



Palestinian Market Development Programme

# Rapid Market System Analysis

## Quality of Engineers for Multinational Enterprises (MNE's)

### Skills Gap between recent graduate and MNE Outsourcing Job Market Needs

April 2015





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## List of Acronyms

BSPs	Business Service Providers
CO-OP	Cooperative Education Program
CS	Computer Science
CSE	Computer System Engineering
CSR	Corporate Social Responsibility
DFID	UK Department for International Development
EIP	Office of the Quartet Representative's Economic Initiative for Palestine
FDI	Foreign Direct Investment
GIZ	Deutsche Gesellschaft für Internationale Zusammenarbeit
GDP	Gross Domestic Product
ICT	Information and Communication Technology
IEEE	Institute of Electrical and Electronics Engineers
IPR	Intellectual Property Rights
ITC	International Trade Centre
ITO	Information Technology Outsourcing
MNE	Multinational Enterprise
MoEHE	Ministry of Education and Higher Education
MoNE	Ministry of National Economy
NES	National Export Strategy
NGOs	Non-Governmental Organizations
MNE	Multinational Enterprises
oPt	occupied Palestinian territories
OQR	Office of the Quartet Representative
PA	Palestinian Authority
PalTrade	Palestine Trade Centre
PITA	Palestinian Information Technology Association of Companies
PMDP	Palestinian Market Development Programme
QIF	Quality Improvement Fund
R&D	Research and Development
SFIA	Skills Framework for the Information Age
UCAS	University College of Applied Science
USAID	United States Agency for International Development



## Executive Summary

Several studies have highlighted the strong potential growth of Information and Communications Technology (ICT) sector in the occupied Palestinian territories (oPt), mainly because of the fact that it is less dependent on cross border movement restrictions. In 2013, the gross revenues for the sector were estimated at around \$637 million<sup>1</sup>, making it a significant part of the Palestinian economy (6% of GDP). There are around 250 local ICT company in the ICT sector employs directly about 5,000 people and creates additional 2-3 indirect jobs for each direct job, so it also has a significant employment potential growth. It is estimated<sup>2</sup> that 5-10% of the total local workforce are females, while the workforce is highly educated with literacy rates exceeding 90%.

The ICT sector activities are partially impeded by a number of external constraints (mainly the Israeli-imposed constraints on ICT infrastructure and connectivity, and also the higher risk factors that the occupation presents on doing business in the oPt). However, ICT sector is also constrained by internal gaps, such as underdevelopment of supporting echo system, supporting functions, policies, standards, and legislation as well as the lack of quality of the education system amongst other factors which have negative impact on the availability of quality of engineers graduates, the ability of the outsourcing, and software development companies to be able to scale. The sector's development and operations are further constrained by low levels of capital investment and short supply of appropriate and innovative financing instruments. Innovation in the oPt also suffers from a lack of research and development (R&D) and a poorly developed information society. Finally, legal and administrative hurdles to foreign direct investment (FDI) in the oPt minimizes the number of investment opportunities. The same situation applies for Gaza strip<sup>3</sup> as well, while the big difference between Gaza and West Bank contributions to GDP is mainly related to Gaza's small market size in addition to the closure imposed on the Gaza Strip and the limited chances for outsourcing.

This report is intended to be a brief analysis on the failure to graduate quality software engineers, which have a direct impact on scaling the software outsourcing as well as attract more Diaspora offshoring investment models. The report compliments the analysis conducted in 2014 by the PMDP on the "Multinational Enterprises (MNEs) outsourcing to Palestinians<sup>4</sup>" market system analysis. The desk research conducted has highlighted that the available software development engineers are neither sufficient nor adequate, and are a main constraint in the value chain of the software outsourcing industry. This report subsequently provides analysis on the core relationship between the universities as suppliers of graduates in information technology related academic programs, the software development industry as buyers and recruiters for such talent to support their software outsourcing and software offshoring operations.

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<sup>1</sup> Economic Initiative for Palestine – OQR: <http://www.quartetrep.org/quartet/news-entry/ipe-overview/>

<sup>2</sup> According to information collected from PITA management

<sup>3</sup> Palestinian ICT Labor Market Gap Analysis : <http://pita.ps/studies>

<sup>4</sup> <http://www.pmdp.ps/page.php?id=aae2y43746Yaae2>

This report provides analysis on the supporting functions and rules related to the supply and demand, largely based on literature desk research and review of several previous studies that have highlighted the lack of quality of engineers in the software outsourcing sector.

It is very important to differentiate between the skills gap according to the different segments. For example, the skills needed for top tier R&D outsourcing to MNE differs from skills needed for lower tier software development outsourcing. Likewise, skills that are needed for the captive outsourcing “offshoring” require much higher skills than those needed for the ready-made application or custom software development made for the local market. None of the studies that were previously conducted in the past five years had addressed this issue and considered the same skills gaps in all of the sub-segments of the ICT sector.

Accordingly, this document attempts to collect additional related information, to prioritize the previously mentioned activities and suggest relevant recommendation, guidance and facilitation to address the failures related to skills gap between recent graduates and MNE job market needs, and on the long term to be able to scale it, therefore it analyze the demand and supply side:

- 1. Problems on Core Functions:** Skills (technical and soft) gap between the recent graduates and the job market needs on both, short and the long terms. Many constraints were highlighted as the lack of the industry Job Classification to translate the skill profiles needed by the private sector as an input for consideration while developing and updating the curriculum by the universities. Although there was a slight improvement in soft skills development lately at the universities, however, it is still far from the international accepted standards such as multinational enterprises. The recent graduates are suffering from the lack of practical training, poor soft skills, creative thinking skills and other related skills. This influx of graduates with poor soft skills limits the ability by the outsourcing companies to scale the volume of outsourcing contracts due to the limited availability of qualified engineers to the level of demand side expectation from the multinationals. Local universities don't have a clear and robust national plan for introducing better quality practical training toward ICT students and graduates, additionally there is no unified national strategy to group all local universities to collectively and jointly upgrade the curriculum and address the gap on national basis. It also indirectly results in high staff attrition within the same pool of talented engineers who continue to search for better paying salaries in Palestine, causing mobility of engineers amongst the outsourcing companies.
- 2. Problems on Supporting Functions:** An information dissemination gap was identified between the private sector and the academia from one side, and between and among the universities. A significant part of the students don't know the potential career opportunities post-graduation as a national or industry recognized online job vacancy boards do not exist nor do information about the skills needed by the private sector is available to aspiring students. The university's department of education, skills and the center of excellence and innovation in liaison with the private sector needs to ensure that the opportunities available within the private sector are being communicated effectively to universities, teachers, and students. This career awareness must have an input from the industry as this will best communicate the skills required by a constantly evolving technology sector. Also, in the absence of a national strategic vision there is a mismatch in curriculum being taught at the local universities level, since the curriculum development is done differently from one university to another. Some of the issues that recent graduates have, are related to poor analytical and problem solving technical skills, with mostly theoretical knowledge without practical experience and lack of knowledge in new technologies that are been demanded by the MNE and international clients. Finally, there are

nascent employment support services by the both sides: academia and private sector on several important type of activities such as: quality internship programs, industry orientation programs, transparent student career path, salary guides and job classification that also detail needed skills and profiles as mentioned earlier.

In addition, students have limited access to labs and equipment, and the curriculum is not balanced with activities on recent technology trends and soft skills competencies e.g. critical thinking and English. There is a lack of R&D Funds, which is not helping in bridging the gap between industry and universities. The best qualified university teachers are usually the ones implementing the best teaching methods, with on-hands research tools, market related methodologies as well as technologies attributed to their work on research projects in cooperation with the industry. Finally, both sides usually target donors to initiate projects that are bound to address market failures.

- 3. Problems on the Rules and Enabling Environment:** On the governmental level, there is a lack of support from the ministry of education and higher education (MoEHE), and other government input to ensure the policy structure and economic conditions are favorable for employment opportunities in the ICT industry and to invest in serious reforms in the ICT education. Taking other countries experience into consideration, such as the case of Ireland who were able to become an outsourcing destination for multinationals in Europe by differentiating their value proposition based on quality of IT graduates and more competitive pricing relevant to European continent. Finally, the student acceptance and graduation criteria should be revised to reflect the good international practices of not passing students who do not meet a minimum requirement in core courses.

The skills gap and its constraints in the value chain were validated from different sources and by different stakeholders. Validation of the analysis included desk research, interviews during the Quality of engineer 1<sup>st</sup> sub-group meeting that was held on march 11<sup>th</sup> 2015 at the Palestinian Information Technology Association (PITA) office and that was attended the major stakeholder (Donors community, local ICT companies, the Ministry of Telecommunication and IT (MTIT) and four local universities), whereby the PMDP presented and validated the summary of supply and demand constraints<sup>5</sup> of this study and previously conducted studies. Later on, and based on this validation, PMDP have developed the proposed impact framework for the Quality of Engineers, which aims to organize the efforts and the required activities, and to improve the sector coordination in order to achieve the required system level change that will impact positively on improving the skills and training/education market. Such change is expected to result in positive change at the business level in order to achieve the goal of introducing new products and functions in the value chain that will ultimately lead to increase value of exports to MNE and investment in Diaspora offshore. Accordingly, it will impact increasing the employment and incomes in this value chain.

Finally, the report highlights the recommendations that can be implemented by the stakeholders, to address these gaps as follows on both sides as below:

### **On the supply side (Universities and Training Centers)**

Ideally, a large-scale coordination engagement between industry and educational institutions to discuss many elements in the education system should take place such as: curriculum development

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<sup>5</sup> The Donut Chart / Figure 2 in this document that was developed by PMDP as part of the QoE for MNE's

based on industry needs and internship programs that facilitate transitioning students from theory-to-practice. Coordination efforts should take into consideration improving the teaching methods and techniques such as inclusion of seminars lead by market experts. Additionally, universities shall assign instructors from industry to teach some courses to share knowledge knowhow and latest trends.

Information dissemination and exchange between and among universities and with industry requires further development. One way of doing that is to develop friction free internal policies at universities to allow the lecturers to interact and work at the industry on part time basis and not just for students to have internship programs with the industry.

### **On the demand side (Palestinian Outsourcing and Offshoring companies)**

Coordination and change of behavior on the demand side is needed for the companies to be active participants in the implementation of a quality graduate internship program and engage in curriculum development based on research of their skills needs. In short, the private sector has to seek more cooperation such as employment support services such as orientation programs and salary guides as well as detailing career path for students. Industry is part and parcel of the solution through information dissemination and engagement with local universities.

### **Regulatory**

Government can assist in growing the sector through the development of **supporting laws** and legislation that would enable a flexible labour market and to introduce policies that would incentivize and facilitate for industry-university cooperation and improve the employment market including gender employment. A better protection regime for intellectual property can attract foreign direct investment and it also will improve the innovation sector in Palestine.

It can also provide incentive schemes to initiate industry-university projects that would support the development of the university teachers and lecturers to become knowledgeable on technology tools, methodologies and standards that would complement the theory taught in the classrooms. This also includes having the opportunity for the faculty to be up-to-date on latest technologies, its trend and practical teaching techniques through research and development (R&D) funds and schemes.

Government leadership can also be a catalyst for many projects such as cooperating with the industry in developing and providing market information and statistics on the actual market needs.

## Introduction

The information and communications technology (ICT) sector activities are partially impeded by a number of external constraints (mainly the Israeli-imposed constraints on ICT infrastructure and connectivity in addition to the trade logistics restrictions on movement and access by Israelis to be able to access new market specially for Gaza strip and also the higher risk factors that the occupation presents on doing business. However, ICT sector is additionally constrained by internal gaps such as underdevelopment of supporting echo system, functions, policies, standards and legislation as well as the education system amongst other factors which have negative impact on quality of engineers and the ability to scale. The sector's development and operations are further constrained by low levels of capital investment and short supply of appropriate and innovative financing instruments. Innovation in the oPt suffers from a lack of research and development (R&D) and a poorly developed information society. Finally, the general doing business index hinder the establishment of business relations to foreign direct investment (FDI) in the oPt.

PMDP's analysis of the ICT sector has revealed that the quality of software engineers is a key constraint on the growth of ICT services in the OPT. This is corroborated by several recent studies of the ICT services sector, as well as by major MNE corporations headquartered in Israel. <sup>6</sup> Analysis points towards a lack of hard programming skills and soft skills which are required for local engineers to compete in an internationally oriented ICT services market.

PMDP decided to investigate the root causes of this failure, by conducting a rapid analysis of the market system for quality software engineers. The provision of software engineers has a direct impact (as a supporting function) on the software outsourcing as well as diaspora offshoring market systems. In doing so, this report builds on the "Multinational Enterprises (MNEs) outsourcing to Palestinians" analysis and subsequently analyses the core relationship between the supply of academic graduates and demand from software industry actors such as software outsourcing and software offshoring companies.

This study brief is intended to address, analyze and attempt to understand and explain the constraints behind quality of engineer gap skills and to address these failures as in figure 1:



Figure 1 Market System Analysis for the Quality of Engineers

<sup>6</sup> "Beyond Aid, the OQR/EIP, the NES/ICT strategy , the Spark Comparative study" The Palestinian education system vs the needs of the private ICT sector, and the Care/AWRAD – skills gap study", the Gaza Labor Market Needs Assessment for the Digital Economy by MercyCorps, the "Linking With Private Sector: IT Curriculum Reform" project : Market Needs Assessment Survey / Al-Najah university, the market mapping of Palestine ICT sector report-2nd-edition by MercyCorps, the Palestinian ICT labor market gap analysis by PITA, the Palestinian ICT labor market gap analysis and the Skills Gaps and Development in the occupied Palestinian study by CARE/AWRAD, and the UCAS Report Final ICT graduates and academic institutions Nov 2011 by Oxfam /ICT skills gap analysis, in addition to other resources and papers.

This report draws significantly on existing industry studies which have emphasized the lack of quality of engineers in the software ICT sector. Key insights from desk research have been validated by stakeholder interviews conducted by PMDP's Market Analysis team.

Overall, the research highlights both a shortage of software engineers, as well as a mismatch between the skill sets of graduates, and the expectations of employers in the software development/outsourcing industry.

For example, out of the 2000 Palestinian IT graduate per year only 119<sup>7</sup> are computer system engineering (CSE) and 169<sup>8</sup> are computer science (CS). The 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 software development requirements by the MNE market and international clients. The need for skillful and talented workforce has been identified as one of the most critical issues that need to be addressed in all of the published studies. Therefore the need is for enhancing the curriculum, the practical experience, critical thinking and technical skills related to software development life cycle process such as systems analysis, project management, professional coding and testing, systems architecture and integration, as well as the same applies to the self-learning skills of ICT graduates and the soft skills as the English writing presentation skills and other skills, etc. Subsequently, recent graduates are becoming qualified enough to speak the international hi-tech language. Furthermore, the majority of students don't know their potential opportunities after graduation<sup>9</sup>, which presents an information gap.

The same situation applies to the Gaza strip<sup>10</sup> as well. While the big difference between Gaza and West Bank contributions to GDP is mainly related to Gaza's small market size in addition to the closure imposed on the Gaza Strip and the limited chances for outsourcing, exporting and interaction with global communities and business, as well as limited growth capabilities in the local Gaza Strip market because of the scarcity of skills, lack of substantial ICT penetration in businesses, lack of innovation and creativity in the development of products and services, and the limited frequency spectrum and machinery allowed by the Israeli authorities in the Gaza Strip. Mr. Ashraf Alyazoury, the general manager of ICT training and consultancy services firm (Vision Plus) in Gaza, mentioned: "our chances among the local market are very limited because of small market size and high competition... this is why we have to look to expand among regional and international markets and to develop local technical skills in order to be qualified for such expansion.

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<sup>7</sup> Please see **Annex Number 1** for the local major university number of graduates per university per colleagues for 2012-2013

<sup>8</sup> Please see **Annex Number 1** for the local major university number of graduates per university per colleagues for 2012-2013

<sup>9</sup> PMDP Study <http://www.pmdp.ps/page.php?id=aae2y43746Yaae2>

<sup>10</sup> Palestinian ICT Labor Market Gap Analysis : <http://pita.ps/studies>



## Importance of the Sector

Several studies have highlighted the strong growth potential of the ICT sector in the occupied Palestinian territories (oPt), mainly because of the fact that it is less dependent on cross border movement restrictions. In 2013 gross revenue for the sector was estimated at around \$637 million<sup>11</sup>, making it a significant part of the Palestinian economy (6% of GDP). There are around 250 local ICT company in the ICT sector that employ about 5,000 people directly and creates additional 2-3 in indirect jobs for each direct job, so it also has a significant employment potential growth. While it is estimated<sup>12</sup> that 5-10% of the total local workforce are females, the entire segment of the workforce is highly educated with literacy rates exceeding 90%.

As per the results of the PMDP “Multinational Enterprises (MNEs) outsourcing to Palestinians” study, the IT Multinational enterprises (MNEs) outsourcing segment is estimated to be around 10 - 12 companies (either specialized or with multiline / mixed services), which employ a total of 400-500 engineers. The estimated size of this market is \$15-20 million<sup>13</sup>. This figure highlights the small overall size of this segment, in spite of the special attention that the sector has from the donor projects and previous corporate social responsibility (CSR) initiatives such as the one from CISCO. The IT MNEs outsourcing sector offers a realistic potential to double in size in the next three years to 800-1,000 engineers and \$30-40 million in sales by adding new products and capturing higher value functions in the value chain. If many of the key systemic issues are resolved, the sector should be able to double again within five years to 2,000 engineers and \$80 million in sales.

## Specific Value Chain Problems Statement

The perception at the demand side is that the number of qualified Palestinian engineers to be hired and the ability of Palestinian companies to scale are limited. As such, on the short term, increasing the number of qualified engineers is a priority and prerequisite to achieve the vision to double the size of the outsourcing subsector and be able to meet the growing demand for the outsourcing.

As many previous studies identified the skills gap in the ICT sector, some universities (Birzeit, Alquds and Al-Najah) have each already started benchmarking their curriculum against Stanford University in order to identify the gaps, not just in the curriculum itself, but also in other missing elements including university linkages with industry on joint projects, research and development and other topics relevant to the industry in providing a better learning experience to students. Furthermore, Al-Quds University already started the Dual System Studies project that is funded by the GIZ. The idea of a dual study program was originated in Stuttgart, Germany in 1972 with the so called “Stuttgart Model“. In a Dual Studies program, which lasts for 4 years in duration, the students study theory half of their time at the university; the other half they are trained and physically work in a company on industry projects. The practical training periods of the students are an integrated part of the official curriculum, whereby the students are awarded credits for this practical period as part of their graduation. Only 3 large companies participated in the program when it first started: 1) Daimler-Benz, 2) Robert Bosch and 3) Standard Elektrick Lorenz (now

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<sup>11</sup> Economic Initiative for Palestine – OQR: <http://www.quartetrep.org/quartet/news-entry/ipe-overview/>

<sup>12</sup> According to information collected from PITA management

<sup>13</sup> based on the average monthly-billed rate calculated based on the number of engineers in this sector multiplied with the average salary by companies charged to multinationals and the average annual productivity output of an engineer

Alcatel). Forty years later, in 2014 the university counted for matching 34,000 students with 9,000 partnering companies. Most of the students are enrolled in Business, Engineering, IT and in social fields.

It is also very important to differentiate between the skills gap according to the different segments in the outsourcing industry. For example the software development skills and competencies needed for top tier Research and Development (R&D) outsourcing to MNE may differ from skills needed for lower tier type of contracts. Likewise, skills that are needed for the captive outsourcing “offshoring” require much higher skills needed for the ready-made application or custom software development made for the local market.

Analysis to be conducted on the supply demand sides:

1. Problems on core function and relationship between supply and demand.
2. Problems on supporting functions in the market system.
3. Problems on the Rules and enabling environment that supports the market system.

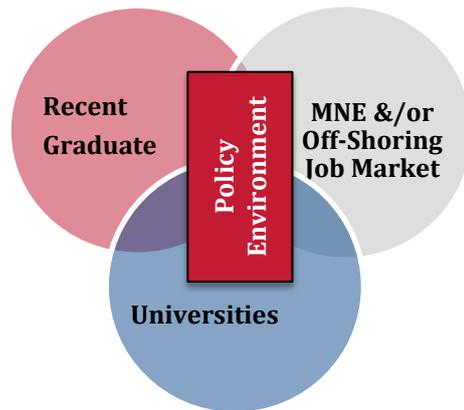


Figure 2 Market System Analysis Scope

## Core Relationship Function

Skills gap, both technical and soft, between what the university has been supplying to the industry and the job market needs has been growing. Many reports have been published on this issue trying to bridge this gap of what are the skills university graduates should have. This report will attempt to identify root cause for the constraints in this market system on both supply and demand sides.

The skills gap is key constraint in this market system. While the universities agree that there is a gap between recent graduates' skills and the job market needs, philosophically they do not believe it is as big as the industry claims. Moreover their argument is that technology gap differs depending on the sub-segment demand for those technical competencies. As such, academia would prefer to provide its students with the basic skills foundations as per their current curriculum. As for the private sector, the counter argument and point of view is that even the basic foundation is still lacking and should incorporate what the MNE's market demand such as excellent technical competency upon graduation and soft skills such as creative thinking, problem solving, and algorithm as well as R&D knowledge.

Palestinian higher education system does not have a clear and robust national plan for better practical training toward ICT students and graduates. Therefore, the quality of the training does not transition from theory to practice and is not focused on student centric learning, but rather takes the traditional form of lecturing. Hence, student skills development progress becomes difficult to measure their knowledge beyond exams.

Scalability is the second issue. The available qualified engineer in terms of numbers and the time and associated cost needed to prepare them to fit and get engaged with the clients are a constraint to scale the Palestinian companies and do not support expansion of current projects or to get engaged on new big projects.

There is a high staff attrition and high internal movement of engineers between companies largely due to the shortage of qualified engineers to respond to MNE demand. Other reasons for the job movement between local ICT firms include a higher pay reflecting a better position. In other brain drain cases, qualified staff may leave the country itself pursuing better jobs and career paths in the MENA and the Arab Gulf area.

## Supply Side Analysis (Universities)

This section provides analysis on the supply side such as the universities and training centers that supply the industry recent graduates. The following are the major constraints identified on the Supply side:

### Supply of Quantity and Qualified Engineers

Eleven universities provide the Palestinian market with an annual supply of about 1,600-2,000 IT graduates (with female graduates comprising around 55%<sup>14</sup>). In addition, there are six university centers of excellence, such as Najjad Zeenni IT Centre of Excellence at Birzeit University, which offers skills development courses. Out of these 2000 IT graduates, only around 119 are Computer System Engineering (CSE) and around 169 Computer Science (CS) that is considered as the most fit for this outsourcing segment<sup>15</sup>. Another resource<sup>16</sup> the Economic Initiative for Palestine (EIP)

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<sup>14</sup> PMDP Study <http://www.pmdp.ps/page.php?id=aae2y43746Yaae2>

<sup>15</sup> Check Annex number 1

identified that only 10% get to find a job in the local market. This low intake at the local market is due to the general and political risks in growing their outsourcing business, the additional investment (perceived as a cost by the companies) needed to train recent graduates.

Certain initiatives have been taken by some universities. For example, Birzeit University plans the Cooperative Education Program (CO-OP)<sup>17</sup> together with the private sector to address this gap and to prepare recent graduates for the market. Additional suggestion by the University includes intensive one-day-a-week training workshops targeting the 4<sup>th</sup> and 5<sup>th</sup> year university students, for a period of a couple of months at the University in order to build the technical skills of the students according to the needs of the job market.

Additionally, recent studies have been conducting comparison on the curriculum taught and the used teaching methods at the local universities against Stanford University. Most Palestinian universities do not apply a strategic method to connect with the industry for the purpose of updating and advancing their curriculum and teaching methods and capabilities. The Stanford University's Computer Science Program offers a much wider course selection and more contemporary technology topics connected to real world situations in addition to a gender-specific curriculum that is also industry relevant. The benchmarking study of Stanford University and the Palestinian universities also illustrated the main difference in the topic of courses; soft skills topics, core, the interactive methods of teaching, wide course selection that offers recent technology trends and clear linkages to industry needs as well as focused on R&D by the lecturer.

“The Palestinian ICT Labour Market Gap Analysis” published by PITA in 2013 investigated the gaps between the current supply of ICT recent graduates’ skills set and the actual industry needs.<sup>18</sup> The research also identified current global trends in the ICT sector to develop certain niche areas and competitiveness to students. The study concluded that universities and the ICT industry need to share information regarding the changing nature of the market and the requirements of employers so that both play a role in preparing students with practical and real world experience. Both parties must encourage and enable students to develop a range of qualities, which consequently will allow them to engage effectively in the market place after graduation. The study indicated the priorities as: 1) catering to the immediate needs of the ICT sector, 2) introducing new courses that better follow market needs and students’ interests through proactive teaching methods, 3) increasing knowledge of technology benefits and uses, 4) developing academic staff’s quality and competency, 5) maintaining on-going research and analysis of the ICT sector situation.

PITA has subsequently published the Comparative Study: “*The Palestinian Education System vs. The Needs of the Private ICT Sector*” in 2015, which was aimed to investigate the reality in linking between ICT Private sector needs and Palestinian education systems, through several aspects in: 1) determining the size of gap between both Demand & Supply sides, 2) determine type of ICT skills that need focus to recover the gap, 3) determine the roles of education systems and activities of ICT graduates to meet needs and enhance their contribution to the ICT private sector. The study<sup>19</sup> was validated with the following main findings:

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<sup>16</sup> EIP/OQR states that only 10% of IT graduates are hired in IT & only 30% are employed overall

<sup>17</sup> Project overall objective: To contribute to bridging the growing supply-demand skills gap & to tackling the problem of lack of job-readiness of university students and recent graduates entering the various Palestinian & international market sectors with the aims to meet the engineering, information technology, business skills and needs of the 21<sup>st</sup> century

<sup>18</sup> Palestinian ICT labor Market Gap Analysis

<sup>19</sup> Spark/PITA Comparative study “The Palestinian education system vs the needs of the private ICT sector Comparative study: 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.

- *There is a significant gap between the Palestinian ICT education system and the needs of ICT market*
- *Most local universities don't have a clear and robust plan for practical training for their students or introducing student-centric learning pedagogy. Limited employment support services. There is no guarantee of employment post university graduation. University collaboration with the industry increases the opportunity for students to be hired.*
- *Government support is required to ensure the policy structure and economic conditions are favorable for employment opportunities*

The 2015 study also highlighted the benchmarking finding between Stanford University Curricula with the Palestinian (Al-Najah and Gaza) universities curricula as table one:

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

Table 1: Curriculum and Teaching Comparison between Stanford University and Palestinian ones

The report found that there is a major weakness 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. Students agree that there are shortages in training in ICT skills and specializations at the universities. Moreover, students advised that the curriculum does not reflect modern technological development neither do they receive a practical training course at companies as it is not planned correctly. Hence, the benefits gained from such internship experiences have not been positive.

Nevertheless, the universities agreed with students, on the gaps in business and soft skills due to curricula shortages in this respect. Furthermore, the majority of Palestinian universities are still under the impression that the curricula is consistent with the local and global market needs, which in itself requires a behavior change about the industry needs, as shown in the tables below:

	Strongly Agree	Agree	Disagree	Strongly Disagree
Curricula In line with ICT local market	16.7%	66.7%	16.7%	0%
Curricula In line with ICT global market	16.7%	50%	33.3%	0%

Table 2: Palestinian ICT curricula relevancy to local market needs

The study highlighted the gap between supply & demand of related skills markets as follows<sup>20</sup> highlighting that the gap is highest in meeting global market needs for software application and it is highest for the local and regional markets for smart phone application development.

	Local		Regional		Global	
	Yes	No	Yes	No	Yes	No
<b>Smart Phone App Develop.</b>	<b>100%</b>	-	<b>75%</b>	<b>25%</b>	<b>25%</b>	<b>75%</b>
<b>Software Application Develop.</b>	<b>50%</b>	<b>50%</b>	-	<b>100%</b>	<b>100%</b>	-
<b>Hardware</b>	-	100%	25%	75%	-	100%
<b>Testing</b>	<b>75%</b>	25%	25%	75%	-	100%

**Table 3: GAPS in Niche Technology Markets**

According to MercyCorps report<sup>21</sup>, both West Bank and Gaza needs to be clear about how it is supporting the education and practical development of the people (both students and existing employees). The primary strategy should be based around education and helping graduates get support and training after graduation. Examples include the school-to-work initiatives carried out by Google, Intel and Cisco along with other organizations in Gaza. Additionally, the industry needs to ensure a meaningful dialogue and relationship with the universities so that appropriate technologies are studied and students understand the business requirements of companies using those technologies. Companies in West Bank and Gaza also need to identify important emerging technologies and look to develop skills and experience in those areas.

Finally, the University College of Applied Science (UCAS)<sup>22</sup> report for Gaza states that while ICT has been listed as a priority sector in Gaza Strip for the last several years, minimal baseline data is available to guide policy makers and sector specialists in devising interventions and strategies that can have maximum impact on the sector’s development. Hence, Gaza ICT sector is also facing a shortage in the skilled manpower that would be needed to sustain the industry’s forward trajectory for the long term. The finding of UCAS report was very similar to the West Bank finding in term of 1) standardizing the training curricula between universities and private sector to meet the needs of domestic and international market, and 2) increase the concentration ratio of practical hours in study plans, especially for (Computer Systems Engineering, Telecommunications Engineering, and Computer Science), 3) strengthen career guidance (employment support services) offered by ICT universities to meet the needs of the market.

## Supply Side Supporting Functions

### ACCESS TO INFORMATION

There is evolving knowledge of what the industry needs in terms of skills, but not on a national basis, but rather on university basis.

As per the Spark study<sup>23</sup>, the level of Universities (both West Bank and Gaza) involvement of ICT demand side in curricula updating process is very low. Additionally there is no awareness; such as

<sup>20</sup> Spark/PITA Comparative study“ The Palestinian education system vs the needs of the private ICT sector

<sup>21</sup> The market mapping of the Palestinian ICT Sector and the Opportunities for Partnerships in the Region report by MercyCorps 2<sup>nd</sup> edition

<sup>22</sup> The UCAS Report Final ICT graduates and academic institutions Nov 2011 by Oxfam

<sup>23</sup> Spark Comparative study“ The Palestinian education system vs the needs of the private ICT sector

job classification, salary guides or orientation sessions to illustrate career path progression to the targeted students before enrolling or before they decide on their major studies at the university

An information gap in employment support services has also been identified in relation to the ICT careers available. A significant part of the students don't know about employment opportunities after graduation as there is no national or industry online job vacancy boards.

### ***INFRASTRUCTURE***

Qualified trainers and professors in keeping up with recent tech trends: There is not specialized lecturers and curriculum that keeps us with industry trends.

Technologies labs and equipment: There is a lack of labs and advanced equipment; software and technical needs to equip students with needs technical and soft skills. The private sector complains that technologies and tools available at universities are out-dated. Insiders estimate that only about a third of graduates in specialties related to ICT succeed in finding employment.<sup>24</sup>

There are no balanced curriculum with practice activities with recent tech trends and soft skills competencies e.g. critical thinking, English. Furthermore, curriculum development is done differently from one university to the other and lack a national strategic vision.

Finally, there is a huge lack in the R&D Funds.

### ***RELATED SERVICES***

Complimenting curriculum with industry relevant training programs (Soft and Technical): locally, there is no complete IT oriented training program to address needs in short-to-medium terms. Additionally there are no real local academia-industry partnerships on employment and training support services such as quality internship programs.

Furthermore, there are no private sector led training programmes to bridge the gap either from a specialized training centre or from the outsourcing companies themselves. However, it is worth mentioning that some private ICT companies and during the development of this report stated that they are starting to plan implementing some initiatives in partnership with the local university in order to bridge this gap. These initiatives need to be well planned and part of the bigger picture, otherwise, will remain to be seen as ad-hoc initiatives.

For a curriculum to be successful it should also have the best and most qualified teachers implementing the best teaching methods, on hand tools, methodologies as well as technologies. PITA research revealed and highlighted many issues with regards to professor's competencies. Locally there are a lack of expertise and trainers for advanced technical trainings and certifications. The Palestinian ICT Labour Market Gap Analysis<sup>25</sup> identified that ICT training and capacity building courses are needed in order to develop and enhance the technical skills of graduates, including: 1) Mobile apps development, 2) Graphic web design (developers and programmers), 3) Cloud computing/certification, 4) Networks administration, 5) Strong database capabilities, 6) Strong analytical skills, 7) Virtual reality skills (simulation), 8) Share point solutions, 9) Network security solutions, 10) ERP solutions, 11) Innovation skills, 12) Animation, 13) Professional montage, 14) Audio production, 15) Advanced programming skills (coding and development), 16) Game design

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<sup>24</sup> Tucker, Tremaine (2012). *The ICT Sector in Palestine – Current State and Potentials*. MAS Publications, Palestine Economic Policy Research Institute, quoting Dr. Saidam and PITA CEO Abeer Hazboun.

<sup>25</sup> Palestinian ICT Labor Market Gap Analysis : <http://pita.ps/studies>

and development, and 17) Creative thinking and innovation skills. Additional soft skills recommended to be included within the capacity building courses for the enhancement of graduates' management as demanded by ICT firms are the following: 1) Team work skills, 2) Reporting skills – technical writing skills, 3) Communication skills, 4) Networking skills, 5) Presentation and self-presentation skills, 6) English language skills, 7) Knowledge regarding basics of business environment standards, 8) Customer care skills, 9) CV preparation, and 10) Problem solving skills. Furthermore, the top<sup>26</sup> 5 identified international technology trends are: 1) Programming and Application Development: emphasis on Java, J2EE & .Net, 2) Cloud/SaaS, 3) Virtualization 4) Networking and 5) Mobile Applications and Device Management.

Most of the previously published studies did not conduct detailed research on curriculum development or delivery. However, the international good practice in terms of reasonable expectations of ICT degree-holders, the Institute of Electrical and Electronics Engineers (IEEE) lists the following skills, which ICT graduates should possess as a minimum upon university graduation<sup>27</sup>:

1. Technical understanding of Computer Science.
2. Familiarity with common themes and principles (such as abstraction, complexity, and evolutionary change).
3. Appreciation of the interplay between theory and practice.
4. System-level perspective (thinking at multiple levels of detail & abstraction).
5. Problem-solving skills.
6. Project experience.
7. Commitment to life-long learning.
8. Commitment to professional responsibility.
9. Communication and organizational skills.
10. Awareness of the broad applicability of computing.
11. Appreciation of domain-specific knowledge.

This list can serve as a professionally sound basis for the local Higher Education Institution to evaluate graduates' overall competence, and the completeness of their educational delivery. The same list might assist students to determine the areas in which they seek supplementary learning

Finally, as analysed earlier, there is a nascent employment support services at the universities e.g. job matchmaking, quality internship programs, co-ops and student career path. This service varies in quality from one program to the other and from one university to the other.

## Supply Side Rules

### *INFORMAL RULES AND NORMS*

Current Culture of being receptive to change: There is culture of “No Fund No Action”, and universities are mostly incentivized once funds are available to launch a project such as the Quality Improvement Fund (OIF) World Bank funded projects in cooperation with MoEHE. The downfall is that there is no unified curriculum development strategy for universities in cooperation with the MoEHE.

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<sup>26</sup> Source: 2012 CW forecast survey / [http://www.computerworld.com/s/article/9231486/10\\_hot\\_IT\\_skills\\_for\\_2013](http://www.computerworld.com/s/article/9231486/10_hot_IT_skills_for_2013)

<sup>27</sup> Institute of Electrical and Electronics Engineers and the Association for Computing Machinery, supra

Methods of Teaching: lecturing vs. student centric learning as teaching pedagogy: Some of the issues that graduates have are related to poor analytical and problem solving skills, theoretical knowledge without practical experience and lack of knowledge in new technologies that are being demanded by the MNE and international clients and it needs further significant improvement by reforming the education system be 'in a qualitative sense<sup>28</sup>, so as to improve critical thinking, creativity and problem-solving at all levels of learning.'

There are many NGO programs working to address the skills gap in the oPt as the Palestine Education for Employment programme, the Welfare programmes, the GIZ education initiatives with universities (Al-Quds universities / Dual system studies) and others that attempting to fill the gaps. It is very challenging for these programs to be a self-sustaining. Additionally they are more concerned with job employment in all economic sectors and not just in the ICT. None of these donor driven initiatives are addressing the critical-thinking, creativity and problem-solving that are underemphasized at all levels of the education system.<sup>29</sup>

Partnership: There is no sustainable academia partnership with the industry. The rationale for this idea is not yet fully appreciated by the academia. Additionally there is no central point to all universities to develop a strategy for such partnership especially with the absence of the leadership and governmental role. PITA initiated the academia and private dialogue two years ago via establishing a dedicated working group, without any substantial results so far as a result of the dialogue.

Additionally the universities suffers from lack of funds dedicated for R&D and innovations, actually the private university claims that they are losing money and not able to cover their cost.

#### ***SECTOR SPECIFIC REGULATIONS and STANDARDS***

Outsourcing Tools, Methodologies and Standards: this specific industry segment requires high level of internationally recognized tools, methodologies and standards. Skills working in this sector need to have acquired such knowledge. The set of knowledge does not exist in the majority of the recent graduate of the CS of CSE collages. Furthermore, the standard is not supplemented with certification to acquire knowledge on standards.

Finally, the student acceptance and graduation criteria should be revised to reflect the good practice policy of not enrolling and sustaining of mediocre performing students and graduating them if they do not pass core courses due to passing score adjustments based on carves. Industry claims that universities need to maintain high standards for the ICT schools.

#### ***LAWS & GOVERNMENT***

Lack of support from MoEHE and other government input is required to ensure the policy structure and economic conditions are favorable for employment opportunities and labour market in the ICT industry. This requires serious reforms in the ICT education taking other country's experience into consideration. For example, Ireland has become an outsourcing destination for multinationals in Europe by differentiating its value proposition based on quality of IT graduates and more competitive pricing relevant to European rates.

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<sup>28</sup> The 2013 Diagnostic Study finds that 'the gender pay gap also exists locally but is not yet empirically evidenced'

<sup>29</sup> NES/ICT strategy

Legislation and general doing business environment in Palestine is not conducive: Government input is required to ensure the policy structure and economic conditions are favorable for doing software outsourcing and offshoring business in the ICT sector. For example, index on “business registration, labor, taxation, incentives, regulatory” needs to be revised and evolve.

Palestine face similar problems to Jordan where many experienced ICT professionals leave the country each year. The brain drain diminishes the national experienced skills base, and the national educational system is no longer felt to be meeting the demands of employers.

As such, the “Workforce Assessment in the Jordanian ICT Industry” study<sup>30</sup> recommended that Jordan increases cooperation between academia and industry, allowing industry to lead in curriculum development that would meet their needs, and initiating integrated curriculum research on ICT trends. Universities were also directed to re-focus on the quality and competency of academic staff, and on the practical component of student experience. It was recommended that universities establish specialized ICT training courses and enhance their English content geared for a global industry.

Egypt too has sought to bring industry directly into the training development process, working with CISCO to establish a national e-learning center, with a comprehensive curriculum in critical skills areas. Egypt’s Information Technology Institute is an example of a holistic nine-month curriculum for training and practice among new entrants to the ICT sector.

Responses to the skills gap like those proposed in Jordan and Egypt demonstrate governments’ acknowledgement that the skills gap has no simple or quick fix, nor does the problem have a single owner. These responses are integrated between the public, private and academic sectors.

In particular, industry is being brought directly into the design of curriculum, rather than partnering only to provide practice or placements for graduating students.

From analyses of the impact of ICT on other sectors of Jordan’s economy comes a final recommendation, that perceptions of ICT must be transformed from a cost center to an enabler of the society and all economic sectors.

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<sup>30</sup> The Gaza Labor Market Needs Assessment for the Digital Economy by MercyCorps

## **Demand Side Analysis (Outsourcing and Offshoring companies)**

This section provides analysis on the demand side, the local outsourcing and offshoring companies that intend supplying clients such as MNE with quality of service. The sector has been growing steadily since 2009. In 2014, the industry is comprised of a combination of home-grown Palestinian firms, which contract directly with MNEs and offshore companies (subsidiaries of Palestinian-owned firms based in other countries), which started to grow in 2009. The offshore companies, which sell their services primarily through their parent companies, have been growing faster. The exceptions in this segment were the numerous local ICT firms (The Mix/Hybrid companies) those which have readymade products and applications and started to target outsourcing projects from MNEs and international companies.

In spite of the fact that labor costs in the West Bank are competitive with the regional competitors, local Palestinian ICT companies have additional difficulties competing on technical, business and project management skills.

It was noticed that there is shortage in the number of local ICT companies that can have capacity to accommodate the high number of students interested to be engaged in practical training especially during the summer semester. In order for local companies to be motivated to get engaged in practical training with universities, a motivation and incentive system is required, to compensate the company's efforts of assigning a team leader and extra overhead burden. Since the only motivation for the local ICT companies is a potential outsourcing contract. Unless business grows organically with limited donor interventions, no serious action will be taken by companies to invest in training new talent from their own resources.

## **Demand Side Supporting Functions**

### ***ACCESS TO INFORMATION***

Weak industry job classification framework and salary guides: there are neither a nationally recognized job classifications system nor salary guide to translate the needs of the local ICT companies into a common language that can be reflected in the universities new developed curriculum and share market information to students. The job classification is defined as a framework for objectively and accurately describing the duties, responsibilities, tasks, and authority level of each job. Furthermore a job description is usually developed by conducting a job analysis, which includes examining the tasks and sequences of tasks necessary to perform the job. The analysis considers the areas of experience, knowledge and skills needed for the job. For more information on this issues please check Annexes 2 for "What the Jobs Are: ICT Professions" and Annex 3 for the ICT Fields of Study. A sample for this job classification framework is the Skills Framework for the Information Age (SFIA) which help the industry at all stages of skills management cycle.

Additionally the recruitment process does not bring positive branding to the industry where salary guides would also address salary pay based on the number of years of experience required. Furthermore, the salary guide may set industry norms for a salary scale to reduce the turnover between local ICT firms, and retain the local qualified engineers. This also serves as guide to students on what to expect when they graduate to incentivize them on their enrolment and in which IT program they aspire to enrol in.

Access to Technology: the challenge to keep in mind is that the software outsourcing can rely on very diverse and abundant technologies. There is no one size that fits all in the technology required by international clients. Each project by MNE can require different types of technical competencies. Hence, economy of scale to train aspiring or existing employees on a specific technology to cater for a specific MNE project becomes a challenge since each project differs in its technology requirement to the other.

#### ***INFRASTRUCTURE***

Limited access to labs and equipment: The current infrastructure does not support hosting the needed recent graduate to scale and fill the gap as needed.

The sector's development and operations are further constrained by low levels of capital investment and short supply of appropriate and innovative financing instruments including (R&D) funds. Israeli-imposed constraints on ICT infrastructure and Internet connectivity are also a major constrain to innovation and developing skills in the software industry. Finally, legal and administrative hurdles to foreign direct investment (FDI) in the State of Palestine hinder the establishment of business relations.<sup>31</sup>

Furthermore, there is a limited specialized industry training capability, to bridge the gap in order to produce the required qualified skills needed to scale. Moreover, the working environment e.g. facilities, input either is relatively high. Furthermore, the sector is missing Tech Parks or Free Zones areas to nurture further positive image and brand of the sector.

#### ***RELATED SERVICES***

All companies expressed difficulty in finding qualified graduates for the job. A company representative who is a software development manager says: "We find great difficulty in finding talent that suits our needs. We have to interview about 50 new graduates just to find 2 or 3 qualified employees. The CV will show that they have something [qualifications], but when you give them a test, large majorities don't pass "In addition he says: It is true that universities might graduate 500 students per year but in reality, not more than 50 of them are qualified."<sup>32</sup>

However, there are nascent employment support services by the demand side e.g. quality internship programs, industry orientation programs, transparent student career path and salary scales. This is compounded with nascent or weak participation in curriculum development with Universities to bridge the gap based on the private sector needs and future plans.

### **Demand Side Rules**

#### ***INFORMAL RULES AND NORMS***

Salary subsidy by donors: The private sector is more depending on risk sharing tool that is provided by donors: The On-Job-Training that are subsidized by donor has been a tool to bridge the gap and develop the recent graduate skills to meet the clients' satisfactions. It will remain to be an important intervention by donors until business growth becomes organic to the outsourcing companies.

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<sup>31</sup> NES/ICT strategy

<sup>32</sup> "LINKING WITH PRIVATE SECTOR: IT CURRICULUM REFORM" PROJECT

There are nascent cooperation with Universities by the demand side, in addition to lack of systemized incentive systems, it is mostly based on personal relationships with universities, which can still be seen as ad-hoc attempts to bridge the skills gap.

***SECTOR SPECIFIC REGULATIONS & STANDARDS***

As discussed earlier, certification and quality systems are important for the Palestinian outsourcing companies. The oPt suffers from an absence<sup>33</sup> of certification and quality systems, and currently no regulatory or autonomous industry certification and quality systems is in place for the Palestinian ICT industry to tap into on national basis.

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<sup>33</sup> Paltrade Outsourcing Export Strategy- 2015



## Gender Analysis

Limited gender participation of recent graduates also contributes to skills shortages. While the female comprise around 55% of the yearly graduates, they are underrepresented in the workforce. It is estimated According to information collected from PITA management that only 5-10% of the total local ICT workforce is females, while in comparison 65% of employees in this sector in the Philippines are women.<sup>35</sup>

It could thus play a critical role in the context of the State of Palestine as women suffer higher unemployment rates than men (28% against 19% in 2011)<sup>36</sup>. Although the best ICT graduates in terms of final grades are female, they still face a higher unemployment rate than men.<sup>37</sup> According to the 2013 Diagnostic Study<sup>38</sup>, software development outsourcing companies perceive recruiting women as more costly in the long run. They anticipate that, once they are married, they will need maternity leave; they will be more frequently absent; and overall will have a lower productivity once they have children. Indeed, that is already partly reflected in female salaries, which are, in general, lower than those of men at the same level of qualifications.

Despite this perception, there are some positive changes that are happening and require further support, such as the Technovation<sup>39</sup> initiatives, which is an entrepreneurship program and competition targeting young women. The program is an intensive three months, fifty hour curriculum, where teams of young women work together to imagine, design, and develop mobile apps, then pitch their “startup” businesses. Additionally, there is one local company that established a branch in Hebron that is dedicated to hire female programmers only. The possibility of local ICT companies to locate their offices in the North and the South will make it easier for women to participate in the workforce since most companies now are in the central areas.

Improving female ICT graduates’ recruitment into the sector may require positive measures such as favorable business legislation for businesses to hire more women through tax breaks, insurance cost coverage and subsidies, working from home schemes, etc. and direct incentives for women to keep working after marriage.

## Validation of the Quality of Engineers Market System Constraints

During the 1<sup>st</sup> meeting for the Quality of Engineer sub group that was held on March 11<sup>th</sup> 2015 at PITA office and was attended the major stakeholder (Donors community, local ICT companies, the Ministry of Telecommunication and IT (MTIT) and four local universities), the PMDP presented and validated the summary of supply and demand constraints<sup>40</sup> that are resulted from this study and previously conducted studies.

Furthermore, PMDP has developed the proposed impact frame work for the Quality of Engineer Market System “As in Figure 3”, which aims to organize the efforts and the required activities, and

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<sup>35</sup> *Ibid.*

<sup>36</sup> <http://www.pcbs.gov.ps/site/512/default.aspx?tabID=512&lang=en&ItemID=725&mid=3172&wvversion=Staging>

<sup>37</sup> Tucker, Tremaine (2012). *The ICT Sector in Palestine – Current State and Potentials*. MAS Publications, Palestine Economic Policy Research Institute.

<sup>38</sup> 2013 Diagnostic Study finds that ‘the gender pay gap also exists locally but is not yet empirically evidenced

<sup>39</sup> [www.technovationchallenge.org](http://www.technovationchallenge.org)

<sup>40</sup> The Daunt Pie / Figure 2 in this document that was developed by PMDP as part of the QoE for MNE’s

to improve the sector coordination in order to achieve the required system level change that will impact positively on improving the skills and training/education market. This change, in turn, will result in positive change at the business level in order to achieve the goal of introducing new products and functions in the value chain that will ultimately lead to increase value of exports to MNE and investment in Diaspora offshore. Accordingly, it will impact increasing the employment and incomes in this value chain.

## Impact Framework for the Quality of Engineer

The below graphic represents the impact framework for the Quality of Engineer market system study. It provides all the opportunities to change the business level and market system levels.

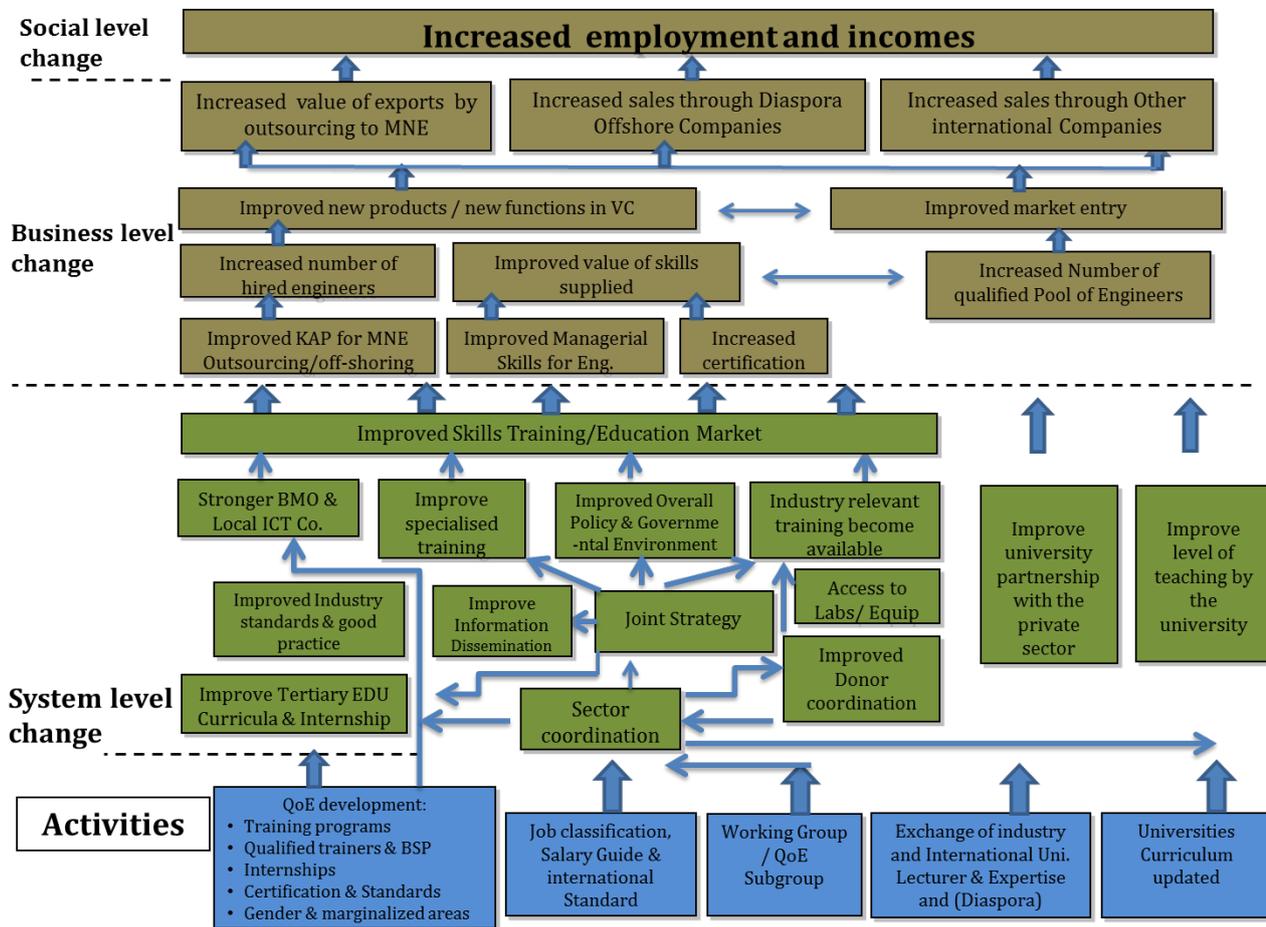


Figure 4: Impact Framework for the Quality of Engineer

As a general direction, PMDP believe that the critical areas in the market system that requires addressing include:

1. Improving the information development and dissemination between the supply and demand side on skills needs
2. Work with stakeholders on specialized training through various initiatives

Future interventions on the above will be discussed in close cooperation with relevant stakeholders.



## Recommendations

So far, there is no strategic direction on the priority of activities to be taken despite a consensus at the validation workshop on the root constraints of the problems. There is an urgent need to have a strategic session that includes all stakeholders, on managerial and technical level to start prioritizing to achieve more coherent market system coordination.

### Quality of Engineer Market System Elements

A high quality of engineer market system will require four different elements to work in coordination and function correctly:

1. The end market (potential local ICT companies as buyers) must define their needs and translate it into a systemic description (job classification) and to communicate them to the aspiring potential employees as well as the universities and training institutions.
2. The university and training institutions must understand the specific skills and quality standards desired by the demand side in a unified strategic way, and to develop capacity to deliver industry relevant curriculum and methods of teaching them in their programmes.
3. The recent graduate / aspiring trainees need to understand the skills demanded by the private sector. In addition, to acquire skills how to continue with their own self-development of ever changing needed technology skills.
4. With a declining index ranking on doing business in Palestine and very old labour and intellectual property protection laws, the policy environment must be improved to be better supportive of the development a quality of engineers in the outsourcing industry, with the proper incentives for universities on one hand to develop their unified curriculum and modify their programmes to meet the needs of the industry, and for the private sector on the other hand to play an active role in this process to ensure quality programmes.

The PalTrade ICT National Export Strategy<sup>41</sup> recommends the Tertiary education for the:

- 1- Curricula<sup>42</sup>: Engage industry in curriculum development based on a market needs programme so that students can be more productive after their graduation and be fully in tune with technology trends and market needs. This should be based on an analysis of best-of-class tertiary education institutions and their methodology for understanding industry needs.
- 2- Internship programme<sup>43</sup>: Develop and exploit industry linkages to develop quality internship programmes to enable students to gain practical training in what would be expected from them upon graduation, to complement the theories they acquire in class and to enable companies to find suitable staff. Internship programmes could and should include an international dimension (e.g. placement in European companies) if possible.

A public-private partnership (PPP), as the Jordanian and the Egyptian initiatives, where government provides support to ICT in the forms of infrastructure, legal environment, market

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<sup>41</sup> Paltrade ICT/NES

<sup>42</sup> Paltrade ICT/NES & Paltrade Outsourcing Export Strategy- 2015

<sup>43</sup> Paltrade ICT/NES & Paltrade Outsourcing Export Strategy- 2015

deregulation, policy priority, ensuring broad social access to technology, and supported market initiatives.

### **Supply side (Universities and Training Centres)**

The below recommendation are meant for the universities and training centres and institutes to consider on the Long Term: Curriculum Upgrades:

- 1- Developing market system relevant information and sharing them amongst all stakeholders such as sharing job classification
- 2- Existing initiatives and pilots should be expanded and complemented as appropriate<sup>44</sup>. The 2013 Diagnostic Study<sup>45</sup> recommends that the education system be reformed 'in a qualitative sense, so as to improve critical thinking, creativity and problem-solving at all levels of learning.' Moreover, on the long term national revision of the current curricula at local universities and benchmarking with regional and international universities is needed to bridge the gap. Working closely with industry to execute the recommendation and develop new standard curricula that will produce highly qualified engineers.
- 3- Improve educational methodologies and techniques by: integrating with real market by cooperation with ICT startups and researches as well as inclusion of seminars and sessions led by market experts. Furthermore, emphasize learning of ICT as an applied science in order to produce graduates who view technology from the perspective of non-ICT employers. Improving the effectiveness of skills training by 1) link business skills to specific job roles as communication for quality assurance or problem solving for security specialist, and 2) integrate skills learning with the practice to translate knowledge into a practical skills
- 4- Host recent technology trend classes and provide latest state-of-the-art labs and equipment to student<sup>46</sup>
- 5- Develop information dissemination between and among universities
- 6- Develop friction free internal policies at universities to allow the lecturers to interact and work at the industry on part time basis. Additionally, universities shall assign instructors from industry to teach some courses to share knowledge knowhow and latest trends.

### **Demand Side (Palestinian Outsourcing and Offshoring Companies)**

The below recommendation are meant for the local ICT outsourcing and offshoring local companies to consider in cooperation with the support of donor projects on the Short Term: Workforce and Graduate Development:

- 1- Proceed in the sector coordination and empower the Quality of Engineer subgroup, to work progressively in conducting a strategy session to prioritize the needed actions and develop action plan for all actors.
- 2- Tertiary education – curricula<sup>47</sup>: Engage industry in curriculum development based on a market needs programme.
- 3- Intensive short-term training: Unifying the efforts of academia and the private sector to work towards establishing a virtual training academy due to the limited local market

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<sup>44</sup> Paltrade ICT/NES

<sup>45</sup> [www.paltrade.org](http://www.paltrade.org) : The 2013 Diagnostic Study

<sup>46</sup> OQR strategy

<sup>47</sup> PalTrade ICT/NES & PalTrade outsourcing export strategy- 2015

capacity, this will provide 3-6 months of practical training. Courses offered will be demand-driven based on feedback from the private sector.

- 4- Quality internship program: actively participate in the implementation of quality internship programs that aims to develop the graduate's skills and providing them with hands-on training. These programs This recommendation was also suggested by ICT/NES<sup>48</sup> strategy as the tertiary education – internship programme<sup>49</sup>
- 5- Increased project engagement with MNEs and international companies: MNEs and international companies can play an active role in upgrading the ICT sector by securing the market for the newly trained graduates.

## Regulatory (Government and Universities)

- 1- Develop new laws that address intellectual property protection, doing business in Palestine, research and development funds, investment schemes and tax incentives as well as free zones located near university campuses as policies to facilitate for industry-university cooperation and improve the employment market.
- 2- Subsequently, initiate industry-university projects that would support the development of the university teachers and lecturers in support of multinational enterprises and international universities to ensure that they have the right skills and up-to-date with latest technologies, trend and practical teaching techniques
- 3- Contribute to the development of a classification / Job profiling and description.
- 4- Develop and provide information and statistics on the actual market needs of disciplines to influence the universities plans of acceptance and to balance the supply to the market
- 5- Revise and develop the student acceptance and graduation criteria to reflect the good practice
- 6- Develop a national incentive scheme between the universities and industries to cooperated such as R&D funds or joint projects

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<sup>48</sup> Paltrade ICT/NES & Paltrade Outsourcing Export Strategy- 2015

<sup>49</sup> To develop and exploit industry linkages to develop quality internship programmes to enable students to gain practical training in what would be expected from them upon graduation, to complement the theories they acquire in class and to enable companies to find suitable staff. Internship programmes could and should include an international dimension (e.g. placement in European companies) if possible. This must focus on gender participation



## **PMDP Engagement**

The PMDP will continue to work with the various stakeholders and market actors to facilitate the implementation of the recommendations in the study above, where appropriate.

### **Output 1-Improved Private Sector Skills and Innovation**

PMDP staff can assist PITA and its members in designing and partially funding firm-level initiatives (individual companies or groups of companies) to develop training for recent graduates and to improve their quality via certifying ICT firms or individuals in different ICT fields to meet the international standards.

### **Output 2 -Market Systems Development**

The Market Systems Development component (Output 2) will proceed in the facilitating and support the recently established Working Group (Quality of Engineer subgroup) efforts to bridge the identified gap for the MNE segments. Output 2 and in cooperating with interested stakeholder may step in to implement any short or long term recommendations.

### **Output 3-Strengthening Trade and Investment Linkages with International Markets**

The PMDP component on Strengthening Trade and Investment Linkages with International Markets (Output 3) can facilitate exchanging the know-how with diaspora, friends of Palestinian, international universities and related stakeholder.



# Annexes

## Annex 1

Distribution of Graduates by Institute, Faculty, Program, Scientific Degree, and Gender 2011-2012 <sup>50</sup>																										
		Computer Science		Elec. Eng. (Minor Eelc. Com. Eng.)		Elec. Eng. (Minor Computer Eng.)		Information Technology		Information System		Applied Electronics		Computer Information Systems		MIS		Computer Engineering		SW Eng.		Communi cations Eng.		Electrical & I.T		
		Female	Total	Female	Total	Female	Total	Female	Total	Female	Total	Female	Total	Female	Total	Female	Total	Female	Total	Female	Total	Female	Total	Female	Total	
1	Hebron Uni.	13	5																							
2	Polytechnic			7	7	4	1	13	8	6	5	1	7													
3	Bethlehem Uni.													21	13											
4	A-Quds Uni.	10	29					1	13							13	6	19	20							
5	BirZeit Uni.	14	20															12	24							
6	Al-Najah Uni.	13	47											20	33			24	20							
7	AAUJ Uni.	7	11											10	15							8	49			
8	Khadori Uni.			14	25							1	3	10	10							10	9	18	7	
9	Palestine Uni.									3	19					5	31			4	14					
		57	112	21	32	4	1	14	21	9	24	2	10	61	71	18	37	55	64	4	14	18	58	18	7	
	<b>Total All</b>	<b>169</b>		<b>53</b>		<b>5</b>		<b>35</b>		<b>33</b>		<b>12</b>		<b>132</b>		<b>55</b>		<b>119</b>		<b>18</b>		<b>76</b>		<b>25</b>		

Table 4: Distribution of Graduates by Institute Faculty, Program, Scientific Degree, and Gender 2011-2012

<sup>50</sup> <http://www.mohe.pna.ps/List/Daleel/Daleel2003-2004.pdf>

### What the Jobs Are: ICT Professions<sup>51</sup>:

Annex 2 details core ICT jobs and study paths for each field, the below link includes a sample of job titles, responsibilities, and the technology used in that field. The source of this information is ONET Resource Center, which includes a database of hundreds of job descriptions, available at [www.onetcenter.org](http://www.onetcenter.org). Additionally there is further useful information on this topic that can be found on the Skills Framework for the Information Age (SFIA) website under the [www.sfia.online.org](http://www.sfia.online.org).

Annex 2 contains the following fields of computer study:

1. Computer and Information Systems Managers
2. Computer Hardware Engineer
3. Computer Network Architects
4. Computer Network Support Specialists
5. Computer Programmers
6. Computer Systems Analysts
7. Computer Systems Engineers/Architects
8. Computer User Support Specialists
9. Database Administrators
10. Database Architects
11. Film and Video Editors
12. Geographic Information Systems Technicians
13. Graphic Designers
14. Information Security Analysts
15. Information Technology Project Managers
16. Management Analysts
17. Multimedia Artists and Animators
18. Network and Computer Systems Administrators
19. Operations Research Analysts
20. Portals & Collaboration specialist
21. Software Developers, Applications
22. Software Developers, Systems Software
23. Software Quality Assurance
24. Web Administrators
25. Web Developers

### Sample Job descriptions: Computer Hardware Engineer:

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<sup>51</sup> [www.onetcenter.org](http://www.onetcenter.org)

- **Main role:** Research, design, develop, or test computer or computer-related equipment for commercial, industrial, military, or scientific use. May supervise the manufacturing and installation of computer or computer-related equipment and components.
- **Sample of reported job titles:** Hardware Engineer, Engineer, Systems Engineer, Design Engineer, Field Service Engineer, Project Engineer, Systems Integration Engineer
- **Responsibilities:**
  - Update knowledge and skills to keep up with rapid advancements in computer technology.
  - Provide technical support to designers, marketing and sales departments, suppliers,
  - Engineers and other team members throughout the product development and implementation process.
  - Test and verify hardware and support peripherals to ensure that they meet specifications and requirements, by recording and analyzing test data.
  - Monitor functioning of equipment and make necessary modifications to ensure system operates in conformance with specifications.
  - Analyze information to determine, recommend, and plan layout, including type of computers and peripheral equipment modifications.
  - Build, test, and modify product prototypes using working models or theoretical models constructed with computer simulation.
  - Analyze user needs and recommend appropriate hardware.
  - Direct technicians, engineering designers or other technical support personnel as needed.
  - Confer with engineering staff and consult specifications to evaluate interface between hardware and software and operational and performance requirements of overall system.
  - Select hardware and material, assuring compliance with specifications and product requirements.
- **Technology used in this occupation:** Analytical or scientific software, computer aided design CAD software, development environment software, object or component oriented development software, operating system software.

## ICT Fields of Study:

Annex 3 outlines fields of computer study as organized internationally. It aims to sharpen discussions of skills, curricula and investments in workforce preparedness, and more fundamentally, it aims to allow students to define and pursue one set of qualifications through their education.

The following are the ICT fields of study:

1. Computer Science<sup>52</sup>:
2. Computer Engineering
3. Computer and Communications Engineering
4. Computer Systems Engineering
5. Software Engineering (Software Development)
6. Information Technology and Communications (ITC)
7. Information Technology (IT)
8. Management Information Systems (MIS)
9. Computer Information Systems (CIS):
10. Information Technology (IT) Management
11. Computer Education
12. Graphic Design
13. Security Engineering
14. Web Engineering
15. Multimedia

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<sup>52</sup> 1) *Source*: School of Engineering and Applied Sciences, University at Buffalo, the State University of New York, available at [www.eng.buffalo.edu/undergrad/academics/degrees/cs-vs-cen](http://www.eng.buffalo.edu/undergrad/academics/degrees/cs-vs-cen), 3) *Source*: Notre Dame University, available at: [www.ndu.edu.lb/academics/fe/ecce/comp\\_comm.htm](http://www.ndu.edu.lb/academics/fe/ecce/comp_comm.htm). 4) *Source*: University of Alaska, Anchorage, available at [www.uaa.alaska.edu/computerscienceandengineering/computersystemsengineering/](http://www.uaa.alaska.edu/computerscienceandengineering/computersystemsengineering/) 5) *Source*: "Computer Science Specializations" was produced by staff of "The Advising Quarterly" a publication for professionals in international education worldwide published by AMIDEAST, available at [www.bibl.u-szeged.hu/afik/compw.html](http://www.bibl.u-szeged.hu/afik/compw.html) 6) *Source*: Wikipedia, available at [http://en.wikipedia.org/wiki/Information\\_and\\_communications\\_technology](http://en.wikipedia.org/wiki/Information_and_communications_technology). 7) *Source*: Wikipedia, available at [http://en.wikipedia.org/wiki/Information\\_Technology](http://en.wikipedia.org/wiki/Information_Technology) 8) *Source*: "Computer Science Specializations" was produced by staff of "The Advising Quarterly" a publication for professionals in international education worldwide published by AMIDEAST, available at [www.bibl.u-szeged.hu/afik/compw.html](http://www.bibl.u-szeged.hu/afik/compw.html) 9) *Source*: "Computer Science Specializations" was produced by staff of "The Advising Quarterly" a publication for professionals in international education worldwide published by AMIDEAST, available at [www.bibl.u-szeged.hu/afik/compw.html](http://www.bibl.u-szeged.hu/afik/compw.html) 10) *Source*: Wikipedia, available at [http://en.wikipedia.org/wiki/Information\\_technology\\_management](http://en.wikipedia.org/wiki/Information_technology_management). 11) *Source*: Korea University, College of Education, available at [http://educa.korea.ac.kr/eng/intro/intro3\\_9.jsp](http://educa.korea.ac.kr/eng/intro/intro3_9.jsp) 12) *Source*: American Intercontinental University, available at [http://www.aiuniv.edu/Degree\\_Programs/Bachelor-Of-Fine-Arts-In-Visual-Communication-Specialization-In-Web-Design](http://www.aiuniv.edu/Degree_Programs/Bachelor-Of-Fine-Arts-In-Visual-Communication-Specialization-In-Web-Design) 13) *Source*: Wikipedia, available at [http://en.wikipedia.org/wiki/Security\\_engineering](http://en.wikipedia.org/wiki/Security_engineering) 14) *Source*: Department of Computing and Information Systems, University of Western Sydney Macarthur, available at <http://www-itec.uni-klu.ac.at/~harald/proseminar/web11.pdf> 15) *Source*: Educational Portal, available at [http://educationportal.com/bachelor%27s\\_degree\\_programs\\_in\\_multimedia.html](http://educationportal.com/bachelor%27s_degree_programs_in_multimedia.html) 16) *Source*: Wikipedia, available at [http://en.wikipedia.org/wiki/Geographic\\_information\\_system](http://en.wikipedia.org/wiki/Geographic_information_system)

## 16. Geographic information system (GIS)

### Sample Job descriptions: Computer Hardware Engineer:

#### Computer Engineering:

**Definition 1:** "A broad discipline that incorporates the fields of computer science and electrical engineering. Computer engineering emphasizes the theory, design, and development of computers and computer related technology including both hardware and software."

**Source:** "Computer Science Specializations" was produced by staff of "The Advising Quarterly" a publication for professionals in international education worldwide published by AMIDEAST, available at [www.bibl.u-szeged.hu/afik/compw.html](http://www.bibl.u-szeged.hu/afik/compw.html).

**Definition 2:** "Computer engineering (CEN) is the design and prototyping of computing devices and systems. While sharing much history and many areas of interest with computer science, computer engineering concentrates its effort on the ways in which computing ideas are mapped into working physical systems. Emerging equally from the disciplines of computer science and electrical engineering, computer engineering rests on the intellectual foundations of these disciplines, the basic physical sciences and mathematics.

The main branches of computer engineering are the following:

- Networks: concerned with design and implementation of distributed computing environments, from local area networks to the World Wide Web.
- Multimedia computing is the blending of data from text, speech, music, still image, video and other sources into a coherent DataStream, and its effective management, coding-decoding and display.
- VLSI systems: involves the tools, properties and design of micro-miniaturized electronic devices (Very Large Scale Integrated circuits).
- Reliable computing and advanced architectures considers how fault-tolerance can be built into hardware and software, methods for parallel computing, optical computing, and testing.
- Other important topics in computer engineering including display engineering, image and speech processing, pattern recognition, robotics, sensors and computer perception."

**Source:** School of Engineering and Applied Sciences, University at Buffalo, The State University of New York, available at: [www.eng.buffalo.edu/undergrad/academics/degrees/cs-vs-cen](http://www.eng.buffalo.edu/undergrad/academics/degrees/cs-vs-cen).