



## **Skills Development in Information and Communication Technology (ICT)**

- 1. Current Skills environment in Afghanistan;**
  - **Institutions involved,**
  - **Past and present initiatives**
  - **Status of related activities**
- 2. Possible Strategies and Plans for proposed skills development**
- 3. Cost estimates, breakdowns, economic and financial analysis for the skills component**

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## 1. Executive Summary

According to the proposed definition by Economic Cooperation Development (OECD) and approved by the United Nations Statistics Division

### ICT is described as:

*"The production (goods and services) of a candidate industry must primarily be intended to fulfill or enable the function of information processing and communication by electronic means, including transmission and display."*

The activities (industries) in the ICT sector can be grouped into the following:

- ICT manufacturing industries,
- ICT trade industries and
- ICT services industries.

Afghanistan ICT Policy vision says:

*To enable Afghanistan Information and Communication Technologies (ICTs) by becoming part of the global information society while preserving Afghanistan's cultural heritage. To promote national goals to achieve a tolerant and vibrant Afghanistan, Afghanistan will use ICTs to expeditiously improve the Government sector, social services and foster the rebuilding process, increase employment, create a vibrant private sector, reduce poverty and support underprivileged groups.*

The objective of this report is to assess Information and Communication Technology (ICT) related skills and the gap which exists between the market growth and available skills set that serves the ICT and non ICT sectors. The study focuses on identifying evident skills gap and implementing plausible strategies to meet the market demand for sufficient ICT related skills. The study will also assess the developmental aspect of the financial resources needed for the implementation of the ITC skills development program.

The following objectives will be carefully reviewed:

- (a) Creating an enabling environment and making strategic investments for the development of Afghanistan's backbone and broadband infrastructure;
- (b) Supporting the mainstreaming of mobile applications across Government by supporting innovations and creation of cross cutting enablers; and
- (c) Developing local IT infrastructure and capacity in the public and private sectors.

The methodology employed desk research, stakeholder interviews, industry consultations, and the collection of firm-level surveys.

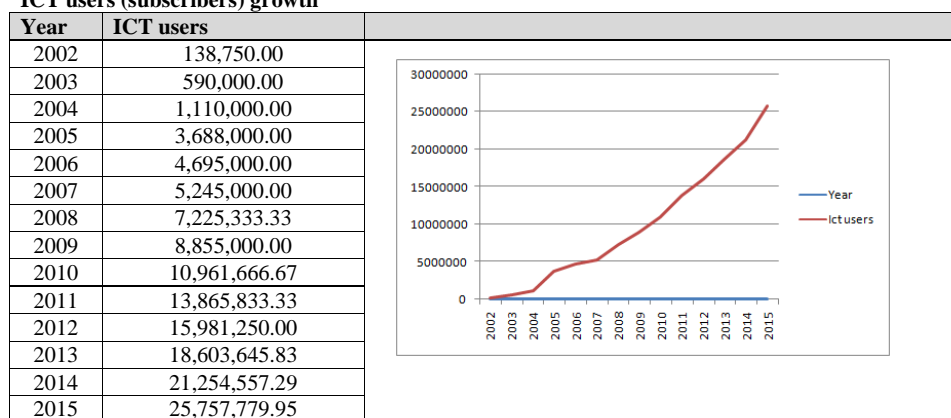
It became evident that the ratio of the ICT technology growth and human resources growth is 3: 1 showing a sharp shortage of skilled and semi skilled labour force in the ICT sector and the gap will



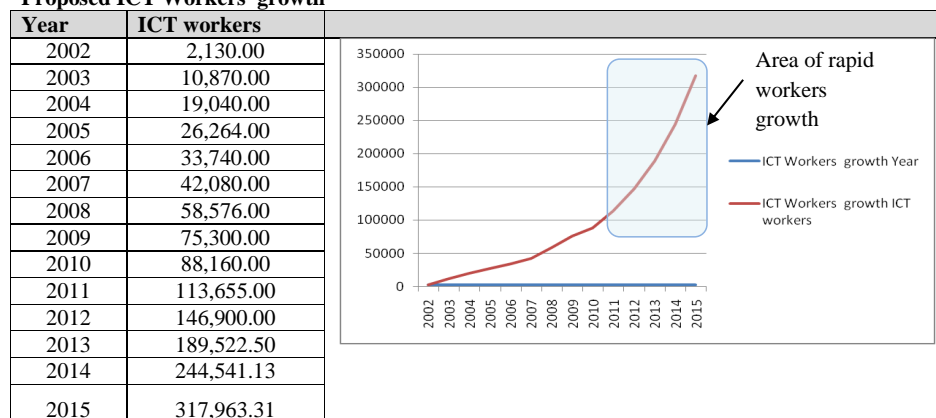
widen in the coming years as shown in the table below. The purpose of this assignment was to assess the current ICT skills level and identify the skills gap which are evident in Afghanistan. This goal was impossible to reach without knowing the current progress made in the ICT sector and overall ICT sector overview. The paper aims to briefly describe the findings of the study and provide critical analysis of the ITC skills, demand for varies skills and potential skills development programs. The Study has undertaken firm level qualitative and quantitative surveys. The results of surveys and growth matrix are shown below.

**Figure 1: ICT Sector Human Resources growth**

**ICT users (subscribers) growth**



**Proposed ICT Workers growth**





The above shaded area of ICT workers and users growth is a desired projection. In case Afghanistan triples its ICT knowledge base among workers, the country can meet the growing demand for the ICT related skills that will enable business growth, production, ICT use in different agricultural and manufacturing fields, ICT education in non ICT educational sectors and finally higher ICT skills in public sector.

The study has also focused on different levels of technical and managerial positions and has identified a number of gaps in the top and middle management and ICT architecture. The study has identified that for every top ICT manager there is need for approximately 10 mid level ICT professionals. These professionals must have obtained either/or a bachelor degree or an advanced Technical Vocational Education Training (TVET) training.

The differences are based on the rapid growth of the ICT sector in telecom and lately the internet industries while the human capabilities and skills growth stayed behind despite attempts in meeting the market demand for ICT skilled workers. The top management in this case would have Master Degree or Bachelor in advance ICT engineering or system analyst. The market is currently lacking the top level managers and significantly lacking the mid level management. Raw data for the project has been gathered in the following manner:

- Gathering existing studies and reports
- Conducting industry surveys in over five categories
- Meeting stakeholders and industry players
- Gathering skills related information at the grassroots level
- Studying similar growth in the regional countries

The study has indicated significant increase in the size and role of the ICT sector in the past five years. The ICT industry that requires basic skills to operate the ICT sets has grown in a faster pace. The ICT industry that requires more advanced skills set has faced difficulties.

Main areas where the skills are required are as follow:

**Figure 2: Main areas requiring ICT skills at strategic level**

No.	Area of HR need	Skills required
1	Top level ICT management	Tasks carried out independently such as data recovery programs, database design, business management application, ICT architecture design, advanced Database Management, etc.
ISP programmers		Internet programmers, Application programmers, Networking engineers
2	Mid level ICT management	Application engineers, networking engineers, ICT architects (mid level), Maintenance specialists, Mid



		level programmers, troubleshooting specialists, for example skills for design and management of database systems.
3	Bridging and placement programs for graduates of ICT institutions	Enabling the entrance of freshly graduated students into the workforce by providing bridging and placement programs.
4	Cutting edge technologies and programmers	Application technologists working in small groups and providing services to larger companies, cyber security applications, strategic ICT programming, E-governance programming, small ICT programs developers.
5	Non ICT sector related ICT skills requirements( <b>General digital literacy</b> )	
	IT services for users	<ul style="list-style-type: none"> <li>a. Networking managers</li> <li>b. Troubleshooting technicians</li> <li>c. E-portal developers and managers</li> <li>d. Web designers</li> <li>e. Web masters</li> </ul>
	Overall ICT literacy for the public servants	<ul style="list-style-type: none"> <li>f. Training specialists for existing government managers and high rank officers</li> <li>g. Easy to use ICT equipment and web based applications</li> <li>h. Web designing and graphic designing</li> <li>i. ICT office assistants</li> <li>j. Server maintenance and data recovery technicians</li> </ul>

**Figure 3: The ICT skills can be divided into the following major areas:**

No.	Industry	Base line and opportunities
1	General Public use of ICT	Requirement for skilled mid to low level technicians (67%), Need for internet speed and cost cutting in ICT services. The surveys indicate that new directions introduced in ICT small businesses will double their current investments.
2	Skills in Telecom	Telecom industry has been developing rapidly and has reached its peak with the current technical capabilities. 89% users of the telecom industry suggested newer terms in mobile phone use and more access packages such as monthly fee, free phone, short term promotions and population category promotion (students, seniors, ICT sector workers and more). New terms and conditions as well as newer technologies will require skills to manage, modify or interconnect the ICT services across the board. The study identified need for mobile telecom services and cross sector financially sustainable services
3	Skills in Internet ICT	Internet is the fastest growing industry. With new market demand the industry is likely to face more difficulties in skills acquisition than in



		<p>the telecom industry. It is anticipated that in the next 5 years the industry will grow by more than 50%. The ISP sector is already suffering from lack of skills in mid to high level management as well as in the hardware installation and maintenance areas such as:</p> <ul style="list-style-type: none"> <li>• Hardware technicians for ISP sector</li> <li>• Installation technicians</li> <li>• Sales and marketing skills</li> <li>• Remote troubleshooting ICT skills</li> <li>• Distance troubleshooting in ICT</li> </ul>
4	Skills in Social networking ICT	<p>Social networking is a new industry and is mainly related to the telecom industry. Social networking has been studied not because of the size of the industry but because of the reasons why this industry is prospering in the country. Due to challenges in internet connectivity and high costs the social networking has been using the mobile applications.</p>
5	Governance ICT	<p>Attempts have been made to introduce electronic and computer based services in the government structures. So far 'there are electronic <i>filing</i> of applications for taxes, licensing, statistics, procedures and some other e governance matters. However E-governance remains to be a priority for the future ICT sector.</p> <p>Major E-Governance priorities where ICT skills are needed:</p> <ul style="list-style-type: none"> <li>• Development of a National Database (including high tech passports, National IDs, Statistics, Pensions funds services, Finger print bank)</li> <li>• Strengthening the National ICT Council and development of a national cyber centre)</li> <li>• National ICT registry and sharing of personal information among government sectors.</li> <li>• Development of a government employment database and records</li> <li>• Development of specialized ICT powered application and license issuance for Driver License, Birth Certificate, Marriage Certificate, Election Card and other important documents</li> <li>• Development of a national E-Governance centre that will technically manage the performance of the E-Governance routine work</li> <li>• Development of ICT powered collateral and credit registries in financial institutions</li> <li>• Establishment of credit registry and collateral registry in financial institutions.</li> </ul>
6.	National Security ICT (Cyber Security)	<p>Cyber security is one of the great opportunities for the ICT sector. So far there are preliminary attempts to develop a coherent networking</p>





		and information sharing between the security ministries coached by International Security Assistance Force (ISAF) ICT advisory. However without a national cyber security program and adequate technical personnel this task seems to be impossible. Preliminary surveys and stakeholder talk in the Ministry of Interior, ISAF, and Ministry of Defense indicate that there is need for over 5,000 ICT professionals (10% high level ICT managers, 65% mid level ICT administrators and 25% ICT associates who will provide ICT based services to ensure national security. The possibilities of the private sector involvement in the strategy shall be examined.
7.	ICT Education	<p>This is the main topic of the study and more can be found in the report body. However it is important to mention that the ICT related educational institutions (public and private) are in their infant stages. Strategic program in ICT education are suggested as:</p> <ol style="list-style-type: none"> <li>National ICT education program at masters degree level that will be far advanced than the current institutions.</li> <li>Bridging programs for graduates and placement as an attempt to help young specialists to enter the workforce.</li> <li>General digital literacy for public servants at varies stages</li> <li>Focus also to be made on the short term ICT training and bursaries for young self though ICT workers. Surveys show that over 82% current ICT workers are self thought and are in need of upgrading and skills development.</li> <li>Support ICT infrastructure such as provision of internet in educational institutions and fund for ICT labs</li> </ol>

Since the gap between the ICT sector growth and the ICT skills development is wide; a comprehensive long term plan to be developed to reach the target number of skilled ICT workers both in high level management and mid level management. This can be reached through a combined training, short term refreshment courses and ICT Skills development grants for talented young groups to enhance ICT sector. The following ICT Skills enhancement programs are recommended in the next 5 years:

**Figure 4: ICT Skills Development Program Outline**

Program No.	Program Objective	Details	Participants breakdown				
			1390	1391	1392	1393	1394
1	ICT in the workplace program	This is the largest area of intervention and is described as the least developed among government employees. The program will include continues training of public sector employees with strong incentives after successful graduation	1000	2500	3000	3000	3000



2	Pilot Mid Level ICT educational program	A 6- month to 12- month ICT Diploma and placement program for Bachelor degree graduates. This program can be run from government universities or private educational institutions.	250	350	400	500	600
3	High level ICT Skills development programs	Development of ICT programs that will enable the production of high level ICT architects, managers and inter-industry technical solutions.	50	75	100	125	150
4	Small ICT innovation grants	Grants to ICT collectives and innovative groups in developing specialized ICT programs for general ICT sector registry, networking, small business enhancement (amount between US\$5,000 to US\$10,000)	10	15	25	30	30
5	Design and establishment of new programs at private educational institutions	Seed and pilot funding would cover the design and running of the ICT education programs or program components at private educational institutions. The design however to be carried out together by the public and private sector institutions and in accordance with the market demand and public sector needs	2	2	3	3	5
6	Cyber Security Training Program	Special training program (12 months to 24 months) with placement for mid level ICT workers to elevate to high level ICT managers. The program may engage security services and military training facilities.(Cyber Security). Existing security ministries' ICT workforce may also be engaged.	40	80	80	100	150
7	Cutting Edge technology	Funding innovative ICT programs that serve better public service. The training maybe co-funded by the private sector alongside the government.	25	50	50	50	50
8	National ICT University	A state of the art ICT University that will combine diverse subjects of the modern ICT sector. The University shall provide Bachelors and Masters degree level standardized education that is accepted by the accredited universities.	400	600	600	800	1000



9	Mobile ICT education	Extending the ICT skills to provinces and districts. Mobile ICT laboratories to be established to provide short term, 1- month, training to existing provincial ICT technicians.	50	100	150	200	250
10	ICT Graduates Placement Program	The objectives of this program are to enable the entrance of senior graduating students into the workplace. The program will fund part of the graduating students' internship and placement in private companies and will provide additional support to public institutions hiring graduating students. The project will grow as a government program.	200	320	380	420	500
11	ICT award	Inaugurating the ICT award for excellence in innovation and new ideas. The registers of the ICT related IP and ICT associations can be nominated as well	5	8	8	8	10
12	ICT Lab funding	This pilot is designed to provide physical assets support to universities, private educational institutions and libraries	5	8	8	8	10
13	Wi Fi space	The provision of free internet coverage in Major universities, private educational institutions and libraries	2	2	3	3	4
14	In Country ICT Masters Program	In response to the growing need for advanced ICT management workforce this program will train up to 20 Graduate students per year. This program is financially reasonable compare to similar programs abroad	0	20	20	30	50
15	ICT Bridging Programs (ICT-Bridge)	3 months ongoing program at MCIT for selected public and private educational institutions graduates, private sector service providers. This may include: · Graduates of private ICT institutions · Graduates of provincial public and private ICT educational institutions The program to pave the way for ICT graduates Placement program	50	100	150	200	200

### Cost estimates and breakdowns, and economic and financial analysis for the skills component

This deliverable is focused on the cost estimates on the suggested ICT Skills development programs. This chapter also provides an estimated time line for the project implementation.



Figure 5: ICT Skills Development Program Estimated Budget

Program No.	Program Objective	Details	Funding Options (US \$) per year		Combination of programs		
			Min.	Max.	Combination 1	Combination 2	Combination 3
1	ICT in the workplace program	This is the largest area of intervention and is described as the best developed among government employees. The program will include continuous training of public sector employees with strong incentives after successful graduation	\$800,000.00	\$1,000,000.00			
2	Pilot Mid Level ICT educational program	A 6 months to 12 months ICT Diploma and placement program for graduates of grade 12 students. This program can be run from government universities or private educational institutions	\$350,000.00	\$750,000.00			
3	High level ICT Skills development programs	Development of ICT programs that will enable the production of high level ICT architects, managers and inter-industry technical relations.	\$600,000.00	\$900,000.00			
4	Small ICT innovation grants	Grants to ICT collecting and innovative groups in developing specialized ICT programs for small ICT sector registry, networking, small business enhancement (amount between US\$5,000 to US\$10,000)	\$175,000.00	\$300,000.00			
5	Design and establishment of new programs at private educational institutions	Seed and pilot funding would cover the design and running of the ICT education programs at private educational institutions. The design however to be carried out together by the public and private sector institutions and in accordance with the market demand and public sector needs	\$300,000.00	\$250,000.00			
6	Cyber Security Training Program	Special training program (12 months to 24 months) with placement for mid level ICT workers to devote to high level ICT managers. The program may engage security services and military training facilities	\$250,000.00	\$450,000.00			
7	Cutting Edge technology	Training on advanced cutting edge technology for businesses before employing it in the industry. The training maybe co funded by the private sector alongside the government	\$50,000.00	\$125,000.00			
8	National ICT University	A state of the art ICT University that will combine diverse subjects of the modern ICT sector. The University shall provide Masters degree level standardized education that is accepted by the accredited universities.	\$1,000,000.00	\$1,000,000.00			
9	Mobile ICT education	Extending the ICT skills to provinces and districts. Mobile ICT laboratories to be established to provide short term 1 month training to existing provincial ICT technicians	\$500,000.00	\$2,900,000.00			
10	ICT Graduates Placement Program	The objectives of this program is to enable the entrance of senior graduating students into the workplace. The program will fund part of the graduating students internship and placement in private companies and will provide additional support to public institutions during graduating students. The project will grow as a	\$500,000.00	\$1,200,000.00			
11	ICT award	Inaugurating the ICT award for excellence in innovation and new ideas. The registers of the ICT related IP can be nominated as well	\$50,000.00	\$100,000.00			
12	ICT Lab funding	This pilot is designed to provide physical assets support to universities, private educational institutions and libraries	\$300,000.00	\$500,000.00			
13	Wi Fi space	The provision of free internet coverage in Major universities, private educational institutions and libraries	\$50,000.00	\$150,000.00			
14	In Country ICT Masters Program	In response to the growing need for advanced ICT management workforce this program will train up to 20 Graduate students. This program is financially reasonable compare to similar programs abroad	\$750,000.00	\$1,900,000.00			
15	ICT Bridging Programs (ICT Bridge)	3 months ongoing program at MCTT for selected public and private educational institutions, graduates, private sector service providers. This may include: Graduates of private ICT institutions Graduates of provincial public and private ICT educational institutions Small business IT management Municipal service IT package	\$250,000.00	\$500,000.00			
					\$2,250,000.00	\$100,000.00	\$250,000.00
					Legend		
					ICT Infrastructure funding		
					Broader digital literacy		
					Foundational ICT education		
					ICT Training programs		



The financial analysis combines the actual project costs, estimated future project costs and results of the demand analysis. The financial analysis does not include infrastructure expenditures. The suggested intervention ranges from minimum to maximum expenditure and is part of series of programs which can be taken at once or in groups. In order to undertake the fifteen programs in several badges, the programs have been divided into three pilots. Each pilot will provide the target number of people and the expenditure necessary to conduct the ICT skills development. The amount of funds distributed to program badges does not translate to the number of people trained. It is rather the quality and depth of the ICT skills development approaches that will require more funding.

### Where to start?

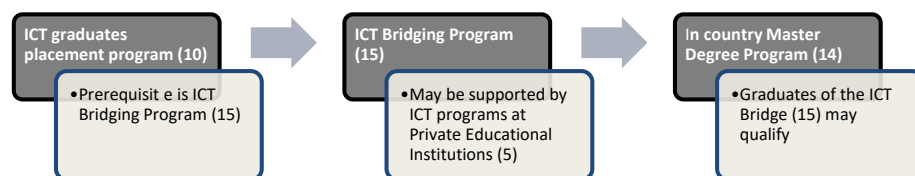
Improving the ICT Skills environment is a multitask and multiyear undertaking. It is recommended to start the skills development from bridging the gaps between the available skills obtained in different ICT educational institutions and the market demand. This first step will pave the way for programs such as the graduates' placement, in country master degree program, ICT granting and other programs. The continuing skills development or bridging program "ICT-Bridge" may accommodate graduates of the following institutions:

- Programs for graduates of public institutions
- Programs for graduates of private institutions
- Programs for graduates of provincial institutions

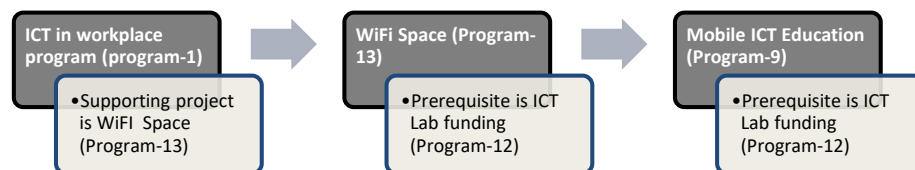
Details of the start up programs are provided in the main report.

The pilot rollout is recommended in the following manner:

**Pilot No.1:** It is a combination of 3 programs identified in the suggested rollout.



**Pilot No.2:** It is a combination of 3 programs identified in the suggested rollout.





**Pilot No.3:** It is a combination of 3 programs identified in the suggested rollout.



The ICT Skills Development programs are picked up and chosen based on the qualitative and quantitative surveys conducted during the first stage of the study. The programs are also aligned with most of the MCIT strategic investments and ICT accessibility to general public and particularly the rural areas residents and users. However the program funding is limited and a more prioritized strategic investment should be made in order to kick off the initiative.

The study team recommends that the “ICT Bridging Program (ICT-Bridge– Program - 15)” to accommodate a number of bridging / continuing skills development programs to be inaugurated to bridge the gap between the skills among recent graduates and the market demand through a comprehensive continuing education program that is designed for different audiences.

**Figure 6: Details of ICT Bridge Program**

	Program	Target	
ICT-Bridge-1	Programs for graduates of public institutions	Graduates of public ICT institutions, TVET graduate from public institutions, Bachelor degree graduates from public universities	This program is designed to bridge the gap between the skills gained during the studies at the publicly run universities, institutions and TVET Schools and the current market demand for employment. Graduates of the ICT- Short 1 may be eligible for the placement program (Program- 10). Refer to <b>Appendix No. 1 D</b> - Curriculum definition and syllabus for this program.
ICT-Bridge-2	Programs for graduates of private institutions	Private ICT institutions, TVET graduate from private institutions, Bachelor degree graduates from private universities	This program is designed to bridge the gap between the skills gained during the studies at the privately run universities, institutions and private TVET Schools and the current market demand for employment. Graduates of the ICT- Short-1 may be eligible for the placement program (Program- 10). Refer to <b>Appendix No. 1 D</b> - Curriculum definition and syllabus for this program.
ICT-Bridge-3	Programs for graduates of provincial institutions	Private ICT institutions, TVET graduate from private and public institutions in the provinces, Bachelor degree graduates from private and public universities in the provinces	This program is designed to bridge the gap between the skills gained during the studies at the privately run universities, public institutions and private TVET Schools and the current market demand for employment. Graduates of the ICT- Short-1 may be eligible for the placement program (Program- 10). Refer to <b>Appendix No. 1 D</b> - Curriculum definition and syllabus for this program. Some modifications of the subjects may be exercised based on the skills gained in provincial educational institutions.



The project does not directly produce profit and the cash flow for the project is the expenditure for the project components' implementation. However the project will provide return in the form of monetary profit to the private sector and will enhance the government service capacity. The project will enable added profit and will significantly increase the utilization and productivity of the workers. The additional profit that a worker can generate as a result of ICT Skills Development program is a net benefit for society. Additional profit is the amount of profit above what the worker would bring if the worker would not received ICT skills enhancement. The additional profit is estimated as additional profit margin that a company or an office enjoys as a result of productivity and cost savings derived from the ICT skills development programs. The company and /or office profitability deeply depends on the ICT application and skills required to conduct ICT related operations.

In the result of the ICT skills development the cost to business is reduced 17.5% and revenue is improved 38.85%. Therefore any increase to the added margin in the ICT enabled service can be taken as 3.8%.

One of the findings of the study is that undertaking the suggested programs at once and as a national ICT priority will save up to 20% of funds in the following areas:

- a. Management expenses
- b. Administration expenses
- c. Marketing and publicity expenses
- d. Curriculum development expenses
- e. Auditing
- f. Monitoring

There are also risks associated in respect to the project implementation.

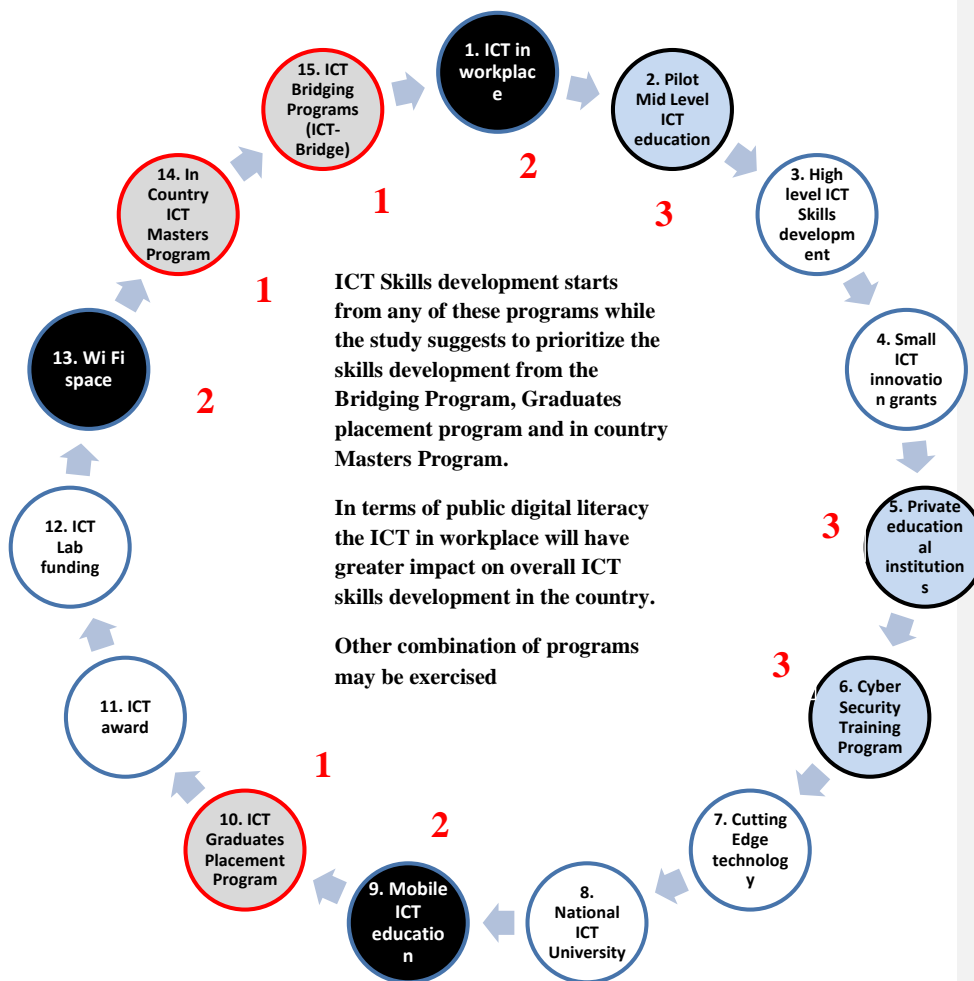
The risks associated with the implementation of this project may be outlined as follow:

- The security situation in the country and government operations is the potential obstacles for the project implementation. During the survey it was revealed that a number of government agencies would not allow their employees to receive trainings within the working hour time. If this issue is not solved during the projects design it can become an obstacle in recruiting the trainees.

In general the proposed initiatives will have a chain connection of programs and initiatives



Figure 7: Combination priority of proposed programs







## **I - Current skills environment in - Afghanistan**

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(Including the institutions involved, past and present initiatives, status of related activities)

### **1. History of Telecommunication and Information Technology role in Afghan Economy**

Over 75% of Afghanistan's terrain is covered with mountains. Lack of paved or graveled roads in rural and mountainous areas create obstacles for individuals to travel frequently. The need for the alternative means of communication between people was evident in the early stages of the ICT industry in Afghanistan. The first telegraph and telephone communication system was brought to Afghanistan in the beginning of the 20<sup>th</sup> century. The telegraph and telephone industry was quickly accepted by the population of northern and eastern communities because it provided accessibility and information exchange without travelling. More telephone lines were extended to Afghan provinces and villages during the King Amanullah era. The development of ICT sector however experienced hardships with the civil war and demolition of major communication junctions and ICT centers across the country. The first wireless mobile communication movement began in early 2000 in Kabul. Due to lack of buying power and slow business exchange, the newly established Afghanistan Wireless Communication Company (AWCC) experienced difficulties. The real ICT revolution has started with the flow of aid and new technologies to Afghanistan. Afghanistan soon became one of the fastest growing ICT countries in the world surpassing other regional countries by the level of growth and acceptance of the technology by the population.

#### ***1.1 Sector background information***

The ICT sector is an essential tool in the successful development of Afghanistan's education, economy, exchange of information, government administration and investment climate. With the landline system nearly non-existent after years of war that destroyed much of Afghanistan's infrastructure, the country now relies on mobile networks in telecommunications. In 2002, there was one telephone line per 1,000 people in the country. There was also no Internet Service Provider in the country. Today there are around 14 million subscribers (2010) covering over 80 % of the country. The total capital investment amount registered initially by these companies in Afghanistan Investment Support Agency (AISA) is US\$255,500,000. As of 2010 more than US\$1.30 billion in private investment and FDI and 50 thousands new direct and indirect jobs was created by the sector, of which one fifth is female workers.

The cost of activating a mobile telephone account has dropped from \$200 to under \$25 and the cost of national calling has dropped from \$2 to as low as 5.5 cents per minute. Traders, merchants and families are now able to stay in touch, developing stronger ties and increasing commerce throughout the country. Total investment in the telecommunications sector is over half a billion USD, most of which derives from the 5 large GSM operators, each paying roughly \$40 million to enter the market. Lan/Wan and other wireless data networks are deployed to major cities and Wimax technology is being procured



to connect Government buildings in provincial capitals. Through Afghan Telecom, there is now a Government Communications Network (GCN) providing reliable high capacity connectivity among all government offices in each of the 34 provinces, as well as the District Communications Network (DCN), a VSAT-based system that serves all 360 districts.

In order to enable the private sector investment and participation in the ICT sector the government has adopted series of laws and regulations. The current legal environment enables competition and participation on the private sector part. A new Telecom Law was passed and established a fully independent regulatory body called the Afghanistan Telecom Regulatory Authority (ATRA). The Telecom Law (2005) also provides for a Telecom Development Fund (TDF), requiring that all licenses must pay 2.5% of net revenues to accelerate the availability of basic telecom services in rural and impoverished areas of Afghanistan.

The Ministry of Communications and Information Technology (MCIT) of Afghanistan's vision for the future is outlined in the following areas:

- Wide coverage of services in all cities, towns and 5000 villages. Improved quality,
- Lower tariffs in next 4 years.
- National optical fiber project backbone completed providing high quality low cost ground based national and international connectivity in next 3 years.
- Cumulative investments in telecom of over US\$1.5 billion in next 4 years.
- 5 million phone users in next 4 years.
- 50,000 jobs created in next 4 years.
- Government revenues from telecom in next 10 years US\$2 billion.

## ***1.2 Afghanistan ICT Sector and the current study***

The Information and Communication Technology (ICT) sector in its modern shape and means is a young but aggressive and dynamic sector in Afghanistan. The ICT development and impact related data is being collected by the Ministry of Communication and Information Technology of Afghanistan continuously. Major ICT related telecom companies also produce valuable data to track the impact of their services and to develop new business opportunities. However the consumer level data that will create a baseline to identify the gaps in the skills development, consumer development and ICT service buying power analysis are lacking in the information market. This study was focused to develop a base line in the ICT sector skills gap assessment using the following sources of information:

- **Desk research**

Reliable secondary research on the ICT sector in Afghanistan is very limited. However, background and statistics were collected from reports and studies previously conducted by the government, donor agencies, NGOs, Major telecom companies and in the media.

- **Stakeholder consultations**

Meetings were held with key stakeholders in government. Government organizations interviewed included MCIT, ISAF ICT Advisory team, AISA, the Afghanistan Land Authority (ALA), Afghanistan Chamber of Commerce and Industries (ACCI), Ministry of Education, Deputy Ministry for Technical and Vocational Education Training (TVET) and USAID.

Major ICT associations and individual businesses were consulted in Kabul and Jalalabad, Kandahar and Herat. Surveys have been conducted among ICT educational institutions and TVET schools. Visits were taken of two ICT educational institutions namely the Information and Communication Training Institute (ICTI) and Afghanistan Technical Vocational Institute (A TVI). In Kabul, a visit was made to



Bagrami Industrial Park and a meeting was held with the President of the association. The possibilities of an IT park or village have been examined. A consultative meeting was also held with members of the ICT associations. Meetings with the students associations and academia held and issues related to the market demand for the ICT skills have been discussed. The team also visited the Ministry of Interior (MoI) and has conducted initial skills assessment and MoI requirements for ICT skills in establishing the Cyber technology and security systems.

- **Firm level surveys**

Due to the lack of reliable secondary research on the targeted sectors, it was necessary to utilize firm-level survey data to extrapolate the information on the current ICT sector human resources skills assessment. In order to gather more specific information pertinent to the study, a number of questionnaires were developed and was administered to over 100 local companies, educational institutions and small ICT related business. The administered questionnaires were focused on the following groups of stakeholders:

- a) ICT Service providers Survey (Large Firms)
- b) ICT Service providers Survey (Small businesses)
- c) ICT Educational Service providers
- d) Private educational service providers
- e) Public educational service providers
- f) Internet service providers (internet clubs and cafes)
- g) Costumer surveys (mobile phone users, internet users and postal services users)

The combined data of all of these sources provided quantitative information on the current (and needed) status of the ICT sector and ICT skills required to meet the current market demand and prepare ICT labour force for the upcoming openings in the industry. The surveys have identified the need for quality of ICT service, the technical requirements for the accessible ICT service, need for the future direction in the ICT sector.



## 2. Current ICT Skills environment

The 2002-2010 invasion of the Afghan business and human relations by the mobile telephone industry have been revolutionary steps towards economic and social development in Afghanistan.

The current ICT environment is closely related to the progress of the following major sectors:

- Cellular (telecom) sector
- Internet various services
- Social networking
- Software development
- Postal services enhancement
- Mass media

By 2011 over 16-million mobile phone subscriptions have been registered in Afghanistan that roughly connects over 13mln Afghans around the country. There are four mobile phone companies active in the country with various discount services to the users of the mobile sets.

The mobile revolution has placed Afghanistan in 5th place in the world from its original 183rd position in 2002. The market share of the mobile companies makes up the largest share of the ICT market to around 85% of the market. The other 15% is shared between the ISP and other ICT service providers.

The Internet service although through satellite medium has engaged over 3-million Afghans to use the internet as an information and communication source. The introduction of fibre optics technology has attracted many ISP companies to offer better packages for the users of internet. MCIT has reduced its cap rate for the internet three times so far and currently the price for 1Mb of internet transfer is \$750 down from \$3000 in 2007. The internet is however entering the era of revolutionary growth and may become the next legacy for the Afghanistan ICT sector. The specifics of the internet industry will be discussed later.

The Social networking is just entering the Afghan market and is in its infant stages.

The rapid development of the ICT sectors in Afghanistan has left the human preparedness to manage and service the ICT sector.

Customer growth for the ICT sector (with over 85% for the telecom sector and 15% for other ICT industries). The calculation indicates 1.55 SIM card per one person that shows the larger number of subscriptions and lesser number of actual mobile phone users. The picture with internet is however on the opposite direction with fewer subscribers for the internet services and more users (average of 5 persons per subscription).

While MCIT has reached its 2005-2009 targets the new targets are being identified that will include the following benchmarks

**Figure 8: MCIT targets**

No.	Targets to be met
1	Increase in internet use by 50% in the next three years
2	Penetration of ICT into remote areas of the country
3	Advancement and further increase in telecom users
4	ICT Skills development to meet the market demand



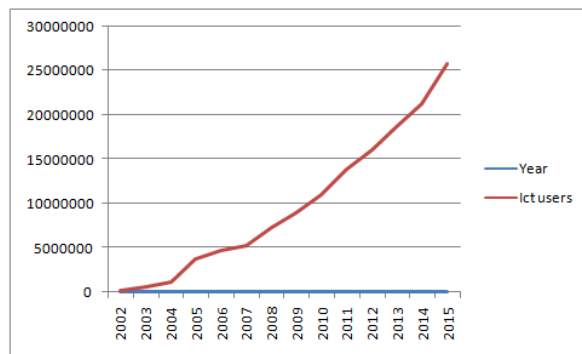
Initial assessment indicates that the targets for the 2009 is fully met and in some areas surpassed by double digits. The new target for the internet sector is 50% growth in the next three years. The overall growth picture is shown below:

**Figure 9: ICT customer growth projection (including population growth ratio)**

ICT customers growth	
Year	ICT users
2002	138,750.00
2003	590,000.00
2004	1,110,000.00
2005	3,688,000.00
2006	4,695,000.00
2007	5,245,000.00
2008	7,225,333.33
2009	8,855,000.00
2010	10,961,666.67
2011	13,865,833.33
2012	15,981,250.00
2013	18,603,645.83
2014	21,254,557.29
2015	25,757,779.95

Also refer to ANNEX No1.

**Figure 10: ICT customer growth illustration**





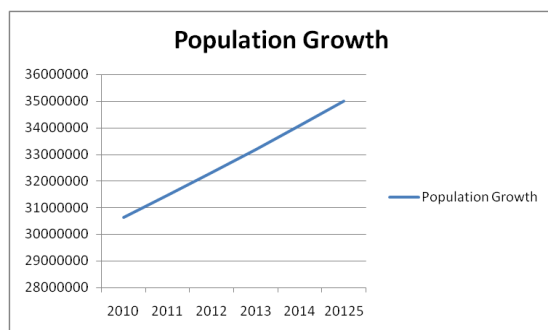
ICT sector growth shall be associated with the rapid population growth and return of Afghan refugees from neighbouring countries.

**Figure 11: Population growth at 2.7% annually**

WB - World development indicator

Year	Previous year population	Growth rate	New population
2010	29,835,392	102.70%	30640947.58
2011	30640947.58	102.70%	31468253.17
2012	31468253.17	102.70%	32317896
2013	32317896	102.70%	33190479.2
2014	33190479.2	102.70%	34086622.13
20125	34086622.13	102.70%	35006960.93

**Figure 12: Population growth illustration**



Key performance indicators for the Telecom and IT sector have been identified by MCIT as targeted in the MCIT 5 years plan show:

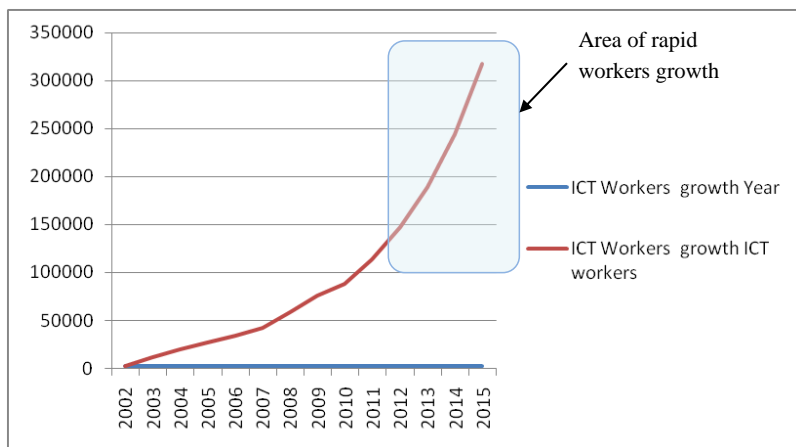
ICT Employment growth:



**Figure 13: ICT workers growth projection**

ICT Workers growth	
Year	ICT workers
2002	2,130.00
2003	10,870.00
2004	19,040.00
2005	26,264.00
2006	33,740.00
2007	42,080.00
2008	58,576.00
2009	75,300.00
2010	88,160.00
2011	113,655.00
2012	146,900.00
2013	189,522.50
2014	244,541.13
2015	317,963.31

**Figure 14: ICT workers growth illustration**



With the best growth rate of 30% the ICT customer growth will outcast the employment growth if necessary interventions are not made in the ICT skills development industry.



The Afghan ICT industry has become one of the major revenue sources for the government and has been a strong indicator of the economic growth.

In the above two charts, growth is a linear connection between the customer growth and the employee's growth in the ICT sector but is differential with a 1:3 ratio. Despite a double digit growth in the ICT sector employment (direct and indirect employment) the number of customers grew 3 times more than the number of employees in the sector.

ICT sector contribution to the government tax base is one of the top among public revenue generation sectors. The following chart indicates the Net Present Value (NPV) of the ICT sector according to the 2010 government and MCIT data.

**Figure 15: NPV for ICT sector**

ICT sector NPV	Mln. US\$
Afghanistan Annual GDP	16600
ICT sector NPV	1290
ICT sector tax base contribution	129

## ***2.1 Institutions involved***

The ICT sector development in Afghanistan is the result of a major intervention by the Government of Afghanistan and in particular the Ministry of Communication and Information Technology.

Since 2002 when the major ICT revolution started in Afghanistan a number of government and civil society organizations were established to provide service to the sector. The purposes of these institutions establishment ranged from regulating the ICT environment to representing the service providers' interests. The ICT organizations representing the interest of the consumers are however weak or not in existence.

Major stakeholders and institutions involved in the ICT sector are as follow:

- a. Government (Regulator and capacity developer)
- b. ICT educational institutions (including public and private institutions)
- c. Telecom industry
- d. Internet Service Providers (ISP)
- e. Social Networking Service Providers
- f. Mass Media
- g. Postal services

For the benefit of time, focus was made on the Government (regulator and capacity developer), ICT Education Institutions (including public and private institutions), Telecom industry, Internet Service Providers (ISP) and Social Networking service providers.

### **2.1.1 Public and Private Education institutions providing ICT training**

It is evident that there is gap between what ICT sector is providing to the users and the





expectations of the users from ICT sector are.

The consulting team has initiated a detailed assessment of the educational facilities, which are providing ICT services. The assessment was based on the mapping of the current services including the customer service, managerial service, and educational service, provision of continuing training, administrative service and mobile technical services in the ICT industry. The assessment included mapping of the current settings, identifying the major gaps. Two out of three respondents from private educational institutions are planning to open or enhance their ICT education departments and branches. The educational service providers have been assessed from two angles a) from a sector perspective (as a sub-sector inside the ICT sector); b) as a facilitator and service provider to the ICT sector.

### **2.1.2 Public Sector Educational Service Providers**

Public sector institutions make up the largest educational portion for ICT skills development. This proportion is however rapidly changing and the private sector is stepping up in the ICT education. The government educational institutions providing among others ICT education are as follow:



**Figure 16: Major Public Institutions involved in ICT Education**

Institution	ICT Program	Teachers	Students	Annual graduation	Curriculum
Information and Communication Technology Institute (ICTI)	Wireless Internet, Fibre Optics, DSL	18	200	34	Communications, Electronic Wireless, MIL, Digital Telephone, Frequency Checker, CDR' 4 different levels
(ATVI)	Information technology	142	1900	453 (2008) 797 (2009)  1900 enrolled (2009-2011)	<p>A TVI's Academic Programs encompass the fields of ICT, Automotive Systems Technology, Agriculture, and Construction trades.</p> <ul style="list-style-type: none"> <li>• Semester 1: Computer Networking: including Microsoft Windows NT, Linux and other open systems, Cisco routing and switching, client-server configurations, and development of local area networks.</li> <li>• Semester 2: Larger scale networks, internet access, Virtual Private Networks, the World Wide Web, firewalls and network security, TCP-IP, and Wireless Networks. IT project management.</li> <li>• Semester 3: Basic Telecommunications: telephone systems, routing and cabling, wire and fibre optic systems, and fibre to the premise.</li> <li>• Semester 4: Wireless Telecommunications: including cellular, satellite, and radio communications. The second half of the semester will focus on management of telecom projects, and general management within the context of the business environment.</li> </ul>
TVET Schools	Basic ICT Skills Information Technology	600	2500 ICT related students	2025	Previous Curriculum



Kabul University	Faculty of Science (ICT department)	5	40		Software Engineering, programming languages (visual, C++, object oriented, Java, network application, database systems, telecom,
Balkh University	Faculty of Science (ICT department)	3	35		Software Engineering, programming languages (visual, C++, object oriented, Java, network application, database systems, telecom,
Nangarhar University	Faculty of Science (ICT department)	4	85		Software Engineering, programming languages (visual, C++, object oriented, Java, network application, database systems, telecom,
Herat University	Faculty of Science (ICT department)	5	83		Software and hardware
Bamyain University	Faculty of Science (ICT department)	3	100		Software and hardware
Kabul Polytechnique University	Faculty of Science (ICT department)	4	123		Software and hardware
Kabul Educational University	ICT faculty	12	150		Software and hardware
Kandahar University	Faculty of Science (ICT department)	4	38		
University of Badakhshan	Faculty of Science (ICT department)	3	45		Software and hardware
Khost University	Faculty of Science (ICT department)	5	66		Software and hardware



### 2.1.3 Information and Communication Technology Institute (ICTI)

The institute is a higher education entity which has gone through major infrastructure and capacity development process with the help of donor agencies. Currently there are over 200 students in 4 different grades. Each year this institute accepts 50 new students who study different ICT subjects during the course of a four years program .Last year for the first time ICTI had 34 graduates. The institute has 18 teachers working on 4 programs. The studies are carried out in one shift. The curriculum is based on the Canadian ICT Curriculum which was approved by the MCIT.

ICTI curriculum is the domain of the Kabul University and the graduates are receiving the ICTI diploma that is recognized by the Kabul University. ICTI accepts students not only from the capital of the country but from all provinces of Afghanistan. According to the policy students, who live 13Km and more from ICTI location in Kabul are entitled to:

- Free accommodation
- Free laptop during all study time (4years)
- Free Technical assistance for their equipment
- Free meal three times a day
- Free training and educational programs after each semester which is held in composes of private sector service providers (Internship).
- Wireless and DSL Internet connection

ICTI is a fully equipped institute with different labs and professionally equipped study rooms. The technology and equipment which is used in ICTI are advanced and can meet international standards.

ICTI is in need of professional teachers and trainers. The institute physical infrastructure and equipment can accommodate up to three times more students if necessary academic and teaching staff is provided to ICTI.

### 2.1.4 Afghanistan Technical Vocational Institute (ATVI)

The Afghanistan Technical Vocational Institute (ATVI) is a coeducational vocational school in Kabul, Afghanistan that provides a comprehensive educational experience for Afghan students. ATVI prepares its graduates for roles in key sectors of: agriculture/horticulture, construction, information and communications technology (ICT), vehicle maintenance, and business administration.

ATVI began operations in April 2007 with 1.8 million USD investments in private funding and a donation of land by Ministry of Education (MoE). ATVI is managed entirely by Afghan citizens. The first class completed its 4 semester program in March 2008 with 453 graduates, 68 girls and 385 boys. The second class graduated in May 2009 with 797 graduates of whom, 188 were girls. The class of 2009-2011 enrolled 1300 students, with 600 in the new satellite campus of ATVI East located in Laghman. The A TVI facility in the main campus consists of 43 large classrooms, one library, two conference rooms, and a student learning resource centre, administrative offices, and seven workshops.



ATVI is a model public/private partnership between a U.S. company, which provided the initial requirement of \$1.8 million to build and start the school, and the Ministry of Education, which has donated land through a 10-year lease. ATVI began operations in April 2007 and is being managed entirely by Afghan citizens.

### 2.1.5 Other public Technical Vocational Educational Training institutions (TVET)

There are 149 Technical and Vocational schools built and managed by the Ministry of Education of Afghanistan. Among these schools only 9 schools are directly focused on ICT skills development. 80% of TVET schools are located in Kabul and the rest 20% is in major cities of Afghanistan such as Herat, Mazar e Sharif, Kandahar, Jalalabad and Kunduz. There are 7.5 Million students in private and public education sector of Afghanistan and 25000 of them are enrolled in TVET schools. 2500 of TVET students are engaged with ICT and ICT related schools.

Over 90% of TVET students are male and 10% of them are female. There are 45 private TVET schools in Afghanistan offering Diploma programs in various fields as well as MS Office Diploma programs. 13000 students were enrolled this year and according to the study carried out by TVET authority the average employment rate of graduates from TVET is 50%. TVET is financially supported by multiple donors' efforts such as NIDA, USAID, UNESCO, DFID, and GTZ.

Among the 9 TVET schools focused on ICT education all of them have laboratories. Each lab is equipped with equipment worth around valued 30000 Euros. TVET has an Internship program with private and public sector firms. Over 500 students are using the internship program as an entrance to the employment and professional field of work.

TVET is organizing over 30 teacher training programs. About half of these programs are within the country in private and public schools and the other half is out of the country, mostly in India. There are two types of teacher salaries. First type salary is paid by the government of Afghanistan which is about \$600 per month and second is paid by donor organizations \$1000 to \$2500 per month. In view of TVET authority there are areas requiring immediate concentration:

- Curriculum
- Teacher Training Programs
- Equipment
- Capacity Building

**Figure 17: Public and Private Education institutions employment and Internship**

Status	Private Sector	Public Sector
Employment	60%	40%
Higher Education	15%	15%
Internship	15%	35%
Jobless	10%	10%

TVET has plans to build:

- 34 Provincial Level TVET schools
- 8 TVET schools in major zones
- 200 District TVET schools



However the capacities in teaching staff, curriculum development, ICT teaching standards and internship programs are either weak or not in existence.

## 2.2 Cellular communication service providers

Currently there are five major cellular companies have the MCIT License for mobile telephone service. These companies serve over 90% of the current customers in Afghanistan. The companies include Afghan telecom; Afghan Wireless Communication Corporation (AWCC), Roshan, Etisalat and MTN. Customer breakdown for the major companies are as follow.

**Figure 18: Telecom industry share of customers**

No	Telecom company	Number of customers
1	Afghan Telecom	500,000
	AWCC	2,000,000
2	MTN	6,000,000
3	Etisalat	2,000,000
4	Roshan	4,000,000

Since Afghanistan emerged as an aggressive ICT country the need for regulating the ICT environment became urgent. In 2004 MCIT has established the Afghanistan Telecommunication Regulatory Authority (ATRA). ATRA mandate is to regulate the ICT sector by providing quality services to the customers and regulate the ICT environment by providing the following:

- Regulate and supervise Operators and Service Providers, in accordance with the provisions of this law;
- Supervise compliance by Operators and Service Providers with international obligations Entered into by Afghanistan in the telecommunications sector;
- Provide advice to Ministry of Communications in development of policies, when needed;
- Issue licenses in accordance with the provisions of this law;
- Prepare and publish forms relating to issuance of licenses in accordance with this Law;
- Monitor and control compliance with the conditions included in licenses and the provisions of this law, and make such decisions as are necessary in the context;
- Assign radio frequencies and grant permits to licensees, in accordance with the national frequency allocation table referred through the Spectrum Management Department;
- Modify, renew, suspend or revoke licenses and permits, in accordance with this law and other enforced laws;
- Respond to complaints of users and dispose of the disputes involving Operators and Service Providers, users and other persons, including interconnection, access to and quality of service, numbering, privacy, unacceptable interference and quality of the networks or services of grantees and other services;
- Specify and approve technical standards for telecommunication equipment and devices;
- Establish and maintain the numbering plan and assign numbers to applicants;
- Establish shares of [contributions to] the Telecom Development Fund and supervise the manner for spending thereof;



- Develop a plan for regulating the affairs related to expenditures of the Telecom Development Fund and the manner for using such funds, in consultation with the Ministry of Communications and Information Technology.

However ATRA and other ICT regulatory bodies including the ICT associations were not able to set the standards for the customer versus customer service ratio that is a qualitative and standard matter. In fact the minimum standard may have been met and the sector has not exceeded to meet the minimum standard which relates to ICT skills and customer service.

ATRA as a young and dynamic organization has provided leadership and guidance in the post war ICT. In addition to the government regulatory bodies and a number of civil society institutions are involved in the ICT sector that are either protecting the interests of a particular ICT sector or the common ICT institutions in the country. These organizations include:

**Figure 19: Organizations involved with ICT sector**

No.	ICT Institutions	Mandate	Membership Spectrum
1	Afghanistan Telecommunication Regulatory Authority (ATRA)	Mandate A government authority aiming to regulate the ICT environment. The organization is legislated and is responsible for suggesting amendment to the ICT legislation	No membership is Required but all ICT related companies are registered with ATRA. A TRA is a License issuance authority
2	National ICT Alliance of Afghanistan	Enable Afghan ICT players to be leaders in national/global economic and social development processes. <ul style="list-style-type: none"> <li>• Address the Digital Divide &amp; develop the human capital in Afghanistan.</li> <li>• Enhance the local ICT industries to support economic growth, employment creation and poverty eradication.</li> <li>• Ensure that all players and consumer are active partners in policymaking.</li> <li>• Support adoption of good governance, ethics, regulatory &amp; self-regulatory standards by all players.</li> </ul>	NICT AA is a consortium of ICT players, NGOs, companies and educational institutions in Afghanistan
3	National Internet Service Provider Association (NISPA)	The newly established Internet Service Providers Association is made up of major internet companies (estimated 40). The association is strong advocate of the interests of the internet service providers sector	Major SIP sector agencies are members of NISPA
4	Afghanistan	The association IS a social club of the	The



	telecommunication Operators Social Association (ATOSA)	Telecommunication service providers. The association is strong advocate of the interests of the telecom service providers	telecommunication sector service provider companies.
5	Afghanistan Computer Science Association (ACSA)	<p>ACSA a is a civil society NGO that promotes the use of computers in the livelihood of population.</p> <p>Lobbying for standardization, policy making and regulation of the ICT sector in the country.</p> <ul style="list-style-type: none"> <li>• To facilitate the professional advancement of personal engaged in ICT and related occupation.</li> </ul> <p>To keep the public posted or aware with the latest revolutions and most recent computer technologies and its usage through the association</p> <ul style="list-style-type: none"> <li>• To promote knowledge on application of ICT in varies fields</li> <li>• To provide a platform for exchange of ideas in the field of ICT application</li> </ul>	Academic institutions, young ICT professionals, Schools, Universities

A major player in the field of ICT service is the ICT educational service providers. Educational service providers are not part of the ICT associations and do not have a single association representing the sector. Major educational institutions do not provide exclusive ICT services rather they have ICT studies as part of the other programs. The only exception is the government runs Information and Communication Technology Institute (ICTI).

### 2.3 Internet

Internet is a relatively smaller industry in the ICT sector. Internet is however a fast growing industry with over 40 internet service provider companies to date in Afghanistan serving around 3million Afghans and foreigners. There is an overage of over US\$1 Mln investment by a single internet company. Surveys indicate that if reasonable legal, taxation and administrative environment is maintained the amount of new investments will grow up to 70%.

The cost of 1 mg.b internet per month for the past five years fluctuated between US\$700 to US\$3,000. Due to high internet costs only foreign institutions, embassies, and some private companies were able to use the internet connection. Because of the high interest in internet among Afghan youth, students and employees of NGOs a large number of internet cafes where established to provide the needed services. The Ministry of Communication and Information technology (MCIT) has made several attempts to reduce the cost of internet provision. In order for ordinary Afghans to reach the internet services there have been two price reductions for internet connection reception in the past 3 years. MCIT has subsequently started the Afghanistan Fibre Optics project that has fundamentally changed the way internet is accessed in the country. However over 95% of the current internet service is still provided through satellite. The remaining 5% internet is provided through Fibre Optics. Afghanistan is now connected with most of its





neighbours such as Uzbekistan, Tajikistan, Turkmenistan and Pakistan. According to the National Internet Service Providers Association it is important to extend the Fibre Optics either to the curb or to the nearest internet point so the end users will have access to fast and quality internet. The other important issue in quality internet through Fibre Optics is the Operations and Maintenance (O&M) services in repairing the breakdowns. Currently Fibre Optics network is managed by the government and despite attempts by the authorities the process of operations and maintenance is time consuming.

Over the Span of 3 years, the Cost of Internet Access has been reduced from \$1,500 per month for "shared 128kb/64Kb" connection to about \$100 showing a significant reduction. Afghan based companies are now offering Internet Services such as, Wi-MAX, VSAT, PTMP Wireless Systems and Dial up Services. However there is a long way to go to reach the level of acceptable connectivity.

Our surveys of a number of internet clubs indicate the price reduction for the end users for up to 30%. Major obstacles for the ISP industry are the following:

- a) Infrastructure for Fibre Optic network - This includes extension of secondary Fibre Optic cables into the neighbourhoods or to the curb. Since a large number of urban housing is informal settlements (around 75%) and the extension of secondary Fibre Optics is difficult in these areas the line could be extended to the nearest point of connection.
- b) Government support and regulatory assistance in the license extension and other Government approvals including customs clearance for the government related hardware.
- c) Human Resources in ICT – This includes lack of sufficient hardware installers, remote access technicians, sales representatives, marketing managers, administrative support staff and modern customer service personnel
- d) Tax issue: The tax issue has been discussed among many internet service providers. Although the price of internet has been reduced by MCIT the Ministry of Finance has established several tax items for the internet service providers.

**Figure 20: Tax net for ISP sector**

No.	Tax amount	Purpose
1	10% - Business Return Tax (BRT)	This tax is deducted from all businesses in both business revenue or losses
2	20%-Income tax	This tax is applied to net revenue
3	14% - Customs tax	Tax on internet related goods clearance
4	7% - Vendor tax	
5	Annual License renewal	This amount is paid to MCIT for license renewal

Overall there is around 48% to 52% taxes applied to the internet service providers. Many industry stakeholders suggest a smarter way of taxation that will benefit the government and the growth of internet services. Despite the challenges and bottlenecks the internet industry has grown rapidly and is advancing within the ICT sector.



**Figure 21: Internet industry Growth**

Year	User increase (%)	Employee increase (%)	Investment increase	Plan for future Investment (%)
2003	5	10	10	50
2004	25	25	10	25
2005	35	100	25	35
2006	50	80	150	100
2007	85	200	200	80
2008	80	120	100	120
2009	60	150	180	150
2010	200	180	200	200

## **2.4 Social networking**

Social Networking (SN) is a new direction in the ICT sector. Social Networking is a way of casual communication between people that does not require the internet connection. Social networking is using the telecom capabilities while establishing the networking. It is however anticipated that the internet will also introduce new SN opportunities in the coming years. So for there are fewer companies and networking groups who are using this type of services.

Social networking can be established with SMS. The idea originated from the slow speed of internet. The SN Company has entered into agreement with the telecom companies for free social networking opportunities. The network is based on multiuser SMS application that enables several people to SMS each other at the same time. The opportunity is free for the customers for the time being. Upon successful use of the network the participants may be charged by Telecom and SN companies. Although many mobile phone users can use the popular internet based social networking tools such as Face book or Twitter the cost for the use of the internet based network is high. That is why the mobile phone version of the social networking is becoming more popular.

SMS based SN has good chances to grow as internet in Afghanistan is expansive.

The start of the SN has been noted by many flaws and failure on some of the telecom company's part as they were not ready for such a reprogramming. The programming architecture is still a challenge for the Social network and Telecom companies that should be solved. Major ICT skills required for the Social networking is noted as follow:

- Programmers
- Mid level professionals in IT applications.
- Hardware specialists

Major requirements for the growing Social networking industry are:

- Public Awareness and education
- Better and prepared Infrastructure (major telecom companies). These companies should hire professional skills to develop better architecture.
- Filtering (group filtering) Filtering social networking groups selection

After initial marketing and word of mouth the users' response is positive and many students and teachers are using the network. Recently a number of Kabul Municipality officers learned how to



use the Social networking. Currently an estimated 200,000 to 500,000 people are using the Social Networking tools according to Paywast Social Networking.

### 3. Past and present initiatives

The Ministry of Communication and Information Technology (MCIT) has been the pioneer of major project implementation. Major initiatives in the ICT sector include:

**Figure 22: Initiatives in ICT underway**

No.	Initiative	Effectiveness	Further Requirements
1	ICT Skills development programs	These programs are being designed. A number of short term programs have been underway for the civil servants and military personnel in the Ministry of Interior and Ministry of Defense. New educational initiatives being designed to meet the market demand	A five year program to be designed in conjunction with the ICT sector growth and funding availability
2	Fibre Optics extension in Afghanistan	Connecting over 20 provinces with Fibre Optics cables. Over 3000km of cable has been extended. This initiative has reduced the cost of internet to the end user to around 81%.Further reduction in cost is anticipated.	Disconnection challenges and extension of the Secondary cables inside urban areas and wireless coverage of urban centers.
3	Extension of mobile and stationary digital phone lines	<ul style="list-style-type: none"> <li>•Extension of over 150,000 wired telephone lines in major Afghan cities such as Kabul, Kandahar, Kunduz, Mazare Sharif and Jalalabad.</li> <li>•Extension of copper lines in 7 Afghan cities such as Khost, Farah, Taluqan, Baghlan, Pulikhumri, Charikar and Ghazni.</li> </ul>	Establishment of service stations and connection points in remote areas.
4	Postal services reform	<ul style="list-style-type: none"> <li>• Post and Parcel web based Postal transfer stations Monitoring.</li> <li>• Activation of Electronic Postage in Badakhshan and Parwan Provinces.</li> <li>• Development of a National and International" Postal Control System" where consumers can monitor their parcels and posts.</li> <li>• Development of International Postage Formal Receipt mechanism, reassurance and Recording System.</li> <li>• Improvement of Customer Service system</li> </ul>	<ul style="list-style-type: none"> <li>• Postal services stations</li> <li>• Administration and management support</li> <li>• Marketing and community engagement</li> </ul>



5	Postal and connectivity services in districts and villages	<ul style="list-style-type: none"> <li>• District and Village level Local postal services,</li> <li>• Communication network in the form of local internet hubs extended in 1386.</li> <li>• Establishment of connectivity in 424 villages out of 1000.</li> </ul>	Regular postal services in districts
6	Construction of ICT technical and administrative buildings	<ul style="list-style-type: none"> <li>• Construction of ICT technical and administrative buildings planned in 1387.</li> <li>• 6 ICT technical and administrative buildings and 8 Post Rooms.</li> </ul>	Effective local ICT management in local ICT offices
7	Construction of the Afghanistan National Data Centre	•Afghan Information Centre "Electronic Depot" is one of Transition projects of 1386. Implementation of the project is started in 1387 and completed in 1388.	Further enhancement of the ICT services through ANDC
8	Strengthening the Afghan Telecom Corporation	•This project started in 1386. The objectives of this project were to employ professionals and build the skills of the ICT managers and technicians.	Human resources capacity and strengthening local ICT institutions
9	Regulation of the ICT sector activities including the issuance of licenses to the ISP, radio and TV stations	Regulatory reform and introduction of ICT related laws and procedures in recognizing the intellectual property, privacy law and updating existing laws and regulations to meet new targets and needs	IP law updates and development of new procedures such as patent registration, industrial design and copyright registration

MCIT has developed a 5 year development plan that was dedicated to increasing the government revenue and enables a faster growing ICT sector. The plans major targets between 2005 and 2009 have been achieved and have paved the way for new objectives and targets to be identified.

**Figure 23: Growth indicator and MCIT five year plan (2005 – 2009)**

Indicator	2005	2007	2009
Fixed Telephone penetration	0.5%	2.00%	4.00%
Mobile phone Penetration	3%	8.00%	16.00%
Internet User Penetration	0.25%	3.00%	10.00%
Number of Cities/Towns/Villages Connected	180	3000	6000
Cumulative Foreign Direct Investment (US \$ Mln)	500	1000	2000
Telecom Direct Employment (jobs)	6000	10000	15000
Indirect Employment (jobs)	12000	25000	35000



The study objective is to evaluate the current ICT skills environment in Afghanistan. Although major ICT industries have been targeted in the study small focus was also made on the mass media as user of the ICT technology.

The current MCIT strategic plan and 5 years plan indicates the improvement of the ICT sector in the following major areas.

- a. Increase in government revenue by 4% from the Telecom sector.
- b. Increase the internet provision by 50% in the next 3 years (tentatively by 2014). This will also include drastic decrease in internet prices by redirecting the internet service providers to fibre optic
- c. The current ICT institutions involved in Afghanistan can be divided into:
  - a) Mobile Phone companies
  - b) Internet companies (ISP)
  - c) Mobile applications
  - d) Mobile hardware service providers
  - e) Mobile software service providers

#### **4. ICT infrastructure growth and human capacities comparative analyses**

It is evident that the ICT infrastructure has grown in Afghanistan in dramatic numbers. Many people use mobile phones while others join the internet coverage area. However the human and labour force capacities in meeting the growing needs of the ICT sector remain unsatisfactory. The simple and straight reason is the faster growing ICT demands and slower growing capacities of the ICT sector (government and private sectors).

The consulting team has conducted numerous surveys and has visited the private and public sector institutions that relate to the ICT sector. The surveys and studies have been concentrated in the following 3 directions:

- a) Qualitative surveys of the ICT sector leaders such as the MCIT directors, managers and responsible bodies on the current ICT environment, opportunities and needs for the market. This included Ministry of Education, MCIT and donor agencies and private sector.
- b) Quantitative surveys of the users, future labour force and educational institutions that relate to the ICT sector. This also included major mobile phone companies such as Afghan Telecom, Afghan Wireless, Roshan, Etisalat, Insta telecom,
- c) Desk research, recent precedents, government strategic programs such as Afghanistan National Development Strategy (ANDS), MICT 5 Years Development Plan (2005-2009) and other relevant documents.

#### **5. Current market demands**

As indicated there are over 13million telecom service users in Afghanistan, over 3million internet users and over half a million social networking users in the country.

The modern technology has penetrated the Afghan household and is furthering its way to the daily lives of the population. The current supply of the ICT tools area superseding the needed human skills and capacities to use, manage and repair the ICT tools. The survey indicates that each mobile phone holder in Afghanistan uses on average 1.55 SIM cards to switch from one service to another one. This is an



indication of technological and human skills shortages to manage the connectivity services and improve the quality of the services.

Although serious attempts have been made to improve the ICT infrastructure in the country the broadband connectivity remains one of the challenges in today's ICT environment.

#### **Use of ICT in Afghan public services**

The use of modern ICT tools in Afghan public services are in its infant stages. This includes use of modern communication services, postal services, internet as a medium for official government communication and adoption of a cyber technology that will help the government to use ICT in the strategic security and military industries. Widespread use of ICT in the public service will require adequate skills development among existing public sector service providers and creation of new services to enable broadband connectivity among the public sector participants to provide quality service to the citizens.

Currently only around 5% government offices are equipped with internet services while less than 1 % government institutions have networking and information sharing services. The ICT use ratio between Kabul and provinces are around 9-1 (nine to one ICT use in Kabul and provinces)

The table below indicates the level of connectivity in the public service

**Figure 24: Level of connectivity**

No.	Service	Connectivity	Institutions
1.	Internet	Low	Ministers offices, independent authorities, Banks
2.	Networking	Less than 1%	This includes Afghan diplomatic missions, Security ministries and MCIT
3.	E - governance, On line applications	5-6%	MoF, Tax offices, visa offices, customs, licensing bodies
4.	Unified postal services	10% (this is the use of internet or other wireless mediums in tracking the postage and parcels)	Postal tracking system, provincial postal service activities. However no official government postal (post delivery) system exists.



The overall objective of the capacities development is:

- Creating the enabling environment and making strategic investments for the development of Afghanistan's backbone and broadband infrastructure. Addresses the missing backbone connectivity across the central provinces and supporting expansion of Internet use across Afghanistan;
- Supporting the mainstreaming of mobile applications (m-apps) across Government. Support an innovation grants program and creates cross cutting enablers for m-apps. Provides the necessary facilities for the Government to use the widespread mobile telephone networks for public service delivery and program management;
- Developing local IT infrastructure and capacity in the private sector. Creates infrastructure and skills to grow the IT based services sector in Afghanistan that can support local demand and complete the ecosystem for Internet services and m-apps mainstreaming; and
- Support development of IT capacity in the public sector. Provides required training, expertise, and program management services to support mainstreaming and strategic use of ICT across the Government.

## 6. Regulatory Environment in the ICT sector and long term MCIT Objectives

The rapid improvement of the ICT sector marked by growth in the ICT related skills development is requiring betterment of the regulatory and legal protection environment for the sector players. This will include the ICT sector service providers, service recipients, regulators and standards developers. Although a number of regulatory reform steps have been made, there are still regulatory gaps that shall be filled. New legislations and procedures will pave the way for rapid ICT related skills development. MCIT has developed a plan for regulatory reform in the ICT sector that is focused on the following areas.

**Figure 25: Regulatory Reform that will include ICT**

No.	Objective	Details
1.	Objective 1: Strengthening of Legal, Regulatory, Policy and Institutional Frameworks	
	Sub-Objective 1.1: Legal Framework	ICT Law, Postal Law
	Sub-Objective 1.2: Regulatory Frameworks	Cyber Security Regulations, Broadband Regulations, E-Governance Regulations, Digital Signatures Regulations, E-Governance Interoperability (Software) Framework, Information Technology Audits, Electronic Certification Regulations, Quality of Service Regulations
	Sub-Objective 1.3: Policy Framework	Broadband Policy, Revision of ICT Policy,
	Sub-Objective 1.4: Institutional Framework	ICT Council, Afghanistan Telecom Regulatory Authority, Afghanistan Postal Regulatory Authority, Electronic Certification Authority
	Objective 2: Expanding Telecommunication Network	Building Telephone Lines Network, Building Internet Exchange Point, Optic Fibre Network,



Objective 3: E-Governance	E-Governance Resource Centre, , Websites for Service Delivery or Interoperability, Establishment of ICT Village, Development of Electronic Government Applications, Improving ICT Training and Digital Literacy
Objective 4: D. Mobile Governance	Enabling Mobile Government, Innovation grants program
Objective 5: Postal Sector Modernization	Postal law
Objective 6: Strengthening the Ministry	Cyber Security Centre, Capacity Building in MCIT, Chief Information Officer Culture Across Government, Creating E-Gov Resource Centre for the Government, Information Communications Institute (university)
Objective 7: Strengthening the Sector	National Internet Registry of Afghanistan, Incubator program and skills development, Skills development program for universities and private institutes





## II- Possible Strategies and Plans for proposed skills development

### 7. Brief description of possible strategies and plans, and detailed description of the proposed Skills component for the project

The study concludes that with the current growth in the ICT use by the public and private businesses as well as the intervention by MCIT in increasing the use for internet and other mobile applications including spreading the use of ICT to remote areas of the country it is anticipated that labour shortage and lack of adequate human resources in the ICT sector will occur. As described in Figure 13 the ICT sector requires a rapid Skills development growth in the next 4 years. This growth shall cover several industries in order to prepare the country towards a popular use of the ICT in daily life and education.

As indicated in the terms of references for the project, the focus shall be put on the CHART, SMART and START skills.

- CHART skills (Communication, Heuristic, Analytical, Relational and Technology): focus on foundational skills needed in the ICT sector.
- SMART Skills (Software, Mobile, Application, Research and Technology): focused on IT industry.
- START Skills (Start-up, Training through Association with Remote Teams): focused on entrepreneurship and cutting edge technologies.

It is however noted that all the above areas of skills development may not get equal attention in the first years of skills development initiatives due to funding constraint and prerequisite eligibility of the potential targeted audiences for the programs.

The following chart will identify the direction for skills development according to the three-pronged approaches:

**Figure 26: General direction for Skills Development at strategic level**

Skills Development Approach	Intervention	Workforce and programs
<b>CHART Skills</b> (Communication, Heuristic, Analytical, Relational and Technology) focus on foundational skills needed in the ICT sector.	Major intervention in this area according to the study is the enhancement for the cement of the current skills by young ICT graduates and preparing them for the market. The bridging, internship or placement programs may be undertaken.	1. To build foundational skills in ICT a core mass of ICT technicians and technologists are to be trained. This mass of ICT workers would carry our major task of ICT solutions for public service entities and for private businesses. This may require a bridging program to enhance the already obtained skills to match the market demands.
		2. Communication officers, graphic designers, webmasters, multimedia developers
		3. ICT architects and managers (bachelor and masters programs graduates)
		4. Database, e-portal and data recovery specialist
<b>SMART Skills</b> (Software, Mobile, Application, Research and Technology) focused on IT industry.	Major intervention in this area would include Skills development in mid level management, Software development, and	5. Mid level management including but not limited to Oracle managers, Network managers, server maintenance specialists, data recovery specialists, small software developers
		6. Market research specialists, marketing specialists, ICT sales specialists



START Skills (Start up, Training through Association with Remote Teams) focused on entrepreneurship and cutting edge technologies.	market research Major areas of intervention would include skills development for remote provincial level ICT, Small granting programs for ICT initiatives and general digital literacy	7. Mobile ICT lab technicians
		8. ICT in workplace programs
		9. Mobile networking technicians
		10. ICT trainers for remote areas (districts and provincial centres)

The area of improvement is described as follow:

**Figure 27: Major intervention areas in ICT skills development**

Area of intervention	Details	Possible Timeline
General knowledge of ICT in the workplace.	This is the largest area of intervention and is described as the least developed among government employees,	2011 to 2014
High level ICT Skills development programs	Development of ICT programs that will enable the production of high level ICT architects, managers and inter-industry technical solutions.	2012-2015
Mid level ICT skills development programs	ICT programs geared towards daily management of the ICT and Business Processing Operations (BPO) by mid level ICT managers. The mid level ICT professionals are making the biggest chunk of skills needed in the industry. As it was indicated there are need for 10 mid level ICT technicians and managers for every High level ICT architect and engineers.	2012-2015
Software development (cutting edge technologies)	Small ICT dedicated groups and innovations through establishing software development labs and intellectual circles. The small group software development program can be promoted through small grants and awards for innovations and applied technological interventions. This case can be fruitful if the intellectual property laws and regulations are in place in the country.	2011-2014
Hardware service skills development	Another major area of intervention is the skills development for hardware service and connectivity oversight in the user communities (all government, non government, engineering, construction, human resources management and healthcare sectors). This field makes up to 25% of the needed work force in the industry.	2012-2015
General ICT service and marketing	The ICT sector although growing in a much faster pace will require better customer care and marketing services. With the introduction of newer ICT methods and communication tools, the need for customer care and marketing is getting more and more important. This includes customer care for the telecom, internet and mass media sectors.	2012-2015
Bridging Program in ICT Skills Enhancement	3 months ongoing program at MCIT for selected public and private educational institutions graduates, private sector service providers. This may include: <ul style="list-style-type: none"> <li>• Graduates of public ICT institutions</li> <li>• Graduates of private ICT institutions</li> <li>• Graduates of provincial public and private ICT educational institutions</li> </ul>	Rotationally for up to three month for a full course



### 7.1. Building partnerships with the private sector

It is evident that the Government of Afghanistan has chosen a path to engage the private sector undertaking major role in the ICT sector including the skills development part of ICT progress. The study indicates a growing private educational institutions role in the ICT skills development. From over 22 Private Institutes and Higher education institutions over, 80% offer small and mid level ICT related educational programs. The study also identified a number of private high schools and TEVT educational institutions also offering short and midterm educational programs to meet the market demand. Major ICT programs in the private educational institutions include:

**Figure 28: Current ICT programs in private educational institutions**

ICT related programs	Details
Diploma in IT (DIT)	<p>An 8months to 1 year program covering basic knowledge about networking, troubleshooting, computer networking, internet connection and basic computer setup. The program is set up for small business to have basic IT support.</p> <p>Diploma in Information Technology (DIT)</p> <p>The course duration vary from 1 to 4 semesters. Each semester is of 3 months duration. This course is designed as per current market needs. Graduates of these programs can be employed as in market as a web designer, computer operator, IT executive.</p> <p>Subjects in this course include:</p> <p><b>Semester 1:</b> MIS (Management Information system), Operating System, Microsoft office 2007 suite professional</p> <p><b>Semester 2:</b> Principles of Accounting, Basics of Hardware, Advanced Hardware</p> <p><b>Semester 3:</b> Programming Language Concepts, Vb.net 2008, Photoshop CS3, CorelDraw CS3</p> <p><b>Semester 4:</b> Networking, Web Designing Suite (HTML,DHTML, Java Script, CSS), Dreamweaver CS3</p>
Diploma in Networking	<p>A short to midterm program that is dedicated to improve communication and sharing data between many ICT points. Based on networking techniques all departments could have their own data stored and shared among employees or network members. This program will identify current problems of sharing data and study mechanism will be adopted accordingly.</p>



Certificate in IT	<p>This course duration is 6 months and in 2 semesters. The course is designed for beginner level IT technicians. Major employment opportunities can be sought in small business, private and family based business.</p> <p>Course outlines include:</p> <p>Semester 1: Computer Fundamentals</p> <p>Computer History and Importance, Introduction to Hardware Introduction to Software, Different types of software and Application, Operating System installation and Guides, Computer arithmetic</p> <p>Semester 2: Microsoft Office Professional (MS. Access, MS. Out Look, Front Page, Publisher etc).</p> <p>System Hardware</p> <p>Function and types of storage device Introduction to system spare parts Installation and Partitioning of Hard drive, System troubleshooting Data Recovery, Data Back Up, Disk Management, Password Recovery Networking , Web net programming</p>
Bachelor Of Information Technology (BIT)	See below

**Figure 29: Bachelor of IT program at private institutions**

First year		Second year		Third year		Fourth year	
Semester 1	Credit	Semester 1	Credit	Semester 1	Credit	Semester 1	Credit
Intro to IT	2	Project Management	2	Network Security	2	Simulation	2
Fundamental of computer	2	Linear Algebra	2	Data structure	2	Simulation Lab	2
Communication skills	2	OS Linux	2	Logical Design	2	Scientific Writing	2
English 1.1	1	Lab OS Linux	1	English 1.5	1	English 1.7	1
Islamic Study 1.1	1	English 1.3	1	Islamic Study 1.5	1	Islamic Study 1.7	1
Application Software	4	Islamic Study 1.3	1	Cisco Networking Academy 1	2	Cisco Networking Academy 3	3
Operating system	3	Psychology	1	Routing Protocols and Concepts	2	Informative Analyses 2	3
Computer Architecture	2	Java Programming	3	Information Analyses 1	3	Robotica	3
MIS, Human computer interaction	1	Java Lab	2	Advanced Database Management System	2	Electronics II,ASP.NET	1
		Computer Networks	3	Cryptography, Interchange	1		



				languages			
		Multimedia, Cryptography ASP.NET	1				
<b>Semester 2</b>		<b>Semester 2</b>		<b>Semester 2</b>		<b>Semester 2</b>	
Computer terminology	2	Probability & Statistics	2	Internet programming	2	Automation	2
Introduction to programming	2	Graphics	1	Lab Internet programming	2	Fuzzy Logic and Applications	1
Basic Numerical Skills	2	Lab Graphics	1	Discrete Mathematics	2	Telecommunications	1
English 1.2	1	Algorithm	2	English 1.6	1	English 1.8	1
Islamic Study 1.2	1	English 1.4	1	Islamic Study 1.6	1	Islamic Study 1.8	1
Database Management System	4	Islamic Study 1.4	1	Embedded System	3	Life Environment 1.8	2
Web design	3	Data mining	3	Embedded System Lab	3	Cisco Networking Academy 4	3
Lab Web design	2	Lab Data structure with Java	3	Cisco Networking Academy 2	3	Information Analyses	3
Macro Flash, Human computer interaction, Electronics 1	1	Data structure with Java	3	Law of Information, Optimization	1	Thesis	4
		Multimedia, Law of Information	1			Law of Information, Human computer interaction	
Total Credits	36	Total Credits	36	Total Credits	36	Total Credits	36

Analysis of the current private sector educational institutions indicate lack of market information, research data and baseline about the market development and directions. It was noted that 15% of the institutions have cancelled their ICT based programs due to lack of funding, lack of market related direction and lack of sufficient teaching staff. Over 65% private sector educational institutions complained about the lack of teaching staff with academic degree such as Bachelor and Masters in Information Technology. A number of institutions have expressed willingness to establish a program for training mid level ICT managers and ICT faculty teachers if adequate financial and guidance support is provided. Afghanistan private sector educational institutions are not at the level to invest in the educational programs beyond the short term timelines. That is why private educational institutions require guidance and market baseline information in order to direct focus to needed programs.

The government and donor agencies can potentially develop partnerships with the private sector educational system in two ways:

- Establishment of the Public and Private educational system partnership – This would include the program exchange, curriculum development and share, Educational materials development



and share, certification synchronization and finally teaching staff sharing and exchange programs.

- b. Direct funding support to private educational institutions in order to promote the ICT related skills development programs. The funding can be provided in the following manner:

**Figure 30: Funding sample of new ICT skills development programs**

Funding	Details
Funding through proposals	Private sector institutions would apply for funding through MCIT as set in the funding guidelines and requirements. The best ideas and proposed programs will get necessary funding for the ICT related educational programs.
Funding through course and program sale	MCIT and other donor agencies would purchase courses and programs for the groups of students from the private sector educational institutions. This may include government employees ICT education, Degree programs for military personnel, ICT education discounts to referee students.
Design and establishment of new programs	Seed and pilot funding would cover the design and running of the ICT education programs at private educational institutions. The design however to be carried out together by the public and private sector institutions and in accordance with the market demand and public sector needs.
Small granting programs for ICT educational institutions	The grants will cover the establishment of ICT labs, Internet infrastructure and student centers equipped with ICT equipment. Clear selection criteria to be developed for eligible institutions.
Bridging programs for graduates of private and public ICT educational institutions	Bridging between the current obtained skills and the industry standards.
Funding grants to cutting edge technologies and innovative private sector industry players	Private sector institutions would apply for funding through MCIT as set in the funding guidelines and requirements. The best ideas and proposed programs will get necessary funding for the ICT related educational programs.

## 8. Designing the training programs

The ICT related Skills Development is a national priority as the ICT use in the next 5 years will dramatically increase in different industries such as mobile phones, digital phones, internet and other ICT applications. Between 2012 and 2015 an aggressive and targeted ICT skills development program to be considered so to catch up with the ICT use progress. However the current government and non government funding capacities are limited to meet the demand in the market. Instead the study is proposing the intervention in a multiplying manner. A smaller contribution in the ICT skills development sector will enable a bigger impact in the area of ICT training. The priority in the skills development should be made in the following manner:

**Figure 31: Suggested Priorities for ICT skills development programs**

Skills development programs	Example programs	Priority	
Foundations ICT Skills development	Masters Degree program, ICT bridging programs, ICT placement programs, High and mid level ICT education, ICT education in Private institutions	High	



General Digital literacy	ICT in workplace, Mobile ICT education, Cyber security education	High (ICT in workplace)	Mid (for other programs)
Cutting edge technologies	Innovation grants, ICT award,		Mid
ICT infrastructure funding	Wi Fi in public and private universities, ICT labs	High	

The study is proposing the following targeted programs:

**Figure 32: ICT Skills Development Programs**

No.	Program Objective	Details	ICT Skills development programs based on priority and type		
			ICT Skills development programs	Granting Programs	ICT Infrastructure funding
1	ICT in the workplace program	This is the largest area of intervention and is described as the least developed among government employees. The program will include continues training of public sector employees with strong incentives after successful graduation			
2	Pilot Mid Level ICT educational program	A 6 months to 12 months ICT Diploma and placement program for graduates of grade 12 students. This program can be run from government universities or privates educational institutions			
3	High level ICT Skills development programs	Development of ICT programs that will enable the production of high level ICT architects, managers and inter-industry technical solutions.			
4	Small ICT innovation grants	Grants to ICT collectives and innovative groups in developing specialized ICT programs for general ICT sector registry, networking, small business enhancement (amount between US\$5,000 to US\$10,000)			
5	Design and establishment of new programs at private educational institutions	Seed and pilot funding would cover the design and running of the ICT education programs at private educational institutions. The design however to be carried out together by the public and private sector institutions and in accordance with the market demand and public sector needs			
6	Cyber Security Training Program	Special training program (12 months to 24 months) with placement for mid level ICT workers to elevate to high level ICT managers. The program may engage security services and military training facilities.			
7	Cutting Edge technology training	Training on advanced cutting edge technology for businesses before employing it in the industry. The training maybe co funded by the private sector alongside the government			
8	National ICT University	A state of the art ICT University that will combine diverse subjects of the modern ICT sector. The University			
9	Mobile ICT education	Extending the ICT skills to provinces and districts. Mobile ICT laboratories to be established to provide short term 1 month training to existing provincial ICT technicians			
10	ICT Graduates Placement Program	The objectives of this program is to enable the entrance of senior graduating students into the workplace. The program will fund part of the graduating students internship and placement in private companies and will provide additional support to public institutions hiring graduating students. The project will grow as a government program.			
11	ICT award	Inaugurating the ICT award for excellence in innovation and new ideas. The registers of the ICT related IP can be nominated as well			
12	ICT Lab funding	This pilot is designed to provide physical assets support to universities, private educational institutions and libraries			
13	Wi Fi Coverage	The provision of free internet coverage in Major universities, private educational institutions and libraries			
14	In-Country Masters Degree Training for ICT Faculty	As an intermediate measure before the ICT University is established an in Country Master Degree one year intensive program to be developed in order to fill some of the gaps in the growing faculty membership in Afghan universities.			
15	ICT Bridging Programs (ICT-Bridge)	3 months ongoing program at MCIT for selected public and private educational institutions graduates, private sector service providers. This may include: - Graduates of private ICT institutions Graduates of provincial public and private ICT educational institutions The program to pave the way for ICT graduates Placement program			

Legend

	ICT infrastructure funding
	Broader digital literacy
	Foundational ICT education
	ICT Granting programs



Brief curriculum description of some of the programs is as follow:

Area of intervention	Details
ICT in the workplace. (ICT-W)	This is the largest area of intervention in the general ICT literacy in the public service institutions and is described as the least developed among government employees,

#### **General Description for the ICT in Work Place**

The is designed to enhance the ICT skills among mid to low level public servants, who are providing services to the citizens in the area of documents certification, applications processing, permits (such as building permits, licensing, electricity supply permits, water bills and other services).

The program would cover the ICT skills development in the workplace and will provide education to the public servants in the workplace or off the workplace by public or private educational institutions.

The program will cover the following components:

- Basic office based networking and filing procedures
- Advanced office ICT procedures and networking systems
- ICT based record keeping procedures and filing records
- Basic networking and information sharing
- Internet browsing and internet communications
- On line communication and communication ethics
- Backing up data and soft documents
- Hardware and software engineering
- Other user interfaces

The ICT in the workplace program would include 10 to 15 people in each course and will run for 120 to 240 hours and for 2 hours each day for 2-4 months. The ICT-W certificate program will provide a full certificate to successful trainees, who completed the examination and testing of the certification in each discipline. Successful employees will receive a financial bonus in their salaries and will improve their employee rating.

It is anticipated that around 12,500 public sector employees will undergo such a program. The cost of the program will fluctuate between US \$ 500,000 to US \$ 1,000,000 and can be run by a private sector lead initiative.

#### **The training institution:**

The program syllabus is described in Annex -1 B. The program may be instructed by private sector trainers or regional instructors managed by the MCIT Project Manager. Requirement for selecting the instructors may include:

- At least bachelor degree in ICT
- Sufficient training in basic ICT skills development.
- Proficiency in local languages (or through a translating source)





- d. Use of international benchmarks and best practices in the outcome of the program.
- e. Certification process for the graduates by MCIT. This includes the records in the employee files and employee records. Moral and material incentives for successful graduates.

Detail breakdown of expenses will be provided in the financial analysis.

Area of intervention	Details
High level ICT Skills development programs	Development of ICT skills development program that will enable the production of high level ICT architects, managers and inter-industry technical solutions.

#### General Description for the High Level ICT Skills Development

The programs may be directed towards establishment of advanced ICT skills development through long terms education and advanced skills through a 3-4 year program for undergraduate studies and a 1 to 2 year program for graduate studies. The study programs may include the following sub divisions:

Computer Systems Technology – Network systems

Computer System Technology – Network Engineering and Security analyst

Computer System Technology – Software support

Computer System Technology – Software development

Computer System Technology – Co op programs

These programs would establish a new direction in ICT sector and will produce professional ICT architects and engineers in the country. The program can be supported as a pilot by the donors and MCIT and will be run by private educational institutions as well as by government educational institutions on a long run bases. The student pool and sustainability can be ensured by the market demand as well as referral from the public sector. The syllabus and curriculum description is provided below:

**Figure 33: High Level Computer Systems Technology - Software Engineering**

Academic Course	Description
Software Design-Software component Design	Development of small software units. Precise specifications expressed using logic and discrete mathematics. Design methods and design patterns. Implementation and testing.
Data Structure and Algorithms	Searching, sorting, dynamic programming, greedy algorithms, abstract data structures, balanced trees, hashing, graphs, design principles, complexity, organization of libraries.
Digital System Principles and Logic Co-Design for Software	Systematic design procedures; combinatorial circuit design, design of sequential machines; redundancy, binary number representations and arithmetic, organization of large logic circuits. Introduction to logic simulators. Software/hardware co-design.
Discrete Mathematics and Logic I	Syntax and semantics of formal languages; propositional logic; proof systems; sets, functions, relations, and algebras; graphs and trees; finite state machines; software engineering applications.
Discrete Mathematics and Logic II	First-order logic; proof by induction; definition by recursion; models of computation; computational limits and complexity; higher-order logic; software engineering applications.



Introduction to Mathematical Modeling of Systems	Linear systems, signals, filters; sampling theorem; state and frequency domain; simple input-output systems; the relation of discrete and continuous space; introduction to mathematical models of systems.
Principles of Programming	Fundamental concepts of imperative programming (procedures, statements, control structures, iteration, recursion, exceptions); basic data structures (references, records, arrays, dynamic structure); basic concepts of operating systems.
Software Design II- Large System Design	Software design process, design and architecture of large systems, design for change and expansion; Documentation, inspection; Incremental design; Classes and objects, structured and object oriented analysis and design; Revision and version control; Project organization.
Software Design III- Concurrent System Design	Processes, threads, concurrency; Synchronization mechanisms, resource management and sharing; Objects and concurrency; Design, architecture and testing of concurrent systems.
Dynamic Models and Control of Physical Systems	Modeling of dynamic continuous physical phenomena in both continuous and discrete time. Control theory, stability analysis and feedback controller design. Application of computer control to continuous processes. Data analysis, empirical modeling.
Machine-Level Computer Programming	Use of assembler language. I/O and storage devices. Highly optimized code. Low level representation of control and data structures. Device drivers.
Computer Architecture and Graphic Processors	Measures of performance, instruction set architecture, computer arithmetic, data path and control, pipelining, the memory hierarchy, I/O systems, multiprocessor systems, multimedia extensions and graphic processors.
Modeling for Virtual Reality	Design of time-evolution of/in three dimensional spaces. Dynamical systems (discrete and continuous). Physical and artificial systems. Design patterns of 4D modeling.
Computer Graphics	Mathematical foundations, the graphics pipeline, geometrical transformations, 3D visualization, clipping, illumination and shading models and the impact of graphics on society.
Communication Skills	Oral and written presentation skills; types and structure of technical documents; software documentation for the user; formulating and presenting proposals.
Software Development	Software design process. Professional responsibility. Using specifications. Documentation. Module Specification. Module interfaces. Module internal documentation. Coding styles. Portability. Software inspection. Software testing.
Software Requirements and Security Considerations	Software requirements gathering. Critical systems requirements gathering. Security requirements. Traceability of requirements. Verification, validation, and documentation techniques. Software requirements quality attributes. Security policies. Measures for data confidentiality. Design principles that enhance security. Access control mechanisms
Software Testing and Management	Measurement, unit testing, slicing and debugging, inspection, integration testing, regression testing, testing strategies, software metrics, software project management
Operating System Concepts	Design principles of major components of an operating system: Management of processes, threads, memory, files, and



	I/O systems: network communication protocols, security and command interpreter systems.
Scientific Computation and Mathematical Simulation	Computer arithmetic, stability, sensitivity. Numerical methods for polynomial manipulation, interpolation, data fitting, integration, differentiation, solving linear and non-linear systems, ordinary differential equations and eigenvalue problems.
Real Time Systems and Control Applications	Hard and soft real-time systems. Safety classification. Fail-safe design, hazard analysis. Discrete event systems. Modes. Requirements and design specifications. Tasks and scheduling. Clock synchronization. Data acquisition. Applications in real-time control.
Computer Networks and Security	Physical networks, TCP/IP protocols, switching methods, network layering and components, network services. Information security, computer and network security threats, defense mechanisms, encryption.
Design of Human Computer Interfaces	Design of user interfaces. Principles of good interface design. Human input. Displaying complex data using graphics and virtual reality. Modes and <i>mode awareness</i> problem. Health issues, information overload. Special purpose graphics hardware. Interface design tools; on-line help systems.
Performance Analysis of Computer Systems	Use of queuing models and simulation to predict computer system performance and find bottlenecks in a system. Types of models, distributions. Markov models. Modeling storage and network behavior, locks, critical sections, concurrency. Introduction to analytical system reliability.
Distributed Computer Systems	Design of multi-computer systems for computation-intensive applications and high-reliability applications, array processing systems. Application of multi-computer systems to finite element methods, simulators, optimization problems.
Software Design IV- Capstone Design Project	Student teams prepare the requirements, design, documentation, and implementation of a software system taking economic, health, safety, legal, marketing factors into account. Students must demonstrate a working system and convincing test results. Software project management.
Sensory perception, cognition and human/computer interfaces for game design	Human sensory perception, learning and cognition. Game aesthetics. Precise control and feedback mechanisms. Use of music and sounds. Critical analysis of existing interfaces. Alternate input devices
Course work in interfaces for game design	Students complete an independent course project in the area of interface design for computer game applications.
Course work in real time systems	Students complete an independent course project in the area of real time systems design with the focus on computer game applications.
Software design iv - capstone computer game design project	Student teams prepare the requirements, design, documentation and implementation of a computer game taking economic, health, safety, and cultural, legal and marketing factors into account. Students must demonstrate a working system and convincing test results. Software project management.
Communications systems	Fundamental communications concepts: information, entropy, channel capacity, codes, data compression, adaptive channel equalizers, modulation/demodulation of signals, tracking,



	Kalman filtering, use of specialized signal processing hardware. Software in communication systems
Databases	Data modeling, integrity constraints, principles and design of relational databases, relational algebra, SQL, query processing, transactions, concurrency control, recovery, security and data storage.
Operations research	Modeling and solutions for engineering optimization problems using Linear and Integer Programming, including transportation and assignment problems, multi-objective problems and scheduling. Solution methods include primal-dual schemes (algorithms), simplex, branch and bound, and heuristics.
Continuous optimization algorithms	Fundamental algorithms and general duality concepts of continuous optimization. Special attention will be paid to the applicability of the algorithms, their information requirements and computational costs. Practical engineering problems will illustrate the power of continuous optimization techniques.

Area of intervention	Details
Mid level ICT skills development programs (ICT-M)	ICT programs geared towards daily management of the ICT and Business Processing Operations (BPO) by mid level ICT managers. The mid level ICT professionals are making the biggest chunk of skills needed in the industry. As it was indicated that there is need for 10 mid level ICT technicians and managers for every High level ICT architect and engineering.

#### General Description for the mid level ICT Skills development

This program is designed for the private sector lead educational institution. The program is a pilot project of academic based learning to foster the management skills of the mid level ICT managers. The Mid level ICT program is a degree program or an upgrade to degree program in the ICT sector. The program is designed for graduates of the Bachelor in IT programs. The program may be run for up to one year full time studies. The Graduates of the program will receive an MCIT practice certification that will enhance their employability and marketability. The certificate will provide series of opportunities for the graduates and will fill the gap between the current ICT development and market needs for skilled workers.

MCIT Practice certification is a model that will make the ICT professional services self regulated and will provide a legal tool to ICT professionals in carrying their duties and receiving adequate financial reward for their services. As an example we can use the accounting certification such as Chartered Accountant (CA) (14 papers passed exams), Certified Accounting Technician (CAT) (9 papers passed exams), Professional Engineer (P. Eng.) and others. The model would enroll graduates of bachelors programs or Masters program to receive MCIT ICT Practice Certification (ICTPC).

The program may include the following eligibility criteria:

ICTPC Eligibility	Details
ICT Graduate Degree Diploma	The Diploma should be genuine and should accompany an ICT transcript
ICT Law and practice Exam	Passing grade in law course for legal matters related to ICT practice
Ethics Exam	Passing grade in ethics subject related to ICT practice



MCIT may lead the examination and certification process or delegate the certification to a well functioning ICT association. The certification process will also introduce 2 exams such as ICT Law, and Ethics for ICT professionals

The course will include the advanced ICT solution in the software engineering and hardware areas. The graduates of the program would be able to manage medium to large ICT enterprise including non ICT sector such as manufacturing, engineering, and design and human resources institutions. The graduates will be able to design and run the centralized salary payment system, centralized employee database, commodity valuation, land and real estate valuation and management as well as the ICT related management. The graduates will be able to fill for high level ICT architects and will be able to manage ICT related data and infrastructure.

This program can run exclusively for the privately owned educational institutions with the clear Terms of Reference and guidance from the MCIT and or donor agency. This program will inaugurate the MCIT certification process that will link MCIT with related existing and newly established ICT associations. The certification will open the door for the sector self regulation and will help the ICT related associations to take lead in the area of skills development.

The syllabus and curriculum description Mid Level ICT Skills development is provided below:

**Figure 34: Mid Level Computer Systems Technology - Software Development**

Academic Course	Description
Communications	Enhance critical thinking and workplace communication skills in a collaborative environment
Programming Fundamentals	This course lays the foundation for learning and practicing the discipline of Software Engineering and the application of tools and methods to produce and maintain quality software systems. The course concentrates on essential software structures and logic. The programming language used in this course is Game Maker, the knowledge and basics which are transferable to any computer-based software problem.
HTML & CSS	Provides an overview of the Hypertext Markup Language (HTML) used to create Web site pages. Topics include basic design, formatting, hypertext links, tables, forms and the use of cascading style sheets
Introduction to Networking	In this course students are introduced to the computer networking field. The features and functions of microcomputer and network hardware components and devices will be covered. The majority of the lecture classes focus on the basic principles, concept sand terminology related to local area networks and wide area networks. The labs will provide students with hands-on experience with Windows and UNIX operating systems and network administration.
Mathematics for Computer Studies	This course is an introductory math course for computer students that cover the following: Binary, Octal, Decimal and Hexadecimal Number Systems, Boolean Algebra including Truth Tables and Boolean Laws, Computer Arithmetic, Graphing, and Basic Algebra and Mathematics Review.
Programming in Java	This course is an introductory math course for computer students that cover the following: Binary, Octal, Decimal and Hexadecimal Number Systems, Boolean Algebra including Truth Tables and Boolean Laws, Computer Arithmetic, Graphing, and Basic Algebra and Mathematics Review.
Adobe Web Applications	This course will concentrate on developing and manipulating various forms of digital media such as text, graphics, sound and video. On successful completion of this course the student will be able to use multimedia software tools to work with text, create graphics, manipulate photos, slice images, create engaging animations, and design rich web



	content pages. Also, through this course the student will be able to understand the various considerations of multimedia on the web and other application areas; critique the quality of graphical interfaces in regard to aesthetics, ease of use, efficiency; and apply the appropriate multimedia technology dependent on the audience and the application.
Computer Training and Tech writing	In this course students will build the skills necessary for training software users, and will create support documents to facilitate this. Topics include learning modalities, special needs students, methods of evaluation and training delivery, evaluating training solutions and creating training materials. Practice training sessions and presentation skills will also be emphasized.
Introduction to System Analysis and Design	Upon successful completion of this course, the student will have demonstrated: An understanding of the steps involved in approaches and investigating system requirements. Acknowledge of the principles in modeling and evaluating alternatives and strategies. An understanding of developing project schedules, requirements analysis and cost/benefit analysis. Knowledge of output design and the ability to design outputs. Knowledge of input design and the ability to design inputs. An understanding of the Human-Computer Interaction. A knowledge of the processes involved in systems operation and support
Discrete Mathematics and Statistics	With help of this program students can create a base of statistical and mathematical data. This program will explain the importance of figures, statistical data and their role in creating an image of professional and non professional al IT programs. There are many programs today which are related directly to figures and statistical data. Students who successfully completed this course can operate and manage any mathematical and statistical data basis and IT based projects.
Enterprise Application Integration	In this course, students will examine enterprise resource planning (ERP) systems that support the main functional business areas, including marketing and sales, production and materials management, accounting and finance, and human resources. Students will also review and discuss the use of other enterprise applications (such as Customer Relationship Management, Supply chain Management, and Human Resources Management), with a view to helping they understand the integration and application of vital electronic business processes within an organization.
Programming in NET	This project-based course, which follows on concepts introduced in previous programming courses, will focus on the design, development and implementation of interactive, "user friendly" software. The principal design concern will centre on GUI (Graphical User Interface); data base processing and file processing in an object-oriented programming environment. Furthermore, students will concentrate on event-driven programming logic; in particular as it applies to navigation amongst and within forms, user data entry validation and data base and file processing. Students will develop a completely operational application, which will demonstrate ease of use and consistent interface designs. The language used will be Visual Basic. NET in conjunction with Microsoft data base technology.
PHP & Java Script	An introduction to two of the major scripting languages used in the creation of dynamic web pages: PHP and JavaScript.
Strategic Systems	Strategic Information Systems are conventional information systems used in innovative and competitive ways. As information systems evolved from transaction processing systems to management information systems, to decision support systems, they started to have impact on how the business firm competes.
Database theory	The student who successfully completes this course will demonstrate knowledge of database terms, SQL, Normalization, Entity Relationship Diagramming, Physical Structures and Database Administration
Software quality and testing	This course will focus on steps and procedures to ensure the production



	of high quality software. The course will be delivered using a hands-on approach to allow students to build and design test procedures, quality feedback mechanism, test planning and test documentation
Project Management for IT	Project Management as it applies to Information Technology. A fundamental understanding of Project Management methodologies according to the Project Management Institutes PMBOK, (Project Management Body of Knowledge). A hands-on case study using Microsoft Project, modules include scheduling, scope, budgeting, risk assessment, critical path and resources
Server platform & Networking security	Students will diagram, install and configure major components, middleware, operating; systems and security mechanisms commonly employed in web based applications.
Ms Office Power User	Students will focus on some of the advanced capabilities of the Microsoft Office suite. Topics will include integration and interoperability, using external data and automation through macro/script programming.
Object oriented systems	The course introduces the student to Object-Oriented methodology including topics in complexity, modularity, object based systems thinking and Unified Modeling Language (UML).
3GL Programming - COBL	Develop problem solving techniques used in commercial programming applications, especially with regard to creating simple reports with final totals; single and multi-level control breaks; array manipulation; data validation. Program and test problem solutions using COBOL-85 programming language.
Web applications ASP. NET	Build dynamic web applications and services, especially with regard to developing those that will help businesses access, update, and process databases. Use web application frameworks, object-oriented programming language, as well as database computer languages.
IT Management	Managing the information technology function in the modern business organization demands a good grasp of management concepts and a detailed knowledge of the specific technical and resource issues surrounding the I.T. function. This course will overview general management concepts and examine current I.T. management issues using resource materials which are updated annually. Systems, models, and measurements that should assist the I.T. manager in improving quality and increasing value are examined closely. Within a framework laid out by the professor, students will research and report on major issues and will develop software based models for some of the metrics studied. Students will solve a number of situational management problems that will require the integration of previous academic and work experience to arrive at practical solutions. The expected outcome is a student well equipped to examine, comprehend, and critically assess the complex decision situations confronting I.T. managers.
Main frame Systems	This course provides students with the skills necessary to use the facilities of a mainframe computer. It covers mainframe concepts, usage and architecture, a comprehensive overview of z/OS operating system, an understanding of mainframe workloads and an overview of the major middleware applications in use in today's mainframe world. Hands-on exercises are provided throughout the course to help students explore the mainframe style of computing. Students will be expected to research the IBM Redbook library in order to complete the exercises.
Advanced Programming in .NET	This is an intermediate level-programming course in object-oriented programming using C#. Topics include: classes, data encapsulation, inheritance, polymorphism and operator overloading.
Mobile programming	This course is a hands-on introduction to the major topics in developing applications for mobile platforms.
Service Oriented Architecture	This course will expose students to SOA. There will be an in depth examination of the protocols that support SOA, XML, SOAP and Web Services.





Software Engineering	Upon the successful completion of this course, the student will appreciate and be able to participate in future activities related to the following areas (in no order of importance): Research and Innovation Resource, Planning and Management, Entrepreneurship, Group Dynamics and Conflict Resolution, Marketing, Consulting, Documentation, Testing, Risk Management, Book Keeping, Reporting to Upper Management, Cost & Budget Estimation and Resource Budgeting.
Enterprise java	This course will expose students to the Java programming language as it is used in Enterprise computing. Students will encounter Java Server Pages and Enterprise JavaBeans.
Electronic Healthcare record Solution	Students will learn about the Electronic Record Solution as proposed by Canada Health Info way. The course will explore the architecture of the EHRS as well as the operational landscape of the Healthcare system in Canada.
Web 2.0 & PHP Framework	Web 2.0 and PHP Frameworks teaches students how to develop and deploy database driven web applications using popular MVC OOP frameworks such as Code Igniter or Zend. The use of JQuery/JavaScript is employed to enhance front-end design. This course will cover all aspects of using a framework including the following topics: controllers, models, views, libraries, helpers, from validation, database interaction, user authentication, application security. Each student will complete a dynamic database driven web site as part of this project oriented course.
iPhone Programming	This course is a hands-on introduction to the major topics in developing applications native to the iPhone, iPod Touch and iPad platforms. Topics include using the Xcode development environment, Objective-C, the Cocoa framework and Interface Builder to create mobile and multi touch applications.
Communications	Enhance critical thinking and workplace communication skills in a collaborative environment
Programming Fundamentals	This course lays the foundation for learning and practicing the discipline of Software Engineering and the application of tools and methods to produce and maintain quality software systems. The course concentrates on essential software structures and logic. The programming language used in this course is GameMaker, the knowledge and basics which are transferable to any computer-based software problem.
Work Experience (3 programs)	

Area of intervention	Details
Small granting program for ICT in Small and Medium Enterprises (ICT-SME)	This program is designed to boost the youth interest in the ICT sector and provide financial and logistics bases for ICT related initiatives in the sector and outside the educational institutions

#### General Description for the Small Business Grants (ICT-SME)

This program is designed to penetrate into cutting edge technologies and innovations market. The program is dedicated to support small groups of SME initiatives in software development, industry networking and new innovative ideas in ICT related use by the public. The initiative will fund eligible applicants in grants from US \$5,000 to US \$10,000 for new software developed in Afghanistan. The program will fund projects and their applications among the ICT dedicated youth and small groups of private sector lead initiatives.

The program is a granting program and will require call for interest or proposals. Eligible applicants will receive the financial assistance in two portions and the products will be examined and may be used in





the industry with additional incentives to the authors of the innovation. Granting process shall be easy to manage and can be managed by a third party implementer. ICT-SME will include the development of hardware and networking initiatives. Application of already created initiatives in real life can also be funded through this program. It is anticipated that the granting program will distribute funds to 10 applicants within the pilot project timeline.

Area of intervention	Details
In-Country Masters Degree Training for ICT Faculty (ICT-Master)	As an intermediate measure before the ICT University is established an in Country Master Degree one year intensive program to be developed in order to fill some of the gaps in the growing faculty membership in Afghan universities. This program may be amalgamated with High Level ICT Skills Development Program (ICT-High)

#### **General Description for In-Country Masters Degree Training for ICT Faculty (ICT-Master)**

Higher education in Afghanistan is slowly rebuilding. The capacity for Afghanistan to design and develop a solid ICT infrastructure that fits the needs of Afghanistan and works within the social and economic framework of Afghanistan needs to be done by Afghans. This can only be accomplished if there are enough teachers at the university level to teach the practitioners. The Ministry of Higher Education has identified this shortfall and listed it as the first area to be addressed in the newly released MOHE Strategic Plan covering 2010-2014:

##### *Program I:*

*To educate and train skilled graduates to meet the socio-economic development needs of Afghanistan; enhance teaching, research and learning; and encourage service to the community and the nation.*

The Strategic Plan shows a projected need for 1,800 new faculty members and an increase in the ratio of female faculty. Estimated cost is \$52 million. In terms of professional development, the Plan proposes to increase the number of Masters degreed faculty members to 60% requiring that 700 faculty be sent abroad for schooling.

That strategy, plus a very ambitious goal of upgrading 330 faculty members from Masters level to PhD carries an estimated cost of an additional \$63 million. The question becomes one of how, best, to fulfill these goals. At a projected cost of \$115 million, a large portion of which would be spent on administrative costs associated with visas, travel and living expenses for Afghan faculty moving abroad, it is well worth the time needed to explore alternative strategies for the achievement of this goal.

Several programs are presently working on higher education degree training in Afghanistan but they all face the same problem, the lack of qualified Afghan professors with the requisite degree skills and experience needed to teach in the programs. The Ministry has recently established the criteria for a National Accreditation System, setting the standards for faculty qualifications. Faculty teaching in Bachelors Degree programs will have a minimum of a Masters Degree. PhD degree for faculty teaching in the Masters Degree programs is desirable; however an advanced Master Degree may be acceptable to teach at the lab or seminar level for this program. .

Sending faculty abroad for degree training is very costly and the system discriminates against female faculty members who, generally, are not able to travel abroad for study. As an alternative to sending Afghan Faculty abroad for their Masters degrees to return as teachers in the newly established Bachelors Degree programs, a temporary Graduate School could be set up in Kabul for one year. An intense graduate program in ICT could be taught by recruiting six international faculty members from the US or another country and spreading them over a year's time. Six faculty members, working over a two



semester period, would be able to deliver the ten courses required for a master's program, plus assist with (and mentor KU faculty) in advising duties. Two of those six faculty members would be offered an additional summer term to assist students in the completion of their Masters Projects or theses writing. Schools in the US, or perhaps Bochum University in Germany where many of the faculty members from Afghanistan go for Masters programs, may be able to provide release time for faculty to come to Afghanistan for a semester and teach a two or three-course load plus do student advising. Paying one-semester salaries for six faculty members and covering their expenses may be far less expensive in the long run than the cost of sending ten Afghan faculty members abroad. It is far less complicated to organize six-month visas for six international university professors than it would be to sort visas and travel permits for ten or more Afghan university faculty traveling to the US or to Germany.

### **The Structure**

Four faculty members from each of five regional schools in Afghanistan holding only a Bachelors Degree in ICT would be identified as candidates for this program. English language levels would be assessed and additional training would be provided for a six-month period, to bring language levels to a point where graduate study is feasible. Language training would be facilitated through the Professional Development Centers at each of the schools.

During this time, recruitment of international faculty begins and candidates with expertise in specific content areas are identified. Six international faculties in total would be selected. Of the six, three faculties would be selected for each term, one functioning as a program coordinator and teaching one course, the other two would teach two courses each and use the remaining time to advise students and/or mentor existing faculty at KU. Faculty members would arrive in August and begin teaching in September in order to have an acculturation period of approximately a month. During this time, they would meet with representatives of the Ministry of Communication, Information and Technology, the leaders of ICT organizations such as NICTAA and NISPA, and various ICT companies and service providers and incorporate some of what they learn into their course syllabi. The term completes in December. New faculty members for the Spring Term would arrive in early December to overlap with the first group. They would receive the same acculturation/training period that the first group received, as well as a hand-over debriefing from the Fall Term faculty members. Five courses would be scheduled for the Spring Term and the senior faculty/acting chair would teach one course and work with individual students to develop research/capstone course topics. The Spring Term would end in May. Two faculty of the group of six would remain/return to assist with capstone project development and completion. It should be two faculty members of the original six because they alone will be familiar with the coursework, research interests/ambitions of individual students. As carry-over faculty, they would also be familiar with the inner workings of the Afghan ICT system and would not require the lengthy acculturation period needed by a new person to be up to speed.

### **Students**

Students who successfully complete the English language program and attain the requisite TOEFL or IELTS scores would move to Kabul in September and prepare for a year of intense study. The program would be structured as a six-day per week schedule, one class per day. The remaining time would be spent in study, doing research for projects, doing additional English study. Laptops would be provided as well as access to library resources and databases. Faculty members would be available all day to assist with questions, project design, and general advising. While it is true that 18-hours of graduate study are very difficult, even for Western students, this group would have nothing else to do but study. They would also have captive faculty available to assist them, unlike the situation in a US university setting where faculty have committee assignments and social engagements to compete with their school time.



### **Needs**

•Needed is an established institution to structure the project through that will provide credibility and legitimacy. That institution should be outside of Kabul University so as not to be encumbered by layers of bureaucracy. One method of doing this would be to set up a bidding structure whereby international institutions bid to provide the program here...though their program costs/fees may make this an unreasonably high cost program. The Kabul University Graduate Center would be a place where the program could be located. In lieu of that, The American University of Afghanistan could be approached to assist.

•Needed is a venue such as classrooms and a research center. This could fall under the (proposed) Kabul University Graduate Center. Two classrooms would be sufficient for teaching a cohort of 20 since the plan would be to hold one course per day.

If an outside institution was needed to legitimize the process, work it through the American University of Afghanistan or let a US based program such as the University of Massachusetts, Indiana University or the University of Nebraska with proven a track-record in Afghanistan become the school of record.

Area of intervention	Details
ICT Bridging Programs (ICT-Bridge)	<p>3 months ongoing program at MCIT for selected public and private educational institutions graduates, private sector service providers. This may include:</p> <ul style="list-style-type: none"><li>• Graduates of public ICT institutions</li><li>• Graduates of private ICT institutions</li><li>• Graduates of provincial public and private ICT educational institutions</li></ul> <p>The program to pave the way for ICT graduates Placement program</p>

### **General Description for ICT Bridging Program (ICT-Bridge)**

This program is designed to meet the private sector needs for ICT skilled workers. The graduates of the ICT-Bridge will receive additional knowledge and training in ICT related troubleshooting in small businesses, networking, data recovery, Oracle training, web applications and internet solutions. The program would enroll graduates of existing public, private and provincial level students who would like to seek employment in the field. In order to meet the gap between the earned skills and the market demand. This 3 months full time course will support recent graduates to receive additional skills and to get ready for challenging jobs. Graduates of the ICT-Bridge program may also qualify for the Graduates Placement program (Program -10).

### **The Structure:**

The current ICT institutions programs will be compared with the market demand and standards required for bachelor degree graduates, technologists and technicians in ICT sector. The base line will be compared with the standards in the industry. Senior students or recent graduates of the private, public and provincial institutions will be enrolled in the ICT-Bridge program. Prior agreements would be signed between the MCIT PMU and the educational institutions. The 3 months extensive course will fill the gap between the already obtained knowledge and the industry standards and market demand and will qualify the graduates to be part of the ICT graduates Placement program (Program-10). This way the recent graduates will successfully integrate into the work force and will independently manage the area of their ICT responsibilities.

### **The process:**

- In order to enrollee the graduates of the ICT- Bridge program; the project will initially announce the ICT Graduates Placement Program (Program -10). And for that the senior students to be



identified in relevant private, public and provincial institutions for the ICT-Bridge program. During the 3 months intensive study within the graduate program or after the graduate program the students will receive additional skills that is required by the market. The graduates of this program will automatically be enrolled in the Placement program that is a full time job. Separate agreements to be made with educational institutions managed by the MCIT Project manager under the PMU. There should also be separate agreements with the employers willing to employ graduates at the placement level. Necessary moral and material incentives to be created for the employer in order to create positions for the graduates. These incentives may include tax credits, non material promotion of the employer, sharing the employee salary for up to 6 months and other similar measure. The employer can also be a government entity with an advanced computer database and networking system.

- b. The students may be thought by 4 to 6 instructors with a Master degree in ICT relevant field mentioned in the above table. The instructors to be identified among talented professionals from regional countries or from within the Afghan Diaspora in the western jurisdiction. Necessary recruitment preparation for the short term instructions to be made by the MCIT PM.
- c. Contracts for the two programs would be signed between the MCIT PMU and the selected private and public educational institutions in the pilot rollout. The private educational institutions may advertise this agreement for their marketing and student enrolment purposes. The successful pilot session may continue for the next year of graduates. The graduates will receive certificate of completion for the Bridging Program and will qualify to enter the Graduates Placement program. Necessary agreements with public sector and private sector employers to be made prior to inaugurating both programs.

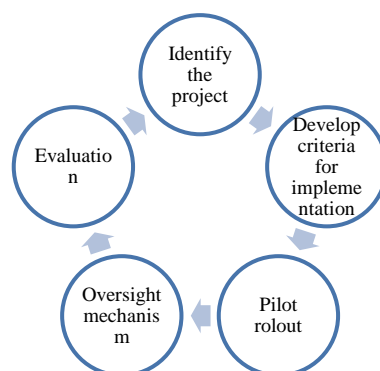


## 9. Pilot rollout

With the identification of the possible ICT skills development programs, it is evident that funding availability may be a constraint to implement all the above initiatives at once. That is why a Pilot Rollout is recommended to start the process of ICT skills upgrading and development so to meet some of markets urgent needs. Since the gap between the ICT sector growth and the ICT skills development is wide (3:1); a comprehensive long term plan to be developed to reach the target number of skilled ICT workers both in high level management and mid level management. It is also recommended to enhance the general public (including the public servants) ICT literacy in order to provide better services to the public. The strategy in pilot rollout is recommending focusing on the following strategic directions:

Strategic Direction	Possible programs
Bridging programs	In order to enhance the capabilities of the recent graduates the bridging programs such as Graduates placement programs, ICT bridging programs and In Country Master Degree programs to be undertaken
General Public servants ICT literacy programs	This may include ICT in workplace program, Mobile ICT education, Wi Fi space provision, ICT lab provision

Bridging programs for existing graduates of the ICT institutions: This can be reached through a combined training, short term courses and ICT Skills development grants for talented young groups to enhance ICT sector. Although the prioritization of the pilot rollout can be suggested in this study, however the first pilot project may comply with the MCIT strategic directions and five year development plan. Pilot rollout will undergo the following steps:

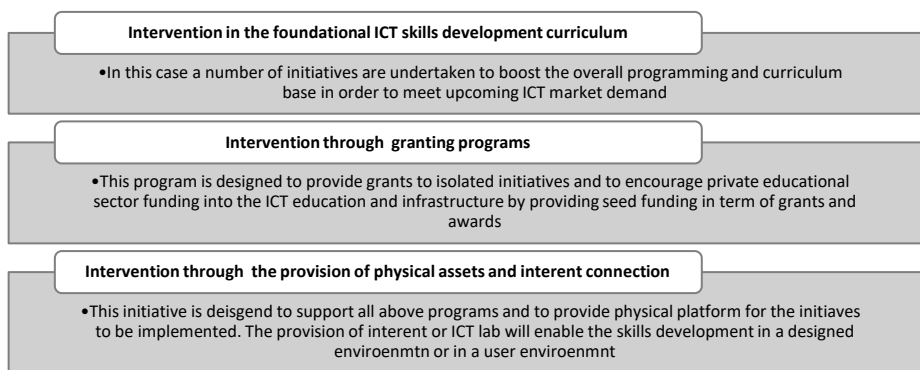




## 10. Scope of Work for activities to be financed under the component

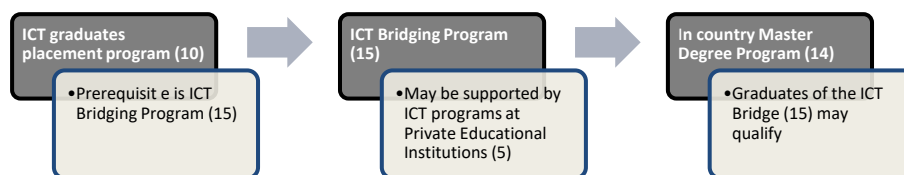
The scope of activities for the ICT Skills development is a general undertaking by the MCIT and Donor agencies to provide reasonable intervention in the ICT Education market to boost the productivity of the educational institutions. The projects financing is a general minimum and maximum contribution that can be corrected or revised while procuring the implementation of the projects.

The intervention is covering three major areas in the ICT skills development process:

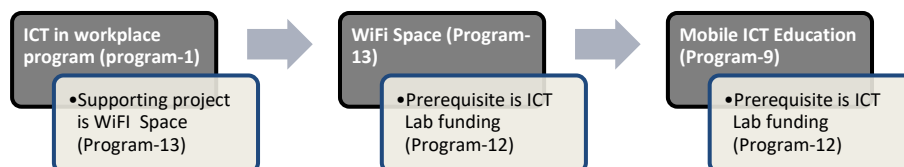


The pilot rollout is recommended in the following manner:

**Pilot No.1:** It is a combination of 3 programs identified in the suggested rollout.

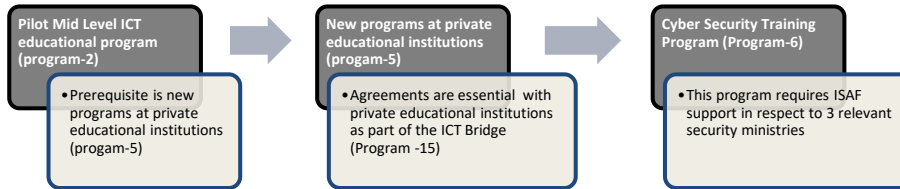


**Pilot No.2:** It is a combination of 3 programs identified in the suggested rollout.





**Pilot No.3:** It is a combination of 3 programs identified in the suggested rollout.



The ICT Skills Development programs are picked up and chosen based on the qualitative and quantitative surveys conducted during the first stage of the study. The programs are also aligned with most of the MCIT strategic investments and ICT accessibility to general public and particularly the rural areas residents and users. However the program funding is limited and a more prioritized strategic investment should be made in order to kick off the initiative.

The study team recommends that the “ICT Bridging Program (ICT-Bridge– Program - 15)” to accommodate a number of bridging / continuing skills development programs to be inaugurated to bridge the gap between the skills among recent graduates and the market demand through a comprehensive continuing education program that is designed for different audiences. These programs are as follow:

**Figure 35: Details of ICT Bridge Program**

	Program	Target	Details
ICT-Bridge-1	Programs for graduates of public institutions	Graduates of public ICT institutions, TVET graduate from public institutions, Bachelor degree graduates from public universities	This program is designed to bridge the gap between the skills gained during the studies at the publicly run universities, institutions and TVET Schools and the current market demand for employment. Graduates of the ICT- Short 1 may be eligible for the placement program (Program- 10). Refer to <b>Appendix No. 1 D</b> - Curriculum definition and syllabus for this program.
ICT-Bridge -2	Programs for graduates of private institutions	Private ICT institutions, TVET graduate from private institutions, Bachelor degree graduates from private universities	This program is designed to bridge the gap between the skills gained during the studies at the privately run universities, institutions and private TVET Schools and the current market demand for employment. Graduates of the ICT- Short-1 may be eligible for the placement program (Program- 10). Refer to <b>Appendix No. 1 D</b> - Curriculum definition and syllabus for this program.
ICT-Bridge -3	Programs for graduates of provincial institutions	Private ICT institutions, TVET graduate from private and public institutions in the provinces, Bachelor degree graduates from private and public universities in the provinces	This program is designed to bridge the gap between the skills gained during the studies at the privately run universities, public institutions and private TVET Schools and the current market demand for employment. Graduates of the ICT- Short-1 may be eligible for the placement program (Program- 10). Refer to <b>Appendix No. 1 D</b> - Curriculum definition and syllabus for this program.



Suggested programs may be housed in private educational institutions through a pilot program within Program -5, (Design and establishment of new programs at private educational institutions). The program may be designed having the following components:

- a. Curriculum definition – Curriculum for the bridging program may include:
  - Networking
  - Cyber Security
  - Oracle
  - Data recovery
  - Trouble shooting
  - Network monitoring
  - E- portals
  - Database development and maintenance
- b. Delivery – Delivery of the program will be the responsibility of the private education institutions who are involved in ICT training. The minimum standard of education and skills development shall be provided by the MCIT based on the market demand.
- c. Quality assurance - may be assured by the MCIT Project manager responsible for the successful delivery of the project. The MCIT Project Management Unit (PMU) to assign a Project manager responsible for the procurement, scope, quality control and monitoring and evaluation of the program.  
The Project manager (PM) would have one or two aids, which will support the PM in managing the process of the skills development. Upon increase in implementation of other ICT skills development programs the PM to increase the number of staff to cover the additional scope of work. It is recommended that for the purposes of the smooth running of the ICT-Short program in private educational institutions qualified ICT professional to be recruited from the regional countries in the area of ICT curriculum development, ICT program management, monitoring and evaluation. It is anticipated that for the first three sub programs listed in Figure xx at least two

Below are the suggested programs and combinations of implementation based on the type of program and timeline.

Recommended strategic interventions based on the beneficiaries of the ICT Skills development in ICT and non ICT sectors are as follow:





**Figure 36: ICT Skills Development Implementation Combinations**

Program No.	Program Objective	Participants breakdown					Timeline	ICT Skills development programs based on priority and type		
		1390	1391	1392	1393	1394		ICT Skills development programs	Granting Programs	ICT Infrastructure funding
1	ICT in the workplace program	1000	2500	3000	3000	3000	2011 -2014			
2	Pilot Mid Level ICT educational program	250	350	400	500	600	2012-2015			
3	High level ICT Skills development programs	50	75	100	125	150	2012-2015			
4	Small ICT innovation grants	10	15	25	30	30	2011-2015			
5	Design and establishment of new programs at private educational institutions	2	2	3	3	5	2011-2015			
6	Cyber Security Training Program	40	80	80	100	150	2012-2015			
7	Cutting Edge technology	25	50	50	50	50	2012-2015			
8	National ICT University	400	600	600	800	1000	2012-2015			
9	Mobile ICT education	50	100	150	200	250	2011-2015			
10	ICT Graduates Placement Program	200	320	380	420	500	2011-2015			
11	ICT award	5	8	8	8	10	2012-2015			
12	ICT Lab funding	5	8	8	8	10	2011-2015			
13	Wi Fi space	2	2	3	3	4	2012-2015			
14	In Country ICT Masters Program	0	20	20	30	50	2012-2015			
15	ICT Bridging Programs (ICT-Bridge)	50	100	150	200	200	2011-2012 and beyond			

**Legend**

	ICT infrastructure funding
	Broader digital literacy
	Foundational ICT education
	ICT Granting programs



### III: Cost estimates, breakdowns, economic and financial analysis for the skills component

#### 11. Cost estimates

##### Actual Project Costs

The cost for the implementation of various components of the suggested programs will vary based on prioritization of projects undertaken by MCIT. Actual project costs consist of curriculum design, course teaching, ICT lab expenses, academic employment, administration, management, monitoring and auditing. The project costs are estimated based on the minimum expenditure for the year of 1390.

Figure 37: Total estimated costs summary of projects

Project Costs by categories	
Total project costs (minimum funding)	\$5,425,000
Total project costs (maximum funding)	\$11,275,000
Project costs for ICT infrastructure funding	\$250,000
Project costs for ICT granting program	\$100,000
Project costs for Foundational ICT Skills development	\$2,900,000
Project costs for Broader Digital literacy	\$2,250,000

##### Infrastructure Costs

Although infrastructure costs are not included in this study; the full implementation of the recommended program will include infrastructure expenditure that will make up a significant portion of the ICT Skills development project. The current study envisions that the infrastructure will be provided from the MCIT and other ICT educational institutions as in kind support.

##### Hard Costs

Hard costs for this project will only include the costs of the following sub projects:

- ICT Lab estimated costs (US \$200,000)
- Wi Fi support estimated costs (US \$50,000) (including hardware)

##### Inflation and Contingency

For all future hard costs, an inflation rate of 5% is applied as well as a 5% contingency cost for any overruns.

##### Soft Costs



Soft costs are classified as those that are not directly spent on infrastructure and include consulting fees, project staff, office equipment, and other related expenses.

#### **Other Consulting**

The amounts spent on other consulting contracts include project management, monitoring, auditing and visiting lecturer (if any).

#### **Project Staff**

The project staff includes the long term and short term contractors of MCIT that are hired under the Skills Development project to work directly on this project. Official employees of MCIT are not included as their responsibilities are not limited to the ICT Skills development.

#### **Office Equipment and Miscellaneous**

Office equipment includes the computers, vehicles, stationary, and communication devices used for the project. The ICT lab project will have its own equipment costs that are direct project costs. The cost breakdown for the ICT lab is described in the detail projects budget and timeline.

#### **Operating Costs**

Operating costs include the ongoing expenses for the management and operations of the ICT Skills Development project. It is anticipated that MCIT will have oversight staff for the entirety of the project.

#### **Administrative Staff**

In order to ensure professional support for the project implementation MCIT will need a dedicated team of professionals on site to handle issues such as maintenance, finance, and operations.

#### **Marketing costs**

Marketing costs will also be incurred to attract trainees and organizations interested in enhancing their employees ICT skills. Marketing is also needed to attract the potential private educational institutions, ICT associations, ICT related companies and innovative groups. These might include advertisements, road shows, etc. The baseline cost is \$20,000 in the first year and is decreased in subsequent years. Marketing costs for each program is part of the suggested budget and timeline in Appendix.

#### **Debt Losses**

It is assumed that there will be losses from the failure of individual programs in the form of no attendance, low turnover of applications for grants, low interest by the public sector to participate. The firm level surveys and ICT related educational institutions survey however indicate that the interest to ICT skills enhancement is high across the country.

#### **Revenues**

There is no direct revenue generated in the result of the ICT Skills Development project. However the revenue will be generated as a benefit to the society and to the sector. The analysis of this revenue is done under the benefit to the society section.



## 12. Financial Analysis

The financial analysis combines the actual project costs, estimated future project costs and results of the demand analysis. Economic analyses are focused on benefit the society and new jobs created or existing jobs enhanced.

### Results of Financial Analysis

The selection of three pilot programs among the suggested priority 15 programs is an attempt to spread the initiative into several stages and to ensure the donor funds proper distribution. However the breakdown comes at a price that can be mitigated if the whole initiative is undertaken as in one package. Over 20% of the funds can be saved if the projects start under a single management. The following items can be combined in terms of spending if the programs are under the same management:

- a. Management expenses
- b. Administration expenses
- c. Marketing and publicity expenses
- d. Curriculum development expenses
- e. Auditing
- f. Monitoring

The financial analyses do not include infrastructure expenditures. It is assumed throughout the analysis that the exchange rate is Afs. 45 per US dollar. The inflation rate is set at 5%.

### Net Present Value (NPV)

The Net Present value (NPV) (difference between cash flow and cash outflow) of the program is the total amount of money to be spent on the suggested programs (negative amount). At present it is difficult to predict the cash flow of companies that will use the skills developed through this program. But based on the other analysis in the result of the ICT Skills use in an industry there is up to 38% increase in productivity and profitability.

### Financial Metrics – Summary Results

The amount allocated for each program is taken as minimum and maximum amounts for the programs to run. The estimated budget for each program in Annex will provide a more detail dollar amount for the project implementation. All calculations are done based on the minimum funding options. The amounts are calculated for the base year of 1390. The amount will change for subsequent year based on the following formula.

$$S = (B \times S_y) / B_y$$

Where: S - Subsequent year budget B - Base year amount  $B_y$  - Subsequent year beneficiaries

$B_y$  - Base year beneficiaries

### Highest priority and the cost-benefit trade-off among choices

It is evident that the priority skill development program may not be the best cost benefit trade off among the suggested programs. However attempts have been made to provide a common denominator between the priority programs and the cost benefit between the programs. The first attempt has been made to



provide the minimum costs for all programs and the maximum cost. This ratio between the ratios are more than 2. The cost analysis are based on the minimum suggested costs. The other attempt is the prioritization of the first 3 pilots based on the costs. The priorities based on costs are provided below:

**Figure 38: Priorities based on costs**

Priority programs	Total combination costs	Trade off among choices
<b>Pilot No.1</b>	US \$1,850,000	This badge of programs are priority programs and shall be undertaken in whole
<b>Pilot No.2</b>	US \$1,300,000	In this badge mobile ICT education may be put for the next stage of skills development if there are funding constrains
<b>Pilot No.3</b>	US \$1,550,000	In this badge the Cyber security program may be put on a later stage as this program may require a much higher government attention and funding

**Figure 39: ICT Skills Development Estimated Budget**

Program No.	Program Objective	Funding Options (US \$) per year	
		Min.	Max.
1	ICT in the workplace program	\$750,000.00	\$1,000,000.00
2	Pilot Mid Level ICT educational program	\$750,000.00	\$900,000.00
3	High level ICT Skills development programs	\$1,000,000.00	\$1,200,000.00
4	Small ICT innovation grants	\$175,000.00	\$300,000.00
5	Design and establishment of new programs at private educational institutions	\$550,000.00	\$750,000.00
6	Cyber Security Training Program	\$250,000.00	\$450,000.00
7	Cutting Edge technology	\$50,000.00	\$125,000.00
8	National ICT University	\$1,000,000.00	\$1,000,000.00
9	Mobile ICT education	\$500,000.00	\$2,500,000.00
10	ICT Graduates Placement Program	\$500,000.00	\$1,250,000.00
11	ICT award	\$50,000.00	\$100,000.00
12	ICT Lab funding	\$200,000.00	\$500,000.00
13	Wi Fi space	\$50,000.00	\$150,000.00
14	In Country ICT Masters Program	\$750,000.00	\$1,500,000.00
15	ICT Bridging Programs (ICT-Bridge)	\$600,000.00	\$750,000.00



## 13. Economic Analysis

### Economic Rate of Return

While the financial analysis only includes the actual financial outflows and inflows, the economic rate of return analysis takes the view of society as a whole. Net costs and benefits to society must be added in to derive the economic rate of return.

### Costs to society

Potential costs to society of the project include:

- **Labour force allocation**

Although the academic and administrative work force will bring benefits to the project but the involvement of the above mentioned labour force will cost the society as the academic and administrative work force will be occupied with this project.

- **Opportunity cost of public sector employees**

In the result of the public sector workers involvement in the project the attendance will have opportunity costs to the public sector and society. Since without the ICT skills in the public sector the impact of the service will be minimal the opportunity costs can be ignored in this study.

### Benefits to society

The following potential benefits were deemed as not applicable:

- **Foreign exchange/current account benefits**

Increased exports would benefit the foreign exchange position of the country. However as the project is expected to be primarily domestically focused, this benefit was not added.

The following benefits were considered applicable:

### New jobs created or current jobs enhanced

New jobs and wages generated by the project or current job performance enhanced are additional benefits to society. The analysis only included the estimated number of new jobs and enhancement of current jobs that would not have been created without the existence of the project.

The methodology for determining benefits to the society is derived from the demand for ICT Skills development and enhancement. The study has assumes that the skills enhancement will benefit existing employees and will enable graduates of the programs to receive new jobs. We assume that the majority of the training recipients are already employed or are contract workers.

The average wage of US \$3600 per year for low level labour and US \$6,000 for skilled labour was extracted from the firm-level surveys. Additionally, it can be expected that the jobs created within ICT sector will create indirect jobs in the private sector. These would include service industries, non ICT



firms and businesses, public sector offices and educational institutions. The wages for indirect labour was assumed to be US \$3,000 per year for unskilled workers and US \$6,000 per year for skilled workers.

The “social opportunity cost of labour” (SOCL) was considered in this study. The SOCL is the cost of taking a worker away from a productive job to take the ICT skills development program. Considering that the productivity of the workers without ICT skills in the workplace is pretty low the SOCL was taken as zero.

The ICT Skills Development suggested programs have been combined in several badges as to prioritize the programs by dates and by funds availability. The combinations are created the way each program can be switched from one badge to another making up a new combination. The amount of funds allocated to different programs is not necessarily a reflection of largest number of people trained for ICT skills development. Rather the fund allocation and prioritization is the function of the intensity and complexity of the programs. A number of programs such as ICT in workplace and Mobile ICT training are a more basic level ICT skills development for non ICT sector while High Level ICT, Mid Level ICT, National ICT University or Cyber Security training are more advanced and are for ICT professionals and support workers.

#### **Added Profit**

The additional profit that a worker can generate as a result of ICT Skills Development program is a net benefit for society. Additional profit is the amount of profit above what the worker would bring if the worker would not received ICT skills enhancement. The additional profit is estimated as additional profit margin that a company or an office enjoys as a result of productivity and cost savings derived from the ICT skills development programs. The company and /or office profitability deeply depends on the ICT application and skills required to conduct ICT related operations.

Added profit can only be calculated based on the revenue improvement of the business or office after the adoption of the ICT skills enhanced through this program. According to a study “Improving the flexibility and profitability of ICT-enabled business network by Dominique J.E. Delporte-Vermeiren” in the result of the ICT skills development the cost to business is reduced 17.5% and revenue is improved 38.85%. Therefore any increase to the added margin in the ICT enabled service can be taken as 3.8%.



## ANNEX No1: General Syllabus for ICT Skills Development Programs

### A. Master Degree Program General Syllabus for ICT

Master's Degree Program in both Computer Science and Software Engineering; and Master's degrees in Mechatronics, and Software Engineering and Virtual Systems Design.

The syllabus will support the graduate studies for the following Master Degree programs

- Master's Degree in Computer Science
- M. Eng. Degree
- Master's Degrees in Software Engineering
- M. Eng. Degree in Mechatronics Engineering
- M. Eng. Degree in Software Engineering and Virtual Systems Design

Masters Program Syllabus	Details
Distributed Computer Systems	Distributed systems; real-time, agent-oriented, heterogeneous, multicomputer, multi-processor, coupling schemes: loose, tight; networking, ATM, frame relay, clustering, software protocols; Communication strategies, client/server approaches.
The Human Computer	A study of the principles of good interface design. Information overloads problems and accommodating user mental models. Human input and technology insertion methods. Information and data visualization techniques. Modes and the mode awareness problem. Human factors and health issues, ergonomics. Interface design tools and Performance Support Systems.
Performance Analysis of Computer Systems	Use of queuing models and simulation to predict computer system performance and find bottlenecks in a system. Types of models, distributions. Markov models. Modeling storage and network behavior, lock, critical sections, concurrency. Introduction to analytical system reliability.
Real-Time Systems and Computer Game Applications	Hard and soft real-time systems. Safety classification. Fail-safe design, hazard analysis. Discrete event systems. Modes. Requirements and design specifications. Tasks and scheduling. Clock synchronization. Data acquisition. Applications in real-time networking, quality of service and multimedia.
Sensory Perception, Cognition and Human/Computer Interfaces for Game	Human sensory perception, learning and cognition. Game aesthetics. Precise control and feedback mechanisms. Use of music and sounds. Critical analysis of existing interfaces. Alternate input devices.





Design	
Databases	Physical organization of data, file structures, need for database management systems, entity-relationship design, the relational data model, concurrent access, mechanisms for data recovery. Assorted applications.
Operations Research	Linear programming, integer programming, decision trees, network flow problems, graph algorithms, route planning, applications to engineering problems.
Syntax-Based Tools and Compilers	Lexical analysis, syntax analysis, type checking; syntax-directed translation, attribute grammars; compiler structure; implications of computer architecture; mapping of programming language concepts; code generation and optimization.
Recursive Function Theory and Computability	Recursive and primitive recursive functions, decidability and undecidability with applications to formal language theory, logic and algebra.
Continuous Optimization Algorithms	Fundamental algorithms and general duality concepts of continuous optimization. Special attention will be paid to the applicability of the algorithms, their information requirements and computational costs. Practical engineering problems will illustrate the power of continuous
Fundamentals of Image Processing	Discrete-time signals and systems, digital filter design, photons to pixels, linear filtering, edge detection non-linear filtering, multi-scale transforms, and motion estimation.
Web Systems and Web Computing	World wide web as networks: protocols, clients/servers and social issues; programming systems: mark ups, scripts, style; platform technologies; WWW services: standard systems, browser-based, security issues, examples.
Logic and Discrete Mathematics in Software Engineering	Mathematical objects and logical concepts used in Software Engineering. Higher-order logic. Partial functions and undefined terms. Practical application of the axiomatic method. Recursive definition and inductive proof. Survey of common mathematical structures and axiomatic theories used in Software Engineering. Effective use of mechanized mathematics systems.
Data Structures and Algorithms	The course will cover some basic material encountered at the relevant undergraduate courses on data structures and algorithms plus more advanced material on topics such as network flows, linear programming, computational geometry and NP-completeness. There will be emphasis on techniques such as greedy and dynamic programming.
Software Design	Formal specification methods. Requirements specifications. Failsafe systems. Verification of safety critical applications. Systematic testing. Specification and design of concurrent, multi-process and distributed



	systems.
Embedded, Real-Time Software Systems	Continuous and discrete event dynamical systems. Stability, Controllability and observability. State space control. Scheduling for soft and hard real-time software systems. Design of software real time control systems and co design issues.
Computability and Complexity	Computability: Finite automata, Turing machines, and recursive functions. The Halting problem and the Church-Turing thesis. Complexity: Classes defined in terms of time, space, and circuits.
Programming Languages	Design, definition and implementation of programming languages.  Programming language paradigms; syntax, attribute grammars, typing; axiomatic, operational and denotational semantics; correctness proofs; implementation techniques, virtual machines; design and implementation of Domain-Specific Languages
Formal Specification Techniques	Pre/Post conditions, refinement, state-based approaches, and event based approaches, algebraic specifications, Petri nets, temporal logic, properties of programs, and specification, verification, and validation.
Scientific Computation	Floating-point arithmetic, solutions of systems of linear equations by direct and iterative methods, sparse matrix algorithms, solving systems of nonlinear equations, integration, differentiation, methods for initial value problems in ordinary differential equations, and automatic differentiation.
Combinatorics and Computing	Topics in applied combinatorics and graph theory of importance to both theoretical computer science and practical computing including combinatorial computing. Main topics: graph theory and algorithms, combinatorial optimization and algorithms, design theory and coding theory. Solving problems in finite combinatorics using computers.
Computing Patterns in Strings	This course deals with algorithms for finding "patterns" in strings, patterns of three main kinds: specific, generic, and intrinsic. The importance of approximate patterns and algorithms which identify them is made clear. Applications to DNA sequence analysis and other scientific areas are emphasized.
Distributed Real-Time Systems	A study of hard and soft systems: specifications, event processing, data concurrency, distribution completeness, corrections, integrity fallback, fault tolerance and applications; timing analysis: synchronization, deadlock, and modeling.
Concurrency Theory	Models based on interleaving and partial order paradigms including the Calculus of Communicating Systems (CCS), Communicating Sequential Processes (CSP), Actors, Petri Nets, Pomsets and COSY. Basic properties of concurrent systems such as deadlock, liveness, safety, fairness, etc. Temporal Logic techniques. The growing role of concurrent systems in



	many diverse scientific and engineering activities will also be discussed.
Formal Methods of Real-Time Systems	Introduction to formal methods including equivalence verification, model-checking and theorem proving. Emphasis on verification of safety-critical real-time control systems using automated theorem provers and simple programming techniques.
Design of Numerical Software	Principles of finite precision computation, subtleties of floating point arithmetic, design of stable and accurate numerical algorithms, techniques of testing numerical software, portability and performance.
Computability on Abstract Data Types	A study of the extension and generalizations of classical computability theory (or recursion theory) to abstract data types.
Problem Solving with Knowledge-Based Systems	A practical study of knowledge-based technology as applied to appropriate problems including knowledge engineering; structure of expert, neural and fuzzy systems; application areas include simulation, fault analysis, rapid prototyping, adaptive scheduling, control and strategic planning.
Machine Learning and Data Mining	A broad study of major approaches and methodologies related to machine learning from the viewpoint of artificial intelligence. Symbolic algorithms of learning. Statistical algorithms of learning. Well-known existing learning systems. Data mining and knowledge discovery.
Symbolic and Logic Programming	Methodology of advanced symbolic programming: data structures and non-standard control techniques. Methodology of logic programming:  Prolog programming for AI, strategies of the resolution principle, reverse resolution, elements of theory revision.
Logical Foundations of Computer Science	A solid logical and mathematical foundation for reasoning about software and software descriptions is provided. Topics include: Introductory concepts in set theory (sets, relations, functions, etc.); various logics (first order, higher order, equational, conditional equational); many-sorted algebras; initial algebra semantics for equational and conditional equational theories.
Formalized Mathematics	Computer-supported, formalized mathematical reasoning for practical applications. Specification and verification in higher-order logic. Interactive theorem proving systems. Techniques for developing axiomatic theories.
Analysis of Stochastic Networks	Techniques for the analysis of large networks that can be modeled in a statistical manner. Single queues, product form networks and mean value analysis. Fluid and diffusion approximations. Simulation techniques, including variance reduction. Hybrid simulation. Current research directions in Stochastic networks.
Relation Algebra and	Advanced course in relation algebra and an introduction to Kleene Algebra.



Kleene Algebra and their Applications	Homogeneous relations, orderings and equivalence relations, heterogeneous relations, basic results of Kleene algebra. Discussion of some computer science and software engineering problems within the framework of these algebras.
Numerical Methods for Ordinary Differential Equations and Differential-Algebraic Equations	Numerical methods for ODEs and DAEs; Runge-Kutta, multistep methods; convergence, accuracy, consistency; error estimation and propagation, stepsize and order control; stability, non-stiff and stiff methods; software for ODEs and DAEs.
Development of Scientific Computing Software	This course presents the basic principles of software development for reliable scientific and engineering software. Using example applications, a systematic process is given for the development and documentation of requirements, high-level design, module design, implementation, testing and inspection.
Methods of Symbolic Computation	This course gives an introduction to symbolic computation methods and their application to (electrical, computer and mechanical) engineering problems. Topics include: linear and nonlinear equations and their solutions; algebraic equations; term-rewriting and their application to formal software specifications; Groebner-basis and their application to geometric problems; differential equations; visualization of dynamic processes.
Functional Programming	The powerful abstraction capabilities and clean semantics of functional programming languages improve programmer efficiency and facilitate correct program derivation and transformation. This course will present practical aspects of software development in modern functional programming languages and theoretical foundations, like term rewriting systems, lambda-calculi, and type systems
Advanced Topics in Design of Algorithms	Advanced design techniques for algorithms, including (but not limited to): approximation algorithms, randomized algorithms, on-line computation and competitive analysis, quantum computing. Each term the course will concentrate mainly on one of these topics for a deeper understanding of the particularities and the defining problems/issues of the field as well as its applications to other fields and to practice. Presentation of up to date results and tackling of open research problems will be the main requirement for the students taking this course.
Supervisory Control of Discrete-Event Systems	This course is an introduction to the control of discrete-event systems (DES), asynchronous systems discrete in space and time (e.g. manufacturing systems, communication systems, etc.). The course will provide a solid foundation for research in this area, focusing on architectural issues such as modular, decentralized, and hierarchical control. The course will also discuss timed DES, as well as current topics of interest.



Advanced Topics in Combinatorial Optimization	This course provides an introduction to useful frameworks for discrete optimization problems. We introduce the basic concepts of polyhedra, lattices and integer cones and illustrate these notions by some examples coming from combinatorial optimization. An algorithm for finding the Hermite normal form of a lattice and the main methods for facet or vertex enumeration are presented.
Advanced Topics in Combinatorial Optimization	This course provides an introduction to useful frameworks for discrete optimization problems. We introduce the basic concepts of polyhedra, lattices and integer cones and illustrate these notions by some examples coming from combinatorial optimization. An algorithm for finding the Hermite normal form of a lattice and the main methods for facet or vertex enumeration are presented.
Software Architecture Modeling and Reverse Engineering	This course exposes the graduate students to the models, techniques, and tools for designing, developing, maintaining, and evolving medium and large software systems. The topics include: software architecture fundamentals; representations; views; components; patterns; model driven architecture; and software architecture recovery and evaluation techniques. The course includes group projects to cover the design and recovery aspects of a software system.
Analysis and Synthesis of Sound	Sound as signals (Fourier Analysis, basic harmony theory), Sound analysis (filters, FFT), Synthesis (band limited signals), over-sampling, real-time signal processing, user interfaces (real time interaction with algorithms), vocoders, physical modeling (fast DSP algorithms to solve PDE's).
Advanced Topics in Computational Geometry	This course provides an introduction to useful frameworks for computational geometry problems in dimension 2, 3 and higher. We introduce the basic concepts of triangulations, Voronoi diagrams, polyhedra, lattices and integer cones, arrangement of hyperplanes and linear programming and illustrate these notions by some examples coming from combinatorial optimization.
Model-Based Image Reconstruction	An overview of three themes in advanced image processing:  Functional analysis (e.g., Fourier, Wavelet and SVD methods), PDEs (e.g., anisotropic diffusion), optimization of statistical models (e.g. Total Variation regularization). And, a detailed look at specific methods and techniques for applying these methods in new areas: medical imaging, visual process control. Including all phases of application development from mathematical modeling, through Complexity analysis.
Symbolic Analysis	This course explores the topic of exact, or closed-form, analysis by computer. This requires merging topics from Computer Algebra, classical analysis and constructive mathematics. Topics covered will involve computations of limits, series, integrals of functions, as well as closed-form solution of algebraic and differential equations. Very close attention will be



	paid to underlying semantics issues.
Specifying, Implementing and Verifying Timing Behaviors for Hard Real-Time Systems	Hard-real-time systems are those in which timing requirements are just as important as any other requirement. The course will present a number of timing specification models and methods, such as timed automata, as well as new methods that cope with tolerances on the time durations. Techniques for implementing timing behaviors and verification of those behaviors, both mathematical and testing based, will be included.
Programming Methodology	Verification and Refinement Methods for Sequential and Concurrent Programs, Specification Techniques, Reliability, Object-Oriented (Modeling, Design, Patterns, Concurrency), Program Design and Program Documentation, Tools and Compilers.
Advanced Computational Methods and Models	Advanced topics in scientific computing, including iterative sparse methods and direct sparse methods for linear systems, QR-type algorithms for computing Eigen Values, perturbation analysis, methods for large-scale ODE systems, choice of preconditioners, Newton-krylov methods for solving nonlinear systems, introduction to multi-grid methods, automatic differentiation, and sensitivity analysis.
Advanced Topics in Formal Methods and Software Architecture	The course presents advanced techniques for formal specification of requirements, designs and implementations of software based systems, focusing on software architecture as the organizing principle for software development. Course content will include some topics amongst: comparative properties of formalisms for specification; meta-properties of specification formalisms, including interpolation properties, modularity and their relationships; component based approaches and the role of category theory in component composition; formalization of encapsulation, cohesion and coupling; externalization of interaction definition; formal toolkit for software architecture.
Modern Software Technology for eHealth	This course exposes the graduate students in software engineering, computer science, or related programs to the challenges in the field of electronic health (eHealth). The course introduces a collection of modern architectures and technologies that are recommended by standardization organizations to build the infrastructure that meets the emerging demands in the growing network of health care systems. The topics include: standard health care and data and service representations; clinical terminology systems; web services and service oriented architecture; decision support systems; data mining techniques on clinical data; data and knowledge interoperability; security and privacy techniques, and health care application development environments.
Advanced Compiler Design and Optimization	Advanced compiler design methodologies with emphasis on control and data flow analyses, code optimization and related issues.



Logic for Practical Use	Attributes of a practical logic. Techniques for improving the practicality of traditional logics. Design, implementation, and use of practice oriented logics.
Generative Programming	This course will explore the rationale for, and the various aspects of generative programming. Special attention will be paid to Domain Specific Languages, and typed Meta programming. The relation with product families and model-driven software engineering will be emphasized. Key techniques in generative programming will be studied.
Cryptography	An introduction to cryptography: the course will cover public key cryptography based on the discrete logarithm problem, factoring, elliptic curves and lattices. Thus, it will examine the Diffie-Hellman and ElGamal pkc, RSA as well as lattice-based cryptographic schemes. Other topics will be key-exchange and authentication, identification, schemes, commitment schemes, electronic elections and digital cash, as well as provably secure encryption.
Independent Study in Computing and Software	Normally a self-study course. Prerequisite: Permission of the Chair of the Department.
Advanced Topics in Computing and Software	Topics of interest to Computer Science and/or Software Engineering. See annual departmental listings for current year topic. A student may receive credit for this course more than once if the specific topic differs.
<i>Recognition to McMaster University Graduate programs</i>	



## B. ICT in Workplace proposed Syllabus

### Course-1 BASIC ICT CONCEPTS General Objective: The Trainee will:

1. understand the basic concepts of ICT and information processing
2. appreciate the impact of ICT in the workplace

UNIT	Specific Goals	Details	Learning medium	Assessment
Unit 1 Information and Communications Technology (ICT)	The student will be able to: 1.1.1 explain the concept of ICT and its related terminologies 1.1.2. describe the Information processing cycle	Definition of ICT, related basic concepts and terminologies e.g. <ul style="list-style-type: none"> <li>• Information and Communications Technology (ICT)</li> <li>• Information and Communication Technologies (ICTs)</li> <li>• Data</li> <li>• Information</li> <li>• e-Learning</li> </ul> Information processing cycle Stage 1 - Receiving data (Input devices) Stage 2 - Processing data (Processing device) Stage 3 - display result (information) (Output devices) Stage 4 - Storing information (Storage devices) Stage 5 - Distribution of Information (human being, e-mail, fax etc)	Let students brainstorm and come out with the meaning of ICT and its related terminologies. . Use a simple diagram to illustrate how data is processed into information stored and distributed using the various devices. - Input devices - keyboard, mouse, microphone, scanner -Processing devices - CPU Such as Celeron, Pentiums AMD, MC68040 etc. -Output devices - printer, monitor, speakers, LCD Projector -Storage devices - hard disk, pen drive, CDs, DVD, tape	<b>Exercise</b> Students to explain some of the basic ICT concepts and terminologies and show the differences e.g. ICT and ICTs Data and Information  <b>Exercise</b> Students to list the devices used in the stages of information processing cycle and describe the process.
UNIT 2 Introduction to computers	The student will be able to: 1.1.3 outline the uses of ICT for educational/social/ economic purposes 1.1.4 analyze the impact of ICT	Uses of ICT tool Impact of ICT on educational, social and economic development Career opportunities <ul style="list-style-type: none"> <li>• Internet Café operator</li> <li>• Programmer</li> <li>• Database administrator</li> </ul>	In groups students to discuss and come out with the Educational, Social, and economic purposes of ICT. In groups students to discuss and come out with the impact of ICT on educational, social and economic development Discuss the various career opportunities with students or	<b>Assignment:</b> 1. 2. Students to select ICT career of their choice and find out the requirements and job description and report in class  <b>Assignment :</b>





	<p>on educational, social and economic development</p> <p>1.1.5 Identify career opportunities in ICT education</p> <p>1.2.1 identify types of computers</p> <p>1.2.2 state the uses of Computers</p> <p>The student will be able to:</p> <p>1.2.3 boot, reboot and shutdown computer correctly</p> <p>1.2.4 Identify possible threats to computers and users.</p> <p>1.2.5 demonstrate the responsible use of computer</p>	<ul style="list-style-type: none"> <li>• Network administrator</li> </ul> <p>Types of computers:</p> <ul style="list-style-type: none"> <li>• Digital e.g. PC, Laptop</li> <li>• Analogue e.g. thermometer, speedometer</li> <li>• Hybrid e.g. Money counting machine, Automated Teller Machine(ATM)</li> </ul> <p>Uses of computers</p> <p>process and store of data and information,</p> <ul style="list-style-type: none"> <li>• to enhance teaching/learning,</li> <li>• produce documents etc</li> <li>• Booting, rebooting and shutting down of computer</li> </ul> <p>Threats to computers and users.</p> <p>Computer - e.g. viruses, dust, power fluctuation, rodents,</p> <p>Users - posture , vision, wrist pain</p> <p>Responsible use of computers</p> <p>Computer ethics e.g. copyright, privacy concerns</p>	<p>invite resource persons to discuss the various opportunities</p> <p>Discuss the history of the development of computers.</p> <p>Display real objects/pictures of types of computers for students to identify. In small groups, students discuss and report on the uses of computers. Discuss and demonstrate how to boot, re-boot and shut down a computer correctly. Stress on the correct procedure e.g. Close running Application and use the start menu button to shut down</p> <p>Explain when reboot is necessary</p> <p>Students to practice booting, rebooting and shutting down of computer. Brainstorm and discuss the possible threats to computer and their users</p> <p>Field Trip:</p> <p>Field trip to places to find out and report on :</p> <ol style="list-style-type: none"> <li>a. different types of computers and their uses.</li> <li>b. Threats to computers and their users</li> </ol> <p>Discuss the responsible use of the computers.</p> <p>Students to come out with their own rules and regulation for the responsible use of computer</p>	<p>Students to write the procedure for booting, rebooting and shutting down a computer.</p>
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## SECTION TWO

### HARDWARE AND SOFTWARE

**General Objective:** The Trainee will:

1. recognize the different types of hardware and software and their uses

UNIT	Specific Goals	Details	Learning medium	Assessment
UNIT 1 Hardware	<p>The student will be able to:</p> <ul style="list-style-type: none"> <li>• describe the categories of Computer Hardware</li> </ul>	<p>Categories of the computer hardware:</p> <p>System Unit, Input / Output and Storage and devices</p> <p>The vital components of the systems Unit e.g.</p>	<p>With the help of a computer identify the categories of the computer hardware.</p> <p>With the help of a computer identify and describe the vital component of the systems unit.</p>	<p><b>Exercise :</b></p> <p>Students to prepare a chart showing the classification of fixed and</p>



	<ul style="list-style-type: none"> <li>identify the vital component of the Systems Unit</li> <li>describe commonly used Input / Output devices and their functions</li> <li>identify the main types of storage devices</li> <li>identify devices which serve as both input and output</li> </ul>	<p>-Front Side : power switch light indicators, floppy and CD ROM drive</p> <p>-Back side: USB ports, serial ports, power socket,</p> <p>-Inside: motherboard, CPU, power supply, memory, hard disk, cards( e.g. sound, network)</p> <p>Input and Output devices</p> <p>-Input devices - Keyboard, Mouse scanner, joystick, trackball, bar code reader</p> <p>-Output devices - Monitors, Printers(LaserJet and DeskJet), speakers, LCD projectors etc.</p> <p>Types of storage devices</p> <p>-CD, DVD, tape, pen drive, floppy diskette,</p> <p>Devices which serve as both input and output</p> <p>-computer, head set, modem etc</p>	<p>Discuss the commonly used input and output devices and their functions.</p> <p>Discuss the types of the main storage devices.</p> <p>Students to brainstorm and come out with devices that serve both input and output.</p>	<p>removable data storage devices</p> <p><b>Exercise :</b></p> <p>Students show the correct procedure for attaching and removing removable data storage device for evaluation</p>
UNIT 2 Software	<p>The student will be able to</p> <ul style="list-style-type: none"> <li>identify types of Software packages</li> <li>distinguish between Open Source and Proprietary software.</li> <li>identify different types, examples and uses of Application software</li> <li>launch some Application software</li> </ul>	<p>Types of Operating Systems such as DOS, Windows, (windows 98, 2000, ME, XP) Linux, Unix, Macintosh etc.</p> <p>Differences between Open Source and Proprietary Software</p> <p>Types, examples and uses of Application software e.g.</p> <p>-Word-processing: WORD and Star Word, Writer</p> <p>-spreadsheets: EXCEL, Lotus 123, Calc-Databases: Access, Base</p> <p>-Presentation: PowerPoint, Impress</p> <p>-Educational: Microsoft Encarta, Mavis Beacon</p> <p>-Games: solitaire, pinball</p> <p>-Browsers: Opera, Internet explorer, Mozilla Firefox</p>	<p>Discuss the types of software packages</p> <p>In groups students discuss and distinguish between Open Source and Proprietary Operating Systems</p> <p>Discuss type, examples and uses of Application software.</p> <p>Uses Word Processing - document creation</p> <p>Database - Storing, sorting and retrieving large amount of data</p> <p>Presentation: presenting information in a number of attractive format etc</p> <p>Assist students to practice how to launch Applications</p>	<p><b>Exercise:</b></p> <p>1. State the principles underlying: Open Source and Proprietary Software</p>



		-Authoring: Dreamweaver, FrontPage, -Graphics: Corel Draw, -Desktop Publisher - Page Maker, Publisher Launching Application software; e.g. -Word Processor -Spreadsheet -browser, -Internet Explorer		
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### SECTION THREE TYPING SPEED DEVELOPMENT

**General Objective:** The Trainee will:

1. improve typing speed

UNIT	Specific Goals	Details	Learning medium	Assessment
UNIT 1 Keyboarding and mouse skills review	The pupil will be able to: <ul style="list-style-type: none"> <li>• type 30 - 35 words per minute</li> <li>• use mouse skills in document creation</li> <li>• use the numeric keypad</li> </ul>	Improving speed in typing using a typing software: e.g. Typing Tutor or Mavis Beacon Using mouse skills in document creation. Using the numeric keypad	software to improve upon their speed <b>NOTE:</b> Teacher should insist on the use of the nine fingers in typing. Guide students to practice mouse skills e.g. Single clicking, Double clicking, Right click, Drag hold and drop in document creation. Assist students to use the numeric keypad. Let students use the drills in Typing Tutor or Mavis Beacon to do more practice on the numeric keypad	<b>Exercise:</b> Students to create and reproduce a given document involving alpha and numeric keypad

## Course-2

### SECTION ONE WORD PROCESSING APPLICATION

**General Objectives** The Trainee will:

1. acquire basic skills creating document in Word Processing

Unit	Specific Goals	Details	Learning medium	Assessment
UNIT 1 Word processing	The student will be able to : <ul style="list-style-type: none"> <li>• identify Word Processing package</li> <li>• state the importance and use of</li> </ul>	Word Processing Package and their uses e.g. -Microsoft Word -Writer -WordPad -Text Editor -Star Word	Letters, memos, reports Guide students to discuss and come out with the importance of Word Processing. Student to type a passage using Word Processor Student to save the typed document using the - Save As -	<b>Exercise:</b> Students to type a letter using name and save in a folder

**Commented [t1]:** Add networking



	<p>Word Processing.</p> <ul style="list-style-type: none"> <li>Create a document using the Word Processor</li> <li>Save a document using the - Save As - command</li> </ul>	<p>Importance of Word Processing</p> <p>Creating document using a Word Processor</p> <p>Saving document using the -Save As command</p>	command	
UNIT 2 Editing text in word processing document	<p>The students will be able to;</p> <ul style="list-style-type: none"> <li>edit, and save Word document using editing tools</li> </ul>	<p>Editing Word document using the following editing Tools;</p> <ul style="list-style-type: none"> <li>-Spell check functions</li> <li>-copy/cut and paste facilities</li> <li>-OVR</li> <li>-undo and redo keys</li> <li>-search and replace)</li> </ul>	<p>Students to type a given document, edit, and save using the given editing and formatting tools.</p> <p>NOTE: Teacher should stress on saving document when working to avoid losing document when power goes off</p>	<p><b>Exercise:</b> Students to edit a given Word document and save.</p>
UNIT 3 Formatting word processing document	<ul style="list-style-type: none"> <li>format Word document using formatting tools</li> </ul>	<p>Formatting and saving a Word document using the formatting tools:</p> <ul style="list-style-type: none"> <li>-Change font (style, size, colour etc)</li> <li>-Text alignment</li> <li>-Numbers and bulleting</li> <li>-Bold</li> <li>-Underline</li> <li>-Italics</li> <li>-Line spacing</li> <li>-Change case</li> </ul>	<p>Students open an existing document format and save using the given formatting tools.</p>	<p><b>Exercise:</b> Students to format a given Word document and save.</p>
UNIT 3 Inserting tables and symbols in word processing document	<p>The students will be able to;</p> <ul style="list-style-type: none"> <li>insert tables in Word Processing document</li> <li>insert symbols and pictures in Word Processing documents</li> </ul>	<p>Inserting tables in Word document</p> <p>Inserting symbols and pictures in Word document</p>	<p>Guide students to practice working with tables in Word document</p> <p>Guide students to insert symbols and pictures</p>	
UNIT 4 Printing	<ul style="list-style-type: none"> <li>print documents using various print options</li> </ul>	<p>Printing Word documents with various print options</p>	<p>Guide students to:</p> <ul style="list-style-type: none"> <li>-preview documents</li> <li>-print documents with various options e.g. Page range, No. of copies, Collate</li> </ul> <p>Assist students to develop a simple brochure for the school using all the</p>	<p><b>Assignment:</b> Assign students to create document inserting tables, symbols, pictures, save and print</p>



		features they have learned	
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## SECTION TWO THE INTERNET

General objectives: The Trainee will

1. Acquire skills in, and appreciate the importance of using the internet.

UNIT	Specific Goals	Details	Learning medium	Assessment
UNIT 1 The internet	<p>The students will be able to;</p> <ul style="list-style-type: none"> <li>• explain basic concepts, requirements and terminologies of internet.</li> <li>• identify the features of browser window</li> </ul> <p>The student will be able to;</p> <p>2.1.3 browse the internet with the help of some features of the Browser window</p> <p>2.1.4 apply the rules and regulations in the use of the internet</p>	<p>Concept, requirements and terminologies</p> <ul style="list-style-type: none"> <li>-chats</li> <li>-discussions boards</li> <li>-synchronous and asynchronous</li> <li>-www (world wide web)</li> <li>-html (hypertext Markup Language)</li> <li>-http (hypertext transfer protocol)</li> <li>-ftp (file transfer protocol),</li> <li>-URL (Uniform Resource Locator)</li> <li>-IP (Internet Protocol)</li> <li>-Email</li> <li>-TCP(Transmission Control Protocol)</li> <li>-Search engines</li> <li>-Blogs</li> <li>-Listservs etc</li> </ul> <p>Features and use of browser window:</p> <ul style="list-style-type: none"> <li>-Address bar</li> <li>-History</li> <li>-Bookmarks/Favorites</li> <li>-Standard bar etc.</li> </ul> <p>Browsing the internet with the help of some features of browser window e.g.</p> <ul style="list-style-type: none"> <li>-address, standard and formatting bars, URLs</li> <li>-Rules and regulations in the use of internet (Netiquette)</li> <li>- spam- unsolicited mails, people's privacy, pornography, intellectual property rights etc</li> </ul>	<p>Discuss World Wide Web (www) and other internet protocols, including:</p> <ul style="list-style-type: none"> <li>-definitions of related terms</li> <li>-how the internet functions</li> <li>-requirement for internet connectivity e.g. internet Service Provider (ISP), Browser, Identify and discuss the features of the browser window.</li> </ul> <p>Assist students to browse the internet with the help of the features of the Browser window</p> <p>In groups, students brainstorm to come out with rules and regulations for responsible use of the internet for class discussion</p> <p><b>NOTE:</b> Teacher should emphasize on the need for students to desist from visiting pornographic site and intruding on people's privacy</p>	
UNIT 2 Using the internet to communicate	<ul style="list-style-type: none"> <li>• 2.2.1 send and access e-mail messages with attachments</li> <li>• use internet to</li> </ul>	<p>Sending, accessing e-mail messages</p> <p>with attachments</p> <p>Using internet to chat</p>	<p>Revise with students how to create an e-mail account</p> <p>Revise with students how to compose, and edit an e-mail</p>	<p><b>Exercise:</b> Students to access and print email</p>



e	chat		message with emphasis on spell check Guide students to send and receive e-mail messages with attachments Guide students to chat in the classroom using the internet	attachment
UNIT 3 Accessing information from the internet	The student will be able to; 2.3.1 Use Uniform Resource Locators (URLs) and Search Engines to access Information <ul style="list-style-type: none"> <li>download information from the internet</li> <li>access copy and paste information from internet to a different Application e.g. Word Processing</li> </ul>	Using Uniform Resource Locators (URLs) and Search Engines to access information Downloading information from the internet Accessing, copying and pasting information from internet to a different Application e.g. Word	<ul style="list-style-type: none"> <li>Guide students to use URLs and</li> <li>Search Engines to access Information</li> <li>Assist students to download information from the internet</li> <li>Guide students to access, copy and paste information from the internet to a different Application e.g. Word</li> </ul>	<b>Exercise:</b> Student to access information on a given topic using URLs and Search Engines <b>Exercise:</b> Student to prepare Word document using the information accessed from the internet

### Course-3

#### SECTION ONE SPREADSHEET APPLICATION

**General Objectives:** The Trainee will:

1. Acquire basic skills in using Spreadsheet packages
2. Appreciate the importance of spreadsheet in data management

UNIT	Specific Goals	Details	Learning medium	Assessment
UNIT 1 Spreadsheet	The student will be able to; <ul style="list-style-type: none"> <li>identify Spreadsheet Packages</li> <li>explain related concepts and terminologies</li> <li>identify features in Spreadsheet window</li> <li>identify types</li> </ul>	Spreadsheet packages e.g. Excel, Quatropro, Lotus 123, Linux Related concepts and terminologies e.g. -cell -rows, -columns, -worksheet, -workbook, Features in the Spreadsheet window tool bars:	Discuss Spreadsheet Packages listed in the content. Discuss related concepts and terminologies Guide students to identify features of Spreadsheet window. Identity types of data and state their uses  Demonstrate how to launch and exit. Spreadsheet Application.	<b>Exercise:</b> Students to label the features of a printed workbook NB: Teacher to capture a workbook, print and give to students to label.  Students to enter a given data and do the following: <ul style="list-style-type: none"> <li>- Find averages</li> <li>- Percentages</li> </ul>



	<p>of data and state their uses The student will be able to;</p> <ul style="list-style-type: none"> <li>• launch and exit Spreadsheet Application</li> <li>• create and save Workbook</li> <li>• construct and insert simple formula</li> </ul>	<p>-formatting bar -standard bar -formulae bar -help facilities, etc Types of data and their uses e.g. -number -date -text -currency -fraction Launching and exit Spreadsheet Application Creating and saving workbook Constructing and inserting simple formula</p>	<p>Guide students to launch and exist. Spreadsheet Application. Guide student to create and save workbook. Demonstrate and guide students on how to construct and apply a simple formula.</p>	
UNIT 2 Application of selected formula and functions	<ul style="list-style-type: none"> <li>• use functions common to arithmetic applications e.g. percentages, averages, count, maximum, minimum for simple calculation</li> <li>• format worksheet</li> </ul>	<p>Using functions common to arithmetic applications</p>	<p>Assign students to use functions common to arithmetic applications. NOTE: Teacher should focus on the 4 operational signs - addition, subtraction, multiplication and division.</p>	
UNIT 3 Formatting worksheet	<ul style="list-style-type: none"> <li>• format worksheet</li> </ul>	<p>Formatting worksheet - Change: column width row height -Insert: rows, columns, cells -Delete: rows, columns, cells -Merge cells -Merge and centre -Text wrap -Cell alignment etc.</p>	<p>Demonstrate how to format a worksheet by changing column, width and row height for students to practice. Assist students to insert and delete rows, columns and cells Assist students to create their own worksheet and format by inserting, deleting and merging. Assist students to merge and centre data in rows and columns.</p>	<p><b>Exercise:</b> Students to create their own worksheet and format by inserting, deleting, merging,</p>
UNIT 4 Editing worksheet	<p>The student will be able to;</p> <ul style="list-style-type: none"> <li>• Demonstrate skills in editing and printing a worksheet.</li> </ul>	<p>Editing and printing worksheet: -check spelling -preview the layout -review page breaks -change page setup and sheet</p>	<p>Guide students to edit and print worksheet by - checking spelling - reviewing layout - reviewing page breaks - changing page setup and</p>	<p><b>Exercise:</b> Students to work on a given data by doing the following: Check - Spelling - Preview the</p>



		settings -set print options	sheet settings	Layout - Review Page Breaks - Change page setup and sheet settings
UNIT 5 Printing worksheet	<ul style="list-style-type: none"> <li>demonstrate skills in previewing and printing a worksheet</li> </ul>	Previewing and changing print settings	Assist students to set print options and print worksheet	Students to print data making use of the features in the print window, e.g. print settings, colour options, number of copies to print, selecting a printer

## SECTION TWO PROJECT WORK

**General Objectives:** The Trainee will:

1. apply internet and Word Processing skills to produce a document

UNIT	Specific Goals	Details	Learning medium	Assessment
UNIT 1 Project work - research report	<p>The student will be able to:</p> <ul style="list-style-type: none"> <li>search for information on the internet</li> <li>copy, paste and save information from the web onto a Word Processing document</li> <li>Format and edit the information using format and editing tools.</li> <li>4 share the information by attaching it to e-mail message</li> <li>Access attached information and print</li> </ul>	<p>Searching information from the internet</p> <p>Copying, pasting and saving information from the web onto Word Processing document.</p> <p>Formatting and editing information.</p> <p>Sharing information through e-mail Attachment.</p> <p>Accessing the printing attachment.</p>	<p>Select two topics from each of the Core Subjects for students to search for information.</p> <p>Students to copy relevant information, paste and save in Word Processing document</p> <p>Students to format, edit and save information - e.g. bold main headings, underline sub headings, aligning text etc.</p> <p>Students to send the information to friends as an attachment</p> <p>Students to access and print their own documents and those of their friends.</p>	<p>Students to produce two documents for assessment</p> <p>Document 1: Research report.</p> <p>Document 2: Attachment from friends</p>





### ***C. Cyber Security and Network Security***

Suggested Textbook: Moore, Robert. (2011). *Cybercrime: Investigating High-Technology Computer Crime*. Cincinnati: Anderson. ISBN: 978-1-4377-5582-4. Note: this is a NEW book adoption starting the spring terms of 2011.

#### **COURSE DESIGNATION: CRJ 3100 Network Security (3 semester hours)**

**COURSE DESCRIPTION AND PREREQUISITES:** This course involves an intense examination of network security defense techniques and countermeasures with defense fundamentals explained in great detail. Topics include network defense techniques such as designing firewall systems and IDS, configuring firewalls, VPNs, Trojan port numbers, and security related RFCs. (no prerequisites)

#### **COURSE OBJECTIVES:**

1. To acquire an understanding of network security and its changing character
2. To understand how network security is conceptualized and carried out
3. To examine the historical evolution of network security
4. To analyze both early and contemporary threats to network security
5. To articulate informed opinion about issues related to network security
6. To identify and investigate threats to network security
7. To appreciate the challenges of network security

#### **GENERAL EDUCATION GOALS:**

In addition to the above objectives, the more general goals of this course are to provide the trainee with the following tools to help develop his or her potential:

1. Development of the trainee's analytical thinking capabilities through comparison and contrast in the application of theories and concepts to social problems
2. Enhancement of the trainee's literacy skills through assigned readings, discussions, examinations, and other requirements
3. Utilization of the historical perspective which helps with trainee understanding of evolutionary developments over time
4. Understanding of the scientific method through research requirements and in-depth case studies
5. Improvement in social interaction skills and understanding human behavior through consideration of the impact legal and social systems has on individuals
6. Increased trainee awareness of cultural and multi-cultural issues through study of how social problems and social movements are related to, and affect, minority groups
7. Preparation for more advanced study in criminal justice/homeland security



## CONTENT OUTLINE:

Week 1:

1	Network Security Overview
2	Introduction to Critical Infrastructure Protection (from Managing Incidents course)

Week 2:

3	Risk Analysis Theory and Practice
4	Eavesdropping and Wiretapping (from Con Law course)
5	Informants and Surveillance

Week 3:

6	Cyber Crime and Cyber Criminals
7	Privacy and Cyberspace Law (from Con Law course)
8	Privacy and Information Operations

Week 4:

9	The Modus Operandi of Hacking
10	Cyber terrorism and Cyber vigilantism
11	Cyber terrorism Threat Spectrum (from Terror Understanding course)
12	Algorithm Security

Week 5:

12	Algorithm Security
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Week 6:

13	Application Software Security Land-Based Networks
14	Application Software Security Wireless Networks
15	Systems Software Security

Week 7:

16	Intrusion Detection, Incident Response, and Integrity Control
17	Malware, Spyware, Risk ware, and Spam
18	Identity Theft and Consumer Profiling (from WCC course)

Week 8:



16	Disaster Data Recovery and Computer Forensics
17	Advanced Digital Forensics

#### **REQUIRED LEARNING RESOURCES:**

Main Textbook/Required Textbook: Moore, Robert. (2011). Cybercrime: Investigating High-Technology Computer Crime. Cincinnati: Anderson. ISBN: 978-1-4377-5582-4

Supplemental Reference: American Psychological Association. (1994). Publication Manual of the American Psychological Association, 5e. Washington DC: APA. Note: trainees do not have to buy this book, but should have access to it or something similar in order to utilize the correct style or format with writing assignments.

#### **COURSE REQUIREMENTS:**

Trainees are expected to read and follow the schedule in the course syllabus, to read assigned text chapters, to read assigned Lecture Notes, and to seek and read additional suggested resources as provided by the textbook and Instructor. In addition, trainees are expected to be alert and attentive with note taking in class and have a demonstrated desire to participate in any discussion. Exams are to be completed within the deadlines given by the Instructor, and any special instructions for the paper and/or writing assignment(s) are to be followed precisely. The Instructor will announce all deadlines and instructions as well as provide reminders about the pace or flow of the course.

*Acknowledgement for [www.drtoconnor.com](http://www.drtoconnor.com) Syllabus contribution*



#### ***D. ICT Bridging Program possible components***

Based on the findings by the study team the main areas where the ICT – Bridge could focus is the following:

Area of focus	Curriculum definition
Small business networking	<p>Small business networking system is an ICT feature that enables small businesses manages their data and customers. Many businesses now reach out to their customers by using their databases and networking system. Networking also helps small businesses to communicate and share data within the small business workers. The small business networking can be as simple as a home based or small business data sharing or be as complex as Oracle database.</p> <p>The graduate of the ICT –Bridget will receive hands on skills to develop and manage the networking systems.</p>
Oracle solutions	<p>Oracle database is an organized collection of data.</p> <p>Some databases have minimal feature sets and only store data, while others include programming languages, facilities and utilities to support enterprise-level applications like ERP and data warehousing. Oracle is the #1 database and has the most advanced feature set.</p> <p>Developing and managing Oracle applications will find new markets in the next 2 to 5 years.</p> <p>Some of Oracle's tools to access the database and create programs are:</p> <ul style="list-style-type: none"> <li>• SQL*Plus has a command line interface.</li> <li>• HTML DB – an application builder geared toward web development</li> <li>• Oracle Enterprise Manager (OEM) is the Enterprise GUI tool to manage the database.</li> </ul> <p>By: Lewis C. From article:  <a href="http://www.suite101.com/welcome.cfm/oracle">http://www.suite101.com/welcome.cfm/oracle</a>.</p>
Data recovery	<p>Data recovery is the retrieval of inaccessible or contaminated data from media that has been damaged in some way. Data recovery is being increasingly used and is an important process nowadays.</p> <p>Many public entities, private businesses, hospitals, stock markets, and human resources entities rely on their servers, networks and data banks. Many use web based data sharing that require security and data recovery support. Php and MySql use has been on the rise on the Internet. Database failure is not uncommon and so it is not a fail proof method of storing information.</p> <p>There can be several causes of data loss.</p> <ul style="list-style-type: none"> <li>• Data loss can occur from unexpected incidences including national tragedies such as floods and earthquakes.</li> <li>• Often power failure can cause loss of data from hard drives. Sudden power surges can also cause a lot of damage to a computer's hard drive.</li> <li>• Accidentally deleting a file or formatting a hard drives is a</li> </ul>



	<p>common reason for data loss.</p> <ul style="list-style-type: none"> <li>• Attacks on the data servers</li> </ul> <p>ICT skills in data recovery are the current market demand and it will rise in the upcoming years.</p>
Cyber security	<p>Cyber security is a technical measure in ICT to enable organizations to practice safe security techniques to minimize the number of successful cyber security attacks. Cyber security guides provide general outlines as well as specific techniques for implementing cyber security. For certain specific standards, cyber security certification by an accredited body can be obtained. There are many advantages to obtaining certification including the ability to get cyber security insurance. Cyber security protects individual and organizational identity and intellectual property. Cyber security services are becoming more important in the ICT sector. Smart cyber security measures can only be ensured with individuals knowing the cyber security concepts, standards and techniques.</p>
Web applications	<p>We help clients achieve their goals by creating and integrating practical yet innovative tools that deliver core e-business functionality. Examples of web applications include employment portals, warehouse management applications, human resources applications, online communities, dynamic web sites, database applications, and e-commerce storefronts.</p> <p>Content Management (CMS) :</p> <p>Selecting and implementing a Content Management System (CMS) can be a challenging process. CMS projects cross departments and often impact a quite a few peoples' day-to-day responsibilities.</p> <p>In brief, Content Management Systems should:</p> <ul style="list-style-type: none"> <li>Remove publishing bottlenecks</li> <li>Automate workflow &amp; content lifecycles</li> <li>Enforce design &amp; metadata standards</li> <li>Centralize information &amp; media assets</li> <li>Reduce content managers' dependency on the IT department</li> <li>Software Selection</li> </ul> <p>Some of CMS include: Sitecore, SharePoint (MOSS), Ektron, Drupal and eZ Publish.</p>
Database development and management	<p>E-Database Technology has proven experience developing Intranet solutions ranging from interface design and usability testing, small/static intranets and large application driven corporate Intranets.</p> <p><u>Complete Intranet Solutions:</u></p> <p>Complete Intranet solutions include project management systems, document management systems, interactive calendars, contacts databases and billing systems.</p> <p><u>Extranet Development Services:</u></p> <p>Our extranet solutions enable users to establish and maintain powerful relationships with their customers and business partners. This</p>



	<p>relationship is facilitated via a secure, password protected area the customer can access to perform any number of interactions.</p> <p>Business-to-Business (B2B) Extranets: Provides business partners access to sensitive information or the ability to track sales and purchase goods.</p>
E - portal development and management	<p>Web portal development and maintenance involves wider area of functions and is evolving as a core component for the software architecture. Web portal developmental services cover all major areas like user interface, content delivery and management, value-added web services, and end-to-end portal management. Major types of web portal are:</p> <ul style="list-style-type: none"><li>➤ Social community web portals<ul style="list-style-type: none"><li>• Blogging portals</li></ul></li><li>➤ Enterprise Content Management<ul style="list-style-type: none"><li>• Web content management</li><li>• Document management</li></ul></li><li>➤ Enterprise Information Portals<ul style="list-style-type: none"><li>• Knowledge portals</li><li>• ERP and CRM enterprise portals</li></ul></li><li>➤ E-Commerce solutions portals<ul style="list-style-type: none"><li>• B2C and B2B portals</li><li>• Supply management/Order management</li></ul></li><li>➤ E-Commerce portal development and implementation<ul style="list-style-type: none"><li>• Web design</li><li>• Back-end and database development</li><li>• Shopping cart development and modification</li><li>• Payment gateway integration</li><li>• Administration of store front</li><li>• Security implementation</li><li>• Integration of inventory module</li><li>• Generation of report and statistics</li></ul></li></ul>



Program No.	ICT in the workplace program (for 1000 attendees)				
No	Scope of work	Unit	Quantity	Unit Price	Total
1	Curriculum development	L/S	1	\$20,000.00	\$20,000.00
2	Workshops	\$	2880	\$120.00	\$345,600.00
3	Trainee recruitment program	\$	1920	\$25.00	\$48,000.00
4	ICT Equipment	\$	20	\$1,700.00	\$34,000.00
5	Publicity and marketing	L/S	5		\$20,000.00
6	Certification and incentives	L/S			\$15,000.00
7	Program management	\$	5760	\$20.00	\$115,200.00
8	Administration	\$	1700	\$15.00	\$25,500.00
9	Monitoring	\$	480	\$25.00	\$12,000.00
10	Auditing	\$	480	\$25.00	\$12,000.00
	Sub total	\$			\$639,800.00
	Inflation provision @ 5%	\$			\$31,990.00
	Contingency @ 5%	\$			\$31,990.00
	Total				\$703,780.00

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No	Scope of Work	Program No.8				National ICT University				
		Unit	Quantity	Unit Price	Total	Month 1	Month 2	Month 3	Month 4	Month 5
1	Curriculum development	L/S	1	\$20,000.00	\$20,000.00					
2	Academic programs	\$	4920	\$20.00	\$98,400.00					
3	Trainee recruitment	\$	1920	\$25.00	\$48,000.00					
4	ICT Equipment	\$	50	\$1,000.00	\$50,000.00					
5	Internet and lab	L/S	1	\$100,000.00	\$100,000.00					
6	Publicity and marketing	L/S	1	\$25,000.00	\$25,000.00					
7	Training	L/S	1	\$20,000.00	\$20,000.00					
8	Certification	L/S	1	\$10,000.00	\$10,000.00					
9	Program management		5760	\$20.00	\$115,200.00					
10	Administration	\$	1200	\$15.00	\$18,000.00					
11	Monitoring	\$	480	\$25.00	\$12,000.00					
12	Auditing		480	\$25.00	\$12,000.00					
Sub total					\$948,600.00					
Initiation provision @ 5%					\$47,430.00					
Contingency @ 5%					\$47,430.00					
Total					\$1,043,460.00					

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Program No.14		In Country ICT Masters Program (20 graduate spots)			
No	Scope of work	Unit	Quantity	Unit Price	Total
1	Curriculum development	L/S	1	\$40,000.00	\$40,000.00
2	Program Design	L/S	1	\$50,000.00	\$50,000.00
3	Academics	\$	6	\$60,000.00	\$360,000.00
4	Master program entrance	\$	960	\$25.00	\$24,000.00
5	ICT Equipment	\$	40	\$1,000.00	\$40,000.00
6	Publicity and marketing	L/S	1	\$20,000.00	\$20,000.00
7	Training	L/S	1	\$25,000.00	\$25,000.00
8	Program management	\$	1920	\$20.00	\$38,400.00
9	Administration	\$	1200	\$15.00	\$18,000.00
10	Monitoring	\$	480	\$25.00	\$12,000.00
11	Auditing	\$	480	\$25.00	\$12,000.00
	Sub total	\$			\$639,400.00
	Inflation provision @ 5%	\$			\$31,970.00
	Contingency @ 5%	\$			\$31,970.00
	Total	\$			\$703,340.00





## ANNEX No3: ICT users and workers' growth Matrix



Customers																
	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017
Cellular (GSM)	100,000.00	200,000.00	700,000.00	3,000,000.00	4,500,000.00	6,000,000.00	8,000,000.00	10,500,000.00	11,500,000.00	14,000,000.00	15,000,000.00	17,000,000.00	19,000,000.00	22,000,000.00	25,000,000.00	28,000,000.00
Internet	5,000.00	15,000.00	180,000.00	220,000.00	250,000.00	300,000.00	500,000.00	750,000.00	1,500,000.00	2,245,000.00	3,500,000.00	4,000,000.00	4,500,000.00	5,000,000.00	5,500,000.00	6,000,000.00
Social networking	0.00	0.00	10,000.00	200,000.00	390,000.00	580,000.00	770,000.00	1,500,000.00	200,000.00	300,000.00	500,000.00	700,000.00	900,000.00	1,100,000.00	1,300,000.00	1,500,000.00
Vendors (computer equipments/electronics sales)	10,000.00	15,000.00	40,000.00	48,000.00	105,000.00	125,000.00	222,000.00	325,000.00	345,000.00	365,000.00	456,250.00	570,312.50	712,890.63	891,113.28	1,113,281.13	1,386,604.66
New Media (multimedia/graphic design)	500.00	2,500.00	5,000.00	7,000.00	8,500.00	10,000.00	12,000.00	15,000.00	18,000.00	20,000.00	23,000.00	28,750.00	33,065.50	38,021.88	43,078.05	48,034.22
Total users	115,500.00	267,500.00	935,000.00	3,475,000.00	5,253,500.00	7,015,000.00	9,594,000.00	11,740,000.00	13,543,000.00	16,930,000.00	19,479,250.00	22,299,062.50	25,145,953.13	30,029,135.16	35,926,113.91	42,822,719.95
Realtime Customers ( Realtime customers are the actual projected users of services)																
Cellular	100,000.00	200,000.00	700,000.00	3,000,000.00	4,500,000.00	6,000,000.00	8,000,000.00	10,500,000.00	11,500,000.00	14,000,000.00	15,000,000.00	17,000,000.00	19,000,000.00	22,000,000.00	25,000,000.00	28,000,000.00
Internet	28,750.00	375,000.00	360,000.00	440,000.00	450,000.00	540,000.00	900,000.00	1,350,000.00	2,700,000.00	3,367,500.00	5,250,000.00	6,000,000.00	6,750,000.00	7,500,000.00	8,250,000.00	9,000,000.00
Social networking	0.00	0.00	10,000.00	200,000.00	390,000.00	580,000.00	770,000.00	1,500,000.00	200,000.00	300,000.00	500,000.00	700,000.00	900,000.00	1,100,000.00	1,300,000.00	1,500,000.00
Vendors (computer equipments/electronics sales)	10,000.00	15,000.00	40,000.00	48,000.00	105,000.00	125,000.00	222,000.00	325,000.00	345,000.00	365,000.00	456,250.00	570,312.50	712,890.63	891,113.28	1,113,281.13	1,386,604.66
Social networking	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30,000.00	50,000.00	50,000.00	1,000,000.00	1,400,000.00	1,800,000.00	2,200,000.00	2,600,000.00	3,000,000.00
Total realtime users	138,750.00	590,000.00	1,110,000.00	3,668,000.00	4,695,000.00	5,245,000.00	7,225,000.00	8,855,000.00	10,961,666.67	13,865,833.33	17,206,250.00	20,003,458.33	22,829,557.29	27,857,779.95	33,887,959.95	39,912,319.95
ICT Employee growth																
Cellular	2,000.00	10,000.00	18,000.00	25,000.00	32,000.00	40,000.00	55,000.00	70,000.00	80,000.00	104,000.00	135,200.00	175,760.00	224,488.00	297,034.40	389,377.60	500,000.00
Internet	50.00	750.00	720.00	880.00	900.00	1,080.00	1,800.00	2,700.00	5,400.00	6,735.00	10,500.00	12,000.00	13,500.00	15,000.00	16,500.00	18,000.00
Social networking	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vendors (computer equipments/electronics sales)	80.00	120.00	320.00	384.00	840.00	1,000.00	1,776.00	2,600.00	2,760.00	2,920.00	3,650.00	4,562.50	5,703.13	7,128.91	8,911.33	11,132.81
Social networking	0.00	0.00	0.00	0.00	0.00	0.00	0.00	30,000.00	50,000.00	50,000.00	1,000,000.00	1,400,000.00	1,800,000.00	2,200,000.00	2,600,000.00	3,000,000.00
Total realtime users	2,130.00	10,870.00	19,040.00	26,264.00	33,740.00	42,080.00	58,576.00	75,300.00	88,960.00	103,655.00	149,350.00	193,322.50	247,691.13	312,163.31	395,881.91	518,000.00