

READINESS FOR THE NETWORKED WORLD

ASSESSMENT: ARMENIA

INFORMATION TECHNOLOGIES GROUP

CENTER FOR INTERNATIONAL DEVELOPMENT

HARVARD UNIVERSITY

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INTRODUCTION

This assessment of Armenia's Readiness for the Networked World has revealed the vulnerability of existing conditions in the field of information and communications technologies. Nonetheless, Armenia possesses a significant number of highly qualified, educated people. Combined with low cost of labor, this factor may positively contribute to Armenia capable participation in the new information economy.

The low level of integration of information and communication technologies (ICT) in everyday life is one of the main obstacles of Armenia's Readiness. Further barriers are created due to the relatively high ratio of cost of telecommunications equipment to the standard of living and a slowly developing regulatory environment in face of new challenges and modern economic trends.

Nevertheless, Armenia shows evidence of developing as a high-tech hub of the Caucasus Region¹, able to provide a full range of products and services of ICT's given its infrastructure, availability of human resources and its geographical location. However, this could be achieved only if the country will develop its main indicators² of readiness for the Networked World.

The purpose of this research is to assess Armenia's actual level of Readiness for the Networked World and to provide suggestions for planning change and developing Armenia's competitiveness in the New Information Economy³.

¹ The Caucasus region received its name for its geographical location near the Caucasus Mountains. The countries of the region are: Armenia, Azerbaijan, and Georgia.

² Network Access, Networked Learning, Networked Society, Networked Economy and Network Policy. For more information, please see www.readinessguide.org.

³ This research is provided at the Information Technologies Group of the Harvard's Center for International Development. It is based on the Guide for Developing Countries: Readiness for the Networked World.

National Background

This section provides a general overview of Armenia providing information about Armenia's demography and socio-economic status.

Geography

Armenia is a landlocked country in the Caucasus Mountain region. Its neighbors are Georgia to the north, Azerbaijan to the east and south, Iran to the south, and Turkey to the west. Armenia's area is 12,000 sq. miles. Eighty percent of the land is mountainous.



Politics

Armenia is a republic, led by the President, Prime Minister, and a unicameral parliament.

Currently, the main political issues discussed in the country are different approaches to the development, privatization of predominantly state-owned economy, usual competition between parties (there are about 60 of them). The ongoing conflict with Azerbaijan over the ethnic Armenian-dominated region, Nagorno-Karabakh, is another issue that is heavily discussed among political

leaders. The territory is 'de-facto' controlled by local Armenians but 'de-jure' is still a part of Azerbaijan. There are continuing negotiations between leaders of two countries to find appropriate solution for this problem.

Controversial privatization of Armenian telecommunication system, when it was sold to the OTE Group (Greece) with granting 15-year monopoly rights on all operations of telephone system and international communications created resistance in Armenian society to further continuation of privatization process, especially in the issue of current privatization of Electricity Distribution Networks.

Demographics

Armenia is inhabited by approximately 3.78 million people (according to 1989 census), 67% urban (1995). Over half of the urban population lives in Yerevan,* the capital. The ethnic makeup of Armenia is exceedingly homogeneous: 95.9% Armenian, 1.6% Russian, 0.3% Ukrainian and 2.1% other.

The official language is Armenian. Most Armenians (90%) are Armenian Apostolic, 9% Catholic and Protestant and others include Russian and Orthodox Christian, and Jewish. The Armenian population has one of the highest literacy rates of the world – 98.6%.

1999 ECONOMIC STATISTICS	
GDP growth rate	3.3%
Industrial production growth	5.2%
Agricultural production growth	1.3%
Freight volume	2.05 billion kilometer tons (down 18.7% from 1998)
Inflation rate	2% (-1.3% in 1998)
Foreign direct investment	\$100 million (\$232.4 million - 1998)

* According to unofficial estimates, during the last decade about 500,000-700,000 people left the country for economic reasons

Trade turnover	\$1.035 billion (down 7.8% from 1998)
Exports	\$233.5 million (up 5.9% from 1998)
Imports	\$801.7 million (down 11.2% from 1998)
Income per Capita (Purchasing power parity)	\$2,900
Percent of Population below poverty line (PPP, \$100/month)	30% – 40%

Sources: Armenia Ministry of Statistics, UNDP

As can be observed from the table above, a downturn of the economy in 1999 was caused by the economic crisis in Russia in August 1998, which had its negative impact on all other countries of the region, including Armenia.

Resource Base

Armenia is rich in copper, iron, bauxite, molybdenum, gold, silver, lead and zinc. Substantial deposits of pumice, marble, tuff, limestone, basal, and salt also exist. Precious and semi-precious stones are abundant.

The richness of Armenian natural resources is mostly covers domestic demand. During the Soviet time Armenia had an industrial economy, supplying machine tools and manufactured goods, but markets had been lost after 1992, when the country regained its independence, and had to establish new economic relationships with its neighbors. Currently, the main exports are diamonds and scrap metal, copper ore and Armenian brandy.

1. NETWORK ACCESS

1.1 Information Infrastructure

General telecommunications services in Armenia, including satellite connections, mobile telephony services and Internet connectivity are solely provided by the Greek-Armenian company, Armentel. Greece's state-owned telecommunications company, OTE, owns 90% of Armentel's shares, for which it paid \$142.5 million, with the remaining 10 percent belonging to the government of Armenia.

Armenian telephone system was initially state owned, then in 1995 it was privatized and 50% sold to an offshore company, by establishing a new company "ArmenTel". In 1997, it was resold to the OTE Group (Greece) and given 15-year monopoly rights on domestic and international telecommunications services in the country⁴. Armentel itself sets tariffs for the use of satellite channels and has exclusive rights to provide satellite services according to the licensing agreement between government and Armentel. The European Bank for Reconstruction and Development (EBRD) is currently planning to purchase a 9% stake in Armentel. This deal may reduce the mobile phone and data transmission monopolies to 5 years⁵.

There are 15.7 telephone mainlines per 100 people in Armenia, and about 650,000 telephones⁶. Although these indicators lie in a relatively better position in comparison with other developing countries, it should be noted that almost all telephone networks operate highly depreciated analogue systems with a digitalization rate of only 15.8%⁷. Poorly operated telephone networks in rural

⁴ Armentel within 15 years would be the only operator of telecommunications networks in the country, including the fixed line telephone network and international communications.

⁵ The EBRD, as an organization established to support market reforms in Eastern and Central Europe is concerned about such a monopoly and its impact on overall development of the economy. It decided to buy stocks of Armentel to participate in decision-making process of the company, and is trying now to reduce the terms of the monopoly to 5 years.

⁶ World Development Report

⁷ Annual Report of the OTE Group Co. (Greece)

areas are a hindering factor with regards to the overall Readiness of Armenia to quickly implement modern ICT infrastructure.

In many cities outside Yerevan, access to telephones is more difficult, especially in the regions hit by the Spitak earthquake in 1988, where 25,000 people were killed, and much of the infrastructure was destroyed.

Connection to the neighborhood countries of the former Soviet Union is provided by the remained landlines or microwave. The rest of the world is connected by satellite and leased line telecommunication system through the Moscow (Russia) gateway switch of the INTELSAT⁸ global communication system.

The number of mobile service customers is 7,900, mostly corporate users⁹. This figure includes both mobile telephone and paging services. The relatively low mobile penetration in Armenia could be explained by the lack of incentives for telecom monopolist Armentel to invest heavily in this area.

⁸ INTELSAT is an international commercial cooperative with 144 member governments that possesses 19 geostationary satellites to provide voice, data, and Internet links in 210 countries. www.intelsat.int.

⁹ Annual report of the OTE Group Co.

1.2 Internet Availability

1.2.1 Internet Service Providers

The market of Internet Services is relatively competitive in Armenia in terms of the number of providers operated on it. However, the existence of monopoly on international communications constantly creates problems between ISPs and ArmenTel that are mainly related to the price issues for using international communication system to provide access for end-users.

There are 8 main Internet Service Providers (ISP), most of whom use microwave networks.

ISP	TWO-WAY CHANNEL	DOWNLINK CHANNEL	# OF RADIO BRIDGES
Arminco	Teleglobe, 256 kb		40
WEB	Teleglobe, 64 kb		60
INFOCOM	Teleglobe, 64 kb		4
Int@rnet	Teleglobe, 64 kb	DirectPC, 400 kb	-
ACC	Teleglobe, 64 kb		-
MegaCom	Teleglobe, 64 kb		-
YerPhi	DESY, Germany, 64 kb Teleglobe 64 kb	DirectPC, 400 kb	60
Freenet	Holland, 16 kb		-

Source: Internet Society of Armenia

There are about **350,000 – 400,000** inhabitants per one Internet Service Provider in Armenia¹⁰.

¹⁰ World Development Report, the World Bank

1.2.2 Internet Public Access

There is a couple of organizations that provide public Internet access: 1) the ***International Research Exchange Program (IREX)*** through its Internet Access and Training Program (IATP) supported by the USAID and 2) ***The Armenian Freenet***, supported by the United Nations Development Programs (UNDP).

The latter provides free public Internet services as well as training for governmental organizations, NGO's, schools and universities as well as for individual users. Access to the Internet is provided through dial-up connectivity. The organization is equipped with relatively modern hardware that includes VSAT satellite communications equipment, and modem pools to facilitate access via local telephone lines.

The Internet Access and Training Program (IATP) was initially established to provide collaboration among alumni of the US-Armenia educational and cultural exchange programs and American host universities, and further expanded its activities by providing free internet access for all users, mainly universities with internet training and access. Four universities and the State Public Library of Armenia located in Yerevan participate in this program. These organizations have computer centers on site and provide Internet services to students and the public, allowing them to use the Internet for free for 30 minutes per day. These Internet centers are very popular among university students and researchers who otherwise would not been able to have an access to the Internet.

1.2.3 Availability for Businesses

Banks, research and development institutions, universities and schools are the main corporate users of Internet services in Armenia. Large businesses, particularly large banking companies can afford to have leased lines as well as instant and high-speed access to their corresponding accounts abroad. Banks are connected to the Net through a high-speed telecommunication network called "Iskra", which was previously used to provide secured high-frequency telecommunication services only for different branches of government. These banks usually use custom-based applications for their services produced by local software companies.

The old-fashioned telephone and paper style of communication between different divisions of businesses is still very common in Armenia. Even manufacturing and large trade companies do not have leased lines due to the low use of the Internet in company premises. Although several large corporations have their own web sites, their web operations are limited to the provision of simple contact information and basic description of their business. Those companies who do business abroad and need to promote their products in international markets are not concerned about using the Internet. This is mainly due to lack of awareness of the potential of the Internet as a marketing and business tool.

1.3 Internet Affordability

Current prices for Internet services mostly reflect the lack of demand due to the low level of business activity in Armenia and the small size of the market. Many corporate users, the most common consumers of information and telecommunication services, very often do not request Internet access due to the lack of funds and small number of medium to large-scale companies. Such a lack of demand has resulted in relatively high prices for

communication services, which are almost as twice as high as in developed countries.

Following is the list of monthly charges and installation fees of main ISPs operated in Armenian market.

	<i>Arminco</i>	<i>Infocom</i>	<i>ACC</i>	<i>Megacom</i>	<i>Web</i>
Dial-Up	\$20 - \$50	\$20-\$50 + \$40 install	\$16-\$50 +\$24 install	\$15 - \$62	\$24 - \$30
Dedicated Lines	\$125- \$256	\$150-\$50 +\$250 install	\$24-\$120 +\$300 - \$2400 install respectively	\$100-\$200	\$228
Wireless	\$125 +\$1300-\$2500 install	-	-	-	\$120 + \$120 set up
Hosting	\$70 for 50 MB	-	-	-	\$30 for 5 MB + \$12 for registration

Source: information announced by corresponding companies. Prices are given without 20% Value Added Tax

The range for dial-up communication in the table above reflects monthly day-time and night-time tariffs that permit individual users to have a cheaper connection on the Internet from 11 p.m. to 8 a.m.

For dedicated lines the range reflects 64 Kbps and 126 Kbps speeds of communication.

Aiming to attract more non-corporate users Internet Service Providers (ISPs) promote various packages, which includes daily and even hourly payment options as well as an unusual option of paying per MB of downloaded information.

From business point of view, such a policy seems reasonable since most companies that can afford dedicated lines have already installed them, and it is unlikely that ISPs will be able to attract more customers from this segment of the

market. On the other hand, the demand for modern information and communication technologies continues to grow among individual users due to an ever-increasing number of people engaged in private work for IT companies that are located abroad; this makes high-speed connectivity extremely critical for these users.

According to the World Bank Development Report there are about 0.88 Internet hosts per 1000 people¹¹ and it is still problematic for an overwhelming majority of population to be able to afford using the Internet in everyday life or to even have a computer at home. More and more people nowadays have access to computers and Internet at the workplace.

1.4 Network Speed and Quality

An outdated telephone network is one of the main obstacle for improvement the quality and speed of telecommunications in Armenia.

Most telephone lines operate under analogue systems. Only 15.8% of telephone lines are digitized.¹² Local calls are free and relatively reliable, with a monthly charge of only \$1.5. However there are a lot of difficulties with international and even long-distance domestic calls. Although there is no available information about approximate number of faults, simple surveys indicate that telephone faults and connection drops are not rare.

1.5 Hardware and Software

Before 1991, Armenia was a key developer, producer and supplier of almost 30 percent of high-tech computer and electronic equipment for the Soviet defense

¹¹ 'Country Profile' of Armenia, World Bank

¹² Annual Report of the OTE Group Co.

and space systems¹³. Traditionally, these companies were best equipped in Armenia, Armenian educational institutions and laboratories for many years produced highly qualified specialists in electronics, hardware and software development.

As a result of the collapse of the Soviet Union, and the subsequent economic crises, and embargoes from neighboring countries, many of these companies have lost their markets and links in the former Soviet Republic. Their expensive equipment is now idle and aging rapidly. Highly qualified researchers, engineers, and workers are underemployed.

The status of the hardware and software industry is more promising in Armenia. Although main hardware components for ICT equipment, such as computer components and network devices are imported into the country, (as in most countries of the world including the US and EU), there are more than 15 small and medium enterprises engaged in assembling computers and designing computer networks.

There are thirteen software companies employing on average 10-15 software professionals, with salaries ranging from \$400 to \$800 per month and providing solutions for banks, educational institutions and governmental organizations. The exception is U.S. Silicon Valley based HPL¹⁴ (Heuristics Physics Laboratories) Company, which employs about 100 programmers in its Armenian operations.

One of the obstacles in the area of development of software industry is weak implementation of copyright protection due to the general lack of awareness. About 90% of packaged software and multimedia sold in Armenia without any copyright payments, in comparing with 60% in Poland, 40% in Western Europe,

¹³ US Department of Commerce, Business Information Service for Newly Independent States (BISNIS)

¹⁴ Heuristics Physics Laboratories, USA, www.hpl.com

and 30 % in the U.S.¹⁵ However, understanding the importance and viability of copyrights has already started to be considered as a foundation for developing the IT industry.

1.6 Service and Support

As mentioned earlier, there is only one telephone service provider in Armenia and such a monopoly adds barriers to the development of this industry. According to the World Bank's World Development Report, the waiting list for fixed lines is 109,981 and 157.2 telephone mainlines per 1,000 people in the country. Most fixed telephone lines are concentrated in urban areas with a teledensity of 20.58 lines per 100 people.

Waiting period for installation a telephone line is about a month in urban areas and 2 months in rural districts. The period for resolving minor telephone problems is from 1 day to a week. The main obstacle for decreasing the number of people in waiting list is relatively high prices for such installation that could reach up to \$1,000 per household that is practically unaffordable for most of the population.

There is an abundance of technicians – 700 - working on R&D projects¹⁶, like INTAS¹⁷ program financed by EU to outsource some of it research work for various projects (Airbus, biotech projects, etc); ISTC¹⁸ project sponsored by the US to convert R&D made before for defense related industry into peaceful areas; several projects related to safety issues of the Armenian Nuclear Power Plant. Thus, shortage of technical specialists is not an issue in Armenia.

¹⁵ McKinsey Global Institute

¹⁶ World Development Report, The World Bank

¹⁷ International Association for Cooperation with Scientists, INTAS, www.intas.be

¹⁸ International Science & Technology Center, www.istc.ru

2. NETWORKED LEARNING

The integration of ICT tools into the education and learning process should be set as a critical priority, as part of a developing country's strategy for growth. Current and future outputs of such integration should not simply produce an educated, ICT-savvy populace, but also help develop the economy and create new businesses and employment opportunities.

Readiness of schools in terms of access to ICT's can be broken down into five main areas: 1. Number of computers, 2. Internet access, 3. Computer configuration, 4. Access to and organization of electronic content, 5. Quality and speed of connectivity.

Progress can not be achieved by simply placing computers in schools but requires well-trained teachers, and appropriate curricula that reflect new trends of the economy. Furthermore, successful integration of ICT into the learning process should create an "ICT-enabled" workforce that would directly contribute to the country's overall socio-economic development.

2.1 Schools' Access to ICTs

2.1.1 Universities

There are 16 State universities in Armenia, where 39,770 students are studied, of which 41,2% are on full state scholarships¹⁹, and about 82 privately owned higher educational institutions with 21,504 students that were established since 1992 when the market was liberalized²⁰.

Most state universities are equipped with computers. However there are still very few PCs available for students. Faculty and staff are the most common users of

¹⁹ Armenian Ministry of Statistics, 2000

²⁰ Armenian Ministry of Statistics, 2000

computers, though integration of ICT's into the study process is mainly limited to engineering schools. Students, especially in state-owned universities, which are traditionally considered better choices for study, have access to computer labs installed for their usage. As a rule, a lab consists of 10 – 15 computers, connected to the Internet.

Private schools are becoming more and more advanced users of information technologies, though they still suffered from the lack of modern equipment due to relatively low tuition payments.

The Internet is still not perceived as an important resource for research information. The largest State Engineering University of Armenia, which has about 8,000 students and 700 faculty members, downloads only 600 MB of information per month via the Internet²¹; the portion of information downloaded by students for their course assignments is 50% of this amount. Computer labs are generally open for computer studies during the day.²²

The only educational institution where conditions are comparable to that of developed countries is the American University of Armenia with its 200 graduate students, which receives appropriate financing from the Armenian Diaspora and the USAID. The university computers are connected through a local area network. The system allows remote computing, electronic mailing, and transferring data between various platforms. Telephone lines also provide a dial-up access for faculty and students. The university is connected to the Internet via dedicated lines, serviced by local Internet service providers with links to Canada (Teleglobe) and USA (MCI). It runs its own Internet domain AUA.AM with WEB and FTP servers. Most of the university computers are Pentiums. There are more than 180 PCs, Macs, and Sun computers integrated into a

²¹ Information posted on the web-site of the State Engineering University of Armenia, www.seua.am

²² These labs are equipped with Pentium 166 – 250 models.

network. The Netra J computer is used as an Armenian Sun SITE, serving local users²³.

2.1.2 Schools

Conditions in secondary and middle schools are significantly worse. Although, IT literacy courses are included in school curricula, an overwhelming majority of schools do not have computers at all. Teachers are usually unaware of modern trends of ICT's. At most, their knowledge is limited to basic packages such as word processing. Only 23 schools out of 1446 are connected to the Internet.

2.2 Developing the ICT Workforce

There is continuous progress in Armenia in terms of availability of training programs for teachers. The School of Applied Mathematics at the Yerevan State University and School of Computer Sciences at the State Engineering University of Armenia produce a sufficient number of highly qualified hardware and software specialists to cover local needs. One can confidently deduce that there is a surplus of such kind of professionals who have to leave the country due to the high rate of unemployment²⁴.

There is a new program organized by the International Scientific and Technological Center (sponsored by US and EU governments), which provides training in software programming and web development for people who previously worked on defense related projects. This program was established to recycle highly qualified people and help them acquire new skills required in peaceful technological areas²⁵.

²³ Information posted in the AUA web-site, www.aua.am

²⁴ Author's own observation

²⁵ International Science & Technology Center, www.istc.ru

Moreover, a wide number of private short- and medium-term courses in computer related subjects are very popular in Armenia and help in preparing skilled workforce in Information and Communication Technologies.

3. NETWORKED SOCIETY

A society's successful integration of ICT's in daily life should reflect a potential gain of joining the Networked World. Bearing in mind Armenia's Readiness, it is very important not only to assess how many people have access to ICT's but also how these technologies are being used and deployed.

There are only 467 Internet hosts²⁶ at the time this report was written, a number too little for a population of three million people. There is fairly good awareness of the Internet but few have actually used it. The overwhelming majority of users are males between the ages of 17 and 35, mostly students and researchers.

Businesses use the Internet, albeit usually for e-mail purposes only. Web sites of local businesses do not provide on-line payment transaction facilities and are rarely advertised via the Internet, preferring traditional mass media such as TV, radio and newspapers. Such a disproportional using of Internet in terms of advertising can be explained by relatively small number of people using the Internet in their everyday life.

Very few websites²⁷ in Armenia contain content that is updated on a continuous basis. Most sites just provide general information about a business or cultural information about the country. Of those 19,000 computers that are used in Armenia only about 23% are connected to the Internet.

²⁶ World Development Report, The World Bank

²⁷ See Appendix with the list of Armenian web-sites of public and private organizations

Public telephones may be found in most parts of Armenia, including rural areas, but most equipment is about 12-15 years old.

There are very few people who have Internet access at home, and cyber cafes that offer computer use and online services to the public for a fee are not very popular due to relatively high prices that are about \$10 per hour.

Communication in the workplace usually takes place by phone or fax and few offices have computers that are networked for internal file sharing. This is mainly because most technologically advanced enterprises, generally oriented to research and development for defense industry, has been closed in the last 7-10 years, and computers in the rest rarely connected to the internal network, with the exception of banks and large public and private institutions.

4. NETWORKED ECONOMY

4.1 Software development in Armenia

Armenia is viewed as a country that offers “attractive opportunities to software developers” as cited by the US Department of Commerce²⁸. There are growing number of software companies. Several US companies have benefited from qualified and low cost labor by sharing their work with Armenian specialists on the time-to-time basis while other Armenia-based programmers also work for US-based companies via the Internet.

The software industry in Armenia currently employs about 400 programmers; of which, approximately 100 are employed by a division of Silicon Valley based HPL Company. Furthermore, five US firms have started software development businesses in Armenia in addition to thirteen local companies that are mainly focussing on designing LANs, and software for banking, education and government sectors.

4.2 ICT Employment Opportunities

Various universities and educational institutions in Armenia are able to provide a sufficient pool of employees to fulfill companies’ needs for technical programmers and managers. The Yerevan State University and the State Engineering University of Armenia (former Yerevan Polytechnic Institute) are the two largest educational institutions in Armenia. Their schools of applied mathematics and computer science produce a significant number of dedicated students with qualified skills that are soon absorbed into the IT industry both in and outside of the country. The American University of Armenia has a 2-year MBA program;

²⁸ US Department of Commerce, BISNIS

approximately 40-45 students graduate from this program armed with international skills and knowledge of local market.

These educational institutions have had a strong impact in building the ICT workforce and in promoting development of ICT's in Armenia.

Actually, there is a surplus of computer professionals in the country. However, there is a shortage of IT managers, equally skillful both in technologies and in management of IT companies.

4.3 B2C, B2B Electronic Commerce & E-Government

Unfortunately, there is no e-commerce in Armenia due to inadequately developed infrastructure and unavailability of banking services to provide on-line transactions. Private companies and banks do not use Internet to provide goods and services for consumers or for other businesses. Local project financing is still inadequately developed; banks provide loans on full collateral, with unaffordably high-interest rates. In addition, although banks and large private companies have their own web sites but they usually provide contact information and description of their businesses only.

As for e-government, very few national governmental organizations operate web-sites (Office of the President, National Assembly, Ministry of Privatization, Environmental Protection, Central Bank, State Register). Only recently, government started to consider IT development as a priority for the development of economy, but still no serious steps are made in that direction.

5. NETWORK POLICY

A viable ICT policy is critical to facilitating a networked economy through creation of favorable climate for Internet use and e-commerce, while encouraging organizations and individuals to invest in and use information and communication technologies. Effective regulation promotes competition within the telecommunication sector. Information and communication technologies become more available and affordable where there are low barriers to trade, including tariffs on ICT equipment and software, and electronically ordered goods and services.

Currently, Armenian law encourages foreign investment. It would be proper to say that the law at least doesn't discourage it. There are 2-year tax-exemption plans for companies investing more than \$1 million dollars in the local economy. However, the relatively high level of taxes imposed on investments of smaller amounts (initiated by small and medium-size companies) discourages entrepreneurs to invest and, in some cases, prevents them from full disclosure of business information. A further burden involves resident companies to pay up to 25% corporate tax on profits, and 20% Value-Added-Tax (VAT) as well as land and property taxes.

No special import certificates are required for imports of computer equipment that are available in many other developing countries, which just add costly barriers to trade. The trade regulations encourage import of components of computer equipment instead of end-user products. These actually provide advantages to local PC manufacturers, which import computer components from abroad and assemble them in the domestic market, thus creating additional employment opportunities. Unlike many other developing countries, which do not have local high-tech producers, there are 5 local PC manufacturers that almost fully cover the demand for personal computers in the local market.

The Armenian government has signed several international and bilateral laws that provide non-discrimination policies towards foreign goods and services. Also, Armenia adopted the copyright law in 1996 and established memberships in World Intellectual Properties Organization's (WIPO) treaties, by promising to protect copyrighted products sold in the country. However, the enforcement of copyright laws is still questionable.

On the other hand, there are no specific laws and regulations related to e-commerce, such as tax exemptions for goods and services traded via the Internet. These regulations would definitely encourage businesses to invest in this area. These policies are not even in the priority list of laws to be adopted in the near future. Government regulations, market-based solutions and industry self-regulation related to information and communication technologies are not established in Armenia till now due to the lateness of understanding the importance and significance of ICT development. Only recently, the government started to consider this issue seriously, and there are a lot of steps to be done in that direction.

PROSPECTIVE

Information and communication technologies (ICTs) have the potential to provide an unprecedented opportunity for growth in transitional economies. Developing countries that have not been able to successfully transition to an industrialized economy may be able to “leapfrog” to the knowledge economy with the aid of ICT. Unlike the process of industrialization, which usually requires large-scale investments, current trends in “new economy” development depend on capable human resources and proper knowledge management. This should be achievable for Armenia if proper policies are implemented and necessary initiatives are undertaken.

Armenia, a country in transition from a state to a free market economy, has retained a wealth of human resources that were trained during the cold war era and were working on highly sophisticated technical projects. This is an integral component of a country’s readiness for the networked world and provides a potential to succeed in the new economy.

However, many important steps need to be taken in the process in order to attain substantial results in terms of Readiness for the Networked World.

Network Access:

- *Information infrastructure* should achieve a level of at least 20 mainlines per 100 people.
- At least 14% of the whole community should have subscription packages of wireless mobile telephony that would increase *Internet affordability* for significant part of population.
- *Network speed and quality* should be significantly improved to reduce the number of faults down to the level of 10 per year for each 100 mainlines. Here a lot should be done to encourage and enforce Armentel, the

- telecom monopolist, either through tax cuts or other mechanisms to invest heavily on improvement in this sector of economy. Particular attention should be paid to mobile penetration as less expensive way to enhance the situation with the quality of communication services and its availability.
- With respect to *Internet availability*, the number of public Internet access points should be increased significantly, especially in rural areas, to provide more people with no access either at home or at work with such an important communication tool as Internet. Also, businesses should be encouraged to implement technologies into their overall operations through incentives creating policies.
 - Special attention should be paid to the development of *software and hardware industry*, as well as *service and support* of available infrastructure. The existence of well-educated and technically strong workforce would significantly facilitate this process, and promotion of attractiveness of this business on international arena should play an important role in implementing ICT policies.

Networked Learning:

- Education is another very important area where significant improvements should be made immediately. *Schools' access to ICTs* is a powerful catalyst to Networked Readiness, and illiteracy in the area of modern Internet technologies may seriously damage the ability of Armenian community to utilize computers and online resources.
- Well-educated and technically strong workforce available in Armenia should be involved actively in the process of *enhancing education* capabilities to facilitate the process of ICT development in general.
- Also, the development of IT management skills in addition to technical knowledge in educational institutions is a key factor for development of businesses in ICT sector. In many cases, the lack of expertise in both areas hinders the progress of ICT in Armenia.

- In addition, re-educating people with mostly hardware technologies' skills to get more expertise in software industry is an important factor due to lower level of investments required and less business risks related to the development of software projects. Here, the ISTC initiative mentioned in the paper plays a significant role and should be encouraged to continue.

Networked Society:

- Significant outcomes of Readiness for the Networked World cannot be achieved without community's incorporation of ICTs into the structure of its activities. More *people* should be able to have an easy access to the Internet, and the level of 10% of the population regularly accessing the Internet is definitely achievable in the nearest future. The number of registered local domains might be considerably increased up to the level of at least 1,000 with the significant portion of *locally relevant content*.
- Efficiency gains of ICT deployment should become obvious for implementing *technologies in the workplaces*. Such elementary important factors as e-mail accounts and networked computers in most workplaces might become a common practice.

Networked Economy:

- Businesses and governments should effectively employ information and communication technologies in order to explore more sophisticated and efficient ways of managing their external relationships and communications. The development in the area of technologies creates a thriving *job market for ICT professionals* and stimulates growth of infrastructure within the economy.
- *Business-to-Business (B2B) and Business-to-Consumer (B2C) Electronic Commerce* may develop a new wave in the country's economy by

reducing physical infrastructure costs, holding smaller inventories, quickly processing payments and augmenting marketing outreach via dynamic communications channels. The experience of many developed countries suggests that this process is better to start with the B2B commerce. Corporations, which have long-term business relationships with their partners and suppliers, can easily perform their transactions electronically. Moreover, very often such transition into the B2B E-Commerce is stipulated by growing competition in the market that changes its structures and redefines industry practices. In addition, the facilitation of on-line transaction can be considered in connection with the development of credit and debit cards system in Armenia that is currently almost unavailable, taking into account that most transactions are still made by cash or through banking transfers.

- Government should establish and start to implement its *e-government* initiatives by providing services directly through the Internet that would encourage both usage of the Internet by population and improve the transparency of government's decision, as well reduce the level of corruption through more automated services where subjective human factors play less significant role.

Network Policy:

- Government can also take advantage of information and communication technologies to improve connections with their citizens by using the Internet to post information online and to offer interactive services for the public. It should become a catalyst for the networked economy, leading to more efficient operations and creation of the local market for ICT equipment and services. Good examples of e-governments are the US, Singapore, UK and Australia. The web sites operated by administrations

- of these countries can serve as a model for appropriately using information technologies in public sector.
- Effective *regulation of the ICT market* promotes competition and establishes fair pricing for consumers. *Low barriers to trade*, including tariffs on ICT equipment and software, and electronically traded goods and services should be introduced in order to promote the use of ICT's in Armenia. Such potential barriers to online trading of goods and services are almost eliminated in most countries of the world. Even the World Trade Organization (WTO) had decided in May 1998 to continue not to impose tariffs on international e-commerce²⁹. In Armenia, the first step towards this objective could be the exemption of Value Added Tax (VAT) from online trading and significant reduction of custom duties for imports and exports of software and hardware.
 - Intellectual property rights are a very important issue that should concern policy makers in Armenia. Zero-tolerance to *piracy* should be established to encourage local software and hardware producers to promote their goods and services in the market. At the same time, special agreements with major manufacturers of such products associated with reduced prices for locally sold software should be developed.

The planning process should be undertaken as a true partnership among businesses, government and non-governmental organizations in Armenia. All interested groups should be able to participate in this process.

A business encouraging environment should be established to achieve significant results by using advantages of having highly-educated workforce to implement ICT strategies for development. Less rapidly changing business regulations and more certainty in policies are core factors to attract investments.

²⁹ WTO, Geneva Ministerial Conference, May 1998

A window of opportunity would not be open for an infinite period of time and earliest years are critical and vitally important for Armenia since the momentum can be lost and the economic conditions can worsen that would inevitably complicate the issue of economic development of the country.

KEY TECHNOLOGICAL INDICATORS

<i>Telephone mainlines per 100 people</i>	15.7
<i>Number of telephones</i>	650,000
<i>Rate of digitalization of telephone system</i>	15.8%
<i>Mobile service customers</i>	7,900
<i>Inhabitants per local ISP</i>	350,000 – 400,000
<i>Organizations providing public Internet access</i>	2
<i>Organizations with public Internet access</i>	5
<i>Internet hosts per 1,000 people</i>	0.88
<i>Hardware companies</i>	15
<i>Software companies</i>	14
<i>People in mainlines waiting list</i>	109,981
<i>Technical workers</i>	700
<i>Mainlines in urban area per 1,000 people</i>	205.8
<i>Schools connected to the Internet</i>	23
<i>Internet hosts</i>	467
<i>Computers in use</i>	19,000
<i>Ratio of computers connected to the Internet</i>	23%

APPENDIX

THE LIST OF REFERRED WEB-SITES

Government:

The Government of Armenia	www.gov.am
The President of Armenia	www.president.am
The Parliament	www.parliament.am
The Constitutional Court	www.concourt.am
The Ministry of foreign Affairs	www.armenianforeignministry.am
The Central Bank	www.cba.am
The Ministry of Privatization	www.privatization.am
The National Academy of Sciences	www.sci.am
The Ministry of Statistics	www.armstat.am

Public, Private and NGOs:

UNDP Armenia	www.undp.am
Armenia Development Gateway	www.gateway.am
AM Network Information Center	www.amnic.net
Armenian Freenet	www.freenet.am
Davidashen – the free hosting service	http://davidashen.aua.am
SunSite Armenia	http://sunsite.aua.am
American University of Armenia	www.aua.am
Yerevan State University	www.ysu.am
State Engineering University of Armenia	www.seua.am
Yerevan Physics Institute	www.yerphi.am
ArmenTel	www.armintel.com
Links Armenia	www.links.am
Internet Access and Training Program	www.iatp.am
European Bank for Reconstruction & Development	www.ebrd.com
OTE Group	www.ote.gr
The World Bank	www.worldbank.org
The US Department of Commerce, BISNIS Database	www.bisnis.doc.gov
Heuristics Physics Laboratories	www.hpl.com
INTELSAT Global Telecom System	www.intelsat.int
McKinsey Global Institute	www.mckinsey.com
International Scientific & Technological Center	www.istc.org
World Trade Organization	www.wto.org
IREX	www.irex.am
INTAS	www.intas.be
ISTC	www.istc.ru

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3. US Department of Commerce, Business Information Service for the Newly Independent States, BISNIS.
4. The Ministry of Statistics
5. Arminco
6. OTE Group, ArmenTel
7. Infocom
8. Yerevan Physics Institute (YerPhi)
9. The Yerevan State Engineering University
10. American University of Armenia
11. International Access & Training Program, IATP, IREX
12. Armenian Internet Users Group
13. Armenian Computer Center, ACC
14. Megacom
15. WEB
16. Armenia Chapter of Internet Society
17. The European Bank of Reconstruction & Development
18. McKinsey Global Institute
19. World Trade Organization
20. International Science & Technology Center, ISTC
21. US International Research Exchange Programs, IREX-Armenia
22. International Association for the Promotion of Cooperation with Scientists from the Newly Independent States of the former Soviet Union, INTAS