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INFORMATION TECHNOLOGIES WORKFORCE SUPPLY ASSESSMENT

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EXECUTIVE SUMMARY

Since 2000 the Government of Armenia has declared the development of Information and Communication Technologies as one of the priorities for economic development. At present, more than 80 percent of information technology (IT) products and services produced in Armenia is exported (5 - 7% of total exports), providing 1.5 – 2 percent of GDP and employing only 0.5 percent of the total number of the employed¹. The IT sector is well positioned for continued growth due to positive factors such as the existence of qualified workforce at competitive labor cost, government support, and foreign direct investments in the IT sector.

OBJECTIVES

The purpose of this study was to collect information and make an assessment on the labor supply in the IT sector of the Republic of Armenia. The study constitutes a part of a larger workforce development assessment of the Armenian IT sector and as such it presently examines the workforce supply side only. It was also aimed at examining the technical skills and competencies of graduates based on the evaluation and rating by rectors, faculty deans and/or chairmen.

The survey has been conducted through a specially designed questionnaire (see Annex 1) and interviews with the higher educational institutions, both public and private, as well as training centers. The study was also based on the analysis of the current situation in the Armenian IT sector, other research and survey findings.

FINDINGS

The analysis of survey results revealed the dynamics of the student enrollment and graduation by various specialties at IT-related Departments of educational institutions, during the period of 2004-2006, as well as the number of trained people at major training centers. It identified the existing problems related to the quality of IT education: the need for renewing the faculty, motivation of the labor force, unemployment of IT specialists and labor market infrastructure development, and the need for further expansion of university-industry partnerships.

- Supply data – higher education institutions

Data on enrollment to IT-related departments demonstrates that in 2005 the number of first year students increased relative to year 2004 by more than 7% and reached 1,908 enrolled in 2005.

¹ Based on official statistics.

The number of graduates in 2006 has increased in comparison to year 2004 by almost one third and the trend line shows future growth of graduates. The number of graduates specifically from the Computer Science, Information Systems and Applied Mathematics departments during 2004-2006 increased by approximately 60%, reaching 1,021 graduates in 2006 as compared to 899 in 2005 and only 646 in 2004.

Despite the fact that more than half of the enrolled and graduated students are from the Yerevan State University (YSU) and State Engineering University of Armenia (SEUA), the share of these two institutions in the total number of enrolled and graduated from IT departments during 2004-2006 has moderately but continually decreased. They combined for 84% of graduates in 2004, 81% in 2005 and only 77% in 2006. This is primarily explained by the emergence and growth of IT departments in the other universities.

- Competencies of Graduates

The survey results revealed, in the opinion of surveyed faculty members, that the graduates have relatively high competence in database systems management, programming languages and tools, Internet applications and E-commerce. Whereas the lowest competence of IT graduates is considered to be in artificial intelligence, CAD/CAM/CASE, embedded software and IT outsourcing.

- Faculty

Analysis of the existing qualification levels of IT faculty demonstrates that the average share of Academicians (members of the National Academy of Science) and PhDs in the total number of faculty is 61%. This indicator is particularly high at the European Regional Institute of IT of Armenia (ERIICTA), “Hrachya Acharyan” private university, YSU and SEUA.

Despite the faculty educational qualification levels, more than 73% of the institutional staff surveyed think the current level of skills and competencies of the faculty should be improved.

An important finding is the average age of faculty, which is 57 years old. Young and talented professionals do not have motivation to stay and teach at academic institutions, thereby leaving for higher paid jobs at IT companies.

- Employment

Although an in depth study of firms’ demand for workers is currently underway by the World Bank funded Enterprise Incubator Foundation, the current study revealed a mismatch between the supply of IT graduates and demand for them.

In general, the average share of graduates from IT departments obtaining jobs is estimated at 58%. The highest level of job provision for graduates was registered at the American University of Armenia (AUA), YSU, SEUA, and State Academy of Arts. The

lowest share was estimated at the Armenian Pedagogical University, with only 5% of graduates of the Department of Mathematics and Informatics finding employment upon graduation. However, interestingly enough, only one of every four graduates of Departments of Cybernetics and Radio-physics of SEUA obtains a job by specialty.

Data from the UNDP survey² of 2002 graduates reveals that the employment rate for specialists in applied mathematics, informatics and computer technologies three years after graduation comprised 69%, including 55.4% of those working in their specialties. However, 31% of specialists were unemployed, often due to the mismatch of qualifications obtained versus industry needs.

- Training Centers

The survey sample included 24 training centers offering IT-related training programs. These programs are often used by firms to assist the existing workers to upgrade their skills. These included computer basics, graphics and web design, Internet network use, programming languages, software engineering, system management and network administration. During 2005 the training centers have trained 5,688 students (26% more than in 2003) and 3,609 students already in the first half of 2006. Training and re-training of workforce for the IT industry to increase supply of personnel is an important element. With more than 5,000 trained on an annual basis, the contribution of IT training providers is certainly quite essential for the structure of IT workforce supply.

SUMMARY RECOMMENDATIONS

- Almost all IT companies are concentrated in Yerevan. Development of pilot projects and relevant infrastructure in regions, within its local context, need to be established in marzes to prevent outward migration flows of young specialists to Yerevan and to support regional development;
- The quality of the IT labor supply should be improved through:
 - enhancing the IT education in accordance with international standards;
 - developing competencies in embedded software, artificial intelligence and systems integration, taking into account that the global export focus should be on embedded software and customized application development;
 - regular retraining of the faculty and wider involvement of young motivated professionals, which will require additional funding and essential growth of salaries;
 - advancing computer education in secondary schools;
 - development of university-cluster partnership models for other state and private universities, comprising regions that have a supply of IT specialists;
- To match the supply of and demand for skilled IT professionals, the labor market infrastructure needs to be developed through:

² “Conceptual Approaches for the Development of the State Policy on Professional Education in Armenia”, 2005

- establishment of information-advertising centers providing regular information on current vacancies and training opportunities;
- creation of databases of unemployed and temporarily unoccupied IT specialists, also using other media sources (TV, radio, Internet);
- strengthening the functions of career centers for alumni at state and private universities.

SURVEY DESIGN AND DATA COLLECTION

The survey of the labor force supply in the IT sector was conducted based on a customized questionnaire (see Annex 1). It was completed through personal interviews, telephone calls and using secondary sources. Interviews with the educational institutions and selected training centers were conducted between the period of June 23 – July 7, 2006, and lasted approximately 40 minutes to 1.5 hours.

Twenty six educational establishments, including 16 state and 10 private universities and their branches, were interviewed (see Annex 2). These have employed in total 868 faculty members. The majority of educational establishments surveyed were concentrated in the capital city, while branches were located in Gyumri, Vanadzor, Kapan, and Goris. This sample was based on the existing and extended, renewed database of IT specialized institutions and covered the majority of educational establishments with IT departments.

SURVEY RESULTS

Results of the survey have been analyzed using the SPSS statistical software and MS Excel.

As the survey showed, along with the traditional significant role of the YSU and SEUA in supply of qualified labor force to IT sector, other universities, including private ones, are constantly emerging or increasing enrollment. In particular, it is expected that the AUA, Russian-Armenian (Slavonic) University and ERIICTA will play a more considerable role in IT labor supply in the coming years.

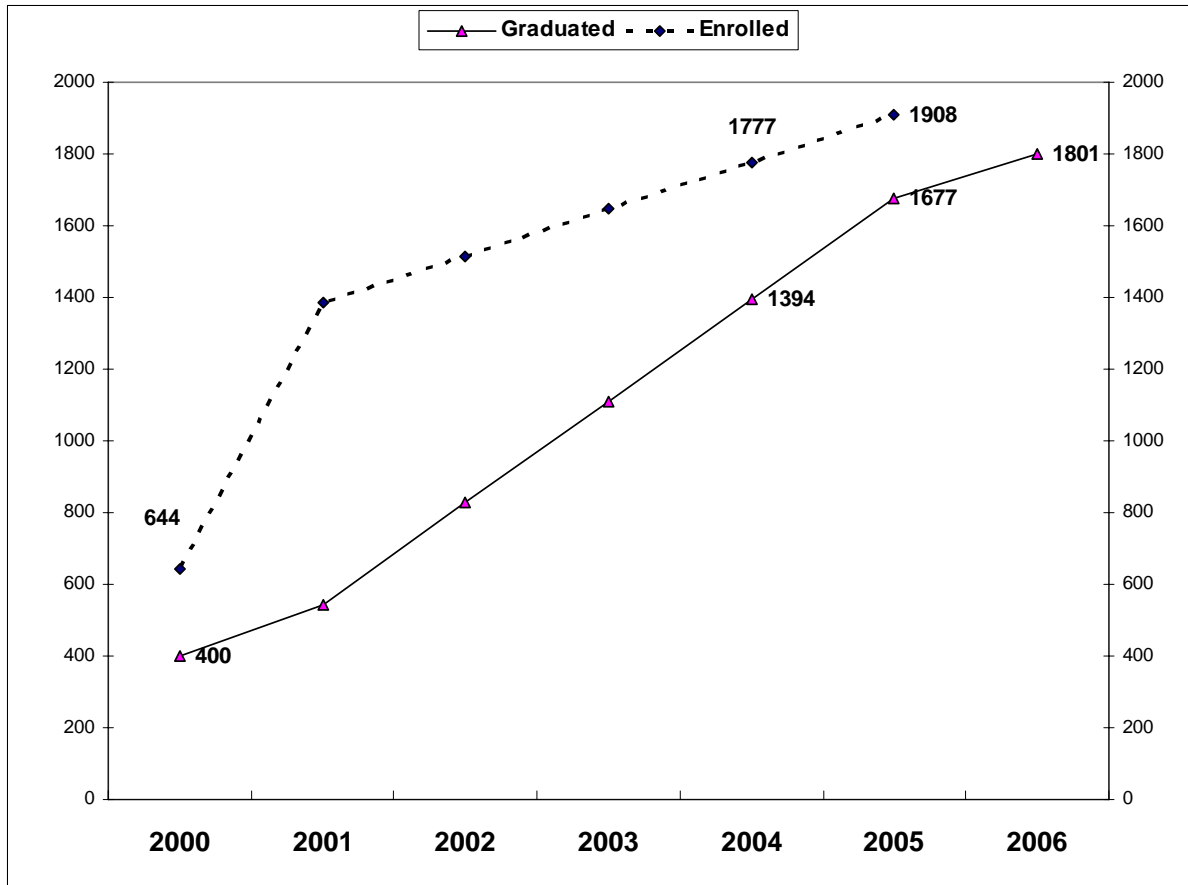
Several private universities such as Haybusak, University of International Economic Relations, Gladzor Management University have recently introduced Departments of Computer Science and Informatics.

It is worth noting that IT departments and particularly the Departments of Computer and Automated Systems of Programming are among the fastest growing in the educational sector and they reflect the high demand of developing industry in the country.

Growth dynamics of the number of the enrolled first year students and graduates from IT related departments in 2000-2006 is reflected in Graph 1. Data on enrollment of students to IT related departments showed that as compared to year 2000 the number of students enrolled to first year courses in 2005 has increased three times, reaching 1,908. Data for 2006 enrollment needs to be finalized at a later stage.

Graph 1

Growth Dynamics of the Number of Graduates and Enrolled First Year Students in IT- related Departments during 2000-2006 (right axis – number of enrolled, left axis – number of graduated)



The current educational system in Armenia supports 4-5 times more graduates per year in IT than in 2000.¹

The trend-line displays a future growth of the number of IT graduates. The number of graduates specifically from the Computer Science, Information Systems and Applied Mathematics departments during 2004-2006 has increased by approximately 60% and reached 1,021 (Table 1).

¹ “Republic of Armenia: ICT Assessment”, SETA, July 2000, p. 41.

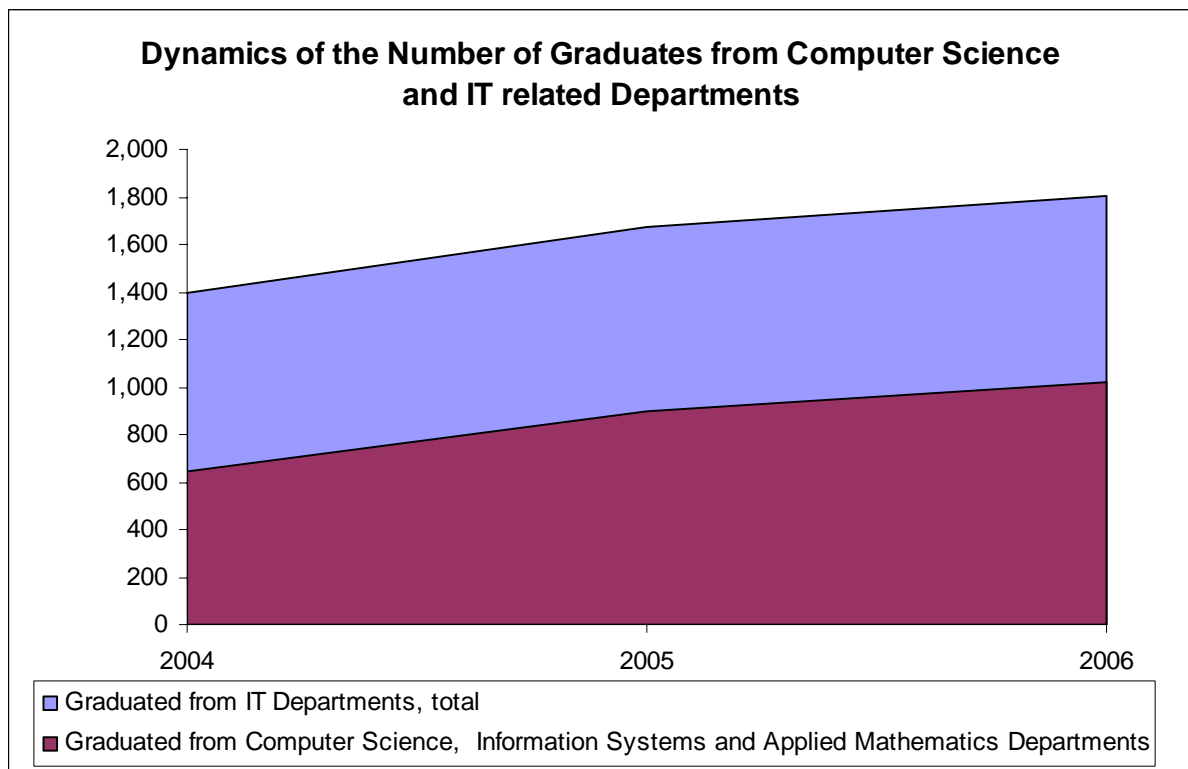
Table 1

IT Graduates during the period of 2004-2006

	2004	2005	2006
Graduated from IT Departments, total	1,394	1,677	1,801
Graduated from Computer Science, Information Systems and Applied Mathematics Departments	646	899	1,021
Share of graduates from Computer Science, Information Systems and Applied Mathematics in Total Number of Graduates from IT-related Departments	46.3%	53.6%	56.7%

Graph 2

Dynamics of the Number of Graduates from Computer Science and IT-related Departments



The share of graduates from the Computer Science, Information Systems and Applied Mathematics departments in the total number of graduates from IT related departments, including Departments of Mathematics, Physics, Radio-Physics, Radio Engineering and Cybernetics, has increased from 46.3% in 2004 to 56.7% in 2006.

The share of private universities is steadily increasing and graduated 214 students in 2006. The detailed list of graduates by departments and specialties during the period of 2004-2006 is provided in Annex 2 of this report.

However, it is important to consider that the growth trend for the coming years (after 2010) can be restricted by general Armenian demographic trends. The issue is that the generation of young people entering a working age of 16 years was born in 1990s when a sharp decline of the birth rate and natural growth rate was registered. Compared to year 1987, the birth rate in 1990s has been cut in half. In 1995 the number of born was lower by 30.9 thousands or 63% compared to 1990. In 2005, the number of children born in Armenia was 42.4 thousands or half of the 1990 figure, which can affect also a supply of labor force to the IT sector (Table 2). This is one factor contributing to the cautious response of interviewers (rectors, deans and deputy deans of IT Departments) regarding the possibilities for further growth of enrollment. Nevertheless, more than 73% of respondents have considered it possible to increase the student enrollment given the fast growth of the IT sector in Armenia.

Table 2

Indicators of Birth Rate in 1990-2005

	1990	1995	2001	2005
Birth rate (%)	22.5	15.0	10.0	8.7
Number of born	79,882	48,960	32,065	37,509

Among types of important measures that need to be undertaken towards increasing the admission to IT departments, the interviewers have identified improvement of the quality of education in compliance with international standards and the expansion of university-industry partnerships.

Table 3

List of Measures Aimed at Increasing IT Enrollment

	Measures (A)	Frequency (% of sample)
1	Improvement of the quality of education according to international standards	65%
2	Development of university-industry partnerships	65%

3	Regular retraining of staff	62%
4	Opportunities for continuous education	62%
5	Increase of faculty compensation	62%
6	Improvement of the infrastructure and capacity of educational institutions	46%
7	Increasing the number of young members in the faculty	39%
8	Establishment of IT specialized new educational institutions and training providers	35%
9	Increasing the number of staff	31%

Other important measures emphasized by the survey respondents included the improvement of computer education in secondary schools, increasing the enrollment by state order, provision of equal status of state and private universities, and state accreditation of private universities.

An essential problem faced currently at the higher educational institutions is the faculty ageing: the average age of the faculty is 57. Even after defending their dissertations, young and talented professionals leave for higher paid jobs at IT companies.

This issue can be solved through providing incentives for young staff, essentially increasing salaries, since high quality education cannot be provided and ensured for a long time based on the staff enthusiasm only.

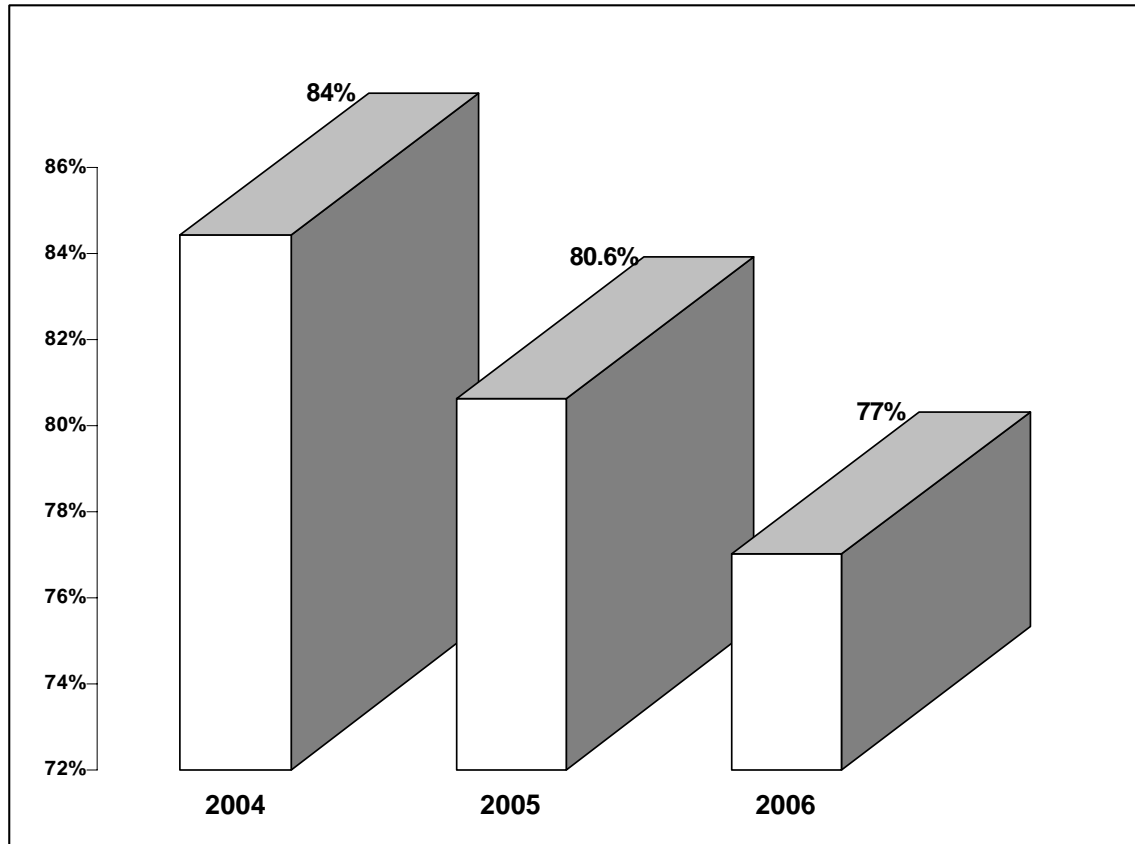
According to projections made by the departments at the surveyed educational establishments, the average growth of enrolled students in 5-10 years will make up 54%. The highest estimates on future enrollment are registered at the AUA, Department of Computer Graphics of the State Academy of Arts, and Hrachya Acharyan private university (200%), as well as at the YSU, ERIICTA and Russian-Armenian University (50-60%).

It is interesting to note that despite the fact that more than half of enrolled and graduated students at IT departments are from the YSU and SEUA, the share of these institutions in the total number of enrolled and graduated from IT departments during 2004-2006 has relatively but constantly decreased. This is primarily due to the growth of IT departments in other educational establishments (Graph 3).

Graduates from the Department of Informatics and Applied Mathematics of the YSU, and Department of Cybernetics and Department of Computer Systems and Informatics of the SEUA made up nearly 47% of all the graduates in 2006.

Graph 3

Share of the SEUA and YSU in the Total Number of Graduates from IT Departments in 2004-2006



As a result of substantial reforms in the educational sector, the number of Bachelor (BA) and Masters (MA) degree graduates from IT departments continues to grow (Table 4).

Table 4

Number of BA and MA Graduates in IT

	2004	2005	2006
BA	1,015	1,172	1,256
Master	272	327	343

Concurrently, it is obvious that the current level of skills and competencies of graduates should be improved to be hired to IT jobs right after graduation. More than 92% of respondents agreed on the urgency to improve the level of competencies.

One of the important objectives of the survey was the evaluation of the technical skills and competencies of graduates. The results of evaluation are presented in Table 4 (1 – the highest competence, 4 – the lowest competence). As the results show, graduates from IT departments have relatively high competence (2) in database systems management, programming languages and tools, Internet applications and E-commerce. The lowest competence is revealed in artificial intelligence, CAD/CAM/CASE.

Table 6
Competencies of Graduates

		1 (highest)	2	3	4 (lowest)	Total	Average
1	Database Systems Management	3	10	1	0	14	1.9
2	Internet Applications, Mobile Commerce	5	10	3	1	19	2.0
3	Programming Languages and Tools	4	11	4	0	19	2.0
4	ISP, Network Management, Communication Systems	3	10	3	1	17	2.1
5	Web Design/Multimedia	2	9	5	1	17	2.3
6	Embedded Software	1	4	7	1	13	2.6
7	IT Services Consulting, Systems Integration	0	5	9	0	14	2.6
8	Customized Software Development and IT Outsourcing	2	4	6	2	14	2.6
9	Artificial Intelligence	0	4	6	3	13	2.9
10	CAD/ CAM / CASE	0	3	4	2	9	2.9

The list of competencies of IT graduates by educational institutions is presented in Annex 3. As the data reported by these educational establishments reveals, the highest level of competencies is provided at the Yerevan State Academy of Arts, YSU, ERIICTA, AUA, and SEUA.

The effectiveness of labor market policy in the country is reflected in matching labor supply and demand. The analysis of survey findings and information available from other

sources illustrates that in Armenia, where the labor supply generally exceeds the demand, there is a qualified human capital potential that can be used in the IT sector in case of advanced training and re-training.

According to the survey estimates, the average share of graduates from IT departments having jobs made up 58%. The highest level of job provision for graduates was registered at the AUA, YSU, SEUA, and State Academy of Arts, while the lowest share – at the Armenian Pedagogical University, where after the school optimization plan only 5% of graduates of the Department of Mathematics and Informatics can get jobs. Moreover, only one of every four graduates of the Departments of Cybernetics and Radio-Physics at the SEUA obtain relevant jobs.

These results are general in agreement with findings from the 2002 UNDP survey conducted among various universities, which revealed that the employment rate for graduates from Applied Mathematics, Informatics, and Computer Technologies three years after graduation has made up 69%, including 55% of those working by their specialties. Whereas the remaining 31% has either been unemployed or temporarily unoccupied due to lack of jobs by their specialty or due to mismatch of qualifications with job requirements,² and *as a consequence, there is a mismatch between such a high supply of IT labor force and high demand for it.*

As the UNDP 2005 survey showed, the quality of education in Applied Mathematics, Informatics and Computer Technologies specialties in 2005 received a comparatively low evaluation by graduates. However, the partnership model between two Armenian universities (the YSU and SEUA) and “Synopsis” and “Lycos” companies is targeted on securing universities with modern technologies, developing technical infrastructure, and assisting students to find jobs in the IT sector (Annex 5).

Furthermore, with regard to the qualification levels of the faculty at IT departments, the analysis revealed that the average share of Academicians and PhDs in the total number of faculty is 61%, which is considered to be a high indicator. It is particularly significant at the ERIICTA, Hrachya Acharyan private university, YSU, SEUA, Russian-Armenian University, and Yerevan branch of Moscow State University of Economics, Statistics and Informatics.

Table 7
Qualification Levels of Faculty at IT Departments

	Institution	Department	Share of Academicians and PhD in total number of Faculty
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² “The conceptual approaches to development of state policy in tertiary education of the Republic of Armenia”, UNDP Armenia branch office, Ministry of Education and Science of RA, Yerevan 2005, p. 34.

1	European Regional Institute of IT of Armenia (ERIICTA)		90%
2	Yerevan University “Hrachya Acharian”	Department of Informatics and Applied Mathematics	89%
3	Yerevan branch of Moscow State University of Economics, Statistics and Informatics	Department of Applied Information Science	88%
4	Yerevan State University	Department of Radiophysics	86%
5	Russian-Armenian University (Slavonic)	Department of Informatics and Applied Mathematics	84%
6	Yerevan State Engineering University of Armenia	Department of Cybernetics	81%
7	Yerevan State University	Department of Mathematics	77%
8	Yerevan State University	Department of Informatics and Applied Mathematics	72%
9	University after Movses Khorenatsi	Department of Applied Mathematics	67%
10	Yerevan State Engineering University of Armenia	Department of Computer Systems and Informatics	61%
11	American University of Armenia	College of Engineering, MS Computer and Information Systems	60%
12	Yerevan State Engineering University of Armenia	Department of Radio Engineering and Communication Systems	58%
13	Hyusisayin University	Department of Computer and Automated Systems Programming	57%
14	Yerevan State Economic Institute	Department of Information Science and Accounting	56%
15	University of International Economic Relations	Department of Computer Systems and Informatics	46%
16	Yerevan University of IT and Management	Department of Mathematics	40%
17	Yerevan State University	Department of Physics	38%
18	Armenian Open University after	Department of Programming	33%

	Loris Kalashyan	and Computer Security	
19	Armenian Pedagogical University	Department of Mathematics and Informatics	31%
20	Yerevan state Academy of Arts	Department of Computer Design	30%
21	Haybusak University of Yerevan	Department of Economics	29%

Nevertheless, despite the high qualification levels of the existing faculty members, more than 73% of staff at IT Departments thinks that the current level of skills and competencies of the faculty should be improved.

In addition, the majority (77%) of respondents indicated that the current number of staff is not sufficient and more faculty is or will be needed in the future. Only at the Department of Physics of the YSU the possibility of staff reduction has not been rejected.

TRAINING CENTERS

Along with the higher educational establishments, training centers also contribute to the development of informational technologies. The 24 training centers that were surveyed have trained 5,688 students in 2005, which is more by over 26% as compared to year 2003 (Annex 4). 3,609 students were trained in the first half of 2006 and at the end of year this figure will increase. The number of trainers has also increased from 190 in 2003 to 204 in 2006. The Electronic Armenia Foundation (EAF), IREX IATP, State Institute for Staff Training, and Yerevan State College of Computer Science had the major input in providing training courses.

The offered trainings comprise a wide range of subjects including computer basics, graphics and web design, Internet network use, programming languages, software engineering, system management, and network administration. Additionally, accounting software and computer training programs are offered for the unemployed. The EAF and IREX IATP have implemented training programs in the regions of Armenia.

In conditions of the IT sector growth, abundant number of training centers, increasing competition, seasonality of work, etc. there is a trend of restructuring some of training centers and changing profiles of activities. For instance, such centers as Gortsarar Tiezerk, Antares Publishing House and Advertising Agency, and Bever Computers have ceased their IT training sessions and re-oriented their scope of activities.

CONCLUSIONS AND RECOMMENDATIONS

1. At present, the study reveals that not all students trained in IT-related subjects find employment in the IT field. This points towards an adequate supply of IT specialists in the country, but anecdotal evidence from industry (which will be explored in more detail in the current study of the industry) suggests that there is a mismatch between the skills produced by the educational sector and those needed most by industry. However, absolute supply has not been the constraint, and it is expected that the number of enrolled and graduated students will increase further in the coming years because of opportunities and benefits that the IT industry offers to young professionals.
2. More than one-third of graduates from IT related departments are unemployed or temporarily unoccupied due to lack of jobs by graduate specialty or mismatch of graduates' qualifications with job requirements.
3. At the same time, there is a demand for highly-qualified IT specialists and the trend of international companies entering Armenia leads to further growth of workforce demand.
4. According to the McKinsey study, the average annual employee increase of 340 that is required for high growth scenario is difficult to achieve based on about 500 computer science graduates annually³. However, the survey findings display that during 2004-2006 a significant growth of annual graduation in IT related fields and Computer Science Departments was registered (1,400-1,800 graduates and more than 1,000 annually respectively). It means that in case of funding and on-the-job training the high growth rate of employment can be achieved. Moreover, according to the McKinsey report only in year 2010 the number of employed in the IT sector will reach 5,000. Meanwhile, according to the latest data the employment in IT has already reached this forecasted figure of 5,000 in 2005-2006. Taking into consideration results of survey among 105 IT companies, the number of employed will increase by 213.4% reaching more than 15,000 by year 2015.⁴ In fact, this forecast exceeds McKinsey's forecast for year 2020 (6,400) by more than twice (Graph 4).
5. These forecasts of employers can be considered cautious, mainly because of the low level of IT development in regions of Armenia. Almost all IT companies are concentrated in Yerevan, meanwhile some branches and infrastructure can be

³ "Growth in Software and IT Services Sector", Armenia 2020, Yerevan, September 2005.

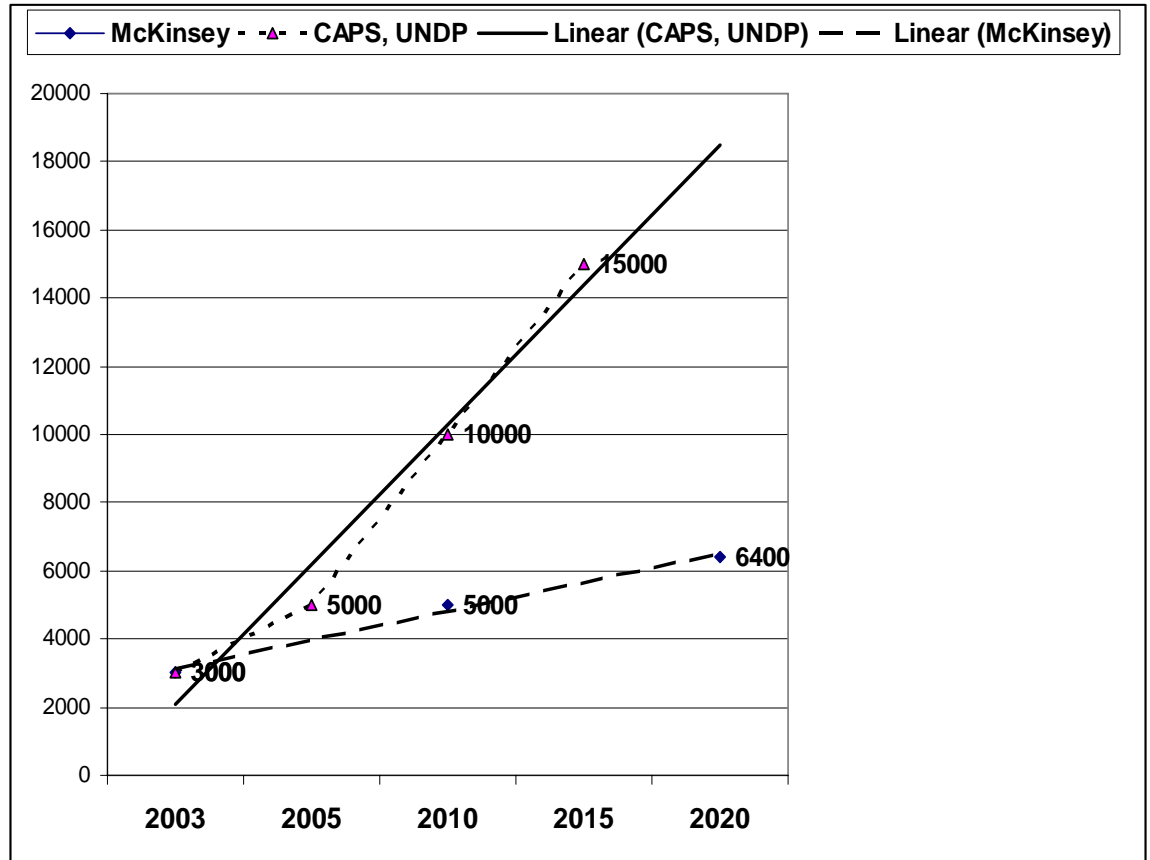
⁴ "The conceptual approaches to development of state policy in tertiary education of the Republic of Armenia", UNDP Armenia branch office, Ministry of Education and Science of RA, Yerevan 2005, pp.108-109.

established in Marz centers in order to prevent out-migration flows of young specialists to the capital city.

6. Analyzing the structure of IT workforce supply it is also necessary to consider the fact that annually more than 5,000 are trained by the IT training centers and additional 500 computer maintenance specialists will be prepared annually through the vocational education system (UNDP estimate).
7. At the same time, impact of the demographic factor on workforce supply needs to be considered with regard to a sharp decline of birth rate in 1990s and the anticipated reduction in the number of working age young people after year 2010.
8. Nevertheless, the forecasted annual demand for 1,000 IT specialists in the coming 10 years can be fully covered.

Graph 4

Dynamics of the Number of Employed in the IT sector in 2003-2020 (according to the estimates by McKinsey, CAPS and UNDP)



9. The issue of current importance is **matching** the IT labor supply and demand.
10. **Quality of supply** must correspond to the structure of demand (according to UNDP survey almost 40% of employers stressed that the university education is not sufficient for further professional activities)⁵, which requires:
- increasing the quality of labor supply and, first of all, increasing the quality of IT education in accordance with international standards. Though the survey has revealed that graduates have relatively high competence in database systems management, programming languages and tools, Internet applications and E-commerce, however, competencies in embedded software, artificial intelligence, and systems integration should be improved taking into account that the country's global export focus should be on embedded software and customized application development.
 - regular retraining of faculty and wider involvement of young motivated professionals to teaching positions, which require additional funding and essential increase of salary levels;

⁵ "The conceptual approaches to development of state policy in tertiary education of the Republic of Armenia", UNDP Armenia branch office, Ministry of Education and Science of RA, Yerevan 2005, p. 146.

- as a first step, improvement of computer education in secondary schools can be considered;
 - development of university-industry partnership model for other state and private universities, comprising regions that have supply of IT specialists. A number of prior surveys revealed that one-third of large employers is ready to provide financial assistance to universities to increase the quality of IT education.
11. Development of labor market infrastructure, including establishment of information-advertising providing regular information on current vacancies and training opportunities, creating databases of unemployed and temporarily unoccupied IT specialists, also using other media sources (TV, radio, Internet); creation of career development centers for alumni at state and private universities

Annex 1 Questionnaire

Questionnaire on Supply of IT Workforce

NUMBER OF QUESTIONNAIRE	
	Number of questionnaire
	<input type="text"/> <input type="text"/>

DATE		
Day	Month	Year
<input type="text"/> <input type="text"/>	<input type="text"/> <input type="text"/>	2006

Interviewer: Fill in the following information before visiting the site

Name of Education Academic Institution, IT training provider, Cluster based-industry partnership			
Name of Department			
Legal form of the Institution, Training Center, Cluster based-university-industry partnership			
Address			
Name/surname of interviewee			
Position		Telephone	

Q1: Please briefly describe your Department (IT training provider, university-industry partnership) specializations.

	Description of specialty (A)
1	
2	
3	
4	
5	

6	
7	
8	
9	
10	
11	
12	
13	
14	
15	

Q2: State the total number of personnel working in your Department (IT training provider, university-industry partnership) including full-time and part-time staff:

Q3: Please state the number of enrolled students by specialties and years:

	Specialty (A)	Number of enrollments (B)		
		2004	2005	2006 (anticipated)
1				
2				
3				
4				
5				
6				
7				
8				
9				

10				
11				
12				
13				
14				
15				

Q4: Taking into account the fast growth rates of the IT sector, do you consider it possible to increase the admission of students to your Department of university?

1. YES _____ NO _____

Q5: What measures should be undertaken to increase admission of students to your Department?

	Measures (A)	
1	Improvement of the infrastructure and capacity of educational institutions	
2	Improvement of the quality of education according to international standards	
3	Regular retraining of staff	
4	Increasing the number of staff	
5	Increasing the number of young members in the faculty	
6	Increase of faculty compensation	
7	Establishment of new IT specialized educational institutions and training providers	
8	Development of university-industry partnerships	
9	Opportunities for continuous education	
10	Others (specify)	
11		
12		

Q6: What are your forecasts about the future enrollment of students by specialties?

	Specialty (A)	Growth rate of enrollments 5-10 years later (%)
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Q7: Please state the number of graduates (trained and retrained specialists) by specialties and years:

	Specialty (A)	Number of graduates (B)					
		2004	2005	2006	2007	2008	2009
1							

2							
3							
4							
5							
6							
7							
8							
9							
10							
11							
12							
13							
14							
15							

Q8: State the number of graduates by specialties and degree level in 2004:

	Specialty (A)	Number of graduates in 2004 (B)			
		BA	MA	Post-graduate	Diploma Specialist
1					
2					
3					
4					
5					
6					
7					
8					

9					
10					
11					
12					
13					
14					
15					

Q9: State the number of graduates by specialties and degree level in 2005:

	Specialty (A)	Number of graduates in 2005 (B)			
		BA	MA	Post-graduate	Diploma Specialist
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					

15					
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Q10: State the number of graduates by specialties and degree level in 2006:

	Specialty (A)	Number of graduates in 2006 (B)			
		BA	MA	Post-graduate	Diploma Specialist
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

Q11: Do you think that the current level of skills and competencies of graduates should be improved in order to be provided with jobs?

YES _____ NO _____

Q12: Please evaluate the following technical skills and competencies of your graduates: 1 – the highest competence; 4 – the lowest competence

	Type of skill and competency	(4)	(3)	(2)	(1)
1	Internet Applications, Mobile Commerce				
2	Web Design/Multimedia				
3	Database Systems Management				
4	Customized Software Development and IT Outsourcing				
5	Embedded Software				
6	Programming Languages and Tools				
7	Artificial Intelligence				
8	ISP, Network Management, Communication Systems				
9	IT Services Consulting, Systems Integration				
10	CAD/ CAM / CASE				
11	Others (specify)				
12					
13					
14					
15					

Q13: Could you please state the share of graduates of your Department having jobs:

	Specialty (A)	Share of graduates with jobs by specialty (%) (B)
1		
2		
3		
4		

5		
6		
7		
8		
9		
10		
11		
12		
13		
14		
15		

Q14: State the number of staff at the Department (training center, university-industry partnership) by specialty and degree level:

	Specialization (A)	Degree (B)			Number (C)
		BA, MA	Cand. of Sciences	Doctor of Sciences, Academician	
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					

12					
13					
14					
15					

Q15: Is the current number of staff sufficient?

1	Not sufficient, more instructors are needed	
2	More instructors will be needed in the future	
3	Staff number is enough	
4	It is likely that the staff will be reduced	

Q16: Do you think that the current level of skills and competencies of the faculty should be improved?

YES _____ Go to Q17 NO _____

Annex 2 Number of Graduates by Departments and Specialties in 2004-2006

#	Institution	Number of Students											
		2004				2005				2006			
		Dipl.	BA	MA	Total	Dipl.	BA	MA	Total	Dipl.	BA	MA	Total
1	AMERICAN UNIVERSITY OF ARMENIA (AUA) www.aua.am												
	College of Engineering, MS Computer and Information Systems			28	28			28	28			30	30
2	RUSSIAN-ARMENIAN (SLAVONIC) UNIVERSITY www.rau.am												
	Department of Informatics and Applied Mathematics		13		13		26		26		27		27
3	YEREVAN STATE UNIVERSITY (YSU) www.ysu.am												
	Department of Radiophysics, including	56	21		77	70	21		91	72	29		101
	<i>Radiophysics and Electronics</i>				44				62				62
	<i>Physics of Semiconductors and Microelectronics</i>				22				17				22
	<i>Telecommunication, Electrodynamics, Radio-Physics of High Frequencies</i>				11				12				17
	Department of Informatics and Applied		146		146		169	58	227		170	60	230

	Mathematics											
	Department of Mathematics (Math. and Actuary Math.)	70	25	95		70	25	95		70	25	95
	Department of Physics, including	73	43	116		87	47	134		92	37	129
	<i>Physics</i>	<i>54</i>	<i>40</i>	<i>94</i>		<i>63</i>	<i>40</i>	<i>103</i>		<i>70</i>	<i>32</i>	<i>102</i>
	<i>Applied Mathematics and Physics</i>	<i>10</i>		<i>10</i>		<i>12</i>		<i>12</i>		<i>15</i>		<i>15</i>
	<i>Nuclear Physics</i>	<i>9</i>	<i>3</i>	<i>12</i>		<i>12</i>	<i>7</i>	<i>19</i>		<i>7</i>	<i>5</i>	<i>12</i>
4	STATE ENGINEERING UNIVERSITY OF ARMENIA (SEUA) www.seua.am											
	Department of Cybernetics	220	60	280		220	60	280		220	60	280
	Department of Computer Systems and Informatics, including	186	55	241		255	48	303		272	57	329
	<i>Computing Systems Software, Computer Engineering</i>	<i>51</i>		<i>51</i>		<i>117</i>		<i>117</i>		<i>75</i>		<i>75</i>
	<i>Information Technologies and Organization; Computer Systems and Nets</i>	<i>61</i>		<i>61</i>		<i>64</i>		<i>64</i>		<i>76</i>		<i>73</i>
	<i>Computer Design and Production</i>	<i>31</i>		<i>31</i>		<i>23</i>		<i>23</i>		<i>46</i>		<i>46</i>
	<i>Information Systems</i>	<i>43</i>		<i>43</i>		<i>51</i>		<i>51</i>		<i>78</i>		<i>78</i>
	Dept. of Radio Engineering and Communication Systems	150	40	190		150	40	190		150	40	190
4.1	SEUA Kapan branch (Automated systems of data	20		20		20		20		20		20

	processing and management)												
4.2	SEUA Vanadzor branch (Computer equipment, mathematical programming)	-	-	-	-	-	-	-	-	-	-	-	-
4.3	SEUA Gyumri branch (Computer Systems)		12		12		12		12		12		12
5	YEREVAN STATE ECONOMIC INSTITUTE												
	Department of Information Science and Accounting	53			53	76			76	79			79
	<i>Math.Methods in Economics</i>	28			28	39			39	49			49
	<i>Information Technologies and Systems</i>	25			25	37			37	30			30
6	ARMENIAN PEDAGOGICAL UNIVERSITY												
	Department of Mathematics and Informatics	54			54	51			51	50			50
	<i>Math.and Economics</i>	19			19	15			15	25			25
	<i>Math and Informatics</i>	24			24	19			19	25			25
	<i>Physics</i>	11			11	17			17	-			-
7	EUROPEAN REGIONAL INSTITUTE OF IT OF ARMENIA (ERIICTA) www.eriicta.am												
	Software Engineering; Information Technologies Business Management; Multimedia Programs and Design	-	-	-	-	-	-	-	-	-	13	-	13
8	GORIS STATE UNIVERSITY												
8.1	Department of Industrial Electronics,	-	-	-	-	-	31	-	31	-	35	-	35

	Department of Mathematics and Informatics												
	<i>Industrial Electronics</i>	-	-	-	-	-	16	-	16	-	20	-	20
	<i>Mathematics and Informatics</i>	-	-	-	-	-	15	-	15	-	15	-	15

9	YEREVAN UNIVERSITY OF IT AND MANAGEMENT www.yumit.am												
9.1	Department of Information Technologies (Information systems in finance and economics, management and entrepreneurship, programming; health)	-	50	-	50	-	47	-	47	-	66	5	71
10	UNIVERSITY AFTER MOVSES KHORENATSI												
10.1	Department of Applied Mathematics	-	14	-	14	-	18	-	18	-	25	-	25
11	YEREVAN UNIVERSITY “HRACHYA ACHARIAN”												
11.1	Department of Informatics and Applied Mathematics (Engineering -mathematics, programming)	-	5	-	5	-	12	-	12	-	39	-	39
12	HAYBUSAK UNIVERSITY OF YEREVAN												
12.1	Department of Economics (Computer and automated systems programming)	-	-	-	-	-	-	-	-	-	-	-	-
13	UNIVERSITY OF INTERNATIONAL ECONOMIC RELATIONS												
13.1	Department of Computer Systems and Informatics (Computer and automated systems programming)	-	-	-	-	-	-	-	-	13	-	-	13
14	HYUSISAYIN UNIVERSITY												
14.1	Department of Computer and Automated	-	-	-	-	-	12	-	12	-	12	-	12

	Systems Programming												
15	YEREVAN STATE ACADEMY OF ARTS												
15.1	Department of Computer Graphics (Design)									10			10
	<i>Web design</i>	-	-	-	-	-	-	-	-	6	-	-	6
	<i>Printing</i>	-	-	-	-	-	-	-	-	3	-	-	3
	<i>Multimedia</i>	-	-	-	-	-	-	-	-	1	-	-	1
16	ARMENIAN OPEN UNIVERSITY AFTER LORIS KALASHYAN												
16.1	Department of Programming and Computer Security	-	-	-	-	-	24	-	24	-	11	-	11
17	YEREVAN BRANCH OF MOSCOW STATE UNIVERSITY OF ECONOMICS, STATISTICS AND INFORMATICS												
17.1	Department of Applied Information Science (Applied information science in economics; Applied information science in management)	-	-	-	-	-	-	-	-	-	-	-	-
18	GLADZOR UNIVERSITY												
18.1	Department of Information Systems and Technologies (Information and computer science; Programming)	-	-	-	-	-	-	-	-	-	-	-	-
	TOTAL	163	980	251	1394	197	1174	306	1677	224	1263	314	1801

Annex 3 Mean Values of Competencies by Institutions

(1 - high competency; 4 - low competency)

#	Institution	12.1	12.2	12.3	12.4	12.5	12.6	12.7	12.8	12.9	12.10	Mean Value of Competence
1	Yerevan State Academy of Arts	1	1	-	-	-	-	-	-	-	-	1.0
2	Yerevan State University (Department of Radio-Physics)	2	-	-	-	1	2	-	1	2	-	1.6
3	European Regional Institute of IT of Armenia (ERIICTA)	1	2	1	2	2	1	2	1	2	2	1.6
4	Yerevan State University (Department of Mathematics)	1	2	-	-	-	2	-	-	-	-	1.7
5	Yerevan State University (Department of Informatics and Applied Mathematics)	2	2	2	2	2	1	2	2	2	2	1.9
6	American University of Armenia (AUA)	1	1	1	1	3	2	4	3	3	2	2.1
7	Yerevan State Engineering University of Armenia (Dept. of Radio Engineering and Communication Systems)	3	2	2	2	3	2	-	1	-	-	2.1
8	Yerevan State Engineering University of Armenia (Department of Computer Systems and Informatics)	3	2	2	1	2	1	3	2	3	3	2.2
9	Yerevan University "Hrachya Acharian"	3	2	2	2	2	3	3	2	2	-	2.3

10	University of International Economic Relations	1	3	2	3	3	2	2	2	3	-	2.3
11	Russian-Armenian University (Slavonic)	2	2	2	3	-	2	3	2		3	2.4
12	University after Movses Khorenatsi	2	3	2	3	3	2	2	2	3	-	2.4
13	Haybusak University of Yerevan	-	-	-	-	-	2	3	-	-	-	2.5
14	Armenian Open University after Loris Kalashyan	-	3	-	-	-	3	-	2	2	-	2.5
15	Yerevan branch of Moscow State University of Economics, Statistics and Informatics	2	-	2	3	3	3		2	3	-	2.6
16	Yerevan State Economic Institute	2	2	1	4	3	2	3	2	3	4	2.6
17	Yerevan University of IT and Management	2	2	3	3	-	2	4	3	3	3	2.8
18	Armenian Pedagogical University	2	4	2	4	3	1	4	2	3	3	2.8
20	Yerevan State University (Department of Physics)	2	3	-	-	-	3	-	4	-	-	3.0
21	Yerevan State Engineering University of Armenia (Department of Cybernetics)	4	3	2	3	4	2	3	3	3	4	3.1

Annex 4 IT Training Centers

##	NAME OF THE CENTER	2004		2005		2006	
		# of trainers	# of students trained annually	# of trainers	# of students trained annually	# of trainers	# of students trained annually
1	Enterprise Incubator Foundation (EIF)	8	181	10	181	8	100
2	Nork Information-Analytical Center	-	150	-	472	-	-
3	Electronic Armenia Foundation	8	200	8	200	8	600
4	Master Plus Language and Computer Training Center	10	200	10	200	10	80*
5	Project Harmony	11	466	11	315	11	124
6	Profy Recruitment Center www.profy.am	3	150	3	150	3	90*
7	Internet Society (ISOC.AM) NGO	10	200	4	200	4	40*
8	ALBION Training Center Co. Ltd www.albion.am	6	300	6	300	6	300
9	CIT (Center for Information Technologies) Co. Ltd www.cit.am	4	80	4	80	4	50
10	Arminco Microsoft Certified Technical Education Center (CTEC) www.arminco.com	3	35	2	50	2	60
11	Quantum College	70	110	70	119	70	115
12	EVA Training Center http://eva02.narod.ru	4	300	8	320	8	300
13	State Institute for Staff Training	20	1250	10	300	10	500
14	Yerevan State College of Computer Science	60	300	40	360	40	360
15	SOFT & SAFE Co. Ltd www.softsafe.am	10	600	-	-	-	-
16	Gortsarar Tiezerk Co. Ltd	12	140	ceased the provision of training courses			
17	SUAF Educational Center Co. Ltd www.suaf.am	4	250	3	250	3	100*
18	A.C.N. Co. Ltd www.acn.am	3	110	2	110	2	110
19	Antares Publishing House & Advertising Agency Co.Ltd	4	48	ceased the provision of training courses			

20	Medinfo Computing Center	-	-	4	90	3	40*
20	Bever Computers Co. Ltd	4	12	ceased the provision of training courses			
21	Business Support Center (BSC) Co. Ltd www.bsc.am	1	15	1	15	1	5*
22	International Accountancy Training Centre Educational Fund www.iatc.am	6	300	3	200	3	200
23	International Research & Exchanges Board (IREX Armenia) (IATP)	30	250	26	1636	6	395*
24	Link	-	-	2	140	2	40*
	TOTAL (24 centers)	191	5647	227	5688	204	3609

* Number of students trained in the first half of 2006.

Annex 5 University-Industry Partnerships

##	CENTER	WHERE	WHO	PARTNER	WHAT	WHEN	HOW	AIM	OBJECTIVES	ACHIEVED
1	Automatic Identification Technologies Center	Slavonic Univ-ty (RAU)	EIF	Mike Ohanian and Intemec Company /donation/	Bar-Code and RFID Study Lab and study literature (curricula of Ohio Uni-ty)	Sept 2003	MOU between EIF and RAU	Prepare qualified specialists, revolutionize a wide range of business and industrial applications	New specialization introduced at RAU	Pilot courses in AIT conducted
2	Industrial Mathematics Project	YSU	EIF, YSU	Bremen Univ-ty, Germany	Math modeling with computational science - modeling mechanical, physical, chemical phenomena using software and hardware facilities	2003-2004	MOU between YSU, EIF and Bremen Univ-ty	Introduce Industrial Mathematics as a specialty in Master's at 3 faculties at YSU	Student internships in Germany, assess current curriculum, prepare detailed programs on IM, organize TOT for faculty	New specialty of IM introduced in 2004, German professors taught courses to MA students
3	Web Technologies Center	YSU, Applied Math and Computer Science dept	EIF	Lycos-Armenia	Advanced research, preparation of suggestions for new MA specializations based on R&D needs	Mar-04	MOU between YSU, EIF and Lycos	Introduce Web Technologies specialty	Train students for practical skills in Web Tech, organization of production environment, advanced English	2004 - Competition for Web Tech training among 125 from diff depts (test to check knowledge math, C++, Pascal, Internet, Eng, then interview by Lycos)

4	Internet Technologies Research and Training Center	SEUA, Informatics and Computer Systems dept	EIF	Lycos-Armenia	Advanced research, preparation of suggestions for new specializations based on R&D needs	Oct-03	MOU between EIF, SEUA and Lycos	Introduce new specialization within BA degree, R&D activities with involvement of faculty and students	Training 2nd and 3rd-year students, involve them in product development processes under direction of Lycos specialists, provide scholarships for internships at Lycos	Opened new lab, introduced Internet Systems and Applications as a new specialty since 2004-05 acad.year. In one year, 32 students participated in trainings by Lycos (IT related and Eng); Summer internship at Lycos; 6 students employed from the first stream.
5	"Alcatel Technologies Laboratory" education and training center	At EIF premises	EIF	Alcatel	Research works, trainings, internships	Dec-05	MOU between Alcatel and EIF, signed at Tunis Summit	Training courses and research works for students and trainers, ensure access of different univ-ies to the Center by using WiMax technology	Provide equipment, training materials to train specialists in the areas of network applications, data communication, microwave and radio engineering, broadband communications, etc., TOT, student internships.	

6	Open Source Lab		EIF, Lycos, USAID	Lycos, USAID	Open Source Laboratory	Dec-04	MOU between EIF, Lycos, USAID - more than 1mln worth	Provide soft development services for various open source projects, including systems integration; perform research and consulting for implementation of open source codes	To have 35-40 staff members, implement projects in E-gov, E-medicine, and E-education, Develop Open Source in Armenia	
7	Interdepartmental Chair of Microelectronic Circuits and Systems	Synopsys Armenia CJSC	SEUA, www.seua.am, http://synopsys.www.am/	Synopsys Inc, National Technical University of Athens, Moscow Engineering-Physics Institute, Moscow State Technical University after Bauman, Kiev Polytechnic Institute, Moscow Aviation Institute, YSU, AUA, Moscow Institute of Electronic Technology		Aug-01	Cooperation Agreement between SEUA and Synopsys Armenia CJSC		Students of three departments of SEUA "Computer Systems and Informatics", "Cybernetics", "Radio and Communication Systems" are selected to continue their further education at the Chair. Student education is effected in two specializations: "VLSI Design" and Electronic Design Automation "EDA". The Chair of MCS prepares specialists especially for Synopsys Armenia by giving advanced	Teaching is performed in compliance with curriculum, matching the best international standards in the area of VLSI Design and Electronic Design Automation (EDA). Synopsys also provided the Chair by all the EDA tools necessary for the educational process.

									degrees in Bachelor, Master and PhD programs.	
8	Electronic Governance Center	ERIICTA	ERIICT A and Marcel II University consortium	ERIICTA and Marcel 2 University consortium	Training and introduction of e-governance	Oct-Dec 2006	In process	Training of all public sector employees on e-governance and introduction of e-governance system at all public agencies		

9	Aviainfotel partnership	SEUA, Informatics and Computer Systems dept				July-Aug 2006	Cooperation Agreement between SEUA and Aviainfotel	Preparation of specialists, student education in accordance with the curriculum designed by Aviainfotel.	Education of students, starting from 1st year, the aim of which is to prepare students to work for Aviainfotel.	
10	University Consortium Project		YSU, SEUA, Yerevan State Institute of Economy (YSIE)			2004-2005		Develop and introduce a joint Masters of Science in Information Systems specialization at the mentioned universities	Sponsored infrastructural and resource upgrades; improved the universities' curricula; provided academic and technical training for the faculty, staff, and students; and established and fostered relationships with national and international faculty.	53 students have enrolled in the MSIS specialization, 24 of whom have graduated in June 2006.