

UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

**TOWARDS A KNOWLEDGE-BASED
ECONOMY**

**COUNTRY READINESS
ASSESSMENT REPORT:**

*CONCEPT, OUTLINE, BENCHMARKING
AND INDICATORS.*



UNITED NATIONS

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COORDINATING UNIT FOR OPERATIONAL ACTIVITIES

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New York and Geneva 2002

BACKGROUND

The knowledge-based economy has emerged in the second half of the last century and has been rapidly evolving ever since, bringing visible economic benefits in terms of productivity growth, economic efficiency and wealth-generation opportunities. A staggering surge of affluence that has been recently observed within the developed market economies, to a much extent, could be attributed to a cumulative effect of the rising knowledge-based economy.

In the qualitative terms, the knowledge-based economy has caused a fundamental change in **the modus operandi and vivendi** of the society as a whole. This has been reflected in alterations, taking place in the ways and means by which social and economic agents acquire, generate, distribute and utilize knowledge and information; organize the production, work processes and trade; interact with each other; participate in political processes; and etc.

The pace of development of the knowledge-based economy has been, however, very uneven throughout the world and the UNECE region. The digital divide has increased not only between the countries of the UNECE region, but also within many countries.

Since the beginning of the 1990s, digital gaps have appeared growing between and within the member-republics of the former USSR, between the CIS and the Eastern European countries, and between the developed market economies and countries in transition.

Some countries, such as the Russian Federation, Ukraine and the Republic of Belarus, appear failing to utilize initial competitive advantages (such as, human resources, research and development potential, the knowledge stock accumulated over the previous decades and etc.) in building a foundation of a knowledge-based economy. The lack of investment resources coupled with a high degree of monopolization of the ICT sector and a growing poverty of the population has constrained the formation of a foundation of a knowledge-based economy in these countries. In a number of the countries in transition, essential conditions and elements of the knowledge-based economy are either missing or at their early stage of development.

There are, however, success stories throughout the region to learn from. Estonia, Hungary and Ireland, for example, have been able to successfully utilize the initial advantages and opportunities provided by globalization and cross-border cooperation and to build upon them a vivid ICT sector.

At the same time, the experience of the most advanced countries evidence, that some conditions are critical for ensuring the expansion of the knowledge-based economy. These are:

- The availability and accessibility of information and communication technologies, an information infrastructure and ICT service-provision.
- A regulatory framework, which is conducive to acquisition, generation and effective utilization of knowledge and information.
- The active role of the Government in promoting a community-wide use of knowledge and information and ensuring their effective utilization and universal access of the population.
- The availability of scientific capacities and capabilities and their effective and efficient utilization.
- Educated and entrepreneurial population.

In short, the basic conditions for a knowledge-based economy to emerge and further progress comprise of: (i) the information system, (ii) the innovation system, (iii) the institutional regime, and (iv) human resources, which are qualitatively distinct from those the traditional ones.

The United Nations Economic Commission for Europe has been active in promoting the creation of a knowledge-based economy in the countries in transition. In 2000, the UNECE E-Transition Program has been introduced. It comprises of a number of sub-programs, which the Commission has been implementing in cooperation with other multilateral, regional and national governmental agencies and non-governmental organizations. They include:

- E-regulation;
- E-Government;
- E-learning;
- E-payment system;
- E-infrastructure;
- E-business;
- On-line dispute resolution, and etc.

In order to assist countries in transition more effectively and to better tailor the UNECE implementing activities to their needs, the UNECE has decided to launch a series of country assessment reports, which would provide an overview of a situation in the areas relevant to the knowledge-based economy, including changes in policies and institutional arrangements that could impact on the activities leading to the creation of a knowledge-based economy.

The series will cover all the UNECE countries in transition and will be complemented with a region-wide survey.

Country assessment reports will be prepared on biennium basis by national experts. The funding will be provided by the UNECE, mainly from extra-budgetary sources.

To ensure consistency and comparability, a methodology and a set of variables, measurements and indicators were selected for this series, the list of which with explanatory notes are attached to this document.

It envisages that country reports will consist of two major parts. Part I, **Building The Foundation of A Knowledge-Based Economy**, will provide an assessment of changes in four major areas: (i) the information system, (ii) the innovation system, (iii) the institutional regime, (iv) human resources. This assessment will be repeated in all the subsequent reports. The second part will be issue-oriented.

The outline of the first series is presented below. In order to set a common point of departure for the future series, the main focus of the national assessment reports of the year 2002 is proposed to be on the **Building The Foundation of A Knowledge-Based Economy**.

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Building the Foundation of a Knowledge-Based Economy

OUTLINE

Regular assessments of a country's readiness, the degree to which it is prepared to participate in the networked world, provide a valuable information to its policy-makers and community at large on a relative advancement of their country in the areas that are most critical for the creation of a knowledge-based economy. Such assessments are detailed snapshots of a country's potential, its unique opportunities and challenges, which would allow policy-makers to identify and/or adjust a country's strategic priorities, to make sound strategic decisions with regards to **institutions, information and innovation systems, human resources development**, and etc.

It is proposed, that the assessment of the progress made in developing the foundation of the knowledge-based economy in each of the countries, participating in the series, be carried out on the basis of a common benchmarking, particularly, of one, suggested by the Center for International Development at Harvard University in its Guide "Capture the Benefits of the Networked World" (see: www.readinessguide.org).

The Guide recommends 19 different categories of indicators, ranking each by levels of advancement in Stage One through Four (presented in the tables bellow in Annex I and II). These categories are interdependent and mutually reinforcing and fall within five groups:

- Network Access
- Networked Learning
- Networked Society
- Networked Economy
- Networked Policy

Annex I

BENCHMARKING

Table 1

Stage	Information Infrastructure	Internet Availability	Internet Affordability
Stage 1	Access to telecommunications infrastructure is very limited. (Roughly: There are few shared facilities for telecommunications access. Telephone penetration is very low, with a teledensity of less than 2 mainlines per 100 people. Mobile wireless penetration is below 0.5 % of the population. No cable services are available)	There is not Internet Service Providers (ISPs) offering local dial-up access. There is no public Internet access. Businesses are unable to lease dedicated lines from the local telephone operator, or there is a multi-year waiting to do so.	Most users are charged long distance or international rates for dial-up access. ISP rates are so high that few individuals can afford Internet access.
Stage 2	A small minority in the community has good access to the telecommunications network, but most of the community does not. (Roughly: Teledensity is between 2 and 8 mainlines per 100 people. Mobile wireless penetration is between 0.5 % and 3 %. Cable penetration is below 5 % of all household in the community)	A limited number of ISPs offers local dial-up access. There are more than 1 million inhabitants per local ISP. Some providers offer only e-mail services. There are limited opportunities for public Internet access. Users often have difficulty establishing a dial-up connection to a local ISP. There is no competition in commercial leased line provision. Businesses may only lease lines from a single telephone operator.	Rates for local telephone calls are high enough to discourage extensive Internet use via local ISPs, even among those, who could afford Internet access. Local access solutions exist, but rates for ISP services are high enough to discourage extensive use. The lack of competition in the provision of commercial leased lines is reflected in prohibitively or very high leasing fees.
Stage 3	A sizeable portion of the community has good access to telephone services. Growth in mobile wireless telephony is accelerating. (Roughly: Teledensity is between 8 and 40 mainlines per 100 people. Mobile wireless penetration is between 3% and 14 %. Between 5-10% of households in the community subscribe to cable services)	There are between 0.5 and 1 million inhabitants per local ISP. ISPs provide full Internet access. Subscribers may have some options between various Internet service packages. There are some opportunities for public Internet access. It is normally possible for users to establish a dial-up connection to a local ISP, except during peak hours. One or two private providers leased lines to businesses.	Telephone charges for Internet access reflect emerging competition in the telecoms market, yet they are high enough to discourage extensive use by some potential users. Internet is priced within the reach of the majority of citizens. Competition in leased line provision for businesses has been introduced, and prices are falling but are still high.

Stage 4	There is widespread access to telecommunications and network services. (Roughly: Teledensity is 40 or more mainlines per 100 people. Penetration of mobile wireless telephony is more than 14% of households, subscribing. Cable penetration is at 10% of household or higher).	There are more than two local ISPs per 1 million inhabitants. Higher bandwidth solutions such as DSL (digital subscriber line) and cable modem access are available. Most customers can tailor services to meet different demands for speed, service, security, quality and cost. ISPs provide web-hosting services to their subscribers. There are adequate opportunities for public Internet access for those without access at home, school or work place. Users are able to establish a dial-up connection to a local ISP on a reliable basis. Multiple private providers leased lines to businesses. Wireless solutions may be available in addition to fixed line solutions.	Prices for telephone usage are set competitively and are affordable for nearly all citizens. Flat rate pricing may be in effect for local telephone calls. Prices for Internet access are set competitively and are affordable for nearly all citizens. Flat rate pricing may be available. Free ISP services may be available, particularly in communities with time-metered pricing of local phone calls. Higher bandwidth solutions such as DSL services and cable modem access are priced competitively, which may included tiered pricing based on speed of access or usage-based pricing based on total volume. “Always-on” connections are available without time-metered pricing. Pricing for leased business lines is set in a competitive environment featuring multiple vendors.
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Table 2

STAGE	Network Speed and Quality	Hardware and Software	Service and Support
Stage 1	Fewer than half of all domestic telephone calls are successful. For voice telephony, sound quality is often not acceptable for regular conversation. More than 100 faults are reported per year for each 100 telephone mainlines. No services beyond limited electronic mail capabilities are supported by the local telecommunications infrastructure. Large businesses, which want access, must link their networks directly to infrastructure backbone outside their community.	There are no distribution/ sales points for ICT hardware/ software within the community. ICT hardware and software are too expensive for all but large businesses and a small minority of citizens and small and medium-sized businesses.	Telephone mainlines take at least four years to be installed from the time their orders are placed. It takes over six months for reported mainline problems to be resolved, if ever. Very few or no software developers, programmers or computer technicians are present in the community.
Stage 2	Packet loss is significant and regularly disruptive for any online activities.	Some off-the shelf hardware and software solutions are available locally, but there are none or very few in the native language of the community. Basic hardware and software are affordable for some citizens and small and medium-sized businesses.	Mainlines take at least six months for installation. It takes over one month for reported mainline problems to be resolved. Providers pay no explicit attention to customer service. A small community of software developers, web designers, network administrators and other technical personnel exists.

<p>Stage 3</p>	<p>70-90 % of domestic telephone calls are successful. Connections are dropped with noticeable frequency and are somewhat disruptive. Fewer than 50 faults are reported per year for each 100 mainlines. Users have access to dial-up modem transfer speeds of up to 28.8 Kbps. Leased lines with transfer speeds of up to 64 Kbps are widely available for businesses and ISPs. Limited higher-speed lines are available in some areas. Backbone facilities servicing the community are usually sufficient, although regular peak demand periods result in slower network response times. Packets loss by the network may occur but it is not generally disruptive.</p>	<p>Most ICT products are sourced from abroad, but there is a strong and growing localization industry to adapt products to local needs. Some software appropriate to local needs and language is available. A variety of hardware and software solutions are available and affordable to most small and medium-sized businesses, as well as many individuals.</p>	<p>Mainlines take at least one month to be installed. It takes over a week for reported mainline problem to be resolved. There is a growing customer service ethic among service and support providers, although it is not a priority for most. Some ICT maintenance and technical support services are available. A nascent software industry is present in the community, and there is a growing number of hardware technicians, web designers and network administrators.</p>
<p>Stage 4</p>	<p>Dropped connections are fairly frequent and not a major disruption. Over 90% of domestic telephone calls placed are successful. Fewer than 10 faults are reported per year for each 100 mainlines. There is a widespread access to dial-up modem transfer speeds up to 56 Kbps, with some access to high speed solutions such as DSL, cable modems and wireless media. High-speed services of 1.5 Mbps are common, with higher speeds available in some areas. Adequate backbone capacity exists to support community needs without significant delays except during infrequent periods of high demand. Packets of loss by the network are below 10%.</p>	<p>A vibrant marketplace exists for software and hardware with a competitive retail and wholesale market for these products. Hardware and software appropriate to local needs and languages are widely available and affordable.</p>	<p>Mainline installation is usually completed within a few days. Service providers can be contacted in a number of ways (e-mail, telephone, mail). Reported problems are usually resolved within 48 hours. Online help is available and may allow for immediate resolution. Customer service is considered a source of competitive advantage for the service provider. ICT maintenance and technical support are widely available. A competitive and sophisticated web design market exists, incorporating the latest technology developments.</p>

Table 3

STAGE	Schools' Access to ICTs	Enhancing Education with ICTs	Developing the ICT Workforce
Stage 1	There are no computers in schools.	Computers are not used by any teachers or students.	Training opportunities for programming, maintenance, support, Web design and other ICT professions are virtually non-existent
Stage 2	Where there are ICTs in schools, it is primarily at the university level, and there are generally fewer than five computers in a school or faculty. Access to the compute(s) is limited to computer teachers and/or administrators. Computers tend to be older generation models, such as stand-alone 486 PCs or the equivalent. Where there are multiple computed installed, they are not networked. Use of the computer(s) is limited to electronic documents that are available on the hard drive or diskettes. There may be connectivity for store-and-forward e-mail.	Only a few teachers use computers in a very limited fashion. Teachers' basic computer literacy involves skills such as use of the keyboard and mouse, a basic understanding of the computer operating system, manipulation of files, and cutting and pasting. Computers are mainly used at the university level.	There are limited opportunities for training in ICT skills development.
Stage 3	Computers can be found at the university level as well as in primary and secondary schools. Up to 10 to 15 computers can be found in laboratories for classroom group work, with about four students per computer. Computer labs are generally only open for computer studies during the day and closed after school, or may be open for teachers for class preparation but closed for students. Computer tend to be older generation models, such as 486 PCs or higher, and they may be networked with a file and mail server. There may be an internal Local Area Network (LAN) in place. If there are multiple computer labs, they may be connected through the school network. Where there are stand-alone PCs, they may have a limited CD-ROM library. The network lab achieves connectivity through a dial-up connection to the Internet, which supports limited World Wide Web access.	Teachers and students use computers to support traditional work and study. Teachers who use computers are generally proficient with work processing applications and may access information offline from CD-ROMs. They may employ computers in some basic drill-and-practice lessons. In some cases, teachers access and organize information from the World Wide Web in their work, share information using e-mail, and create information in electronic format to share with others both inside and outside the school.	Technical classes and programs on ICT-related subjects are available from a variety of public and private centers. Some limited online access to training is available. Some employers offer training in the use of information and communication technologies to their employees.

Stage 4	<p>Most schools at all educational levels have access to computers. There may be a number of computer labs in each school, and computers may be found in the classroom. In some cases, students and teachers may have individual laptop computers. Computer labs are open to students and reserved for subject matter classes to use, and are open after school hours. The lab may be open to the community and other schools after school and on weekends. There may be an internal Web server on the school network – computers as well as other devices are connected to the network. Classrooms may be wired and connected to the school’s Wide Area Network (WAN). Clusters of schools may be connected to a regional WAN to share electronic resources. A national school network may be in place. Connectivity may be obtained through a leased line or wireless connection with at least 64 to 128 Kbps of dedicated access.</p>	<p>Information and communication technologies are fully integrated into the curricula, are used in the classroom and are essential to the learning process. The curricula may feature collaborative, project-based learning activities that enable students to use the Internet and advanced software skills to work with other students and teachers in their school, outside their community and internationally. Teachers are well trained in methods for incorporating computers and ICTs into their instruction and curricula.</p>	<p>There are many technical schools with specialized curricula in information and communication technologies and compute science. There are a variety of training opportunities relating to information and communication technologies available through vendor certification programs, employers, educational institutions, private training centers and distance learning courses. Online resources and courses are widely available for the development of technical skills.</p>
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Table 4

STAGE	People and Organizations Online	Locally Relevant Content	ICTS in Everyday Life	ICTs in the Work-place
Stage 1	<p>Most of the population has never heard of the Internet.</p>	<p>No websites exist providing information on local topics. Few or no websites are available in local languages or a dominant Web language spoken locally.</p>	<p>Members of the community do not normally employ information and communication technologies in their daily lives. Most social communication is paper based and/or oral.</p>	<p>Employees have limited access to telephones. A small minority of business and government offices has at most a few computers, none of which are networked. Most business communication takes place in person or by mail. A small number of businesses use telephone and fax.</p>

Stage 2	<p>Much of the population has never heard of the Internet, and most people do not know anyone who has ever used it. Less than 0.5% of the population has used the Internet recently, and few are regular users. Some local businesses and institutions have registered domain names. There are fewer than two of these domains per 1000 inhabitants. There is no advertising in traditional media for online companies or resources.</p>	<p>Few websites covering local topics exist, and most of them are created and hosted outside the community. Some websites are available in local languages or a domain Web language spoken locally. There is little use of online bulletin-board systems, Usenet groups, newsletters, and/or listservs.</p>	<p>Information and communication technologies (telephones, fax machines, pagers, computers) are used to a limited degree by some members of the community. Public telephones are available in some parts of the community and are used regularly by many community members. Personal computers with e-mail capability are made publicly available by some businesses, but most users are from outside the community (e.g. tourists and visiting business people).</p>	<p>Organizations achieve sporadic efficiency gains through limited deployment of ICT systems in their internal workings. Some employees have access to telephones. Few offices have computers that are networked for internal files sharing and basic enterprise applications. In offices where there are computers, only some employees use them for their work, though not for electronic communications.</p>
Stage 3	<p>Most of the population has heard of the Internet, although few have used it. Less than 10% of the population uses the Internet regularly. The overwhelming majority of Internet users are males between the ages of 10 and 35. The number of registered domains locally is at least 2 per 1000 people. Advertising in traditional media for online companies or resources is infrequent.</p>	<p>Some local websites are available, though most carry static content and are updated infrequently. Websites carry diverse types of information relevant to different groups within the community. Many websites are available in local languages or a dominant Web language spoken locally. There is some use of online bulletin-board systems, Usenet groups, newsletters, and/or listservs. There are opportunities for Web-related training, although they may be expensive and accessible only in certain areas.</p>	<p>Public telephones may be found in most parts of the community and are heavily used. Some members of the community have Internet access at home. Growing numbers of community members use telecenters, cyber-cafes and other businesses that offer computer use and online services to the public for a fee.</p>	<p>Organizations achieve some efficiency gains through some degree of deployment of ICT systems in their internal workings. Many computers in business offices are internally networked for data processing, management reporting, and other enterprise applications. Some employees conduct research and business transactions over the Web, though most often they use a shared workstation to do so. Some employees use e-mail for internal communications.</p>

<p>Stage 4</p>	<p>Most of the population is interested in using the Internet and knows others who do. At least 10% of the population accesses the Internet with some regularity. Males between the ages of 10 and 35 no longer represent the overwhelming majority of Internet users. The number of registered local domains is at least 20 per 1000 population. Advertising in traditional media for online companies or resources is fairly common.</p>	<p>Many websites provide dynamic information on local topics and are updated at least several times per week. Local content is generated by citizens at all levels of society, including websites and online bulletin-board systems, Usenet groups, newsletters, and/or listservs. A significant amount of information is available through websites in local languages or a dominant Web language spoken locally. Many affordable opportunities exist for Web-related training.</p>	<p>Many members of the community use information and communication technologies (wireless phones, digital assistants, pagers, personal computers) to assist in their personal lives. Many members of the community use information and communication technologies for household commerce (online shopping, banking, investing) and for a variety of social and commercial interactions with other people (including bartering, consumer-to-consumer trade, online chat). Citizens without access through home, school or work use a variety of public and private Internet access options.</p>	<p>Organizations achieve major efficiency gains through web-spread deployment of ICT systems in their internal processes. Computers in offices are fully networked. Different office locations are connected to each other through external networks. These networks may extend nationally or internationally. Most employees have Internet access from their own workstations. Workers commonly list their e-mail and website addresses on their business cards.</p>
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Table 5

STAGE	ICT Employment Opportunities	B2C Electronic Commerce	B2B Electronic Commerce	E-Government
<p>Stage 1</p>	<p>Few, if any, local businesses hire workers on the basis of their technical background.</p>	<p>No businesses in the community operate websites. There is little awareness of online business, and all dealings between businesses and consumers consist of oral and /or paper-based transactions.</p>	<p>Businesses have few sources of market information. The efficiency of most B2B interactions is hampered by this lack of transparency, as are prospects for new business opportunities. B2B transactions are carried out in person or remotely through paper-based transactions.</p>	<p>No government resources are online. There is no awareness of online governments, and all dealings between government and citizens or businesses are in person or paper-based. There is limited information available by phone.</p>

Stage 2	Although there are some employment opportunities that call for technical skills, most workers with ICT experience either must leave the community to find employment or are unable to find work in their field.	Some businesses operate websites. The basic information they provide is static and infrequently updated. Some businesses accept orders by phone or fax. Some businesses distribute hard-copy catalogs for remote browsing of goods and services.	B2B interactions remain insufficient with little transparency. Faxes and telephones are commonly used to facilitate orders or for remote client support, although some paper-based transactions (e.g. signature) are required.	A few governmental websites exist, providing basic information, often directed at parties outside of the community. This information is static and infrequently updated. Some limited interaction with the government is possible by phone or fax. A few governmental The government distributes some information about services, procedures, rights and responsibilities in hard copy.
Stage 3	Technical skills in the community are becoming a source of competitive advantage and are beginning to attract investment and employment opportunities by companies form outside the community.	Many businesses post key information on websites. Information is often not kept current and relevant. Websites provide information on goods and services for sale. Purchases take place primarily in persons, by fax of phone, though electronic mail may expedite the process. Some businesses may have introduced online ordering.	The deployment of electronic systems has increased efficiency and transparency and lowered transaction costs in B2B interactions. Some B2B transactions are supported by electronic systems (e.g. proprietary systems and databases), but some paper-based transaction (e.g. signature) is usually required at some point. Electronic B2B transactions are a small percentage of overall B2B commerce.	Some governmental agencies post key information on websites, including directories of services, hours of operation, and downloadable forms. Information is often not kept current and relevant. Transactions take place primarily in person, by fax or by telephone, though electronic mail may expedite the process. The government manages relationships with some contractors and suppliers online or with other electronic mediation.

Stage 4	A significant number of employees in the community require technical skills to perform their jobs. A sizeable portion of the community's economy is based on the management of and trade in information, employing a large number of "knowledge workers". Information and communication technologies are considered central to the strategies of many organizations.	Many businesses in the community have incorporated the World Wide Web into their sales, marketing, and custom service systems. The total volume of online retail is a noticeable component of the community's commercial activity, as may be evidenced by advertisements for commercial websites in traditional media and other indicators.	Much efficiency in B2B transactions is apparent as a result of the deployment of electronic systems. These efficiencies have changed market structure and redefined industry practices. Many businesses have incorporated the Web into sales, procurement and inventory management. Some transactions occur online over automated, fully integrated systems. Order processing and delivery may be executed electronically and monitored through online tracking systems. Overall levels of electronic B2B transactions are a noticeable and growing percentage of total B2B transactions within the community.	All governmental agencies post key information on websites and some have incorporated the Web into their strategy for interaction with the public. Interactive government websites allow the public to conduct transactions (e.g. apply for permits, pay taxes) online. Much government procurement and many interactions with suppliers take place online or with other electronic mediation.
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Table 6

STAGE	Telecommunications Regulation	ICT Trade Policy
Stage 1	There are no plans for the liberalization of the community's telecommunications sector. There are no regulatory provisions, which promote universal access to telecommunications services. A single operator provides all services, whether private or state-owned. Voice and data service offerings are limited.	Trade in equipment for information and telecommunication technologies is impeded by high tariffs and other restrictions, including cumbersome technical standards or licensing requirements. Service sectors are not open to trade, creating a barrier for electronic commerce and the building and operation of ICT networks. Domestic regulation may create de facto trade barriers for ICT use. There is little or no direct foreign investment.

Stage 2	Plans for the liberalization of telecommunications services are in place or are being formulated. Provisions for universal access to services have been established, though they are ineffective.	Trade barriers for ICT equipment have been reduced, but are still relatively high. There has been some opening in service sectors related to electronic commerce and ICT networks. Foreign direct investment is allowed in network sectors under certain conditions.
Stage 3	Plans for the liberalization of the telecommunications sector are in place and are being implemented. Progress is being made in achieving universal access, but there are many hurdles in implementation. Services such as data, paging and mobile telephony are available from competing private providers. Alternative carriers compete for private network services, leased lines and other telecommunications services for businesses. Incumbent provider networks are being opened to competition through interconnection and/or unbundling obligations.	Trade in ICT equipment is not restricted through unnecessary standards or licensing arrangements, and tariffs are low and uniform. The community has at least temporary agreed not to apply disproportionate tariffs on electronically delivered products. There has been significant opening in services that facilitate electronic commerce and building and operations of ICT networks, but some restrictions remain. Foreign direct investment in the ICT sector is encouraged with some restrictions.
Stage 4	The telecommunications sector has been liberalized, with a regulatory regime in place to promote open competition. Regulation is effective in promoting universal access. An independent regulatory body sets and enforces telecommunications regulations. Citizens and businesses have a number of options for their telecommunications and data services. Incumbent networks have been opened to competitors, and new competing carriers are taking advantage of these arrangements to offer services. There is vibrant competition among mobile wireless providers. Spectrum has been allocated consistently with international standards, and licensing arrangements encourage new market entrants. The provision of value-added services such as broadband Internet is recognized as a source of commercial advantage.	If tariffs exist on ICT goods, they are low and uniform. Trade in services is fully liberalized, including services delivered electronically. The community has explicitly affirmed that it will not apply disproportionate tariffs on electronically delivered products. Foreign investment in the ICT sector is encouraged and subject to few or no restrictions.

Annex II

Knowledge-Based Economy Indicators

1. Network Access

1.1. Information infrastructure

- Telephone penetration (number of mainlines per 100 people)
- Mobile wireless penetration (%), growth trend
- Total number of mobile telephone subscribers
- Total number of mobile telephone subscribers per 1000 people
- Wireless penetration (percentage of the population)
- Growth trend
- Total number of cable TV subscribers
- Cable TV subscribers, % of households

1.2. Internet availability

- Total number of ISP providers
- Prevailing types of ISPs' networks (microwaves/radio...)
- % of unsuccessful local calls
- Is there competition among ISP providers?
- What are opportunities for public Internet access (libraries, Internet-cafes, etc.)?
- Are there dedicated line lease possibilities? Are there competing providers?

1.3. Internet affordability

- What are the prices of Internet access (unlimited access, per minute charge)?
- Is it affordable for majority/minority (compare with average salary/income)?
- What are the rates for leasing lines?
- Are the rates affordable for small businesses or individuals?

1.4. Network speed and quality

- What is the percentage of successful calls?
- What is the quality of voice connection?
- How many faults are reported per year for each 100 telephone mainlines?
- How long it takes to clear faults (48 hours, a week, month)?
- Which services are supported by local telecommunications infrastructure: e-mail, high-speed modem connection, what is the maximum speed?
- Are there sufficient backbone facilities/networks? Even for peak demand?
- What is the percentage of packet loss by the network?

1.5. Hardware and software

- Are there local IT hardware/software sales points?
- Is the price of IT hardware/software affordable for majority/minority of citizens/businesses?
- Is there software in local languages?
- Is software imported or adapted locally? (percentage of the imported, adapted, produced locally hardware or software in total number in circulation)
- Is there a broad variety/some/very few software business applications?
- Are the IT software/hardware retail and wholesale markets competitive and vibrant?

1.6. Service and support

- How long is the waiting period for telephone line installment? (total number of those on the waiting list; waiting period: days, weeks, months, years)
- How long is the waiting period for reported telephone line problem to be fixed? (minutes, hours, days and etc.)
- Are there software developers, web designers, network administrators and other technical personnel, and how many (working where, employed/unemployed)?

2. Networked Learning

2.1. Schools' access to ICTs.

- Are there computers in schools? How many students per computer? On which level (university/secondary/primary)?

Number of schools	
Number of computers in schools	
Number of schools with computer labs	
Number of computers per school	
Number of students	
Students per computer	
% of schools with computer labs	

- Who has access to computers (technical staff/faculty/students)?
- What is the quality of hardware (386/486/Pentium...)?
- Are there LANs in schools? Regional WANs? National school networks?
- Do schools have Internet connectivity? Is it dial up or through a leased line, wireless?

2.2. Enhancing education with ICTs

- What is the percentage of students and teachers who using computers? (in universities/primary schools/secondary schools)
- What are the computers used for? What is the level of computer literacy/skills?
- What is the level of information and communication technologies integration in the curriculum?

2.3. Developing the ICT workforce

- Are there training opportunities for programming, maintenance, and support?
- Who is offering them (public/private centers)?
- Are they affordable for majority/minority of the population?
- Is there an on-line training available?
- Do employers offer training?

3. Networked Society

3.1. People and organization online

- What is the percentage of the population:
 - Is aware of Internet existence?
 - Has used Internet recently?
 - Uses Internet regularly?
- What is the structure of users by gender, age, social and educational status?
- What is the number locally registered domain names (per 1000 people)?
- Is there advertising for online companies, and how common is it?

3.2. Locally relevant content

- Are there (and how many: no, few, some, many) websites:
 - Providing local topics?
 - In local languages?
- How often are they updated and is content static or dynamic?
- Are the above websites created in the community?
- Are bulletin board systems, Usenet groups, newsletters, and/or listservs in use?
- Are there opportunities for Web-related training?

3.3. ICTs in Everyday life

- Does population include information and communication technologies (phones, faxes, pagers, computers) in everyday life?
- Are there phones, wireless phones, digital assistants, pagers, PCs and are they being used regularly? Are they used for household commerce (banking, online shopping, investing) and social and commercial interaction (bartering, online chat and etc.)
- Are there PCs with e-mail capability available (cyber cafés, telecenters) and are they being widely used?

3.4. ICTs in the workplace

- Do employees have:

- (Un)limited access to phones?
- Personal e-mail accounts?
- Internet access from personal workstations?
- E-mail and web addresses on business cards?

- What percentage of businesses and government offices has computers, how many of them, how many employees use them?
- Are they networked?
- Is business mostly conducted in person or by e-mail, or are there data sharing, enterprise, reporting, transaction, and research applications? How intensively are they used?
- Are there efficiency gains resulting from the use of ICT systems?

4. Networked Economy

4.1. ICT employment opportunities

- Are there opportunities for technically skilled workers within the country?
- Are companies from outside of the country investing in IT related projects?
- What is the portion of knowledge workers and information related business in the economy? (percentage of labor force, percentage of GDP)?
- Are businesses considering IT in their strategies?

4.2. B2C electronic commerce

- Do local businesses have websites and how many? Is content current or static?
- Are there online B2C transactions, or are transactions mainly oral and/or paper-based, phone or fax-based?
- Is online retail noticeable component of the overall commercial activity?

4.3. B2B electronic commerce

- What are the sources of market information, are they sufficient for providing transparency?
- Are there online B2B transactions, or are transactions mainly oral, paper-based, phone or fax-based?
- Can transactions be conducted online without any paper documents? Is the process automated? Does it allow online tracking, monitoring?
- What portion of B2B activity is conducted on line? Is there gain in efficiency?

4.4. E-Government

- Number of government resources online? Does it include information, hours of operation, any services? Is information current and relevant?
- Is there online interaction between government and citizens, or is interaction mainly oral, paper-based, phone or fax-based?
- Is there online interaction between government and suppliers and contractors, or is

the interaction mainly oral, paper-based, phone or fax-based?

- Is it possible to download applications from the websites?
- Can citizens apply for permits, licenses, and taxes on line?

5. Network Policy

5.1. Telecommunications regulation

- Is liberalization of telecommunications sector planned or implemented?
- Is there competition between telecommunications service providers?
- Is broadband Internet access offered?
- Is regulation set and enforced by an independent body?

5.2. ICT trade policy

- Do tariffs or other restrictions (technical standards, domestic regulation, etc.) exist?
- Are there restrictions in the service (including information services) sector?
- Are there disproportional taxes on electronically delivered services?
- Is Foreign Direct Investment in IT sector existent, and is it encouraged, discouraged, restricted?

6. Media

6.1. Radio, TV and newspapers

- Number of Radio and TV stations, newspapers
- The size of audience/circulation.

6.2. Employment in the media

- Number of employees in the media
- Trend: is the number increasing/decreasing?

7. Intellectual Capital

7.1. Patents

- What is the number issued per annum?
- What are the trends?

7.2. Copyrights

- What is the number issued per annum?
- What are the trends?

7.3. Licenses

- What is the number issued per annum?
- What are the trends?

7.4. Trademarks

- What is the number issued per annum?
- What are the trends?

7.5. Scientific and/or tech associations

- List with a brief profile

8. Education

8.1. High education

- Total number of high education establishments (public/private).
- Total number of students (total average per annum, in the private and in the public sector))
- Prevailing specializations. (distribution of students among the fields)
- Cumulative number of population with higher education degrees (total and in science and technology fields)

8.2. Distant learning

- Distant learning facilities
- Number of students trained per center

9. Labor Force

9.1. Employment in science and technical fields

- Number of employees and trends in the fields
- Compensation rates in the fields (average salaries)

9.2. Employment in electronics industry

- Number of employees and trends in the fields
- Compensation rates and trends in the fields

9.3. Employment in telecom industry

- Number of employees and trends in the fields
- Compensation rates and trends in the fields

10. Research and Development

10.1. Research institutions

- Number of research institutions

10.2. Investments in research and development

- The total amount
- Government and private business breakdown of total investment in research and development

11. Other issues

National initiatives regarding science and technology policy, venture capital, stimuli for students, scientists, etc.