, incentives, benefits, trainings and education opportunities). There is a need to minimize politicization and impulsive intervention in recruitment of the faculties. There is a need for sufficient remuneration of faculties. There is a need for vigour in faculties to remain relevant or competitive.

Table 35

Ranking of Equity and Access Issues

	high	low
Items	Fr percent	Fr percent
I19	85.2	1.3
I20	46.1	23.0
I21	86.1	2.2
I22	86.1	3.5
I23	78.3	4.8
I24	80.9	3.0
I25	84.8	2.2
I26	70.0	11.3
I27	67.8	7.4

There were nine issue statements in issue of equity and access. Table 35 showed that some of those issues were highly supported by respondents and others were not given priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent issues. Following this benchmark, five of the statements have scored more than 80 percent. Those statements in highest priorities are as follows;

There is a need for provision to provide access to engineering education for competent students living in remote and poverty stricken areas. There is a need for financial support in terms of loan or scholarship to the competent students from marginalized areas. There is a need to develop a system with guidelines and processes to identify meritorious and needy students. There is a need to develop a system with guidelines and processes to ensure the fair distribution of scholarship/loan to the poor students. There is a need for special financial support from government to marginalized students.

Table 36

Ranking of Management Issues

	high	low
Items	Fr percent	Fr percent
I28	86.5	4.8
I29	92.2	2.6
I30	80.4	2.6
I31	91.7	1.3
I32	85.2	1.7
I33	90.9	1.3
I34	87.4	3.0
I35	83.5	3.5
I36	89.1	1.7
I37	88.3	2.6

There were ten issue statements in issue of management and the institutional barrier. The table 36 showed that almost all of those issues were highly supported by respondents. All the respondents had given high priority to the issue of management. This category contained ten issue statements and they are all highly supported by the respondents. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent issues. Following this benchmark, all the statements have scored more than 80 percent. Among them, three of the statements scored more than 90 percent.

Those statements in highest priorities are as follows;

There is a need for accountability and transparency in management. There is a need for smooth functioning of routine works in the institution. There is a need for visionary leadership in academic institutions to drive the institution with clear vision and strong determination. There is a need for norms and regulations to guide the behaviour of management, faculties, staffs and students. There is a need for optimum use of resources and practice simple tools of management to enhance efficiency and effectiveness in the management. There is a need for delegation of authority to different levels of management and develop a mechanism for monitoring implementation of rules and regulations. There is a need for wider participation of stakeholders (students, faculties, employers, parents, politicians, policy makers etc.) in policy making in engineering education. There is a need for harmony within the institution eliminating intra-institutional Barriers, such as; inter-departmental issues, perception of cost and time, work culture, incentive structure to promote quality. There is a need to identify dysfunctional components in the engineering institutions. There is a need for advisory team comprising of senior faculties and persons from former management bodies.

Table 37

Ranking of Students and Their Activities

	high	low
Items	Fr percent	Fr percent
I38	84.3	0.9
I39	90.0	1.7
I40	86.1	1.7
I41	89.1	1.7
I42	86.5	1.7
I43	80.4	2.6
I44	73.0	7.0
I45	89.6	1.3
I46	81.3	3.5
I47	90.4	2.6
I48	78.7	3.0

There were eleven issue statements in issue of students and their activities. The table 37 showed that some of those issues were highly supported by respondents and others were not given priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent issues. Following this benchmark, nine of the statements have scored more than 80 percent.

Those statements in highest priorities are as follows;

There is a need for clear and transparent regulation and practices for Students' fee structure, scholarships and education loan. There is a need for students' motivation to learn and continuous assessment of students' learning (knowledge and skills). There is a need for support in graduate research/project works. There is a need to orient students for ethical and moral values. There is a need for resource personnel for career guidance to students. There is a need for providing counselling on career guidance services to students. There is a need for enhancing Students' competencies (interpersonal, team working and ICT skills). There is a need for developing proper program to address the students' mobility. There is a need for developing positive approaches of protecting rights and values of students in institution.

Table 38

Ranking of Socio-Cultural Imperatives

	high	low
Items	Fr percent	Fr percent
I49	88.3	3.5
I50	90.0	2.2
I51	85.2	3.5
I52	81.7	5.2
I53	70.0	8.3
I54	77.0	5.2
I55	82.6	3.5
I56	77.8	7.0
I57	84.8	3.9
I58	88.7	1.7

There were ten issue statements in issue of Socio-Cultural Imperatives. Data showed that some of those issues were highly supported by respondents and others were not given priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent issues. Following this benchmark, seven of the statements have scored more than 80 percent. Those statements in highest priorities are as follows;

There is a need for drawing the attention of engineers in societal issues. There is a need to persuade the benefits of engineering and technology in the society. There is a need for increase in value of social image of the engineers. There is a need for developing collaboration culture among students, faculties and managements to reduce conflict among them due to political influences. There is a need to create ability among students to improve traditional technology within social context. There is a need to draw the attention of policy makers on increasing role of “integrated” engineering (integration of all discipline). There is a need to establish good relationship within and outside institutions to reduce tensed cross-cultural relation and ensure effective implementation of engineering service delivery.

Table 39

Ranking of Infrastructure Issues

	high	low
Items	Fr percent	Fr percent
I59	89.1	4.8
I60	82.6	3.9
I61	82.2	2.2
I62	84.3	3.9
I63	86.5	2.2
I64	73.0	6.5
I65	93.0	1.7
I66	92.2	1.3

I67	92.2	2.2
I68	89.6	2.6
I69	89.6	2.6

There were eleven issue statements in issue of infrastructures. Data showed that some of those issues were highly supported by respondents and others were given less priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent issues. Following this benchmark, ten of the statements have scored more than 80 percent. Three statements in this category scored more than 90 percent.

Those statements in highest priorities are as follows;

There is a need of rich library with sufficient reading and research facilities. There is a need for electronic network with national & international reputed institution's libraries. There is a need for sufficient text books, reference books & other extra curricular books, journals, newspaper & magazine documentation centre, etc. in library and their updating and replacement. There is a need for renovation of laboratory instruments. There is a need for investment in infrastructure development for quality improvements. There is a need for adequate infrastructure (buildings, laboratories, libraries etc.), physical facilities necessary for the program goals of the institution. There is a need for periodic repair and maintenance of infrastructures. There is a need for strengthening and upgrading existing outmoded infrastructures and incorporating current technologies. There is a need for provision of critical infrastructure construction, re-construction and protection. There is a need of proper inventory system with monitoring and evaluation physical and academic infrastructures and assessment of physical environment.

Table 40
Ranking of Curriculum Issues

	high	low
Items	Fr percent	Fr percent
I70	77.4	8.7
I71	85.2	4.8
I72	83.5	6.5
I73	92.2	1.7
I74	73.9	8.3
I75	88.7	2.6
I76	90.9	1.7
I77	89.6	2.2
I78	90.4	1.7
I79	75.2	2.6
I80	85.2	4.3
I81	69.1	8.7
I82	75.2	5.7
I83	83.5	3.9
I84	79.6	4.8
I85	77.0	1.3
I86	85.2	2.2
I87	77.0	3.9
I88	91.3	1.3
I89	85.7	1.3

There were twenty issue statements in issue of curriculum. Data showed that some of those issues were highly supported by respondents and others were given less priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent issues. Following this benchmark, twelve of the statements have scored more than 80 percent. Three statements in this category scored more than 90 percent. Those statements in highest priorities are as follows;

There is a need for review of breadth and depth of subject coverage in the curriculum based on market needs. There is a need for updating prevailing technology and introducing new technologies in the institution. There is a need for systematic evaluation of; institutional performance; course prescribed; administrative practices; feedback system from lower to higher level and from students on course taught. There is a need for conformity of standard of Nepalese graduates with standard abroad. There is a need for developing and enforcing national standards for engineering education (academic degree and engineering colleges). There is a need to develop curriculum responsive to labour market needs resulting in job advancement, entrepreneurship, education and training. There is a need for regular peer-review for new engineering institutions and accreditation of engineering qualifications. There is a need to develop a system for designing curriculum from all levels of management, departments to faculties, in the institution. There is a need to establish the provision for continuing education and lifelong learning in engineering education. There is a need for providing exposure of technical know how evolving in application of technologies. There is a need for subject courses matched and harmonized (synchronized) with global courses and schedules. There is a need for review of failure rate in all regular examination.

Table 41

Job-Market Issues

	high	low
Items	Fr percent	Fr percent
I90	91.7	1.7
I91	90.0	3.0
I92	74.8	9.1
I93	80.0	3.9
I94	80.4	4.8
I95	95.2	1.7
I96	90.9	3.5

I97	83.0	4.8
I98	91.3	1.7
I99	91.7	0.9

There were ten issue statements in issue of job-market. Data showed that some of those issues were highly supported by respondents and others were given less priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent issues. Following this benchmark, nine of the statements have scored more than 80 percent. Six statements scored more than 90 percent.

Those statements in highest priorities are as follows;

There is a need for providing on-the-job learning experiences (experimental learning opportunities) in engineering education. There is a need of collaboration between industry and academic institution for need based delivery and research. There is a need for effective networking and exchange programs with different academic institution and industries with in and outside the country. There is a need for a mechanism of receiving regular information and feedback from job market. There is a need for matching between engineering graduates especially in academic programs and job market. There is a need to respond new challenges posed by increasing liberalization economy in higher engineering education in Nepal. There is a need for delegation of academic authority to departments and faculties to enhance ability to serve the market demand. There is a need to develop private public partnerships for assessment of the academic performance of students and market response to their performances. There is a shortage of skilled human resource in some critical areas and are in over supply of engineering graduates in conventional areas.

To summarise the discussion concerning research question 4, the following essences are drawn;

Analysis was done of mean values of responses to find the deviations of opinions of the respondents on the issue statements. The mean values of the rating of all the respondents were in the same level on financing issue. The mean value of the rating on faculties and their role was similar or slightly lower and mean values of the employers and policy makers was similar or slightly higher in this issue. The mean values of the rating of all the respondents were similar or in the lower range on equity and access issue. The mean values of rating of the respondents other than policy makers were in the same range on management and institutional barrier. Policy makers marked slightly higher on this issue. The issue of students' role was marked slightly higher but in the similar range by all the respondents. The issue of socio-cultural imperative was more emphasized by employer and marked in the higher side compare to other respondents. All the respondents rated in the similar range on the infrastructure issue. The mean values for issue of curriculum and assessment system were very high indicating high emphasis by all the respondents. Students have marked still higher compare to other respondents. The mean value of rating of policy makers was higher compare to the values of other respondents on market issues.

However, the deviations of opinions of the respondents were not substantial in all issue categories, There were small differences of opinions between respondents in some individual statements. Policy makers rated slightly higher compared to others on I4 and I8. The faculties rated higher on I16. Students rated higher on I26, I46 and I70. Faculties emphasized more on I59 (refer appendix-xii).

Despite the fact that the respondents marked all the statements as highly considerable, the outstanding statements 20 percent from above have been marked as most prominent statements in all categories as follows;

The prominent statements in category-financing are; more investment for supporting research and innovation and new educational technologies, and efficient utilization of available human, financial and material resources.

The prominent statements in category-faculties and their role are, dynamic teaching and research process in higher engineering education, and periodic meetings and discussions of faculties to maintain the quality standards.

The prominent statements in category-equity and access issues are; the provision to provide access to engineering education for competent students living in remote and poverty stricken areas, and financial support in terms of loan or scholarship to the competent students from marginalized areas.

The prominent statements in category-management issues are, accountability and transparency in management, smooth functioning of routine works in the institution.

The prominent statements in category-students and their activities are, clear and transparent regulation and practices for Students' fee structure, scholarships and education loan, and students' motivation to learn and continuous assessment of students' learning (knowledge and skills).

The prominent statements in category -socio-cultural imperatives are, drawing the attention of engineers in societal issues, and persuading the benefits of engineering and technology in the society.

The prominent statements in category -infrastructures are; rich library with sufficient reading and research facilities, and electronic network with national & international reputed institution's libraries.

The prominent statements in category -curriculum updating are; review of breadth and depth of subject coverage in the curriculum based on market needs, updating prevailing technology and introducing new technologies in the institution, systematic evaluation of; institutional performance; course prescribed; administrative practices; feedback system from lower to higher level and from students on course taught, and conformity of standard of Nepalese graduates with standard abroad.

The prominent statements in category -job-market are; providing on-the-job learning experiences (experimental learning opportunities) in engineering education, and collaboration between industry and academic institution for need based delivery and research.

Research Question-5 Perceptions of Respondents on Future strategies to reform engineering education

The respondents were asked to rate 99 statements related to the reform strategies for quality of engineering education. These statements were grouped into nine major categories. These categories were related to; financing in Engineering Education, Faculties and Their Role, Equity and Access, Management and Institutional Development, Students and Their Activities, Socio-Cultural Imperatives, Infrastructure strategies, Curriculum and Assessment System, Job Market and Its Reality.

The rating of the respondents for each statement on reform strategies to resolve issues influencing quality of engineering higher education is presented in the appendix-xi. In the table almost all respondents rated fair to good to the statement for strategies. The rating of the sum of the statements in the categories as derived by SPSS program is presented in the table-42 below;

Table 42

Rating of the Reform Strategies for Engineering Education

Strategies	NA	SD	D	ND	A	SA	Total
S-1 Financing in Engineering Education	1	1	4	17	47	31	100
S-2 Faculties and Their Role	0	0	2	7	51	40	100
S-3 Equity and Access	1	1	3	15	47	32	100
S-4 Mgmt and Institutional Development	0	0	2	11	52	35	100
S-5 Students and Their Activities	0	0	2	12	49	37	100
S-6 Socio-Cultural Imperatives	1	2	3	15	52	27	100
S-7 Infrastructure Strategy	0	0	2	13	50	35	100
S-8 Curriculum and Assessment System	0	0	1	11	53	34	100
S-9 Job Market and Its Reality	0	0	1	7	46	45	100

The data presented in the table 42 showed the respondents perceptions concerning financial strategies for engineering education. The data indicated that respondents considered the financial strategy a governing component for the quality of engineering education. Data showed that 78 percent of the respondents either strongly agreed or agreed the financial aspect as the major strategy to attain quality of engineering education. Among the respondents, 17 percent were neutral in this strategy and 4 percent respondents disagreed financing as a reform strategy, 1 percent strongly disagreed and 1 percent opined as not applicable.

In the table 42, respondents had divided opinions regarding faculties and their role as the reform strategy to attain quality of engineering education. Among the respondents, 91 percent strongly agreed or agreed on the faculties and their role as a strategy for quality of engineering education, whereas, 7 percent were neutral, 2 percent disagreed.

The data in the table 42 showed the respondents perceptions concerning equity and access strategy for quality of engineering education. The rating indicated that respondents considered the equity and access as a governing component for the quality of engineering education. Data showed that 79 percent of the respondents either strongly agreed or agreed the equity and access as the major strategy to attain quality of engineering education. 15 percent of the respondents were neutral in this strategy and 3 percent respondents disagreed, 1 percent strongly disagreed on the strategy.

The table 42 showed the respondents perceptions concerning the strategy for management and institutional development to attain the quality of engineering education. The data indicated that respondents considered the management and institutional barrier as a governing component for the quality of engineering education. Data showed that 87 percent of the respondents either strongly agreed or agreed the management and institutional development as the major strategy to attain quality of engineering education. 11 percent of the respondents were neutral in this strategy and 2 percent respondents disagreed.

The table 42 presented the respondents perceptions concerning strategy for students and their activities to attain quality of engineering education. The data indicated that respondents considered the students and their activities as a governing component for the quality of engineering education. Data showed that 86 percent of the respondents either strongly agreed or agreed students and their activities as the major strategy to attain quality of engineering education. 12 percent of the respondents were neutral in this strategy and 2 percent respondents disagreed.

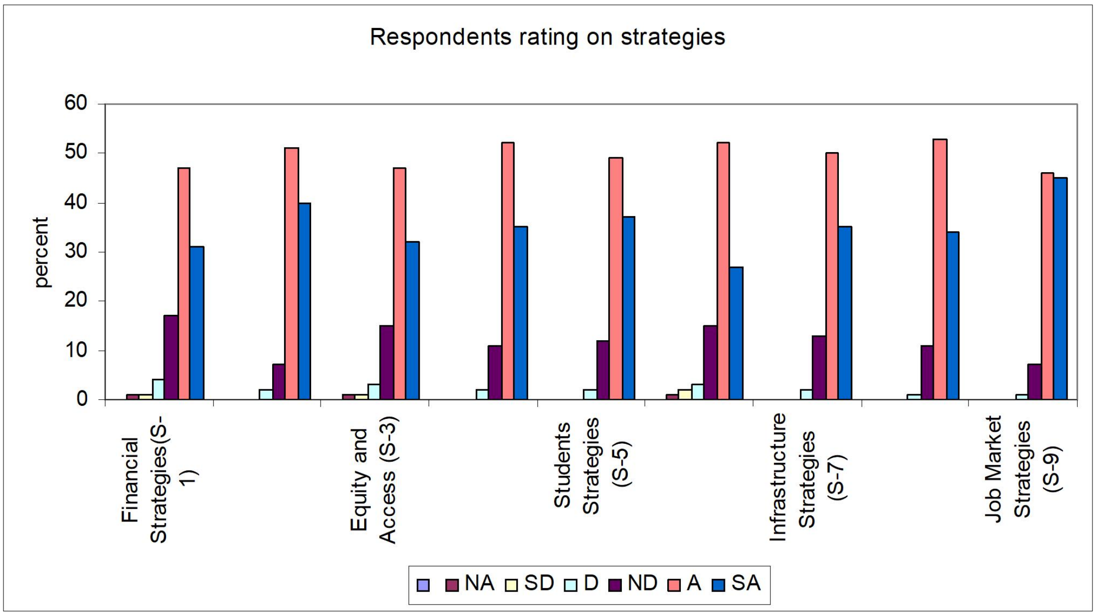
The data in the table 42 showed the respondents perceptions concerning strategy for socio-cultural imperatives to attain quality of engineering education. The data indicated that respondents considered the socio-cultural imperatives as a governing component for the quality of engineering education. Data showed that 79 percent of the respondents either strongly agreed or agreed the socio-cultural imperatives as the major strategy to attain quality of engineering education. 15 percent of the respondents were neutral in this strategy and 3 percent respondents disagreed, 2 percent strongly disagreed and 1 percent opined as not applicable.

The table 42 showed the respondents perceptions concerning infrastructure strategy to attain quality of engineering education. The data indicated that respondents considered the infrastructure strategy as a governing component for the quality of engineering education. Data showed that 85 percent of the respondents either strongly agreed or agreed the infrastructure strategy as the major strategy to attain quality of engineering education. 13 percent of the respondents were neutral in this strategy and 2 percent respondents disagreed.

The data in the table 42 showed the respondents perceptions concerning curriculum and assessment system to attain quality of engineering education. The data indicated that respondents considered the curriculum and assessment system as a governing component for the quality of engineering education. Data showed that 87 percent of the respondents either strongly agreed or agreed the curriculum and assessment system as the major strategy in influencing engineering education. 11 percent of the respondents were neutral in this strategy and 1 percent respondents disagreed.

The rating in the table 42 showed the respondents perceptions concerning job-market strategy to attain the quality of engineering education. The data indicated that respondents considered the job-market strategy as a governing component for the quality of engineering education. Data showed that 91 percent of the respondents either strongly agreed or agreed the job-market issue as the major strategy to attain quality of engineering education. 7 percent of the respondents were neutral in this strategy and 1 percent respondents disagreed.

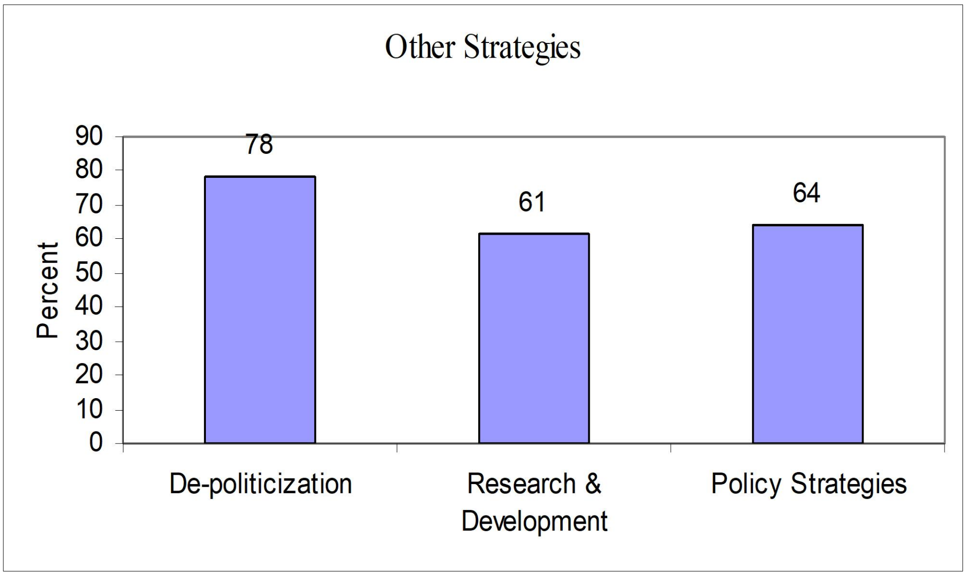
Figure 10. Respondents rating on strategies



The rating of the respondents on the strategies is illustrated in the histogram, such that those identified strategies are overwhelmingly accepted by the respondents.

Other Strategies. The respondents had also marked some of the strategies in the space left for respondents' opinion in the open ended question part. Not all the respondents responded in this part. The open ended questions were very much valuable to find other prominent strategies from the responses of the respondents. Initially 25 numbers of samples were manually noted and verified. The substantial majority of the responses (76 percent) indicated the other prominent strategies as; politicization, research and development and policy strategy. The ratings of these strategies are illustrated in the figure-10.

Figure 11. Other strategies to attain quality of engineering education



Following the figure 11, large numbers of respondents (78 percent) responded that strategy should be made for de-politicization in the engineering education system to attain quality of engineering education. They indicated that the students, faculties and staffs are all politicizing to satisfy their vested interest and quality is left in the second priority. Some of the respondents (61 percent) gave the opinion that strategy should be made for research and development in the institution to attain quality of engineering education. Sufficient numbers of respondents (64 percent) gave the opinion that the policy strategy is responsible for the quality of engineering education. To summarise the discussion concerning research question 5, the following essences are drawn;

The respondents were asked to rate 99 statements related to the strategy to resolve issues influencing quality of engineering education. These statements were grouped into nine major categories, namely; financing in Engineering Education, Faculties and Their Role, Equity and Access, Management and Institutional Development, Students and Their Activities, Socio-Cultural Imperatives, Infrastructure Strategy, Curriculum and Assessment System, Job Market and Its Reality.

Almost all respondents rated strongly agree or agree to the statement for the strategy statements to resolve the issues influencing quality of engineering education, whereas, very small numbers of respondent rated neutral or disagree for the strategy statements. Average rating on the categories was also very high (strongly agree or agree).

The respondents identified other strategies influencing quality of engineering education, namely; politicization, research and development and policy issues. Among them, large numbers of respondents (78 percent) emphasized on strategy to resolve issue of politicization, 61 percent opined for research & development and 64 percent opined for policy strategies.

Research Question-6 Examination of Perception of Respondent Groups on future strategies

To address this research question, analysis was done of mean values of responses. The table 43 gives the detail picture of all categories of strategies to resolve issues influencing engineering education.

Table 43

Strategies to Resolve the Issues (Mean Values)

Strategies	Faculty	Student	Policy Maker	Employers
S-1 Financing in Engineering Education	36.86	36.68	38.03	38.79
S-2 Faculties and Their Role	39.16	37.74	39.63	39.09
S-3 Equity and Access	36.69	35.84	35.56	37.48
S-4 Mgmt and Institutional Development	42.45	41.40	42.78	42.64
S-5 Students and Their Activities	45.16	46.68	44.53	47.00
S-6 Socio-Cultural Imperatives	39.98	39.40	40.31	41.39
S-7 Infrastructure Strategy	47.61	46.91	46.91	47.24
S-8 Curriculum and Assessment System	82.90	83.49	84.03	86.12
S-9 Job Market and Its Reality	43.84	42.98	43.59	44.58

The table-43 presented the mean values of the responses. The mean values of the responses of faculty and students for financing strategy are found similar, and also the policy makers and employers opinions are similar. Policy makers and employer ranked higher in compare to others. On the strategy for faculties and their role, employers, policy makers and faculties have rated higher to the students. The student rated slightly lower to the strategy related with faculties and their role. Students and

policy makers rated slightly lower to the strategy for equity and access, whereas, faculty and employer rated higher. The students have rated lower to the strategy for management and institutional development. The students and employer rated higher to the strategy for students and their activities compared to the policy makers and faculty. The employers and policy makers rated slightly higher to others to strategy for socio-cultural imperatives. All the respondents rated more or less in the same level to the strategy for infrastructure. Students and faculties rated lower and policy makers and employers emphasized more to the strategy for curriculum and assessment system. The employer marked more to the job-market strategy to attain the quality.
The deviations in the mean values were further analyzed with the help of analysis of variance (ANOVA). This was used to determine if there are significant differences in the perceptions among the responding groups for 99 statements in four categories (refer appendix-ii) included in the questionnaire. The details of the ANOVA for 99 statements for existing level are included in the appendix-xii. The level of significance of each statement and of categories was found through this analysis. Visualizing the each statement in the ANOVA table included in the appendix-xii, the perceptions of the respondents were not found significantly different.

As stated earlier, the strategy statements were grouped in nine categories. Among them, financing, faculty and equity & access categories contained 9 statements, management, socio-cultural imperatives and job-market strategy categories contained 10 statements, students and infrastructure categories contained 11 statements and curriculum and assessment system contained 20 statements (refer appendix-ii). The responses were further analysed in the categories as well. The summary ANOVA for each of nine categories regarding level of agreements is shown in the table 44.

Table 44
ANOVA Table for Strategy for Financing in Engineering Education

Strategies		Sum of Squares	df	Mean Square	F	Level of Sig.
s1_sum	Between Groups	133.5	3.0	44.5	1.329	0.266
	Within Groups	7,431.3	242.0	33.5		
	Total	7,564.8	245.0			
s2_sum	Between Groups	137.7	3.0	45.9	2.427	0.066
	Within Groups	4,196.8	242.0	18.9		
	Total	4,334.5	245.0			
s3_sum	Between Groups	80.3	3.0	26.8	0.996	0.396
	Within Groups	5,965.0	242.0	26.9		
	Total	6,045.2	245.0			
s4_sum	Between Groups	77.3	3.0	25.8	1.093	0.353
	Within Groups	5,234.5	242.0	23.6		
	Total	5,311.8	245.0			
s5_sum	Between Groups	152.5	3.0	50.8	2.054	0.107
	Within Groups	5,494.5	242.0	24.7		
	Total	5,647.0	245.0			
s6_sum	Between Groups	87.6	3.0	29.2	0.941	0.422
	Within Groups	6,895.0	242.0	31.1		
	Total	6,982.6	245.0			
s7_sum	Between Groups	22.8	3.0	7.6	0.203	0.894
	Within Groups	8,294.2	242.0	37.4		
	Total	8,317.0	245.0			
s8_sum	Between Groups	138.5	3.0	46.2	0.659	0.578
	Within Groups	15,542.5	242.0	70.0		
	Total	15,680.9	245.0			
s9_sum	Between Groups	59.8	3.0	19.9	0.915	0.434
	Within Groups	4,837.9	242.0	21.8		
	Total	4,897.8	245.0			

Above ANOVA table-44 has given the values of level of significance between the opinions of the respondents on strategies to resolve issues influencing the quality of engineering education under nine categories. Considering the level of significance by 5 percent, any group that has level of significance less than 0.05 is accepted as significant difference of opinion and needs for further Scheffe's multiple comparison test. In the table 44, all the nine groups- S1, S2, S3, S4, S5, S6, S7, S8 and S9 have level of significance-0.266, 0.066, 0.396, 0.353, 0.107, 0.422, 0.894, 0.578 and 0.434 respectively. Therefore, there exists no significant difference in the perception of respondents in all nine categories.

Ranking of Reform Strategies. Analysis of variance for each of the 99 strategy statements in nine categories was calculated to determine whether there are statistically significant differences in the perceptions of respondents - faculty, student, policy maker and employer. Following the 5 point Likert rating, the ranks of responses (4 & 5) above average (3) are marked in the high range. Those ranked on the good (3) level (the average) is marked as middle and those ranked (NA,1 & 2)below the average (3) are marked in low range. The ranking of the respondents on the statements concerning strategies is included in the appendix-xi. According to the table, overwhelming responses are to the higher side establishing the statements to be true.

Most Prominent Reform Strategies

Following the five point Likert rating, ranking was made in such a way that those statements with; not applicable, poor and fair (N, 1 & 2) were marked as low. Others with good level (3) were marked as middle and those statements with; very good and excellent levels (4 & 5) were marked as high level. The statements with middle marking were not included in the table as they do not influence the analysis. In the table, percentages of frequencies are taken for the analysis.

Most prominent issue statements were found from the descriptive statistical analysis. Following tables 45-53 give picture of highest ranking of reform strategy statements.

Table 45

Ranking of Financial Strategy

Items	High percent	Low percent
S1	73.0	8.3
S2	88.3	0.4
S3	93.9	1.3
S4	89.6	0.9
S5	63.9	14.8
S6	81.7	3.0
S7	80.0	5.2
S8	87.4	2.6
S9	79.1	7.4

There were nine strategy statements in financing strategy. Some of those strategies were highly supported by respondents and others were not given priority. Data in the table 45 showed that almost all of those strategy statements were highly supported by respondents. All the respondents had given high priority to the financing strategy. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent strategy. Following this benchmark, six statements were found standing in this ranking in the financing category.

Those statements in highest priorities are as follows: Allocate appropriate budget for research and innovation, Allocate appropriate budget for new technologies, Minimize wastage, optimize overheads and encourage efficient and effective use of resources, Establish cost control measures with transparent & effective financial management, Explore and initiate to find resources and funding from business and industry for academic programs and research in engineering education, Explore and initiate to find resources and funding from private sector for development and expansion of engineering education, etc.

Table 46

Ranking of Strategy for Faculty

Items	High percent	Low percent
S10	90.9	0.9
S11	90.9	2.2
S12	93.9	1.3
S13	90.9	2.2
S14	90.9	2.2
S15	92.2	2.2
S16	88.7	2.2
S17	87.0	2.2
S18	88.7	2.6

There were nine strategy statements in strategy of faculties and their role. Data in the table 46 showed that almost all of those strategy statements were highly supported by respondents. All the respondents had given high priority to the strategy of faculties and their role. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent strategy.

Following this benchmark, all the statements have scored more than 80 percent. Among them, six of the statements scored more than 90 percent.

Those statements in highest priorities are as follows: Start and establish dynamic teaching and research process in higher engineering education, Establish system of continuing professional development of faculties, Support and encourage participation of faculties in regional conferences, workshops and electronic conferences, Provide internet facilities and encouraging publications over internet, Develop institutional set-up, formulate comprehensive guidelines and conduct transparent procedures of faculties' recruitment. Develop, implement, and assess new instructional models, materials, and learning environments. Encourage faculties for Joint research or design projects within college and with other stakeholders, Develop a teacher management system that includes teacher education and training and conditions of service (appointment, deployment, transfer, salaries and benefits, career path etc.), Ensure technical competency of faculties that includes all requirement for certification and credentialing, evaluation includes; technical competency, instructional competency/certification, and technical updating, Motivate the faculties in the job by involving in continuing education program, consultancy services, and research projects, thus encouraging for additional remuneration. Prepare next generation of faculty and professionals wishing to pursue work in the field of engineering education, Coordinate and facilitate discussions to maintain the required quality standards of faculties, Set, maintain and control the quality standards of faculties, etc.

Table 47

Ranking of Strategy for Equity & Access

Items	High percent	Low percent
S19	77.4	4.3
S20	61.7	11.3
S21	83.0	3.9
S22	90.0	2.2
S23	79.1	8.3
S24	75.2	4.3
S25	83.5	4.8
S26	83.9	5.2
S27	78.7	6.1

There were nine strategy statements in strategy of equity and access. Data in the table 47 showed that some of those strategies were highly supported by respondents and others were not given priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent strategies. Following this benchmark, four of the statements have scored more than 80 percent.

Those statements in highest priorities are as follows: Encourage government for financial assistance, manage financial assistance by reliable organizations to needy students, Develop financing model with bank loan facilities and target subsidies to poor and needy students with a focus on reducing inequalities, discouraging inefficiencies and encouraging incentives for positive innovation and generation of additional resources, Start supporting programs for students from marginalized areas in pre-engineering level for building their capacity to compete in entry level of higher engineering education, Formulate the guidelines and processes to distribute scholarship to meritorious and needy students through the participation of stakeholders (students, faculties), Organize a system of selecting bright students from different regions in the scholarship scheme in the engineering education, etc.

Table 48

Ranking of Management Strategy

Items	High percent	Low percent
S28	82.6	2.2
S29	83.9	2.2
S30	87.0	3.0
S31	87.0	1.3
S32	92.2	0.9
S33	88.7	1.7
S34	83.5	3.9
S35	83.9	2.6
S36	90.9	2.6
S37	90.4	1.3

There were ten strategy statements in strategy of management and the institutional development. Data in the table 48 showed that almost all of those strategies were highly supported by respondents. All the respondents had given high priority to the strategy of management. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent strategies. Following this benchmark, all the statements have scored more than 80 percent. Among them, three of the statements scored more than 90 percent.

Those statements in highest priorities are as follows: Conduct periodic meetings of all departments, committees and centres and arrange discussions on issues, challenges and programs, Develop norms and regulations to guide the behaviours of the management, faculties and staffs and avoid ad-hoc decisions, Simplify the methods of management and maintenance and make it output oriented, optimize the utilization of available space and equipment, make mandatory the periodic performance audit of campuses, Ensure dynamic and visionary leadership in all level of administration, Establish mechanism to entertain advices and guidance in design, development, operation, evaluation initiatives in the institution from; former deans, assistant deans, campus chiefs; senior professors and educational experts, Ensure and monitor routine works of the institutions, such as; conduction of defined meetings, recruitment practices, compliance with audit observation, academic monitoring, public information etc.(as important job of heads-Deans, principals/campus-chiefs, HOD etc.), Formulate detail job description for all level of management of staffs and ensure their role, responsibility, authority and accountability in the institution, provide an added mechanism of accountability of the process, through public disclosures of its progress, Identify and Chuck-out dysfunctional components in the engineering institution. Ensure financial, academic and management authority in the autonomy of institution, such as; appointment of staff on contract, term extension of contract faculties, staff selection appointment and dismissal, acceptance of resignation, frame policies and regulations on academic and administrative affairs, formulate financial regulations etc. Ensure dedicated and more concerned stakeholders (faculties, students, parents, industry, politicians, policy makers etc.) in management & development council/ authorities; in the engineering institutions, etc.

Table 49

Ranking of Strategy for Students

Items	High percent	Low percent
S38	92.2	1.3
S39	90.0	2.6
S40	91.3	1.3
S41	92.2	0.4
S42	85.2	0.9
S43	81.3	3.0
S44	73.0	5.7
S45	87.4	2.2
S46	87.0	0.4
S47	85.2	3.9
S48	77.8	4.3

There were eleven strategy statements in strategy of students and their activities. Data showed that some of those strategies were highly supported by respondents and others were not given priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent strategies. Following this benchmark, nine of the statements have scored more than 80 percent.

Those statements in highest priorities are as follows: Encourage academic and professional key skills, such as; publications of journals, new-letters web etc, interpersonal team working, presentation skill and ICT skills, Orient students for; well prepared to be leading engineers, as well as researchers, with a clear understanding of the strategic value of their area, Establish a system of Meaningful Career Counselling/social/emotional counselling mechanism. Encourage student led performances as a part of curricula, co-curricula and extra-curricula activities. Ensure supports (financial and academic guidance) for students' project works, Develop relevant programs to address students' mobility, Ensure availability of resource personnel to provide career guidance services, Fix Minimum & maximum fee structure in cost basis for quality improvement, formulate proper scholarship scheme and introduce education loan. Support the students' activities concerning their rights and values, etc.

Table 50

Strategy for Social-cultural Imperatives

Items	High percent	Low percent
S49	81.7	5.7
S50	87.8	1.7
S51	69.1	13.5
S52	83.0	2.2
S53	66.1	12.2
S54	79.6	3.0
S55	79.1	3.0
S56	77.4	4.8
S57	86.5	2.6
S58	87.0	2.2

There were ten strategy statements in strategy of Socio-Cultural Imperatives. Data showed that some of those strategies were highly supported by respondents and others were not given priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent strategies. Following this benchmark, five of the statements have scored more than 80 percent.

Those statements in highest priorities are as follows: Develop curriculum such that students can understand societal issues and social implication of technology, Promote public understanding of engineering and technology, Make efforts in the application of engineering and technology for poverty eradication developing traditional technology, Establish cross cultural harmony and inter-university and institutional cooperation, including fellowships, Make periodic campaigns to establish status and social image of the engineer in the community, etc.

Table 51

Infrastructure Strategy

Items	High percent	Low percent
S59	91.3	2.2
S60	87.4	2.2
S61	93.5	2.2
S62	84.8	1.7
S63	88.3	1.7
S64	88.7	0.4
S65	90.0	1.3
S66	93.9	0.4
S67	92.2	1.3
S68	93.5	0.9
S69	83.5	1.7

There were eleven strategy statements in strategy of infrastructures. Data showed that all of those strategies were highly supported by respondents. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent strategies. Following this benchmark, all of the eleven statements have scored more than 80 percent. Six statements scored more than 90 percent.

Those statements in highest priorities are as follows: Develop functional electronic network with national & international reputed institution's libraries, Establish monitoring & evaluation unit for physical and academic infrastructure & their quality. Ensure renovation of laboratory instruments, Ensure sufficient text books, reference books & other extra curricular books, journals, newspaper & magazine documentation centre, etc. in library and also update and replace them regularly, Ensure physical facilities, equipment and tools used in the program and be of the quality and type needed to training to meet the program goals and performance objectives, ensure that facilities and equipment shall effectively accommodate the number of students, instructors, support staff and program objectives, Ensure copy, documentation and database facilities in the library, Develop Infrastructures in accordance with the new paradigm in engineering education, Prepare a data base of all infrastructures and conduct periodic repair and maintenance, Ensure that there are in sufficient quantity and quality of critical infrastructures to meet the instructional objectives and needs of the academic program, Strengthen and/or replace outmoded infrastructures, ensure Infrastructures to reflect current technologies and applications, Provide grant, soft loan, aid & donation for infrastructure development & quality improvement, etc.

Table 52

Strategy for Curriculum

Items	High percent	Low percent
S70	80.4	7.4
S71	92.6	2.6
S72	88.3	1.3
S73	87.4	1.3
S74	77.0	5.7
S75	86.5	1.3
S76	85.7	1.7
S77	90.4	1.3
S78	90.9	0.9
S79	82.2	3.0
S80	87.0	1.3
S81	89.1	1.7
S82	90.0	0.8
S83	92.6	0.4
S84	81.3	3.0
S85	87.8	1.3
S86	90.4	1.3
S87	83.5	1.3
S88	91.7	0.9
S89	85.7	0.9

There were twenty strategy statements in strategy of curriculum. Data showed that some of those strategies were highly supported by respondents and others were given less priority. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent strategies. Following this benchmark, nineteen of the statements have scored more than 80 percent. Seven statements scored more than 90 percent.

Those statements in highest priorities are as follows: Initiate curriculum reform synchronized with global courses and schedules, Conduct review of failure rate in all regular exams, identify causes and apply corrective measures, Ensure technology development in a socially beneficial way/direction by updating prevailing technology and introducing new technology in the institution, Initiate for regional agreements between educational institutions and insure conformity of Nepalese engineering degree, Develop national norms and standard for engineering education (academic degree and engineering colleges) and ensure its effective enforcement. Conduct exposure of technical know how and trainings necessary to understand application of new technologies, Ensure frequent and integrated assessment with teaching process, Ensure use of varieties of assessment tools (written and oral test, tutorials, and presentations), and Establish performance based assessment, Conduct review and ensure consistent and rigid academic calendar, Conduct the process of curriculum revision in all level of management (departments, instruction committee, academic council and floor) with up-to-date review and integrating Conceiving - Designing - Implementing - Operating (CDIO) model. Conduct the process of curriculum revision in all level of management (departments, instruction committee, academic council and floor) with up-to-date review and integrating Conceiving - Designing - Implementing - Operating (CDIO) model, Preserve rigor and breadth of coverage in the curriculum of every discipline based on market needs, Initiate for continuing education and lifelong learning through professional organizations. Ensure the Sequence of curriculum organization, such that it leads students to; entry level employment, job advancement, entrepreneurship, education and training, personal use etc. Start implementing quality assurance scheme and complete the first cycle of evaluation within a year in all departments leading to accreditation in short-term period (5years), Conduct regular peer-review for new engineering institutions and activities for the accreditation of engineering qualifications establishing substantial equivalence, Develop classroom delivery developing web-based learning in engineering education, Initiate for the conformity of ISO 9000 standards quality of engineering education, Conduct review of the process of Exams making it objective. Ensure uniformity in the basis of entry eligibility (eligibility criteria should be Physical group in pre-engineering level (+2/ I.Sc.)) in higher engineering education (B.E. Level), etc.

Table 53

Job-Market Strategy

Items	High percent	Low percent
S90	93.5	1.3
S91	93.0	1.3
S92	93.9	0.4
S93	93.9	0.9
S94	85.7	2.2
S95	93.9	1.3
S96	92.2	1.3
S97	86.5	3.9
S98	91.7	0.4
S99	93.9	1.7

There were ten strategy statements in strategy of job-market. Data showed that all of those strategies were highly supported by respondents. The mathematical ranking of distinction (80 percent and above), as the outstanding ranking, has been taken as the basis of marking prominent strategies. Following this benchmark, all of the statements have scored more than 80 percent. Eight statements scored more than 90 percent.

Those statements in highest priorities are as follows: Ensure quality academic performance; establish periodic review and monitoring of the academic performance, Conduct research works by establishing Research & Development centres and identify the critical and conventional areas of jobs thus canalizing necessary human resources, Conduct internships/ on-the-job-training as a practical learning in engineering education, Encourage effective networking and exchange programs with other reputed academic institution within the region and abroad, organize exposure of faculties in different industries, Establish industry – academic institute collaboration for need based research, Develop institution to produce the quality of human resource as demanded by global market, changing needs of society and as per the requirements of the technology development, Develop market relevance courses in academic programs with sufficient contribution on manner and values, Ensure regular and realistic market feedback as an input for course design, Establish global connections and review the market trends thus procuring necessary human resources in global market, Ensure academic decentralization in institution's administrative structure to response the market demand, Strengthen private public partnerships for assessment of the academic performance of students and market response of their performances,

To summarise the discussion concerning research question 6, the following essences are drawn;

Analysis was done of mean values of responses to find the deviations of opinions of the respondents on the strategy statements.

The mean values of the rating on financing strategy were similar and in the lower range of the faculty & student and slightly higher of the employer & policy makers. The mean values of all respondents except student were in the similar range and of the student in the slightly lower range on strategy for faculties and their role.

The mean values of the rating of all the respondents were similar and in the lower range on equity and access strategy. The mean values of rating of all the respondents were in the same range on management and institutional development strategy. The strategy for students' role was marked slightly higher by employer and lower by policy makers. The strategy for socio-cultural imperative was more emphasized by employer and marked in the higher side compare to other respondents. All the respondents rated in the similar range on the infrastructure strategy. The mean values for strategy for curriculum and assessment system were very high indicating high emphasis by all the respondents. Employers have marked still higher compare to other respondents. The mean value of rating of policy makers was higher compare to the values of other respondents on market strategy.

However, the deviations of opinions of the respondents were not substantial in all strategy categories, There were small differences of opinions between respondents in some individual statements. Faculties rated slightly higher on S35. Students rated higher on S43. Faculties rated higher on S46. Employer rated higher on S53. Employer rated higher on S94. Faculties rated higher on S95.

Despite the fact that the respondents marked all the statements as highly considerable, the outstanding statements 20 percent from above have been marked as most prominent statements in all categories as follows;

The prominent statements in category-financing are, more investment for supporting research and innovation and new educational technologies, and efficient utilization of available human, financial and material resources.

The prominent statements in category-financing are, allocating appropriate budget for research and innovation, and allocating appropriate budget for new technologies.

The prominent statements in category-faculties and their role are, starting and establishing dynamic teaching and research process in higher engineering education, and establishing system of continuing professional development of faculties, supporting and encouraging participation of faculties in regional conferences, workshops and electronic conferences, providing internet facilities and encouraging publications over internet.

The prominent statements in category-equity and access strategies are, encouraging government for financial assistance, manage financial assistance by reliable organizations to needy students, develop financing model with bank loan facilities and target subsidies to poor and needy students with a focus on reducing inequalities, discouraging inefficiencies and encouraging incentives for positive innovation and generation of additional resources, and starting support programs for students from marginalized areas in pre-engineering level for building their capacity to compete in entry level of higher engineering education.

The prominent statements in category-management strategies are, conducting periodic meetings of all departments, committees and centres and arrange discussions on strategies, challenges and programs, and developing norms and regulations to guide the behaviours of the management, faculties and staffs and avoid ad-hoc decisions.

The prominent statements in category-students and their activities are, encouraging academic and professional key skills, such as; publications of journals, new-letters web etc, interpersonal team working, presentation skill and ICT skills, and orienting students for; well prepared to be leading engineers, as well as researchers, with a clear understanding of the strategic value of their area.

The prominent statements in category-socio-cultural imperatives are, developing curriculum such that students can understand societal strategies and social implication of technology, and promoting public understanding of engineering and technology.

The prominent statements in category-infrastructure strategies are, developing functional electronic network with national & international reputed institution's libraries, and establishing monitoring & evaluating unit for physical and academic infrastructure & their quality.

The prominent statements in category-curriculum strategies are, initiating curriculum reform synchronized with global courses and schedules, conducting review of failure rate in all regular exam, identify causes and apply corrective measures, ensuring technology development in a socially beneficial way/direction by updating prevailing technology and introducing new technology in the institution, and initiate for regional agreements between educational institutions and insure conformity of Nepalese engineering degree.

The prominent statements in category-job-market strategies are, ensuring quality academic performance, establishing periodic review and monitoring of the academic performance, and conducting research works by establishing Research & Development centres and identifying the critical and conventional areas of jobs thus canalizing necessary human resources.

CHAPTER V

SUMMARY, FINDINGS AND CONCLUSIONS

Introduction

This study supplements the body of knowledge on the status of engineering education in Nepal. More specifically, the study analyzed and described current issues influencing quality of engineering education and reform strategies associated with the quality of engineering education.

A descriptive research methodology was employed for this study. The respondents surveyed in this study were policy makers, faculties, student and employers. The policy makers comprised of authorities from; Nepal Engineering Council, ministry of education and sports, management of engineering colleges and concerned universities. The faculties comprised of professors, associate professors and senior lecturers from different universities. The student comprised of final year engineering students in bachelor level, i.e. graduating engineers. The employers comprised of consultants and government departments. The survey procedure took long time. The survey was conducted from August 2007 to February 2008. Based on the information received from the survey, data were analyzed and presented in the previous chapter IV. This chapter summarises the nature of the problem, methodology and the findings of the study. Based on the findings, conclusions are drawn and discussed.

Summary

Poverty is widespread in Nepal. Almost half of the population is below the poverty line. In spite of improvements in basic social and economic infrastructures, Nepal still lags behind other south Asian countries in most areas of social and economic development (Joshi, 2004). The unemployment and underemployment are serious problems in Nepal. The underemployment problem is even more severe in Nepal and is estimated to be 38.4 percent in the rural areas and 15.7 percent in the urban areas (CBS, 2003). The literacy rate for the year 2001 is 53.7 per cent (CBS, 2003).

Globalization has globalized the economy, society, industry and education (Rahman, 2003). For every country, economic growth is the major agenda. There has been the paradigm shift in the belief of education. Engineering education has become the instrument for economic growth. Education is widely accepted as a leading instrument for promoting economic growth. To be more precise, engineering education can lead to economic growth through both private and public channels. The private benefits for individuals are well established and include better employment prospects, higher salaries and great ability to save and invest. These benefits may results in better health and improved quality of life, thus setting off a virtuous spiral in which life expectancy improvements enable individuals to work more productively over a longer time further boosting lifetime earnings (Bloom, 2004).

Fast pace of technology development has brought paradigm shift. Education as understood now and then has changed. The society has to be developed technologically literate one. In the course of time, it has become inevitable for the population to be prepared for knowledgeable about technology- its evolution, systems, techniques, utilization, ethical considerations, and social and cultural significance (Lin, 2004).

There is the gap between the needs of the quality engineering education and the performance of the engineering graduates. In the course of time, there has been a dire need of effective and competent high skilled human resources in Nepal (NPC, 2003). Human capital is the greatest natural resource of any country. A country can be prosperous if the capabilities of the people are improved and upgraded. Engineering education can be instrumental in improving and upgrading the capabilities of people.

In the course of time, there has been the paradigm shift in understanding education. Nepalese policy makers have given attention on the development of engineering education. In spite of sizeable investment from private sector in engineering education, the quality remained low. The competency requirement of the entry level professional practice is not satisfactory (Aryal, 2006).

In most countries, the competency is measured on the basis of performance of the graduate. The knowledge, skill, attitude and preparedness of the engineering graduate to discover, create and solve confronting problems. And therefore create or hold job and move horizontally and/ or vertically up to the professional spectrum. A review of recent studies (Paudel, 2006; Bhattarai, 2004; Aryal, 2006; Joshi, 2004; NPC, 2004; IOE, 2005; UGC, 2004; Suwal, 2006 & Shrestha, 2006) revealed that there has a need for immediate action for improving engineering education program in Nepal for increasing employment and earning capacity of the engineering graduates. These studies have also suggested the need for comprehensive and functional engineering education policy which enhances the knowledge and skill to improve the employment and productivity of the Nepalese human resource.

In order to improve employment and productivity of the Nepalese human resource, Nepal is in need of an appropriate engineering education policy. Selecting appropriate policy options that are meaningful and usable for producing competent engineer is complex phenomena. Consensus of key role players, namely; policy makers, faculties, employers, students etc. is extremely important to formulate effective engineering education policy that is responsive to employment and productivity of the Nepalese human resource. By understanding the perceptions of major stakeholders successful engineering education program can be designed. In order to formulate meaningful and usable engineering education policies to support employment and productivity of the Nepalese thus promoting economic growth of the country, it is essential to examine existing issues and identify reform strategies to resolve those issues.

Purpose of Study

This study analyzed and described current issues and future reform strategies associated with the engineering higher education in Nepal. The problem of the study was to identify the governing issues influencing the quality of engineering higher education and to suggest future reform strategies to resolve these issues.

The study addressed the following six research questions:

1. To the observation of respondent groups, what is the existing and desired level of competence of graduates on quality engineering education in Nepal?
2. Is there a significant difference between the values of level of competence of graduates on quality engineering education in Nepal in the observation of respondent groups?

3. What are the issues influencing quality of higher engineering education in Nepal in the observation of respondent groups?
4. Is there a significant difference between the issues influencing quality of engineering education in Nepal as identifies by the respondent groups?
5. What are the strategies in resolving these issues influencing quality in order to reform higher engineering education in Nepal?
6. Is there a significant difference between the observations of respondent groups on the strategies for reforming higher engineering education in Nepal?

Procedure

A survey methodology was employed to collect data for this study. Survey instrument was prepared after wide-ranging and vigorous review of related literatures. The survey instrument consists of; (a) eight items related to demographic information of the respondents, (b) thirty items related to competencies required to entry level engineering professional practice in two column- existing and desired level in the form of Likert-type statements, (c) ninety-nine items related to issues influencing quality of engineering education in the form of Likert-type statements, (d) ninety-nine items related to reform strategies to resolve issues influencing quality of engineering education in the form of Likert-type statements, (e) the instrument also allowed respondents to express additional comments in the third part.

After pilot testing and necessary revisions, the survey instrument along with the cover letter was personally given to respondents by researcher. The questionnaire was distributed to 41 policy makers, 68 faculties, 202 students and 63 employers. Out of 374 questionnaires distributed, only 246 usable responses were received. Follow up e-mail, mobile message and telephone were made for early response on the questionnaire.

Responses received were analyzed using descriptive and inferential statistics. Tables and graphs were used to display frequencies, means, percentages and other statistics. Respondents were grouped according to their organizational affiliation, academic back ground, gender, experience and age range. Analysis of variance supplemented by the Scheffe's Range Test was used to determine if differences in perceptions existed among the groups of policy makers, employers, faculties and students. Descriptive analysis supplemented the priorities of the statements and therefore, prominent statements were identified. The Statistical Package for the Social Sciences (SPSS) was utilized for analysis of data. The findings of the study are organized around six research questions of the study.

Summary of Findings

Findings of this study are organized and presented in relation with six research questions.

Research Question 1

The existing and desired level of competence of graduates

The main parameters representing competencies requirements for entry level engineering professional practice were found to be categoryed in four categories: 1) Basic knowledge and skill, 2) Specific professional capacity, 3) Understanding society and social phenomena and, 4) Management and leadership. Attempt was made to collect the opinions of the respondents on the existing level of competency in the graduating engineer and also on the desired level of these competency-parameters to cope market demands.

In every category, statistical analysis was made to find most prominent statements in the perception of respondents.

1. Basic Knowledge and Skill

   Less than 37 percent of the respondents responded either very good or excellent level on basic knowledge and skill. The majority of the respondents (63 percent) agreed that present state of condition of basic knowledge and skill capacity of graduating engineers is either satisfactory or poor.

   Whereas, almost 90 percent of the respondents agreed the desired level of state of condition of basic knowledge and skill capacity of graduating engineers should be either very good or excellent.

2. Specific Professional Capacity

   Among the total respondents, only 20 percent or less numbers of respondents agreed on the existing level of specific professional capacity of graduating engineers to be either very good or excellent. Almost 50 percent respondents gave the lowest rating stating on the existing level of specific professional capacity to be either poor or fair.

   Whereas, almost 90 percent respondents agreed the desired level of specific professional capacity of the graduating engineers to be in the level of either very good or excellent.

3. Understanding Society and Social Phenomena

   Among the total respondents, only 18 percent or less numbers of respondents agreed on the existing level of understanding society and social phenomena of graduating engineers to be either very good or excellent. Almost 60 percent respondents gave the lowest rating stating on the existing level of understanding society and social phenomena to be either poor or fair.

Whereas, almost 90 percent respondents agreed the desired level of understanding society and social phenomena of the graduating engineers to be in the level of either very good or excellent.

4. Management and Leadership

   Among the total respondents, only 18 percent or less numbers of respondents agreed on the existing level of management and leadership of graduating engineers to be either very good or excellent. Almost 60 percent respondents gave the lowest rating stating on the existing level of management and leadership to be either poor or fair.

   Whereas, almost 90 percent respondents agreed the desired level of management and leadership of the graduating engineers to be in the level of either very good or excellent.

Research Question 2

Significant difference between observations of respondent groups on level of competence of graduates

All 30 statements on the competency requirements for the entry level engineering professional practice were grouped in four categories and the level of significance was tested from analysis of variance. There were no significant differences in these categories in the responses of the policy makers, employers, faculties and students. While selecting prominent statements in the competency area by the use of descriptive analysis, some interesting picture appeared on the surface.

1. More than 90 percent of the respondents strongly agreed the desired level of competencies requirements of the entry level engineering professional practice to be either very good or excellent.
2. The existing level of graduating engineer on basic knowledge and skill is not weak but need to be improved.
3. To the opinion of the respondents, considering four categories, the existing level of graduating engineers is relatively weak in; understanding society and social phenomena, and management and leadership of professional works. More specifically, graduating engineers are weak in; understanding socio-cultural context of the country; project management and leadership; understanding sustainable development; etc.
4. Considering the responses of respondents on desired level, they gave the highest priority to the basic knowledge and skill and specific professional capacity. More specifically, the first ranking statement was concerned with electronic communication capacity, the second and third statements were concerned with specific professional capacity. Among the high ranked statements five numbers were related with communication skill. This is an indicative that basic knowledge and skill, though exists in satisfactory level, need to be further developed.

Research Question 3

The issues influencing quality of higher engineering education in Nepal

The main issues influencing the quality of engineering education were found to be categorised in nine categories. These categories were related to; financing in Engineering Education, Faculties and Their Role, Equity and Access, Management and Institutional Barriers, Students and Their Activities, Socio-Cultural Imperatives, Infrastructure Issues, Curriculum and Assessment System, Job Market and Its Reality etc.

1. Financing in Engineering Education

   Among the respondents, 79 percent respondents either strongly agreed or agreed that financial issue is governing factor influencing quality of engineering education. About 15 percent respondents were neutral to accept the financial aspect as the influencing factor in achieving quality of engineering education.

2. Faculties and Their Role

   Data showed that 85 percent of the respondents either strongly agreed or agreed that the faculties and their role is the major issue in influencing engineering education. About 11 percent respondents were neutral in this issue and 3 percent respondents disagreed, 1 percent strongly disagreed on the issue.

3. Equity and Access

   Data showed that 76 percent of the respondents either strongly agreed or agreed the equity and access as the major issue in influencing engineering education. 17 percent of the respondents were neutral in this issue and 3 percent respondents disagreed, 2 percent strongly disagreed on the issue.

4. Management and Institutional Barriers

   Data showed that 88 percent of the respondents either strongly agreed or agreed the management and institutional barrier as the major issue in influencing engineering education. 10 percent of the respondents were neutral in this issue and 2 percent respondents disagreed, 1 percent strongly disagreed on the issue.

5. Students and Their Activities

   Data showed that 84 percent of the respondents either strongly agreed or agreed students and their activities as the major issue in influencing engineering education. 13 percent of the respondents were neutral in this issue and 2 percent respondents disagreed.

6. Socio-Cultural Imperatives

   Data showed that 83 percent of the respondents either strongly agreed or agreed the socio-cultural imperatives as the major issue in influencing engineering education. 13 percent of the respondents were neutral in this issue and 3 percent respondents disagreed, 1 percent strongly disagreed on the issue.

7. Infrastructure Issues

   Data showed that 87 percent of the respondents either strongly agreed or agreed the infrastructure issue as the major issue in influencing engineering education. 10 percent of the respondents were neutral in this issue and 2 percent respondents disagreed, 1 percent strongly disagreed on the issue.

8. Curriculum and Assessment System

   Data showed that 87 percent of the respondents either strongly agreed or agreed the curriculum and assessment system as the major issue in influencing engineering education. 10 percent of the respondents were neutral in this issue and 2 percent respondents disagreed, 1 percent strongly disagreed on the issue.

9. Job Market and Its Reality

   Data showed that 83 percent of the respondents either strongly agreed or agreed the job-market issue as the major issue in influencing engineering education. 13

percent of the respondents were neutral in this issue and 3 percent respondents disagreed, 1 percent strongly disagreed on the issue.

10. Other Issues

    The respondents had also marked some of the issues in the space left for respondents' opinion in the part of open ended question, namely; politicization, research and development and policy issues.

    Large numbers of respondents (83 percent) responded that politicization has been the issue influencing quality of engineering education. They indicated that the students, faculties and staffs are all politicizing to satisfy their vested interest and quality is left in the second priority. Some of the respondents (45 percent) gave the opinion that absence of research and development in the engineering education is one of the issues for the degradation of the quality. Sufficient numbers of respondents (56 percent) gave the opinion that the policy issues are very much responsible for the quality of engineering education.

Research Question 4

Significant difference between the observations of respondent groups on the issues influencing quality of engineering education in Nepal

All statements regarding issues influencing the quality of engineering education were grouped in nine categories and the level of significance was tested from analysis of variance for every category taking level of significance by 5 percent. There were significant differences in different level in these categories in the responses of the policy makers, employers, faculties and students.

To find which respondent responded significantly in different way, Scheffe's Range Test was done. This test identifies that this difference of opinion appeared in the analysis was due to the fact that the means calculated in the statistical analysis was for homogeneous samples. But, in this study, the sample sizes of responding groups are varying significantly, i.e. students 123, employers 33, policy makers 32 and faculties 58. For this, calculation of geometrical means is more appropriate and ANOVA does not permit this.

In the data for all the groups, the means for homogeneous samples has been displayed and as the sample sizes are significantly different, the level of significance is obviously high. The group sizes are different and due to this factor this types of error has appeared.

Most Prominent Issues

The prominent issues in each category were identified with the help of descriptive statistical analysis. Prominent issues are the issues which are primarily given emphasis by the respondents.

Taking the basis of opinions of 80 percent and more respondents either agreed or strongly agreed on the statements, following statements in different issue categories are marked as the most prominent issues;

1. Most prominent financial issues

   There is a need of more investment for supporting research and innovation and new educational technologies. There is a need for efficient utilization of available human, financial and material resources. There is a need of more investment for new educational technologies. There is a need for review of work-load of faculties and staffs of the engineering colleges to identify financial burden.

2. Most prominent faculty issues

   There is a need for dynamic teaching and research process in higher engineering education. There is a need for periodic meetings and discussions of faculties to maintain the quality standards. There is a need for joint research or design project within colleges and with other stakeholders (industries, employers etc). There is a need for developing and implementing long term planning of faculty development. There is a need for shift of teaching methodology from conventional (explanatory-one-way traffic method, formal technique, monotonous & insensible, spoon feeding model, course completion oriented) to interactive practice. There is a need for faculty development and retention programs (career path, incentives, benefits, trainings and education opportunities). There is a need to minimize politicization and impulsive intervention in recruitment of the faculties. There is a need for sufficient remuneration of faculties. There is a need for vigour in faculties to remain relevant or competitive.

3. Most prominent equity and access issues

   There is a need for provision to provide access to engineering education for competent students living in remote and poverty stricken areas. There is a need for financial support in terms of loan or scholarship to the competent students from marginalized areas. There is a need to develop a system with guidelines and processes to identify meritorious and needy students. There is a need to develop a system with guidelines and processes to ensure the fair distribution of scholarship/loan to the poor students. There is a need for special financial support from government to marginalized students.

4. Most prominent management issues

   There is a need for accountability and transparency in management. There is a need for smooth functioning of routine works in the institution. There is a need for visionary leadership in academic institutions to drive the institution with clear vision and strong determination. There is a need for norms and regulations to guide the behaviour of management, faculties, staffs and students. There is a need for optimum use of resources and practice simple tools of management to enhance efficiency and effectiveness in the management. There is a need for delegation of authority to different levels of management and develop a mechanism for monitoring implementation of rules and regulations. There is a need for wider participation of stakeholders (students, faculties, employers, parents, politicians, policy makers etc.) in policy making in engineering education. There is a need for harmony within the institution eliminating intra-institutional Barriers, such as; inter-departmental issues, perception of cost and time, work culture, incentive structure to promote quality. There is a need to identify dysfunctional components in the engineering institutions. There is a need for advisory team comprising of senior faculties and persons from former management bodies.

5. Most prominent student issues

There is a need for clear and transparent regulation and practices for Students' fee structure, scholarships and education loan. There is a need for students' motivation to learn and continuous assessment of students' learning (knowledge and skills). There is a need for support in graduate research/project works. There is a need to orient students for ethical and moral values. There is a need for resource personnel for career guidance to students. There is a need for providing counselling on career guidance services to students. There is a need for enhancing Students' competencies (interpersonal, team working and ICT skills). There is a need for developing proper program to address the students' mobility. There is a need for developing positive approaches of protecting rights and values of students in institution.

6. Most prominent socio-cultural issues

   There is a need for drawing the attention of engineers in societal issues. There is a need to persuade the benefits of engineering and technology in the society. There is a need for increase in value of social image of the engineers. There is a need for developing collaboration culture among students, faculties and managements to reduce conflict among them due to political influences. There is a need to create ability among students to improve traditional technology within social context. There is a need to draw the attention of policy makers on increasing role of “integrated” engineering (integration of all discipline). There is a need to establish good relationship within and outside institutions to reduce tensed cross-cultural relation and ensure effective implementation of engineering service delivery.

7. Most prominent infrastructure issues

   There is a need of rich library with sufficient reading and research facilities. There is a need for electronic network with national & international reputed institution's libraries. There is a need for sufficient text books, reference books & other extra curricular books, journals, newspaper & magazine documentation centre, etc. in library and their updating and replacement. There is a need for renovation of laboratory instruments. There is a need for investment in infrastructure development for quality improvements. There is a need for adequate infrastructure (buildings, laboratories, libraries etc.), physical facilities necessary for the program goals of the institution. There is a need for periodic repair and maintenance of infrastructures. There is a need for strengthening and upgrading existing outmoded infrastructures and incorporating current technologies. There is a need for provision of critical infrastructure construction, re-construction and protection. There is a need of proper inventory system with monitoring and evaluation physical and academic infrastructures and assessment of physical environment.

8. Most prominent curriculum issues

   There is a need for review of breadth and depth of subject coverage in the curriculum based on market needs. There is a need for updating prevailing technology and introducing new technologies in the institution. There is a need for systematic evaluation of; institutional performance; course prescribed; administrative practices; feedback system from lower to higher level and from students on course taught. There is a need for conformity of standard of Nepalese graduates with standard abroad. There is a need for developing and enforcing national standards for engineering education (academic degree and engineering colleges). There is a need to develop curriculum responsive to labour market needs resulting in job advancement, entrepreneurship, education and training. There is a need for regular peer-review for new engineering institutions and accreditation of engineering qualifications. There is a need to develop a system for designing curriculum from all levels of management, departments to faculties, in the institution. There is a need to establish the provision for continuing education and lifelong learning in engineering education.

9. Most prominent job-market issues

   There is a need for providing on-the-job learning experiences (experimental learning opportunities) in engineering education. There is a need of collaboration between industry and academic institution for need based delivery and research. There is a need for effective networking and exchange programs with different academic institution and industries with in and outside the country. There is a need for a mechanism of receiving regular information and feedback from job market. There is a need for matching between engineering graduates especially in academic programs and job market. There is a need to respond new challenges posed by increasing liberalization economy in higher engineering education in Nepal. There is a need for delegation of academic authority to departments and faculties to enhance ability to serve the market demand. There is a need to develop private public partnerships for assessment of the academic performance of students and market response to their performances. There is a shortage of skilled human resource in some critical areas and are in over supply of engineering graduates in conventional areas.

Research Question 5

The strategies in resolving issues influencing quality in order to reform higher engineering education in Nepal

The main reform strategies to resolve the pertinent issues influencing the quality of engineering education were found to be categorised in nine categories. These categories were related to; financing in Engineering Education, Faculties and Their Role, Equity and Access, Management and Institutional Development, Students and Their Activities, Socio-Cultural Imperatives, Strategy for Infrastructure, Strategy for Curriculum and Assessment System, Job Market Strategy etc.

1. Financing in Engineering Education

   Data showed that 78 percent of the respondents either strongly agreed or agreed on the financial strategy as the major component for reforming engineering education. 17 percent of the respondents were neutral in this issue and 4 percent respondents disagreed, 1 percent strongly disagreed on this strategy.

2. Faculties and Their Role

   Data showed that 91 percent of the respondents either strongly agreed or agreed on the strategy for faculties and their role as the major component for reforming engineering education. 7 percent of the respondents were neutral in this issue and 2 percent respondents disagreed, 0 percent strongly disagreed on this strategy.

3. Equity and Access

   Data showed that 79 percent of the respondents either strongly agreed or agreed on the financial strategy as the major component for reforming engineering education. 15 percent of the respondents were neutral in this issue and 3 percent respondents disagreed, 1 percent strongly disagreed on this strategy.

4. Management and Institutional Development

   Data showed that 87 percent of the respondents either strongly agreed or agreed on the financial strategy as the major component for reforming engineering education. 11 percent of the respondents were neutral in this issue and 2 percent respondents disagreed, 0 percent strongly disagreed on this strategy.

5. Students and Their Activities

Data showed that 86 percent of the respondents either strongly agreed or agreed on the strategy for students and their activities as the major component for reforming engineering education. 12 percent of the respondents were neutral in this issue and 2 percent respondents disagreed, 0 percent strongly disagreed on this strategy.

6. Socio-Cultural Imperatives

   Data showed that 79 percent of the respondents either strongly agreed or agreed on the financial strategy as the major component for reforming engineering education. 15 percent of the respondents were neutral in this issue and 3 percent respondents disagreed, 2 percent strongly disagreed on this strategy.

7. Strategy for Infrastructure

   Data showed that 85 percent of the respondents either strongly agreed or agreed on the infrastructure strategy as the major component for reforming engineering education. 13 percent of the respondents were neutral in this issue and 2 percent respondents disagreed, 0 percent strongly disagreed on this strategy.

8. Curriculum and Assessment System

   Data showed that 87 percent of the respondents either strongly agreed or agreed on the curriculum strategy as the major component for reforming engineering education. 11 percent of the respondents were neutral in this issue and 1 percent respondents disagreed, 0 percent strongly disagreed on this strategy.

9. Job Market Strategy

   Data showed that 91 percent of the respondents either strongly agreed or agreed on the job-market strategy as the major component for reforming engineering education. 7 percent of the respondents were neutral in this issue and 1 percent respondents disagreed, 0 percent strongly disagreed on this strategy.

10. Other Strategies

    The respondents had also marked some of the reform strategies to resolve additional issues indicated in the space left for respondents' opinion in the part of open ended question, namely; de-politicization, research and development and policy strategies.

    Large numbers of respondents (78 percent) responded that strategy should be made for de-politicization in the engineering education system to attain quality of engineering education. They indicated that the students, faculties and staffs are all politicizing to satisfy their vested interest and quality is left in the second priority. Some of the respondents (61 percent) gave the opinion that strategy should be made for research and development in the institution to attain quality of engineering education. Sufficient numbers of respondents (64 percent) gave the opinion that the policy strategy is responsible for the quality of engineering education.

Research Question 6

Significant difference between the observations of respondent groups on the strategies for reforming higher engineering education in Nepal

All statements regarding reform strategies to resolve pertinent issues influencing the quality of engineering education were grouped in nine categories and the level of significance was tested from analysis of variance for every category taking level of significance by 5 percent. There were significant differences in different level in these categories in the responses of the policy makers, employers, faculties and students.

To find which respondent responded significantly in different way, Scheffe's Range Test was done. This test identifies that this difference of opinion appeared in the analysis was due to the fact that the means calculated in the statistical analysis was for homogeneous samples. But, in this study, the sample sizes of responding groups are varying significantly, i.e. students 123, employers 33, policy makers 32 and faculties 58. For this calculation of geometrical means is more appropriate and ANOVA does not permit this.

In the data for all the groups, the means for homogeneous samples has been displayed and as the sample sizes are significantly different, the level of significance is obviously high. The group sizes are different and due to this factor this types of error has appeared.

Most Prominent Strategies

The prominent reform strategies in each category were identified with the help of descriptive statistical analysis. Prominent reform strategies are the strategies which are primarily given emphasis by the respondents.

Taking the basis of opinions of 80 percent and more respondents either agreed or strongly agreed on the statements, following statements in different strategy categories are marked as the most prominent strategies;

1. Prominent strategy for financing in engineering education

   Appropriate budget must be allocated for research and innovation and for new technologies. There must be a system of minimize wastage, optimize overheads and encourage efficient and effective use of resources. Establishment of cost control measures with transparent & effective financial management is necessary. Programs has to be designed to find resources and funding from business and industry for academic programs and research in engineering education and also to find resources and funding from private sector for development and expansion of engineering education.

2. Prominent strategy for faculties and their role

   Start and establish dynamic teaching and research process in higher engineering education. Establish system of continuing professional development of faculties, Support and encourage participation of faculties in regional conferences, workshops and electronic conferences, Provide internet facilities and encouraging publications over internet. Develop institutional set-up, formulate comprehensive guidelines and conduct transparent procedures of faculties' recruitment. Develop, implement, and assess new instructional models, materials, and learning environments. Encourage faculties for Joint research or design projects within college and with other stakeholders. Develop a teacher management system that includes teacher education and training and conditions of service (appointment, deployment, transfer, salaries and benefits, career path etc.) Ensure technical competency of faculties that includes all requirement for certification and credentialing, evaluation includes; technical competency, instructional competency/certification, and technical updating. Motivate the faculties in the job by involving in continuing education program, consultancy services, and research projects, thus encouraging for additional remuneration. Prepare next generation of faculty and professionals wishing to pursue work in the field of engineering education. Coordinate and facilitate discussions to maintain the required quality standards of faculties, Set, maintain and control the quality standards of faculties

3. Prominent strategy for equity and access

   Encourage government for financial assistance, manage financial assistance by reliable organizations to needy students, Develop financing model with bank loan facilities and target subsidies to poor and needy students with a focus on reducing inequalities, discouraging inefficiencies and encouraging incentives for positive innovation and generation of additional resources. Start supporting programs for students from marginalized areas in pre-engineering level for building their capacity to compete in entry level of higher engineering education. Formulate the guidelines and processes to distribute scholarship to meritorious and needy students through the participation of stakeholders (students, faculties). Organize a system of selecting bright students from different regions in the scholarship scheme in the engineering education

4. Prominent strategy for management and institutional development

   Conduct periodic meetings of all departments, committees and centres and arrange discussions on issues, challenges and programs. Develop norms and regulations to guide the behaviours of the management, faculties and staffs and avoid ad-hoc decisions. Simplify the methods of management and maintenance and make it output oriented, optimize the utilization of available space and equipment, make mandatory the periodic performance audit of campuses. Ensure dynamic and visionary leadership in all level of administration. Establish mechanism to entertain advices and guidance in design, development, operation, evaluation initiatives in the institution from; former deans, assistant deans, campus chiefs; senior professors and educational experts. Ensure and monitor routine works of the institutions, such as; conduction of defined meetings, recruitment practices, compliance with audit observation, academic monitoring, public information etc.(as important job of heads-Deans, principals/campus-chiefs, HOD etc.). Formulate detail job description for all level of management of staffs and ensure their role, responsibility, authority and accountability in the institution, provide an added mechanism of accountability of the process, through public disclosures of its progress. Identify and Chuck-out dysfunctional components in the engineering institution. Ensure financial, academic and management authority in the autonomy of institution, such as; appointment of staff on contract, term extension of contract faculties, staff selection appointment and dismissal, acceptance of resignation, frame policies and regulations on academic and administrative affairs, formulate financial regulations etc. Ensure dedicated and more concerned stakeholders (faculties, students, parents, industry, politicians, policy makers etc.) in management & development council/ authorities; in the engineering institutions.

5. Prominent strategy for students and their activities

   Encourage academic and professional key skills, such as; publications of journals, new-letters web etc, interpersonal team working, presentation skill and ICT skills. Orient students for; well prepared to be leading engineers, as well as researchers, with a clear understanding of the strategic value of their area. Establish a system of Meaningful Career Counselling/social/emotional counselling mechanism. Encourage student led performances as a part of curricula, co-curricula and extra-curricula activities. Ensure supports (financial and academic guidance) for students' project works. Develop relevant programs to address students' mobility. Ensure availability of resource personnel to provide career guidance services. Fix

Minimum & maximum fee structure in cost basis for quality improvement, formulate proper scholarship scheme and introduce education loan. Support the students' activities concerning their rights and values

6. Prominent strategy for social- cultural imperatives

   Develop curriculum such that students can understand societal issues and social implication of technology. Promote public understanding of engineering and technology. Make efforts in the application of engineering and technology for poverty eradication developing traditional technology. Establish cross cultural harmony and inter-university and institutional cooperation, including fellowships. Make periodic campaigns to establish status and social image of the engineer in the community.

7. Prominent strategy for infrastructures

   Develop functional electronic network with national & international reputed institution's libraries. Establish monitoring & evaluation unit for physical and academic infrastructure & their quality. Ensure renovation of laboratory instruments. Ensure sufficient text books, reference books & other extra curricular books, journals, newspaper & magazine documentation centre, etc. in library and also update and replace them regularly. Ensure physical facilities, equipment and tools used in the program and be of the quality and type needed to training to meet the program goals and performance objectives, ensure that facilities and equipment shall effectively accommodate the number of students, instructors, support staff and program objectives. Ensure copy, documentation and database facilities in the library. Develop Infrastructures in accordance with the new paradigm in engineering education. Prepare a data base of all infrastructures and conduct periodic repair and maintenance. Ensure that there are in sufficient quantity and quality of critical infrastructures to meet the instructional objectives and needs of the academic program. Strengthen and/or replace outmoded infrastructures, ensure Infrastructures to reflect current technologies and applications. Provide grant, soft loan, aid & donation for infrastructure development & quality improvement.

8. Prominent strategy for curriculum and assessment system

   Initiate curriculum reform synchronized with global courses and schedules. Conduct review of failure rate in all regular exams, identify causes and apply corrective measures. Ensure technology development in a socially beneficial way/direction by updating prevailing technology and introducing new technology in the institution. Initiate for regional agreements between educational institutions and insure conformity of Nepalese engineering degree. Develop national norms and standard for engineering education (academic degree and engineering colleges) and ensure its effective enforcement. Conduct exposure of technical know how and trainings necessary to understand application of new technologies. Ensure frequent and integrated assessment with teaching process, Ensure use of varieties of assessment tools (written and oral test, tutorials, presentations), Establish performance based assessment. Conduct review and Ensure consistent and rigid academic calendar. Conduct the process of curriculum revision in all level of management (departments, instruction committee, academic council and floor) with up-to-date review and integrating Conceiving - Designing - Implementing - Operating (CDIO) model. Conduct the process of curriculum revision in all level of management (departments, instruction committee, academic council and floor) with up-to-date review and integrating Conceiving - Designing - Implementing - Operating (CDIO) model. Preserve rigor and breadth of coverage in the curriculum of every discipline based on market needs. Initiate for continuing education and lifelong learning through professional organizations. Ensure the Sequence of curriculum organization, such that it leads students to; entry level employment, job advancement, entrepreneurship, education and training, personal use etc. Start implementing quality assurance scheme and complete the first cycle of evaluation within a year in all departments leading to accreditation in short-term period (5years). Conduct regular peer-review for new engineering institutions and activities for the accreditation of engineering qualifications establishing substantial equivalence. Develop classroom delivery developing web-based learning in engineering education. Initiate for the conformity of ISO 9000 standards quality of engineering education. Conduct review of the process of Exams making it objective. Ensure uniformity in the basis of entry eligibility (eligibility criteria should be Physical group in pre-engineering level (+2/ I.Sc.)) in higher engineering education (B.E. Level).

9. Prominent job-market strategy

   Ensure quality academic performance, establish periodic review and monitoring of the academic performance. Conduct research works by establishing Research & Development centres and identify the critical and conventional areas of jobs thus canalizing necessary human resources. Conduct internships/ on-the-job-training as a practical learning in engineering education. Encourage effective networking and exchange programs with other reputed academic institution within the region and abroad, organize exposure of faculties in different industries. Establish industry –

academic institute collaboration for need based research. Develop institution to produce the quality of human resource as demanded by global market, changing needs of society and as per the requirements of the technology development. Develop market relevance courses in academic programs with sufficient contribution on manner and values. Ensure regular and realistic market feedback as an input for course design, Establish global connections and review the market trends thus procuring necessary human resources in global market. Ensure academic decentralization in institution's administrative structure to response the market demand. Strengthen private public partnerships for assessment of the academic performance of students and market response of their performances.

Conclusions

Six research questions guided the researcher during this study. Those research questions helped to document how the policy makers, employers, faculties and students perceive the status of competency requirements for entry level engineering professional practice, the key issues influencing quality of engineering education and reform strategies to resolve those issues and achieve quality engineering education. Based on the findings for each of the research questions, several conclusions have been drawn by the researcher.

1. The graduating engineers coming into the engineering professional practice have satisfactory level of basic knowledge and skills; however, this is not enough to cope with present day confronting engineering problems. The basic knowledge and skill enhancing components must be included in the curriculum of engineering education. The emphasis should be given on the communication skill and the skill of demonstrating full responsibility for own actions and decisions.

2. The graduating engineers are found to further build the capacity on identify, formulate, and solve engineering problems. Besides, emphasis should be given on the practice of principles of sustainable development.
3. Graduating engineers' capacity must be build to analyze the impact of the engineering service on society and also to analyze economic and financial consequences of engineering projects.
4. More investment should be allocated for supporting research and innovation and new educational technologies. Besides, efficient utilization of available human, financial and material resources in engineering education is must. It is also suggested to develop cost control measures in the institutions.
5. A comprehensive human resource development program must be formulated along with the long term planning of faculty development, such as; career path, incentives, benefits, trainings and education opportunities and also review of work-load of faculties and staffs of the engineering colleges to identify financial burden. A dynamic teaching and research process must be initiated in higher engineering education. Besides, periodic meetings and discussions of faculties to maintain the quality standards are suggested. It is also suggested to encourage faculties to participate in workshops, seminars and internet discussions.
6. A provision should be developed to provide access to competent students living in remote and poverty stricken areas in engineering education. Besides, programs for financial support in terms of loan or scholarship to the competent students from marginalized areas must be designed. It is also suggested to develop financing model with bank loan facilities and target subsidies to poor and needy students with a focus on reducing inequalities, discouraging inefficiencies and encouraging

incentives for positive innovation and generation of additional resources. Emphasis should also be given on supporting programs for students from marginalized areas in pre-engineering level for building their capacity to compete in entry level of higher engineering education.

7. Accountability and transparency in management is inevitable to achieve quality in engineering education. The emphasis should be given on the smooth functioning of routine works in the institution and also the harmony within the institution eliminating intra-institutional Barriers, such as; inter-departmental issues, perception of cost and time, work culture, incentive structure to promote quality along with the regular meeting and interactions with faculties and staffs on strategies, challenges and programs. Visionary leadership in academic institutions is prerequisite to drive the institution with clear vision and strong determination. More over, Norms and regulations should be developed to guide the behaviours of the management, faculties and staffs and avoid ad-hoc decisions.
8. It is suggested to encourage students the academic and professional key skills, such as; publications of journals, new-letters web etc, interpersonal team working, presentation skill and ICT skills. In addition to this, students should be oriented for; well prepared to be leading engineers, as well as researchers, with a clear understanding of the strategic value of their area. The emphasis should be given to the students' motivation to learn and for continuous assessment of students' learning (knowledge and skills).There is also a need for clear and transparent regulation and practices for Students' fee structure, scholarships and education loan.

9. The attention of engineers should be drawn in societal issues. In addition to this, emphasis should be given to persuade the benefits of engineering and technology in the society. Besides, public understanding of engineering and technology should be promoted.
10. It is suggested to establish monitoring & evaluation unit for physical and academic infrastructure & their quality. Emphasis should be given to develop and enrich library with sufficient reading and research facilities and functional electronic network with national & internationally reputed institution's libraries.
11. Review of breadth and depth of subject coverage in the curriculum based on market needs and updating of prevailing technology and introducing new technologies in the institution is must. Besides, there must be a system of systematic evaluation of; institutional performance; course prescribed; administrative practices; feedback system from lower to higher level and from students on course taught. Along with this, conformity of standard of Nepalese graduates with standard abroad should be done. There is a need to conduct review of failure rate in all regular exams, identify causes and apply corrective measures.
12. On-the-job learning experiences (experimental learning opportunities) should be established in engineering education. Emphasis should be given to the collaboration between industry and academic institution for need based delivery and research. Matching between engineering graduates especially in academic programs and job market is must and also a mechanism should be established to receive regular information and feedback from job market. Besides, it is suggested to conduct research works by establishing Research & Development centres and

identify the critical and conventional areas of jobs thus canalizing necessary human resources.

13. Different programs must be designed for de-politicization in the institutional running to enhance the quality of engineering education.
14. The concrete policy should be made regarding direction of future engineering higher education thus establishing quality of engineering higher education.

Discussions of the Findings

The researcher compared the findings of this study with relevant literature presented in chapter II. Several findings were consistent with the findings presented in this study.

The issues influencing the quality of engineering education and the reform strategies to resolve these issues were consistent with the issues and reform strategies as identified by different international bodies working in the areas of higher education and engineering higher education and also as identified by Nepalese policy makers in engineering education. The formulation of issues and reform strategies in this study was primarily based on the reports from; (IOE-Strategic Plan, 2000; IOE, 2005; The World Bank, 2000; The World Bank, 2001; The World Bank, 2002; The World Bank, 2004; The World Bank, 2005; Paudel, 2006; Aryal, 2006; Joshi, 2004; Bloom, 2005; Lin, 2004; Ashford, 2006; Jones, 2004; Shrestha, 2006; Jones & Reynolds, 2004; Ibrahim, 2002; Jones, 2006; ABET, 2002; ASCE, 2000; WCE, 2006; ASEE, 2003 & ASEE, 2004) and also other national reports related with engineering education in Nepal. The perceptions of the respondents and the issues and reform strategies drawn from the literatures are found to be consistent.

The findings of this study show that respondents are aware of the engineering knowledge and skill and gave high emphasis on the reform strategies. It seems that human resource development through engineering education has drawn the attention of the Nepalese policy makers and employers. Growing awareness was also found in the graduating engineers and faculties on the career development. It is found that the respondents are emphasizing on the understanding of society and social phenomena.

The study also showed significant differences on the performance competency areas. The perspective of students and others are found differing. These differences are perhaps associated with public perceptions. There were no differences in the perception of issues and reform strategies presented in the instrument.

The issues and reform strategies were formulated taking references of different countries in the world and the international experiences of institutions associated with engineering education. All though, this study had dig-out the issues influencing quality of engineering higher education and suggested pertinent reform strategies, their implication depends on the policy makers of the engineering higher education. It seems that policy makers are not fully prepared for the reform of engineering higher education. In addition to this, the feudal-cultural aspect of the society is also impeding on the progressive reforms in engineering education. This attitude encourages the attachment with the authority for the individual benefits.

The literature review was focused fundamentally on the international literatures, as there were limited literatures in this area in Nepal. However, the trend of this study is following universality representing international and domestic context.

Further Research Initiatives

This research has contributed to the body of literature on the present status and issues affecting engineering higher education in Nepal. It has also provided strategies to resolve those existing issues of engineering education. Each of the issues identified in this study may serve as a topic for further study. Further investigations into any of the issues identified in this study would be useful. The researcher offers following recommendations for further research in order to address the significant issues confronting engineering higher education in Nepal.

1. This study should be replicated with other stakeholders to identify their perceptions and expectations. Also, it would be useful to program planners and implementers to determine if there were differences in the perceptions among the groups of stakeholders.
2. Since the study was not designed to include uniform representation of respondents having similar demographic characteristics, findings concerning the influence of demographic variables in the perceptions of respondents on the issues of engineering education can not be conclusive. Therefore, further research is recommended to investigate the influence of demographic variables, such as; education, gender, age and experiences by designing a similar study with uniform representative group samples.
3. A detailed study is essential to identify appropriate financing system in engineering education. In the course of time, demand of engineering education is growing and investment in the infrastructure is heavy. The alternative financing system, such as; demand based or supply based financing, block grants systems, loans and their payback system and mechanism of subsidy are now drawing the attention of researcher.
4. Additional research work should be conducted concerning the management of engineering education institutions. The issue of decentralization, autonomy, intra- and enter-institutions relationships are matters under discussion at present. The

findings derived such study may be meaningful to achieve quality in engineering education.

5. Further research is essential to determine the efficient system of support to the needy students. The issue of equity and access to the marginalized students is now getting momentum and is new area of research.
6. A study should be conducted in the areas of curriculum and students' assessment system. The relevancy of curriculum and its periodic revision and updating process are very important parts. Besides, student evaluation process is getting complex in the course of time. This is indeed ample area of research.
7. A detailed study is essential to determine the market condition and absorptivity of graduating engineer in the entry level engineering practice in Nepal and abroad.

REFERENCES

Abdul Kalam, A.P.J. (2002). *India 2020-A vision for the new millennium*. New Delhi: Penguin Books.

American Board for Engineering and Technology [ABET]. (2000). *The criteria of outcomes assessment for engineering education program* (Annual report). USA: Author.

American Society for Engineering Education [ASEE]. (2003). *Proceedings of the 2003 annual conference & exposition.* USA: Author.

ASEE. (2004). *Proceedings of the 2004 annual conference & exposition*. USA: Author

American Society of Civil Engineers[ASCE]. (2004). *Civil engineering body of knowledge for 21st century, preparing the civil engineers for the future*. USA: Author.

Aryal, M. P, (2006, January), *Management and financing of engineering education: policy perspective*, (A seminar paper presented in a seminar organised in Institute of Engineering), Kathmandu, Nepal.

Aryal, M. P. (2004, October). *Concept of full fee system as a tool of sustaining regular program of IOE* (A seminar paper presented in a seminar organised in Institute of engineering), Pulchowk campus, Kathmandu.

Ashford, N. A. (2006). *Major challenges to engineering education for sustainable development, What has to change to make it creative, effective, and acceptable to the established disciplines?* Center for Technology, Policy and Industrial Development, Massachusetts, Institute of Technology (MIT), Cambridge, Massachusetts, USA.

Audu, T.O.K.(2000). *Strategies for improving engineering education in Africa: Nigerian experience.* T.0.K. Audu, Faculty of Engineering, University of Benin, Benin City, Nigeria: Author.

Azim, M.A. (2002, March). *Dynamics of challenges of engineering profession early 21st century, (* Jabbar Memorial lecture presented in the 46th national convention of the Institution of Engineers), Dhaka, Bangladesh.

Bales, V. (2006, March). *Influence of long-term societal trends on technical education and research (* A paper presented in the 7th world congress of engineering education), Budapest, Hungary.

Banker, R., Chang, H., & Majumdar, S. (1998). Economies of scope in the U.S. telecommunications industry. *Information economics and policy, 10*(2), 253-72.

Barro, R. J.& Sala-i-Martin, X. (1995). *Economic growth. New York*: McGraw-Hill.

Bhattarai, D. (2002, May). *Engineering education: Dilemma to policy makers in Nepal*, (A paper presented in the IOE Alumni seminar. Institute of Engineering), Pulchowk, Kathmandu.

Bird, R. M. (2005, January). f*inancing decentralized education, (*Remarks prepared for conference on education finance and decentralization), The World Bank, Washington, D.C.

Bloom, D.E., Canning, D. & Chan, K. (2005). *Higher education and economic development in Africa.* Harvard University, September 20, 2005.

Bloom, D.E., Hartley, M. & Rosovsky (2004), *Beyond private gain: The public benefits of higher education*. Harvard University. USA.

Boda, M. (2006, March). *Competitiveness without engineers and modern research infrastructure (* A Paper presented in the 7th world congress on engineering education), Budapest, Hungary.

Bond, J. (1997). *The drivers of the information revolution—cost, computing power and convergence. In the information revolution and the future of telecommunications*. Washington D.C. The World Bank.

Borg, W.R. & Gall, M.D.(1979). *Educational research: An introduction*. New York: Longman Publication.

Boston Group (2005, November). *Higher education in Pakistan: Towards a reform agenda, (* A contribution to the Task Force on Improvement of Higher Education in Pakistan), Scholars in Massachusetts, USA: Author.

Carnoy, M. (2002). *Are educational reform working in Latin America*? Washington DC.: Council on foreign relations, The World Bank.

Central Bureau of Statistics (2003). *Statistical year book of Nepal, 2003*. Kathmandu Nepal.

Creative Research Centre (2006, September 20). *Determination of research sample size,* (A formula developed by Creative research centre of USA), September 20, 2006, website http://www.wessa.net.

Deuja, B.B. (2003, April). *A vision of social transformation in Nepal, Engineers in Social transformation (*a paper presented in 8th National convention of Nepal Engineers' Association), Kathmandu.

Diamond, J. (1989, December). The accidental conqueror. *Discover 11*(2), 22-24.

Education Standards & Practices Board (2004). *Standards for technology education*. North Dakota, USA: Author.

Edwardson, J.A. (2006, March). *Engineering education in a changing world (* A paper presented in 7th world congress on engineering education), Budapest, Hungary.

Federation of Engineering Institutions in South and Central Asia (2005, December). *Minutes of the 34th executive meeting of Federation of Engineering Institutions in South and Central Asia*. Kolkata, India.

Fuchs, W. (2006, March). *A Way to the international comparability of engineering education,(* a paper presented in the 7th world congress on engineering education), Budapest, Hungary.

Gabriele, G.A. (2006). *Engineering education today: meeting the global challenge?* USA: National Science Foundation, Engineering Education Centers.

Gibbons, M. (1998). *Higher education relevance in the 21st century*. Washington D.C.: The World Bank.

Government of Pakistan (2006). *A Report of* t*ask force on improvement of higher education in Pakistan*. Ministry of education, Government of Pakistan: Author.

Gurung, H. (2006, February). *Social inclusion and nation building in Nepal*, (a paper presented in Civil Society Forum Workshop for Research Programme on Social Inclusion and National Building in Nepal), Kathmandu.

Hariston, J.E. (2002). Perceived knowledge level, utilization, and implementation of School- to-Work by preservice teacher educators in Ohio. *Journal of Vocational Education Research,* 27 (2), 1-14.

Hay, A.J. (2006, March). *International recognition of engineering professionals, (* a Paper presented in the 7th world congress on engineering education), Budapest, Hungary.

High Level Education Commission[HLEC]. (1984). *High level education commission Report 2040 B.S.* His Majesty's Government of Nepal: Author.

HLEC. (1955). *High level education commission Report 2011 B.S*. His Majesty's Government of Nepal: Author.

Higher Education Directive. (1972). *Higher education directive in Nepal, 2028 B.S.* (1972), Ministry of education, His Majesty's Government of Nepal: Author.

Holm-Nielsen, L.B. (2001, August). *Challenges for higher education systems,* (a working paper presented in International conference on higher education reform), Jakarta, Indonesia.

Ibrahim, A. (2002). *Constructing knowledge societies: New challenges for tertiary education.* The World Bank, 1818 H Street, Washington, DC 20433.

Institute of Engineering[IOE] Strategy Plan. (2000). *The Strategic vision 2020. institute of engineering*. Tribhuvan University.

IOE, (2005), *Annual report of the Institute of Engineering*. Tribhuvan University, Pulchowk, Lalitpur.

IOE-exam (2006). *IOE exam report.* Institute of Engineering, Examinations Control Division, Pulchowk, Lalitpur.

Jacobson, S.L.& Berne, R. (1993). *Reforming education-The emerging systemic approach.* California, USA: Corwin press, Inc.

Jamieson, L, (2007, March). *Engineering education in a changing world (a* paper presented in the 7th world congress on engineering education) Budapest, Hungary.

Jenkins, H. (1995, November). *Education and production in the United Kingdom*. (economic discussion Paper No.101), Nuffield College, Oxford University.

Johnson, D.& Daniel, M. (2006). *Evolving curriculum to promote mobility of engineers, (* a paper presented in 7th WFEO World Congress on Engineering Education), Budapest, Hungery.

Jones, R.C. & Reynolds, A. (2004). Engineering for a better world. *a journal of WFEO committee on capacity building*, UNESCO, 25 (10), 56-62.

Jones, R.C. (2004). Quality engineering education-A review for discussion within the Arab State region (*A commission report)*: UNESCO office in Cairo, Egypt.

Jones, R.C. (2006). Updating for engineering faculty members in developing countries. *International education digest*, World Expertise LLC (USA), 10(64), 27-30.

Jones, R.C. 2006). Capacity building on the mobility of engineers. *International education digest,* World Expertise LLC (USA), *10*(2), 10-13.

Jones, R.C.& Oerst, B.S. (2006). Meghatrends in engineering education. *International education digest,* World Expertise LLC (USA), *10*(4), 17-21.

Jones, R.C.(2005). Global accreditation trends. *International education digest,* World Expertise LLC (USA), *8*(1), 23-26.

Joshi, K.K. (2005). The role of state, private and public sector in the development of education. *Hamro Sampada,* 2063 kartik, 16-19.

Joshi, R.D. (2004). *Reforms at the Institute of Engineering.* Kathmandu: The World Bank.

K.C., S. (2005). Politicization in education, published in *Hamro Sampada*, 2063 kartik, 23-24.

Kapu, D. & Mehta, P.B. (2004, September). *Indian higher education reform: From half-baked socialism to half-baked capitalism*. Massachusetts: Harvard University.

Katehi, L.P.B. (2004, March). *A New framework for academic reform in engineering education.* (An article presented in the Annual Conference & Exposition of American Society for Engineering Education), Purdue University West Lafayette, IN.

Khaniya, T. R. (2004, September). *The concept of Multi-University and quality of higher Education* (a paper presented at the seminar organized by Center for Education innovation Nepal), Kathmandu, Nepal..

Khati,R. (2003). *Education in Dilemma: A Nepalese perspective*. Kathmandu: Author.

Kothari, C.R. (1997). *Research methodology: methods and techniques*. New Delhi Wishwa Prakashan.

Krejcie, R. V. & Morgan, D. W.(1970). *Determination of research sample size*. Texas: Texas A & M university.

KU-exam (2008). *The record from 2003 to 2007* of the Controller of Examinations of Kathmandu University: Author.

KU-Strategic plan. (2008). *The Strategic plan 2008-2013,* School of Engineering, Kathmandu university: Author.

Lin, T-C. (2004). The role of higher education in economic development: An empirical study of Taiwan case, *Journal of Asian Economics,* 15 (2), 355-371.

Lohani, S.R. (2004, October). *Financing of Education* (*Lecture Notes).* Kathmandu university, School of Education, Kathmandu Nepal.

Marcus, A.I. (2005). *Engineering in a land-grant context: The past, present, and future of an Idea.* Finland: Purdue University Press.

Massaquoi, J.G.M.(2000, August). Financing and management of engineering education in Africa. *Proceedings of the workshop*, Kenya.

McGinn, N. (2002, April). *Why we should end reforms in education, (* a paper presented to the Inter-American Development Bank's Regional policy dialogue), education network, Washington DC.

Mcgrath, D. (2006, March). *Accreditation criteria for engineering programmes using an outcomes-based approach,* (a paper presented in the 7th world congress on engineering education), Budapest, Hungary.

Michel, J.(2006, March). *Globalization and the mobility of engineers, integrating the international education of engineers in the curriculum, the european experience*, (a paper presented in the 7th world congress on engineering education), Budapest, Hungary.

Ministry of Education and Sports (2002). *Human resource development Plan. HMG*, Nepal, Ministry of Education and Sports. Nepal: Author.

Nachmias, C.F.& Nachmias, D. (1996), *Research methods in the social sciences*, Fifth edition, New York:St. Martin's Press.

National Academy of Sciences (2006). *The Engineer of 2020: Visions of engineering in the new Century.* USA: Author.

National Education Committee[EC], (1961). *Report of the National Education Committee.* Ministry of Education, HMG Nepal: Author.

EC, (1972). *Report of the National Education Commission*. Ministry of Education, HMG Nepal: Author.

EC, (1993). *Report of the National Education Commission.* Ministry of Education, HMG Nepal:Author.

EC, (1998). *Report of the High level National Education Commission*. Ministry of Education, HMG Nepal: Author.

National Planning Commission [NPC], (2002), *10th five year plan (2002-2007),* National Planning Commission of Nepal: Author.

NPC, (1992). *8th five year plan (1992-1997),* National Planning Commission of Nepal: Author.

NPC, (1997). *9th five year plan (1997-2002),* National Planning Commission of Nepal: Author.

NPC, (2003). *The Tenth Plan, Poverty Reduction Strategy Paper,* 2002–2007. Nepal: Author.

NPC, (2007). *Three year interim plan's approach paper,* Government of Nepal: Author.

National Society for Earthquake Technology-Nepal [NSET], (2005). *A Study of inventory of buildings in Kathmandu valle*y. Nepal: Author.

Nepal Engineering Council [NEC], (2002). *Norms and Standards for Engineering Education.* Nepal Engineering Council: Author

NEC, (2007). *Annual report 2007*, Nepal Engineering Council: Author.

Nepal Engineers' Association [NEA], (2003). *Annual report* of Nepal Engineers' Association, Engineer's Bhawan, Pulchowk, Kathmandu. Author.

NEA, (2005). *Proceeding* of the National Conference of Nepal Engineers' Association. Author.

NEA, (2006). *Annual report* of Nepal Engineers' Association. Engineer's Bhawan, Pulchowk, Kathmandu. Author.

Nepal living standard survey [NLSS], (2001). *Nepal Living standard survey 1996* developed during Nepal Public Expenditure Review 2001, The World Bank.

Nyborg, P. (2004). *The Bologna process*. Moscow Academy of Economics and Law: Secretariat of the Bologna follow up group.

Pahari, B.R. (2003, August). *Engineering profession: context and challenges* (a working paper in the seminar organised by Development Times Magazine in Kathmandu), Nepal.

Pahari, B.R. (2006, January). *Engineering education: quality and competency perspective,(* a seminar paper presented in the seminar organised in Institute of Engineering), Pulchowk campus, Kathmandu..

Pandey, D.R. (1999). *Failed development in Nepal: Reflections on the mission and materials,* Nepal south-Asia center, Kathmandu: Author

Pandey, S.(2001). *Rajballabhamandanam, a tretise of vastushastra*. A Hindi Script on vastu philosophy. Ist edition, Varanashi, India. Chaukhamba Surbharati publications.

Parajuli, M.N. (2003). School and bikas: Looking for a new linkage. *Educational Innovation,* 2(1), 110-118.

Pasacharopaulos, G.& Patrinos, H. (2002, September). *Return to investment in education: A future update,*(Policy Research Working Paper 2881). The World Bank.

Paudel, G.R. (2002). *Outcomes of mechanical engineering education in Nepal*. A PhD research proposal submitted by Er. Guna Raj Paudel, to School of Education, Kathmandu University.

Paudel, R.K. (2006, January). *Priorities and strategies of engineering education: national and global perspective,* (a seminar paper presented in a seminar organised in Institute of engineering), Kathmandu.

Pokhrel, J.C. (2003, April). *Nepali engineers in social transformation: past, present and future.* Engineers in Social transformation, (key note presented in 8th National convention of Nepal Engineers' Association), Kathmandu.

Polczynski, M. & Jaskolski, S. (2005, March). *Entrepreneurial engineering education*, (peer reviewed paper presented in the NCIIA 9th Annual Meeting), San Diego, CA.

Prennushi, G. (1999, November). *Nepal: Poverty at the turn of the twenty-first century, (* South Asia Region Discussion Paper 174), The World Bank.

Quality Assurance Agency (2000). *Code of practice for assurance of academic quality and standards in higher education.* - External Examining, January, Quality Assurance Agency, USA:Author.

Rahman, M.H. (2003, January). *Globalisation and the challenges of developing countries: Bangladesh Perspective*, (Key note speech presented in the 47th national convention of the Institution of Engineers), Bangladesh in Chittagong.

Robbins, S.P. & Coutler, M. (2003). *Management*, 7th edition, Pearlson edition.

Saiju, M.M. (2003, April). *Engineers in Social Transformation. Engineers in Social transformation*, (key note presented in 8th National convention of Nepal Engineers' Association), Kathmandu.

Salmi, J. (2000, June). *Tertiary Education in the Twenty-First Century: Challenges and Opportunities*, (Human Development Department, LCSHD Paper series No. 62), The World Bank.

Schwartman, S. (2002, July). *Higher education and the demand of the new economy in Latin America),(* Background paper for the 2003 LAC Flagship report), Washington DC: World Bank.

Shah, S.G. (2006, April). *Social inclusion of madheshi community in nation building.* (presented by in civil society forum workshop for research programme on social inclusion and national building in Nepal organised by Social Inclusion Research Fund).

Shakya, N.M. (2005, August). *Entry system of engineering higher education in Nepal*. (a seminar paper presented in a seminar organised by TSAN).

Sharma, G.N. (2000). Nepal ko Shaikshik Itihas *(History of Education in Nepal)*. Bidhyarthi publication.

Sharma, T.N.(1999). *The role of technical education and vocational training in the broader perspective of Nepal's employment and training system*. (An unpublished PhD thesis submitted to Southern Illinois University), Carbondale, U.S.A.

Shrestha, D.P. & Panth, B. (2000, January). *Nepal Education Management Reform,* (Background paper for the working paper on management for The World Bank education sector review), The World Bank..

Shrestha, K.N. (2004, November). *Establishing new Universities (* An article in English National daily- Kathmandu Post).Kathmandu, Nepal.

Shrestha, K.N.(2003). *Human resource management*. Kathmandu: Nabin Prakashan.

Shrestha, N.R. (1997). *In the name of development: A reflection on Nepal.* Lanham, Maryland: University press America, Inc.

Shrestha, P.B. (2006, January). *Quality assurance strategy, policy framework and guidelines for the institutionalisation of a quality assurance system in the engineering education and training sector in Nepal*, (A comment paper presented in the seminar organised in IOE), Kathmandu.

Splitt, F.G. (2002, October). *Engineering education reform: a trilogy*, (a paper presented in Northwestern University, McCormick School of Engineering and Applied Science).

Splitt, F.G. (2003*). Systemic engineering education reform: A grand challenge*. Illinois, USA:Author.

Suwal, R. (2006, January). *The quality of engineering education in Nepal,* (A seminar paper presented in Institute of engineering), Kathmandu.

Tamrakar, T. (2006, April). *Issues on social inclusion: dalit perspective,* (presented in civil society forum workshop for research programme on social inclusion and national building in Nepal organized by Social Inclusion Research Fund), Nepal.

The World Bank & UNESCO (2000). *Higher education in developing countries: Peril and Promise[Electronic version],* New York: Author.

The World Bank (1998). *World development report*: Knowledge for Development. New York: Oxford, University Press.

The World Bank (2001). *Nepal: priorities and strategies for education reform*, (Human Development Unit, South Asia Region Report No. 22065-NEP), World Bank: Author.

The World Bank (2002). *The World Bank atlas 2002*. USA: Author.

The World Bank (2003). *The World Bank atlas 2003*. The World Bank.

The World Bank (2004). World Bank-w*orld development indicators 2004. World Bank,* USA: Author.

The World Bank (2005). *Korea as a knowledge economy, knowledge for development program*, USA: Author.

Thorn, K. & Soo, M. (2006, August). *Latin American universities and the third Mission: trends, challenges and policy options,* (policy research working paper 4002). The World Bank.

Tribhuvan University [TU],(2000). Tribhuvan University: *The Strategic Vision for Twenty years.* Kathmandu: Author.

UICEE, (2003, January). World Transactions on Engineering and Technology Education , *a journal of UICEE*, 2(1), 37-41.

University Grant Commission [UGC], (2004). *Annual Report-2003/2004* of University Grant Commission, Kathmandu: Author.

UGC, (2007). *Annual report (2007)* of University Grant Commission, Sanothimi, Bhaktapur, Nepal: Author.

Upadhyaya, S.N. (2003, April). *Society, Engineers and the CIAA*, (Key mote presentation in 8th National convention Engineers on Social transformation, Nepal Engineers' Association, Kathmandu.

Vaid, K.N. (1999). *Construction Industry in Nepal*. India, TATA McGravell.

Verghese, N.V. (2001). *Economic crisis and higher Education in East Asia.* International Institute for Educational planning, Paris, 2001: UNESCO.

Wessa, P. (2007). *Determination of Research Sample Size.* [Electronic version], a free software developed for Research development and education, website http://www.wessa.net.

Whitwell, J. (2002, March). *Engineering to meet the challenges of globalisat*ion. (a paper presented by John Whitwell, Chairmen of Global Development Consultancy, in the 46th national convention of Institution of Engineers), Bangladesh, Dhaka.

Williamson, S., Lamb, F. & Davis, L. (2001, August). *Engineering Education Issues are same across the World. (* Paper presented in International Conference on Engineering Education), Oslo, Norway.

World Conference on Higher Education (1998). *World Conference on Higher Education: Higher Education in the Twenty-first Century Vision and Action*, UNESCO, Paris: Author.

World Conference on Science & Technology (1999). *The Proceeding of the World Conference* on science & technology, USA: Author.

World Congress on Engineering Education (2006). *Conference Proceeding*. 7th WFEO World Congress on Engineering Education, Budapest, Hungary.

Wulf, W.A. (2002, March). *The Urgency of Engineering Education Reform*. A paper presented in Auburn University, Germany.

APPENDICES

Appendix i Research Instrument

Kathmandu University
School of Education

30 July 2007

To………………………………………

I am the Associate Professor at Institute of engineering under Tribhuvan University (TU), currently conducting a research entitled "*Reform Priorities and Strategies for Quality and Need-based Engineering Education in Nepal*, as a Doctoral Candidate in Kathmandu University (KU). The purpose of this study is to identify desired and actual level of competencies of entry level Engineers, emerging issues influencing the quality of engineering education and strategies necessary to resolve those issues for enhancing quality of engineering education in Nepal.

You, as an engineering student/ faculty/policymaker/employer, are aware of the growing complexity in engineering profession that is demanding general and specific engineering abilities that help the entry level engineers from any disciplines to perform better in a globalized context by understanding their role in society as a change agent, development worker and be professionally successful demonstrating technical leadership. To provide a quality engineering education, concerned institutions and individuals need to understand the needs and expectations of their customers. In this relation, I am seeking answer to the major question- *what are the issues affecting the quality of higher engineering education in Nepal and what policy priorities and strategies should be adopted to address these issues?*. I hope your valuable input through attached questionnaire will help me to find the answer to this major question and conceive a model improvement in engineering education in Nepal.

You have been selected to participate in this study as Faculty/ Policy maker/ Employer/ Student. Your advice and suggestion as a primary source of data are very important. I would appreciate if you could give a part of your valuable time to complete the attached questionnaire and give me back or send it back in the enclosed self-addressed envelope or through e-mail by November 2007. It is estimated that you will be able to complete the questionnaire within 1 hour. I would like to assure that your responses would be kept strictly confidential. Only aggregate data from all surveys will be reported.

By completing the questionnaire you are indicating your consent to participate in the study. If you have any questions about the research, please feel free to contact me at 01- 6205946(Res) /9851046112(cell) or Prof. Dr. Mana Prasad Wagley, Office of the Dean, School of Education, K.U., at 01-5-548891 (Off).

Thank you very much for both your time and input.

Mailing Address:
Bharat Raj Pahari, IOE, Pulchowk Campus, Teacher's Quarter-29, Pulchowk Lalitpur, Nepal, e-mail- <brpahari@ioe.edu.np>.

Sincerely

…………………
(Bharat Raj Pahari)

Appendix ii General Instructions for Respondents & Instrument

The purpose of this study is to identify desired and actual level of competencies of entry level Engineers, emerging issues influencing the quality of engineering education and strategies necessary to resolve those issues for enhancing quality of engineering education in Nepal. You are cordially requested to provide appropriate response based on the following directions:

Initially, please answer the questions related to the Part I of the questionnaire set (demographic information) given in the next page as required. Then, you are requested to assess all item statements (competencies, issues, strategies) listed in the table 4 in part II, in terms of;

- The degree to which the competence of graduates exists (existing level) and to be demonstrated (desired level) to achieve quality of engineering education (based on the rating scales as shown in the table 1).
- The degree to which the level of agreement of respondents exists on issues influencing quality, strategies to address issues influencing quality of engineering education if applicable (based on the rating scales as shown in the table 2)

Put a tick (√) mark in the appropriate box under each relevant column in the questionnaire. Finally, you are requested to provide responses on open-ended questions given in part III (last page) of the questionnaire set.

Table 1(Rating scales to measure desired and existing level of competence on performance competency areas)					
N = Not Applicable	1 = Poor level	2 = Fair level	3 = Good level	4 = Very Good level	5= Excellent level

Table 2 (Rating scales to measure level of agreement of; issues influencing quality, strategies to address issues influencing quality of engineering education)					
N = Not Applicable	1 = Strongly disagree	2 = Disagree	3 = Neither agree nor disagree/ mid level	4 = Agree	5= Strongly agree

Please, use following criteria while using the rating scales demonstrated in the table 1, 2 and 3:

1 = Poor level/ Strongly disagree-

The graduate has the ability to recognize a concept and basic facts about the topic, issue has very low influence on the quality, strategy is less effective to achieve quality of engineering education, issue and strategy have very low level of agreement.

2 = Fair level/ Disagree-

The graduate has ability to understand the terms, facts, definitions, concepts, principles, relationships, functions, processes, theories, etc. (s/he knows what), issue has moderate influence on the quality, strategy is moderately effective to achieve quality of engineering education, issue and strategy have low level of agreement.

3 = Good level/ Neither agree nor disagree/ mid level-

The graduate has comprehensive understanding of subject matter, and able to apply the ideas in professional practice (s/he knows how), issue has good influence on the quality, strategy is effective to achieve quality of engineering education, issue and strategy have moderate level of agreement.

4 = Very good level/ Agree-

The graduate has knowledge, understanding, application and analytical ability (s/he can show how and has limited practical competency, if applicable), issue has substantial influence on the quality, strategy is substantially effective to achieve quality of engineering education, issue and strategy have high level of agreement.

5 = Excellent level/ Strongly agree-

The graduate has the ability to combine ideas (synthesis), make judgments (evaluation), does independently practical activities in his/her area with positive attitudes, issue has complete influence on the quality, strategy is completely effective to achieve quality of engineering education., issue and strategy have highest level of agreement.

SURVEY QUESTIONNAIRE ON
REFORM STRATEGIES FOR QUALITY OF ENGINEERING HIGHER EDUCATION IN NEPAL

Respondent's Group: Code No. of Respondent:

Part I: Demographic Information

	Table 3: Information about personal and professional background of respondent.							
1.	Please check one of the respondent group best suited to you and mark it by (√)							
	Faculty							
	TU		KU		PokharaU		PurwanchalU	
	Student							
	TU		KU		PokharaU		PurwanchalU	
	Policy makers							
	MoEd		Uni/College authorities				NEC	
	Employers							
	Departments		Consultants		Contractor		Industry	
2.	Please check your gender in the given box and mark it by (√)							
			Male		Female			
3	Please write your age in years in given box?							
4	Which of the following best describes your educational background? Please mark it by (√) at the appropriate area?							
	PhD		Master		Bachelor		Below bachelor	
5	Please write the name of your organization.							
6	What are the major services of your organization?							
	Consulting services							
	Construction Services							
	Engineering Industry							
	Education delivery							
	Formulation of education policy							
	Monitoring of engineering education and services							
7	What is your position in your organization?							

8	Please indicate your years of experiences in the profession.	

Part II: Actual and Desired Level of Competencies of Entry Level Graduates of Engineering Education in Nepal

The followings are the statements to identify; the essential competencies required for quality of engineering education of entry level graduates. You are requested to provide ratings on the "existing level of competence" (Column A) and "Desired Level of Competence" (Column B) by putting tick mark (√) in appropriate box (in the right hand side) for each of the statement in the left hand side for the table using the explanations of rating scale given below.

N = Not Applicable	1 = Poor level	2 = Fair level	3 = Good level	4 = Very Good level	5= Excellent level

P	Competencies required for Entry Level Engineering Professional Practice (Fresh Engineer)												
	Ability to:	Column A Existing Level of competence Low ↔ High						Column B Desired level of competence Low ↔ High					
		N	1	2	3	4	5	N	1	2	3	4	5
P -1	Basic knowledge and skill												
	Effective Communication												
1.	Communicate orally												
2.	Communicate through written documents												
3.	Present technical information using audiovisuals												
4.	Communicate through graphical means												
5.	Communicate through electronic means;(e-mail, internet)												
	Basic Technical Knowledge												
6.	Apply knowledge of mathematics, science and engineering												
7.	Demonstrate full responsibility for own actions and decisions												
8.	Design & conduct research/ feasibility studies for specific projects												
9.	Design & conduct laboratory tests (experiments)												
10.	Interpret data and prepare documents												
P -2	Specific Professional Capacity												
11.	Design a system, component, or process to meet desired requirements and needs												
12.	Conduct and coordinate quality control and quality assurance procedures												
13.	Analyze properties of engineering materials to be used in engineering design												
14.	Identify, formulate, and solve engineering problems												
15.	Use the techniques, skills, and modern engineering tools necessary for engineering practice												
16.	Understand & practice professional and ethical responsibility												

	Ability to:	Column A Existing Level of competence Low ⟷ High						Column B Desired level of competence Low ⟷ High					
		N	1	2	3	4	5	N	1	2	3	4	5
17.	Practice the principles of sustainable development in engineering design												
18.	Produce effective documentation of the engineering design												
19.	Practice the principles of sustainable development in engineering design												
20.	Evaluate the impact of engineering design in the society												
P -3	Understanding society and social phenomena												
21.	Understand the impact of engineering solutions in a global and societal context												
22.	Analyze the impact of the engineering service on society												
23.	Demonstrate understanding of socio-cultural context of the country												
24.	Demonstrate understanding of the political and legal context regarding engineering practices												
25.	Demonstrate understanding of democratic practices and community participation												
P -4	Management and Leadership												
26.	Analyze economic and financial consequences of engineering projects												
27.	Coordinate smooth operation of the projects using basic principles of management												
28.	Lead for system development & improvement by making projects technically sound & viable as a leader & as a member												
29.	Assess effectiveness of the projects in relation with established standard understanding interrelationship between society, technology and environment												
30.	Adhere with contextual issues governing management of projects												

The followings are the statements to identify the issues influencing the quality of engineering education. You are requested to provide ratings on the "level of agreement" by putting tick mark (√) in appropriate box (in the right hand side) for each of the statement in the left hand side for the table using the explanations of rating scale given below.

N = Not Applicable	1 = Strongly disagree	2 = Disagree	3 = Neither agree nor disagree/ mid level	4 = Agree	5= Strongly agree

I	Issues influencing the Quality of engineering education						
	State of Condition	Level of agreement Low ⟷ High					
I -1	Financial Issues	N	1	2	3	4	5
1.	Engineering colleges are constrained with inadequate financial support from Government to maintain their recurrent and management cost						
2.	There is a need for efficient utilization of available human, financial and material resources						
3.	There is a need of more investment for supporting research and innovation and new educational technologies						
4.	There is a need of more investment for new educational technologies						
5.	There is a need for Policy regarding Return on Investment (ROI)						
6.	There is a need of private sector support from business and industry for the development of engineering education						
7.	There is a need for involving private sector investment in the development and expansion of engineering education						
8.	There is a need for developing cost control measures						
9.	There is a need for review of work-load of faculties and staffs of the engineering colleges to identify financial burden						
I -2	Faculty Issues						
10.	There is a need to minimize politicization and impulsive intervention in recruitment of the faculties						
11.	There is a need for shift of teaching methodology from conventional (explanatory-one-way traffic method, formal technique, monotonous & insensible, spoon feeding model, course completion oriented) to interactive practice						
12.	There is a need for dynamic teaching and research process in higher engineering education						
13.	There is a need for joint research or design project within colleges and with other stakeholders (industries, employers etc)						
14.	There is a need for faculty development and retention programs (career path, incentives, benefits, trainings and education opportunities)						
15.	There is a need for vigor in faculties to remain relevant or competitive						
16.	There is a need for sufficient remuneration of faculties						
17.	There is a need for periodic meetings and discussions of faculties to maintain the quality standards						

	State of Condition	Level of agreement					
		Low ⟷ High					
		N	1	2	3	4	5
18.	There is a need for developing and implementing long term planning of faculty development						
I -3	Equity and Access Issues						
19.	There is a need to develop a system with guidelines and processes to identify meritorious and needy students						
20.	Gender disparity is a burning reality in engineering education						
21.	There is a need for provision to provide access to engineering education for competent students living in remote and poverty stricken areas						
22.	There is a need for financial support in terms of loan or scholarship to the competent students from marginalized areas						
23.	There is a need to increase the rate of access in engineering for poor and deprived students						
24.	There is a need for special financial support from government to marginalized students						
25.	There is a need to develop a system with guidelines and processes to ensure the fair distribution of scholarship/loan to the poor students						
26.	There is a need to revise present system of pre-engineering levels(+2, I.Sc. level) that do not consider equity issue (student's entry system is meritorious and this system permit access to well-to-do students having higher score (from private boarding school) in engineering programs and students from marginalized sectors having less score (from public schools) may be eligible for entry in full fee stream, even the reservation quota is opportunity for elites (from geographical, ethnical and gender areas)						
27.	There is a need for social integration of marginalized students						
I -4	Management Issues						
28.	There is a need for wider participation of stakeholders (students, faculties, employers, parents, politicians, policy makers etc.) in policy making in engineering education						
29.	There is a need for accountability and transparency in management						
30.	There is a need for advisory team comprising of senior faculties and persons from former management bodies						
31.	There is a need for smooth functioning of routine works in the institution						
32.	There is a need for harmony within the institution eliminating intra-institutional Barriers, such as; inter-departmental issues, perception of cost and time, work culture, incentive structure to promote quality.						
33.	There is a need for visionary leadership in academic institutions to drive the institution with clear vision and strong determination						
34.	There is a need for delegation of authority to different levels of management and develop a mechanism for monitoring implementation of rules and regulations						
35.	There is a need to identify dysfunctional components in the engineering institutions						
36.	There is a need for norms and regulations to guide the behaviour of management, faculties, staffs and students						

	State of Condition	Level of agreement Low ⟷ High					
		N	1	2	3	4	5
37.	There is a need for optimum use of resources and practice simple tools of management to enhance efficiency and effectiveness in the management						
I -5	Students Issues						
38.	There is a need for enhancing Students' competencies (interpersonal, team working and ICT skills)						
39.	There is a need for students' motivation to learn and continuous assessment of students' learning (knowledge and skills)						
40.	There is a need for providing counselling on career guidance services to students						
41.	There is a need to orient students for ethical and moral values						
42.	There is a need for resource personnel for career guidance to students						
43.	There is a need for developing positive approaches of protecting rights and values of students in institution						
44.	There is a need for interactions and feedback with parents						
45.	There is a need for support in graduate research/project works						
46.	There is a need for developing proper program to address the students' mobility						
47.	There is a need for clear and transparent regulation and practices for Students' fee structure, scholarships and education loan						
48.	There is a need of development of standard on numbers of students (increasing or limiting enrolment in colleges) enrolment in the colleges						
I -6	Socio-Cultural Issues						
49.	There is a need for increase in value of social image of the engineers						
50.	There is a need for drawing the attention of engineers in societal issues						
51.	There is a need for developing collaboration culture among students, faculties and managements to reduce conflict among them due to political influences						
52.	There is a need to establish good relationship within and outside institutions to reduce tensed cross-cultural relation and ensure effective implementation of engineering service delivery						
53.	There is a need to develop mechanism for ethnical harmony and gender equality in engineering education						
54.	There is a need for dedication and determination of students for social connection and community attachment						
55.	There is a need to draw the attention of policy makers on increasing role of "integrated" engineering (integration of all discipline)						
56.	There is a need for political will to reform on engineering education at the highest leadership levels						
57.	There is a need to create ability among students to improve traditional technology within social context						
58.	There is a need to persuade the benefits of engineering and technology in the society						

I -7	Infrastructure Issues						
	State of Condition	Level of agreement Low ↔ High					
		N	1	2	3	4	5
59.	There is a need for adequate infrastructure (buildings, laboratories, libraries etc.), physical facilities necessary for the program goals of the institution						
60.	There is a need for provision of critical infrastructure construction, re-construction and protection						
61.	There is a need of proper inventory system with monitoring and evaluation physical and academic infrastructures and assessment of physical environment						
62.	There is a need for strengthening and upgrading existing outmoded infrastructures and incorporating current technologies						
63.	There is a need for periodic repair and maintenance of infrastructures						
64.	Functional aspect of the prevailing infrastructures are changing in the course of time						
65.	There is a need of rich library with sufficient reading and research facilities						
66.	There is a need for electronic network with national & international reputed institution's libraries						
67.	There is a need for sufficient text books, reference books & other extra curricular books, journals, newspaper & magazine documentation centre, etc. in library and their updating and replacement						
68.	There is a need for renovation of laboratory instruments						
69.	There is a need for investment in infrastructure development for quality improvements						
I -8	Curriculum Issues						
70.	There is a need for uniformity in the basis of entry eligibility (eligibility criteria for some university-Physical group and others- Biological group) in higher engineering education (B.E. Level)						
71.	There is a need to develop a system for designing curriculums from all levels of management, departments to faculties, in the institution						
72.	There is a need for subject courses matched and harmonized (synchronized) with global courses and schedules						
73.	There is a need for review of breadth and depth of subject coverage in the curriculum based on market needs						
74.	There is a need for text books based on local source, skill, originality & Nepali culture & market conditions						
75.	There is a need to develop curriculum responsive to labor market needs resulting in job advancement, entrepreneurship, education and training						
76.	There is a need for systematic evaluation of; institutional performance; course prescribed; administrative practices; feedback system from lower to higher level and from students on course taught						
77.	There is a need for developing and enforcing national standards for engineering education (academic degree and engineering colleges)						

78.	There is a need for conformity of standard of Nepalese graduates with standard abroad						
	State of Condition	Level of agreement Low ⟷ High					
		N	1	2	3	4	5
79.	There is a need for conformity of ISO 9000 standards quality of engineering education (as accreditation and conformity with ISO 9000 standards for quality are not same and they are not mutually exclusive)						
80.	There is a need to establish the provision for continuing education and lifelong learning in engineering education						
81.	There is a need to review flexibility of academic calendar						
82.	There is a need for review of internal assessment						
83.	There is a need for review of failure rate in all regular exam						
84.	There is a need for review of the process of Exams (clerical, tedious and creating pressure)						
85.	There is a need to incorporate ICT courses in all engineering programs						
86.	There is a need for providing exposure of technical know how evolving in application of technologies						
87.	There is a need for classroom delivery developing web-based learning in engineering education						
88.	There is a need for updating prevailing technology and introducing new technologies in the institution						
89.	There is a need for regular peer-review for new engineering institutions and accreditation of engineering qualifications						
I -9	Job Market Issues						
90.	There is a need of collaboration between industry and academic institution for need based delivery and research						
91.	There is a need to respond new challenges posed by increasing liberalization economy in higher engineering education in Nepal						
92.	There is increased threat to quality higher engineering education by commercial organizations making product more commercialized						
93.	There is a shortage of skilled human resource in some critical areas and are in over supply of engineering graduates in conventional areas						
94.	There is a need to develop private public partnerships for assessment of the academic performance of students and market response to their performances						
95.	There is a need for providing on-the-job learning experiences (experimental learning opportunities) in engineering education						
96.	There is a need for matching between engineering graduates especially in academic programs and job market						
97.	There is a need for delegation of academic authority to departments and faculties to enhance ability to serve the market demand						
98.	There is a need for a mechanism of receiving regular information and feedback from job market						
99.	There is a need for effective networking and exchange programs with different academic institution and industries with in and outside the country						

The followings are the statements to identify strategies for quality of engineering education. You are requested to provide ratings on the "level of agreement" by putting tick mark (√) in appropriate box (in the right hand side) for each of the statement in the left hand side for the table using the explanations of rating scale given below.

N = Not Applicable	1 = Strongly disagree	2 = Disagree	3 = Neither agree nor disagree/ mid level	4 = Agree	5= Strongly agree

S	Reform Strategies for Quality of engineering education						
	Proposition	Level of agreement Low → High					
S -1	Financial Strategy	N	1	2	3	4	5
1.	Provide grant, soft loan, aid & donation to maintain recurrent and management costs of engineering colleges						
2.	Minimize wastage, optimize overheads and encourage efficient and effective use of resources						
3.	Allocate appropriate budget for research and innovation						
4.	Allocate appropriate budget for new technologies						
5.	Introduce greater cost recovery and cost sharing plan, such as; full-fee system in IOE						
6.	Explore and initiate to find resources and funding from business and industry for academic programs and research in engineering education						
7.	Explore and initiate to find resources and funding from private sector for development and expansion of engineering education						
8.	Establish cost control measures with transparent & effective financial management						
9.	Establish reasonable and financially tenable students/faculty and staff ratios in the engineering colleges thus minimizing financial burden						
S -2	Faculty Strategy						
10.	Develop institutional set-up, formulate comprehensive guidelines and conduct transparent procedures of faculties recruitment						
11.	Develop, implement, and assess new instructional models, materials, and learning environments,						
12.	Start and establish dynamic teaching and research process in higher engineering education						
13.	Encourage faculties for Joint research or design projects within college and with other stakeholders						
14.	Develop a teacher management system that includes teacher education and training and conditions of service (appointment, deployment, transfer, salaries and benefits, career path etc.) Ensure technical competency of faculties that includes all requirement for certification and credentialing, evaluation includes; technical competency, instructional competency/certification, and technical updating						
15.	Establish system of continuing professional development of faculties, Support and encourage participation of faculties in regional conferences, workshops and electronic conferences, Provide internet facilities and encouraging publications over internet						

	Proposition	Level of agreement					
		Low ↔ High					
		N	1	2	3	4	5
16.	Motivate the faculties in the job by involving in continuing education program, consultancy services, and research projects, thus encouraging for additional remuneration						
17.	Coordinate and facilitate discussions to maintain the required quality standards of faculties, Set, maintain and control the quality standards of faculties						
18.	Prepare next generation of faculty and professionals wishing to pursue work in the field of engineering education						
S -3	Equity and Access Strategy						
19.	Identify meritorious and needy students through proxy means testing						
20.	Give emphasis to gender equality						
21.	Organize a system of selecting bright students from different regions in the scholarship scheme in the engineering education						
22.	Encourage government for financial assistance, manage financial assistance by reliable organizations to needy students, Develop financing model with bank loan facilities and target subsidies to poor and needy students with a focus on reducing inequalities, discouraging inefficiencies and encouraging incentives for positive innovation and generation of additional resources						
23.	Provide limited reservation and for short period to students to increase the rate of access in engineering for poor and deprived students						
24.	Reallocate State Subsidies to bring marginalized students to mainstream of the market						
25.	Formulate the guidelines and processes to distribute scholarship to meritorious and needy students through the participation of stakeholders (students, faculties)						
26.	Start supporting programs for students from marginalized areas in pre-engineering level for building their capacity to compete in entry level of higher engineering education						
27.	Encourage NGO's and CBO's for awareness programs and financial supports to the marginalized students						
S -4	Management Strategy						
28.	Ensure dedicated and more concerned stakeholders(faculties, students, parents, industry, politicians, policy makers etc.) in management & development council/ authorities; in the engineering institutions						
29.	Formulate detail job description for all level of management of staffs and ensure their role, responsibility, authority and accountability in the institution, provide an added mechanism of accountability of the process, through public disclosures of its progress						
30.	Establish mechanism to entertain advices and guidance in design, development, operation, evaluation initiatives in the institution from; former deans, assistant deans, campus chiefs; senior professors and educational experts						

	Proposition	Level of agreement					
		Low ⟷ High					
		N	1	2	3	4	5
31.	Ensure and monitor routine works of the institutions, such as; conduction of defined meetings, recruitment practices, compliance with audit observation, academic monitoring, public information etc.(as important job of heads-Deans, principals/campus-chiefs, HOD etc.)						
32.	Conduct periodic meetings of all departments, committees and centers and arrange discussions on issues, challenges and programs						
33.	Ensure dynamic and visionary leadership in all level of administration						
34.	Ensure financial, academic and management authority in the autonomy of institution, such as; appointment of staff on contract, term extension of contract faculties, staff selection appointment and dismissal, acceptance of resignation, frame policies and regulations on academic and administrative affairs, formulate financial regulations etc.,						
35.	Identify and Chuck-out dysfunctional components in the engineering institution						
36.	Develop norms and regulations to guide the behaviors of the management, faculties and staffs and avoid ad-hoc decisions						
37.	Simplify the methods of management and maintenance and make it output oriented, optimize the utilization of available space and equipment, make mandatory the periodic performance audit of campuses						
S -5	Students Strategy						
38.	Encourage academic and professional key skills, such as; publications of journals, new-letters web etc, interpersonal team working, presentation skill and ICT skills						
39.	Encourage student led performances as a part of curricula, co-curricula and extra-curricula activities						
40.	Establish a system of Meaningful Career Counseling/social/emotional counseling mechanism						
41.	Orient students for; well prepared to be leading engineers, as well as researchers, with a clear understanding of the strategic value of their area						
42.	Ensure availability of resource personnel to provide career guidance services						
43.	Support the students activities concerning their rights and values						
44.	Establish contact and counseling with parents on the study and behavior of student						
45.	Ensure supports (financial and academic guidance) for students project works						
46.	Develop relevant programs to address students mobility						
47.	Fix Minimum & maximum fee structure in cost basis for quality improvement, formulate proper scholarship scheme and introduce education loan						
48.	Establish a notion by campaign that quality of engineering product is imperative and quantity of students may be as large as possible meeting the global demand						

	Proposition	Level of agreement Low ↔ High					
		N	1	2	3	4	5
S -6	Socio-Cultural Strategy						
49.	Make periodic campaigns to establish status and social image of the engineer in the community						
50.	Develop curriculum such that students can understand societal issues and social implication of technology						
51.	Develop conducive environment for coordination and cooperation among political interest groups in the institutions						
52.	Establish cross cultural harmony and inter-university and institutional cooperation, including fellowships						
53.	Address ethnic and gender issues by developing a mechanism in engineering education						
54.	Promote activities to strengthen social connection and community attachment of the institution (different kinds of supports to the society)						
55.	Revise the curriculum with the integration of other social discipline						
56.	Establish strong co-operation network between experts in education and scholars in the various subjects, Ensure continuous campaign for political commitment in the leadership						
57.	Make efforts in the application of engineering and technology for poverty eradication developing traditional technology						
58.	Promote public understanding of engineering and technology						
S -7	Infrastructure Strategy						
59.	Ensure physical facilities, equipment and tools used in the program and be of the quality and type needed to training to meet the program goals and performance objectives, ensure that facilities and equipment shall effectively accommodate the number of students, instructors, support staff and program objectives						
60.	Ensure that there are in sufficient quantity and quality of critical infrastructures to meet the instructional objectives and needs of the academic program						
61.	Establish monitoring & evaluation unit for physical and academic infrastructure & their quality						
62.	Strengthen and/or replace outmoded infrastructures, ensure Infrastructures to reflect current technologies and applications						
63.	Prepare a data base of all infrastructures and conduct periodic repair and maintenance						
64.	Develop Infrastructures in accordance with the new paradigm in engineering education						
65.	Ensure copy, documentation and database facilities in the library						
66.	Develop functional electronic network with national & international reputed institution's libraries						

	Proposition	Level of agreement					
		Low ↔ High					
		N	1	2	3	4	5
67.	Ensure sufficient text books, reference books & other extra curricular books, journals, newspaper & magazine documentation centre, etc. in library and also update and replace them regularly						
68.	Ensure renovation of laboratory instruments						
69.	Provide grant, soft loan, aid & donation for infrastructure development & quality improvement						
S -8	Curriculum Strategy (Knowledge, skills and attitudes)						
70.	Ensure uniformity in the basis of entry eligibility (eligibility criteria should be Physical group in pre-engineering level (+2/ I.Sc.)) in higher engineering education (B.E. Level)						
71.	Initiate curriculum reform synchronized with global courses and schedules						
72.	Conduct the process of curriculum revision in all level of management (departments, instruction committee, academic council and floor) with up-to-date review and integrating Conceiving - Designing - Implementing - Operating (CDIO) model						
73.	Preserve rigor and breadth of coverage in the curriculum of every discipline based on market needs						
74.	Encourage text books based on local source, skill, originality & Nepali culture & market condition						
75.	Ensure the Sequence of curriculum organization, such that it leads students to; entry level employment, job advancement, entrepreneurship, education and training, personal use etc.						
76.	Start implementing quality assurance scheme and complete the first cycle of evaluation within a year in all departments leading to accreditation in short-term period (5years)						
77.	Develop national norms and standard for engineering education (academic degree and engineering colleges) and ensure its effective enforcement						
78.	Initiate for regional agreements between educational institutions and insure conformity of Nepalese engineering degree						
79.	Initiate for the conformity of ISO 9000 standards quality of engineering education						
80.	Initiate for continuing education and lifelong learning through professional organizations						
81.	Conduct review and Ensure consistent and rigid academic calendar						
82.	Ensure frequent and integrated assessment with teaching process, Ensure use of varieties of assessment tools (written and oral test, tutorials, presentations), Establish performance based assessment						
83.	Conduct review of failure rate in all regular exam, identify causes and apply corrective measures						
84.	Conduct review of the process of Exams making it objective						
85.	Apply ICT system (soft wares, networking, internet, etc.) in all engineering programs						
86.	Conduct exposure of technical know how and trainings necessary to understand application of new technologies						

	Proposition	Level of agreement					
		Low ⟷ High					
		N	1	2	3	4	5
87.	Develop classroom delivery developing web-based learning in engineering education						
88.	Ensure technology development in a socially beneficial way/direction by updating prevailing technology and introducing new technology in the institution						
89.	Conduct regular peer-review for new engineering institutions and activities for the accreditation of engineering qualifications establishing substantial equivalence						
S -9	Job Market Strategy						
90.	Establish industry – academic institute collaboration for need based research						
91.	Develop institution to produce the quality of human resource as demanded by ;global market, changing needs of society and as per the requirements of the technology development						
92.	Ensure quality academic performance, establish periodic review and monitoring of the academic performance						
93.	Conduct research works by establishing Research & Development centers and identify the critical and conventional areas of jobs thus canalizing necessary human resources						
94.	Strengthen private public partnerships for assessment of the academic performance of students and market response of their performances						
95.	Conduct internships/ on-the-job-training as a practical learning in engineering education						
96.	Develop market relevance courses in academic programs with sufficient contribution on manner and values						
97.	Ensure academic decentralization in institution's administrative structure to response the market demand						
98.	Ensure regular and realistic market feedback as an input for course design, Establish global connections and review the market trends thus procuring necessary human resources in global market						
99.	Encourage effective networking and exchange programs with other reputed academic institution within the region and abroad, organize exposure of faculties in different industries						

Part III: Open Ended Questions

1. In your opinion, what significant issues are there influencing quality of engineering education in Nepal?
   - … … …
   - … … …
   - … … …
2. In your opinion, what should be the pertinent reform strategies to resolve those significant issues to achieve quality in engineering education?
   - … … …
   - … … …
   - … … …

NB - Please check to make sure that you have responded to every item of the questionnaire.
Finally, read the following sentence and provide your signature:
All above responses provided based on my personal understanding and experience.

Signature of the respondent:

(Thank you very much for your active participation in this study)

SPECIFIC NOTES OF RESEARCHER:

Appendix iii Test-Retest Data

Pilot Test- Paired Samples Test (T-Test)
For Existing Level

Competency Parameters for Entry Level Engineering Professional Practice

Pairs	Competency Statements	Mean	Std. Deviation	T-value	Significance
Pair 1	q1p_a - q1p_2_a	0.400	0.548	1.633	0.178
Pair 2	q2p_a - q2p_2_a	-0.200	0.447	-1.000	0.374
Pair 3	q3p_a - q3p_2_a	-0.200	0.447	-1.000	0.374
Pair 4	q4p_a - q4p_2_a	-0.500	0.577	-1.732	0.182
Pair 5	q5p_a - q5p_2_a	-0.250	0.500	-1.000	0.391
Pair 6	q6p_a - q6p_2_a	0.200	0.447	1.000	0.374
Pair 7	q7p_a - q7p_2_a	-0.400	0.548	-1.633	0.178
Pair 8	q8p_a - q8p_2_a	-0.400	0.548	-1.633	0.178
Pair 9	q9p_a - q9p_2_a	-0.200	0.447	-1.000	0.374
Pair 10	q10p_a - q10p_2_a	-0.500	0.577	-1.732	0.182
Pair 11	q11p_a - q11p_2_a	0.200	0.447	1.000	0.374
Pair 12	q12p_a - q12p_2_a	0.200	0.447	1.000	0.374
Pair 13	q13p_a - q13p_2_a	0.400	0.548	1.633	0.178
Pair 14	q14p_a - q14p_2_a	-0.250	0.500	-1.000	0.391
Pair 15	q15p_a - q15p_2_a	0.200	0.447	1.000	0.374
Pair 16	q16p_a - q16p_2_a	-0.200	0.447	-1.000	0.374
Pair 17	q17p_a - q17p_2_a	-0.250	0.500	-1.000	0.391
Pair 18	q18p_a - q18p_2_a	-0.200	0.447	-1.000	0.374
Pair 19	q19p_a - q19p_2_a	-0.500	0.577	-1.732	0.182
Pair 20	q20p_a - q20p_2_a	0.200	1.095	0.408	0.704
Pair 21	q21p_a - q21p_2_a	0.400	0.548	1.633	0.178
Pair 22	q22p_a - q22p_2_a	0.200	0.447	1.000	0.374
Pair 23	q23p_a - q23p_2_a	0.000	0.707	0.000	1.000
Pair 24	q24p_a - q24p_2_a	0.200	0.447	1.000	0.374
Pair 25	q25p_a - q25p_2_a	0.400	0.894	1.000	0.374
Pair 26	q26p_a - q26p_2_a	0.400	0.894	1.000	0.374
Pair 27	q27p_a - q27p_2_a	0.200	0.447	1.000	0.374
Pair 28	q28p_a - q28p_2_a	0.200	0.447	1.000	0.374
Pair 29	q29p_a - q29p_2_a	0.400	0.548	1.633	0.178
Pair 30	q30p_a - q30p_2_a	-0.400	0.894	-1.000	0.374

Pilot Test-Paired Samples Test (T-Test)
For Desired Level

Competency Parameters for Entry Level Engineering Professional Practice

Pairs	Competency Statements	Mean	Std. Deviation	T-value	Significance
Pair 1	q1p_b - q1p_2_b	-0.200	0.447	-1.000	0.374
Pair 2	q2p_b - q2p_2_b	-0.400	0.548	-1.633	0.178
Pair 3	q3p_b - q3p_2_b	-0.200	0.447	-1.000	0.374
Pair 4	q4p_b - q4p_2_b	-0.250	0.500	-1.000	0.391
Pair 5	q5p_b - q5p_2_b	-0.200	0.447	-1.000	0.374
Pair 6	q6p_b - q6p_2_b	-0.200	0.447	-1.000	0.374
Pair 7	q7p_b - q7p_2_b	-0.400	0.894	-1.000	0.374
Pair 8	q8p_b - q8p_2_b	-0.200	0.447	-1.000	0.374
Pair 9	q9p_b - q9p_2_b	-0.200	0.447	-1.000	0.374
Pair 10	q10p_b - q10p_2_b	-0.250	0.500	-1.000	0.391
Pair 11	q11p_b - q11p_2_b	-0.500	0.577	-1.732	0.182
Pair 12	q12p_b - q12p_2_b	-0.200	0.447	-1.000	0.374
Pair 13	q13p_b - q13p_2_b	-0.400	0.548	-1.633	0.178
Pair 14	q14p_b - q14p_2_b	-0.200	0.447	-1.000	0.374
Pair 15	q15p_b - q15p_2_b	-0.200	0.447	-1.000	0.374
Pair 16	q16p_b - q16p_2_b	-0.250	0.500	-1.000	0.391
Pair 17	q17p_b - q17p_2_b	0.200	0.447	1.000	0.374
Pair 18	q18p_b - q18p_2_b	0.200	0.447	1.000	0.374
Pair 19	q19p_b - q19p_2_b	-0.500	0.577	-1.732	0.182
Pair 20	q20p_b - q20p_2_b	0.000	0.707	0.000	1.000
Pair 21	q21p_b - q21p_2_b	-0.200	0.447	-1.000	0.374
Pair 22	q22p_b - q22p_2_b	-0.200	0.447	-1.000	0.374
Pair 23	q23p_b - q23p_2_b	0.000	0.707	0.000	1.000
Pair 24	q24p_b - q24p_2_b	0.000	0.707	0.000	1.000
Pair 25	q25p_b - q25p_2_b	0.000	0.707	0.000	1.000
Pair 26	q26p_b - q26p_2_b	-0.200	0.447	-1.000	0.374
Pair 27	q27p_b - q27p_2_b	-0.200	0.447	-1.000	0.374
Pair 28	q28p_b - q28p_2_b	-0.800	1.304	-1.372	0.242
Pair 29	q29p_b - q29p_2_b	-0.250	0.500	-1.000	0.391
Pair 30	q30p_b - q30p_2_b	-0.600	0.894	-1.500	0.208

Pilot Test- Paired Samples Test (T-Test)

Issues Influencing Quality of Engineering Education

Pairs	Issue Statements	Mean	Std. Deviation	T Value	Sig. (2-tailed)
Pair 1	qi_1 - qi_2_1	-0.400	0.548	-1.633	0.178
Pair 2	qi_2 - qi_2_2	-0.200	0.447	-1.000	0.374
Pair 3	qi_3 - qi_2_3	0.000	0.707	0.000	1.000
Pair 4	qi_4 - qi_2_4	-0.200	1.095	-0.408	0.704
Pair 5	qi_5 - qi_2_5	-1.000	1.225	-1.826	0.142
Pair 6	qi_6 - qi_2_6	-0.200	0.447	-1.000	0.374
Pair 7	qi_7 - qi_2_7	-0.400	0.548	-1.633	0.178
Pair 8	qi_8 - qi_2_8	-0.800	1.095	-1.633	0.178
Pair 9	qi_9 - qi_2_9	-0.600	1.140	-1.177	0.305
Pair 10	qi_10 - qi_2_10	0.200	0.447	1.000	0.374
Pair 11	qi_11 - qi_2_11	-0.200	0.447	-1.000	0.374
Pair 12	qi_12 - qi_2_12	-0.800	1.095	-1.633	0.178
Pair 13	qi_13 - qi_2_13	0.000	0.707	0.000	1.000
Pair 14	qi_14 - qi_2_14	-0.200	0.447	-1.000	0.374
Pair 15	qi_15 - qi_2_15	0.000	0.707	0.000	1.000
Pair 16	qi_16 - qi_2_16	-0.800	1.095	-1.633	0.178
Pair 17	qi_17 - qi_2_17	-0.200	0.447	-1.000	0.374
Pair 18	qi_18 - qi_2_18	-0.600	0.548	-2.449	0.070
Pair 19	qi_19 - qi_2_19	-0.600	0.894	-1.500	0.208
Pair 20	qi_20 - qi_2_20	-0.200	0.837	-0.535	0.621
Pair 21	qi_21 - qi_2_21	0.200	0.447	1.000	0.374
Pair 22	qi_22 - qi_2_22	0.400	0.548	1.633	0.178
Pair 23	qi_23 - qi_2_23	-0.200	0.447	-1.000	0.374
Pair 24	qi_24 - qi_2_24	-0.800	1.095	-1.633	0.178
Pair 25	qi_25 - qi_2_25	-0.200	0.447	-1.000	0.374
Pair 26	qi_26 - qi_2_26	-0.400	1.140	-0.784	0.477
Pair 27	qi_27 - qi_2_27	0.500	0.577	1.732	0.182
Pair 28	qi_28 - qi_2_28	-0.400	0.548	-1.633	0.178
Pair 29	qi_29 - qi_2_29	0.000	0.707	0.000	1.000
Pair 30	qi_30 - qi_2_30	0.200	0.447	1.000	0.374
Pair 31	qi_31 - qi_2_31	0.200	0.447	1.000	0.374
Pair 32	qi_32 - qi_2_32	0.400	0.548	1.633	0.178
Pair 33	qi_33 - qi_2_33	0.200	0.447	1.000	0.374
Pair 34	qi_34 - qi_2_34	0.000	0.707	0.000	1.000
Pair 35	qi_35 - qi_2_35	-0.800	1.304	-1.372	0.242
Pair 36	qi_36 - qi_2_36	-0.200	0.837	-0.535	0.621
Pair 37	qi_37 - qi_2_37	-0.200	0.447	-1.000	0.374
Pair 38	qi_38 - qi_2_38	0.000	0.707	0.000	1.000

Pair 39	qi_39 - qi_2_39	-0.800	1.095	-1.633	0.178
Pair 40	qi_40 - qi_2_40	0.200	0.837	0.535	0.621
Pair 41	qi_41 - qi_2_41	0.200	0.447	1.000	0.374
Pair 42	qi_42 - qi_2_42	0.000	0.707	0.000	1.000
Pair 43	qi_43 - qi_2_43	0.000	0.707	0.000	1.000
Pair 44	qi_44 - qi_2_44	-0.400	0.894	-1.000	0.374
Pair 45	qi_45 - qi_2_45	0.400	0.548	1.633	0.178
Pair 46	qi_46 - qi_2_46	-0.400	0.548	-1.633	0.178
Pair 47	qi_47 - qi_2_47	-0.200	0.837	-0.535	0.621
Pair 48	qi_48 - qi_2_48	-0.200	0.447	-1.000	0.374
Pair 49	qi_49 - qi_2_49	0.000	0.707	0.000	1.000
Pair 50	qi_50 - qi_2_50	0.000	0.707	0.000	1.000
Pair 51	qi_51 - qi_2_51	-1.000	1.414	-1.581	0.189
Pair 52	qi_52 - qi_2_52	-0.800	1.304	-1.372	0.242
Pair 53	qi_53 - qi_2_53	-0.400	0.548	-1.633	0.178
Pair 54	qi_54 - qi_2_54	0.200	0.447	1.000	0.374
Pair 55	qi_55 - qi_2_55	-0.200	0.447	-1.000	0.374
Pair 56	qi_56 - qi_2_56	0.200	0.447	1.000	0.374
Pair 57	qi_57 - qi_2_57	-0.200	0.837	-0.535	0.621
Pair 58	qi_58 - qi_2_58	-0.200	0.447	-1.000	0.374
Pair 59	qi_59 - qi_2_59	-0.600	0.548	-2.449	0.070
Pair 60	qi_60 - qi_2_60	-0.200	0.837	-0.535	0.621
Pair 61	qi_61 - qi_2_61	0.200	0.447	1.000	0.374
Pair 62	qi_62 - qi_2_62	0.200	0.447	1.000	0.374
Pair 63	qi_63 - qi_2_63	0.000	0.707	0.000	1.000
Pair 64	qi_64 - qi_2_64	-0.200	0.447	-1.000	0.374
Pair 65	qi_65 - qi_2_65	-0.200	0.447	-1.000	0.374
Pair 66	qi_66 - qi_2_66	0.200	0.837	0.535	0.621
Pair 67	qi_67 - qi_2_67	-0.800	1.304	-1.372	0.242
Pair 68	qi_68 - qi_2_68	-0.200	0.447	-1.000	0.374
Pair 69	qi_69 - qi_2_69	-0.200	0.447	-1.000	0.374
Pair 70	qi_70 - qi_2_70	-0.400	0.548	-1.633	0.178
Pair 71	qi_71 - qi_2_71	-0.600	0.548	-2.449	0.070
Pair 72	qi_72 - qi_2_72	-0.200	0.447	-1.000	0.374
Pair 73	qi_73 - qi_2_73	0.200	0.447	1.000	0.374
Pair 74	qi_74 - qi_2_74	-0.200	0.837	-0.535	0.621
Pair 75	qi_75 - qi_2_75	0.200	0.447	1.000	0.374
Pair 76	qi_76 - qi_2_76	0.000	0.707	0.000	1.000
Pair 77	qi_77 - qi_2_77	-0.200	0.447	-1.000	0.374
Pair 78	qi_78 - qi_2_78	-0.200	0.447	-1.000	0.374
Pair 79	qi_79 - qi_2_79	-0.600	0.548	-2.449	0.070
Pair 80	qi_80 - qi_2_80	-0.800	1.304	-1.372	0.242

Pair 81	qi_81 - qi_2_81	0.200	1.095	0.408	0.704
Pair 82	qi_82 - qi_2_82	0.800	0.837	2.138	0.099
Pair 83	qi_83 - qi_2_83	-0.200	0.447	-1.000	0.374
Pair 84	qi_84 - qi_2_84	-0.400	0.548	-1.633	0.178
Pair 85	qi_85 - qi_2_85	0.000	0.707	0.000	1.000
Pair 86	qi_86 - qi_2_86	-0.200	0.837	-0.535	0.621
Pair 87	qi_87 - qi_2_87	-0.400	0.548	-1.633	0.178
Pair 88	qi_88 - qi_2_88	-0.400	0.548	-1.633	0.178
Pair 89	qi_89 - qi_2_89	-0.200	0.837	-0.535	0.621
Pair 90	qi_90 - qi_2_90	-0.200	0.447	-1.000	0.374
Pair 91	qi_91 - qi_2_91	-0.200	0.447	-1.000	0.374
Pair 92	qi_92 - qi_2_92	-0.400	1.140	-0.784	0.477
Pair 93	qi_93 - qi_2_93	-0.600	0.894	-1.500	0.208
Pair 94	qi_94 - qi_2_94	-0.400	0.894	-1.000	0.374
Pair 95	qi_95 - qi_2_95	-0.600	0.548	-2.449	0.070
Pair 96	qi_96 - qi_2_96	0.000	0.707	0.000	1.000
Pair 97	qi_97 - qi_2_97	-0.800	1.304	-1.372	0.242
Pair 98	qi_98 - qi_2_98	-0.200	0.447	-1.000	0.374
Pair 99	qi_99 - qi_2_99	-0.200	0.447	-1.000	0.374

Pilot Test- Paired Samples Test (T-Test)

Strategies to Resolve Issues Influencing Quality of Engineering Education

Pairs	Strategy Statements	Mean	Std. Deviation	T-value	Sig. (2-tailed)
Pair 1	qs_1 - qs_2_1	-0.200	0.447	-1.000	0.374
Pair 2	qs_2 - qs_2_2	-0.400	0.548	-1.633	0.178
Pair 3	qs_3 - qs_2_3	0.600	0.894	1.500	0.208
Pair 4	qs_4 - qs_2_4	-0.200	0.447	-1.000	0.374
Pair 5	qs_5 - qs_2_5	-0.400	0.548	-1.633	0.178
Pair 6	qs_6 - qs_2_6	-0.400	1.517	-0.590	0.587
Pair 7	qs_7 - qs_2_7	-0.200	1.095	-0.408	0.704
Pair 8	qs_8 - qs_2_8	0.000	0.707	0.000	1.000
Pair 9	qs_9 - qs_2_9	-0.200	0.447	-1.000	0.374
Pair 10	qs_10 - qs_2_10	-0.200	0.447	-1.000	0.374
Pair 11	qs_11 - qs_2_11	-0.200	0.447	-1.000	0.374
Pair 12	qs_12 - qs_2_12	-0.400	0.548	-1.633	0.178
Pair 13	qs_13 - qs_2_13	-0.400	0.548	-1.633	0.178
Pair 14	qs_14 - qs_2_14	-0.400	0.894	-1.000	0.374
Pair 15	qs_15 - qs_2_15	0.000	0.707	0.000	1.000
Pair 16	qs_16 - qs_2_16	0.200	0.447	1.000	0.374
Pair 17	qs_17 - qs_2_17	-0.200	0.447	-1.000	0.374
Pair 18	qs_18 - qs_2_18	0.600	0.894	1.500	0.208
Pair 19	qs_19 - qs_2_19	0.000	0.707	0.000	1.000

Pair 20	qs_20 - qs_2_20	-0.200	0.447	-1.000	0.374
Pair 21	qs_21 - qs_2_21	0.200	0.447	1.000	0.374
Pair 22	qs_22 - qs_2_22	0.200	0.447	1.000	0.374
Pair 23	qs_23 - qs_2_23	-0.400	0.548	-1.633	0.178
Pair 24	qs_24 - qs_2_24	-0.200	0.447	-1.000	0.374
Pair 25	qs_25 - qs_2_25	0.600	0.894	1.500	0.208
Pair 26	qs_26 - qs_2_26	0.200	0.837	0.535	0.621
Pair 27	qs_27 - qs_2_27	0.200	0.837	0.535	0.621
Pair 28	qs_28 - qs_2_28	-0.600	0.548	-2.449	0.070
Pair 29	qs_29 - qs_2_29	0.200	0.447	1.000	0.374
Pair 30	qs_30 - qs_2_30	0.200	0.447	1.000	0.374
Pair 31	qs_31 - qs_2_31	0.200	0.447	1.000	0.374
Pair 32	qs_32 - qs_2_32	0.000	0.707	0.000	1.000
Pair 33	qs_33 - qs_2_33	0.200	0.447	1.000	0.374
Pair 34	qs_34 - qs_2_34	0.200	0.837	0.535	0.621
Pair 35	qs_35 - qs_2_35	-0.200	0.447	-1.000	0.374
Pair 36	qs_36 - qs_2_36	-0.600	0.548	-2.449	0.070
Pair 37	qs_37 - qs_2_37	-0.800	0.837	-2.138	0.099
Pair 38	qs_38 - qs_2_38	-0.200	0.447	-1.000	0.374
Pair 39	qs_39 - qs_2_39	-0.600	1.342	-1.000	0.374
Pair 40	qs_40 - qs_2_40	0.400	0.548	1.633	0.178
Pair 41	qs_41 - qs_2_41	0.600	0.894	1.500	0.208
Pair 42	qs_42 - qs_2_42	0.000	0.707	0.000	1.000
Pair 43	qs_43 - qs_2_43	0.000	0.707	0.000	1.000
Pair 44	qs_44 - qs_2_44	0.200	0.447	1.000	0.374
Pair 45	qs_45 - qs_2_45	0.400	0.548	1.633	0.178
Pair 46	qs_46 - qs_2_46	0.000	0.707	0.000	1.000
Pair 47	qs_47 - qs_2_47	-0.400	0.548	-1.633	0.178
Pair 48	qs_48 - qs_2_48	0.600	0.894	1.500	0.208
Pair 49	qs_49 - qs_2_49	0.000	0.707	0.000	1.000
Pair 50	qs_50 - qs_2_50	0.400	0.548	1.633	0.178
Pair 51	qs_51 - qs_2_51	0.200	1.304	0.343	0.749
Pair 52	qs_52 - qs_2_52	0.000	0.707	0.000	1.000
Pair 53	qs_53 - qs_2_53	0.400	0.548	1.633	0.178
Pair 54	qs_54 - qs_2_54	0.600	0.548	2.449	0.070
Pair 55	qs_55 - qs_2_55	-0.200	0.447	-1.000	0.374
Pair 57	qs_57 - qs_2_57	0.200	0.447	1.000	0.374
Pair 58	qs_58 - qs_2_58	0.000	0.707	0.000	1.000
Pair 59	qs_59 - qs_2_59	0.000	0.707	0.000	1.000
Pair 60	qs_60 - qs_2_60	0.000	0.707	0.000	1.000

Pair 61	qs_61 - qs_2_61	0.200	0.447	1.000	0.374
Pair 62	qs_62 - qs_2_62	0.000	0.707	0.000	1.000
Pair 63	qs_63 - qs_2_63	0.000	0.707	0.000	1.000
Pair 64	qs_64 - qs_2_64	0.400	0.548	1.633	0.178
Pair 65	qs_65 - qs_2_65	0.600	0.894	1.500	0.208
Pair 66	qs_66 - qs_2_66	-0.400	0.548	-1.633	0.178
Pair 67	qs_67 - qs_2_67	0.200	0.447	1.000	0.374
Pair 68	qs_68 - qs_2_68	0.000	0.707	0.000	1.000
Pair 69	qs_69 - qs_2_69	0.200	0.447	1.000	0.374
Pair 70	qs_70 - qs_2_70	0.200	0.837	0.535	0.621
Pair 71	qs_71 - qs_2_71	-0.200	0.447	-1.000	0.374
Pair 72	qs_72 - qs_2_72	0.000	0.707	0.000	1.000
Pair 73	qs_73 - qs_2_73	-0.200	0.447	-1.000	0.374
Pair 74	qs_74 - qs_2_74	-0.200	0.447	-1.000	0.374
Pair 75	qs_75 - qs_2_75	0.200	0.447	1.000	0.374
Pair 76	qs_76 - qs_2_76	0.000	0.707	0.000	1.000
Pair 77	qs_77 - qs_2_77	-0.200	0.447	-1.000	0.374
Pair 78	qs_78 - qs_2_78	-0.200	1.304	-0.343	0.749
Pair 79	qs_79 - qs_2_79	-0.600	0.894	-1.500	0.208
Pair 80	qs_80 - qs_2_80	-0.400	0.548	-1.633	0.178
Pair 81	qs_81 - qs_2_81	-0.200	0.837	-0.535	0.621
Pair 82	qs_82 - qs_2_82	-0.400	0.894	-1.000	0.374
Pair 83	qs_83 - qs_2_83	-0.200	0.447	-1.000	0.374
Pair 84	qs_84 - qs_2_84	-0.200	0.447	-1.000	0.374
Pair 85	qs_85 - qs_2_85	0.000	0.707	0.000	1.000
Pair 86	qs_86 - qs_2_86	0.400	0.548	1.633	0.178
Pair 87	qs_87 - qs_2_87	-0.200	0.447	-1.000	0.374
Pair 88	qs_88 - qs_2_88	-0.200	0.447	-1.000	0.374
Pair 89	qs_89 - qs_2_89	-0.200	0.447	-1.000	0.374
Pair 90	qs_90 - qs_2_90	0.000	0.707	0.000	1.000
Pair 91	qs_91 - qs_2_91	-0.400	0.548	-1.633	0.178
Pair 92	qs_92 - qs_2_92	-0.200	0.447	-1.000	0.374
Pair 93	qs_93 - qs_2_93	-0.200	0.447	-1.000	0.374
Pair 94	qs_94 - qs_2_94	-0.400	0.894	-1.000	0.374
Pair 95	qs_95 - qs_2_95	0.200	0.447	1.000	0.374
Pair 96	qs_96 - qs_2_96	0.000	0.707	0.000	1.000
Pair 97	qs_97 - qs_2_97	0.000	1.000	0.000	1.000
Pair 98	qs_98 - qs_2_98	-0.600	0.548	-2.449	0.070
Pair 99	qs_99 - qs_2_99	-0.200	0.447	-1.000	0.374

Appendix iv

Respondents Rating on Competency Requirements

Respondent Rating on Individual Statements for Competency Requirements
(NA=not applicable, P=poor, F=fair, G=good, VG=very good, E=excellent, Fr= Frequency)

Existing Level

	p_1a		p_2a		p_3a		p_4a		p_5a		p_6a		p_7a		p_8a		p_9a		p_10a	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	1	0.4	2	0.9	5	2.2	9	3.9	8	3.5	1	0.4	1	0.4	9	3.9	2	0.9	1	0.4
P	8	3.5	11	4.8	26	11.4	24	10.5	5	2.2	7	3.1	23	10.0	30	13.1	23	10.0	27	11.8
F	54	23.6	45	19.7	63	27.5	68	29.7	53	23.1	37	16.2	59	25.8	75	32.8	76	33.2	81	35.4
G	115	50.2	101	44.1	95	41.5	79	34.5	77	33.6	103	45.0	89	38.9	77	33.6	87	38.0	71	31.0
VG	40	17.5	58	25.3	35	15.3	40	17.5	58	25.3	75	32.8	39	17.0	35	15.3	33	14.4	40	17.5
E	12	4.8	13	5.2	6	2.2	10	3.9	29	12.2	7	2.6	19	7.9	4	1.3	9	3.5	10	3.9
Total	246	100	246	100	246	100	246	100	246	100	246	100	246	100	246	100	246	100	246	100

	p_11a		p_12a		p_13a		p_14a		p_15a		p_16a		p_17a		p_18a		p_19a		p_20a	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	7	3.1	6	2.6	6	2.6	5	2.2	3	1.3	10	4.4	11	4.8	3	1.3	8	3.5	2	0.9
P	39	17.0	32	14.0	19	8.3	29	12.7	26	11.4	34	14.8	34	14.8	28	12.2	29	12.7	39	17.0
F	63	27.5	68	29.7	87	38.0	81	35.4	84	36.7	62	27.1	79	34.5	71	31.0	77	33.6	73	31.9
G	87	38.0	91	39.7	76	33.2	69	30.1	71	31.0	75	32.8	67	29.3	96	41.9	87	38.0	72	31.4
VG	29	12.7	26	11.4	35	15.3	38	16.6	36	15.7	37	16.2	27	11.8	27	11.8	21	9.2	31	13.5
E	5	1.7	7	2.6	7	2.6	8	3.1	10	3.9	12	4.8	12	4.8	5	1.7	8	3.1	13	4.8
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	99.6

	p_21a		p_22a		p_23a		p_24a		p_25a		p_26a		p_27a		p_28a		p_29a		p_30a	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	3	1.3	5	2.2	8	3.5	5	2.2	4	1.7	4	1.7	3	1.3	6	2.6	6	2.6	3	1.3
P	35	15.3	27	11.8	25	10.9	31	13.5	33	14.4	34	14.8	34	14.8	33	14.4	33	14.4	37	16.2
F	77	33.6	87	38.0	99	43.2	88	38.4	76	33.2	69	30.1	81	35.4	85	37.1	87	38.0	89	38.9
G	71	31.0	69	30.1	68	29.7	70	30.6	75	32.8	80	34.9	78	34.1	69	30.1	74	32.3	68	29.7
VG	33	14.4	32	14.0	24	10.5	28	12.2	28	12.2	33	14.4	26	11.4	26	11.4	19	8.3	25	10.9
E	11	4.4	10	3.9	6	2.2	8	3.1	14	5.7	10	3.9	8	3.1	11	4.4	11	4.4	8	3.1
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Desired level

	p_1b		p_2b		p_3b		p_4b		p_5b		p_6b		p_7b		p_8b		p_9b		p_10b	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA							1	0.4							1	0.4			1	0.4
P	2	0.9			2	0.9							1	0.4	2	0.9			3	1.3
F	4	1.7	4	1.7	2	0.9	5	2.2	2	0.9	1	0.4	2	0.9	2	0.9	6	2.6	4	1.7
G	21	9.2	23	10.0	30	13.1	29	12.7	20	8.7	24	10.5	20	8.7	22	9.6	26	11.4	19	8.3
VG	99	43.2	85	37.1	106	46.3	115	50.2	100	43.7	82	35.8	99	43.2	102	44.5	106	46.3	115	50.2
E	103	45.0	117	51.1	89	38.9	79	34.5	107	46.7	122	53.3	107	46.7	100	43.7	91	39.7	87	38.0
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

	p_11b		p_12b		p_13b		p_14b		p_15b		p_16b		p_17b		p_18b		p_19b		p_20b	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA															1	0.4	1	0.4		
P			3	1.3	2	0.9	1	0.4	3	1.3	2	0.9	4	1.7	1	0.4	2	0.9	1	0.4
F	7	3.1	4	1.7	5	2.2	4	1.7	2	0.9	4	1.7	7	3.1	3	1.3	3	1.3	4	1.7
G	29	12.7	27	11.8	26	11.4	17	7.4	18	7.9	18	7.9	16	7.0	24	10.5	16	7.0	17	7.4
VG	104	45.4	111	48.5	94	41.0	102	44.5	110	48.0	102	44.5	113	49.3	118	51.5	123	53.7	98	42.4
E	89	38.9	84	36.7	102	44.5	105	45.9	96	41.9	103	45.0	89	38.9	82	35.8	84	36.7	110	47.6
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	99.6

	p_21b		p_22b		p_23b		p_24b		p_25b		p_26b		p_27b		p_28b		p_29b		p_30b	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA																			1	0.4
P	1	0.4	1	0.4	1	0.4	2	0.9	1	0.4	2	0.9	1	0.4	3	1.3	3	1.3	5	2.2
F	5	2.2	5	2.2	8	3.5	9	3.9	8	3.5	7	3.1	8	3.5	7	3.1	8	3.5	11	4.8
G	24	10.5	23	10.0	34	14.8	36	15.7	34	14.8	18	7.9	23	10.0	27	11.8	32	14.0	33	14.4
VG	106	46.3	103	45.0	107	46.7	101	44.1	100	43.7	107	46.7	106	46.3	98	42.8	103	45.0	110	48.0
E	93	40.6	97	42.4	79	34.5	81	35.4	86	37.6	95	41.5	91	39.7	94	41.0	83	36.2	69	30.1
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Appendix v

ANOVA Table for Existing Level of Competencies

		Sum of Squares	df	Mean Square	F	Sig.
p_1a	Between Groups	4.254	3	1.418	2.937	0.034
	Within Groups	109.12	236	0.483		
p_2a	Between Groups	11.198	3	3.733	7.206	0
	Within Groups	117.067	236	0.518		
p_3a	Between Groups	4.913	3	1.638	3.14	0.026
	Within Groups	117.874	236	0.522		
p_4a	Between Groups	2.949	3	0.983	1.642	0.18
	Within Groups	135.294	236	0.599		
p_5a	Between Groups	2.92	3	0.973	1.493	0.217
	Within Groups	147.341	236	0.652		
p_6a	Between Groups	3.471	3	1.157	2.224	0.086
	Within Groups	117.577	236	0.52		
p_7a	Between Groups	12.859	3	4.286	7.799	0
	Within Groups	124.202	236	0.55		
p_8a	Between Groups	5.365	3	1.788	3.326	0.02
	Within Groups	121.522	236	0.538		
p_9a	Between Groups	6.279	3	2.093	3.94	0.009
	Within Groups	120.069	236	0.531		
p_10a	Between Groups	8.943	3	2.981	5.05	0.002
	Within Groups	133.405	236	0.59		
p_11a	Between Groups	2.779	3	0.926	1.829	0.143
	Within Groups	114.443	236	0.506		
p_12a	Between Groups	4.013	3	1.338	2.735	0.044
	Within Groups	110.531	236	0.489		
p_13a	Between Groups	6.423	3	2.141	3.87	0.01
	Within Groups	125.038	236	0.553		
p_14a	Between Groups	8.244	3	2.748	4.761	0.003
	Within Groups	130.452	236	0.577		
p_15a	Between Groups	2.754	3	0.918	1.535	0.206
	Within Groups	135.142	236	0.598		
p_16a	Between Groups	13.325	3	4.442	7.933	0
	Within Groups	126.541	236	0.56		
p_17a	Between Groups	6.235	3	2.078	3.792	0.011
	Within Groups	123.857	236	0.548		
p_18a	Between Groups	4.877	3	1.626	3.447	0.017
	Within Groups	106.584	236	0.472		
p_19a	Between Groups	8.906	3	2.969	6.631	0
	Within Groups	101.185	236	0.448		
p_20a	Between Groups	17.147	3	5.716	11.031	0
	Within Groups	116.582	225	0.518		
p_21a	Between Groups	17.992	3	5.997	11.502	0
	Within Groups	117.839	236	0.521		
p_22a	Between Groups	13.667	3	4.556	8.566	0

	Within Groups	120.198	236	0.532		
p_23a	Between Groups	7.316	3	2.439	5.12	0.002
	Within Groups	107.658	236	0.476		
p_24a	Between Groups	2.354	3	0.785	1.431	0.235
	Within Groups	123.976	236	0.549		
p_25a	Between Groups	1.478	3	0.493	0.846	0.47
	Within Groups	131.605	236	0.582		
p_26a	Between Groups	9.968	3	3.323	6.201	0
	Within Groups	121.093	236	0.536		
p_27a	Between Groups	5.604	3	1.868	3.695	0.013
	Within Groups	114.24	236	0.505		
p_28a	Between Groups	12.214	3	4.071	8.047	0
	Within Groups	114.347	236	0.506		
p_29a	Between Groups	7.264	3	2.421	5.122	0.002
	Within Groups	106.827	236	0.473		
p_30a	Between Groups	8.763	3	2.921	5.93	0.001
	Within Groups	111.328	236	0.493		

Multiple Comparisons for existing level of competency
Scheffe's Range Test

	(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
p_1a	Faculty	Student	-0.195	0.116	0.424	-0.523	0.133
		Policy Maker	0.103	0.156	0.932	-0.336	0.543
		Employers	0.127	0.155	0.879	-0.309	0.563
	Student	Faculty	0.195	0.116	0.424	-0.133	0.523
		Policy Maker	0.298	0.139	0.207	-0.094	0.690
		Employers	0.322	0.137	0.143	-0.065	0.709
	Policy Maker	Faculty	-0.103	0.156	0.932	-0.543	0.336
		Student	-0.298	0.139	0.207	-0.690	0.094
		Employers	0.024	0.172	0.999	-0.462	0.509
	Employers	Faculty	-0.127	0.155	0.879	-0.563	0.309
		Student	-0.322	0.137	0.143	-0.709	0.065
		Policy Maker	-0.024	0.172	0.999	-0.509	0.462
p_2a	Faculty	Student	-0.390	0.121	0.017	-0.729	-0.050
		Policy Maker	-0.022	0.162	0.999	-0.477	0.434
		Employers	0.157	0.160	0.810	-0.294	0.609
	Student	Faculty	0.390	0.121	0.017	0.050	0.729
		Policy Maker	0.368	0.144	0.092	-0.038	0.774
		Employers	0.547	0.142	0.002	0.146	0.948
	Policy Maker	Faculty	0.022	0.162	0.999	-0.434	0.477
		Student	-0.368	0.144	0.092	-0.774	0.038
		Employers	0.179	0.179	0.800	-0.324	0.682
	Employers	Faculty	-0.157	0.160	0.810	-0.609	0.294
		Student	-0.547	0.142	0.002	-0.948	-0.146
		Policy Maker	-0.179	0.179	0.800	-0.682	0.324
p_3a	Faculty	Student	-0.219	0.121	0.353	-0.560	0.122
		Policy Maker	0.067	0.162	0.982	-0.390	0.524

		Employers	0.147	0.161	0.841	-0.306	0.600
	Student	Faculty	0.219	0.121	0.353	-0.122	0.560
		Policy Maker	0.287	0.145	0.273	-0.121	0.694
		Employers	0.366	0.143	0.090	-0.036	0.769
	Policy Maker	Faculty	-0.067	0.162	0.982	-0.524	0.390
		Student	-0.287	0.145	0.273	-0.694	0.121
		Employers	0.080	0.179	0.978	-0.425	0.584
	Employers	Faculty	-0.147	0.161	0.841	-0.600	0.306
		Student	-0.366	0.143	0.090	-0.769	0.036
		Policy Maker	-0.080	0.179	0.978	-0.584	0.425
p_4a	Faculty	Student	-0.212	0.130	0.447	-0.577	0.153
		Policy Maker	-0.046	0.174	0.995	-0.535	0.444
		Employers	0.067	0.172	0.985	-0.418	0.552
	Student	Faculty	0.212	0.130	0.447	-0.153	0.577
		Policy Maker	0.166	0.155	0.765	-0.270	0.603
		Employers	0.279	0.153	0.347	-0.152	0.710
	Policy Maker	Faculty	0.046	0.174	0.995	-0.444	0.535
		Student	-0.166	0.155	0.765	-0.603	0.270
		Employers	0.113	0.192	0.951	-0.428	0.653
	Employers	Faculty	-0.067	0.172	0.985	-0.552	0.418
		Student	-0.279	0.153	0.347	-0.710	0.152
		Policy Maker	-0.113	0.192	0.951	-0.653	0.428
p_5a	Faculty	Student	-0.254	0.135	0.320	-0.635	0.127
		Policy Maker	-0.233	0.181	0.648	-0.744	0.278
		Employers	-0.047	0.180	0.995	-0.553	0.460
	Student	Faculty	0.254	0.135	0.320	-0.127	0.635
		Policy Maker	0.021	0.162	0.999	-0.435	0.476
		Employers	0.207	0.160	0.641	-0.243	0.657
	Policy Maker	Faculty	0.233	0.181	0.648	-0.278	0.744
		Student	-0.021	0.162	0.999	-0.476	0.435
		Employers	0.187	0.200	0.833	-0.378	0.751
	Employers	Faculty	0.047	0.180	0.995	-0.460	0.553
		Student	-0.207	0.160	0.641	-0.657	0.243
		Policy Maker	-0.187	0.200	0.833	-0.751	0.378
p_6a	Faculty	Student	-0.150	0.121	0.673	-0.491	0.190
		Policy Maker	0.209	0.162	0.645	-0.247	0.666
		Employers	-0.006	0.161	1.000	-0.458	0.446
	Student	Faculty	0.150	0.121	0.673	-0.190	0.491
		Policy Maker	0.359	0.144	0.106	-0.048	0.766
		Employers	0.144	0.143	0.796	-0.258	0.546
	Policy Maker	Faculty	-0.209	0.162	0.645	-0.666	0.247
		Student	-0.359	0.144	0.106	-0.766	0.048
		Employers	-0.215	0.179	0.696	-0.719	0.289
	Employers	Faculty	0.006	0.161	1.000	-0.446	0.458
		Student	-0.144	0.143	0.796	-0.546	0.258
		Policy Maker	0.215	0.179	0.696	-0.289	0.719
p_7a	Faculty	Student	-0.489	0.124	0.002	-0.839	-0.139
		Policy Maker	-0.115	0.167	0.923	-0.585	0.354
		Employers	0.029	0.165	0.999	-0.436	0.493
	Student	Faculty	0.489	0.124	0.002	0.139	0.839
		Policy Maker	0.374	0.148	0.099	-0.044	0.792
		Employers	0.518	0.147	0.007	0.105	0.931

	Policy Maker	Faculty	0.115	0.167	0.923	-0.354	0.585
		Student	-0.374	0.148	0.099	-0.792	0.044
		Employers	0.144	0.184	0.893	-0.374	0.662
	Employers	Faculty	-0.029	0.165	0.999	-0.493	0.436
		Student	-0.518	0.147	0.007	-0.931	-0.105
		Policy Maker	-0.144	0.184	0.893	-0.662	0.374
p_8a	Faculty	Student	-0.220	0.123	0.365	-0.566	0.127
		Policy Maker	-0.111	0.165	0.930	-0.575	0.353
		Employers	0.213	0.163	0.636	-0.246	0.673
	Student	Faculty	0.220	0.123	0.365	-0.127	0.566
		Policy Maker	0.109	0.147	0.908	-0.305	0.523
		Employers	0.433	0.145	0.033	0.024	0.842
	Policy Maker	Faculty	0.111	0.165	0.930	-0.353	0.575
		Student	-0.109	0.147	0.908	-0.523	0.305
		Employers	0.324	0.182	0.368	-0.189	0.836
	Employers	Faculty	-0.213	0.163	0.636	-0.673	0.246
		Student	-0.433	0.145	0.033	-0.842	-0.024
		Policy Maker	-0.324	0.182	0.368	-0.836	0.189
p_9a	Faculty	Student	-0.221	0.122	0.355	-0.565	0.123
		Policy Maker	0.079	0.164	0.972	-0.382	0.541
		Employers	0.219	0.162	0.612	-0.238	0.675
	Student	Faculty	0.221	0.122	0.355	-0.123	0.565
		Policy Maker	0.300	0.146	0.241	-0.111	0.711
		Employers	0.439	0.144	0.028	0.033	0.845
	Policy Maker	Faculty	-0.079	0.164	0.972	-0.541	0.382
		Student	-0.300	0.146	0.241	-0.711	0.111
		Employers	0.139	0.181	0.898	-0.370	0.649
	Employers	Faculty	-0.219	0.162	0.612	-0.675	0.238
		Student	-0.439	0.144	0.028	-0.845	-0.033
		Policy Maker	-0.139	0.181	0.898	-0.649	0.370
p_10a	Faculty	Student	-0.352	0.129	0.061	-0.715	0.010
		Policy Maker	-0.079	0.173	0.976	-0.566	0.407
		Employers	0.153	0.171	0.850	-0.329	0.634
	Student	Faculty	0.352	0.129	0.061	-0.010	0.715
		Policy Maker	0.273	0.154	0.372	-0.160	0.706
		Employers	0.505	0.152	0.013	0.077	0.933
	Policy Maker	Faculty	0.079	0.173	0.976	-0.407	0.566
		Student	-0.273	0.154	0.372	-0.706	0.160
		Employers	0.232	0.191	0.687	-0.305	0.769
	Employers	Faculty	-0.153	0.171	0.850	-0.634	0.329
		Student	-0.505	0.152	0.013	-0.933	-0.077
		Policy Maker	-0.232	0.191	0.687	-0.769	0.305
p_11a	Faculty	Student	-0.155	0.119	0.642	-0.490	0.181
		Policy Maker	0.053	0.160	0.991	-0.397	0.503
		Employers	0.131	0.158	0.878	-0.316	0.577
	Student	Faculty	0.155	0.119	0.642	-0.181	0.490
		Policy Maker	0.207	0.142	0.549	-0.194	0.609
		Employers	0.285	0.141	0.254	-0.112	0.682
	Policy Maker	Faculty	-0.053	0.160	0.991	-0.503	0.397
		Student	-0.207	0.142	0.549	-0.609	0.194
		Employers	0.078	0.177	0.979	-0.420	0.575
	Employers	Faculty	-0.131	0.158	0.878	-0.577	0.316

		Student	-0.285	0.141	0.254	-0.682	0.112
		Policy Maker	-0.078	0.177	0.979	-0.575	0.420
p_12a	Faculty	Student	-0.163	0.117	0.585	-0.493	0.167
		Policy Maker	-0.072	0.157	0.976	-0.515	0.370
		Employers	0.221	0.156	0.568	-0.217	0.660
	Student	Faculty	0.163	0.117	0.585	-0.167	0.493
		Policy Maker	0.091	0.140	0.935	-0.303	0.486
		Employers	0.385	0.138	0.055	-0.005	0.775
	Policy Maker	Faculty	0.072	0.157	0.976	-0.370	0.515
		Student	-0.091	0.140	0.935	-0.486	0.303
		Employers	0.294	0.174	0.415	-0.195	0.782
	Employers	Faculty	-0.221	0.156	0.568	-0.660	0.217
		Student	-0.385	0.138	0.055	-0.775	0.005
		Policy Maker	-0.294	0.174	0.415	-0.782	0.195
p_13a	Faculty	Student	-0.206	0.125	0.436	-0.557	0.145
		Policy Maker	0.103	0.167	0.944	-0.367	0.574
		Employers	0.241	0.166	0.550	-0.236	0.707
	Student	Faculty	0.206	0.125	0.436	-0.145	0.557
		Policy Maker	0.309	0.149	0.232	-0.110	0.729
		Employers	0.447	0.147	0.029	0.032	0.861
	Policy Maker	Faculty	-0.103	0.167	0.944	-0.574	0.367
		Student	-0.309	0.149	0.232	-0.729	0.110
		Employers	0.137	0.185	0.907	-0.382	0.657
	Employers	Faculty	-0.241	0.166	0.550	-0.707	0.236
		Student	-0.447	0.147	0.029	-0.861	-0.032
		Policy Maker	-0.137	0.185	0.907	-0.657	0.382
p_14a	Faculty	Student	-0.261	0.127	0.244	-0.619	0.098
		Policy Maker	0.115	0.171	0.928	-0.365	0.596
		Employers	0.221	0.169	0.634	-0.255	0.698
	Student	Faculty	0.261	0.127	0.244	-0.098	0.619
		Policy Maker	0.376	0.152	0.110	-0.052	0.805
		Employers	0.482	0.150	0.018	0.059	0.906
	Policy Maker	Faculty	-0.115	0.171	0.928	-0.596	0.365
		Student	-0.376	0.152	0.110	-0.805	0.052
		Employers	0.106	0.188	0.957	-0.425	0.637
	Employers	Faculty	-0.221	0.169	0.634	-0.698	0.255
		Student	-0.482	0.150	0.018	-0.906	-0.059
		Policy Maker	-0.106	0.188	0.957	-0.637	0.425
p_15a	Faculty	Student	-0.190	0.130	0.543	-0.555	0.175
		Policy Maker	-0.072	0.174	0.982	-0.561	0.417
		Employers	0.100	0.172	0.952	-0.385	0.585
	Student	Faculty	0.190	0.130	0.543	-0.175	0.555
		Policy Maker	0.118	0.155	0.901	-0.318	0.554
		Employers	0.290	0.153	0.311	-0.141	0.721
	Policy Maker	Faculty	0.072	0.174	0.982	-0.417	0.561
		Student	-0.118	0.155	0.901	-0.554	0.318
		Employers	0.172	0.192	0.848	-0.368	0.713
	Employers	Faculty	-0.100	0.172	0.952	-0.585	0.385
		Student	-0.290	0.153	0.311	-0.721	0.141
		Policy Maker	-0.172	0.192	0.848	-0.713	0.368
p_16a	Faculty	Student	-0.386	0.125	0.025	-0.739	-0.033
		Policy Maker	0.159	0.168	0.828	-0.315	0.632

		Employers	0.142	0.167	0.868	-0.327	0.611
	Student	Faculty	0.386	0.125	0.025	0.033	0.739
		Policy Maker	0.545	0.150	0.005	0.123	0.967
		Employers	0.528	0.148	0.006	0.111	0.945
	Policy Maker	Faculty	-0.159	0.168	0.828	-0.632	0.315
		Student	-0.545	0.150	0.005	-0.967	-0.123
		Employers	-0.017	0.186	1.000	-0.540	0.506
	Employers	Faculty	-0.142	0.167	0.868	-0.611	0.327
		Student	-0.528	0.148	0.006	-0.945	-0.111
		Policy Maker	0.017	0.186	1.000	-0.506	0.540
p_17a	Faculty	Student	-0.221	0.124	0.368	-0.570	0.128
		Policy Maker	0.183	0.166	0.752	-0.286	0.651
		Employers	0.133	0.165	0.883	-0.331	0.598
	Student	Faculty	0.221	0.124	0.368	-0.128	0.570
		Policy Maker	0.404	0.148	0.063	-0.014	0.821
		Employers	0.355	0.146	0.122	-0.058	0.767
	Policy Maker	Faculty	-0.183	0.166	0.752	-0.651	0.286
		Student	-0.404	0.148	0.063	-0.821	0.014
		Employers	-0.049	0.184	0.995	-0.567	0.468
	Employers	Faculty	-0.133	0.165	0.883	-0.598	0.331
		Student	-0.355	0.146	0.122	-0.767	0.058
		Policy Maker	0.049	0.184	0.995	-0.468	0.567
p_18a	Faculty	Student	-0.209	0.115	0.350	-0.533	0.115
		Policy Maker	-0.123	0.154	0.889	-0.557	0.312
		Employers	0.202	0.153	0.626	-0.228	0.633
	Student	Faculty	0.209	0.115	0.350	-0.115	0.533
		Policy Maker	0.087	0.138	0.941	-0.301	0.474
		Employers	0.411	0.136	0.029	0.029	0.794
	Policy Maker	Faculty	0.123	0.154	0.889	-0.312	0.557
		Student	-0.087	0.138	0.941	-0.474	0.301
		Employers	0.325	0.170	0.306	-0.155	0.805
	Employers	Faculty	-0.202	0.153	0.626	-0.633	0.228
		Student	-0.411	0.136	0.029	-0.794	-0.029
		Policy Maker	-0.325	0.170	0.306	-0.805	0.155
p_19a	Faculty	Student	-0.200	0.112	0.365	-0.516	0.116
		Policy Maker	0.315	0.150	0.236	-0.109	0.738
		Employers	0.202	0.149	0.606	-0.217	0.622
	Student	Faculty	0.200	0.112	0.365	-0.116	0.516
		Policy Maker	0.515	0.134	0.002	0.138	0.893
		Employers	0.403	0.132	0.028	0.030	0.775
	Policy Maker	Faculty	-0.315	0.150	0.236	-0.738	0.109
		Student	-0.515	0.134	0.002	-0.893	-0.138
		Employers	-0.113	0.166	0.927	-0.580	0.355
	Employers	Faculty	-0.202	0.149	0.606	-0.622	0.217
		Student	-0.403	0.132	0.028	-0.775	-0.030
		Policy Maker	0.113	0.166	0.927	-0.355	0.580
p_20a	Faculty	Student	-0.485	0.121	0.001	-0.827	-0.143
		Policy Maker	0.127	0.162	0.894	-0.330	0.584
		Employers	0.077	0.161	0.973	-0.376	0.530
	Student	Faculty	0.485	0.121	0.001	0.143	0.827
		Policy Maker	0.612	0.144	0.001	0.206	1.018
		Employers	0.562	0.142	0.002	0.161	0.963

	Policy Maker	Faculty	-0.127	0.162	0.894	-0.584	0.330
		Student	-0.612	0.144	0.001	-1.018	-0.206
		Employers	-0.050	0.179	0.994	-0.553	0.453
	Employers	Faculty	-0.077	0.161	0.973	-0.530	0.376
		Student	-0.562	0.142	0.002	-0.963	-0.161
		Policy Maker	0.050	0.179	0.994	-0.453	0.553
p_21a	Faculty	Student	-0.561	0.121	0.000	-0.902	-0.220
		Policy Maker	0.060	0.162	0.987	-0.397	0.517
		Employers	-0.081	0.161	0.968	-0.534	0.372
	Student	Faculty	0.561	0.121	0.000	0.220	0.902
		Policy Maker	0.621	0.145	0.000	0.214	1.028
		Employers	0.480	0.143	0.012	0.077	0.882
	Policy Maker	Faculty	-0.060	0.162	0.987	-0.517	0.397
		Student	-0.621	0.145	0.000	-1.028	-0.214
		Employers	-0.141	0.179	0.892	-0.646	0.364
	Employers	Faculty	0.081	0.161	0.968	-0.372	0.534
		Student	-0.480	0.143	0.012	-0.882	-0.077
		Policy Maker	0.141	0.179	0.892	-0.364	0.646
p_22a	Faculty	Student	-0.518	0.122	0.001	-0.862	-0.174
		Policy Maker	-0.022	0.164	0.999	-0.483	0.440
		Employers	-0.100	0.162	0.944	-0.557	0.357
	Student	Faculty	0.518	0.122	0.001	0.174	0.862
		Policy Maker	0.496	0.146	0.010	0.085	0.908
		Employers	0.418	0.144	0.041	0.011	0.824
	Policy Maker	Faculty	0.022	0.164	0.999	-0.440	0.483
		Student	-0.496	0.146	0.010	-0.908	-0.085
		Employers	-0.079	0.181	0.979	-0.588	0.431
	Employers	Faculty	0.100	0.162	0.944	-0.357	0.557
		Student	-0.418	0.144	0.041	-0.824	-0.011
		Policy Maker	0.079	0.181	0.979	-0.431	0.588
p_23a	Faculty	Student	-0.303	0.116	0.080	-0.628	0.023
		Policy Maker	0.048	0.155	0.992	-0.389	0.485
		Employers	0.120	0.154	0.894	-0.313	0.553
	Student	Faculty	0.303	0.116	0.080	-0.023	0.628
		Policy Maker	0.351	0.138	0.095	-0.039	0.740
		Employers	0.423	0.137	0.024	0.038	0.807
	Policy Maker	Faculty	-0.048	0.155	0.992	-0.485	0.389
		Student	-0.351	0.138	0.095	-0.740	0.039
		Employers	0.072	0.171	0.981	-0.410	0.554
	Employers	Faculty	-0.120	0.154	0.894	-0.553	0.313
		Student	-0.423	0.137	0.024	-0.807	-0.038
		Policy Maker	-0.072	0.171	0.981	-0.554	0.410
p_24a	Faculty	Student	-0.159	0.124	0.650	-0.509	0.190
		Policy Maker	0.089	0.166	0.963	-0.380	0.558
		Employers	0.043	0.165	0.996	-0.422	0.507
	Student	Faculty	0.159	0.124	0.650	-0.190	0.509
		Policy Maker	0.248	0.148	0.426	-0.170	0.666
		Employers	0.202	0.147	0.596	-0.211	0.614
	Policy Maker	Faculty	-0.089	0.166	0.963	-0.558	0.380
		Student	-0.248	0.148	0.426	-0.666	0.170
		Employers	-0.046	0.184	0.996	-0.564	0.471
	Employers	Faculty	-0.043	0.165	0.996	-0.507	0.422

		Student	-0.202	0.147	0.596	-0.614	0.211
		Policy Maker	0.046	0.184	0.996	-0.471	0.564
p_25a	Faculty	Student	-0.155	0.128	0.692	-0.515	0.206
		Policy Maker	-0.041	0.171	0.996	-0.524	0.442
		Employers	0.040	0.170	0.997	-0.439	0.518
	Student	Faculty	0.155	0.128	0.692	-0.206	0.515
		Policy Maker	0.114	0.153	0.907	-0.317	0.544
		Employers	0.194	0.151	0.648	-0.231	0.619
	Policy Maker	Faculty	0.041	0.171	0.996	-0.442	0.524
		Student	-0.114	0.153	0.907	-0.544	0.317
		Employers	0.080	0.189	0.981	-0.453	0.614
	Employers	Faculty	-0.040	0.170	0.997	-0.518	0.439
		Student	-0.194	0.151	0.648	-0.619	0.231
		Policy Maker	-0.080	0.189	0.981	-0.614	0.453
p_26a	Faculty	Student	-0.343	0.123	0.052	-0.689	0.002
		Policy Maker	0.139	0.164	0.869	-0.324	0.603
		Employers	0.092	0.163	0.956	-0.367	0.551
	Student	Faculty	0.343	0.123	0.052	-0.002	0.689
		Policy Maker	0.483	0.147	0.014	0.070	0.896
		Employers	0.436	0.145	0.031	0.028	0.843
	Policy Maker	Faculty	-0.139	0.164	0.869	-0.603	0.324
		Student	-0.483	0.147	0.014	-0.896	-0.070
		Employers	-0.047	0.182	0.995	-0.559	0.464
	Employers	Faculty	-0.092	0.163	0.956	-0.551	0.367
		Student	-0.436	0.145	0.031	-0.843	-0.028
		Policy Maker	0.047	0.182	0.995	-0.464	0.559
p_27a	Faculty	Student	-0.240	0.119	0.257	-0.576	0.095
		Policy Maker	0.070	0.160	0.979	-0.380	0.520
		Employers	0.145	0.158	0.841	-0.301	0.590
	Student	Faculty	0.240	0.119	0.257	-0.095	0.576
		Policy Maker	0.310	0.142	0.195	-0.091	0.711
		Employers	0.385	0.141	0.061	-0.011	0.781
	Policy Maker	Faculty	-0.070	0.160	0.979	-0.520	0.380
		Student	-0.310	0.142	0.195	-0.711	0.091
		Employers	0.075	0.176	0.981	-0.422	0.572
	Employers	Faculty	-0.145	0.158	0.841	-0.590	0.301
		Student	-0.385	0.141	0.061	-0.781	0.011
		Policy Maker	-0.075	0.176	0.981	-0.572	0.422
p_28a	Faculty	Student	-0.313	0.119	0.079	-0.648	0.023
		Policy Maker	0.144	0.160	0.846	-0.306	0.594
		Employers	0.277	0.158	0.385	-0.169	0.723
	Student	Faculty	0.313	0.119	0.079	-0.023	0.648
		Policy Maker	0.457	0.142	0.018	0.056	0.858
		Employers	0.589	0.141	0.001	0.193	0.986
	Policy Maker	Faculty	-0.144	0.160	0.846	-0.594	0.306
		Student	-0.457	0.142	0.018	-0.858	-0.056
		Employers	0.133	0.176	0.904	-0.364	0.630
	Employers	Faculty	-0.277	0.158	0.385	-0.723	0.169
		Student	-0.589	0.141	0.001	-0.986	-0.193
		Policy Maker	-0.133	0.176	0.904	-0.630	0.364
p_29a	Faculty	Student	-0.310	0.115	0.068	-0.634	0.015
		Policy Maker	-0.026	0.154	0.999	-0.462	0.409

		Employers	0.139	0.153	0.843	-0.292	0.570
	Student	Faculty	0.310	0.115	0.068	-0.015	0.634
		Policy Maker	0.283	0.138	0.240	-0.104	0.671
		Employers	0.449	0.136	0.014	0.066	0.832
	Policy Maker	Faculty	0.026	0.154	0.999	-0.409	0.462
		Student	-0.283	0.138	0.240	-0.671	0.104
		Employers	0.166	0.171	0.815	-0.315	0.646
	Employers	Faculty	-0.139	0.153	0.843	-0.570	0.292
		Student	-0.449	0.136	0.014	-0.832	-0.066
		Policy Maker	-0.166	0.171	0.815	-0.646	0.315
p_30a	Faculty	Student	-0.261	0.118	0.180	-0.592	0.070
		Policy Maker	0.094	0.158	0.950	-0.350	0.538
		Employers	0.258	0.156	0.439	-0.182	0.698
	Student	Faculty	0.261	0.118	0.180	-0.070	0.592
		Policy Maker	0.355	0.141	0.098	-0.041	0.751
		Employers	0.519	0.139	0.004	0.127	0.910
	Policy Maker	Faculty	-0.094	0.158	0.950	-0.538	0.350
		Student	-0.355	0.141	0.098	-0.751	0.041
		Employers	0.164	0.174	0.829	-0.327	0.654
	Employers	Faculty	-0.258	0.156	0.439	-0.698	0.182
		Student	-0.519	0.139	0.004	-0.910	-0.127
		Policy Maker	-0.164	0.174	0.829	-0.654	0.327

Appendix vi

ANOVA Table for Desired Level of Competencies

		Sum of Squares	df	Mean Square	F	Sig.
p_1b	Between Groups	1.017	3	0.339	1.953	0.122
	Within Groups	39.248	236	0.174		
p_2b	Between Groups	0.193	3	0.064	0.419	0.74
	Within Groups	34.629	236	0.153		
p_3b	Between Groups	0.722	3	0.241	1.395	0.245
	Within Groups	38.999	236	0.173		
p_4b	Between Groups	0.427	3	0.142	0.711	0.547
	Within Groups	45.264	236	0.2		
p_5b	Between Groups	0.165	3	0.055	0.492	0.688
	Within Groups	25.33	236	0.112		
p_6b	Between Groups	1.264	3	0.421	4.002	0.008
	Within Groups	23.797	236	0.105		
p_7b	Between Groups	0.999	3	0.333	2.683	0.048
	Within Groups	28.062	236	0.124		
p_8b	Between Groups	0.374	3	0.125	0.759	0.518
	Within Groups	37.174	236	0.164		
p_9b	Between Groups	1.388	3	0.463	2.47	0.063
	Within Groups	42.334	236	0.187		
p_10b	Between Groups	0.159	3	0.053	0.262	0.852
	Within Groups	45.515	236	0.201		
p_11b	Between Groups	0.773	3	0.258	1.192	0.313
	Within Groups	48.81	236	0.216		
p_12b	Between Groups	0.803	3	0.268	1.291	0.278
	Within Groups	46.888	236	0.207		
p_13b	Between Groups	1.427	3	0.476	2.357	0.073
	Within Groups	45.616	236	0.202		
p_14b	Between Groups	2.279	3	0.76	5.442	0.001
	Within Groups	31.551	236	0.14		
p_15b	Between Groups	1.022	3	0.341	2.294	0.079
	Within Groups	33.569	236	0.149		
p_16b	Between Groups	0.932	3	0.311	1.889	0.132
	Within Groups	37.155	236	0.164		
p_17b	Between Groups	1.751	3	0.584	2.539	0.057
	Within Groups	51.97	236	0.23		
p_18b	Between Groups	0.437	3	0.146	0.855	0.465
	Within Groups	38.536	236	0.171		
p_19b	Between Groups	0.849	3	0.283	1.789	0.15
	Within Groups	35.743	236	0.158		
p_20b	Between Groups	1.45	3	0.483	3.284	0.022
	Within Groups	33.126	225	0.147		
p_21b	Between Groups	1.048	3	0.349	1.91	0.129
	Within Groups	41.317	236	0.183		

p_22b	Between Groups	0.481	3	0.16	0.88	0.452
	Within Groups	41.193	236	0.182		
p_23b	Between Groups	0.304	3	0.101	0.395	0.757
	Within Groups	57.94	236	0.256		
p_24b	Between Groups	0.822	3	0.274	0.959	0.413
	Within Groups	64.552	236	0.286		
p_25b	Between Groups	0.282	3	0.094	0.366	0.778
	Within Groups	57.962	236	0.256		
p_26b	Between Groups	1.423	3	0.474	2.25	0.083
	Within Groups	47.625	236	0.211		
p_27b	Between Groups	1.175	3	0.392	1.73	0.162
	Within Groups	51.156	236	0.236		
p_28b	Between Groups	0.988	3	0.329	1.306	0.273
	Within Groups	56.995	236	0.252		
p_29b	Between Groups	2.236	3	0.742	2.744	0.044
	Within Groups	61.096	236	0.27		
p_30b	Between Groups	1.376	3	0.459	1.294	0.277
	Within Groups	80.107	236	0.354		

Multiple Comparisons for desired level of competency
Scheffe's Range Test

	(I)	(J)	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
p_1b	Faculty	Student	-0.151	0.070	0.200	-0.348	0.046
		Policy Maker	-0.075	0.094	0.889	-0.338	0.189
		Employers	-0.019	0.093	0.998	-0.280	0.243
	Student	Faculty	0.151	0.070	0.200	-0.046	0.348
		Policy Maker	0.077	0.083	0.839	-0.158	0.312
		Employers	0.132	0.082	0.462	-0.100	0.365
	Policy Maker	Faculty	0.075	0.094	0.889	-0.189	0.338
		Student	-0.077	0.083	0.839	-0.312	0.158
		Employers	0.056	0.103	0.961	-0.235	0.347
	Employers	Faculty	0.019	0.093	0.998	-0.243	0.280
		Student	-0.132	0.082	0.462	-0.365	0.100
		Policy Maker	-0.056	0.103	0.961	-0.347	0.235
p_2b	Faculty	Student	-0.067	0.066	0.792	-0.252	0.118
		Policy Maker	-0.017	0.088	0.998	-0.265	0.231
		Employers	-0.022	0.087	0.996	-0.267	0.224
	Student	Faculty	0.067	0.066	0.792	-0.118	0.252
		Policy Maker	0.050	0.078	0.939	-0.171	0.271
		Employers	0.045	0.077	0.952	-0.173	0.263
	Policy Maker	Faculty	0.017	0.088	0.998	-0.231	0.265
		Student	-0.050	0.078	0.939	-0.271	0.171
		Employers	-0.005	0.097	1.000	-0.278	0.269
	Employers	Faculty	0.022	0.087	0.996	-0.224	0.267
		Student	-0.045	0.077	0.952	-0.263	0.173
		Policy Maker	0.005	0.097	1.000	-0.269	0.278
p_3b	Faculty	Student	-0.126	0.070	0.352	-0.322	0.070

		Policy Maker	-0.031	0.093	0.990	-0.294	0.232
		Employers	-0.129	0.092	0.586	-0.389	0.132
	Student	Faculty	0.126	0.070	0.352	-0.070	0.322
		Policy Maker	0.095	0.083	0.729	-0.139	0.329
		Employers	-0.003	0.082	1.000	-0.234	0.239
	Policy Maker	Faculty	0.031	0.093	0.990	-0.232	0.294
		Student	-0.095	0.083	0.729	-0.329	0.139
		Employers	-0.098	0.103	0.826	-0.388	0.193
	Employers	Faculty	0.129	0.092	0.586	-0.132	0.389
		Student	0.003	0.082	1.000	-0.239	0.234
		Policy Maker	0.098	0.103	0.826	-0.193	0.388
p_4b	Faculty	Student	-0.015	0.075	0.998	-0.227	0.196
		Policy Maker	0.058	0.101	0.954	-0.236	0.341
		Employers	-0.101	0.100	0.792	-0.382	0.179
	Student	Faculty	0.015	0.075	0.998	-0.196	0.227
		Policy Maker	0.073	0.090	0.882	-0.179	0.325
		Employers	-0.086	0.089	0.815	-0.336	0.163
	Policy Maker	Faculty	-0.058	0.101	0.954	-0.341	0.236
		Student	-0.073	0.090	0.882	-0.325	0.179
		Employers	-0.159	0.111	0.562	-0.472	0.154
	Employers	Faculty	0.101	0.100	0.792	-0.179	0.382
		Student	0.086	0.089	0.815	-0.163	0.336
		Policy Maker	0.159	0.111	0.562	-0.154	0.472
p_5b	Faculty	Student	-0.065	0.056	0.716	-0.223	0.093
		Policy Maker	-0.060	0.075	0.887	-0.272	0.152
		Employers	-0.063	0.075	0.870	-0.273	0.147
	Student	Faculty	0.065	0.056	0.716	-0.093	0.223
		Policy Maker	0.005	0.067	1.000	-0.184	0.194
		Employers	0.002	0.066	1.000	-0.184	0.189
	Policy Maker	Faculty	0.060	0.075	0.887	-0.152	0.272
		Student	-0.005	0.067	1.000	-0.194	0.184
		Employers	-0.003	0.083	1.000	-0.237	0.231
	Employers	Faculty	0.063	0.075	0.870	-0.147	0.273
		Student	-0.002	0.066	1.000	-0.189	0.184
		Policy Maker	0.003	0.083	1.000	-0.231	0.237
p_6b	Faculty	Student	-0.034	0.054	0.941	-0.187	0.119
		Policy Maker	0.185	0.073	0.095	-0.020	0.390
		Employers	0.055	0.072	0.899	-0.148	0.259
	Student	Faculty	0.034	0.054	0.941	-0.119	0.187
		Policy Maker	0.219	0.065	0.011	0.036	0.402
		Employers	0.090	0.064	0.585	-0.091	0.270
	Policy Maker	Faculty	-0.185	0.073	0.095	-0.390	0.020
		Student	-0.219	0.065	0.011	-0.402	-0.036
		Employers	-0.130	0.081	0.460	-0.356	0.097
	Employers	Faculty	-0.055	0.072	0.899	-0.259	0.148
		Student	-0.090	0.064	0.585	-0.270	0.091
		Policy Maker	0.130	0.081	0.460	-0.097	0.356
p_7b	Faculty	Student	-0.006	0.059	1.000	-0.172	0.160
		Policy Maker	0.111	0.079	0.584	-0.112	0.334
		Employers	0.166	0.078	0.220	-0.055	0.386
	Student	Faculty	0.006	0.059	1.000	-0.160	0.172
		Policy Maker	0.117	0.071	0.436	-0.082	0.315

		Employers	0.172	0.070	0.112	-0.025	0.368
	Policy Maker	Faculty	-0.111	0.079	0.584	-0.334	0.112
		Student	-0.117	0.071	0.436	-0.315	0.082
		Employers	0.055	0.087	0.941	-0.191	0.301
	Employers	Faculty	-0.166	0.078	0.220	-0.386	0.055
		Student	-0.172	0.070	0.112	-0.368	0.025
		Policy Maker	-0.055	0.087	0.941	-0.301	0.191
p_8b	Faculty	Student	-0.028	0.068	0.981	-0.220	0.163
		Policy Maker	0.053	0.091	0.953	-0.204	0.310
		Employers	0.078	0.090	0.864	-0.177	0.332
	Student	Faculty	0.028	0.068	0.981	-0.163	0.220
		Policy Maker	0.081	0.081	0.801	-0.147	0.310
		Employers	0.106	0.080	0.628	-0.120	0.332
	Policy Maker	Faculty	-0.053	0.091	0.953	-0.310	0.204
		Student	-0.081	0.081	0.801	-0.310	0.147
		Employers	0.025	0.101	0.996	-0.259	0.308
	Employers	Faculty	-0.078	0.090	0.864	-0.332	0.177
		Student	-0.106	0.080	0.628	-0.332	0.120
		Policy Maker	-0.025	0.101	0.996	-0.308	0.259
p_9b	Faculty	Student	-0.123	0.073	0.413	-0.327	0.081
		Policy Maker	0.038	0.097	0.984	-0.235	0.312
		Employers	0.061	0.096	0.939	-0.210	0.333
	Student	Faculty	0.123	0.073	0.413	-0.081	0.327
		Policy Maker	0.162	0.087	0.327	-0.083	0.406
		Employers	0.184	0.086	0.204	-0.057	0.425
	Policy Maker	Faculty	-0.038	0.097	0.984	-0.312	0.235
		Student	-0.162	0.087	0.327	-0.406	0.083
		Employers	0.023	0.107	0.998	-0.280	0.325
	Employers	Faculty	-0.061	0.096	0.939	-0.333	0.210
		Student	-0.184	0.086	0.204	-0.425	0.057
		Policy Maker	-0.023	0.107	0.998	-0.325	0.280
p_10b	Faculty	Student	0.016	0.075	0.998	-0.196	0.228
		Policy Maker	-0.010	0.101	1.000	-0.294	0.274
		Employers	0.078	0.100	0.896	-0.204	0.359
	Student	Faculty	-0.016	0.075	0.998	-0.228	0.196
		Policy Maker	-0.025	0.090	0.994	-0.279	0.228
		Employers	0.062	0.089	0.923	-0.188	0.312
	Policy Maker	Faculty	0.010	0.101	1.000	-0.274	0.294
		Student	0.025	0.090	0.994	-0.228	0.279
		Employers	0.087	0.111	0.893	-0.236	0.401
	Employers	Faculty	-0.078	0.100	0.896	-0.359	0.204
		Student	-0.062	0.089	0.923	-0.312	0.188
		Policy Maker	-0.087	0.111	0.893	-0.401	0.236
p_11b	Faculty	Student	-0.089	0.078	0.727	-0.309	0.130
		Policy Maker	-0.043	0.104	0.982	-0.337	0.251
		Employers	0.072	0.103	0.921	-0.219	0.364
	Student	Faculty	0.089	0.078	0.727	-0.130	0.309
		Policy Maker	0.046	0.093	0.970	-0.216	0.308
		Employers	0.161	0.092	0.381	-0.098	0.420
	Policy Maker	Faculty	0.043	0.104	0.982	-0.251	0.337
		Student	-0.046	0.093	0.970	-0.308	0.216
		Employers	0.116	0.115	0.800	-0.209	0.440

	Employers	Faculty	-0.072	0.103	0.921	-0.364	0.219
		Student	-0.161	0.092	0.381	-0.420	0.098
		Policy Maker	-0.116	0.115	0.800	-0.440	0.209
p_12b	Faculty	Student	-0.068	0.076	0.849	-0.283	0.147
		Policy Maker	0.058	0.102	0.957	-0.231	0.346
		Employers	0.080	0.101	0.890	-0.205	0.366
	Student	Faculty	0.068	0.076	0.849	-0.147	0.283
		Policy Maker	0.126	0.091	0.592	-0.131	0.383
		Employers	0.149	0.090	0.437	-0.105	0.403
	Policy Maker	Faculty	-0.058	0.102	0.957	-0.346	0.231
		Student	-0.126	0.091	0.592	-0.383	0.131
		Employers	0.023	0.113	0.998	-0.296	0.341
	Employers	Faculty	-0.080	0.101	0.890	-0.366	0.205
		Student	-0.149	0.090	0.437	-0.403	0.105
		Policy Maker	-0.023	0.113	0.998	-0.341	0.296
p_13b	Faculty	Student	-0.114	0.075	0.514	-0.326	0.098
		Policy Maker	0.070	0.101	0.924	-0.215	0.354
		Employers	0.061	0.100	0.945	-0.220	0.343
	Student	Faculty	0.114	0.075	0.514	-0.098	0.326
		Policy Maker	0.184	0.090	0.246	-0.069	0.437
		Employers	0.175	0.089	0.276	-0.075	0.426
	Policy Maker	Faculty	-0.070	0.101	0.924	-0.354	0.215
		Student	-0.184	0.090	0.246	-0.437	0.069
		Employers	-0.009	0.111	1.000	-0.322	0.305
	Employers	Faculty	-0.061	0.100	0.945	-0.343	0.220
		Student	-0.175	0.089	0.276	-0.426	0.075
		Policy Maker	0.009	0.111	1.000	-0.305	0.322
p_14b	Faculty	Student	-0.147	0.063	0.143	-0.323	0.030
		Policy Maker	-0.017	0.084	0.998	-0.253	0.220
		Employers	0.130	0.083	0.487	-0.104	0.364
	Student	Faculty	0.147	0.063	0.143	-0.030	0.323
		Policy Maker	0.130	0.075	0.393	-0.081	0.340
		Employers	0.276	0.074	0.004	0.068	0.485
	Policy Maker	Faculty	0.017	0.084	0.998	-0.220	0.253
		Student	-0.130	0.075	0.393	-0.340	0.081
		Employers	0.147	0.093	0.475	-0.114	0.408
	Employers	Faculty	-0.130	0.083	0.487	-0.364	0.104
		Student	-0.276	0.074	0.004	-0.485	-0.068
		Policy Maker	-0.147	0.093	0.475	-0.408	0.114
p_15b	Faculty	Student	-0.111	0.065	0.400	-0.293	0.071
		Policy Maker	-0.048	0.087	0.958	-0.292	0.196
		Employers	0.069	0.086	0.884	-0.172	0.311
	Student	Faculty	0.111	0.065	0.400	-0.071	0.293
		Policy Maker	0.063	0.077	0.881	-0.154	0.280
		Employers	0.180	0.076	0.136	-0.034	0.395
	Policy Maker	Faculty	0.048	0.087	0.958	-0.196	0.292
		Student	-0.063	0.077	0.881	-0.280	0.154
		Employers	0.117	0.096	0.681	-0.152	0.387
	Employers	Faculty	-0.069	0.086	0.884	-0.311	0.172
		Student	-0.180	0.076	0.136	-0.395	0.034
		Policy Maker	-0.117	0.096	0.681	-0.387	0.152
p_16b	Faculty	Student	-0.102	0.068	0.520	-0.294	0.089

		Policy Maker	-0.017	0.091	0.998	-0.273	0.240
		Employers	0.069	0.090	0.898	-0.185	0.324
	Student	Faculty	0.102	0.068	0.520	-0.089	0.294
		Policy Maker	0.085	0.081	0.775	-0.143	0.314
		Employers	0.172	0.080	0.209	-0.054	0.398
	Policy Maker	Faculty	0.017	0.091	0.998	-0.240	0.273
		Student	-0.085	0.081	0.775	-0.314	0.143
		Employers	0.086	0.101	0.865	-0.197	0.370
	Employers	Faculty	-0.069	0.090	0.898	-0.324	0.185
		Student	-0.172	0.080	0.209	-0.398	0.054
		Policy Maker	-0.086	0.101	0.865	-0.370	0.197
p_17b	Faculty	Student	-0.132	0.080	0.443	-0.358	0.094
		Policy Maker	0.070	0.108	0.936	-0.234	0.373
		Employers	0.061	0.107	0.954	-0.239	0.362
	Student	Faculty	0.132	0.080	0.443	-0.094	0.358
		Policy Maker	0.202	0.096	0.224	-0.069	0.472
		Employers	0.193	0.095	0.250	-0.074	0.460
	Policy Maker	Faculty	-0.070	0.108	0.936	-0.373	0.234
		Student	-0.202	0.096	0.224	-0.472	0.069
		Employers	-0.009	0.119	1.000	-0.344	0.327
	Employers	Faculty	-0.061	0.107	0.954	-0.362	0.239
		Student	-0.193	0.095	0.250	-0.460	0.074
		Policy Maker	0.009	0.119	1.000	-0.327	0.344
p_18b	Faculty	Student	-0.086	0.069	0.672	-0.281	0.109
		Policy Maker	-0.036	0.093	0.985	-0.297	0.225
		Employers	0.020	0.092	0.997	-0.239	0.279
	Student	Faculty	0.086	0.069	0.672	-0.109	0.281
		Policy Maker	0.050	0.083	0.947	-0.183	0.283
		Employers	0.106	0.082	0.642	-0.124	0.336
	Policy Maker	Faculty	0.036	0.093	0.985	-0.225	0.297
		Student	-0.050	0.083	0.947	-0.283	0.183
		Employers	0.056	0.102	0.960	-0.233	0.344
	Employers	Faculty	-0.020	0.092	0.997	-0.279	0.239
		Student	-0.106	0.082	0.642	-0.336	0.124
		Policy Maker	-0.056	0.102	0.960	-0.344	0.233
p_19b	Faculty	Student	-0.111	0.067	0.428	-0.299	0.077
		Policy Maker	-0.017	0.089	0.998	-0.269	0.235
		Employers	0.039	0.089	0.978	-0.210	0.288
	Student	Faculty	0.111	0.067	0.428	-0.077	0.299
		Policy Maker	0.094	0.080	0.705	-0.130	0.319
		Employers	0.150	0.079	0.305	-0.071	0.372
	Policy Maker	Faculty	0.017	0.089	0.998	-0.235	0.269
		Student	-0.094	0.080	0.705	-0.319	0.130
		Employers	0.056	0.099	0.956	-0.222	0.334
	Employers	Faculty	-0.039	0.089	0.978	-0.288	0.210
		Student	-0.150	0.079	0.305	-0.372	0.071
		Policy Maker	-0.056	0.099	0.956	-0.334	0.222
p_20b	Faculty	Student	-0.132	0.065	0.246	-0.315	0.050
		Policy Maker	0.011	0.087	0.999	-0.233	0.255
		Employers	0.066	0.086	0.898	-0.176	0.307
	Student	Faculty	0.132	0.065	0.246	-0.050	0.315
		Policy Maker	0.143	0.077	0.326	-0.073	0.360

		Employers	0.198	0.076	0.081	-0.016	0.412
	Policy Maker	Faculty	-0.011	0.087	0.999	-0.255	0.233
		Student	-0.143	0.077	0.326	-0.360	0.073
		Employers	0.055	0.095	0.954	-0.213	0.323
	Employers	Faculty	-0.066	0.086	0.898	-0.307	0.176
		Student	-0.198	0.076	0.081	-0.412	0.016
		Policy Maker	-0.055	0.095	0.954	-0.323	0.213
p_21b	Faculty	Student	-0.123	0.072	0.402	-0.325	0.079
		Policy Maker	0.007	0.096	1.000	-0.263	0.278
		Employers	0.031	0.095	0.991	-0.237	0.299
	Student	Faculty	0.123	0.072	0.402	-0.079	0.325
		Policy Maker	0.130	0.086	0.511	-0.111	0.371
		Employers	0.154	0.085	0.349	-0.084	0.392
	Policy Maker	Faculty	-0.007	0.096	1.000	-0.278	0.263
		Student	-0.130	0.086	0.511	-0.371	0.111
		Employers	0.024	0.106	0.997	-0.275	0.322
	Employers	Faculty	-0.031	0.095	0.991	-0.299	0.237
		Student	-0.154	0.085	0.349	-0.392	0.084
		Policy Maker	-0.024	0.106	0.997	-0.322	0.275
p_22b	Faculty	Student	-0.086	0.072	0.694	-0.288	0.115
		Policy Maker	-0.005	0.096	1.000	-0.275	0.265
		Employers	0.020	0.095	0.998	-0.248	0.287
	Student	Faculty	0.086	0.072	0.694	-0.115	0.288
		Policy Maker	0.081	0.085	0.824	-0.159	0.322
		Employers	0.106	0.084	0.666	-0.132	0.344
	Policy Maker	Faculty	0.005	0.096	1.000	-0.265	0.275
		Student	-0.081	0.085	0.824	-0.322	0.159
		Employers	0.025	0.106	0.997	-0.274	0.323
	Employers	Faculty	-0.020	0.095	0.998	-0.287	0.248
		Student	-0.106	0.084	0.666	-0.344	0.132
		Policy Maker	-0.025	0.106	0.997	-0.323	0.274
p_23b	Faculty	Student	-0.027	0.085	0.991	-0.266	0.212
		Policy Maker	0.082	0.114	0.915	-0.239	0.402
		Employers	-0.019	0.113	0.999	-0.336	0.299
	Student	Faculty	0.027	0.085	0.991	-0.212	0.266
		Policy Maker	0.109	0.101	0.764	-0.177	0.395
		Employers	0.009	0.100	1.000	-0.274	0.291
	Policy Maker	Faculty	-0.082	0.114	0.915	-0.402	0.239
		Student	-0.109	0.101	0.764	-0.395	0.177
		Employers	-0.100	0.126	0.887	-0.454	0.253
	Employers	Faculty	0.019	0.113	0.999	-0.299	0.336
		Student	-0.009	0.100	1.000	-0.291	0.274
		Policy Maker	0.100	0.126	0.887	-0.253	0.454
p_24b	Faculty	Student	-0.085	0.090	0.826	-0.337	0.167
		Policy Maker	0.087	0.120	0.914	-0.252	0.425
		Employers	-0.046	0.119	0.985	-0.381	0.289
	Student	Faculty	0.085	0.090	0.826	-0.167	0.337
		Policy Maker	0.171	0.107	0.465	-0.130	0.473
		Employers	0.039	0.106	0.987	-0.259	0.337
	Policy Maker	Faculty	-0.087	0.120	0.914	-0.425	0.252
		Student	-0.171	0.107	0.465	-0.473	0.130
		Employers	-0.133	0.133	0.801	-0.506	0.241

	Employers	Faculty	0.046	0.119	0.985	-0.289	0.381
		Student	-0.039	0.106	0.987	-0.337	0.259
		Policy Maker	0.133	0.133	0.801	-0.241	0.506
p_25b	Faculty	Student	-0.075	0.085	0.856	-0.314	0.164
		Policy Maker	-0.050	0.114	0.978	-0.371	0.270
		Employers	0.003	0.113	1.000	-0.314	0.321
	Student	Faculty	0.075	0.085	0.856	-0.164	0.314
		Policy Maker	0.024	0.101	0.996	-0.262	0.310
		Employers	0.078	0.100	0.895	-0.204	0.360
	Policy Maker	Faculty	0.050	0.114	0.978	-0.270	0.371
		Student	-0.024	0.101	0.996	-0.310	0.262
		Employers	0.054	0.126	0.980	-0.300	0.408
	Employers	Faculty	-0.003	0.113	1.000	-0.321	0.314
		Student	-0.078	0.100	0.895	-0.360	0.204
		Policy Maker	-0.054	0.126	0.980	-0.408	0.300
p_26b	Faculty	Student	-0.181	0.077	0.141	-0.397	0.036
		Policy Maker	-0.113	0.103	0.753	-0.403	0.178
		Employers	-0.027	0.102	0.995	-0.315	0.261
	Student	Faculty	0.181	0.077	0.141	-0.036	0.397
		Policy Maker	0.068	0.092	0.909	-0.191	0.327
		Employers	0.154	0.091	0.414	-0.102	0.410
	Policy Maker	Faculty	0.113	0.103	0.753	-0.178	0.403
		Student	-0.068	0.092	0.909	-0.327	0.191
		Employers	0.086	0.114	0.903	-0.235	0.407
	Employers	Faculty	0.027	0.102	0.995	-0.261	0.315
		Student	-0.154	0.091	0.414	-0.410	0.102
		Policy Maker	-0.086	0.114	0.903	-0.407	0.235
p_27b	Faculty	Student	-0.154	0.080	0.294	-0.379	0.070
		Policy Maker	-0.082	0.107	0.900	-0.383	0.219
		Employers	0.003	0.106	1.000	-0.295	0.302
	Student	Faculty	0.154	0.080	0.294	-0.070	0.379
		Policy Maker	0.072	0.095	0.901	-0.196	0.341
		Employers	0.158	0.094	0.424	-0.107	0.423
	Policy Maker	Faculty	0.082	0.107	0.900	-0.219	0.383
		Student	-0.072	0.095	0.901	-0.341	0.196
		Employers	0.085	0.118	0.914	-0.247	0.418
	Employers	Faculty	-0.003	0.106	1.000	-0.302	0.295
		Student	-0.158	0.094	0.424	-0.423	0.107
		Policy Maker	-0.085	0.118	0.914	-0.418	0.247
p_28b	Faculty	Student	-0.100	0.084	0.706	-0.337	0.137
		Policy Maker	-0.031	0.113	0.994	-0.349	0.287
		Employers	0.083	0.112	0.906	-0.231	0.398
	Student	Faculty	0.100	0.084	0.706	-0.137	0.337
		Policy Maker	0.068	0.101	0.927	-0.215	0.352
		Employers	0.183	0.099	0.338	-0.097	0.463
	Policy Maker	Faculty	0.031	0.113	0.994	-0.287	0.349
		Student	-0.068	0.101	0.927	-0.352	0.215
		Employers	0.115	0.125	0.838	-0.236	0.466
	Employers	Faculty	-0.083	0.112	0.906	-0.398	0.231
		Student	-0.183	0.099	0.338	-0.463	0.097
		Policy Maker	-0.115	0.125	0.838	-0.466	0.236
p_29b	Faculty	Student	-0.147	0.087	0.419	-0.392	0.099

		Policy Maker	0.118	0.117	0.797	-0.211	0.447
		Employers	0.015	0.116	0.999	-0.311	0.341
	Student	Faculty	0.147	0.087	0.419	-0.099	0.392
		Policy Maker	0.265	0.104	0.094	-0.029	0.558
		Employers	0.161	0.103	0.484	-0.128	0.451
	Policy Maker	Faculty	-0.118	0.117	0.797	-0.447	0.211
		Student	-0.265	0.104	0.094	-0.558	0.029
		Employers	-0.103	0.129	0.887	-0.467	0.260
	Employers	Faculty	-0.015	0.116	0.999	-0.341	0.311
		Student	-0.161	0.103	0.484	-0.451	0.128
		Policy Maker	0.103	0.129	0.887	-0.260	0.467
p_30b	Faculty	Student	-0.086	0.100	0.861	-0.367	0.195
		Policy Maker	0.067	0.134	0.969	-0.309	0.444
		Employers	0.117	0.133	0.856	-0.257	0.490
	Student	Faculty	0.086	0.100	0.861	-0.195	0.367
		Policy Maker	0.154	0.119	0.646	-0.182	0.490
		Employers	0.203	0.118	0.398	-0.129	0.535
	Policy Maker	Faculty	-0.067	0.134	0.969	-0.444	0.309
		Student	-0.154	0.119	0.646	-0.490	0.182
		Employers	0.049	0.148	0.990	-0.367	0.465
	Employers	Faculty	-0.117	0.133	0.856	-0.490	0.257
		Student	-0.203	0.118	0.398	-0.535	0.129
		Policy Maker	-0.049	0.148	0.990	-0.465	0.367

* The mean difference is significant at the .05 level.

Appendix vii

Multiple Comparison Test for Level of Competencies-Categorywise

Dependent Variable	(I) di1	(J) di1	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
p1_a_sum	Faculty	Student	-3.869	1.204	0.018	-7.260	-0.479
		Policy Maker	-0.566	1.599	0.989	-5.072	3.939
		Employers	0.402	1.599	0.996	-4.103	4.908
	Student	Faculty	3.869	1.204	0.018	0.479	7.260
		Policy Maker	3.303	1.409	0.142	-0.666	7.273
		Employers	4.272	1.409	0.029	0.302	8.241
	Policy Maker	Faculty	0.566	1.599	0.989	-3.939	5.072
		Student	-3.303	1.409	0.142	-7.273	0.666
		Employers	0.969	1.759	0.959	-3.987	5.924
	Employers	Faculty	-0.402	1.599	0.996	-4.908	4.103
		Student	-4.272	1.409	0.029	-8.241	-0.302
		Policy Maker	-0.969	1.759	0.959	-5.924	3.987
p2_a_sum	Faculty	Student	-3.525	1.479	0.131	-7.690	0.640
		Policy Maker	0.682	1.965	0.989	-4.853	6.216
		Employers	1.401	1.965	0.917	-4.134	6.935
	Student	Faculty	3.525	1.479	0.131	-0.640	7.690
		Policy Maker	4.207	1.731	0.119	-0.669	9.083
		Employers	4.926	1.731	0.047	0.050	9.802
	Policy Maker	Faculty	-0.682	1.965	0.989	-6.216	4.853
		Student	-4.207	1.731	0.119	-9.083	0.669
		Employers	0.719	2.161	0.991	-5.369	6.806
	Employers	Faculty	-1.401	1.965	0.917	-6.935	4.134
		Student	-4.926	1.731	0.047	-9.802	-0.050
		Policy Maker	-0.719	2.161	0.991	-6.806	5.369
p3_a_sum	Faculty	Student	-2.353	0.739	0.019	-4.435	-0.271
		Policy Maker	0.346	0.982	0.989	-2.421	3.112
		Employers	0.096	0.982	1.000	-2.671	2.862
	Student	Faculty	2.353	0.739	0.019	0.271	4.435
		Policy Maker	2.699	0.865	0.023	0.261	5.136
		Employers	2.449	0.865	0.048	0.011	4.886
	Policy Maker	Faculty	-0.346	0.982	0.989	-3.112	2.421
		Student	-2.699	0.865	0.023	-5.136	-0.261
		Employers	-0.250	1.080	0.997	-3.293	2.793
	Employers	Faculty	-0.096	0.982	1.000	-2.862	2.671

		Student	-2.449	0.865	0.048	-4.886	-0.011
		Policy Maker	0.250	1.080	0.997	-2.793	3.293
p4_a_sum	Faculty	Student	-2.239	0.755	0.034	-4.365	-0.114
		Policy Maker	0.562	1.003	0.957	-2.263	3.386
		Employers	1.187	1.003	0.706	-1.638	4.011
	Student	Faculty	2.239	0.755	0.034	0.114	4.365
		Policy Maker	2.801	0.883	0.020	0.313	5.290
		Employers	3.426	0.883	0.002	0.938	5.915
	Policy Maker	Faculty	-0.562	1.003	0.957	-3.386	2.263
		Student	-2.801	0.883	0.020	-5.290	-0.313
		Employers	0.625	1.103	0.956	-2.482	3.732
	Employers	Faculty	-1.187	1.003	0.706	-4.011	1.638
		Student	-3.426	0.883	0.002	-5.915	-0.938
		Policy Maker	-0.625	1.103	0.956	-3.732	2.482

Scheffe Multiple Comparisons Test for desired level of competence-Categorywise

Dependent Variable	(I) di1	(J) di1	Mean Difference (I-J)	Std. Error	Sig.	95% Confidence Interval	
						Lower Bound	Upper Bound
p1_b_sum	Faculty	Student	-3.200	0.925	0.009	-5.807	-0.594
		Policy Maker	0.490	1.239	0.984	-2.973	3.953
		Employers	0.677	1.239	0.959	-2.786	4.141
	Student	Faculty	3.200	0.925	0.009	0.594	5.807
		Policy Maker	3.690	1.083	0.010	0.639	6.742
		Employers	3.878	1.083	0.006	0.826	6.929
	Policy Maker	Faculty	-0.490	1.239	0.984	-3.953	2.973
		Student	-3.690	1.083	0.010	-6.742	-0.639
		Employers	0.188	1.352	0.999	-3.622	3.997
	Employers	Faculty	-0.677	1.239	0.959	-4.141	2.786
		Student	-3.878	1.083	0.006	-6.929	-0.826
		Policy Maker	-0.188	1.352	0.999	-3.997	3.622
p2_b_sum	Faculty	Student	-2.770	0.987	0.051	-5.551	0.010
		Policy Maker	1.265	1.311	0.818	-2.430	4.959
		Employers	2.733	1.311	0.230	-0.961	6.428
	Student	Faculty	2.770	0.987	0.051	-0.010	5.551
		Policy Maker	4.035	1.155	0.008	0.780	7.290
		Employers	5.504	1.155	0.000	2.249	8.759
	Policy Maker	Faculty	-1.265	1.311	0.818	-4.959	2.430
		Student	-4.035	1.155	0.008	-7.290	-0.780
		Employers	1.469	1.443	0.792	-2.595	5.532
	Employers	Faculty	-2.733	1.311	0.230	-6.428	0.961

		Student	-5.504	1.155	0.000	-8.759	-2.249
		Policy Maker	-1.469	1.443	0.792	-5.532	2.595
p3_b_sum	Faculty	Student	-1.332	0.562	0.135	-2.917	0.252
		Policy Maker	0.491	0.747	0.933	-1.614	2.596
		Employers	0.866	0.747	0.719	-1.239	2.971
	Student	Faculty	1.332	0.562	0.135	-0.252	2.917
		Policy Maker	1.824	0.658	0.056	-0.031	3.678
		Employers	2.199	0.658	0.012	0.344	4.053
	Policy Maker	Faculty	-0.491	0.747	0.933	-2.596	1.614
		Student	-1.824	0.658	0.056	-3.678	0.031
		Employers	0.375	0.822	0.976	-1.941	2.691
	Employers	Faculty	-0.866	0.747	0.719	-2.971	1.239
		Student	-2.199	0.658	0.012	-4.053	-0.344
		Policy Maker	-0.375	0.822	0.976	-2.691	1.941
p4_b_sum	Faculty	Student	-1.302	0.601	0.199	-2.995	0.392
		Policy Maker	0.420	0.799	0.964	-1.830	2.670
		Employers	0.858	0.799	0.764	-1.392	3.108
	Student	Faculty	1.302	0.601	0.199	-0.392	2.995
		Policy Maker	1.722	0.704	0.115	-0.260	3.705
		Employers	2.160	0.704	0.026	0.177	4.142
	Policy Maker	Faculty	-0.420	0.799	0.964	-2.670	1.830
		Student	-1.722	0.704	0.115	-3.705	0.260
		Employers	0.438	0.879	0.969	-2.038	2.913
	Employers	Faculty	-0.858	0.799	0.764	-3.108	1.392
		Student	-2.160	0.704	0.026	-4.142	-0.177
		Policy Maker	-0.438	0.879	0.969	-2.913	2.038

Appendix viii

Prominent Competency Statements

Ranking of Competency Statements(P)					Most Prominent Statements							
Items	Existing		Desired		Items	Existing	Items	Existing	Items	Desired	Items	Desired
	high	low	high	low		high		low		high		low
p1	22.2	27.4	88.3	2.6	p5	37.4	p23	57.8	p5	90.4	p30	7.4
p2	30.9	25.2	88.3	1.7	p6	35.7	p30	56.1	p14	90.4	p17	4.8
p3	17.8	40.9	85.2	1.7	p2	30.9	p29	54.8	p19	90.4	p24	4.8
p4	21.3	43.9	84.8	2.6	p7	24.8	p17	54.3	p7	90.0	p29	4.8
p5	37.4	28.7	90.4	0.9	p1	22.2	p28	54.3	p15	90.0	p28	4.3
p6	35.7	19.6	89.1	0.4	p4	21.3	p24	53.9	p20	90.0	p23	3.9
p7	24.8	36.1	90.0	1.3	p10	21.3	p22	52.2	p16	89.6	p25	3.9
p8	16.5	49.6	88.3	2.2	p16	20.9	p27	51.7	p6	89.1	p26	3.9
p9	17.8	43.9	86.1	2.6	p14	19.6	p21	50.4	p1	88.3	p27	3.9
p10	21.3	47.4	88.3	3.5	p15	19.6	p20	50.4	p2	88.3	p10	3.5
p11	14.3	47.8	83.9	3.0	p21	18.7	p14	50.0	p8	88.3	p11	3.0
p12	13.9	46.5	85.2	3.0	p20	18.3	p19	50.0	p10	88.3	p12	3.0
p13	17.8	49.1	85.7	3.0	p25	18.3	p8	49.6	p17	88.3	p13	3.0
p14	19.6	50.0	90.4	2.2	p26	18.3	p13	49.1	p26	87.8	p1	2.6
p15	19.6	49.1	90.0	2.2	p3	17.8	p15	49.1	p18	87.4	p4	2.6
p16	20.9	46.5	89.6	2.6	p9	17.8	p25	49.1	p22	87.4	p9	2.6
p17	16.5	54.3	88.3	4.8	p13	17.8	p11	47.8	p21	87.0	p16	2.6
p18	13.5	44.8	87.4	2.2	p22	17.8	p10	47.4	p9	86.1	p19	2.6
p19	12.2	50.0	90.4	2.6	p8	16.5	p26	47.0	p13	85.7	p21	2.6
p20	18.3	50.4	90.0	2.2	p17	16.5	p12	46.5	p27	85.7	p22	2.6
p21	18.7	50.4	87.0	2.6	p24	15.7	p16	46.5	p3	85.2	p8	2.2
p22	17.8	52.2	87.4	2.6	p28	15.7	p18	44.8	p12	85.2	p14	2.2
p23	12.6	57.8	81.3	3.9	p11	14.3	p4	43.9	p4	84.8	p15	2.2
p24	15.7	53.9	79.6	4.8	p27	14.3	p9	43.9	p11	83.9	p18	2.2
p25	18.3	49.1	81.3	3.9	p12	13.9	p3	40.9	p28	83.5	p20	2.2
p26	18.3	47.0	87.8	3.9	p30	13.9	p7	36.1	p23	81.3	p2	1.7
p27	14.3	51.7	85.7	3.9	p18	13.5	p5	28.7	p25	81.3	p3	1.7
p28	15.7	54.3	83.5	4.3	p23	12.6	p1	27.4	p29	81.3	p7	1.3
p29	12.6	54.8	81.3	4.8	p29	12.6	p2	25.2	p24	79.6	p5	0.9
p30	13.9	56.1	78.3	7.4	p19	12.2	p6	19.6	p30	78.3	p6	0.4

Appendix ix

Respondents Rating on Issues Statements

Respondent Rating on Individual Issue Statements

(NA=not applicable, SD=strongly disagree, D=disagree, ND=not disagree, A=agree, SA=strongly agree)

Financial Issues (I-1)

	I_1		I_2		I_3		I_4		I_5		I_6		I_7		I_8		I_9	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	10	4.4	1	0.4					1	0.4			2	0.9			2	0.9
SD	13	5.7			1	0.4			1	0.4	1	0.4	5	2.2	3	1.3	6	2.6
D	29	12.7	5	2.2	1	0.4	2	0.9	13	5.7	11	4.8	13	5.7	10	4.4	5	2.2
ND	48	21.0	15	6.6	18	7.9	22	9.6	50	21.8	45	19.7	39	17.0	36	15.7	29	12.7
A	90	39.3	86	37.6	79	34.5	100	43.7	107	46.7	90	39.3	105	45.9	107	46.7	118	51.5
SA	39	17.0	122	53.3	130	56.8	105	45.9	57	24.9	82	35.8	65	28.4	73	31.9	69	30.1
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Faculties Issues (I-2)

	I_10		I_11		I_12		I_13		I_14		I_15		I_16		I_17		I_18	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	1	0.4									1	0.4	1	0.4				
SD	9	3.9	3	1.3					6	2.6	1	0.4	1	0.4	1	0.4		
D	8	3.5	4	1.7	3	1.3	2	0.9	20	8.7	7	3.1	6	2.6	1	0.4	5	2.2
ND	12	5.2	16	7.0	9	3.9	18	7.9	91	39.7	26	11.4	26	11.4	12	5.2	15	6.6
A	67	29.3	87	38.0	80	34.9	85	37.1	111	48.5	114	49.8	104	45.4	89	38.9	71	31.0
SA	132	57.6	119	52.0	137	59.8	124	54.1	1	0.4	80	34.9	91	39.7	126	55.0	138	60.3
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Equity and Access (I-3)

	I_19		I_20		I_22		I_22		I_23		I_24		I_25		I_26		I_27	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	1	0.4	6	2.6			1	0.4			1	0.4			5	2.2	2	0.9
SD			27	11.8			2	0.9	1	0.4	5	2.2			10	4.4	5	2.2
D	2	0.9	20	8.7	5	2.2	5	2.2	10	4.4	1	0.4	5	2.2	11	4.8	9	3.9
ND	31	13.5	70	30.6	27	11.8	24	10.5	39	17.0	37	16.2	30	13.1	43	18.8	57	24.9
A	134	58.5	79	34.5	118	51.5	95	41.5	95	41.5	91	39.7	98	42.8	88	38.4	108	47.2
SA	61	26.6	27	11.8	79	34.5	102	44.5	84	36.7	94	41.0	96	41.9	72	31.4	48	21.0
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Management Issues (I-4)

	I_28		I_29		I_30		I_31		I_32		I_33		I_34		I_35		I_36		I_37	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	2	0.9							1	0.4					1	0.4			1	0.4
SD	3	1.3	2	0.9			1	0.4	1	0.4			1	0.4	1	0.4	2	0.9	1	0.4
D	6	2.6	4	1.7	6	2.6	2	0.9	2	0.9	3	1.3	6	2.6	6	2.6	2	0.9	4	1.7
ND	20	8.7	12	5.2	38	16.6	16	7.0	30	13.1	18	7.9	22	9.6	29	12.7	20	8.7	21	9.2
A	106	46.3	86	37.6	111	48.5	106	46.3	114	49.8	69	30.1	108	47.2	100	43.7	114	49.8	92	40.2
SA	92	40.2	125	54.6	74	32.3	104	45.4	81	35.4	139	60.7	92	40.2	92	40.2	91	39.7	110	48.0
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Student Issues (I-5)

	I_38		I_39		I_40		I_41		I_42		I_43		I_44		I_45		I_46		I_47		I_48	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA					1	0.4	1	0.4	1	0.4			4	1.7	1	0.4	1	0.4			2	0.9
SD			1	0.4							1	0.4	4	1.7	1	0.4	1	0.4	2	0.9	1	0.4
D	2	0.9	3	1.3	3	1.3	3	1.3	2	0.9	5	2.2	8	3.5	1	0.4	5	2.2	4	1.7	3	1.3
ND	34	14.8	19	8.3	28	12.2	21	9.2	27	11.8	38	16.6	45	19.7	20	8.7	35	15.3	16	7.0	42	18.3
A	101	44.1	108	47.2	90	39.3	95	41.5	122	53.3	116	50.7	107	46.7	102	44.5	111	48.5	89	38.9	97	42.4
SA	92	40.2	98	42.8	107	46.7	109	47.6	77	33.6	69	30.1	61	26.6	104	45.4	76	33.2	118	51.5	84	36.7
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Socio-Cultural Issues (I-6)

	I_49		I_50		I_51		I_52		I_53		I_54		I_55		I_56		I_57		I_58	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	2	0.9	1	0.4	2	0.9	1	0.4	4	1.7	1	0.4			2	0.9			1	0.4
SD	2	0.9			2	0.9	2	0.9	5	2.2	4	1.7	3	1.3	4	1.7				
D	4	1.7	4	1.7	4	1.7	8	3.5	10	4.4	7	3.1	4	1.7	9	3.9	9	3.9	3	1.3
ND	18	7.9	17	7.4	25	10.9	30	13.1	49	21.4	40	17.5	32	14.0	35	15.3	25	10.9	21	9.2
A	98	42.8	116	50.7	104	45.4	114	49.8	97	42.4	96	41.9	97	42.4	76	33.2	115	50.2	111	48.5
SA	105	45.9	91	39.7	92	40.2	74	32.3	64	27.9	81	35.4	93	40.6	103	45.0	80	34.9	93	40.6
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Infrastructure Issues (I-7)

	I_59		I_60		I_61		I_62		I_63		I_64		I_65		I_66		I_67		I_68		I_69	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	2	0.9	3	1.3			2	0.9			2	0.9									1	0.4
SD	1	0.4	1	0.4			3	1.3			4	1.7	1	0.4	1	0.4			2	0.9		
D	8	3.5	5	2.2	4	1.7	3	1.3	5	2.2	9	3.9	3	1.3	2	0.9	5	2.2	4	1.7	4	1.7
ND	13	5.7	30	13.1	36	15.7	27	11.8	26	11.4	46	20.1	12	5.2	15	6.6	13	5.7	17	7.4	18	7.9
A	81	35.4	108	47.2	129	56.3	111	48.5	113	49.3	124	54.1	70	30.6	80	34.9	64	27.9	85	37.1	106	46.3
SA	124	54.1	82	35.8	60	26.2	83	36.2	85	37.1	44	19.2	143	62.4	131	57.2	147	64.2	121	52.8	100	43.7
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Curriculum Issues (I-8)

	I_70		I_71		I_72		I_73		I_74		I_75		I_76		I_77		I_78		I_79	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	3	1.3	3	1.3			1	0.4	3	1.3	1	0.4							1	0.4
SD	7	3.1	2	0.9			3	1.3	3	1.3	2	0.9	1	0.4	2	0.9	1	0.4		
D	10	4.4	6	2.6			14	6.1	13	5.7	3	1.3	2	0.9	3	1.3	3	1.3	4	1.7
ND	31	13.5	22	9.6	15	6.6	87	38.0	41	17.9	20	8.7	17	7.4	19	8.3	17	7.4	51	22.3
A	105	45.9	123	53.7	95	41.5	123	53.7	100	43.7	98	42.8	118	51.5	92	40.2	93	40.6	99	43.2
SA	73	31.9	73	31.9	119	52.0	1	0.4	69	30.1	105	45.9	91	39.7	113	49.3	115	50.2	74	32.3
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

	I_80		I_81		I_82		I_83		I_84		I_85		I_86		I_87		I_88		I_89	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	2	0.9	3	1.3	1	0.4	1	0.4	2	0.9	1	0.4	1	0.4	2	0.9	1	0.4		
SD			4	1.7	3	1.3	3	1.3	4	1.7					2	0.9	1	0.4		
D	8	3.5	13	5.7	9	3.9	5	2.2	4	1.7	2	0.9	4	1.7	4	1.7			3	1.3
ND	24	10.5	51	22.3	43	18.8	28	12.2	36	15.7	49	21.4	28	12.2	44	19.2	17	7.4	30	13.1
A	116	50.7	105	45.9	108	47.2	103	45.0	111	48.5	128	55.9	137	59.8	108	47.2	105	45.9	100	43.7
SA	79	34.5	53	23.1	65	28.4	89	38.9	72	31.4	49	21.4	59	25.8	69	30.1	105	45.9	96	41.9
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Job Market Issues (I-9)

	I_90		I_91		I_92		I_93		I_94		I_95		I_96		I_97		I_98		I_99	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	1	0.4	1	0.4	3	1.3			2	0.9			1	0.4	1	0.4				
SD	3	1.3			6	2.6	4	1.7	3	1.3			2	0.9	2	0.9			1	0.4
D	14	6.1	6	2.6	12	5.2	5	2.2	6	2.6	4	1.7	5	2.2	8	3.5	4	1.7	1	0.4
ND	91	39.7	16	7.0	37	16.2	37	16.2	34	14.8	7	3.1	13	5.7	27	11.8	16	7.0	16	7.0
A	119	52.0	117	51.1	103	45.0	81	35.4	106	46.3	93	40.6	110	48.0	120	52.4	122	53.3	90	39.3
SA	1	0.4	89	38.9	68	29.7	102	44.5	78	34.1	125	54.6	98	42.8	71	31.0	87	38.0	121	52.8
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Appendix x

ANOVA Table of Issue Statements

		Sum of Squares	df	Mean Square	F	Sig.
I_1	Between Groups	1.411	3	0.47	0.69	0.559
	Within Groups	154.137	236	0.682		
I_2	Between Groups	1.212	3	0.404	2.637	0.051
	Within Groups	34.619	236	0.153		
I_3	Between Groups	0.355	3	0.118	1.137	0.335
	Within Groups	23.54	236	0.104		
I_4	Between Groups	1.203	3	0.401	3.504	0.016
	Within Groups	25.858	236	0.114		
I_5	Between Groups	0.388	3	0.129	0.358	0.784
	Within Groups	81.786	236	0.362		
I_6	Between Groups	1.45	3	0.483	1.533	0.207
	Within Groups	71.246	236	0.315		
I_7	Between Groups	0.859	3	0.286	0.709	0.548
	Within Groups	91.315	236	0.404		
I_8	Between Groups	2.456	3	0.819	2.688	0.047
	Within Groups	68.831	236	0.305		
I_9	Between Groups	0.561	3	0.187	0.628	0.598
	Within Groups	67.287	236	0.298		
I_10	Between Groups	1.939	3	0.646	2.027	0.111
	Within Groups	72.044	236	0.319		
I_11	Between Groups	0.514	3	0.171	0.978	0.404
	Within Groups	39.573	236	0.175		
I_12	Between Groups	0.269	3	0.09	1.025	0.382
	Within Groups	19.753	236	0.087		
I_13	Between Groups	0.384	3	0.128	1.239	0.3
	Within Groups	23.512	236	0.104		
I_14	Between Groups	0.736	3	0.245	1.429	0.235
	Within Groups	38.812	236	0.172		
I_15	Between Groups	0.723	3	0.241	1.031	0.38
	Within Groups	52.859	236	0.234		
I_16	Between Groups	2.678	3	0.893	4.233	0.006
	Within Groups	47.653	236	0.211		
I_17	Between Groups	0.165	3	0.055	0.665	0.574
	Within Groups	18.722	236	0.083		
I_18	Between Groups	0.803	3	0.268	1.921	0.127
	Within Groups	31.48	236	0.139		
I_19	Between Groups	0.719	3	0.24	1.491	0.218
	Within Groups	36.329	236	0.161		
I_20	Between Groups	2.302	3	0.767	1.2	0.311
	Within Groups	144.485	236	0.639		
I_21	Between Groups	0.428	3	0.143	0.793	0.499
	Within Groups	40.62	236	0.18		
I_22	Between Groups	0.241	3	0.08	0.373	0.773

	Within Groups	48.802	236	0.216		
I_23	Between Groups	1.39	3	0.463	1.6	0.19
	Within Groups	65.432	236	0.29		
I_24	Between Groups	0.729	3	0.243	1.036	0.377
	Within Groups	52.963	236	0.234		
I_25	Between Groups	0.281	3	0.094	0.495	0.686
	Within Groups	42.763	236	0.189		
I_26	Between Groups	4.141	3	1.38	3.01	0.031
	Within Groups	103.62	236	0.458		
I_27	Between Groups	0.238	3	0.079	0.207	0.891
	Within Groups	86.172	225	0.383		
I_28	Between Groups	1	3	0.333	1.361	0.255
	Within Groups	55.331	236	0.245		
I_29	Between Groups	0.394	3	0.131	0.898	0.443
	Within Groups	33.101	236	0.146		
I_30	Between Groups	1.757	3	0.586	2.65	0.05
	Within Groups	49.935	236	0.221		
I_31	Between Groups	0.175	3	0.058	0.512	0.674
	Within Groups	25.721	236	0.114		
I_32	Between Groups	0.275	3	0.092	0.524	0.666
	Within Groups	39.447	236	0.175		
I_33	Between Groups	0.18	3	0.06	0.496	0.686
	Within Groups	27.316	236	0.121		
I_34	Between Groups	1.128	3	0.376	1.965	0.12
	Within Groups	43.237	236	0.191		
I_35	Between Groups	0.119	3	0.04	0.169	0.917
	Within Groups	52.681	236	0.233		
I_36	Between Groups	0.154	3	0.051	0.348	0.79
	Within Groups	33.19	236	0.147		
I_37	Between Groups	0.375	3	0.125	0.708	0.548
	Within Groups	39.89	236	0.177		
I_38	Between Groups	0.844	3	0.281	1.823	0.144
	Within Groups	34.878	236	0.154		
I_39	Between Groups	0.484	3	0.161	1.164	0.324
	Within Groups	31.346	236	0.139		
I_40	Between Groups	1.157	3	0.386	2.342	0.074
	Within Groups	37.209	236	0.165		
I_41	Between Groups	0.336	3	0.112	0.767	0.514
	Within Groups	33.008	236	0.146		
I_42	Between Groups	0.161	3	0.054	0.353	0.787
	Within Groups	34.084	225	0.151		
I_43	Between Groups	1.457	3	0.486	2.186	0.091
	Within Groups	50.234	236	0.222		
I_44	Between Groups	1.925	3	0.642	1.776	0.152
	Within Groups	81.623	236	0.361		
I_45	Between Groups	0.455	3	0.152	1.168	0.323
	Within Groups	29.375	236	0.13		
I_46	Between Groups	4.08	3	1.36	5.955	0.001
	Within Groups	51.611	236	0.228		

I_47	Between Groups	0.206	3	0.069	0.426	0.735
	Within Groups	36.386	236	0.161		
I_48	Between Groups	0.734	3	0.245	0.994	0.396
	Within Groups	55.631	236	0.246		
I_49	Between Groups	1.533	3	0.511	2.617	0.052
	Within Groups	44.141	236	0.195		
I_50	Between Groups	0.216	3	0.072	0.473	0.702
	Within Groups	34.376	236	0.152		
I_51	Between Groups	0.745	3	0.248	1.131	0.337
	Within Groups	49.586	236	0.219		
I_52	Between Groups	0.652	3	0.217	0.759	0.518
	Within Groups	64.67	236	0.286		
I_53	Between Groups	1.095	3	0.365	0.904	0.44
	Within Groups	91.236	236	0.404		
I_54	Between Groups	1.521	3	0.507	1.658	0.177
	Within Groups	69.109	236	0.306		
I_55	Between Groups	1.457	3	0.486	2.089	0.102
	Within Groups	52.526	236	0.232		
I_56	Between Groups	1.485	3	0.495	1.434	0.234
	Within Groups	77.998	236	0.345		
I_57	Between Groups	0.792	3	0.264	1.131	0.337
	Within Groups	52.79	236	0.234		
I_58	Between Groups	0.427	3	0.142	0.955	0.415
	Within Groups	33.66	236	0.149		
I_59	Between Groups	2.078	3	0.693	3.112	0.027
	Within Groups	50.288	236	0.223		
I_60	Between Groups	0.393	3	0.131	0.527	0.664
	Within Groups	56.168	236	0.249		
I_61	Between Groups	0.915	3	0.305	1.503	0.215
	Within Groups	45.885	236	0.203		
I_62	Between Groups	0.751	3	0.25	1.059	0.367
	Within Groups	53.445	236	0.236		
I_63	Between Groups	0.323	3	0.108	0.608	0.611
	Within Groups	40.042	236	0.177		
I_64	Between Groups	0.208	3	0.069	0.193	0.901
	Within Groups	81.014	236	0.358		
I_65	Between Groups	0.201	3	0.067	0.582	0.627
	Within Groups	26.059	236	0.115		
I_66	Between Groups	0.578	3	0.193	1.776	0.153
	Within Groups	24.505	236	0.108		
I_67	Between Groups	0.116	3	0.039	0.285	0.836
	Within Groups	30.584	236	0.135		
I_68	Between Groups	0.03	3	0.01	0.059	0.981
	Within Groups	38.057	236	0.168		
I_69	Between Groups	0.724	3	0.241	1.461	0.236
	Within Groups	37.363	236	0.165		
I_70	Between Groups	3.379	3	1.126	2.957	0.033
	Within Groups	86.082	236	0.381		
I_71	Between Groups	0.25	3	0.083	0.326	0.807

	Within Groups	57.945	236	0.256		
I_72	Between Groups	0.089	3	0.03	0.479	0.697
	Within Groups	13.933	236	0.062		
I_73	Between Groups	0.215	3	0.072	0.585	0.625
	Within Groups	27.681	236	0.122		
I_74	Between Groups	1.628	3	0.543	1.39	0.247
	Within Groups	88.238	236	0.39		
I_75	Between Groups	0.092	3	0.031	0.176	0.913
	Within Groups	39.456	236	0.175		
I_76	Between Groups	0.164	3	0.055	0.411	0.745
	Within Groups	30.118	236	0.133		
I_77	Between Groups	0.676	3	0.225	1.468	0.224
	Within Groups	34.668	236	0.153		
I_78	Between Groups	0.12	3	0.04	0.292	0.831
	Within Groups	30.941	236	0.137		
I_79	Between Groups	1.163	3	0.388	1.548	0.203
	Within Groups	56.581	236	0.25		
I_80	Between Groups	1.378	3	0.459	1.915	0.128
	Within Groups	54.205	236	0.24		
I_81	Between Groups	1.182	3	0.394	0.949	0.418
	Within Groups	93.814	236	0.415		
I_82	Between Groups	1.851	3	0.617	1.914	0.128
	Within Groups	72.845	236	0.322		
I_83	Between Groups	1.028	3	0.343	1.424	0.237
	Within Groups	54.368	236	0.241		
I_84	Between Groups	1.447	3	0.482	1.706	0.167
	Within Groups	63.926	236	0.283		
I_85	Between Groups	0.261	3	0.087	0.409	0.747
	Within Groups	48.104	236	0.213		
I_86	Between Groups	0.273	3	0.091	0.488	0.691
	Within Groups	42.114	236	0.186		
I_87	Between Groups	0.574	3	0.191	0.69	0.559
	Within Groups	62.713	236	0.277		
I_88	Between Groups	0.295	3	0.098	0.843	0.472
	Within Groups	26.405	236	0.117		
I_89	Between Groups	0.395	3	0.132	0.827	0.48
	Within Groups	35.971	236	0.159		
I_90	Between Groups	67.313	3	22.438	1.981	0.118
	Within Groups	2560.031	236	11.328		
I_91	Between Groups	0.406	3	0.135	0.77	0.512
	Within Groups	39.681	236	0.176		
I_92	Between Groups	1.709	3	0.57	1.397	0.244
	Within Groups	92.156	236	0.408		
I_93	Between Groups	1.137	3	0.379	1.458	0.227
	Within Groups	58.711	236	0.26		
I_94	Between Groups	0.682	3	0.227	0.807	0.491
	Within Groups	63.683	236	0.282		
I_95	Between Groups	0.127	3	0.042	0.437	0.727
	Within Groups	21.895	236	0.097		

I_96	Between Groups	0.307	3	0.102	0.564	0.64
	Within Groups	41.036	236	0.182		
I_97	Between Groups	0.178	3	0.059	0.219	0.883
	Within Groups	60.953	236	0.27		
I_98	Between Groups	0.165	3	0.055	0.425	0.735
	Within Groups	29.33	236	0.13		
I_99	Between Groups	0.359	3	0.12	1.192	0.314
	Within Groups	22.723	236	0.101		

Appendix xi

Respondents Rating on Strategy Statements

APPENDIX-XIII

Respondents' Rating for Individual Strategy Statements

(NA=not applicable, SD=strongly disagree, D=disagree, ND=not disagree, A=agree, SA=strongly agree)

Financial Strategy (S-1)

	S_1		S_2		S_3		S_4		S_5		S_6		S_7		S_8		S_9	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	2	0.9							9	3.9	1	0.4	1	0.4	1	0.4	2	0.9
SD	3	1.3					2	0.9	6	2.6	3	1.3	1	0.4	1	0.4	2	0.9
D	14	6.1	1	0.4	3	1.3	21	9.2	18	7.9	3	1.3	10	4.4	4	1.7	13	5.7
ND	43	18.8	26	11.4	11	4.8	94	41.0	49	21.4	35	15.3	34	14.8	22	9.6	30	13.1
A	126	55.0	114	49.8	103	45.0	111	48.5	82	35.8	103	45.0	102	44.5	106	46.3	114	49.8
SA	41	17.9	88	38.4	112	48.9	1	0.4	65	28.4	84	36.7	81	35.4	95	41.5	68	29.7
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Faculties Strategy (S-2)

	S_10		S_11		S_12		S_13		S_14		S_15		S_16		S_17		S_18	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA							1	0.4					1	0.4	1	0.4	2	0.9
SD			1	0.4					1	0.4			2	0.9				
D	2	0.9	4	1.7	3	1.3	4	1.7	4	1.7	5	2.2	2	0.9	4	1.7	4	1.7
ND	19	8.3	15	6.6	10	4.4	16	7.0	15	6.6	13	5.7	21	9.2	24	10.5	20	8.7
A	130	56.8	123	53.7	95	41.5	101	44.1	113	49.3	114	49.8	93	40.6	140	61.1	133	58.1
SA	78	34.1	86	37.6	121	52.8	107	46.7	96	41.9	97	42.4	110	48.0	60	26.2	70	30.6
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Equity and Access (S-3)

	S_19		S_20		S_22		S_22		S_23		S_24		S_25		S_26		S_27	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	2	0.9	5	2.2	2	0.9			1	0.4			1	0.4	1	0.4	6	2.6
SD			8	3.5			2	0.9	4	1.7	4	1.7	2	0.9	3	1.3	2	0.9
D	8	3.5	12	5.2	7	3.1	3	1.3	14	6.1	6	2.6	8	3.5	8	3.5	6	2.6
ND	42	18.3	62	27.1	30	13.1	18	7.9	28	12.2	47	20.5	26	11.4	25	10.9	35	15.3
A	114	49.8	91	39.7	104	45.4	115	50.2	121	52.8	104	45.4	112	48.9	116	50.7	100	43.7
E	63	27.5	51	22.3	86	37.6	91	39.7	61	26.6	68	29.7	80	34.9	76	33.2	80	34.9
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Management Strategy (S-4)

	S_28		S_29		S_30		S_31		S_32		S_33		S_34		S_35		S_36		S_37	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA			1	0.4							1	0.4	1	0.4			1	0.4		
SD	1	0.4	1	0.4							1	0.4			2	0.9	1	0.4		
D	4	1.7	2	0.9	6	2.6	2	0.9	2	0.9	2	0.9	8	3.5	4	1.7	3	1.3	3	1.3
ND	34	14.8	32	14.0	23	10.0	27	11.8	15	6.6	22	9.6	29	12.7	31	13.5	15	6.6	18	7.9
A	121	52.8	106	46.3	123	53.7	122	53.3	107	46.7	122	53.3	125	54.6	121	52.8	121	52.8	119	52.0
SA	69	30.1	87	38.0	77	33.6	78	34.1	105	45.9	81	35.4	66	28.8	71	31.0	88	38.4	89	38.9
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Students Strategy (S-5)

	S_38		S_39		S_40		S_41		S_42		S_43		S_44		S_45		S_46		S_47		S_48	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA			1	0.4							2	0.9	2	0.9					2	0.9	1	0.4
SD	1	0.4	2	0.9							1	0.4	3	1.3	1	0.4			1	0.4	3	1.3
D	2	0.9	3	1.3	3	1.3	1	0.4	2	0.9	4	1.7	7	3.1	4	1.7	1	0.4	5	2.2	6	2.6
ND	15	6.6	16	7.0	17	7.4	17	7.4	32	14.0	36	15.7	49	21.4	24	10.5	28	12.2	25	10.9	41	17.9
A	97	42.4	119	52.0	116	50.7	101	44.1	121	52.8	116	50.7	107	46.7	106	46.3	131	57.2	107	46.7	118	51.5
SA	114	49.8	88	38.4	93	40.6	110	48.0	74	32.3	70	30.6	61	26.6	94	41.0	69	30.1	89	38.9	60	26.2
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Socio-Cultural Strategy (S-6)

	S_49		S_50		S_51		S_52		S_53		S_54		S_55		S_56		S_57		S_58	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	3	1.3			4	1.7	1	0.4	7	3.1	2	0.9	1	0.4	1	0.4				
SD	3	1.3	1	0.4	11	4.8			7	3.1	1	0.4	4	1.7	5	2.2	2	0.9	2	0.9
D	6	2.6	3	1.3	15	6.6	4	1.7	14	6.1	4	1.7	2	0.9	5	2.2	4	1.7	3	1.3
ND	29	12.7	23	10.0	40	17.5	33	14.4	49	21.4	39	17.0	40	17.5	41	17.9	25	10.9	24	10.5
A	125	54.6	118	51.5	102	44.5	144	62.9	115	50.2	132	57.6	125	54.6	102	44.5	112	48.9	123	53.7
SA	63	27.5	84	36.7	57	24.9	47	20.5	37	16.2	51	22.3	57	24.9	75	32.8	86	37.6	77	33.6
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Infrastructure Strategy (S-7)

	S_59		S_60		S_61		S_62		S_63		S_64		S_65		S_66		S_67		S_68		S_69	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	1	0.4																			1	0.4
SD			1	0.4	1	0.4	2	0.9	4	1.7			1	0.4			2	0.9				
D	4	1.7	4	1.7	4	1.7	1	0.4	21	9.2	1	0.4	2	0.9	1	0.4	1	0.4	2	0.9	3	1.3
ND	15	6.6	24	10.5	9	3.9	31	13.5	119	52.0	24	10.5	20	8.7	13	5.7	15	6.6	13	5.7	34	14.8
A	136	59.4	130	56.8	137	59.8	109	47.6	84	36.7	117	51.1	121	52.8	102	44.5	95	41.5	104	45.4	118	51.5
SA	73	31.9	70	30.6	78	34.1	86	37.6	1	0.4	87	38.0	85	37.1	113	49.3	116	50.7	110	48.0	73	31.9
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Curriculum Strategy (S-8)

	S_70		S_71		S_72		S_73		S_74		S_75		S_76		S_77		S_78		S_79	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA			2	0.9					1	0.4			1	0.4					1	0.4
SD	8	3.5	1	0.4	2	0.9	1	0.4	4	1.7	1	0.4								
D	8	3.5	3	1.3	1	0.4	2	0.9	8	3.5	2	0.9	3	1.3	3	1.3	2	0.9	5	2.2
ND	28	12.2	10	4.4	24	10.5	26	11.4	40	17.5	27	11.8	28	12.2	18	7.9	19	8.3	34	14.8
A	126	55.0	122	53.3	148	64.6	135	59.0	115	50.2	127	55.5	128	55.9	104	45.4	111	48.5	106	46.3
SA	59	25.8	91	39.7	54	23.6	65	28.4	61	26.6	72	31.4	69	30.1	104	45.4	97	42.4	83	36.2
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

	S_80		S_81		S_82		S_83		S_84		S_85		S_86		S_87		S_88		S_89	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA															1	0.4				
SD	1	0.4							1	0.4										
D	2	0.9	4	1.7			1	0.4	6	2.6	3	1.3	3	1.3	2	0.9	2	0.9	2	0.9
ND	27	11.8	21	9.2	23	10.0	15	6.6	35	15.3	25	10.9	19	8.3	34	14.8	17	7.4	30	13.1
A	126	55.0	130	56.8	124	54.1	116	50.7	114	49.8	119	52.0	113	49.3	119	52.0	122	53.3	110	48.0
SA	73	31.9	74	32.3	82	35.8	97	42.4	73	31.9	82	35.8	94	41.0	73	31.9	88	38.4	87	38.0
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Job Market Strategy (S-9)

	S_90		S_91		S_92		S_93		S_94		S_95		S_96		S_97		S_98		S_99	
	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%	Fr	%
NA	1	0.4							2	0.9			1	0.4	1	0.4	1	0.4		
SD			2	0.9	1	0.4			1	0.4					1	0.4				
D	2	0.9	1	0.4			2	0.9	2	0.9	3	1.3	2	0.9	7	3.1			4	1.7
ND	12	5.2	13	5.7	13	5.7	12	5.2	28	12.2	11	4.8	15	6.6	22	9.6	18	7.9	10	4.4
A	96	41.9	107	46.7	118	51.5	102	44.5	109	47.6	76	33.2	116	50.7	112	48.9	122	53.3	106	46.3
SA	118	51.5	106	46.3	97	42.4	113	49.3	87	38.0	139	60.7	95	41.5	86	37.6	88	38.4	109	47.6
Total	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0	246	100.0

Appendix xii

ANOVA Table of Strategy Statements

		Sum of Squares	df	Mean Square	F	Sig.
s_1	Between Groups	0.497	3	0.166	0.417	0.741
	Within Groups	89.976	236	0.398		
s_2	Between Groups	0.244	3	0.081	0.696	0.555
	Within Groups	26.348	236	0.117		
s_3	Between Groups	0.356	3	0.119	1.253	0.291
	Within Groups	21.388	236	0.095		
s_4	Between Groups	78.746	3	26.249	2.153	0.094
	Within Groups	2,755.85	236	12.194		
s_5	Between Groups	3.042	3	1.014	1.871	0.135
	Within Groups	122.441	236	0.542		
s_6	Between Groups	0.496	3	0.165	0.718	0.542
	Within Groups	52.065	236	0.23		
s_7	Between Groups	0.575	3	0.192	0.648	0.585
	Within Groups	66.799	236	0.296		
s_8	Between Groups	0.139	3	0.046	0.253	0.859
	Within Groups	41.535	236	0.184		
s_9	Between Groups	0.48	3	0.16	0.451	0.717
	Within Groups	80.15	236	0.355		
s_10	Between Groups	0.586	3	0.195	1.83	0.142
	Within Groups	24.114	236	0.107		
s_11	Between Groups	0.466	3	0.155	1.077	0.36
	Within Groups	32.595	236	0.144		
s_12	Between Groups	0.143	3	0.048	0.498	0.684
	Within Groups	21.601	236	0.096		
s_13	Between Groups	0.588	3	0.196	1.365	0.254
	Within Groups	32.472	236	0.144		
s_14	Between Groups	0.143	3	0.048	0.326	0.806
	Within Groups	32.918	236	0.146		
s_15	Between Groups	0.134	3	0.045	0.33	0.803
	Within Groups	30.566	236	0.135		
s_16	Between Groups	0.42	3	0.14	0.869	0.458
	Within Groups	36.402	236	0.161		
s_17	Between Groups	1.154	3	0.385	2.258	0.083
	Within Groups	38.519	236	0.17		
s_18	Between Groups	0.314	3	0.105	0.602	0.614
	Within Groups	39.234	236	0.174		
s_19	Between Groups	0.743	3	0.248	0.868	0.459
	Within Groups	64.544	236	0.286		
s_20	Between Groups	0.673	3	0.224	0.466	0.707
	Within Groups	108.823	236	0.482		
s_21	Between Groups	1.244	3	0.415	1.713	0.165
	Within Groups	54.738	236	0.242		
s_22	Between Groups	0.199	3	0.066	0.435	0.728

	Within Groups	34.393	236	0.152		
s_23	Between Groups	0.859	3	0.286	0.765	0.515
	Within Groups	84.624	236	0.374		
s_24	Between Groups	1.095	3	0.365	1.243	0.295
	Within Groups	66.387	236	0.294		
s_25	Between Groups	1.12	3	0.373	1.419	0.238
	Within Groups	59.441	236	0.263		
s_26	Between Groups	0.127	3	0.042	0.153	0.927
	Within Groups	62.434	236	0.276		
s_27	Between Groups	0.148	3	0.049	0.152	0.928
	Within Groups	73.595	236	0.326		
s_28	Between Groups	1.368	3	0.456	2.298	0.078
	Within Groups	44.828	236	0.198		
s_29	Between Groups	0.779	3	0.26	1.347	0.26
	Within Groups	43.552	236	0.193		
s_30	Between Groups	0.444	3	0.148	0.75	0.523
	Within Groups	44.604	236	0.197		
s_31	Between Groups	0.369	3	0.123	0.819	0.484
	Within Groups	33.897	236	0.15		
s_32	Between Groups	0.479	3	0.16	1.657	0.177
	Within Groups	21.782	236	0.096		
s_33	Between Groups	0.499	3	0.166	1.12	0.342
	Within Groups	33.588	236	0.149		
s_34	Between Groups	2.259	3	0.753	3.203	0.024
	Within Groups	53.137	236	0.235		
s_35	Between Groups	2.717	3	0.906	4.627	0.004
	Within Groups	44.244	236	0.196		
s_36	Between Groups	0.167	3	0.056	0.352	0.788
	Within Groups	35.664	236	0.158		
s_37	Between Groups	0.275	3	0.092	0.74	0.529
	Within Groups	28.007	236	0.124		
s_38	Between Groups	0.154	3	0.051	0.465	0.707
	Within Groups	24.929	236	0.11		
s_39	Between Groups	0.653	3	0.218	1.341	0.262
	Within Groups	36.69	236	0.162		
s_40	Between Groups	0.116	3	0.039	0.327	0.805
	Within Groups	26.584	236	0.118		
s_41	Between Groups	0.603	3	0.201	2.411	0.068
	Within Groups	18.828	236	0.083		
s_42	Between Groups	0.306	3	0.102	0.677	0.567
	Within Groups	34.059	236	0.151		
s_43	Between Groups	3.402	3	1.134	5.153	0.002
	Within Groups	49.729	236	0.22		
s_44	Between Groups	1.482	3	0.494	1.487	0.219
	Within Groups	75.062	236	0.332		
s_45	Between Groups	0.917	3	0.306	1.815	0.145
	Within Groups	38.057	236	0.168		
s_46	Between Groups	1.2	3	0.4	3.272	0.022
	Within Groups	27.622	236	0.122		

s_47	Between Groups	1.491	3	0.497	2.183	0.091
	Within Groups	51.47	236	0.228		
s_48	Between Groups	0.151	3	0.05	0.176	0.913
	Within Groups	64.671	236	0.286		
s_49	Between Groups	2.079	3	0.693	2.381	0.07
	Within Groups	65.769	236	0.291		
s_50	Between Groups	1.023	3	0.341	2.233	0.085
	Within Groups	34.525	236	0.153		
s_51	Between Groups	1.918	3	0.639	1.237	0.297
	Within Groups	116.847	236	0.517		
s_52	Between Groups	1.112	3	0.371	1.884	0.133
	Within Groups	44.47	236	0.197		
s_53	Between Groups	4.033	3	1.344	2.785	0.042
	Within Groups	109.114	236	0.483		
s_54	Between Groups	0.466	3	0.155	0.64	0.59
	Within Groups	54.856	236	0.243		
s_55	Between Groups	0.164	3	0.055	0.222	0.881
	Within Groups	55.684	236	0.246		
s_56	Between Groups	1.756	3	0.585	2.004	0.114
	Within Groups	65.988	236	0.292		
s_57	Between Groups	0.258	3	0.086	0.455	0.714
	Within Groups	42.79	236	0.189		
s_58	Between Groups	0.603	3	0.201	1.163	0.325
	Within Groups	39.071	236	0.173		
s_59	Between Groups	0.544	3	0.181	1.29	0.279
	Within Groups	31.739	236	0.14		
s_60	Between Groups	0.749	3	0.25	1.476	0.222
	Within Groups	38.225	236	0.169		
s_61	Between Groups	0.157	3	0.052	0.421	0.738
	Within Groups	28.104	236	0.124		
s_62	Between Groups	0.998	3	0.333	1.908	0.129
	Within Groups	39.389	236	0.174		
s_63	Between Groups	6.036	3	2.012	0.266	0.85
	Within Groups	1,712.44	236	7.577		
s_64	Between Groups	0.1	3	0.033	0.292	0.831
	Within Groups	25.731	236	0.114		
s_65	Between Groups	0.578	3	0.193	1.528	0.208
	Within Groups	28.483	236	0.126		
s_66	Between Groups	0.294	3	0.098	1.41	0.241
	Within Groups	15.727	236	0.07		
s_67	Between Groups	0.269	3	0.09	0.817	0.486
	Within Groups	24.813	236	0.11		
s_68	Between Groups	0.103	3	0.034	0.395	0.756
	Within Groups	19.64	236	0.087		
s_69	Between Groups	0.513	3	0.171	0.923	0.43
	Within Groups	41.818	236	0.185		
s_70	Between Groups	0.342	3	0.114	0.326	0.806
	Within Groups	78.945	236	0.349		
s_71	Between Groups	0.419	3	0.14	0.978	0.404

	Within Groups	32.281	236	0.143		
s_72	Between Groups	0.067	3	0.022	0.159	0.924
	Within Groups	32.019	236	0.142		
s_73	Between Groups	0.294	3	0.098	0.665	0.574
	Within Groups	33.254	236	0.147		
s_74	Between Groups	0.387	3	0.129	0.402	0.752
	Within Groups	72.673	236	0.322		
s_75	Between Groups	0.332	3	0.111	0.723	0.539
	Within Groups	34.641	236	0.153		
s_76	Between Groups	1.132	3	0.377	2.249	0.083
	Within Groups	37.916	236	0.168		
s_77	Between Groups	0.594	3	0.198	1.616	0.186
	Within Groups	27.689	236	0.123		
s_78	Between Groups	0.31	3	0.103	0.959	0.413
	Within Groups	24.39	236	0.108		
s_79	Between Groups	0.93	3	0.31	1.373	0.252
	Within Groups	51.052	236	0.236		
s_80	Between Groups	0.096	3	0.032	0.212	0.888
	Within Groups	34.169	236	0.151		
s_81	Between Groups	0.676	3	0.225	1.558	0.2
	Within Groups	32.668	236	0.145		
s_82	Between Groups	0.428	3	0.143	1.592	0.192
	Within Groups	20.272	236	0.09		
s_83	Between Groups	0.255	3	0.085	1.049	0.372
	Within Groups	18.336	236	0.081		
s_84	Between Groups	0.74	3	0.247	1.064	0.365
	Within Groups	52.391	236	0.232		
s_85	Between Groups	0.802	3	0.267	1.888	0.132
	Within Groups	32.019	236	0.142		
s_86	Between Groups	0.34	3	0.113	0.918	0.433
	Within Groups	27.942	236	0.124		
s_87	Between Groups	0.727	3	0.242	1.406	0.242
	Within Groups	38.964	236	0.172		
s_88	Between Groups	0.28	3	0.093	0.925	0.429
	Within Groups	22.802	236	0.101		
s_89	Between Groups	0.552	3	0.184	1.255	0.291
	Within Groups	33.122	236	0.147		
s_90	Between Groups	0.322	3	0.107	1.088	0.355
	Within Groups	22.27	236	0.099		
s_91	Between Groups	0.359	3	0.12	1.171	0.321
	Within Groups	23.072	236	0.102		
s_92	Between Groups	0.16	3	0.053	0.761	0.517
	Within Groups	15.861	236	0.07		
s_93	Between Groups	0.081	3	0.027	0.324	0.808
	Within Groups	18.806	236	0.083		
s_94	Between Groups	1.521	3	0.507	2.851	0.038
	Within Groups	40.2	236	0.178		
s_95	Between Groups	0.79	3	0.263	2.841	0.039
	Within Groups	20.953	236	0.093		

s_96	Between Groups	0.342	3	0.114	1.041	0.375
	Within Groups	24.741	236	0.109		
s_97	Between Groups	1.505	3	0.502	2.289	0.079
	Within Groups	49.538	236	0.219		
s_98	Between Groups	0.364	3	0.121	1.377	0.251
	Within Groups	19.897	236	0.088		
s_99	Between Groups	0.254	3	0.085	0.787	0.502
	Within Groups	24.337	236	0.108		

References

National Planning Commission, (1992). 8th five year plan (1992-1997), National Planning Commission of Nepal, 1992, p. 22

National Planning Commission, (1997). 9th five year plan (1997-2002), National Planning Commission of Nepal, 1997, p.17.

National Planning Commission (2002), 10th five year plan (2002-2007), National Planning Commission of Nepal, 2002, p.28.

Robbins, S.P. & Coutler,m. (2003). Management, 7th edition, Pearlson edition.

Source: (Robbins, 2003, p.8)