

The Story of the Emerging IT Cluster in Armenia

The beginning of 1990s ... The breakdown of Armenia's ICT industry, a major R&D and production center of the former Soviet Union, sometimes called "Silicon Valley of the USSR", gave birth to a class of thousands of jobless and abandoned, but highly qualified professionals. Being exposed to market forces these people had to find their way out of the crisis. Networks of immigrant professionals from Armenia created the basis for industry development within the country, contributing to the rebirth of IT by going abroad and later on sending contracts to their compatriots in Armenia.

After declaring independence from the Soviet Union in 1991, the government of Armenia launched a comprehensive reform program aimed at building a democratic society with a market-driven economy. Reforms were carried out in an environment of sharp economic decline, hyperinflation, and severe shortage of energy, accompanied with a blockade of transportation routes. In 1994 the economic decline was stopped. Since then and until 2000, annual economic growth averaged about 5 percent.

During the first decade of ongoing reforms, Armenia's IT industry was left without any attention by the government. However, small groups of talented and enthusiastic IT professionals managed to breathe life into the totally disrupted IT industry and make it the most dynamic, productive and fastest growing sector of Armenia's economy, with CAGR of 30 percent. Many well-known western, mostly US-based, companies, mainly of Armenian origin and/or participation, established development centers in Armenia.

At the beginning of 2000s, local as well as foreign IT companies, recognizing the need for concerted action and collaboration, established industry unions and initiated joint programs with educational institutions. These realities stimulated the government of Armenia to announce the IT sector as a priority at the end of 2000, and establish an IT Development Support Council in 2001.

2005-2008 were marked as the most favorable years for IT sector development. The industry witnessed a sharp increase both in terms of newly formed companies and in terms of growth of revenues with number of operating companies reaching 210 enterprises by 2008. Emergence of new players on mobile and internet market, as well as recognition of the development of IT sector as government priority are other highlights of the last four years. Despite the adverse impact of the global economic crisis and deep economic decline in Armenia the industry recorded 17% growth in 2009.

Country Background

Geography and History

Armenia (full name - the Republic of Armenia) is a small, landlocked country located at the crossroads of Europe and Asia in the northeast of the Armenian Plateau. The country occupies 29,800

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square kilometers or 11,500 square miles (about the size of Belgium or Maryland) of mountainous terrain centered around the Ararat Mountain, the heart of the Armenian nation, where Noah's Ark rested after the flood. Ancient geographers called the Armenian Plateau the "Island of Mountains" or the "Rooftop of Asia Minor". Armenia's average altitude is about 1800 meters above sea level. The climate is sunny, dry and continental with hot summers and moderate to cold winters. The country borders Azerbaijan in the east and southwest, Georgia in the north, Iran in the south, and Turkey in the west.

Armenia is an extremely ethnically homogenous society with about 98 percent of the 3.2 million population being Armenian. The official language is Armenian, a separate branch of the Indo-European language family. Most Armenians are also fluent in Russian, and many, especially in the capital city of Yerevan, also speak English.

Armenians are one of the oldest civilizations in the world, and Armenia was the first nation to adopt Christianity as a state religion in 301 A.D. After being a powerful and influential state in Asia Minor for thousands of years, Armenia gradually weakened. Eventually, Armenia lost independence in 387 A.C. and was conquered by Persia and Byzantine. Since then Armenia has been occupied several times by different empires, and in recent years has been part of the Russian and Ottoman Empires starting from 1828, and Soviet Russia and Turkey in 1921. From the 1890s to the 1920s Armenians experienced the most difficult trial in their history. Between 1915 and 1918 the Ottoman Empire, under the rule of Muslim Turks, followed a policy to eliminate the Christian Armenian population, and carried out genocide of Armenians. Over 1,500,000 Armenians were killed, and hundreds of thousands forced from their historic homeland in the Armenian Plateau. This genocide was preceded by series of massacres in 1894-96 and 1909, and was followed by another series of massacres beginning in 1920. After the defeat of the Ottoman Empire in WWI, the independent Republic of Armenia was established on May 28, 1918, but survived only until the end of 1920 when it was annexed by the Soviet Army. In 1922, the Soviets united Georgia, Armenia, and Azerbaijan to form the Transcaucasian Soviet Socialist Republic, which later became part of the USSR. In 1936, after reorganization, Armenia became a separate republic of the USSR. Since 1988, Armenia has been involved in a territorial dispute with Azerbaijan over the enclave of Nagorno-Karabagh. In the same year a devastating earthquake killed thousands of people, destroyed most of the country's infrastructure, and wreaked economic havoc. Following the collapse of the Soviet Union, Armenians declared their independence and established the Republic of Armenia on September 21, 1991.

The history of Armenia has been characterized by a long, difficult struggle for independence, and an astonishingly energetic revival and creativity. Armenia's geographical location and historical events have required Armenians to become an open-minded yet traditional society, as they are open to other cultures and novelties, while at the same time remain faithful to their own customs. Entrepreneurial spirit and the impressive ability of Armenians to offer creative solutions to problems were the keys to their economic success under all types of rule. After the loss of sovereignty and subsequent large-scale migrations, the establishment of Armenian communities all over the world became an important feature of Armenian history. The population of Armenians worldwide is about ten million, an estimated 70 percent of whom are of Diaspora communities. The biggest communities live in the US and Russia, with over one million each. Significant Armenian communities are located in Georgia, France, Iran, Lebanon, Syria, Argentina, and Canada. Despite dispersion and the effects of globalization which have drawn Armenians to the four corners of the globe, they continue to uphold strong cultural, religious, and historical customs and traditions, and have renewed spirit for their homeland.

Economy

Little Armenia was one of the major R&D and production centers in the areas of computer science and electronics, precision engineering and chemicals in the huge Soviet Union. During the 1980s Armenia reached its highest level of industrialization with the industrial sector accounting for more than 65 percent of the GDP in 1988, the GDP in 1988 being over 13.5 billion Soviet Rubles.¹

¹ Statistical Yearbook of Armenian SSR, 1988.

At the beginning of the 1990s Armenia suffered from a severe economic decline with a 60 percent decrease of output in three years, plus four-digit hyperinflation, and the resulting social difficulties. The transition to a market-oriented economy after the breakup of the Soviet Union brought significant changes in the economic structure of the country. Although the industrial sector was the dominant sector, it was also the most vulnerable, and when it declined dramatically, it was replaced by agriculture. In 1993, agriculture accounted for about half of Armenia's GDP (48 percent), compared to 22 percent for the industrial sector.

Since the mid-90s Armenia has become one of the highest growing economies in the region. Over 2002-2007 Armenia experienced double-digit economic growth mainly due to boosting construction sector and rising private transfers to Armenia. The average real growth throughout that period reached about 13 percent. In 2008 real GDP growth at 6.8 percent has been effected by financial crisis in the last quarter of the year. The global economic downturn had inevitable consequences on driving forces of economic growth in Armenia - the construction sector and remittance income - resulting in significant economic slump in 2009. According to preliminary statistic data the GDP declined by 16% as compared to the same indicator of 2008. Overall, during the last decade the country has been characterized by comparably stable macroeconomic situation with low inflation and a stable exchange rate.

The 1950s to the late 1980s: The Emergence and Flourishing of the ICT Sector Under Soviet Patronage

The Outset

Armenia's ICT sector started in the 1950s with the establishment of two large R&D entities: the Yerevan Scientific Research Institute of Mathematical Machines (YSRIMM) in 1956 and the Institute of Informatics and Automation Problems (IIAP) under the National Academy of Sciences (NAS) in 1957. The former, which was also the bigger one, was and is well-known as the "Mergelyan Institute" after the academician S. Mergelyan, a famous scientist in the former USSR, who also designed and founded the Institute.

The Mergelyan Institute focused on computer-related problems and the development of computer hardware, particularly performance computers of small and medium size (under the classification system of the times) and special purpose computers and automated control systems. In order to ensure sustainable progress, a number of supporting departments dealing with such areas as electronics and construction, computer-aided design, memory systems and power units were created. By the end of the 1960s the Institute was designing various computers, mainframes, automated control systems as well as operating systems, and networking and application software. The Institute designed and produced dozens of computers at its own plants, some of which were compatible with PDP of Digital Equipment and IBM mainframe series (computers of the "NAIRI" series). A significant achievement of the Institute was a project to design a telecommunication system for the mission to the moon in 1967-1968.

"The Ministry of Radio Industry of the USSR ...insisted on developing and organizing the production of an unusual device for our Institute product – a device for controlling the flight to the moon. For two years one of the biggest scientific centers of the Soviet Union was trying to accomplish the task, but without success... Because of that the flight to the moon was at stake... We didn't come out of the Institute for nine months... and the task was fulfilled even before the deadline": expressed academician F. Sarkisyan, the President of the National Academy of Sciences, who was the Director of the Mergelyan Institute during 1963-1977, in his "Lessons of My Life".

Mergelyan Institute became the major center for development of computers and automatic control systems for civil and defense purposes, and had a very important coordinating role in the sector. The expansion of the Institute's activities contributed significantly to the development of other institutions related to science and technology, including the NAS, educational institutes as well as production facilities and infrastructures necessary for the development, production and utilization of computer

equipment. From the 1980s until 1991 the Institute employed over 10,000 employees, including over 7000 of the personnel of experimental and production plants.

Flourishing

A short period of time after the establishment of the Mergelyan Institute, the IT, electronics and precision engineering industries became the most technologically advanced sectors of Armenia's economy. They served the needs of production processes throughout the Soviet Union. These sectors benefited from large military and aerospace contracts and were also significant exporters. Around 40 R&D centers were established in the IT sector, many of them with their own production facilities making both hardware and software. Dozens of production facilities with spectacular names such as Sirius, Astra, Transistor, Posistor, Electron, and the like mushroomed at an astonishing pace. According to different estimates, at the end of 1980s the IT, electronics and precision engineering sectors employed approximately 40,000 to 60,000 employees, half of them ICT professionals. Armenia's R&D centers and production facilities provided approximately 25 percent of the output of the Soviet Union's IT industry.

The IT, electronics and precision engineering industries in Armenia were not only employers of large numbers of people, but also attracted strong backing for the development of talent and expertise in universities and research institutes. A dozen of specialized departments were opened in universities of Armenia for serving the needs of the industry. The two major universities were Yerevan State University (YSU) and the State Engineering University of Armenia (SEUA). Since 1961, the higher education system produced more than 13,000 ICT professionals (computer programmers, computer scientists/engineers, system analysts, and IT hardware specialists).

Despite the high degree of development and its considerable size, the high-tech industry, including the IT sector, was an assemblage of separate entities producing components, but not final products. It served as an important supplier of components for the huge Soviet economy as well as for the military.

"There was huge, but highly dispersed potential which allowed the solving of scientific and technical problems, but was not conducive to production": Aram Vardanyan, General Director of Viasphere Technopark, and the Director of former "Transistor" R&D Center for Power Semiconductors, explained.

The government as well as manufacturing entities were not interested in organizing and realizing high value final products. Moreover, there was poor knowledge and experience of how to turn the virtual product – technology secrets and innovations – into marketable products, a legacy of the Soviet system.

In the end of eighties the Soviet government started to rethink its economic policies and experiment with new policy measures aimed at liberalization and the introduction of freedom in business activities. Armenia launched economic reforms, as did other Soviet Republics, which were marked with a widespread movement of private cooperatives. In 1987, the first private packaged software company, "Armenian Software", was established to provide services to the financial and banking sectors.

At the same time, the era of the PC began. Forceful entry of PCs into the IT sector and their rapidly increasing use implied significant changes in numerous aspects of life. Many existing technologies and professions were becoming obsolete. Manufacturers and service providers as well as R&D institutions of the Soviet Union were not flexible enough to adapt their operations and resources. Similarly, educational institutions were too slow in introducing a necessary set of courses in their programs in order to catch up with the ongoing changes.

However, many enthusiastic students and ICT professionals were more flexible in learning and adapting themselves to the new changes in the ICT sphere. A famous professional club, Edik Manoukyan's Club, was created and led by one of the University professors. It was a momentous center for new and creative ideas and approaches. Hovhannes Avoyan, one of the progressive IT specialists, with a small group of his young friends, also started to learn more and experiment with new technologies

and new programming languages. In collaboration with the Club, they established a cooperative called ISMA (Intellectual System-Ani), which concentrated on developing accounting programs (at that time for which there was a big demand) and expert systems. The demand for financial and accounting programs was enhanced by ongoing economic reforms, and generated by the banking sector as well as the increasing number of private businesses.

1991-1994: Collapse ... the launch of market reforms and struggle for stabilization

Economic developments

The beginning of the 1990s marked the collapse of the Soviet Union and brought devastating economic turmoil in the country. The disruption of trade flows, accompanied by the financial crisis (blocked state financing), resulted in destruction and contraction of input as well as output markets. Operations of most of the industries, enterprises and institutions, including those of the electronics, ICT and precision engineering sectors, were paralyzed. The industrial sector was the most vulnerable to disintegration of the Soviet Union. As a result of the transitional shock this sector was the most badly hit in the early 1990s both by unfavorable moves in relative prices and the disruption of centrally planned orders and traditional markets with former socialist countries. Moreover, the recovery of the industry sector was the weakest among other sectors of the economy.

After declaring independence in 1991, the government launched a comprehensive reform program aimed at building a democratic society with a market-driven economy. Armenia was strongly committed to the liberalization of the economy and integration into the world economic system. For these purposes, the government introduced freedom of business activities, liberalized prices on practically all goods, and launched a comprehensive privatization program. Privatization of land in Armenia was probably the fastest and the most widely spread in the former Soviet republics. In the short term, the land reform helped to address acute food security problems and recover agricultural production. It provided a cushion against the dramatic economic crisis, land being the ultimate refuge for food self-sufficiency of households and partial employment generation, absorbing superfluous labor from other sectors.

Despite the efforts of the government, during the first four years of transition the economy experienced a sharp decline and suffered from hyperinflation and a severe shortage of energy. The structure of the economy changed significantly, and agriculture, with an army of about 350,000 small private land owners, became the driving force of the economy due to more severe contraction in other sectors. In 1993, agriculture accounted for almost half of Armenia's GDP (48 percent), as compared to 22 percent for the industrial sector.

The difficulties of transition in Armenia were exacerbated by the devastating consequences of the earthquake in 1988, the military conflict with neighboring Azerbaijan (the Nagorno Karabagh conflict), and the related blockade of transportation routes by Turkey and Azerbaijan. Transportation routes via Georgia were unstable and insecure.

Industry picture

Research and development centers, experimental and production plants operating in the ICT, electronics, and precision engineering sectors lost their customers, and were left without state orders and state financing. Ironically, there was a huge legacy, including numerous research institutes, production facilities and highly qualified professionals, but a weak and inept management system, which did not know what to do with the country's potential under the new realities. Inordinately large enterprises were forced to cut the number of their staffs significantly. Many R&D centers and production plants were shut down and abandoned. Equipment and other resources, including human resources, were becoming outdated at an accelerated rate. A large portion of resources was destroyed, lost or stolen. Thus, at the beginning of 1990s, the breakdown of the ICT industry gave birth to a class of thousands of jobless and

abandoned, but highly qualified professionals. Exposed to market forces, these people had to find their way out of the crisis. Many of them left the country in order to find jobs abroad, and many others changed professions to make a living.

In the typical IT business in Armenia at that time, computer programming specialists started to establish small groups (from two to five) and experiment with learning new programming languages and trends in the world IT sector, developing programs and trying to establish contacts with potential customers, particularly with those abroad. What they needed was their creative minds and networking spirit, a table with a computer on it, and communication. Many of these people managed to create valuable software products, and to demonstrate to interested businessmen abroad that they are capable of high-quality production. And success meant an average monthly salary of 20 to 30 US dollars for a product that was sold at a much higher price abroad. Some of the successful initiatives turned into small companies concentrating mainly on providing system integration and custom software development services, particularly for accounting and financial applications targeted at local customers. The largest of them was Aragast Ben (employed about 80 IT specialists), which, although aimed at the local market, also put forth efforts to enter foreign markets (North America, the Near East, European countries).

Deficient and limited local market urged young resourceful ICT professionals to switch to overseas market. This fostered a boom of outsourcing activities in 1992-93: for example, one of the programs, a web-shop program, created by such a group, was obtained by "Boomerang", then sold for use under Windows, becoming a bestseller in the US. According to one of the industry experts - Hovhannes Avoyan - the local market at that period was inadequate, and in order to prosper the business had to be related to Western markets. The technologies that we used and the products that the local professionals could develop were far more advanced than the economy and institutions could need.

In 1992, the use of the Internet became a reality in Armenia with the set up of the first service of Arminco Company, and made the things for IT entrepreneurs much easier. The company was established as a simple network service provider, and has soon grown into the largest Internet Service Provider in Armenia.

1994-2000: Recovery and the risk of stagnation

Economic Developments

In 1994 the government was able to stop the economic decline in the country, despite four-digit hyperinflation. During the following years, stringent monetary policies allowed a reduction of inflation to a single-digit level in 1998. After an estimated 60 percent decline between 1991 and 1993, the real GDP grew 5.4 percent in 1994. Since then and until 2000, annual growth averaged about 5 percent, a remarkably resilient performance in the face of the Russian financial crisis in 1998. The economic expansion during 1995-2000 was fueled by such factors as the recovery of electricity supply, expansion of external private transfers from migrants that pushed domestic demand, and a major program of international assistance. Armenia was a leading regional recipient of international donor funding in per capita terms. According to a World Bank study, on average in 1995-1999, the international donor community provided about 7 percent of Armenia's GDP in annual budget support through a combination of grants and low-interest credits.²

However, these types of growth could not serve as long-term engines for economy-wide growth. Macroeconomic achievements were not supported by adequate measures for improving the microeconomic environment. Moreover, economic reforms were not accompanied with the creation and development of appropriate institutions and infrastructure. Productivity on the micro level was well behind the macro reforms, thus sustainability for further development was not achieved. Average labor

² World Bank, 2002, "Growth Challenges and Government Policies in Armenia" - Country Study,.

productivity (adjusted for PPP differences) was quite low and stood at only 11.5 percent of average US labor productivity.³ The country continued suffering from a quite uneven distribution of wealth, a high level of unemployment and poverty. Corruption and the existence of power groups became major enemies of entrepreneurship and businesses. In fact, most of the businesses perceived to be lucrative were controlled by few power groups.

Industry picture

Interestingly, the IT industry was abandoned and left without any attention to the government as well as by power groups. IT business was not considered as a lucrative one. Being specific and requiring extensive knowledge and skills was a dark forest for many and hence was not attractive. For the government it was also practically impossible to control the very fragmented IT market in Armenia, even though virtually all IT entities were concentrated in Yerevan. At the beginning of 1990s most of the IT groups and enterprises were not officially registered.

Being “granted relatively wider freedom and with no tax burden”, groups of software specialists continued their attempts aimed at exploiting business opportunities. In addition to this, the sector benefited from the fact that it was not dependent on transport costs. Exports could easily be organized by air and/or satellite. The availability of the Internet starting in 1992-93 opened more opportunities for reaching potential customers and entering foreign markets. IT entities were engaged mainly in skills outsourcing activities, and, in fact, were small development centers for foreign companies. The talent and impressive ability to provide creative solutions to problems drew the attention of foreign IT companies, especially of those with Armenian origin or participation. Another major factor that attracted foreigners was the extremely low labor cost. In 1993-94, average salary of a skilled programmer, who worked for and was paid by a foreign company, ranged from USD 30 to USD 50 per month (in exceptional cases it could reach USD 100). By the second half of the 1990s the IT industry demonstrated rapid growth and started to offer higher paying jobs. The growth was supported also by economic recovery in the country as well as a flowering worldwide IT industry. More and more local companies were established and registered. During this period, many western, mostly US-based, companies such as HPL Technologies (1995), Boomerang Software (1997), Credence Systems (1999), Epygi Technologies, LEDA Design, Virage Logic (1999), Synergy International Systems (1999) and others established development centers in Armenia. Almost all foreign companies that entered the Armenian IT market were of Armenian origin and/or participation.

Developments in the international IT market supported the growth of Armenian IT industry and opened opportunities for Armenian IT businesses and specialists. Increasing demand and huge size of the world IT market created practically “unlimited” market opportunities for Armenian IT businesses, with their extremely low cost and high quality. The size of the global software and IT services market in 1996 was around USD 340 billion, the IT services market being twice the size of the software market. In 2001, the software and IT services market reached about USD 530 billion, with CAGR about 10 percent.⁴ In general, software and IT services segments together with computer hardware were the main driving forces of the growth in the IT market, the first two representing over 25 percent of the total IT market. Global exports of IT products in 1997 amounted USD 681 billion and imports USD 618 billion. The main players in the, accounting for over 90 percent of exports/imports during 1997 were the USA, Japan, EU, Singapore, Malaysia, Republic of Korea, China, Thailand, Canada, Hong Kong.⁵ The McKinsey Report determined (in a “bubble analysis”) sub-sectors with the greatest growth potential taking into account the world IT market situation. On a first priority basis, customized applications development and embedded software received the highest ranking. Second priority targets included software support and

³ McKinsey&Company, 2003, “Key Levers of Productivity Improvement and Software and IT Services Sector Potential”, Armenia 2020 Project.

⁴ IDC; McKinsey&Company.

⁵ ITC, Geneva.

implementation, business process outsourcing, vertical business applications and cross industry business applications.

An important “bad and good” factor affecting the developments in the Armenian IT sector was the increasing global shortage of well-trained IT personnel and growing skills outsourcing. Thus, the USA reported a shortage of 346,000 IT specialists at the end of 1997.⁶ The figure for Europe was estimated at 165,000. This created attractive job opportunities for Armenian IT specialists, and caused high migration. It is interesting to note that as result of changes in international demand the patterns of migration have somewhat changed since mid-1990s. According to a survey conducted by the Union of Information Technology Enterprises (UITE)⁷, before 1995 the majority of migrated IT specialists were highly qualified computer programmers, while after 1995 foreign companies began attracting mainly IT instructors. Thus, 70 percent of IT specialists who migrated after 1995 were IT instructors. Migration was “bad” for the IT industry since it resulted in “brain drain”, and was “good” because many of the migrants managed to succeed overseas in their businesses and established very important business links and/or invested in Armenia.

Not surprisingly, the most rapid growth was registered in the software (SW) sub-sector, started particularly in 1998-1999, followed, though with a quite big gap, by IT education and IT services. The SW sub-sector was the most influential and capable of producing a major spillover effect on the rest of the economy in terms of productivity and global linkages. Thus, according to the UITE survey, by the year 2000, over 65 percent of IT professionals were SW specialists (computer programmers (CPs) and computer scientists/engineers (CS/Es)), and 20 percent were computer hardware (HW) specialists. Systems analysts and IT instructors represented 6.5 percent, each. During 1996-2000 the average annual growth rate of personnel in the SW sub-sector reached 60 percent, while the number of people involved in IT education doubled. Importantly, on average more than the quarter of non-SW companies, e.g. IT education, IT services, Internet services, and electronic data processing (EDP) HW production companies, were also involved in SW development as a secondary activity. Increasing demand for IT instructors was stimulated by growth in the SW sub-sector and related need for specialists (especially software developers) as well as the escalating use of PCs and the Internet by enterprises and by general public.

The majority of foreign IT companies operating in Armenia were in the SW sub-sector (45 percent of all SW companies operating in Armenia, which, however, employed 60 percent of all SW developers). During 1995-2000, the average number of employees per SW company increased by more than five times and reached 40 employees per company. The main SW products were database applications, the demand for which came from an increasing number of businesses and from the diversification of products manufactured in Armenia. The majority of companies used Windows operating systems ('98, NT, 2000). Some companies (about 25 percent) used Linux. By the end of the 1990s, there was an increasing trend also with respect to web-design and web-development, even though the Armentel monopoly on communication (fixed, mobile and uplink Internet) caused serious problems. Overall, a very appealing quality/price ratio was probably the strongest side of Armenian SW entities. The quality of IT products, especially SW, was quite high and able to satisfy the needs of international markets. More than half of local SW companies were engaged in exporting activities (via orders from abroad), and were perspective partners for skills outsourcing activities.

Along with the SW sector, IT businesses started to diversify their production in order to meet the increasing demand in local and foreign markets. More and more companies were entering into IT education, IT services, Internet services, and EDP HW production. In a relatively short period EDP HW production (e.g. computer HW assembly and sales, HW maintenance and support, other HW manufacturing, chip design, testing and related businesses) became a large revenue-generating segment within the IT industry and attracted a number of large foreign direct investments. About 70 percent of companies were authorized resellers, dealers and distributors of products of such famous companies as Intel, IBM, Cisco, Dell, Asus, and HP. The IT services sub-sector provided mainly advertising, computer

⁶ UNIDO.

⁷ (UITE), 2001, “Armenia: The State of IT Industry – Findings of the Survey of Information Technology Enterprises”.

design, printing services, sales, Internet services, publishing services, media services, TV programs, , repair/sales of equipment, and web-design. This sub-sector was quite dynamic and had diversified exports (percentage shares as follows: US-20%, Russia-17%, Germany-13%, China-12%, France-12%, UK-12%, India-6%, other countries-8%). IT services and EDP hardware sub-sectors served mainly the needs of the local market, and, thus, the growth in these sub-sectors was constrained by the small size of the domestic market. The same related also to Internet service providers (ISP), which also suffered the most from problems related to the poor state and high costs of telecommunications in Armenia. The majority of ISP companies provided access to the Internet via dial-up and dedicated line connection. However, dedicated line connection was affordable for only a small number of businesses due to its high price.

In general, the IT sector suffered from the lack of world-class communications, infrastructure and service. These lacks were related to the monopoly in telecommunication services. Armentel, a Greek/Armenian joint venture, was granted monopoly rights in both basic and mobile telecommunication services for a 15-year period, scheduled to run until 2014. Monopoly of Armentel in mobile telephone services was eliminated in 2005 with the entry into the market of K-Telecom. Armentel could not resolve, and perhaps contributed to poor quality service, a low level of infrastructure development and high costs for services including low line capacity and the high costs of Internet connection. In 2000, prices for Internet access were on average 200 times higher than in Germany, India, China.⁸ This “notable” difference was directly related to the fact that ISPs acquired the bulk Internet access through ArmenTel.

Despite the fact that the two main institutions providing IT education remained the YSU and SEUA (plus four other state institutions), by the year 2000, about two dozens private educational institutions entered the market, including 15 entities offering short-term training courses on programming and user applications. SEUA offered courses on computer and hardware design, software design and development, electronics and chip design. YSU provided majors in algorithmic languages, discrete math, system programming and modeling. Half of the educational institutions were involved in SW development, and over ten percent were involved in providing IT network services and IT professional services. Private educational institutions were much more flexible in adapting themselves to market realities, and state institutions were too slow, resistant to changes and dependent upon Government decisions and bureaucratic difficulties. However, as a general rule, throughout the 1990s, educational institutions lacked resources and capacities and, to a large extent, the willingness necessary for adequate flexibility in learning and meeting the market demand. As an example, very important and highly demanded computer-programming languages (e.g. Java, Java++, Java Script, HTML, Flash, Flash Script, XML) were included in curricula of educational institutions only in the year 2000. Things were even worse with regard to courses on IT management, IT marketing, IT policy, Internet economy, e-commerce and e-business. The majority of educational institutions, especially the state-owned ones, were insufficiently equipped with computers and other EDP hardware and office equipment, and had very limited possibilities for utilizing Internet resources. As a result, very frequently IT companies had to spend time and resources for training of graduates from universities in order to raise their skills up to the required level.

During the second half of the 1990s, surprisingly for Armenians, IT businesses started to feel that there was a shortage of professionals with up-to-date qualifications (before that, most Armenians were sure that there was an unlimited qualified labor force in the country and that universities could provide adequate education). The shortage of IT specialists caused competition and enterprises started to use “head hunting” practices. At that time, an entry of a moderate size company into the market could significantly affect the level of wages. As indicated by a UITE survey⁹, in 2000 the surplus demand for IT specialists equaled to about 50 percent of the total labor force employed in the industry. The highest extra demand was in the SW sub-sector (especially for computer programmers and computer scientists/engineers), followed by ISP sub-sector (especially for computer programmers and system analysts). Employee turnover was especially high in the SW sub-sector, where there were also more job

⁸ McKinsey&Company.

⁹ UITE, 2001, “Armenia: The State of IT Industry – Findings of the Survey of Information Technology Enterprises”.

opportunities. During 1995-2000, about half of “exchanged” IT professionals left for overseas, while others moved among companies within Armenia (mostly from local to foreign companies, as the latter offered higher salaries). During 1997-1998 high-quality professionals could already get up to USD 500 per month. Major non-IT industry employers were the government and the banking sector. Most private enterprises preferred to subcontract IT companies rather than keep full-time IT personnel.

In general, local and foreign IT companies differed significantly in terms of product coverage, competition and corporate culture, management and marketing practices. Local companies concentrated more on accounting, payroll and banking/financial SW packages, while foreign companies focused on operating systems, automatic IC test equipment, secure e-business solutions, e-commerce, m-commerce SW, yield optimization for the semiconductor industry, wireless applications and cross-platform messaging systems for clients in corporate, government, ISP and the educational sector. In terms of competition, foreign companies did not face or participate in any serious competition in the local market, since they exported most of their products. They mainly produced orders from their headquarters abroad or SW projects from other foreign companies. Local companies usually competed in the local market, particularly in the market of accounting and banking SW. The major export markets for SW products (for both local and foreign companies) were the US, Germany, France, Russia, the Netherlands, and Georgia. Foreign companies conducted their sales through direct sales to end-users (50 percent), through agents/representatives (17 percent), and through other not-identified channels (33 percent), and local companies conducted their sales through direct sales to end-users (70 percent), wholesales to intermediaries (15 percent), and through agents/representatives (15 percent).¹⁰

Together with the development of the industry, IT companies, particularly local ones, started to face problems related to poor financing and business planning, weak marketing and market intelligence and poor management practices.. These weaknesses created productivity problems and did not allow companies to better utilize their potential. On the other hand, foreign IT companies had better financing, stronger management and marketing as well as business planning, since they were supported from headquarters abroad.

Even though local IT companies employed more persons than foreign companies, the latter employed more IT specialists, while local companies had larger administrative and supporting personnel. Foreign companies fulfilled most of their management and marketing tasks using their administrative and marketing resources in their headquarters abroad. Thus, the distribution of IT specialists and non-IT specialists in local SW companies was 60 vs. 40 percent, respectively, while the corresponding distribution in foreign companies was 90 vs. 10 percent, respectively.

2000-2005: Collaboration and Concerted Action - Planting Cluster Seeds

Economic developments

Starting from 2000 the economy has shown an additional improvement in performance, supported by export expansion. In 2002 and 2003 economic growth reached two-digit levels. However, despite the considerable improvement of the current account position, the country continued to be highly dependent on imports, especially of food. The foreign trade deficit was still high (over 20 percent of GDP). Low diversification was a central weakening feature of export performance. In 2002, exports of diamonds and jewelry accounted for over 50 percent of all exports (USD 260 million, 80 percent being cut diamonds). Another 12 percent was attributed to agricultural and food products, of which about 80 percent beverages, mostly alcoholic. Uneven distribution of wealth, corruption, high level of unemployment and poverty, plus poorly functioning transportation routes remained yet major challenges for the government.

¹⁰ UITE, 2001, “Armenia: The State of IT Industry – Findings of the Survey of Information Technology Enterprises”

At the beginning of 2001, recognizing the vital role of improving the business environment, the Government initiated a comprehensive package of regulatory and structural reform measures, including an anti-corruption program. A Steering Committee to coordinate the anti-corruption program efforts was established, and an Anti-Corruption Strategy was endorsed in collaboration with the World Bank. Parallel to this, a Poverty Reduction Strategy Paper (PRSP) was elaborated during 2000-2003. The PRSP aimed at fighting poverty and social inequality, and ensuring sustainable economic development in the country. Furthermore, since 2002, the government started to give due consideration to the promotion and development of small and medium size enterprises (SMEs) as well as to the urgent need for diversification of production and exports. In this framework, a fund for the “SME Development National Center of Armenia” was created in March 2002. The Center’s mission was to assist SMEs via liaising between the government, business community and international community. State support for SMEs in Armenia was conducted under Annual Program of State Support to SMEs. In order to further streamline the SME’s development activities a Coordination Council for Support to SME was established in 2004.

Industry picture

At the end of the 1990s and beginning of the 2000s the developments in the Armenian ICT sector obtained a good picture demonstrating to the government as well as to the international community that the country has real potential. Numerous studies conducted by various organizations recognized that Armenia’s IT sector ranked first in terms of potential impact on the economy, cluster structure, and level of readiness.

The number of IT companies in 2003 reached about 110, with about 25 percent growth rate during 1998-2003 (some studies suggested over 200, with a significant portion being inactive). There were over 20 companies with foreign ownership. In 2003 the IT sector generated about USD 38 million, with a 30 percent growth rate during 1998-2003. Foreign companies, 84 percent of which were established within the last six years, accounted for about two-thirds of industry turnover. In 2003, the estimated number of jobs in the IT sector varied between 3,000 and 3,500 (some studies suggested 5,000), with a nearly 25 percent growth rate during 1998-2003. The growth and dynamic developments were also evidenced by an increasing level of FDI and exports as well as unprecedented for Armenia corporate acquisitions (e.g. acquisition of CEDIT by Brience Inc. (2000), and then of Brience Armenia by Lycos Europe (2002); acquisition of Leda Systems by Synopsys (2004); acquisition of HPLA by Synopsys for USD 13,5 million (2005)). In 2003, about 65 percent of IT production (over USD 24 million) was exported to over 20 countries, with the largest share of exports, about 70 percent, going to the US and Canada. Russia and CIS markets accounted for 16 percent of exports and Europe 10 percent. More than 80 percent of exports was produced by companies with foreign ownership.

The IT sector ranked among the first in terms of productivity, employing 0.2 percent of the total labor force with the total output at about 1.5 percent of the GDP in 2003. In terms of nominal labor productivity for 2001, the IT sector was almost eight times more productive than the economy-wide average. Nominal labor productivity ranged from USD 400 per employee in the education sector to approximately USD 15,000 per employee in the software and IT sector.¹¹ In 2003, the PPP-adjusted productivity of local IT companies stood at 23 percent of the US average level and the productivity of foreign companies – 43 percent of the US level.

The majority of IT companies relied on the *Armenian Diaspora* as their main marketing and distribution partners. Armenian connections formed an important part of a firm’s strategy in seeking markets and market intelligence. Thus the typical Armenian IT export was through outsourcing arrangements or through foreign firms, most often with Armenian connections, that were vertically integrated through operations in Armenia. In 2003, out of 25 foreign-owned companies operating in Armenia, only three were of non-Armenian origin. Outside the Diaspora, the Armenian industry had little reputation or image.

¹¹ McKinsey & Company, 2003, “Key Levers of Productivity Improvement and Software and IT Services Sector Potential”, Armenia 2020 Project.

In general, after declaring independence in 1991, the collaboration with the Armenian Diaspora played an important role in the recovery and the development of the economy. This was particularly true regarding the development of the IT sector. Together with “old Diaspora” members, many of the professionals who had left the country during the first years of independence for making their businesses and careers abroad (so-called “new Diaspora members”), managed to make considerable achievements. Some of them established their own quite successful businesses, among which there were well-known companies in the international market, acting mainly in the US. These people knew very well the potential of Armenian specialists, had good contacts in the IT sphere, and also were looking for opportunities to do business in their homeland. According to the UITE survey¹², 17 percent of new Diaspora IT specialists continued keeping contacts and about 10 percent of migrated specialists helped their former companies get orders and projects.

Driven by the increasing demand for IT professionals and the continuing inability of the education system to fill the demand, a number of new institutions started to offer IT education. Particularly, the American University of Armenia (AUA), providing degrees in MBA and computer and information science and an affiliate of the University of California; the European Regional Institute of Information and Communication Technologies in Armenia (ERIICTA), established by the EU and offering degrees in SW engineering and IT business management; the Russian-Armenian (Slavonic) University, established by the initiative of the Armenian and Russian governments and providing majors in mathematics and math modeling, system programming, electronics and microelectronics.

With the development of the IT sector the shortage of qualified professionals became more and more problematic. The education system for the IT was not equipped and developed for meeting the needs of business, even though more and new educational institutions were becoming involved in IT education and offering IT courses. Additional, but not less important constraints faced by local IT companies included the lack of adequate managerial capacities as well as of strategic market intelligence and international market access, plus the small size of the domestic market leading to inefficiencies in scale and branding discounts. These realities forced local as well as foreign IT companies to recognize that there is a need for more concerted action between them and also for collaboration with other institutions, including the government. The impulse for collaboration was particularly strong with respect to technology transfer, joint R&D, marketing expertise and market information, joint ventures and sub-contracting. Foreign companies were more interested in qualification exchange (i.e. attracting qualified programmers).

Planting cluster seeds

The first steps aimed at concerted action were taken by IT companies and professionals, the driving force in the development of the sector. Thus, in spring 2000, six IT enterprises, including Bricence, founded the ***Union of Information Technology Enterprises (UITE)*** of Armenia. Hovhannes Avoyan was elected as the President of UITE. It became the first and the biggest IT Association in Armenia to consolidate industry issues for advocacy, to facilitate business, and to encourage R&D. In 2001, the UITE, in cooperation with Eurasia Foundation, conducted the first comprehensive study of the Armenian IT industry potential. It played a key lobbying role in the recognition of IT industry development as a priority by the government. The UITE actively promoted local and international collaboration such as membership in international organizations (BITKOM), participation in the IT trade fair (CeBIT-2001, 2002), joint projects with local/international organizations (e.g. IESC, ProSME, World Bank).

A little later, in fall 2000, a group of Armenian-American high-tech entrepreneurs and executives got together to form the ***Armenian High Tech Council of America (ArmenTech)*** with the primary goal to promote and support the creation and development of technology-based businesses in Armenia by utilizing the collective expertise of its membership. ArmenTech was incorporated in Massachusetts as a non-profit corporation. Many ArmenTech's members were proven entrepreneurs and executives who

¹² UITE, 2001, “Armenia: The State of IT Industry – Findings of the Survey of Information Technology Enterprises”.

generated millions of dollars in economic value in high-tech companies in the US, and created significant business in Armenia. In 2004, ArmenTech involved 20-30 key members with prospects of fast growth and expansion in Armenia, Europe, and throughout the Armenian Diaspora.

The increasing activity of the IT community called also the government to take action. In December 2000, under the pressure of impressive and promising developments in the IT sector, the government officially declared the development of the IT sector as one of the priorities for the Armenian economy. Following this, an *IT Development Support Council (ITDS Council)* was created with the Prime Minister serving as Chairman. The ITDS Council established a permanently working secretariat to act as a bridge between the government, private and public sectors as well as with the international donor community. In 2001, the government, with close coordination and support from the World Bank and USAID, developed an IT Master Strategy and IT development implementation plan to establish Armenia as a regional IT hub.

Technical as well as financial assistance from *international donor organizations* played a significant role in Armenia's economic development since the early years of transition. With respect to the IT industry, starting from 2000, the international community showed increasing interest in the sector. Various large and small programs were designed by and with the support of international organizations to assess the competitiveness and to support the successful performance of the IT sector in Armenia. Organizations involved in these activities included, among others, the World Bank, USAID, GTZ, OSI-AF, Eurasia Foundation, EU-TACIS, UNDP, IESC, UNIDO, and others. Some of the projects implemented in the IT sector are discussed below as examples of collaboration of various stakeholders with the IT industry.

In 2002, the government set up the *Enterprise Incubator Foundation (EIF)* under the World Bank's "Enterprise Incubator" project. The EIF's mission was to stimulate Armenia's economic growth by assisting the local information and high technology enterprises in business development. The EIF provided business, skill development, and facility services, and created opportunities for partnership and investment. The EIF established three representations in the US, Canada and the EU in order to support businesses in marketing their products as well as to provide market intelligence. There were two other incubators established, *Viasphere Technopark* and *SolarEn*. The former was established in 2001 by Viasphere International, a Silicon Valley-based venture capital firm and incubator (with branches in Italy, India and Brazil), that invests in and provides management services to start-up technology companies. Viasphere Technopark offers office space and state of the art networking, communications and computer infrastructure to technology companies. It serves as an important center of technological innovation and collaboration. SolarEn, is a technology incubator in the energy sector established in 2000.

Open Source Armenia (OSA) was established and supported by a pool of international private, public and academic institutions. The OSA domain was opened and started its operations at the beginning of 2003. OSA was a website designed to promote, host, sponsor, and provide support for open-source Software projects in Armenia. It aimed at developing a large international community of IT professionals, students and entrepreneurs and to promote the Armenian high-tech industry worldwide. Later, the Eurasia Foundation, Lycos, and the American University of Armenia assisted with the project.

An important and promising turning point in terms of effective collaboration was the launch of several joint projects between large IT companies (such as Lycos Armenia, Leda Systems (acquired by Synopsys in 2004), HPLA) and the main educational institutions, YSU, SEUA, and AUA. This collaboration was necessitated by a dangerously increasing shortage of qualified human resources in the IT sector and limited capabilities of educational institutions for providing required set of services.

In 2002, *Lycos-Europe*, a leading European Internet company established Lycos Armenia. Lycos Europe was originally founded in May 1997 as a joint venture between Lycos, Inc., USA, and Bertelsmann AG, Germany. Lycos was one of the first Internet search engines. Lycos Armenia was engaged in the development of programs for the main services of Lycos Europe: searching, communications, communities and shopping. The quality of products corresponded to the highest international standards, while the prices were much lower than those in Europe.

Said Lycos Europe's Chief Technical Officer, Frank Weller, who also visited Armenia for a due diligence mission before the acquisition:

"Many Internet companies are considering remote development locations in India or other so called low cost countries. Few of them see these remote locations become fully operational and efficient within the first three months, some will never get there. This is due to the fact that they underestimate the cultural barriers and the amount of effort and management attention you need to put into building a remote location from scratch.

Acquiring an existing development location with vast experience in co-developing software with a headquarter in the US is like a golden bullet".

However, the expansion of Lycos Armenia was constrained by the limited availability of adequately qualified IT specialists in the market. In 2003, in order to solve the problem of human resources, Lycos Armenia decided to start joint programs with educational institutions, and to provide necessary courses for students.

Recognizing the potential of the development of open source in Armenia, Lycos Armenia, in collaboration with EIF and USAID, decided to invest in the establishment of more than USD 1 million worth Open Source Lab in Armenia in 2005. The ultimate goal was to create a new commercial entity with 35-40 staff members, which would concentrate on providing software development services for various open source projects, including systems integration, as well as performing research and consulting for implementation of open source codes. The Lab's operation was considered to be particularly important for projects in areas like e-government, e-medicine, and e-education.

2005-2009: consistent growth

Economic developments

Over 2005-2008 Armenia experienced impressive double-digit economic growth, triggered by booming construction sector and the export of labor with the return of remittance income to Armenia. However, the global financial crisis severely hit the Armenian economy, resulting in 14.4% GDP decrease in 2009. The volume of industrial output throughout January-November, 2009, has slumped by 9,9%. As expected the worst was hit the construction sector, registering decline of about 38,4%. In IMF deputy managing director Murilo Portugal's words:

"Falling private transfers and capital inflows have aggravated external imbalances and affected household incomes and investor confidence. Construction activity, the main driver of growth in previous years, has collapsed, and the economy is experiencing a deep contraction."

Global downturn had inevitable negative effect on remittance inflows – particularly from Russia – and led to the sharp decline of export volumes. As reported by the National Statistical Service the level of export was decreased by 37,4% throughout January-November 2009. The numbers were extremely negative in the trade relations with the European Union, with a 40 percent decrease. Russia's decision to reverse the flow of the work permits further restricted the private transfer inflows. After 4 years consecutive growth the private transfers has fallen by 32% in January-June 2009 as compared to the same period of 2008. While the trade deficit has widened, the loss of remittance income, resulting in decline in the supply of foreign exchange, posed significant pressure on the national currency. In the pursuit to protect the national current the Central Bank sold about 40% of its foreign reserves, however, eventually was forced to return to the floating exchange rate regime. As a consequence, in March 2009, the national currency depreciated by 20 per cent overnight. As a part of anti-crisis strategy the government intends to follow the expansionary monetary and fiscal policy, implying the lowering of interest rate by 2.75 percent and volumetric expansion.

Industry picture

The stable economic growth throughout 2005-2008 served as a basis to the consistent development of IT sector in Armenia. The industry witnessed a sharp increase both in terms of newly formed companies and growth of revenues. In 2009 the number of operating IT companies reached 210 enterprises, from which 58 were foreign owned. Around 80% of these companies were established within the last ten years. Almost all companies were concentrated in Yerevan, where a pool of qualified human resources existed and a proper infrastructure for conducting business were established.

In 2008 the Armenian IT sector generated over US\$110 million and employed around 5,000 people. The average annual growth rate of the industry throughout 1998-2008 reached 27% per annum (CAGR), which nearly twice exceeded the CAGR of GDP in the same period. According to the Enterprise Incubator Foundation (EIF), in 2008 the sector revenues constituted about 1.2% of GDP and about 6% of total exports.

The sector was predominantly based on outsourcing activities and development of products for export markets. These accounted for about 70% of produced products and services, with about 60% of the output exported to USA and North America, around 18% to Europe, and 16% to Russia and CIS countries.

However, according to the industry experts, the high development rates of the industry would be difficult to sustain due to inadequate IT-related human capital. Overall IT workforce had increased by around 17% since 1998, twice less than the industry growth throughout the same period. Although specific segments of the Armenian IT sector were well-endowed with qualified workforce at competitive prices, the educational system in general remained incapable of supporting an adequate supply of qualified specialists to cope with mounting IT market demand due to insufficient university-industry cooperation and shortage of competent academic staff. According to industry experts the companies also lacked the workforce efficiency culture with most of the enterprises still exploiting ineffective company management mechanisms, inherited from the Soviet era.

In 2008 around 85% of the workforce consisted of technical specialists, such as software engineers, analysts, developers, project managers, and others. From about 5,000 business and technical professionals employed by the sector about 87% were specialized in software development and IT consulting. Chip design, internet services, networking systems and communications formed the second largest group of generated IT products and services.

In recent years Armenian specialists have gained more experience with a range of internet technologies and programming languages, such as AJAX, JSP, ASP, PHP, ColdFusion, HTML, DHTML, XML, Flash, Visual Basic, Delphi, Perl, popular database systems such as Microsoft SQL Server, MySQL, Oracle, and Informix. Applications were being developed for Windows, Solaris, Linux, and for handheld platforms. Open source development became increasingly popular among young professionals and students, as well as IT businesses.

High dependence of the industry on outsourcing was another hazard facing Armenia's IT sector, which exhibited negative effect on real value-added products and made the industry vulnerable to external factors and fluctuations in the export markets. Thus appreciation of local currency in 2008 increased the salary costs per employee and made some foreign owned companies cut down the personnel. However, currency depreciation in March 2009 adjusted the workforce prices with the international levels, increasing the competitiveness of Armenia's IT sector in the international arena.

Another positive trend contributing to the sector development was the entry of new players into the domestic telecommunication and internet market. In 2009 most internet service providers had access to global Internet via satellite connections or leased international lines from Armentel/Beeline and Fibernet, these channels ran via Georgia and Iran. Launch of GNC Alpha with a new line at 10 Gbits/sec

Broadband Fiber Backbone Network capacity, was assumed to extend and upgrade the existing broadband network of Armenia and provide the foundations for high-speed wired/wireless networks. Broadband diffusion was expected to provide the basis on which an Internet economy would emerge, holding much potential for future commercial, government and social services.

In general, wireless solutions such as WiFi and WiMAX have garnered much interest, with alternative operators rapidly deploying networks in a number of cities. In 2008 Cornet-AM (owned by "COMSTAR - United TeleSystems" the leading integrated telecommunications operator in Russia and the CIS) launched the first WiMax network in Armenia. Another newcomer, iCON Communications, launched WiMax services, covering all the major cities and large enterprise locations in Armenia.

Entry of French telecommunication company Orange on domestic market was a further highlight of the sector development. Orange presented the next growth opportunity both for the mobile and internet market. Along with other two incumbent operators Orange introduced mobile broadband offering 3G services, which in that time were in much demand on the market.

Emergence of new players on telecom and internet market significantly decreased the prices on internet and communication technologies. However, the internet access was still not affordable for majority of the population: according to various estimates the number of Internet users comprised about 15-20% of the entire population, which was far behind the European internet penetration rate, where the number of regular internet users reached 56% in 2008. The quality of the internet access was also far behind of that of the developed countries: as reported by industry experts the number of broadband subscribers was about 25,000, comprising 0.78% of population, whereas the broadband internet in developed countries was available to over 93% of the population.

Comparatively high prices for internet, limited broadband and internet penetration in the regions, the underdeveloped infrastructure and facilities and absence of unified platforms were still crucial constraints on the way to the development of sustainable information society. The majority of local population still had low computer literacy levels and didn't use any e-service systems. Some of the products and applications such as e-commerce were still in incipient stage on the local market. According to the industry experts the inadequate local market and lack of success stories within the national market represent a serious limitation for sector development.

One of the other essential factors hindering the IT development is the limited financial support for start-ups in IT sector and absence of venture capital. Industry growth during the last 5 years was mainly fostered by private sector initiatives and foreign investment. Global financial downturn added further pressure on IT budgets, reducing investment for new business capabilities.

Government recognition of Armenian IT industry as priority sector was considered to be the major breakthrough on the way to sector development. According to the industry specialists the governmental policies will pave the way to government-private sector cooperation and foster public relation activities supporting the IT industry activities. An important area for government intervention was considered to be training and skills development and support in accessing foreign markets. According to the action plan approved by the government, given the right circumstances by 2018 the IT sector was planned to achieve rather ambitious objectives, such as sharp growth of the number of IT operating companies, totaling 1000 by 2018; qualitative and quantitative expansion of the IT workforce, targeted to reach 40,000 specialists; growth of industry revenues up to US\$1billion; development of e-society and comparably high internet and home computer penetration. The plan lists the actions to be undertaken by the industry players to reach the IT sector target indicators throughout the next 10 years.

International and local organizations and associations supporting the industry (such as USAID funded CAPS project, the Enterprise Incubator Foundation, Union of IT Enterprises, IT Development Support Council, etc) play distinguished role in IT sector development, enhancing workforce training activities,

organizing national/regional conferences and forums. A major \$30mln. IT competitiveness enhancement program funded by the World Bank was underway with key focus on creating a backbone of broadband internet throughout the country, start-up funds, technoparks and commercialization schemes.

According to the industry experts the Armenian Technology Congress (ArmTech) forum held in Silicon Valley since 2007, was the largest and the most eminent event. The objective of the forum was creation of a network between Armenian and American IT and High-Tech companies. ArmTech represented a networking opportunity for Armenian IT companies, connecting those with the leading business, government and academia thinkers for the discussion of the issues and challenges.

DigiTec ICT Armenia Fair organized by UITE was another distinguished initiative aiming at promotion of Armenian technology sector in international and Armenian Diaspora business communities. The fair targeted strengthening business bonds with South Caucasus and Middle East markets through demonstration of the latest technologies created by the Armenian IT sector.

While the sector recorded considerable success in Armenia and the government became more active in promoting it, there were still considerable challenges on the way to make it play a role of key driver of economic development.

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