Abstract. The Information Technology revolution is going on. It has been making significant impacts on our day lives and has changed the very landscape of human existence. The IT industry today stands as the maximum growth industry and demand for core IT professionals have been on the rise and is growing worldwide. The demand of these professionals has been so huge worldwide that at present the demand simply outnumbers the supply of these professionals. As a result of the same, rapid growth in highly skilled IT occupations, low unemployment rate, rising salaries etc. have become typical attributes of this profession. With regards to the opportunities available in the IT profession, of recent there has been an extraordinary demand for IT related courses from students worldwide. Nepal is no exception to the same and demand for IT related courses have been on the rise here as well. To cater to this demand, like their counterparts abroad, universities and colleges in Nepal have also come out extensively with IT related courses and programs. In this paper, an attempt has been made to critically investigate the prevailing IT education scenario in Nepal. The paper also provides key recommendations with regards to the steps that need to be taken to enhance the overall quality of IT education in Nepal.

1. Introduction

The Information Technology (IT) revolution is going on. It has been making significant impacts in our daily lives and within a short span of time it has managed to change the very landscape of human existence. It has dramatically altered and redefined virtually every aspect of our lives in terms of how we work, conduct business and entertain ourselves. With the Internet, also popularly known as the net, all physical barriers like geography etc. are gone and the world today stands as a global village.

To describe IT, it can be defined as a contemporary term that describes the combination of computer technologies with telecommunication technologies. Its vast power to affect change has put it in the forefront of all other industries. Today, IT is the fastest growing economic activity in the world and the IT industry as such is the biggest industry. The IT industry is valued at 800 billion US Dollar worldwide per year growing at a rate of approximately 15% annually [URL01]. IT can substantially enhance an organization's ability to obtain, share and structure information, thereby enabling it to widen continually its knowledge base, improve its efficiency and competitiveness. In this new era, IT stands as the central force in shaping organizations, societies and nations. Based on the presumption that IT is the key to achieve progress, today every organization, region and nation seeks to define its future by its projected leadership role in IT. In recent times, governments through out the world have started to look at IT not only as a tool for improving governance and creating more jobs, but more significantly, as a means to greatly enhance the standard of living of its people [URL03], [URL04]. Nepal has been no exception to the same.

As IT evolves, it has been transforming resource-based economies to knowledge-based economies. In this new era of information, access to information and hence knowledge have become critical in defining the might of a country. Today, countries with access to information are the most successful and prosperous ones. However, success has its own requirements in this age of information. The presence of a sound telecommunication infrastructure and the availability of quality human resources are the most important requirements for any country to reap the benefits from the ongoing IT revolution [URL04]. Today countries with good telecommunication infrastructures and quality human resources are prospering to new heights.
Human resources of any country is developed by education, which unfortunately can not be imparted overnight. For an industry as dynamic as the IT industry, where new technologies keep on emerging on a daily basis, while the same also become obsolete in a similar basis, finding competent human resource to handle these technologies in order to reap the benefits from the ongoing IT revolution has been a global problem for quite some time now. The demand for highly skilled IT human resources has been strong the world over and growing. At present this demand simply outnumbers the available supply and as a result of the same enormous opportunities, rapid growth in highly skilled IT occupations, low unemployment rates and rising salaries etc. have become typical features of the IT profession as a whole [URL01].

With regards to the above global demand and the associated opportunities in the IT profession, in the last couple of years there has been an extraordinary demand from students the world over for various IT related courses. Nepal is no exception to the same and the demand for various IT related courses have been on the rise here as well. To cater to this demand, like their counterparts abroad, universities and colleges in Nepal have also come out extensively with various IT related courses and programs. For a country like Nepal, which has traditionally lacked a sound education system, an attempt has been made in this paper to critically investigate the prevailing scenario of IT education in the country. This paper also provides key recommendations that the author feel will go a long way in enhancing the overall quality of IT education in Nepal.

2. Role of IT in Ed

Like all other sectors, the education sector as well has not been able to remain isolated from the ongoing IT revolution. IT has virtually altered and redefined the educational and research landscape in academic institutions the world over. In this new era of IT, one of the most critical challenge that most of the educational institution have been confronted with is how to best educate students for what has been variously called the Knowledge Age, the information Age, or, more recently the Digital age. The educational implications of the Digital age are enormous. If information is power, how can they make sure that all students are empowered with information? And in a time, when information is ubiquitous, how can information be used to build knowledge, and knowledge used to build the understandings that lead to wisdom? In this age of information, if students are to succeed in their future, they must become critical users and thinkers of information. Understanding the implications of the above, in recent times the entire perspective of education has changed globally and IT has been the driving force behind such change [FULT, 99].

With the advancements in IT and its penetration in education, over the years the objectives of learning has significantly changed from the acquisition of routine facts in a typical classroom setting to the acquisition of information through drill and practice. With the Internet, information has crossed all physical boundaries and can come from anywhere. It is no longer subject to the libraries of an institution. In this era of information explosion, skills like problem solving, critically thinking, complex reasoning, collaboration and communication, ability to access information using the best searching strategies and the best sources for various kinds of information are the set of skills that have become the critical ones for students to acquire form them to succeed in their future. In the following paragraphs we discuss how IT has been influencing the education sector [KARA, 00], [URL02]. We discuss the influence of IT on teaching and learning, research and administration in educational institutions.

2.1 Teaching and Learning

In the last couple of years, IT has significantly changed the teaching and learning environment in educational institutions the world over. With the advancement in IT, in the last couple of years the ways in which curriculum are designed and delivered have significantly changed. Similarly, with the penetration of IT in education, there has been a significant shift in the teaching and learning strategies. The learning processes of today encourage more on the acquisition of information through drill and practice e.g. using the Internet than the acquisition of routine facts in a typical classroom setting. Likewise, with the adoption of IT, in the last couple of years the ways in which the curriculums are delivered have also significantly changed. Multimedia presentations of lectures have gradually replaced the traditional method of delivering lectures e.g. on whiteboards. Following are some of the trends and influences that IT has made in the teaching and learning environment.

- In the last couple of years the teaching and learning methodologies have changed significantly. The use of IT in education has enabled the faculty to focus in helping students select and structure
concepts and information, and engage in discussions. In this new setting, the faculty needs to spend less time in transmission of routine facts and information to students and the students are encouraged to obtain that information for themselves using various IT tools.

- Penetration of IT in education has provided more choices to the students in the way they learn. With IT, the learning process has become more personalized with different modes and paces of learning, which fit the individual cognitive styles of students.

- With the available networking technologies (specially the Internet) of today, a student seeking information on some subject is no longer restricted to the libraries of the particular institution. In this new era, information can come from anywhere and geography is no longer a barrier. The use of IT has facilitated the development of research culture amongst students where students are encouraged to acquire information from a variety of resources (many of them networked). The students in the process use a wide variety of learning tools such as analysis and simulation, drill and practice modules, multimedia presentation of information, self test modules with corrective feedback, networked based tutors etc and acquire several key skills deemed necessary in this digital age.

- In the last couple of years Smart classrooms have gained significant popularity and are rapidly replacing the settings of traditional classrooms. The smart classrooms of today are typically equipped with audio-visual aids and have high-speed network connectivity in the classroom to access networked resources including the Internet. The reason that smart classrooms have gained such widespread popularity is because of their ability to qualitatively improve the teaching and learning process in any institutions.

- With the networking technologies of today, a new model of education known as distance education has evolved and gained significant popularity amongst students the world over. The Internet has played a key role in this evolution. The main reason behind such popularity of distance education has been the fact that it supports learning anywhere and anytime. It also allows learning across a range of environment and in individualized, flexible format. With distance education, students can obtain education in a setting that they are comfortable with e.g. their homes, and in their own time and pace. The lectures, assignments etc. are generally posted on the Internet from where students obtain it. In this model of education, students don't need to come to classrooms at all to attend lectures etc. Considering the numerous advantages and hence the high demand for this mode of learning, more and more institutions the world over have started to adopt this model of education.

A different but fascinating dimension of distance education is that with the available multimedia technologies of today, it is possible today for students to attend lectures, seminars, conferences etc. in real time happening any where in the world. They can become a part of a global classroom receiving lectures and participating in discussions etc. without being physically present.

- In addition to face-face communication in and outside classrooms, IT has helped to develop stronger intellectual bond between professors and students. Electronic communications like emails has helped a lot bridged the communication gap that is often found between the professors and students.

2.2 Research
IT has significantly redefined the research scenario in last couple of years. Networked computing resources and especially the Internet have surfaced up as a predominant tool to conduct cutting edge research in any discipline. The Internet has been instrumental in providing tools and information vital to conduct research activities in minimal time thereby accelerating the pace of research. Due to Internet, it has become possible to publish research papers on the net and obtain comments much faster than the conventional methods of attending seminars or conferences.

With the available networking technologies including the Internet, collaborative research has become possible. Availability of greater and greater computational power required for developing cutting edge technologies through networking has immensely helped the research community all over the world.

2.3 Administration
IT has found a significant place in educational institutions as well to manage the administration of the institutions. The use of IT to manage administration has allowed the quality of services provided to
students and the faculties alike to be significantly improved. Like wise IT has also helped to increase the efficiency and effectiveness of the administrative systems in a whole. With computer networks, online, paperless systems can be deployed to deliver information more quickly, conveniently and accurately. For example:

- Information for students: Course syllabus, courseware, course registrations, results, assignments, address etc.
- Information for faculties: Students counseling, grade submission, assignments, project monitoring etc.
- Information for administration: Training, personnel and financial management, activity planning, inventory management and control, campus interviews etc.

In a time of continuous financial constraints, IT has become an enabling force, which lets organizations rethink redesign and improve the way it conducts its administrative process and delivers the resulting information.

3. Review of Existing IT Education in Nepal

Nepal has traditionally lacked a sound education system. Until a few years back students aspiring to obtain higher education and specially in technical disciplines had no option but to go abroad spending huge sums of money. However, in recent times the country has taken a big leap as far as the higher education is concerned. In the last couple of years, the country has seen the emergence of a couple of new universities namely Kathmandu University, Pokhara University and Purbanchal University. With the opening of these universities, a variety of courses from various disciplines, which were not available previously in Nepal, have also become available. The availability of these courses at home and that too at a minimal cost as compared to the cost of studying the same aboard has been a significant development for the country and is very encouraging.

In light of the above developments, a variety of courses in IT have also become available in Nepal. In the last couple of years Tribhuvan University, Kathmandu University, Purbanchal University and Pokhara University have come out extensively with their own programs in IT, which they have been conducting either by themselves or through their affiliated colleges. At present the yearly intake of various universities (along with their affiliated colleges), in different IT program in Nepal is as follows: Tribhuvan University with an intake of 860 per year, Kathmandu University with an intake of 110 per year, Purbanchal University with an intake of 940 and Pokhara University with an intake of 1212 per year. Similarly, the various IT courses offered by the above universities in Nepal are Bachelor in Computer Application (BCA), Bachelor in Computer and Information Systems (BCIS), Bachelor in Information Technology (BIT), Bachelor of Engineering in Information Technology (BEIT), Bachelor in Information Management (BIM), Bachelor of Engineering Computer Engineering (BE comp engg.) etc [GHIM, 01]. Each of the above courses have their own eligibility criteria and has been designed to serve their own objectives. However, the common thing in all the above courses is that they aim to prepare students for a lucrative career in IT.

Even though, the opening of the numerous colleges in the country to cater the huge demand of students to study various IT related courses domestically can be considered as a positive development for the country, however real success in this field can only be achieved, when these colleges are able to provide international standard quality education in IT. For a program as versatile and dynamic as IT, availability of quality human resources, presence of sound IT infrastructure, good management etc. are essential requirements that significantly influences the overall quality of the IT program and can become critical in the overall success of the program. The quality of the IT education can seriously get affected even if one of the above requirements is compromised. In light of the above, a study of the various educational institutions engaged in various undergraduate programs in IT was made by the authors. The study was restricted to colleges in Kathmandu and the objectives of the study was to find out the present status, constraints, problem areas both in administrative and functional domains, future requirements etc.. The study revealed the followings.

- It was found that a proper controlling mechanism through which the universities can supervise its guidelines and the overall quality of education being imparted by its affiliated colleges was absent in most of the universities. For those universities, which had such controlling mechanism, it was found that they were loosely implemented. As a result of the above, the risk of these affiliated
collaborations compromising the university guidelines and significantly affecting the overall quality of IT education was highly present.

• It was found that availability of qualified faculties was a major constraint in most of the institutions. Elsewhere, where a PhD degree is generally considered the minimum requirement for faculties to teach in graduate and post-graduate courses, it was found that most of the institutions here were having bachelor level faculties to teach the university level courses in IT. For these institutions, finding faculties with a Master’s degree or higher was often difficult. However, on the other side, it was found that some of the institutions were guided by cost when selecting faculties, as it was relatively cheaper to hire a bachelor level faculty than a faculty with a Master’s or a PhD degree. In the absence of qualified faculties with adequate teaching experiences, the chances of the overall quality of IT education being compromised was seriously high.

• It was found that most of the institutions were using faculties from other disciplines than IT to teach core IT/Computing courses. Often trainings in some IT courses or packages was found to be sufficient for these faculties to qualify them to teach university level courses in IT. It was noted with great concerns that that there was a serious threat of the overall quality of IT education being compromised due to this practice of allowing faculties with absolutely no formal educational background in IT to teach university level courses in IT.

• It was found that most of the institutions had very limited full time faculties working for them. The associated cost of hiring full time faculties was often considered to be the main reason behind the same. In most of the cases, these institutions were using part time faculties. As a result of the same, students often faced great difficulties in accessing the faculty to answer their queries etc. Similarly it was also found with great concerns that for most of such part time faculties, teaching was just another profession that they were involved in to earn money. Elsewhere and specially in the first world countries, where faculties are found to be dedicated in the teaching profession alone (including research), the faculties in Nepal were found to be involved in several other professions besides teaching. Due to this the dedication that is usually required in the teaching profession was found to be absent.

• It was found that good quality IT manpower for planning and developing IT facilities as well as maintaining them effectively was a major constraint in most of the institutions. The problem was further compounded due to the volatile nature of their stay in view of plentiful and better opportunities available outside. It was found that in the absence of professional expertise, the chances of bad plans being formulated, substandard materials being acquired etc. was very high.

• Development of new facilities needs professional expertise, market knowledge, appreciation of precise user requirements and then selection of suitable configuration, choice of supplier etc. Each institution or department on the campus making unilateral decision in respect of their needs in the absence of adequate professional knowledge and market information can jeopardize the overall interest of the organization in deriving maximum benefits as far as cost, acceptance, installation and product support are concerned. Due to the above the need for a central level IT department to look after the IT requirements of the entire organization is necessary and the same was found to be absent in some of the institutions.

• It was found that most of the institutions lacked a comprehensive computer laboratory. Still some others were found to be using obsolete computers in view of the financial implication of upgrading the same. At times it was found that these computers were not able to meet the throughput requirements of the modern syllabi. It was also found with great concerns that in most of the cases the computers were not networked in order to derive optimum benefit through shared resources.

• It was found that, most of the educational institutions lacked good Internet centers for students to browse and collect useful information to enhance their academic inputs. The Internet center in a true sense functions as a good library extension and information on any subject can be retrieved without delay. Such Internet center puts students at par with any of the students in the world.

• It was found that in most of the institutions the libraries were not up to the mark. It was found that in most of the cases the libraries were not well stocked and didn’t had the latest editions of the
books in their collection. Besides text and reference books, important manuscripts like leading research journals, periodicals, conference papers etc. were found to be absent in almost all of the libraries.

- It was found that in most of the institutions the libraries operated as traditional libraries with books and other paper manuscripts in their collection. These libraries lacked computer facilities and hence the collection of e-books, e-magazines was not available.

- It was found that most of the educational institutions lacked a comprehensive backbone of high-speed computer networks spreading all over the campus. In the absence of this backbone network, a variety of e-services that can be introduced for the benefit of academic staff and the students over the network were not possible.

- It was found that the type of relationship that usually exists between the leading universities of the world with the concerned IT industry was relatively lacking in Nepal. It was found that most of the universities here were relatively isolated with the local IT industry and had little or no idea about the happenings and the requirements of the local IT industry. It was found with great concerns that the syllabi of some of the universities often lagged behind the industry requirements and didn't cater to the demand of the local IT industry. Similarly, it was also found that the syllabi of the Nepalese universities in general were not up to the par with the syllabi of the international universities offering similar courses. Therefore, it is predictable with great concerns that the products coming out of such institutions can hardly be acceptable to the software industries without sufficient value addition.

- It was found that besides routine academic courses, educational institutions in Nepal had very little to offer in terms of other professional IT courses e.g. certifications of various software (CNE, MCSE etc.). Besides academic degrees, these trainings are often considered significant value addition by the IT companies and can provide advantages to the students in their job search.

- It was found that research, which constitutes one of the major activities in most of the leading academic institutions the world over, was absolutely missing in the Nepalese academic institutions.

4. Recommendations

After reviewing the various educational institutions offering various undergraduate level courses in IT in Nepal, it was found that there were numerous areas of concerns in the way IT education was being imparted in the country. Numerous limitations and compromises existed in educational institutions, which required immediate attentions. It was noticed with great concerns that if corrective actions were not taken immediately, the chances of the overall quality of IT education being affected was significantly high. At the end of day, all of the above can have serious repercussions for the students graduating from such colleges as they are the one who are going to be the most affected.

From our study, it was found that most of the educational institutions required plenty of planning and re-equipping in IT areas for them to compete at the international levels. It is predicted that unless and until institutions engaged in graduate and post-graduate IT education in Nepal overcome the problem areas and constraints outlined in the previous section, it is going to be very difficult to improve the overall quality of IT education in the country. It is also predicted with deep concerns that if the above limitations are left unattended, it will be very difficult for the products coming out of Nepalese institutions to compete internationally. In view of the above delicate situation, the following recommendations can have long lasting impacts in improving the overall quality of IT education in the country and bring the Nepalese educational institutions at par with international standards.

- It is recommended that each university constitute an IT Quality Monitoring Team without any delay to monitor the overall quality of IT education provided by its affiliated institutions. It is recommended that the members of this team be academicians and professionals from core IT background (Computer Science, Computer Engineering, Computing, IT etc.) with at least a Master's level degree. The major responsibility of the above team be to monitor the affiliated institutions in terms of the set guidelines of the universities and ensure that the overall quality of the IT education is not compromised at any level (e.g. from various reasons mentioned in the previous sections). It is recommended that in particular the IT Quality Monitoring Team needs to be sensitive to the followings:
The available faculties in the affiliated institutions. As was found by the study, availability of qualified faculties to teach courses in IT was a major constraint in most of the affiliated institutions. Since, due to the above the chances of overall quality of IT education being compromised was higher, it is recommended that universities come out with proper guidelines with regards to the academic backgrounds and qualities required to teach various courses in IT at different levels and enforce it strictly. The quality monitoring team can then do the policing of these guidelines and ensure that proper faculties are involved in the teaching of the IT courses.

Since there is a trend of hiring part time faculties, which was often guided by the costs, it is recommended that the universities make their affiliation process more elaborate and the requirement of a certain number of full time faculties be made mandatory before the affiliation is given. It is recommended that the universities enforce the above strictly through the quality monitoring team.

Besides human resources, other basic infrastructures like libraries with sufficient number of latest edition books, various laboratories and the availability of modern equipments in these laboratories as per the requirements of various curriculums also needs to be monitored to ensure the overall quality of the IT education.

Besides maintaining vigilance with regards to quality of IT education, the above team can also be instrumental to provide the universities with various insights on such important issues as curriculums designs, IT trends and emerging technologies, understanding the requirements of the local IT industry, relationship building between the local IT industry and the respective university, trends of foreign universities, formulating of IT policies, etc.

It is recommended that each academic institution constitute an IT Task Force. This task force can bring about synergy in all IT related activities in the institution to optimize quality, cost, manpower management, resource generation and above all safeguarding overall objectives and interests of the institution. Similarly this task force can also become instrumental to implement the various guidelines of the universities with regards to IT education. Some of the responsibilities that the above IT Task Force may assume are as enumerated below:

- Implement the IT guidelines of the respective university (e.g. computer labs, human resources etc.) as required for various IT courses of the university.
- Formulate IT policies and lay down short term and long term perspective plans for the institution.
- Act as ‘apex body’ to take all policy decisions pertaining to IT.
- Handle all IT related major and minor projects on the campus.
- Evolve technical and administrative structure to effectively support all computer labs to make available maximum ‘resource sharing’ opportunities among various institutions and departments.
- Set up work groups for centralized purchase of computer hardware and software to achieve standardization, optimization of cost/benefit ratio, avoidance of duplication of resources etc.
- IT manpower management including acquiring the IT manpower including faculties on a central basis for the institution.
- Maintain a central pool of IT human resources for streamlining maintenance support activities on the basis of cost effectiveness.
- Organize IT seminars, conferences, exhibitions etc. to promote awareness among larger cross section of student and staff community.
- Since the availability of qualified human resources (faculties, IT professionals etc.) with postgraduate degrees in IT to teach various university level courses in IT as well as to manage...
various IT resources was scarce in the country, there is a need for the government as well as the various universities in Nepal to come out with comprehensive human resources development programs to develop the above human resources. The above will significantly help to improve the overall quality of IT education in the country and will also serve as a catalyst to boost the IT industry of the country.

- With regards to the dynamic nature of the IT industry where newer technologies have been emerging at a significant pace, there is a need for the Nepalese universities to be as dynamic as well as their counterparts abroad in offering new curriculums covering the emerging technologies. This can help to produce much sought after human resources in emerging technologies and can significantly help to boost the overall IT industry of the country.

- Research, which generally constitutes one of the important activities in the leading universities of the world, is relatively absent in the Nepalese universities. It is recommended that significant stress be given on research activities in IT such that indigenous technologies can be invented and the dependency on borrowed technology is minimized. Similarly, this can also help to promote and preserve local language (e.g. development of software in local languages), heritage and culture.

- It is recommended that the creation of major IT facilities such as fully equipped computer labs, backbone computer networks, digital libraries etc. needs be encouraged in all educational institutions. The availability of a backbone network along the campus with powerful centralized servers can offer significant opportunities to establish many e-services such as online attendance recording, time-table and class-scheduling, library management, bulletin boards, computer based trainings (CBTs) etc. Similarly smart-class rooms can also have its foundation on this backbone network.

- It is recommended that the availability of a good Internet centers for students to browse and collect useful information to enhance their academic inputs be made compulsory in all educational institutions of higher learning in the country.

- It is recommended that the concept of smart-class rooms be promoted extensively to reap the benefits provided by them and stay at par with International standards.

- For a country like Nepal with such difficult terrains, distance education can play an important role in providing education to the masses leaving in remote and inaccessible parts of the country. Therefore, it is recommended that distance education be promoted extensively at various levels (schools, colleges, universities) in the country.

- In order to offset the disadvantage of following outdated syllabi in most of the institutions and also to meet the requirement of local IT industry, it is recommended that the education, training and consultancy services be set up in collaboration with professional IT education providers to provide the opportunities to students to bridge the knowledge gaps.

5. Conclusions

The IT revolution is going on. It has been making significant impacts in our daily lives and within a short span of time it has managed to change the very landscape of human existence. IT is transforming resource-based economies to knowledge-based economies. In this new era of knowledge based economies, besides a sound telecommunication infrastructure, the success or failure of a nation is governed by the availability of human resources to it. Considering, the very dynamic nature of the industry where new technologies have been emerging on a daily basis, while the same also becoming obsolete in a similar basis, demand for competent IT professionals to manage these technologies is strong globally. At present the demand for such IT professionals simply outnumber the supply and as a result of the same, enormous opportunities, rapid growth in highly skilled IT occupations, low unemployment rates and rising salaries have become typical features of the IT profession as a whole. Considering the huge opportunities that exist in the IT industry, in recent times there has been an extraordinary demand from students for various IT related courses worldwide. Nepal is no exception to the same and demand for similar IT related courses have been on the rise here as well. To cater to this demand, like their counterparts abroad, of recent universities and colleges in Nepal have also come out extensively with IT related courses and programs. For a
country like Nepal, which has traditionally lacked a sound education system, an attempt was made in this paper to critically investigate the prevailing scenario of IT education in the country. After critically reviewing the various educational institutions offering various undergraduate level courses in IT in Nepal, it was found that there were numerous areas of concerns in the way IT education was being imparted in the country. These have been extensively reviewed in this paper. Several recommendations have also been provided in this paper, which can go a long way in enhancing the overall quality of IT education in the country.

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