



## Comparative Study: The Palestinian Education System vs. The Needs of the Private ICT Sector



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## EXECUTIVE SUMMARY

To enhance and continue PITA and Paltel Group Foundation for Community Development work with global organizations, which recognize the value of leveraging of Palestine's greatest asset: its people, this study was made. Given today's technology, access to the global, social Internet, an entrepreneurial culture and Palestine's strategic location in the Middle East makes it an ideal location for innovation. The Study aimed to investigate the reality in linking between ICT Private sector needs and Palestinian education systems, through several aspects in: determining the size of gap between both Demand & Supply sides, determine type of ICT skills that need focus to recover the gap, determine the roles of education systems and activities of ICT graduates to meet needs and enhance their contribution in the ICT private sector.

A series of interviews and focus groups have been carried out with ICT targeted elements to study and identify this gap including; ICT regional experts, ICT university members, ICT students, ICT and Non ICT companies. The main findings can be summarized as follows:

- There is a significant gap between the Palestinian ICT education system and the needs of ICT market. This gap has been pointed out by the ICT targeted elements according to their respective fields.
- An information gap has been identified in relation to the ICT careers; a significant part of the students don't know their potential opportunities after graduation.
- There is a slight improvement in soft skills courses in the last few years. However, it is still far from the international universities such as; Stanford and Cambridge.
- Most Palestinian universities don't have a clear and robust plan for practical training toward ICT students and graduates. Therefore, the quality of the training is divergent and difficult to measure.
- The education system in developing countries universities concentrates on practical and effective learning, core-customized technology courses and interactive learning while the education in Palestine still depends on memorization and old-style teaching methods.

- Universities cannot guarantee employment for their graduates without collaboration with the employers in the ICT sector. The students themselves have to make the effort to learn and acquire the knowledge and skills within an enabling environment.
- Government input is required to ensure the policy structure and economic conditions are favorable for employment opportunities in the ICT industry.



## INTRODUCTION

The ICT sector plays a vital role in the Palestinian economy, and is seen as one of the fastest growing sectors. More than 2000 students graduate from higher education institutions every year.

The new growth in the Palestinian ICT sector has created a new demand for well-trained ICT professionals. Palestinian companies are demanding a great number of software developers, architects, and engineers who can meet the requirements of the market. The need for skillful and talented workforce has been identified as one of the most critical issues that need to be tackled. PITA and Paltel will be fulfilling this need by enhancing the practical experience, critical thinking, and self-learning skills of ICT graduates. Subsequently, graduates are becoming qualified enough to speak and add value to the international hi-tech language.

Technological progress is a considerable driving force behind economic growth and job creation. Information and communication technologies (ICTs), in particular, are reshaping many aspects of the world's economies, governments, and societies. In developing countries, governments, businesses and people are harnessing the transformative power of ICTs to make public services more efficient, to grow businesses, and to strengthen and expand social networks. More than 75 percent of the world's inhabitants now have access to a cell phone, with the number of mobile-cellular subscriptions approaching 7 billion globally at the end of 2013. New services and industries are emerging. In Tanzania, for example, mobile money agents now outnumber all other financial intermediaries by ten to one. Over half of those living on less than \$2 a day in that country have access to mobile technology.

## 1. SCOPE OF STUDY AND AREAS OF INTERVENTION

### 1.1. Study Objective

The study aims at gaining a depth understanding of the Palestinian education system against the Needs of the Private ICT Sector in the West Bank and Gaza.

It also seeks to gain insights on the labor market needs as a tool for forecasting of employment related data of labor market sector, particularly for developing jobs opportunities within the ICT sector in West Bank and Gaza.

**The study scope** is structured in several specific phases that constitute the study specific objectives as:

1. Research design.
2. Design of data collection tools.
3. Data collection.
4. Data Analysis.
5. Gap Analysis.
6. Write-up.
7. Benchmarking.

## 1.2. STUDY FRAMEWORK

### 1.2.1. Research Methodology

Analytical approach was used in the study of linking between education systems and needs of ICT private sector in Palestine, through scanning of the market and interviews of all stakeholders in order to achieve objectives of research.

This conceptual research type validation was heavily aimed at having an accurate and certain results, to have evidence-based information that have clearly represented the five segments of focus; ICT companies, non ICT organizations, ICT professionals, universities and ICT students and graduates with as minimum as possible statistical deviation.

The kind of approach has been undertaken through the participatory-based multi-methods of data collection, or the multi-methodological tools, based on the triangulation through checking a set of data through another stemmed from various perspectives and sources of information, adopting a flexible approach that combines qualitative, cross checking and validation.

**The research type** is objective-oriented descriptive/qualitative research.

The research kind of approach has been undertaken through the following multi-methods:

- Desk/literature review.
- Survey method adopting online/mail survey and offline semi-structured interviews, telephone calls.
- Focus group discussions.

The participatory approach fosters the effective interact and engagement of the various under-study sectors' organizations, as a powerful data collection/sampling method to guarantee validation and the ownership of the result and the emerging recommendations and action points.

Under such methodology, different tasks and different methods were conducted to achieve the qualitative research in alignment with the following scope:

### 1.2.2. Research Scope and Methods

#### 1.2.2.1. Data Collection

Collecting data around the indicators associated with the five segments of focus.

## **First Stage**

Reviewed the various key issues associated with ICT private sector needs as demand side and the Palestinian ICT education system in the West Bank and Gaza.

The review has looked at these issues and validated additional regional patterns as key components and indicators where the outputs were used to help frame the questionnaires and discussion guides for Stages 2 and 3 and were an integral part of the Gap Analysis in Stage 3.

## **Second Stage**

### **1. The Research**

This stage reviews the under-study issues, their current position, the opportunities and threats. A number of variables have been looked at and evaluated.

### **2. Phase I: Secondary Data - Desk Research “Literature Review”**

In this phase, existing information were used to review the main areas of focus, evaluate them for, and mapping them to the preset and finally tune the questionnaires and discussion guides themes emerged from stage I.

This work was carried out by using desk research, to be later supported by qualitative research. Additionally key representatives of the various 5 segments study population were identified for further discussions (through interviews).

### **3. Phase II: Primary Data - Qualitative Research Design**

Open-ended qualitative questionnaires for semi-structured interviews relevant to the 5 study segments population as well as focus group discussion guides weredesigned from the information collected in Phase 1 as well as taking inputs from the scanning work.

These were used in a series of direct face to face interviews and focus group discussions with an agreed upon blend of targeted key informants.

### **4. Phase III: Assembling and compilation**

All the information collected in the research was compiled and a detailed set of findings and conclusions produced.

#### 1.2.2.2. Data Analysis

##### **Third Stage:**

##### **1. Phase I: Issues Review**

Analyzing the information around the indicators of the five areas of focus; the findings and conclusions were analyzed and compared to provide a detailed view of the relationships between these five areas (qualitative analysis) with a view to understanding the overall current position of the under-study issues. It has also positioned the recommended solutions and interventions in regard to the trends and environmental context in Palestine.

##### **2. Phase II: GAP Analysis**

As a result of the Issues Review, a GAP analysis has been carried out to identify the development requirements of the Palestinian educational system against the ICT private sector needs.

##### **3. Phase III: Conclusions and Recommendations**

From the GAP analysis, a number of realistic and actionable conclusions and recommendations were made to addressing the ICT private sectors needs in terms of ICT labor qualities, specializations and skills shortages and accordingly provide serious actionable recommendations to the ICT Palestinian educational sector in order to bridge the gap.

#### 1.2.2.3. Study Population

##### **Design Sample Population**

Population of the study consist of all parts or stakeholders on linking between education systems and needs of ICT private sector, which include (ICT & Non-ICT Companies, Students, Universities and ICT Experts in MENA region) the sample took in each side according to what has been agreed upon with PITA (40% Gaza & 60% West Bank):

The survey's targeted a study population that making up the ICT sector amongst the followings:

##### **ICT Demand Side:**

- ICT companies/producers in West Bank and Gaza.
- Non ICT organizations/users in West Bank and Gaza.

### ICT Supply Side:

- Universities and colleges in the West Bank and Gaza.
- ICT students and graduates in the West Bank and Gaza.

### ICT Professionals:

- ICT MENA experts.

1.	Face-to-face Interviews with 20 ICT companies
2.	Face-to-face Interviews with 15 non-ICT companies
3.	Face-to-face Interviews with 40 students
4.	Electronic Interview with 5-7 ICT experts in MENA region

### Tools of Study:

Qualitative tools used in the study: Face-to-face interviews and questionnaire for surveys the current situation of education systems and ICT private sector. The tools were designed in light of the literature review and previous studies and in accordance with the objectives and questions of the research, and through consultation with a number of specialists in the field.

#### 1.2.2.4. Benchmarking

This section presents all the information that is needed to benchmark the curricula of the most popular Palestinian universities with those for Stanford University in the field of computer information systems (CIS).

##### 1. Benchmarking CIS Curricula between Stanford University and the West Bank Universities:

**Table 1: Benchmarking CIS Curricula between Stanford University and the West Bank Universities**

Course	Autumn Stanford CIS Title	ANU CIS Close Equivalent	Alquds Uni CIS Close Equivalent	Birzeit Uni CIS Close Equivalent
<a href="#"><u>cs1C</u></a>	Introduction to Computing at Stanford			
<a href="#"><u>cs1U</u></a>	Practical Unix			
<a href="#"><u>cs2C</u></a>	Multimedia Production	Introduction to Multimedia systems		Multimedia Systems
<a href="#"><u>cs21N</u></a>	Can Machines Know? Can			

	Machines Feel?			
<a href="#">cs47N</a>	Computers and the Open Society			
<a href="#">cs76N</a>	Elections and Technology			
<a href="#">cs77</a>	Interaction Design Basics			
<a href="#">cs103</a>	Mathematical Foundations of Computing	Discrete Mathematics	Discrete Structures	Discrete Mathematics
<a href="#">cs105</a>	Introduction to Computers	Introduction to Computer Introduction to Computer Architecture	Introduction to Computer Science	Introduction to Computer and Computer Ethics
<a href="#">cs106A</a>	Programming Methodology	Principles of Programming & Problem Solving	Fundamentals of Programming	Introduction to Computer and Programming
<a href="#">cs106B</a>	Programming Abstractions			
<a href="#">cs106X</a>	Programming Abstractions (Accelerated)			

<a href="#"><u>cs107</u></a>	Computer Organization and Systems		Computer Organization	Introduction to Computer
<a href="#"><u>cs108</u></a>	Object-Oriented Systems Design	<p>Fundamentals of Object Oriented Programming</p> <p>Object Oriented Analysis and Design</p> <p>Object-Based Systems Programming</p>	<p>Fundamentals of Programming</p> <p>Software Engineering I</p>	<p>Advanced Programming</p> <p>Software Engineering</p>
<a href="#"><u>cs110</u></a>	Principles of Computer Systems			
<a href="#"><u>cs140</u></a>	Operating Systems and Systems Programming	Operating Systems	Computer Operating Systems	Operating Systems
<a href="#"><u>cs144</u></a>	Introduction to Computer Networking	Computer Networks	Computer Networks	Introduction to Computer and Programming
<a href="#"><u>cs145</u></a>	Introduction to Databases	<p>Data Structures</p> <p>Database Administrations</p>	Data Structure and Algorithms I	Database Systems



		Database design & Programming	Database Systems I Database Systems II	
<a href="#"><u>cs147</u></a>	Introduction to Human- Computer Interaction Design			Human Computer Interaction
<a href="#"><u>cs148</u></a>	Introduction to Computer Graphics and Imaging	Computer Graphics	Computer Graphics. Computer Vision & Pattern recognition	Computer Graphics& User Interface
<a href="#"><u>cs157</u></a>	Logic and Automated Reasoning			
<a href="#"><u>cs161</u></a>	Design and Analysis of Algorithms	Algorithm and Programming Techniques	Data Structure and Algorithms II	Analysis of Algorithms
<a href="#"><u>cs181</u></a>	Computers, Ethics and Public Policy			Introduction to Computer and Computer Ethics
<a href="#"><u>cs181W</u></a>	Computers, Ethics and Public Policy (WIM)			
<a href="#"><u>cs191</u></a>	Senior Project	Graduation Project	Graduation Project	Introduction to

				Graduation Project
				Graduation Project
<a href="#"><u>cs191W</u></a>	Writing Intensive Senior Project	Technical Report writing		
<a href="#"><u>cs192</u></a>	Programming Service Project			
<a href="#"><u>cs198</u></a>	Teaching Computer Science			
<a href="#"><u>cs199</u></a>	Independent Work			Independent Study in Computer Science
<a href="#"><u>cs199P</u></a>	Independent Work			
<a href="#"><u>cs207</u></a>	The Economics of Software			
<a href="#"><u>cs221</u></a>	Artificial Intelligence: Principles & Techniques	Artificial Intelligence systems	Intelligent Systems	Artificial Intelligence
<a href="#"><u>cs224N</u></a>	Natural Language Processing			
<a href="#"><u>cs224W</u></a>	Social and Information Network Analysis			
<a href="#"><u>cs229</u></a>	Machine Learning			

<a href="#"><u>cs231A</u></a>	Introduction to Computer Vision		Computer Vision & Pattern recognition	
<a href="#"><u>cs242</u></a>	Programming Languages	New Trends in Programming Game Programming Visual systems Programming	Parallel Programming  Logic Programming	Advanced Programming  Translators and Programming Languages
<a href="#"><u>cs249A</u></a>	Object - Oriented Prog: A Modeling & Simul Perspect	Object-Based Systems Programming	Performance Evaluation of Computer Systems	Advanced Software Engineering
<a href="#"><u>cs259Q</u></a>	Quantum Computing			
<a href="#"><u>cs274</u></a>	Reps and Algor for Computational Molecular Bio			
<a href="#"><u>cs300</u></a>	Departmental Lecture Series			
<a href="#"><u>cs309A</u></a>	Cloud Computing			

<a href="#"><u>cs316</u></a>	Advanced Multi-core Systems			
<a href="#"><u>cs331</u></a>	Advanced Reading in Computer Vision			
<a href="#"><u>cs377T</u></a>	Behavior Design for Better Health	Business and human behavior modeling and simulation Health Information Systems		Human Computer Interaction
<a href="#"><u>cs390A</u></a>	Curricular Practical Training			
<a href="#"><u>cs390B</u></a>	Curricular Practical Training			
<a href="#"><u>cs390C</u></a>	Curricular Practical Training			
<a href="#"><u>cs393</u></a>	Computer Laboratory			
<a href="#"><u>cs395</u></a>	Independent Database Project			
<a href="#"><u>cs399</u></a>	Independent Project			
<a href="#"><u>cs399P</u></a>	Independent Project			
<a href="#"><u>cs402</u></a>				

	Beyond Bits & Atoms: Designing Technological Tools			
<a href="#">cs402L</a>	Beyond Bits and Atoms: Lab			
<a href="#">cs448B</a>	Data Visualization		Visualizations	Introduction to Knowledge Discovery and Data Mining
<a href="#">cs499</a>	Advanced Reading and Research	Scientific Research Seminar Operation Research Applications	Operation Research	Operation Research
<a href="#">cs499P</a>	Advanced Reading and Research			
<a href="#">cs546</a>	Seminar on Liberation Technologies			
<a href="#">cs547</a>	Human-Computer Interaction Seminar	Human Computer Interactions		Human Computer Interaction

<a href="#"><u>cs801</u></a>	TGR Project			
<a href="#"><u>cs802</u></a>	TGR Dissertation			
<a href="#"><u>cs142</u></a>	Web Applications	Web programming I & II		Web Application and Technology
<a href="#"><u>cs9</u></a>	Problem-solving for the CS Technical Interview			
<a href="#"><u>cs78</u></a>	Understanding Women's Expertise in High-Tech Companies			
<a href="#"><u>cs109</u></a>	Intro to Probability for Computer Scientists			
<a href="#"><u>cs109L</u></a>	Statistical Computing with R Laboratory			
<a href="#"><u>cs147</u></a>	Introduction to Human-Computer Interaction Design	Human Computer Interactions		Human Computer Interaction
<a href="#"><u>cs149</u></a>				

	Parallel Programming			
<a href="#">cs194</a>	Software Project	Software Engineering Software Project Management Software Testing and Quality Assurance	Software Quality Control  Software Engineering I	Advanced Software Engineering
<a href="#">cs194W</a>	Software Project (WIM)			
<a href="#">cs196</a>	Computer Consulting			
<a href="#">cs210A</a>	Software Project Experience with Corporate Partner			
<a href="#">cs229T</a>	Statistical Learning Theory	Elementary Probability and Statistic Methods of Statistics I.		Introduction to Statistics
<a href="#">cs231A</a>	Computer Vision:From 3D Reconstruct to Recognition			
<a href="#">cs232</a>	Digital Image Processing	Image Processing	Image processing	Image Processing and Pattern Recognition

<a href="#">cs243</a>	Program Analysis and Optimizations			
<a href="#">cs245</a>	Database System Principles			
<a href="#">cs246</a>	Mining Massive Data Sets	Data Mining		Introduction to Knowledge Discovery and Data Mining
<a href="#">s248</a>	Interactive Computer Graphics			
<a href="#">cs254</a>	Computational Complexity			
<a href="#">cs255</a>	Introduction to Cryptography			
<a href="#">cs261</a>	Optimization and Algorithmic Paradigms			
<a href="#">cs262</a>	Computational Genomics			
<a href="#">cs267</a>	Graph Algorithms			
<a href="#">cs270</a>	Modeling Biomedical Systems			
<a href="#">cs275</a>	Translational Bioinformatics			
<a href="#">cs275A</a>	Symbolic Musical Information			
<a href="#">cs334A</a>	Convex Optimization			
<a href="#">cs345D</a>	Advanced Topics in Database			



	Systems			
<a href="#">cs348A</a>	Computer Graphics: Geometric Modeling			
<a href="#">cs364B</a>	Topics in Algorithmic Game Theory			
<a href="#">cs476B</a>	Mobile Music			
<a href="#">cs546</a>	Seminar on Liberation Technologies			
<a href="#">cs93SI</a>	Introduction to Functional Programming in Haskell			

## 2. Benchmarking CIS Curricula between Stanford University and Gaza Universities:

**Table 2: Benchmarking CIS Curricula between Stanford University and Gaza Universities**

Course	Autumn Stanford CIS Title	Islamic University of Gaza (IUG) CIS Close Equivalent	Palestine UNI. E-IT CIS Close Equivalent
<a href="#">cs1C</a>	Introduction to Computing at Stanford	Introduction to Computing	Computer skills
<a href="#">cs1U</a>	Practical Unix		
<a href="#">cs2C</a>	Multimedia Production	Introduction to Multimedia systems.	Multimedia ,Interactive multimedia I, Interactive Multimedia II
<a href="#">cs21N</a>	Can Machines Know? Can Machines Feel?		
<a href="#">cs47N</a>	Computers and the Open Society		
<a href="#">cs76N</a>	Elections and Technology		
<a href="#">cs77</a>	Interaction Design Basics		
<a href="#">cs103</a>	Mathematical Foundations of Computing	Calculus I, Calculus II, Discrete Mathematics, Mathematics for computing	Linear Algebra , Mathematics for IT.

<a href="#">cs105</a>	Introduction to Computers	Introduction to Computer. Introduction to Computer – Practical.	Information System Technology
<a href="#">cs106A</a>	Programming Methodology	Programming I, Programming Practical I	Programming I, Programming II
<a href="#">cs106B</a>	Programming Abstractions		
<a href="#">cs106X</a>	Programming Abstractions (Accelerated)	Programming III Practical	
<a href="#">cs107</a>	Computer Organization and Systems	Computer Arch. & Assembly Lang. Computer Arch.& Assembly Language Practical	
<a href="#">cs108</a>	Object-Oriented Systems Design		
<a href="#">cs110</a>	Principles of Computer Systems	Computing Engineering	Introduction to Software Engineering
<a href="#">cs140</a>	Operating Systems and Systems Programming	Operating Systems , Operating Systems Practical	Operating Systems for Administrators
<a href="#">cs144</a>	Introduction to Computer Networking	Computer Networks, Computer Network Practical	Understanding Telecommunications  Data Communications and Networking  Moderns telecommunications

<a href="#">cs145</a>	Introduction to Databases	Data Structure and Algorithms RDBMS I , RDBMS I Practical RDBMS II Practical II	Data Structure and Algorithms Database Management Database Systems II
<a href="#">cs147</a>	Introduction to Human-Computer Interaction Design	Human Computer Interaction	Human Computer Interaction
<a href="#">cs148</a>	Introduction to Computer Graphics and Imaging	Computer Graphics	Computer Graphics.
<a href="#">cs157</a>	Logic and Automated Reasoning		
<a href="#">cs161</a>	Design and Analysis of Algorithms	Data Structure and Algorithms	Data Structure and Algorithms
<a href="#">cs181</a>	Computers, Ethics and Public Policy	Professional Ethics	
<a href="#">cs181W</a>	Computers, Ethics and Public Policy (WIM)		
<a href="#">cs191</a>	Senior Project	Graduation Project , Research Project	Graduation Project I, Graduation Project II
<a href="#">cs191W</a>	Writing Intensive Senior Project	Technical Report writing	
<a href="#">cs192</a>	Programming Service Project		
<a href="#">cs198</a>	Teaching Computer Science		

<a href="#">cs199</a>	Independent Work		
<a href="#">cs199P</a>	Independent Work		
<a href="#">cs207</a>	The Economics of Software		
<a href="#">cs221</a>	Artificial Intelligence: Principles & Techniques	Artificial Intelligence systems	
<a href="#">cs224N</a>	Natural Language Processing		
<a href="#">cs224W</a>	Social and Information Network Analysis		
<a href="#">cs229</a>	Machine Learning		
<a href="#">cs231A</a>	Introduction to Computer Vision		Data Visualization
<a href="#">cs242</a>	Programming Languages	Programming II , Programming II Practical.  Logical Design.  Programming Languages , Programming Languages Practical	Advanced Programming  Digital Logic Design
<a href="#">cs249A</a>	Object-Oriented Prog: A Modeling & Simul Perspect	Object-Based Systems Programming	
<a href="#">cs259Q</a>	Quantum Computing		
<a href="#">cs274</a>	Reps and Algor for Computational Molecular Bio		
<a href="#">cs300</a>	Departmental Lecture Series		

<a href="#">cs309A</a>	Cloud Computing		
<a href="#">cs316</a>	Advanced Multi-core Systems		
<a href="#">cs331</a>	Advanced Reading in Computer Vision		
<a href="#">cs377I</a>	Behavior Design for Better Health		
<a href="#">cs390A</a>	Curricular Practical Training		
<a href="#">cs390B</a>	Curricular Practical Training		
<a href="#">cs390C</a>	Curricular Practical Training		
<a href="#">cs393</a>	Computer Laboratory		
<a href="#">cs395</a>	Independent Database Project		
<a href="#">cs399</a>	Independent Project		
<a href="#">cs399P</a>	Independent Project		
<a href="#">cs402</a>	Beyond Bits & Atoms: Designing Technological Tools		
<a href="#">cs402L</a>	Beyond Bits and Atoms: Lab		
<a href="#">cs448B</a>	Data Visualization		Visualizations
<a href="#">cs499</a>	Advanced Reading and Research	Scientific Research Seminar.  Operation Research Applications.	Operation Research

<a href="#">cs499P</a>	Advanced Reading and Research		
<a href="#">cs546</a>	Seminar on Liberation Technologies		
<a href="#">cs547</a>	Human-Computer Interaction Seminar	Human Computer Interactions.	
<a href="#">cs801</a>	TGR Project		
<a href="#">cs802</a>	TGR Dissertation		
<a href="#">cs142</a>	Web Applications	Web programming ,Web Programming Practical	Web Programming
<a href="#">cs9</a>	Problem-solving for the CS Technical Interview		
<a href="#">cs78</a>	Understanding Women's Exper in High-Tech Companies		
<a href="#">cs109</a>	Intro to Probability for Computer Scientists		
<a href="#">cs109L</a>	Statistical Computing with R Laboratory		Applied Statistics
<a href="#">cs147</a>	Introduction to Human-Computer Interaction Design	Human Computer Interactions.	
<a href="#">cs149</a>	Parallel Programming		
<a href="#">cs194</a>	Software Project	Software Engineering. Software Project Management.	Software Quality Control Software Engineering I

		Software Testing and Quality Assurance.	
<a href="#">cs194W</a>	Software Project (WIM)		
<a href="#">cs196</a>	Computer Consulting		
<a href="#">cs210A</a>	Software Project Experience with Corporate Partner		
<a href="#">cs229T</a>	Statistical Learning Theory	Probability and Statistics Theory	Statistics
<a href="#">cs231A</a>	Computer Vision: From 3D Reconstruct to Recognition		
<a href="#">cs232</a>	Digital Image Processing	Image Processing.	Image processing
<a href="#">cs243</a>	Program Analysis and Optimizations		
<a href="#">cs245</a>	Database System Principles		
<a href="#">cs246</a>	Mining Massive Data Sets	Data Mining.	
<a href="#">s248</a>	Interactive Computer Graphics		
<a href="#">cs254</a>	Computational Complexity		
<a href="#">cs255</a>	Introduction to Cryptography		
<a href="#">cs261</a>	Optimization and Algorithmic Paradigms		
<a href="#">cs262</a>	Computational Genomics		
<a href="#">cs267</a>	Graph Algorithms		



<a href="#">cs270</a>	Modeling Biomedical Systems		
<a href="#">cs275</a>	Translational Bioinformatics		
<a href="#">cs275A</a>	Symbolic Musical Information		
<a href="#">cs334A</a>	Convex Optimization		
<a href="#">cs345D</a>	Advanced Topics in Database Systems		
<a href="#">cs348A</a>	Computer Graphics: Geometric Modeling		
<a href="#">cs364B</a>	Topics in Algorithmic Game Theory		
<a href="#">cs476B</a>	Mobile Music		
<a href="#">cs546</a>	Seminar on Liberation Technologies		
<a href="#">cs93SI</a>	Introduction to Functional Programming in Haskell		

### 3. Benchmarking Findings

The following table illustrates the main differences between Stanford University Curricula with the Palestinian universities curricula:

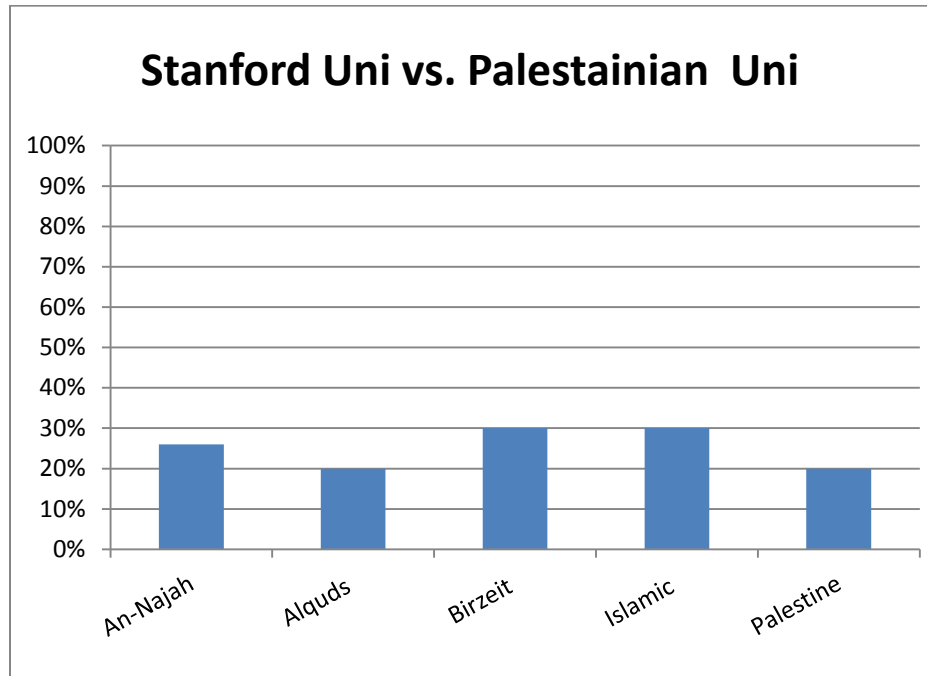
**Table 3: Benchmarking: Stanford University vs. the Palestinian Universities**

Aspect	Stanford University	Palestinian Universities
<b>Nature of Courses</b>	Customized	General
<b>Soft Skills Topics</b>	Much Higher	Less
<b>Core Courses Theoretical Sciences</b>	Higher (Focuses on technology)	Less (Focuses on Theoretical Science; such as Maths)
<b>Interactive Methods of Teaching</b>	Much Higher	Less
<b>Possibility of Course Selection</b>	Higher	Less
<b>Linking with Modern Technology</b>	Higher	Less

### 4. Palestinian Universities vs. Stanford University

The comparison to Stanford University has been considered as a vital element to show how much the current gap in ICT core courses.

The following figure shows the comparison between Stanford University and the Palestinian universities core courses in the field of “Computer Information System” core courses of Stanford University against Palestinian universities.



**Figure 1: Stanford University vs. The Palestinian Universities in the field of CIS**

## 2. Results, Findings and Conclusions

ICT sector is evolving at a rapid pace. It is therefore not easy to forecast future developments or analyze a certain pattern. However, the analysis performed on the targeted population has been divided into two major clusters; ICT Supply Side and ICT Demand Side.

### 2.1. ICT Supply Side Analysis

This section shows the main findings resulted from the analysis of “ICT Students” and “ICT Universities”.

#### 2.1.1. ICT Students

From students point view, there is a major dereliction from universities side regarding ICT education. Students Satisfaction on the quality of education is very low as analysis shows more than 70% of them are not satisfied. Furthermore, the majority of students agree upon that there are ICT skills and specializations shortages in the academic programs that universities and colleges provide.

The following table shows students perspective about Palestinian ICT educational system:

**Table 4 : Students' perspective about Palestinian ICT Educational System**

criteria	Strongly Agree	Agree	Disagree	Strongly Disagree
<b>the ability of universities to meet the needs of the labor market</b>				
University has a clear vision about specification of new graduates	4.4%	37.8%	48.9%	8.9%
The University makes Developmental Research job for information and communication technology market, as well as the local labor market and its needs.	2.2%	31.1%	42.2%	24.4%
The University engages us in research work for the IT market and guides our graduate project toward it.	2.2%	33.3%	44.4%	20%
The university facilitate implementation of our graduate projects in collaboration with private companies or other institutions	4.4%	28.9%	51.1%	15.6%
The company has Strategic plan special for graduates.	2.2%	33.3%	46.7%	17.8%
The university ease procedures of employability for graduates after graduation	4.4%	22.2%	51.1%	22.2%
The university plan take into account improve graduates after graduation.	2.2%	17.8%	60% <sup>1</sup>	20%
The university extrapolates regional labor market and it needs.	2.2%	26.7%	60%	11.1%
There is an association of graduates that coordinate with university in the field of operate graduates.	4.4%	31.1%	51.1%	13.3%
The university extrapolates international labor market and its needs	-	22.2%	48.9%	28.9%
<b>Academic Guidance</b>				
The University provides academic guidance to students about labor market trends	2.2%	28.9%	51.1%	17.8%
Students know well on specialization before enrollment	-	46.7%	40%	13.3%
The university use motivational method to guide student for specific disciplines	-	22.2%	62.2%	15.6%

<sup>1</sup> The red-marked region shows the most dissatisfaction aspects toward Palestinian ICT education system from ICT students' point view.

academic guidance includes directing students toward specific disciplines according to labor market	2.2%	22.2%	53.3%	22.2%
Academic guidance that university provide make balance between supply and demand	2.2%	13.3%	57.8%	26.7%
In academic guidance the university depend on guides related to the labor market	-	17.8%	64.4%	17.8%
The universities make studies and researches that take into account developing academic guidance	-	24.4%	53.3%	22.2%
<b>Academic plans</b>				
Academic plans for departments contain requirements	-	37.8%	44.4%	17.8%
Department adoption for academic plans on basis that balance between skills and knowledge	-	44.4%	46.7%	8.9%
Update academic plans according to requirements from labor market	-	37.8%	51.1%	11.1%
Preparing students to compete in scientific and technological fields	8.9%	37.8%	48.9%	4.4%
Quality of university offered program is suitable for labor market	2.2%	22.2%	57.8%	17.8%
University open new department in light of requirements of labor market	4.4%	26.7%	60%	8.9%
Academic plans facilitate converting plans to skills	4.4%	35.6%	44.4%	15.6%
Academic plans for scientific field characterizes internationally according to content.	4.4%	42.2%	44.4%	8.9%
Examination process depend on determine percent for knowledge and skills in exams.	2.2%	53.3%	35.6%	8.9%
Academic plans in scientific field characterize as internationally according to implementation methodology	-	22.2%	60%	17.8%
The university modify system of acceptance in different department based on number of unemployed graduates	2.2%	28.9%	44.4%	24.4%
<b>Fourth axis: Relationship with association</b>				
University or colleges have relationships with training centers, associations and local, regional and international universities that help in Improve product knowledge and skills for students	4.4%	44.4%	40%	11.1%

Universities/ colleges with same discipline contribute in creating competitive condition to increase graduates quality	4.4%	44.4%	37.8%	13.3%
Universities/ colleges communicate with vocational unions in developing skills of graduates to meet labor market needs	4.4%	33.3%	46.7%	15.6%
Universities and colleges coordinate with each other in integration of disciplines provide and not to repeat program offered.	4.4%	28.9%	42.2%	24.4%
Acceptance policy in universities and colleges make fit between enrolled students in different discipline and need of labor market qualitative and quantitative.	2.2%	35.6%	42.2%	20%
<b>administrative, practical skills and English language skills</b>				
Universities/colleges prepare students with these skills:				
Ability to write reports	11.1%	51.1%	31.1%	6.7%
Communication skills	13.3%	44.4%	31.1%	11.1%
Ability to work within a team	15.6%	60%	22.2%	2.2%
Career ethics	22.2%	48.9%	24.4%	4.4%
Creative thinking	8.9%	42.2%	37.8%	11.1%
Presentation skills	11.1%	55.6%	31.1%	2.2%
Project Management	15.6%	37.8%	40%	6.7%
Problem solving skills	17.8%	42.2%	40%	-
Change Management	11.1%	28.9%	57.8%	2.2%
University provide students English language skills with standard requirements that required for the local labor market	6.7%	46.7%	33.3%	13.3%
University has centers for developing in English with low price	4.4%	37.8%	42.2%	15.6%
<b>Sixth Axis: satisfaction on quality of education</b>				

I am satisfy on education quality I gained from university	2.2%	31.1%	44.4%	22.2%
I was well prepared for ICT labor market and its need through my study in the university	2.2%	26.7%	44.4%	26.7%
Academic curricula provide good experience in our discipline	-	26.7%	44.4%	28.9%

The following points are concluded from ICT students' perspectives:

- The curricula do not keep pace with the modern technological development.
- Practical training course at companies is not planned correctly, and the benefit obtained is not as predicted.
- Students have lack of awareness regarding each ICT specialization before studying it.
- The curricula have poor alignment of specialization with labor market.
- There is an obvious lack of denominators between the curriculum and the needs of the labor market and the lack of balance between the theoretical and the practical side.
- Sometimes, funded abroad scholarships are not allocated to the concerned ICT department. Often, they are directed to the same ICT department.
- The weight of practical application (i.e. projects) in the topics is not comparable with the effort exerted.
- In general, the curricula rely on memorizing a set of concepts and methods with the minimum limit of application.
- Lack of soft skills exercises, such as; creative thinking, innovation and interactive participation.
- Lack of keeping up with new studies and research methods in the world in the area of specialization.
- The education system does not improve the ability to analyze - in creativity - brainstorm – teamwork.
- Most of instructors don't have a practical background in the market.
- The university/college academic system is very hard and sometimes impossible to get updated.
- Most of students complain about traditional approach of teaching; it does not suit the main objective of the material.
- Some instructors have issues in delivering information.
- Unemployment has spread among the graduates.

### 2.1.2. ICT Universities

While the ICT departments in the targeted universities emphasize that the ICT students and graduates have a fundamental and accepted level of ICT technical skills, they agreed with the ICT students on the lacking of business and soft skills due to curricula shortages in this respect. Furthermore, the results show that the majority of Palestinian universities agree on the curricula consistency with ICT local and global market needs as shown in the tables below:

**Table 5: Palestinian ICT curricula relevancy to local market needs**

	Strongly Agree	Agree	Disagree	Strongly Disagree
<b>Curricula In line with ICT local market</b>	16.7%	66.7%	16.7%	-

**Table 6: Palestinian ICT curricula relevancy to global market needs**

	Strongly Agree	Agree	Disagree	Strongly Disagree
<b>Curricula In line with ICT global market</b>	16.7%	50%	33.3%	-

The study also shows that 50% of universities pursue monitoring and evaluation systems towards curricula development and the other 50% do not.

**Table 7: Utilization of monitoring and evaluation systems towards curricula development**

	Strongly Agree	Agree	Disagree	Strongly Disagree
<b>Sufficient of evaluation procedures</b>	16.7%	33.3%	50%	-



The following table shows Business and soft skills' contribution in Palestinian ICT academic programs and curricula according to the ICT departments:

**Table 8: Business and soft skills the universities provide to the ICT students**

	<b>Weak</b>	<b>Fair</b>	<b>Good</b>	<b>Distinguished</b>
<b>Communication skills</b>	66.7%	33.3%	-	-
<b>Team Work</b>	33.3%	16.7%	50%	-
<b>Proficiency in English Language</b>	66.7%	33.3%	-	-
<b>Technical Writing</b>	16.7%	50%	33.3%	-
<b>Creative Thinking</b>	16.7%	83.3%	-	-
<b>Presentation skills</b>	33.3%	50%	16.7%	-
<b>Planning Skills</b>	33.3%	50%	66.7%	-
<b>Marketing/Sales Skills</b>	50%	50%	-	-
<b>Project Management</b>	33.3%	66.6%	-	-
<b>Problem Solving</b>	33.3%	50%	16.7%	-

On the other hand, there is an obvious improvement regarding ICT technical skills' contribution in Palestinian ICT academic programs and curricula as the following table explains:

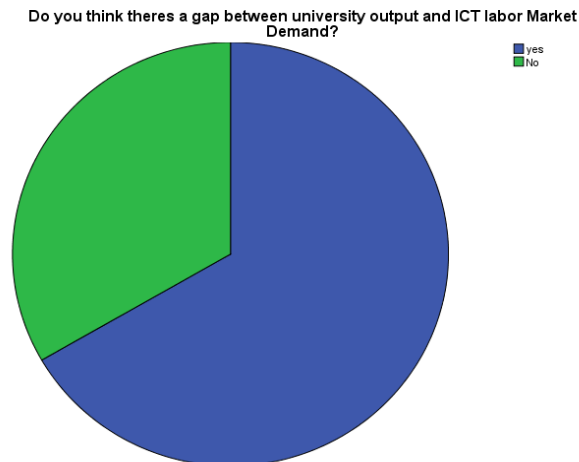
**Table 9: Technical skills the universities provide to the ICT students**

<b>Technical Competency</b>	<b>Weak</b>	<b>Fair</b>	<b>Good</b>	<b>Distinguished</b>
<b>Programming Language C#</b>	16.7%	66.7%	16.7%	-
<b>Programming Language C++</b>	16.7%	50%	16.7%	16.7%
<b>Programming Language Java</b>	-	16.7%	50%	33.3%
<b>Programming Language Visual Basic</b>	16.7%	33.3%	50%	-
<b>PHP</b>	16.7%	50%	16.7%	16.7%
<b>ASP.Net</b>	16.7%	66.7%	16.7%	-
<b>Database Platform Oracle</b>	50%	-	50%	-
<b>Database Platform MySQL</b>	16.7%	16.7%	66.7%	-
<b>Database Platform Microsoft SQL server</b>	16.7%	16.7%	66.7%	-
<b>Windows Platform</b>	-	50%	16.7%	33.3%
<b>Linux Platform</b>	16.7%	-	66.7%	16.7%
<b>Mobile Platform – Android</b>	16.7%	-	50%	33.3%
<b>Mobile Platform – IOS</b>	50%	16.7%	33.3%	-

<b>HTML5</b>	33.3%	33.3%	16.7%	16.7%
<b>JSON</b>	33.3%	16.7%	33.3%	16.7%
<b>XML</b>	16.7%	16.7%	16.7%	50%
<b>Java Platform</b>	16.7%	16.7%	50%	16.7%
<b>.Net Platform</b>	33.3%	-	66.7%	-
<b>Web Design</b>	16.7%	-	83.3%	-
<b>Multimedia Applications</b>	33.3%	16.7%	16.7%	33.3%
<b>System Analysis</b>	16.7%	16.7%	66.7%	-

## Is there a gap?

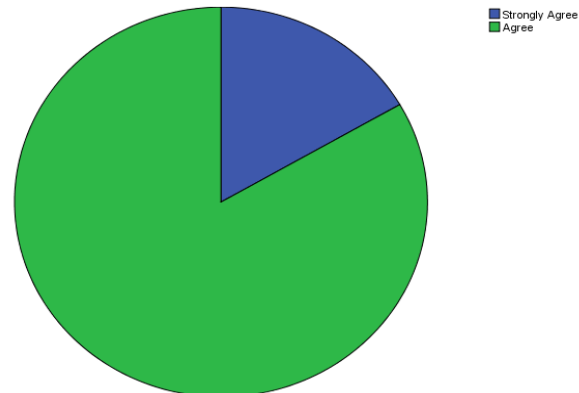
According to the ICT departments in the targeted population, two-thirds said there is an obvious gap between university output and ICT labor market demand.



**Figure 2: The gap between Palestinian universities outputs and ICT market needs**

The following figure shows that the majority of universities agree on the appropriateness and relevance of their ICT academic programs to ICT labor market needs and trends:

To Which degree your training program is appropriate in line to palestine ICT LM needs and trends



**Figure 3 : Universities programs appropriateness to local ICT labor market needs and trends**

- **Is there a gap between universities training activities output and Market Demand and the availability of future trend toward producing ICT HR with certification?**

In this criterion, half of the Palestinian universities answered with yes and 66.7% answered with no.

## **ICT Research and Development/Graduation Projects:**

The results illustrate that the majority of universities have real trends towards further detection of ICT market problems and initiation of innovative graduation projects as solutions towards a strategic trend of labor market access provision. The following table details the obtained trends:

**Table 10: ICT Research & Development and Graduation Projects**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>Adopt innovation research and development</b>	-	33.3%	50%	16.7%
<b>consistent with ICT market needs</b>	-	33.3%	50%	16.7%
<b>relevant to ICT companies Innovative research</b>	-	33.3%	50%	16.7%
<b>Cooperation and coordination with ICT private sector before graduation project selection and during implementation.</b>	-	33.3%	50%	16.7%
<b>Trends toward detecting and selecting actual ICT market Problems.</b>	-	-	83.3%	16.7%
<b>Trends toward provide students access to ICT labor market during the selection of graduation Project</b>	-	16.7%	66.7%	16.7%

The main conclusion obtained from the universities can be summarized as follows:

- There is an inherent lack of interest regarding training course from both; companies and students.
- There is a Lack of ICT training providers due to the limited size of ICT private sector.
- Some universities have developed continuing education units to strengthen the skills and knowledge of ICT students.
- Some universities have developed career units to enhance the employment conditions for the graduates.
- Curricula development process in Palestinian universities are as follows:

**Table 11: Curricula Development in Palestinian Universities**

University	Curricula Development	Input
An-Najah	No clear schedule	No clear input
Birzeit	In collaboration with ICT private sector each 4-5 years	Graduates feedback, private sector feedback, international trends in ICT like ACM and IEEE
Islamic	In collaboration with local ICT companies' experts every 5 years	Graduates feedback, private sector feedback

**Main challenges facing universities against development of curricula:**

- **AN-Najah National University**
  - There is an obvious communication issue with the market in order to address market needs.
  - University regulations hinder the development of curricula.
  - Lack of research and development (R&D) studies.
- **Birzeit University**
  - Lack of Expertise of the academic staff toward developing curricula that bridges the gap with the industry.
  - Limited size of private sector and resources in Palestine.
  - Lack of research and development (R&D) studies.
  - Lack of cooperation, collaboration, and trust between academia and private sector.
- **Islamic University of Gaza**
  - Lack of research and development (R&D) studies.
  - Lack of cooperation, collaboration, and trust between academia and private sector.

**Trends towards partnering with ICT Palestinian private sector representative PITA**

All universities are willing to partner with PITA and construct brand new look programs that bridging the gap between educational outputs and ICT market needs.

### Universities measure and methods to equip students with soft skills:

- Provide practical and vocational courses and demo projects during semesters.
- Deliver courses such as technical writing and project management.

## 2.2. ICT Demand Side Analysis

As part of this study, employers have been surveyed to find out whether they are satisfied toward ICT university graduates and what shortcomings they see in their education.

This section shows the main findings resulted from the analysis of ICT and Non-ICT organizations.

### 2.2.1. ICT Organizations

Table 12 shows the opinion of ICT Demand Market/employers toward ICT Graduates from Palestinian universities:

**Table 12: Companies satisfaction regarding the ICT graduate (Educational Preferences)**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>Theoretical know-how</b>	5%	10%	85%	-
<b>Practical skills</b>	15%	50%	30%	-
<b>Business and soft skills</b>	20%	70%	10%	-
<b>Needed induction time</b>	15%	55%	20%	10%
<b>Technical skills</b>	5%	65%	30%	-

According to Theoretical know-how it seems very good with percent of 85% that reflects high level of satisfaction on ICT graduates.

The majority of ICT employers are not satisfied on graduates' technical skills with a percent of 70% as well as business and soft skills with a percent of 90%. It is concluded that there are important skills universities should take into consideration to deliver good graduates to the ICT labor market. These figures give an alert that graduates need ICT technical skills and specializations development and improvement.

**Soft skills and job roles needed by the ICT Producers Employers:**

The following table shows soft skills and job roles required by the ICT employers:

**Table 13: Soft skills and job roles required by ICT employers**

	Strongly Disagree	Disagree	Agree	Strongly Agree
<b>Communication Skills</b>	5%	20%	30%	45%
<b>Team Work</b>	10%	20%	45%	25%
<b>Proficiency in English Language</b>	5%	20%	50%	25%
<b>Professional ethics</b>	-	20%	55%	25%
<b>Technical writing</b>	10%	20%	50%	20%
<b>Creative Thinking</b>	5%	25%	40%	30%
<b>Presentation Skills</b>	5%	30%	55%	10%
<b>Planning Skills</b>	5%	30%	60%	5%
<b>Marketing/ Sales Skills</b>	10%	45%	35%	10%
<b>Project Management Skills</b>	15%	40%	35%	10%
<b>Customer Service Skills</b>	20%	40%	25%	15%
<b>Business Analysis</b>	5%	50%	30%	15%
<b>Problem Solving</b>	-	35%	40%	25%



The summary responds of employers who disagreed on the acquisition of the above skills is shown in Table 14:

**Table 14 : Soft skills that do not exist in ICT graduates according to ICT employers**

Criteria	Percentage
Customer service skills	60%
Marketing and sales skills	55%
Project Management Skills	55%
Business Analysis	55%
Problem Solving skills	35%
Proficiency in English	25%
Creative thinking	30%
Presentation skills	35%
Communication Skills	25%
Professional ethics	20%

The above table demonstrates that there is shortages in customer service skills, Marketing and sales skills, project Management skills and Business Analysis.

Which need more focusing from universities and colleges on how to include or compensate these in curricula.

### Employers level of satisfaction in ICT graduates:

#### Core knowledge and Skills

Table 15 shows that the majority of employers are not satisfied with multimedia applications, Linux platform and responsive development. This implies that there is a real need for improvement in these ICT important core skills.

**Table 15: Employers opinion about ICT students' core knowledge and skills**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>Programing language C#</b>	5%	25%	55%	15%
<b>Programing language C++</b>	5%	25%	60%	10%
<b>Responsive development</b>	20%	20%	25%	35%
<b>Programing language java</b>	5%	25%	25%	45%
<b>PHP</b>	5%	15%	35%	45%
<b>ASP.Net</b>	5%	5%	40%	50%
<b>Database platform Oracle</b>	5%	25%	45%	25%
<b>Database platform MySQL</b>	5%	15%	40%	40%
<b>Database Platform Microsoft SQL server</b>	5%	15%	55%	25%
<b>Windows Platform</b>	10%	15%	50%	25%
<b>Linux Platform</b>	5%	35%	20%	40%
<b>Mobile Platform –</b>	15%	15%	25%	45%

<b>Android</b>				
<b>Mobile Platform – IOS</b>	15%	15%	30%	40%
<b>HTMLS</b>	10%	5%	45%	40%
<b>JSON</b>	15%	15%	45%	25%
<b>XML</b>	5%	15%	40%	40%
<b>Java Platform</b>	10%	20%	40%	30%
<b>.NET Platform</b>	5%	20%	45%	30%
<b>Web Design</b>	10%	15%	45%	30%
<b>Multimedia Applications</b>	15%	35%	35%	15%
<b>Software Testing</b>	5%	15%	35%	45%
<b>AJAX</b>	10%	15%	50%	25%
<b>JQuery(both AJAX and JQuery put it under HTMLS)</b>	10%	15%	45%	30%

### Certification

There is a need to develop ICT students in the area of software and network certifications and produce quality assurance future specialists.

**Table 16: Level of employers' satisfaction with ICT certifications**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>Oracle</b>	5%	20%	50%	25%
<b>ISTQ Testing</b>	-	20%	40%	40%
<b>Cisco</b>	5%	30%	50%	15%
<b>Adobe</b>	5%	25%	35%	35%

### Universities and Colleges dealing with Practical training

Table 17 shows that there is a real need in following up on, and supervising practical training by universities and colleges.

**Table 17: Employers level of satisfaction on practical training delivery by universities**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>Adopting Practical training</b>	15%	25%	40%	20%
<b>Follow up and Supervise Practical Training</b>	20%	35%	25%	20%
<b>Practical training relevant to ICT Market needs</b>	15%	50%	25%	10%
<b>ICT Company Benefits</b>	20%	25%	35%	20%

### ICT Market Driven Graduation Projects

The majority of ICT employers are against the consistency of graduation projects and ICT market needs in terms of innovative solution provision, cooperation and coordination, access to jobs and innovative market researches. The following table illustrates more:

**Table 18: ICT Graduation projects vs. market needs**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>consistent with ICT market needs</b>	10%	40%	30%	20%
<b>relevant to ICT companies Innovative research</b>	10%	55%	20%	15%
<b>Cooperation and coordination with ICT private sector before graduation project selection</b>	20%	45%	20%	15%
<b>Trends toward detecting and selecting actual ICT market Problems</b>	45%	30%	20%	5%
<b>Trends toward provide access to ICT labor market during the selection of graduation Project</b>	35%	30%	20%	15%

### Curriculum Adoption Interest

Table 19 shows that the majority of ICT employers are strongly interested in adopting the ICT curricula in alignment with ICT market practical needs.

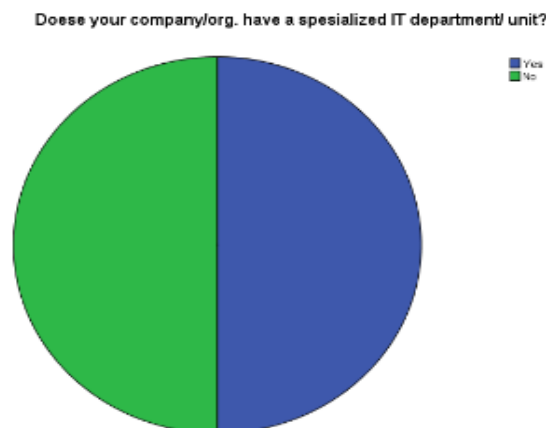
**Table 19: Employers interest in ICT market-driven curriculum**

	Strongly Disagree	Disagree	Agree	Strongly Agree
<b>Link Curricula to ICT Market Demand</b>	-	5%	35%	60%
<b>Graduation Research trends to:</b>				
<b>ICT market problems and needs detection</b>	-	10%	25%	65%
<b>ICT market problems and needs innovation and problem solving</b>				

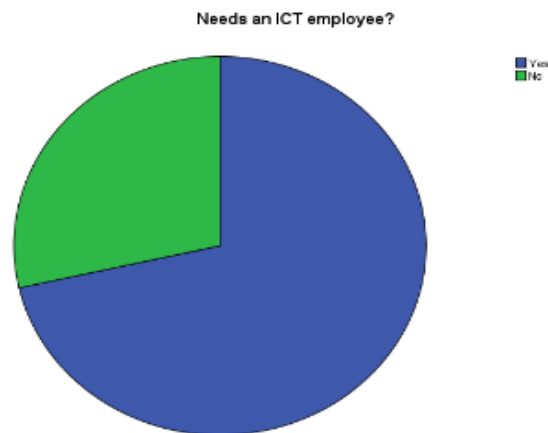
#### 2.2.2. Non-ICT Organizations

The other part of ICT demand side is the non-ICT organizations; they are considered as vital employer for the ICT students and graduates. Nevertheless, half of these organizations don't have IT departments and they look at ICT as extra or unnecessary expenses.

Figures 4 and 5 show the percentage of IT departments in Non-ICT organizations and the need of ICT staff:



**Figure 4: Percentage of IT departments in Non-ICT organizations**



**Figure 5: The need of ICT staff**

It has been concluded that about 20% of organizations demand IT staff and do not have IT departments. In some cases, they rely on one IT staff and sometimes on temporarily bought ICT service.

### **Organizations future trends towards ICT adoption**

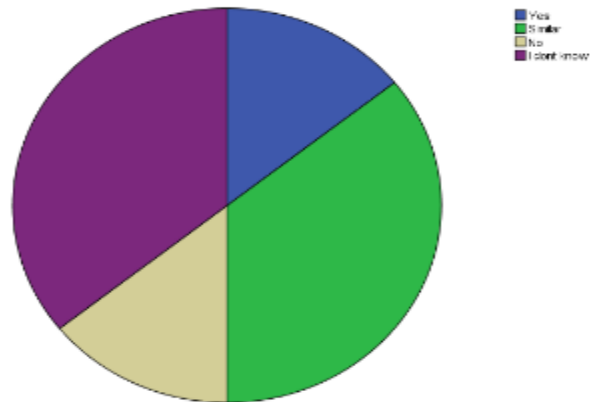
The majority of organizations are planning to:

- Add new websites, hardware and software, particularly:ERP, HRM and media communication.
- Improve communication needs MIS health information system.
- Create some new IT projects, initiatives and applications are under study to be implemented.
- Assign new employees for maintenance, Management and archiving system.

### **Competitor levels.**

The results show that non ICT organizations are not benchmarking themselves in terms of ICT adoption and are not considering ICT sector as a comparative advantage where the majority do not know whether their competitors use ICT or not.

Do your competitors use IT at the same level as you do?



**Figure 6: Competitors level of ICT adoption**

**Table 20: Competitors level of ICT adoption**

Do your competitors use IT at same level of you?	Yes	Similar	No	I don't know
	14.3%	35.7%	14.3%	35.7%

## Importance of soft and business skills for the IT Person

Table 21 demonstrates that the majority of non ICT employers agree on the importance of soft and business skills to the ICT employees especially problem solving, customer service, presentation, technical writing, communication and teamwork.



**Table 21: Importance of soft and business skills of IT Person**

	Not Important	Less Important	Important	Very Important
<b>Communication Skills</b>	-	-	35.7%	64.3
<b>Team Work</b>	-	-	35.7%	64.3%
<b>Proficiency in English Language</b>	14.3%	21.4%	28.6%	35.7%
<b>Professional ethics</b>	7.1%	7.1%	35.7%	50%
<b>Technical writing</b>	21.4%	21.4%	35.7%	21.4%
<b>Creative thinking</b>	7.1%	7.1%	50%	35.7%
<b>Presentation Skills</b>	14.3%	21.4%	50%	14.3%
<b>Planning Skills</b>	7.1%	7.1%	42.9%	42.9%
<b>Marketing and Sales skills</b>	28.6%	35.7%	21.4%	14.3%
<b>Project Management</b>	7.1%	14.3%	71.4%	7.1%
<b>Customer service Skills</b>	14.3%	14.3%	42.9%	28.6%
<b>Business Analysis Skills</b>	21.4%	35.7%	21.4%	21.4%
<b>Problem Solving Skills</b>	-	-	42.9%	57.1%

The following table shows the most important skills in descending order:

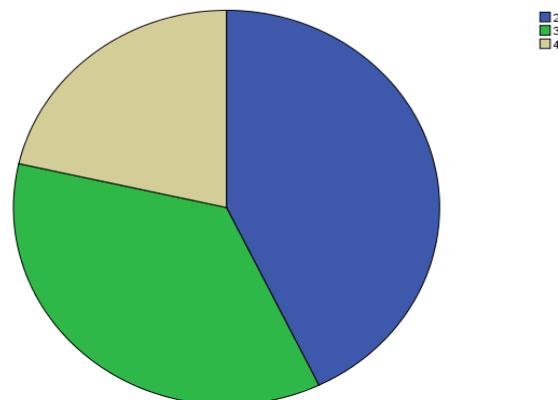
**Table 22: Most important ICT skills**

Communication Skills	100%
Team Work	100%
Problem Solving Skills	100%
Planning Skills	85.8%
Creative Thinking	85.7%
Project Management	78.5%
Customer Service Skills	71.5%
Proficiency in English Language	64.3%
Presentation Skills	64.3%
Technical Writing	57.1%

### **Performance of ICT employees graduated from local ICT Universities**

Figure 7<sup>2</sup> shows that the performance of ICT employees gained a high score by the majority of ICT employers; this can be considered as a good indicator of the quality of Palestinian ICT student.

In a scale from 1-4 Rate performance of your employees who graduated from local ICT universities/colleges?



**Figure 7: Rating ICT employees performance by non ICT employers**

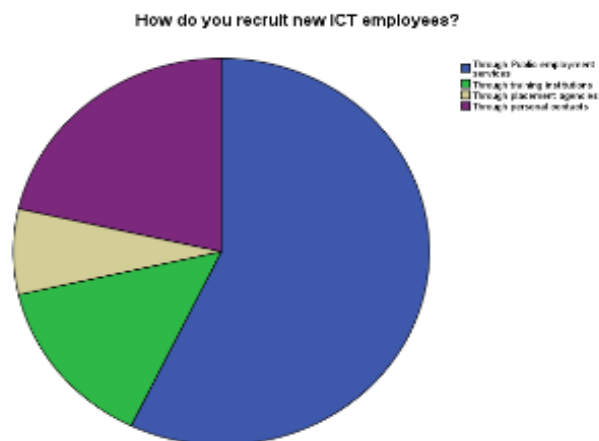
<sup>2</sup> Scale (1-4): 1 represents weak performance of ICT employees, 4 represents excellent performance of them and this scale represents non ICT employers' perspective.

### New ICT employees' methods of employment

Table 23 and figure 8 show that the most used way by the majority of non ICT employers to recruit ICT employees is through public employment services

**Table 23: Methods of employment**

<b>Through Public employment services</b>	57.1%
<b>Through training institutions</b>	14.3%
<b>Through placement agencies</b>	7.1%
<b>Through personal contacts</b>	21.4%



**Figure 8: Methods of employment**

### 2.3. MENA Experts

The results of an expert opinion session are usually a list of perceived problems or reservations regarding the usability of a product, and a list of recommendations for improvement. Involving Middle East and North Africa (MENA) experts in this study can assist in identifying the gap between Palestinian ICT education system and ICT market needs.

### Skills and Job Roles

Tables 24 and 25 describe the importance of ICT core skills as well as business and soft skills from experts' side opinion. Experts agree that all skills mentioned are very important to any graduates, and organization requires them strongly.

**Table 24: Rating of business and soft skills importance**

	Strongly Disagree	Disagree	Agree	Strongly Agree
<b>Communication skills</b>	-	-	25%	75%
<b>Team Work</b>	-	-	50%	50%
<b>Proficiency in English Language</b>	-	-	50%	50%
<b>Professional ethics</b>	-	25%	25%	50%
<b>Technical writing</b>	-	50%	25%	25%
<b>Creative Thinking</b>	-	25%	25%	50%
<b>Presentation Skills</b>	-	-	25%	75%
<b>Planning Skills</b>	-	-	50%	50%
<b>Marketing/ Sales Skills</b>	-	25%	50%	25%
<b>Project Management Skills</b>	-	25%	25%	50%
<b>Customer Service Skills</b>	-	25%		75%
<b>Business Analysis</b>	-	25%	75%	
<b>Problem Solving</b>	-	-	50%	50%

**Table 25: ICT core skills importance**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>Application Developer</b>	-	25%	75%	-
<b>Database &amp; Application Administrator</b>	-	-	50%	50%
<b>Network Administrator</b>	-		25%	75%
<b>System Programmer</b>	-	75%	25%	-
<b>Test specialist</b>	25%	75%	-	-
<b>Security Service Specialist</b>	-	75%	-	25%
<b>Portals &amp; collaboration specialist</b>	-	50%	50%	-
<b>Systems Analyst</b>		25%	75%	
<b>Quality assurance specialist</b>	25%	25%	25%	25%
<b>Graphic Design specialist</b>	25%	50%	25%	-
<b>Multimedia specialist</b>	25%	25%	50%	-

### **Skills Level and ICT Market Demand**

Table 26 shows that the majority of ICT regional experts agree that ICT software skills are very relevant to market demand as to importantly be acquired by students.

Table 26: Skills importance as per market demand

	Strongly Disagree	Disagree	Agree	Strongly Agree
Programing language C#	50%	-	50%	-
Programing language C++	25%	50%	-	25%
Responsive development	25%	25%	50%	-
Programing language Java	25%	-	25%	50%
PHP	25%	25%	25%	25%
ASP.Net	25%	-	25%	50%
Database platform Oracle	25%	-	25%	50%
Database platform MySQL	25%	-	25%	50%
Database platform Microsoft SQL server	25%	-	25%	50%
Windows Platform	100%	-	-	-
Linux Platform	-	25%	25%	50%
Mobile Platform - Android	-	50%	25%	25%
Mobile Platform – iOS	-	50%	25%	25%
HTML5	25%	25%	25%	25%
AJAX	25%	25%	25%	25%
jQuery	25%	25%	25%	25%
both AJAX and jQuery	25%	25%	25%	25%
JSON	25%	25%	25%	25%
XML	25%	25%	25%	25%
Java Platform	25%	-	50%	25%

<b>.NET Platform</b>	-	25%	50%	25%
<b>Web design</b>	-	25%	50%	25%
<b>Multimedia applications</b>	25%	25%	25%	25%
<b>Software Testing</b>	25%	25%	25%	25%

### Training

Table 27 demonstrates the agreement of the majority ICT regional experts on the importance of training on ICT topics especially cloud computing and virtualization, share point and networking.

**Table 27: Importance of training on ICT skills**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>SharePoint Development</b>	-	25%	50%	25%
<b>Social Media Marketing (SMM)</b>	25%	50%	25%	-
<b>Cloud computing &amp; Virtualization</b>	-	-	75%	25%
<b>E-content</b>	25%	25%	25%	25%
<b>mobile apps</b>	25%	25%	25%	25%
<b>phone gap</b>	25%	25%	25%	25%
<b>Android/IOS</b>	-	50%	25%	25%
<b>Networking</b>	-	-	25%	75%

### Applications

Table 28 shows the importance of software applications as an increasing market demand especially web design and ERP.

**Table 28: Importance of ICT applications as per market demand**

	<b>Strongly Disagree</b>	<b>Disagree</b>	<b>Agree</b>	<b>Strongly Agree</b>
<b>Human Resource Management (HRM)</b>	-	50%	25%	25%
<b>Point of Sale (POS)</b>	25%	25%	50%	-
<b>Hotels and restaurant</b>	-	50%	25%	25%
<b>NGOs management</b>	-	50%	50%	-
<b>Multimedia</b>	25%	25%	50%	-
<b>Schools management</b>	25%	75%	-	-
<b>FMIS</b>	25%	75%	-	-
<b>Web Design</b>	-	25%	25%	50%
<b>Games</b>	25%	50%	-	25%
<b>Enterprise Resource Planning (ERP)</b>	25%	-	25%	50%
<b>Oracle Financial</b>	25%	-	25%	50%

**GAP between supply & demand of ICT HR related skills in ICT niche markets**

Table 29 shows experts point of view, that gap is high in Smart phone App. Development (locally-Regionally), testing with 75% (Locally) and Also in software Application development is 100% there is a gap (Globally).



**Table 29: GAP between supply & demand of ICT HR related skills in ICT niche markets**

ICT HR subsector	Local		Regional		Global	
	Yes	No	Yes	No	Yes	No
Smart Phone App Develop.	100%	-	75%	25%	25%	75%
SW Application Develop.	50%	50%	-	100%	100%	-
Hardware	-	100%	25%	75%	-	100%
Testing	75%	25%	25%	75%	-	100%

**Drawbacks, concerns, and obstacles associated with the ICT labor market VS ICT Education System:**

There is a lack of knowledge between the labor market and the current disciplines in the faculties of information technology, computer engineering and electronics engineering, management information systems.

Since most of officials employment have no awareness to differentiate between the disciplines under the umbrella of information technology, where the academics does not promote the correct disciplines and do not communicate with the labor market to find out the real needs, but are just following up new disciplines that come from outside the region.<sup>3</sup>

<sup>3</sup>“Answered Experts from ALARD International – Dubai”.

### 3. Recommendations and Suggested Roadmap

#### 3.1. Recommendations

The recommendations in this study are primarily phrased as interventions to improve the functioning of Palestinian labor market, as we recommend the following:

1. The practical training course shall be reactivated. The universities shall coordinate with the companies to assign trainees at their premises, in addition, they should activate and follow-up a "To-Do" plan for the students to measure the expected outcomes that should be achieved. On the other hand, the companies shall assign an employee to provide a daily follow-up on the trainees, also giving them a chance to participate in the daily duties without affecting the company's interests.
2. Awareness sessions must be held to illustrate ICT disciplines to the targeted students before engaging in the university. Furthermore, awareness sessions given to secondary stage students in collaboration between PITA and ICT private sector are highly recommended.
3. Universities shall Increase the involvement of ICT demand side (ICT & Non ICT firms) in curricula periodic updating process.
4. Universities shall assign instructors from industry to teach some courses.
5. Before hiring a graduate, it is highly recommended that companies launch ongoing program with specific period of time aimed at providing him/her with the required knowledge and skills.
6. Universities shall allocate funded abroad scholarships to all ICT disciplines, not only for one or two.
7. It is preferable that students' graduation projects emerge from real needs of ICT market.
8. An annual research shall be conducted to study ICT professions needs of graduates.
9. Universities shall activate specialized marketing units to market their graduates in different employment sectors.
10. Universities shall enhance and conduct the practical projects, brainstorming sessions, presentations and interactive exercises instead of theoretical subjects.
11. Universities shall enhance self-learning skills in their students and minimize "spoon feeding" approach as much as possible.
12. Universities shall invest more in developing their teaching staff. This will help adapt to, and follow the ICT market rapid changes. One way to do this is by

- encouraging them to work on certain projects in the market. This will absolutely reflect positively on their students.
13. Improve the quantity and the quality of ICT courses provided by continuing education units<sup>4</sup>.
  14. It is highly recommended that universities communicate with their graduates and ask them where they were and where they are now.
  15. Provide soft skills courses such as: customer service skills, marketing and sales skills, project Management skills and Business Analysis either directly by universities or via their continuing units.
  16. Enhance ICT research and development field in collaboration with the industry. This can be done through formulating an ICT board between the university and renewable ICT private sector segment. This board states the market issues and needs in order to design related graduation projects and theses.
  17. There is a need to develop ICT students in the area of software and network certifications and produce quality assurance future specialists.
  18. Periodic meetings between academia and private sector should be held to discuss ICT curricula, technological advancement, ICT national strategic goals, challenges, etc.
  19. Universities shall open more channels and execute more coalitions with regional and international universities to exchange expertise in all fields; especially ICT.
  20. Universities shall limit number of courses that are not related to the ICT core field.

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<sup>4</sup>Continuing education units are units which concerning in holding conferences and training courses to develop the expertise, abilities, scientific and professional skills of participants.

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## 5. Annex

### 5.1. Suggested Road Map

Suggested 6 month roadmap for fresh ICT students to become employable is a very important plan; in which its purpose is to present the detailed training plan needed for ICT graduates to help them in their future careers. It also evaluates results of a training initiative, undertaken in Palestine that targeted fresh graduates in information and communication technology (ICT) disciplines. It describes a practical training model to develop, upgrade and enhance students' qualifications prior to their entrance into the labor market.

This paper presents the 6 month roadmap, of a newly implemented technology training program which targeted many students but for limiting budget issues, we described every single detail this plan costs for 20 students and then it can be calculated for any number wanted from students in West-Bank and Gaza Strip. In order to determine most appropriate courses and training workshops for fresh graduates, the researchers traced the trainees' endeavors and behaviors through their pursuit of jobs utilizing focus group meetings, individual interviews with stakeholders, and interviews with employed graduates, as well as questionnaires, surveys, observations of on-going activities and interviewing staff, graduates and students.

The training program will attempt to promote practical training and develop entrepreneurial capabilities in order to make vast majority of the surveyed trainees feel that they gain valuable knowledge and experience in their field of specialization, and believe that the training is critical to their successful job search. Also trainees should clearly agree that the practical training they will receive via the training program is a necessary supplement to their theoretical technical education in university ICT programs.

Palestinian universities annually graduate large numbers of ICT students while these graduates need many skills and qualifications in order to be ready to inter job world. The program serves this purposes of providing a needed service to equip fresh graduates with state-of-the-art technical skills, thus increasing the chance of fresh graduates being hired into positions related to their university degrees, and shortening their job search.

The model and program, presented in this paper describes a modern training framework, where students receive practical training. The model, when adopted, completes the role of universities to help graduates in following the ever-changing

needs of the technology market. The training program also helps the market to differentiate the large number of ICT students and graduates from one another, based not only on area of study but also on concrete skill sets.

#### 5.1.1. Introduction

Palestine's ICT graduates' numbers are increasing rapidly, and related ICT private sector companies are increasing too, but there is a huge gap between these two elements. Universities' ICT curriculums are good from theoretical point of view but they need more focusing on practice fields.

The lack of knowledge and skills amongst ICT graduates has been described as one of the reasons why graduates struggle to find employment after graduating. Whilst some are good in their technical skills, most have been found lacking in their soft skills. As a result, they become one dimensional in identity as opposed to exhibiting the multiple identities. This creates unnecessary distractions toward many organizations, where on one hand; they have to grapple with rapid changes of the world huge development and the challenges that come with that, while on the other hand, they are handicapped by the inadequate competency of their future workforce. As such, they have to be selective in recruiting those that they want to work for them.

In Palestine, unemployment rate of graduates has been increasing due to social and economic reasons beside the limited demand for employees while number of graduates increases among years. Not surprisingly, the number includes some engineering and ICT graduates from local universities. Even though they are supposed to be well equipped with relevant technical skills, they still lack important soft skills, like communication, language, critical and creative thinking skills, leadership, etc.

Several researchers in engineering education have discussed the ineffectiveness of the current engineering and ICT educational system in equipping the graduates with relevant employability skills as required by their potential employers. These findings, unfortunately, have a bearing on how employers perceive local engineering and ICT graduates and whether these graduates will be employed by them. Thus, it is crucial to assess the employers' perception, especially in ICT working fields, to ask a sample from ICT private sector companies about their point of view on ICT graduates, their work's quality level, skills they have and skills missing and must work on them and all related issues that can be gained through training.

Also students' participation is very important in order to discuss their situation after graduation, problems they faced during training or job's interviews and after that to motivate them getting the necessary training after collage which is going to help them skipping that gap between them and private sector.

#### 5.1.2. Literature Review

Many studies and reports have been made about the ICT students' training. The establishment of some specific academies for that purpose and the success of them provided incentives for researchers and some universities to work on in depth technical studies that will benefit ICT students and help them to be involved in the private sector and labor market.

Employability skills can be effectively assessed where the specific skill and its application is described in course materials and learning objectives, and where it is clearly located within the context of a given discipline. Good assessment practice is underpinned by curriculum and course design which makes explicit the requirements for employability skills and describes how and at what point in the course they will be addressed.

Unfortunately, a lot of universities today are training ICT students on products because these certain products are widely-used in the market, which is fine but when they graduate, it does not give them the overall skill set of a computer science graduate.

In its efforts to move from an efficiency-driven economy to an innovation-driven economy, our country must focus on creating higher value jobs and securing the skilled workforce to support and attract domestic and foreign investments in strategic sectors, such as the information and communications technology (ICT) sectors, as well as build competitiveness. One of the major factors in making investment decisions is workforce development and availability, since access to a skilled and consistent labor force is of ultimate importance. Moreover, research showed a clear gap between the higher education ICT outcome and the ICT sector employment needs. This led to high unemployment rates within ICT graduates. In order to bridge this gap, create employable graduates, and increase the percentage of working women in the sector, there must be an establishing for ICT Training program to equip ICT graduates with the required skills to secure jobs, generate a proficient labor force, and increase competitive advantage when it comes to the recruitment of foreign investments in the ICT industry.

### 5.1.3. Training benefits to students

- Working in a setting which puts theory into practice.
- Developing an awareness of workplace culture.
- Appreciation of the rapidly changing world of work.
- Opportunity to develop a range of personal attributes - time management, self-confidence & adaptability.
- Development of key interactive attributes -team working, interpersonal & communication skills.
- Short-term financial benefits where some students get paid on work placement.
- Enhanced employment prospects & potential for commanding higher wages when starting employment after graduation.
- Assistance in developing career strategies, such as help with career choice, becoming aware of opportunities, and building up a network of contacts
- Opportunity for students to see their subject area in practice.

### 5.1.4. Expected Outcomes and Deliverables

The proposed subject assessment item is an operational response to strategic aims. The proposed project has the capacity to improve the learning experiences of domestic and international postgraduate students, particularly in the ICT field, and has the potential to boost the key employability skills of graduates. This approach to learning is student-centered allowing students to explore, problem-solve, and reflect in small cross-cultural teams. Two main outcomes of the project are expected from the project: 1) motivated graduates who are well prepared for the workforce with competence in intercultural and self-management skills, and realistic perceptions of employer expectations; and 2), establishment of a bank of enthused employers willing to participate in the project in the future through the establishment of dialogue between educators and industry.

Proceedings of Informing Science & IT Education Conference (InSITE) 2010, a Project to Improve the Employability Skills of Postgraduate ICT Students through Workplace Cultural Awareness.



### **5.1.5. Methodology**

#### **5.1.5.1. Graduates' focus groups**

A group of ICT graduates joined us in a focus group meeting which was held in Spark Company, Spark's partner, Paltel Group and PITA. This meeting was as brainstorming for graduates in order to summarize the current situation for them after graduation, what they face in their training and the beginning of their employment from a lack of expertise in various fields in addition to unfamiliarity with some important skills that must be acquired before entering the real world of work. Students also summed up all knowledge and experiences they were asked for in job interviews and in job applications.

#### **5.1.5.2. Companies individual meetings**

Companies and private sector's opinion is an important branch in our tree plan. All ICT graduates aims to find jobs in these companies, so to increase number of employed students there must be no gap between companies' demand of skills and what graduates have. For that reason, Spark and its partners arranged meetings with different companies in order to get their feedback about our universities' graduates and what knowledge and skills are missing. Companies focused on some communication skills beside technical skills and according to their response we updated the proposed plan.

#### **5.1.5.3. Searching the WEB to identify new IT trends**

ICT sector has updates software and technics every short period, so that graduates have to improve their skills according to what is used nowadays in all ICT companies and to be familiar with updated knowledge. To achieve that goal, we searched the web to obtain what is needed for IT and Computer graduates in order to be ready for real work world. Many ICT training websites and manuals include several topics that benefit graduates. These topics includes administrative skills, career development, personal development, workplace essentials, business writing, sales and marketing and all courses in their specialization's domain.

#### **5.1.5.4. Recommended 6 months roadmap**

Most important and touching courses and workshops were selected to be included in this 6 month plan. This plan is intense and full of necessary topics and courses which will

lead all trainees to the first step of their career's stairs. ICT trainers scrutinized the plan and made sure that it's suitable for graduates and can be done in 6 months. Hours needed to complete the whole training is mentioned, also estimated budget each course and workshop will cost is calculated and included for 20 students; which means that every number under the column of cost is for 20 trainees.

This 6 month plan for ICT graduates is as what was required and it will be under the title of plan 'A', but we suggest another type of plan which will contain same material as plan 'A' but with different duration and trainees' target sector, this plan will be under the name of plan 'B'.

Plan 'B' has the same target as plan 'A' to give high quality training for ICT students, but the difference is that plan 'B' provides this training while students are still undergraduate. IT students (CS, CIS & MIS) have this training in their third and fourth years while Computer Engineering students have it in their fourth and fifth years. This will help them linking the theoretical and practical sides at the same time. With practical projects which are required in the plan, students will practice more and more in ICT science knowledge's field in the way used in ICT private sector and labor market.

The advantage of plan 'B' concentrates on investing the same time -which students are still in collage in it- in also training programs. This will prevent wasting more 6 months after graduation until the ICT students is ready for real working world. If training begins in collage period, trainees will be more serious with their training, benefit more because they will be taking similar and close topics but in theoretical and scientific side, there will be no withdrawals from students because of finding a job and many more positive sides.

Here we provides plan 'A' & plan 'B' in details and both plans targets:

1. Computer Information System (CIS).
2. Computer System (CS).
3. Management Information System (MIS).
4. Computer Engineering.

#### 5.1.5.5. Plan 'A'

##### A. Main soft skills for all ICT specializations

Number	Course/Workshop	Hours	Cost in \$ (20 trainees)
1	Meeting & Time management	6	420
2	Anger & Change management	6	420
3	Business ethics & etiquette	6	480
4	Emotional intelligence	6	480
5	Social intelligence	6	420
6	Public speaking & Presentation skills	6	540
7	Proposal and reports writing & Business letters and action plans	18	1440
8	Project management	24	1920
9	IT Marketing basics & Sales' skills	30	2400
10	Team building	18	3300
11	Working under pressure	6	480
12	Thinking outside the box	6	480
13	Risk Management	24	2160
14	Basic bookkeeping	12	840

## B. Specific & top courses needed for each specialization

Number	Needed Courses	Hours	Cost in \$ (20 trainees)
1	<b>Database</b> <ul style="list-style-type: none"> <li>• SQL Server</li> <li>• Database Rules</li> <li>• Database Design and Development</li> </ul>	60	7200
	<b>Project</b>		
2	<b>Software Engineering</b> <ul style="list-style-type: none"> <li>• Software Design</li> <li>• Solution Design</li> <li>• Performance Analysis</li> <li>• Development Lifecycle</li> <li>• Software Management</li> <li>• Problem Solving Techniques</li> </ul>	84	10080
	<b>Project</b>		
3	<b>Programing Languages</b> <ul style="list-style-type: none"> <li>• .NET</li> <li>• Java</li> <li>• Python</li> </ul>	72	10080
	<b>Project</b>		
4	<b>Quality Assurance</b> <ul style="list-style-type: none"> <li>• Software Testing</li> </ul>	30	3600

	Tools		
	Project		
5	<b>Network</b>	42	5040
	<ul style="list-style-type: none"> <li>• Network Administration</li> <li>• Cisco networking systems</li> </ul>		
6	<b>Project</b>	84	10080
	<b>WEB</b>		
	<ul style="list-style-type: none"> <li>• Design: Front-End</li> <li>• HTML 5</li> <li>• CSS 3</li> <li>• JQuery</li> <li>• Ajax</li> <li>• PHP</li> <li>• Web Computing and Mining</li> </ul>		
7	<b>Project</b>	30	4200
	<b>Security</b>		
	<ul style="list-style-type: none"> <li>• System Security Management</li> <li>• Information Security in Public and Private Sectors</li> </ul>		
8	Mobile Applications	36	5040
	<b>Project</b>		
9	Unix Shell Programming	36	5040

	Project		
10	System & Servers Administrations	36	4320
	Project		
11	Final Project	132	13200

#### 5.1.5.6. Plan 'B'

This plan has the same material (courses & workshops) as plan 'A' but it's for undergraduate ICT students. This plan's duration is two years as follows:

- Third & Fourth years for CIS, CS and MIS students.
- Fourth & Fifth years for Computer Engineers.

#### Why did we suggest and recommend plan 'B'?

- Students will have less chance to withdraw from the training program
- It's better to give this necessary training during the period of undergraduate study in order to link between the scientific and theoretical side obtained at the university and the practical side which is necessary in the labor market.
- If trainees were still undergraduate, utilization ratio from training will be higher.
- Graduates will save 6 months in finding a job.
- This training due collage period will give students the chance of knowing more people from the private sector and the labor market and consolidate their relations, which increases the rate of employment after graduation.

#### 5.1.6. Recommendations

After all searching analysis, meetings and interviews we recommend this 6 month plan as you required (plan A) and we also propose another way and direction of training which is 2 years plan (plan B) to be adopted. And to benefit trainees and give them the right chance to be ready for real job world, we recommend the following:

- Full compliance with the plan.
- Arranging interviews for students before selecting approved trainees from them in order to select the most committed ones.
- Provide the best trainers and lecturers for all the topics.
- Trainers are preferred to be from the private sector and practitioners of the profession in the labor market.
- There must be a big project during the whole training and after each course, groups must work on their project and apply the part related to the course they were taking.
- Groups' projects will be as startups for all groups and then when training period ends, their startups will be ready to work on and establish.
- Accompany all topics with practical and applied side for each subject as well as the theory side.
- Focus on practical projects which will benefit trainees in the long run.
- PITA organized a training program last year and trainees took three months training and then they went to different companies in order to practice what they took in training courses but trainees didn't get the required benefits from that last three months in the private sector because when they started working in these companies, the projects they worked on were already started before their arrival and a big part from these projects was finished which means they didn't follow the whole project lifecycle.
- Split trainees into groups according to this criteria:
  - Each group should contains trainees from different specializations
  - Number of members in each group is 4 trainees
  - Each group members should be together in the same group until the end of their training.
- Plan 'A' is according to the required one, but we suggest plan 'B' due to these reasons:
  - The likelihood of the plan's commitment from the graduate trainee for six months is weak.
  - There will be many withdrawal cases from trainees during the training period if they got jobs.
  - It's better to give this necessary training during the period of undergraduate study in order to link between the scientific and theoretical side obtained at the university and the practical side which is necessary in the labor market.
  - If trainees were still undergraduate, utilization ratio from training will be higher.

- In case of plan 'B', graduates don't need to train extra 6 months in order to be prepared for the job market and get a job.
- This training due collage period will give students the chance of knowing more people from the private sector and the labor market and consolidate their relations, which increases the rate of employment after graduation.

So, according to previous reasons plan 'B' may help students to enter work world strongly.



## 5.2. SOME GLOBAL AND REGIONAL ICT EDUCATIONAL SYSTEMS PATTERNS

This part of study explores, with a sort of benchmarking, global issues and literatures relevant to the study key aspects.

### 5.2.1. Jordan<sup>5</sup>

The ICT sector is the fastest growing sector in Jordan's economy with an average of 25% growth. It includes more than 400 companies in Telecom, IT, Outsourcing, Games, Online and Mobile Content, and contributes by approximately 14% to the GDP (10% direct, 4% indirect).

As for availability of ICT human resources, the ICT related labor force is growing by more than 6,000 graduates yearly, which is facilitating Jordan's emergence as a regional leader in ICT. Jordan ranked 26<sup>th</sup> out of 133 countries for the number of engineers and scientists; Jordan has a higher proportion of university graduates in technological fields than any other country in the region .

However, and based on the extensive analysis conducted by the Ministry of Information and Communications Technology, and other supporting organizations and partners including the USAID Jordan Economic Development Program, it is concluded that :

**Asignificant gap** exists between the hiring needs of ICT companies (skills and qualifications) and the potential workers that are being produced through Jordan's institutions of higher education. In addition, other Problems so to bridge this problem they establish Jordan's ICT Academy that will create an umbrella of integrated networks that include all existing academies whether international academies in Jordan hosted in centers, knowledge stations or universities, or local companies offering various training programs .

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<sup>5</sup>Concept paper- ICT Training Academy (Bridge Academy).

The goal of the virtual academy training is to initiate broad-based skills development to bridge the gap between higher education outcomes and market demand, facilitate fresh graduate transition into the workplace, and develop a world-class technology workforce as a baseline for the facilitation of internal and external investment .

Ministry of Information and Communication Technology will work closely with academies, universities, and other key stakeholders to establish the virtual academy and achieve the following:

- 1- Designing a training program according to ICT sector needs. The Academy program will comprise multiple tracks depending on market needs (e.g. infrastructure, web programming, call centers, etc.). Each track will include core, functional and advanced skills courses .
- 2- Signing agreements with training centers, academies and universities. The virtual academy will integrate all types of training facilities under one umbrella to introduce a strategic framework and provide synergy in preparing the fresh graduates to meet market demand. The role of each stakeholder will be clearly defined in order to ensure commitment and sustainability .
- 3- Announcing courses and organizing workshops. Courses will be announced using various media, followed by workshops for potential academy students/fresh graduates to introduce offered courses, explain about various tracks, and create awareness about prospective career paths .
- 4- Reaching rural and underprivileged areas. Since this is a virtual academy, fresh graduates living in governorates, and females who have difficulty traveling, will benefit from academy training through local Knowledge Stations, academies or university labs, whether direct or e-learning methods are adopted .
- 5- Building workforce capacity and developing industry specialization. The skills of Jordan's workforce will be improved in terms of enhancing managerial, linguistic and vertical skills. Moreover, the training academy will facilitate acquiring

certification in basic, advanced, and specialized ICT fields including software development, call centers, and media/digital content .

- 6- Supporting ICT graduates through recruitment activities. A process will be established to introduce graduates to job opportunities at both the local and the regional level. Furthermore, introducing skilled labor in rural areas (e.g. call center skills) will encourage businesses to invest in those areas and provide job opportunities<sup>6</sup>.

### 5.2.2. Malaysia<sup>7</sup>

The curricula of ICT programs in universities will be revised to reflect industry needs in an effort to tackle the perennial problem of skills mismatch among graduates.

With only 10% of new entrants to the workforce directly employable while the rest require training before they can start work. The National ICT Association of Malaysia, the education ministry as well as other industry players are working to breathe new life into the current syllabus to make it more reflective of the industry's needs.

"The curriculum was revised six years ago but with technological changes, you really need to revise it," said MDeC talent division director.

While he did not mention when the new curriculum is expected to take off, Muhammad Imran said there are already some efforts put in place ways to improve the employability of ICT students.

These include getting industry players to lecture in universities, introducing short-term professional courses and engagements between the universities and industry players to match employee-employer needs.

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<sup>6</sup><http://www.weforum.org/best-practices/talent-mobility/bridging-skills-gaps-jordan%E2%80%99s-ict-sector>

<sup>7</sup>Study of "Graduate employability in Asia"

"Universities should not be teaching about products. Students should be taught about disciplines and analysis such as techniques of programming as opposed to learning about certain products".

"Unfortunately, a lot of universities today are training ICT students on products because these certain products are widely-used in the market, which is fine but when they graduate, it does not give them the overall skill set of a computer science graduate," said Pikom's research committee chairman Woon Tai Hai.

The National ICT Association of Malaysia's (Pikom) ICT Job Market Outlook 2014 revealed that fresh ICT graduates are still struggling to command higher salaries due to a mismatch of skills and higher employer expectations.

IT graduates employability in Malaysia. The Asia-Pacific region is facing high levels of unemployment and underemployment. The economic slowdown has reduced the employment growth rates enjoyed by the region in the 1990s (Bandara, 2006). The International Labor Organization estimated that the number of unemployed in Asia was likely to have increased by between 9 and 26.3 million in 2009, compared to 2007. Thus, governments in the region were urged to invest in their labor forces and provide crisis response packages to ensure quick recovery.

They focus on the IT graduate employability issue in Malaysia under a UNESCO-initiated research on graduate employability. The study presents the employment status of IT graduates, identifies the skills acquired by the graduates in comparison to the skills required by employers, and discusses the concept of employability. It is hoped that the findings will facilitate more concerted efforts among government agencies, HEIs and IT companies to re-examine the development of IT curricula and programs, as well as to enhance the employability of IT graduates.

The early 1990s, many universities in Malaysia began offering IT programs and significant efforts were made to attract students to enroll in these programs. To keep pace with changing needs during the mid-2000s, the IT industry had to realign the job

descriptions of their staff to cater to greater demands for customer support and application maintenance. This in turn requires IT graduates to possess different sets of skills.

Conducting Quantitative research design to give measures and techniques for data analysis then Qualitative research design was generated to answer these questions:

- What is the level of employment among IT graduates in Malaysia?
- What are the knowledge and skills acquired by IT graduates from HEIs?
- What is the employability skills needed, as perceived by employers?
- How do HEIs prepare their students to be employable?
- How does industry determine the important skills needed when hiring graduates? - How does university prepare students to be ready for the job market?
- Are there any differences in expectations of graduate performance and employability among industry, academics and students themselves?

There is a distinct gap between the expectations of the employers and academics. While both would like the graduates to be creative, think critically and have solid technical know-how, they disagreed about the university's contribution in producing such graduates. The academics considered their graduates to be sufficiently trained; the employers did not. To address this gap, it is expedient for the universities and employers to re-examine and re-adjust their expectations accordingly.

Another recommendation is for universities to review their IT curriculum annually to keep up with the fast changing nature of the field. At the same time, they need to balance the demand to turn out productive workers against the fundamental goal of educating students to be moral, ethical and responsible citizens. Universities should re-examine their activities designed to improve creativity and critical thinking to ensure that the students are in fact gaining these skills, and to incorporate problem-based learning as much as possible to encourage greater creativity and critical thinking.

It cannot be assumed that all employers have the same demands and expectations. Employers themselves are often under great pressure to innovate and adapt within a short period of time. Therefore it would be unrealistic to expect the universities to churn out graduates who can meet each and every need in the workplace considering the time consuming process for the academics to update their own knowledge and then to revise the curriculum and courses. Rather, the universities can focus on inculcating more general skills and aptitudes in their students, while the industry hones the specific knowledge and skills required through on-the-job training.

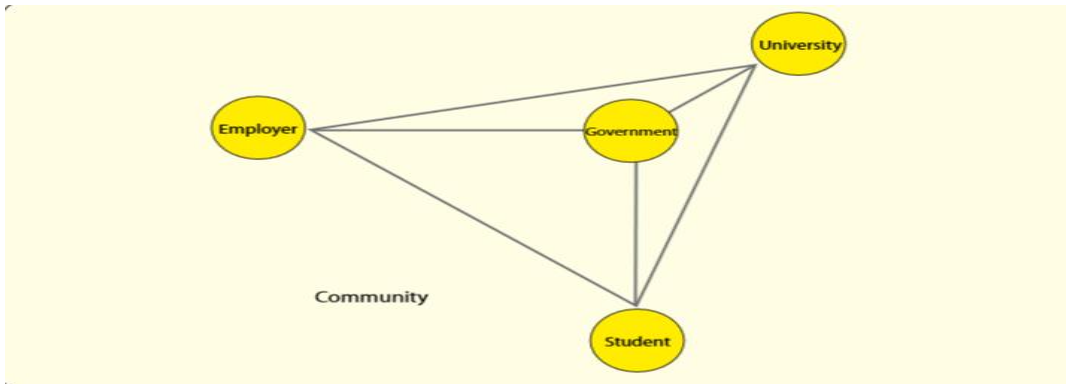
Meanwhile, the students should not depend entirely on the university and the formal education system for their personal development. They have to be more proactive and take the initiative to acquire essential skills. Involvement in extracurricular activities is an excellent outlet for building self-confidence and soft skills. Starting a business, instead of waiting for job offers to materialized, is increasing seen to be an attractive option, supported by many examples of successful and enterprising young entrepreneurs in the IT industry.

Playing its role, the Ministry of Higher Education has formulated a National Higher Education Strategic Plan to address issues of employability. To implement the action plan, it would appropriate for the government to establish a regulatory body for Computer Science and Information Technology Education to support professionals in this field.

Last but not least, major IT players in Malaysia have initiated efforts to create a platform to look into issues of the quality of IT graduates and professional recognition of IT graduates. This initiative is still in its infancy, but efforts have been made to incorporate this into the 10<sup>th</sup> Malaysian Plan commencing in 2011.

It is clear from the above discussion that the major stakeholders (graduates, academics/university, employers and the government) must work together to improve graduate employability. Universities cannot guarantee employment for their graduates without collaboration with the employers in the ICT sector. Certainly, the students

themselves have to make the effort to learn and acquire the knowledge and skills within an enabling environment. Government input is required to ensure the policy structure and economic conditions are favorable for employment opportunities in the ICT industry. The linkages among the stakeholders are illustrated in Figure 9.



**Figure 9: Stakeholders in Improving ICT graduate employability**

There have been positive developments since the launch of this study in 2009. Several parties –Dec, 26 ICT Deans Council and the Human Resource ICT Task Force 27 – have initiated activities to enhance graduate employability, particularly in terms of employment for ICT graduates and the need for a regulatory body for ICT professionals. The ICT Deans Council has recommended changing the three - year computer science or ICT university degree to a 3.5 - or four - year program. The revised curriculum will be aligned to the Association for Computer Machinery guidelines, with a compulsory 6 - month on-the-job training. Public universities have begun implementing this in stages.

ICT companies have also taken action to improve the situation. For example, Intel will roll out TRIZ, a methodology that relies on the study of patterns of problems and solutions, to all universities and, in the long run, to all primary and secondary schools.

In 2010, the MoHE announced the formation of 19 Industry Clusters for various domains including ICT. The clusters will foster a more structured collaboration between universities and industries, and thereby help to raise the level of university education in Malaysia. One of the goals of the clusters is to improve graduate employability. The ICT Cluster is co-chaired by the Chairperson of the ICT Deans Council and MDeC, with MOHE

playing a steering role. Members of the ICT Cluster are representatives of the ICT Deans Council and industry.

The MoHE also introduced the National Professors Council as a forum to congregate Malaysian academics. The Council has several sub-categories, each to be headed by a professor. One of the areas is ICT, also named as the ICT Cluster. It is likely that this group will also examine the issue of ICT graduate employability.

In conclusion, these initiatives serve to underscore the importance the various stakeholders have given to graduate employability in Malaysia.

### **Key Findings and Recommendationsto bridge the Gap in Malaysia:**

- 1- It is vital to increasethe efforts are made to engage students with the idea of a career in ICT fields.
- 2- There is a vast amount of information available on the subject of the ICT skills demand in Ireland. This is both in terms of reports and initiatives which are underway to address the problem. This document has attempted to clarify the area by collecting the information together in one cohesive document. Positive strides are being made in closing the ICT skills gap, however, there is much left to be done. The continued work of EGFSN-Forfás is driving the process forward. Their work should be commended .
- 3- The ICT Action Plan (IAP) is an important milestone in addressing the skills demand. The targets set out in the IAP must be monitored to ensure that maximum effectiveness is achieved. In particular, the issue of adequate resources for schools still persists. This must be tackled if the ICT Action Plan is to reach its targets .
- 4- The program used by 54% of schools in terms of having ICT on the curriculum is the ECDL (European Computer Driver's License). This program does not offer any significant insight into the creative use of ICT equipment. The Department of Education and Skills needs to look at making programming and/or computer science as much a part of the curriculum as French or German. Our students



- must have the opportunity to learn the global languages of programming such as Java and C++.
- 5- The aim should be to create a single compulsory transition year programming module with uniform implementation .
  - 6- There is an information gap in relation to careers in the technology sector. The Department of Education and Skills in liaison with the Department of Jobs, Enterprise and Innovation needs to ensure that the opportunities available within the sector are being communicated effectively to schools, students, teachers and parents. This career awareness must have an input from industry as this will best communicate the constantly evolving technology sector. The activities of DSE must be continued and further expanded to ensure that the message of opportunity within the technology is reaching as many schools as possible. This will necessitate increased funding and the industry should be encouraged to contribute to further develop their partnership with DSE .
  - 7- Graduate conversion courses provide an excellent opportunity to fill some of the ICT vacancies in the short term. It is vitally important that there is a strong uptake in these graduates' conversion courses for ICT coupled with a strong emphasis on continuous monitoring of the quality of these courses and the skills capacity of the graduates. The number of applications for the 768 places on the graduate conversion programs was well in-excess of the available places. This shows that the desire is out there to engage with these programs to up-skill in ICT. The graduate conversion programs, which have now commenced must be monitored closely to ensure that the quality of graduates is meeting the needs of industry .
  - 8- There is a need for a more nuanced terminology to be developed in relation to ICT. ICT skills can mean everything from Microsoft Word to C++ to Ruby on Rails. Jobs in ICT can mean everything from advanced software engineers to project managers. There is a need to break the term „ICT skills“ down into exactly what

- is industry is looking for. The FIT skills audit currently underway will be particularly revealing in terms of what precise ICT skills industry is looking for .
- 9- The dropout rate for ICT courses is significantly higher than the average dropout rates for all disciplines. Approximately 350 students of ICT/Engineering courses do not progress from first to second year of their course every year.<sup>16</sup> Universities and Institutes of Technology need to examine alternative progression routes for these individuals. These are people who may not be at the standard of software engineers but are capable of carving out a solid career in the ICT sector as project managers etc. The commissioning of a report under the ICT Action Plan into this matter and examining alternative ICT progression routes for students will be an important contribution. We can boost graduate output quickly and effectively by supporting students who are struggling to pass and creating alternative pathways within technology courses. This should involve monitoring and assessing the progress of students. By the end of the first term in first year (falls mostly occur in first year), personal engagement and mentoring of those having difficulty and arranging for them from the second term on to attend relevant classes in the College which may be helpful to their progress or encouraging them to avail otherwise of supplementary tuition.
  - 10- There is a need to boost the level of ICT-literacy among teachers. Only 25% of post-primary teachers rated themselves as having -intermediate or -advanced ICT skills according to a 2008 inspectorate report. It will be impossible to further the development of computing within schools unless we have teachers who are capable of showing their students how to engage with the creative use of ICT.

### 5.2.3. Australia<sup>8</sup>

In the study in South Australia, entitled (An Analysis of the Supply and Demand for ICT skills in South Australia economy) Summarized key finding as:

- There is a significant agreement in the perceptions of the supply and demand for ICT skills, particularly in the need for “soft skills” and “on-the-job skills”, but there is a lack of specificity regarding the nature of these skills.
- Information mismatches affect perceptions of early career choices – graduates may not appreciate that some employers will induct them into the workforce and help them in their career paths. However, such employers may be rare.
- Many ICT graduates become employed in non-ICT jobs. In addition, the number of annual ICT graduates is large relative to the ICT employment pool.
- Work experience for current ICT students is an important opportunity to acquire on-the-job and soft skills, and to focus career paths. Employers, providing real and relevant training and building relationships may view it as an investment strategy for the future.
- Employers want “the top 5%”. Is it possible for more of the people perceived to be in the middle to be more as the people perceived to be at the top?
- There should be a clear distinction between the government's role in addressing its own ICT employee needs and its role in addressing the functioning of the ICT market. Policy intervention specifically in the ICT sector should be evaluated against similar demands for employees and skills in other sectors of the economy.

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<sup>8</sup>[http://s3.amazonaws.com/zanran\\_storage/www.informationeconomy.sa.gov.au/ContentPages/52833281.pdf](http://s3.amazonaws.com/zanran_storage/www.informationeconomy.sa.gov.au/ContentPages/52833281.pdf)