UNITED NATIONS ECONOMIC COMMISSION FOR EUROPE

TOWARDS A KNOWLEDGE-BASED ECONOMY

BULGARIA

COUNTRY READINESS ASSESSMENT REPORT

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FOREWORD

The last decades of the 20th century have represented a turning point in the global development process. It is knowledge that has become the engine of the social, economic and cultural development in the today's world. Knowledge-intensive economic activities are now a factor of production of strategic importance in the leading countries. They have also become the main indicator of the level of development and the readiness of every country for a further economic and cultural growth in the 21st century. Taking into consideration all these factors, the United Nations Economic Commission for Europe has launched an initiative of monitoring and analyzing the development of the knowledge-based economy in all the European countries in transition and emerging market economies.

The major goal of this initiative is to stimulate the exchange of national experiences, to identify best practices and to promote region-wide and global-wide cooperation of the UNECE member States, which would accelerate the development of a knowledge-based economy in the countries in transition and emerging market economies. It envisages the preparation of country assessment reports on the biennium basis by national experts, nominated by the Governments, the creation of a High-Level Task Force on the Knowledge-Based Economy, which will consider the reports and provide policy advice and recommendations to the participating countries, and the development of progress measurements and indicators, policy guidelines and tools to assist countries in overcoming obstacles to the development of a knowledge-based economy.

We hope that the country assessment reports, showing a detailed level of the countries' potential and providing information on various approaches and solutions, will help policy-makers to take strategic decisions with regards to the challenges facing them in the development of institutions, information and innovation systems, human resources development and other areas crucial for the development of a knowledge-based economy.

Brigita Schmőgnerová
Executive Secretary
United Nations Economic Commission for Europe

The Economic Commission for Europe intensified its actions with the purpose of creating an economy based on knowledge in the countries in transition. This includes a lot of sub-programmes that the Commission implements in multilateral co-operation with regional and national governmental agencies and non-governmental organizations.

In order to support the countries in transition, ECE initiated a series of assessment reports that will provide a snapshot of the situation in the respective economy sectors, including political changes and institutional organizations.

ECE supports the preparation of such evaluation reports by all the member countries that are in transition, with a detailed evaluation manual "Readiness for the Networked World", being developed by the Harvard University. The proposed methodology is possible to use not only for a comparison of the results, but also for evaluating the development and application of information and communication technologies in individual countries. This would allow that each country to develop towards a desired direction by focusing on those crucial elements, which seem being wither underdeveloped or missing.

In the preface to this methodology, Mr. Jeffrey Sachs, Director of the Center for International Development at Harvard University, says that this initiative will become a basis that will allow the business, political, and non-governmental circles to reveal the huge potential the information and communication technologies have. It will also allow evaluating the readiness and the hindrances that exist to their still wider entry into the economy of countries in transition.

In the light of the above, I suggested supporting the participation of Bulgarian experts in the preparation of the UNECE country assessment reports on the subject "Towards a Knowledge-Based Economy".

Nikola Yankov
Deputy Minister
Ministry of Economy of Bulgaria

PREFACE

The industrial revolution of the 19th century and the scientific revolution of the 20th century have prepared the conditions for the rise of the knowledge-based economy. Economic activities associated with the production and utilization of information and knowledge have become an engine of economic growth in the developed market economies, increasingly transforming all the other dimensions of development and the entire societal ***modus vivendi*** and ***modus operanti*** of the humanity.

What do we mean by "the knowledge-based economy"?

It is not just the digital economy, which incorporates the production and use of computers and telecommunication equipment. It is not quite the networked economy, which incorporates the telecommunication and networking growth during the last decades and its impact on human progress.

The knowledge-based economy is a much complex and broader phenomenon. There are different dimensions and aspects of the knowledge-based economy:

1. The knowledge-based economy has a very powerful technological driving force – a rapid growth of information and telecommunication technologies (ICT). Every three – four year there appears a new generation of ICT. Today, the ICT companies are among the largest corporations. The ICT sector is among the fastest growing economic sectors.

2. Telecommunication and networking, stimulated by a rapid growth of ICTs, have penetrated all the spheres of human activity, forcing them to work into an absolutely new mode and creating new spheres. The information society has become a reality.

3. Knowledge, based on information and supported by cultural and spiritual values, has become an independent force and the most decisive factor of social, economic, technological and cultural transformation.

4. The knowledge-based economy has allowed a quick integration of the enormous intellectual resources of economies in transition into the European intellectual pool, stimulating the development of the former countries. Every country can benefit from developing a knowledge-based economy to become a more equal participant in the global development process.

5. The emerging knowledge-based economy has been affecting other areas of societal activity in every country, including institutional and innovation system, human resources development and etc. and visa versa. The knowledge-based economy has become an engine of progress in every country. If a country is developed, it has a developed knowledge-based economy, if a country is lagging behind, a knowledge-based economy constitutes just a small fraction of its economy.

The report below was prepared by a national expert, nominated by the Government, and represents an overview of the present situation and an assessment of the emerging trends in all the major areas, constituting the foundation of the knowledge-based economy, such as policy and policy instruments, institutional regime, ICT infrastructure, information system, national innovation capacities and capabilities.

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Introduction

The Bulgarian institutions responsible for development of an information society are aware that a strong, efficient and widespread information infrastructure underpins any knowledge-based economy, and plays an important role in economic development and poverty reduction. As such, the Bulgarian government's programme in this sphere is founded on the premises that an information infrastructure:

- is essential to growth;
- is necessary in order to develop a country's production capacity in all sectors of the economy;
- links a country with the global economy and ensures competitiveness;
- contributes to poverty reduction by increasing productivity and providing new opportunities;
- is essential for efficient public administration, social and other public services;
- is important for transparency and good governance.

Bulgaria's legal framework has recently evolved to produce conditions that are favourable to the development of widely accessible information and communication technologies (ICT). This is highlighted by the fact that:

- over a period of four months (December 2001-April 2002), Internet penetration increased from 10% to 14%;
- a survey shows that in early 2002, the country ranked eighth in the world based on its number of IT certificates as a whole, and third compared to its ratio of certificates to population.

The main goal of this report is to assess the current state of ICT infrastructure and the availability of Internet and ICT-related services. The assessment will facilitate identification of: the key barriers to developing ICTs; and opportunities upon which it is possible to capitalise in this field

The document provides a "snap-shot" of Bulgaria's state of e-readiness, as well as a benchmarking instrument against which progress can be monitored.

1. National strategy and action plan

1.1. Strategies and action plans

State policy in the field of ICT is a key issue when assessing a country's readiness for the information society. The following analysis examines government policy in the ICT sector, focusing primarily on the legal framework as the most significant and powerful instrument for state intervention. State policy on the development of an information society is based on several documents as listed below.

- **The Strategy on Information Society Development of the Republic of Bulgaria -** adopted in October 1999. This strategy document defines national priorities for transition to an information society at legislative, technological, economical and social levels and outlines basic related activities. It combines the European Union's (EU) concept of an information society with national interests, and takes into account issues specific to Bulgaria such as: consolidation of the democratic system; European and Euro-Atlantic integration; and, the development of a market economy. This document also looks at EU strategy, national strategies and programmes for transition to an information society of a number of other European countries, as well as political and legal documents of the EU, the Council of Europe and other international organisations.

- **National Programme on Information Society Development of the Republic of Bulgaria -** adopted in October 1999 and updated in April 2001. This programme is based on the above-mentioned strategy document and specifies, in detail, measures to be taken, and identifies the government agencies responsible for their implementation.

- ***e*Europe+ Action Plan for the accession countries**. *e*Europe+ mirrors the priority objectives and targets of *e*Europe but also provides for activities that tackle the specific situation of candidate countries. Like *e*Europe, the *e*Europe+ Action Plan aims to accelerate reform and modernisation of the economies in candidate countries, encourage capacity and institution building, and improve overall competitiveness.

  The primary objective of the eEurope+ Action Plan is to ensure, via strong, political commitment, that EU candidate countries fulfil the full potential offered by an information society, avoiding any broadening of the digital divide with the EU. This will also allow candidate countries to work alongside EU member states to ensure that the whole of Europe becomes "the most competitive and dynamic knowledge-based economy in the world". Such parallel action will allow players in the EU and candidate countries to cooperate, to exchange experiences and best practice, and to thereby assist the effective integration of Europe.

- **National Strategy for e-Commerce** - adopted in June 2000.

1.2. Legal framework

1.2.1. Access to information

The development of an information society depends, to a great extent, on legal regulations concerning access to information and the protection of citizens' communication rights. In this field, three separate laws address detailed regulation on: access to public information; personal data protection; and, confidential information as listed below.

- **The Law on Access to Public Information** - adopted in July 2000**.** This law defines the term "public information" and declares the principle of free and unlimited access to this. It also specifies the procedures for obtaining public information and the authorities responsible for its provision.
- **The Law on Personal Data Protection** - adopted in December 2001**.** This piece of legislation corresponds to Directive 95/46/EC of the European Parliament and the Council of 24 October 1995 on the protection of individuals with regard to the processing of personal data and on the free movement of such data. It is also considered a prerequisite for the ratification of Convention No. 108 of the Council of Europe on the Protection of Individuals with regard to Automatic Processing of Personal Data, signed by Bulgaria in June 1998. This law specifies the obligations of individuals dealing with personal data processing, the protection of such data, and the terms and procedures that provide access to personal information. The establishment of an independent Commission on Personal Data Protection is also envisaged.
- **The Law on the Protection of Classified Information** is still in the process of adoption**.** A strategic government priority for NATO integration is the development of a legal and institutional framework in the field of confidential information protection. This requirement is also a key element of the NATO Membership Action Plan, adopted in Washington in 1999. This law envisages the establishment of a modern legal framework in conformity with NATO policy and standards. It also defines principles and procedures for the protection of classified information as well as specifying responsible specialised authorities and their powers.

1.2.2. Telecommunications

Legal regulations in telecommunications aim to achieve a mature and competitive market with a modern infrastructure and a high quality services for businesses and individuals at competitive and, where possible, affordable prices. The market is regulated in accordance with the EU regulatory framework on telecommunications in order to create a climate that:

- ensures a common market;
- supports effective competition;
- effectively manages frequency usage;
- effectively manages the numbering space;
- ensures the provision of a universal service;
- supports user protection;
- resolves disputes.

1.2.3. Electronic media

The Law on Radio and Television, adopted in 1998 and substantially amended in 2001, regulates radio and television activities in Bulgaria. The operators are divided into two main groups, i.e. commercial operators and public operators. The national public television and radio operators are Bulgarian National Television and Bulgarian National Radio respectively. Both operators have specific status under law and are partially funded by the state.

The remaining television operators perform their activities on the basis of either a licensing or registration regime, dependent on the technical means of broadcasting. The Council on Electronic Media carries out both licensing and registration. This is an independent state authority responsible for the overall regulation of, and control over, the activities of radio and television operators. Both licensed and registered operators are obliged to pay initial and annual state fees at a government rate.

1.2.4. Electronic documents and electronic signature

The Law on Electronic Documents and Electronic Signatures has been in effect since 7 October 2001. It corresponds to the primary principles of Directive 1999/93/EC of the European Parliament and of the Council of 13 December 1999 on a community framework for electronic signatures. This law defines the terms “electronic statement” and “electronic document”. It also envisages obligations on the signatory, the owner, the addressee, and the intermediary of an electronic statement as well as on the determination of the time and place of sending and receiving electronic statements. Under this law, it is also stipulated with the composition of an electronic document, the written form is deemed to have been observed .

Three types of electronic signatures are specified, i.e. simple, advanced and universal. Their use depends on both the technical means of their creation and their legal validity. The simple and advanced electronic signatures have the same effect as a hand written signature except in cases where the owner or the addressee of the electronic statement is a central or local state authority. The universal electronic signature has the same effect, but also in the public sphere.

The status of certification-service-providers and their relations with the owner and the signatory are also regulated. A registration regime is envisaged for providers that will issue certificates for universal electronic signatures. The Commission on Communications Regulation will carry out registration.

1.2.5. Copyright

The Law on Copyrights and Related Rights was adopted in 1993. This law includes special provisions concerning the protection of copyright on computer programmes and databases, specifying in detail the types of operations programme users are permitted to perform. Free copying of computer programmes for personal use is explicitly prohibited. Fines are envisaged for illegal possession, reproduction, distribution or use of computer programmes, and seizure of the subject of the violation is also provided for.

2. The Institutional regime

2.1. Bodies involved in the development of an information society

2.1.1. Ministry of Transport and Communications – policy maker

The Ministry of Transport and Communications establishes policy in the field of telecommunications and information society development. The ministry is responsible for:

- the coordination and supervision of state institutional activities in carrying out strategies and programmes for the development of an information society;
- state positions on drafts of secondary legislation acts related to the development of an information society;
- coordination of the participation in forums related to the development of an information society;
- contributing to problem-solving related to the interaction and usage of ICT in conformity with the law;
- assisting the realisation of projects of national importance for the development of an information society.

The Information Society and Information Technologies Directorate, in the Ministry of Transport and Communications, supervises the completion of these tasks.

2.1.2. ICT Development Agency

The ICT Development Agency officially commenced activity on 15 February 2002. This agency is subordinate to the Minister of Transport and Communications and carries out functions related to administration, collection and expenditure of funds in order to support the development of: telecommunications posts; infrastructure; and, ICT in general. A director, who is appointed by the Minister of Transport and Communications and approved by the Prime Minister, manages the agency.

According to the Telecommunications Act and the agency's regulations - adopted by the Council of Ministers - the agency is funded: partly by the state budget; partly from the income of its individual business activities connected to the provision of services; and partly from participation in national and international projects. The agency's budget will be collected from licence taxes, including: 25% of the single initial and supplementary licence tax provided for in the licences for telecommunication activity; 45% of the licence tax and the tax for registration of non-universal postal service; 50% of the annual tax for the radio-frequency spectrum provided in the licences; 30% of the annual tax for limited resource - number capacity, etc.

The agency’s numerous activities include:

- activities that support the development of an information society including promotion, information conferences, training, seminars and marketing with a view to attracting investment in ICT;
- the administrative, financial and technological support of projects and activities with national impact on ICT, and relating to the Bulgaria’s admission process into the EU

and to opportunities to obtain funds from EU projects under the "Information Society Technologies" programme;

- administrative, financial and technological support of projects and activities in the field of ICT in higher education;
- the presentation of achievements by Bulgarian organisations in ICT development, including the presentation of innovative Bulgarian ICT products and services at international fairs;
- the financial support of the prime postal operator to carry out a universal postal service under non-profitable economic conditions, in compliance with the requirements of the Telecommunications Act;
- the financing of important projects in the telecommunications field, relating to the government, defence and security of the country;
- the liberation of the radio frequency spectrum in line with civilian requirements.

2.1.3. CCICMT
(The Coordination Centre for Information, Communications and Management Technologies*)*

The Coordination Centre for Information, Communications and Management Technologies (CCICMT) was created as a special coordination unit under the auspices of the Council of Ministers with the support of the United Nations Development Programme (UNDP). A Memorandum of Understanding was signed between the Bulgarian Government and UNDP on 6 February 2002 for this purpose.

The mission of the centre is to further implement ICT through the support and coordination of state efforts, the donor community and the private sector, in order to achieve an overall improvement in the quality of public-administrative services and decision-making processes.

The goals of the CCICMT are as follows:

- to improve the effectiveness of state administration through a systematic and coordinated implementation of ICT and the introduction of e-government services;
- to increase the efficiency of budget and donor funds invested in ICT in the public sector and to attract new investment;
- to establish an effective partnership with the private sector for the implementation of e-government projects;
- to encourage the overall progress of technology and improve business and social environments.

2.1.4. Information Society Promotion Office (ISPO)

The national Information Society Promotion Office (ISPO) was established in June 2001. Its mission is to support the development of an information society by raising IT awareness in the general public, private sector, public administration, non-governmental organisations (NGOs) and academic institutions, and by fostering the spread of innovative business practices and IT applications among Bulgaria's SMEs.

The ISPO operates as a public-private partnership between the Ministry of Transport and Communications and the Applied Research and Communications Fund (www.arc.online.bg), an NGO specialising in the areas of information society development and innovation.

The office:

- disseminates information about the EU and national policies, programmes, and legislative initiatives associated with information society development and innovation;
- maintains an online inventory of information society policies, projects and activities (www.ispo.bg);
- keeps track of the latest trends in information society development in various sectors of Bulgarian society, and the level of public awareness of these issues in the country;
- publishes the *Information Society Newsletter* and other specialised publications on key aspects of an information society;
- provides information on European, national and regional programmes and projects in the fields of innovation and information society development;
- assists Bulgarian companies and other organisations to identify appropriate EU programmes, develop project proposals, and locate EU partners;
- advises local companies on existing opportunities for technology transfer projects with European partners;
- organises seminars and conferences on topics related to the development of an information society in Bulgaria;
- implements educational programmes and information campaigns on the importance of ICT and its impact on the economic and social development of the country.

3. Present situation and trends in the country's information system

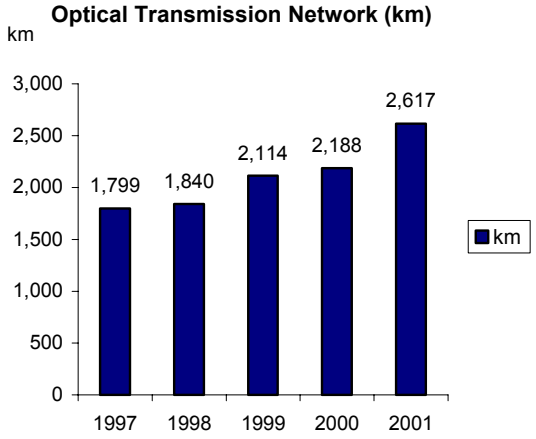
The availability and affordability of ICT for individuals, organisations and society as a whole determines a country's ability to take full advantage of the knowledge and information revolution. A dynamic information infrastructure is therefore a critical component of a knowledge-based economy. This comprises telephone infrastructure, the Internet and the use of other ICTs throughout society and the economy. A key element of the information infrastructure is hardware, but content and applications that enable effective use of new technologies are also essential.

3.1. Communications infrastructure

3.1.1. Telecommunications

The telecommunications infrastructure in Bulgaria has undergone considerable modernisation and expansion in the past twelve years. Prior to transition to a market economy, Bulgaria had one of the highest telephone penetration rates among the former COMECON countries with 30 main lines per 100 inhabitants. These lines were, however, outdated analogue connections designed exclusively for voice transmission and did not allow high-speed network access.

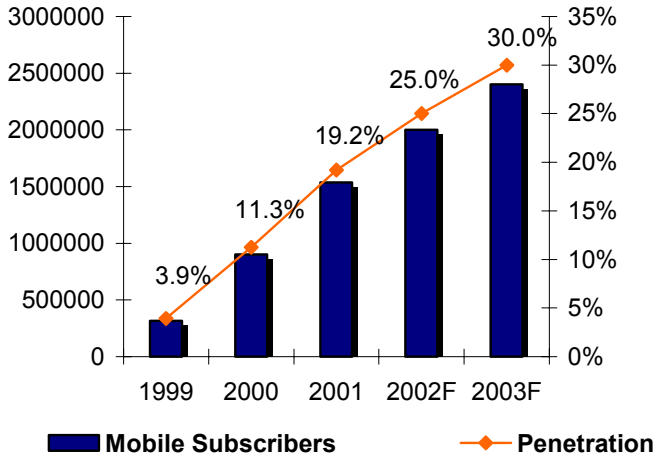
In the last decade, the number of PSTN lines has grown by about 25%, reaching a teledensity of 37 lines per 100 people. These new lines are entirely digital (56 Kbps capable lines). Penetration in households has reached 83 lines per 100. The rate of digitalisation, as reported by the Bulgarian Telecommunications Company (BTC) in January 2002, was 22%. BTC plans to reach 60% digitalisation by 2005 and has started to construct a high-speed backbone for the Internet and multimedia. To this end, more than 5,000 km of fibre optics will be installed by the end of 2002.



The market for mobile telephone services is developing rapidly. Three mobile phone operators currently compete for market share: one analogue NMT-450i (Mobikom) and two GSM operators (Mobiltel and Globul) using frequencies in the 900 MHz and 1800 MHz range. Their market shares (calculated by number of subscribers) at the end of 2001 were: 78% for Mobiltel, 12% for Mobikom, and 10% for Globul. The second GSM operator, Globul, was launched as recently as September 2001.

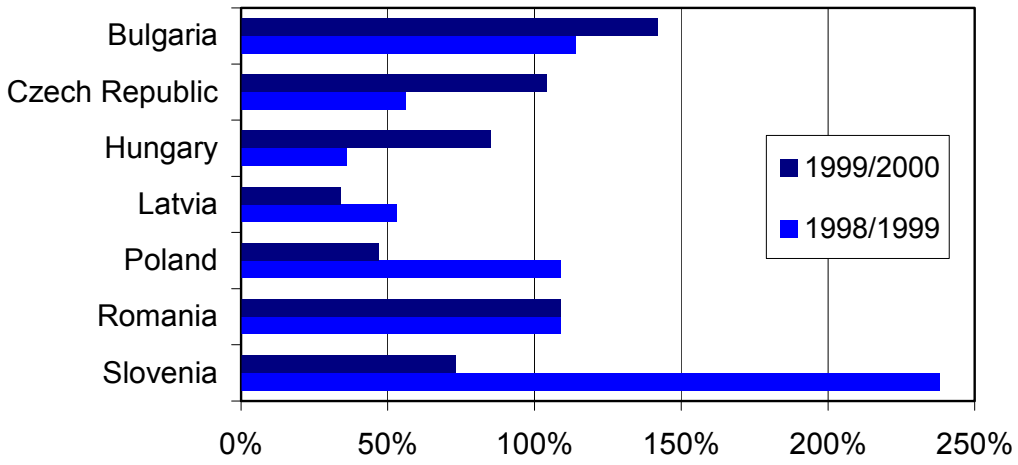
Although the high cost of mobile phone services has long been an obstacle to development of this market, the past two years has seen the number of subscribers grow more than five times. In April 2002, 23% of the population were reported as using mobile telephones, with one quarter of households possessing at least one mobile device.

Number of Mobile Subscribers



It is important to note that the growth of mobile lines in Bulgaria is still increasing, while in other Central and Eastern Europe (CEE) countries this growth is already slowing. Alongside traditional mobile telephony, advanced mobile services are also starting to emerge with the introduction of such as WAP. However, the high price and limited availability of mobile phones supporting this technology limit the number of users.

Growth rates of mobile lines in selected CEE countries



The frequency bands for the Universal Mobile Telecommunication System (UMTS) – a total of 230 MHz – have not yet been released. A schedule for a phased release of UMTS frequency bands is currently being prepared. As a first priority, frequency blocks of a

minimum of 2x10 MHz in the frequency bands 1920-1980 MHz and 2110-2170 MHz should be available by mid-2003. Licenses for 3G operators are expected to be awarded by mid-2004.

In addition to mobile and fixed telephony, cable TV networks have significantly developed in the last ten years. As a result of the early liberalisation of this sector and the availability of TV sets in almost every household, cable TV is quite well developed.[1] It provides an inexpensive alternative to terrestrial broadcasting while offering more entertainment possibilities. According to a market survey conducted in October 2001, about 48% of households have access to cable TV. The availability of alternative networks has become an important opportunity to provide consumers with low cost information and communications services. First attempts to provide Internet access via cable modems have already been made. The service is still limited to Sofia and some other large cities but is becoming increasingly attractive to consumers. Approximately 3.3% of households were estimated to have Internet access via cable by the end of 2001.

In June 2001, the State Telecommunications Commission (currently the Commission for Regulation of Communications) awarded the first license to establish an experimental telecommunications network for digital terrestrial broadcasting and to provide telecommunications services over this network in the region of the capital Sofia. This event marked the first step towards introducing digital terrestrial television into the country.

Table1: Primary Telecommunications Indicators

	1999	**mid-2002**
Total lines per 100 inhabitants	34	39
Mobiles lines per 100 inhabitants	6.2	22.6
Level of network digitisation	19%	22%
PCs per 100 inhabitants	4.5	6.1
Share of PCs (%) in households		17%
TV sets per 100 inhabitants		45
Cable TV users per 100 inhabitants		18

Despite this progress, considerable investment and reform is still needed in ICTs to raise the country to EU standards. In particular, the privatisation of BTC and the opening of the telecoms market to competition (scheduled for early 2003) is expected to provide further impetus to the modernisation and expansion of the telecommunications infrastructure, more advanced technologies and the development of a wider variety of communications services.

[1] *Information and Communication Technologies*, Enlargement Futures Series 05, Institute for Prospective Technological Studies, Seville, March 2002

3.2. The Internet

The current communications infrastructure provides the technical means for the majority of the population to access the Internet and its information resources. Access is enhanced through competition among Internet Service Providers (ISPs). The number of ISPs fell in 2001 as a result of a series of mergers and consolidations. Currently, 12 large companies and approximately 100 small ISPs operate in the country. The major wholesalers include:

- BTC Net (subsidiary of the Bulgarian Telecommunications Company);
- Digital Systems (the Bulgarian TLD registry);
- Mobikom (the first mobile phone operator);
- Orbitel (a private company established in 1997 with portfolio investments from the European Bank for Reconstruction and Development);
- Spectrum Net (a private company acquired in 2000 by the Austrian EuroPro Net);
- ITD Networks (a private company currently owned by the Belgian Sky Vision, a subdivision of UU Net).

A broad range of services is available to consumers including pre-paid access and VoIP. Connectivity is still dominated by narrowband technology and most users access the Internet via dial-up connections. Dedicated access via leased lines is available to the private sector in most large cities and mid-sized towns. Public access is also essential in making the Internet available to a greater numbers of individuals and companies. Telecentres, Internet cafés and community information centres are important in allowing access to those who cannot afford personal access at home, in school, at the workplace or elsewhere. In many cases, public access points are supported by international organisations and NGOs. Two notable examples of this are.

- **The Public Computer and Communication Centre (PC3)** project sponsored by the U.S. Agency for International Development (USAID). This project supports local entrepreneurs by providing technical assistance, limited hardware, software and Internet connection. The project also provides training and on-going technical and business management support to selected PC3 telecentres in small, under-served Bulgarian towns. The PC3s train local users and provide free or subsidised access for specifically-targeted social groups, such as women, minorities and the unemployed, in an effort to address specific community needs and create a customer base for the telecentres.

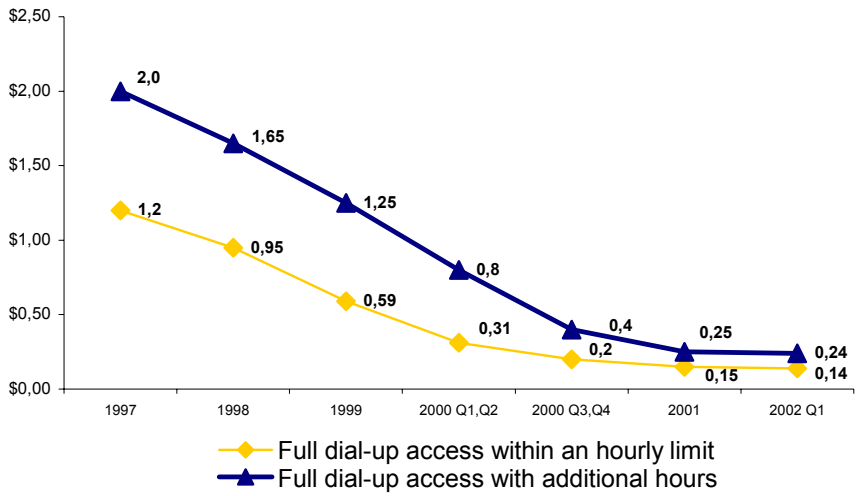
- The United Nations Development Programme (UNDP), USAID, and the Dutch Government, sponsor **the Chitalishta project**. The project is developed and supervised by the Ministry of Culture, which aims to promote the cultural and educational role of traditional Chitalishta community centres. Under an agreement between UNDP and Cisco Systems, ICT training and special qualification programmes will be implemented in a total of 25 Bulgarian "chitalishta" and in 3 regional centres nationwide.

Two specific developments have encouraged Internet growth in Bulgaria. The first was the introduction, by BTC, of nationwide Internet access through a universal dial-in system. This system uses a single access number reachable from around the country without long-distance telephone charges. The second development was the introduction of a national peering

system. By the end of 1998 most major Internet suppliers in Bulgaria combined efforts to construct a domestic network of cross-links. The primary purpose of this network was to capture all domestic traffic, thereby significantly reducing international traffic and lowering the average cost. It is estimated that approximately 30% of traffic in Bulgaria is domestic (i.e. a Bulgarian host accessing a Bulgarian server). Because of the cross-links, this domestic traffic is now about six to eight times cheaper than international traffic.

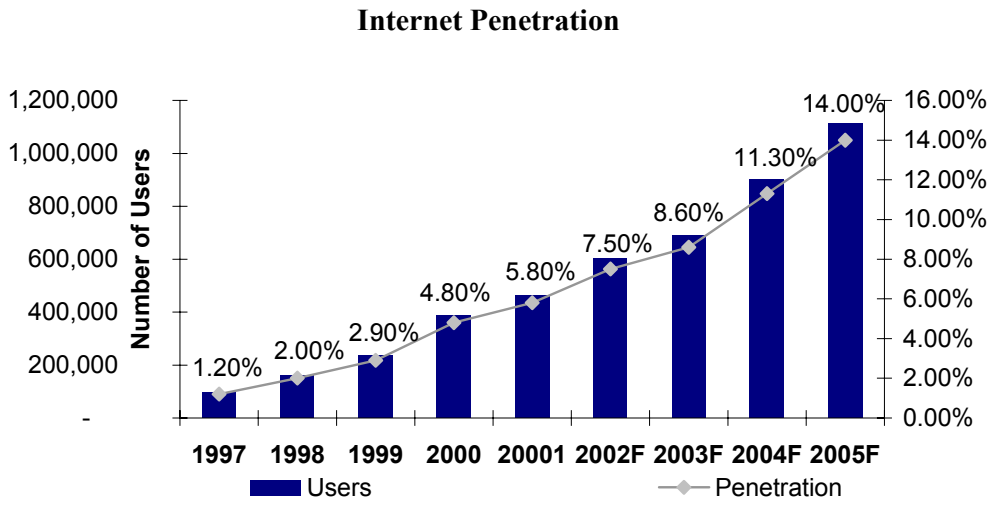
Affordability is another important factor for the growth of Internet connectivity. As a result of greater competition among ISPs and improved peering networks, the cost of access to the Internet has dropped three times in the last two years and 10 times over a period of five years (see chart below). Some problems still persist. According to ISPs, telecom charges still comprise a large percentage (approximately 70%) of Internet access costs, presenting a serious disincentive to wider network usage. The incumbent monopoly is considered to be one reason for the high cost of Internet access. It is expected that full liberalisation of the telecom market will bring significant changes in the provision of leased lines and access at local level, resulting in a reduction in charges.

Internet Access Affordability



3.3. Internet penetration and use

Internet use is now more frequent in Bulgaria as barriers to Internet access are addressed, and connection costs fall. Despite important growth in the last few years (see chart below), Bulgaria still lags behind EU member states and other developed countries in all measures of Internet access and usage.



A relatively small number of individuals currently have access to PCs and the Internet. As of October 2001, computer users were estimated to include 940,000 adult citizens, or 14.4% of the population aged 18+. The number of people using Internet resources as a percentage of the total population is also rather small with about 8.5% using the Internet at least once a week.

Computers and the Internet are typically used in the workplace and in public locations such as cybercafés, computer games clubs, and telecentres. Home Internet users and those accessing the Web from educational institutions represent a smaller relative share.

An area of growing concern is the uneven penetration rate of Internet use according to location, income levels and age. There are substantial regional disparities and a growing "digital divide" both in terms of access to ICT infrastructure and provision of Internet-related services. The overwhelming majority of Internet users are young, well educated and live in large cities. Half of those with access to a PC and the Internet are aged 18-30, and about one-quarter fall into the 30-40 age group. Internet use is highest among residents of larger cities. Access is limited in rural areas and small towns. According to the findings of a survey conducted in 2000[2], fewer than 3% of all Internet users in the country were residents of small towns.
The Internet is most commonly used as a source of specific information, an alternative source of international news, and a means for personal communications. Cost, availability, local economic conditions, and perceived security risks limit the use of the Internet for electronic banking, electronic commerce, or personal activity planning. Barely 3% of Internet users in Bulgaria are reported to shop online, while 10% make travel plans with the help of Internet resources.

3.4. Content and services

The domination of the English language on the World Wide Web poses a serious obstacle to the integration of various user groups. However, this situation also presents good opportunities for Bulgarian content providers to develop the local market.

[2] *Conditions, Trends and Problems for Development of Information Society Technology and Services in Bulgaria*, Vitosha Research, 2000

Online local content has grown in the past few years. According to data from the electronic edition of *The World of Internet* in May 2001, the number of indexed Bulgarian web pages within the .bg domain was 66,992, while the sub-domains within .bg numbered 1,556 (see Table 2 below).

Table 2: Bulgarian Internet presence

	Dec. 1998	Dec. 1999	Dec. 2000	Jun. 2001	March 2002
Keyword: Bulgaria					
Google	n.a.	n.a.	1,080,965	2,110,000	3,766,000
Alta Vista	382,600	284,875	498,835	671,744	5,104,693
AllTheWeb	n.a.	345,864	1,150,000	1,954,500	2,299,710
HotBot	219,650	n.a.	n.a.	n.a.	741,900
InfoSeek	205,021	70,736	116,022	n.a.	
Excite	56,792	76,084	n.a.	n.a.	
Yahoo	252	281	322	253	287+45

Source: Svetat na Internet, Bulgarian Internet Fixing, http://I-world.vega.bg/.

Although the number of domain names under the country's top-level domain (TLD) has grown by more than 50% in 2001, this figure is still relatively low. This is due to the high fee charged by the country's sole register (the annual subscription fee is about 2.5 times higher than for a .com domain name), the long registration procedure, and the lack of online registration and convenient transfer mechanisms. As of March 2002, approximately 1,900 domains were registered under the .bg TLD, which were used by roughly 700 organisations. About 2,500 domains were registered in .com, .net and .org, but a large number of organisations maintained two or more domains. In addition, approximately 800 company sites are believed to be hosted by local portal sites offering free hosting services, such as www.hit.bg, www.dir.bg, www.online.bg, www.bol.bg, www.search.bg and others.

Currently, Bulgarian Internet users are free to choose from a wide range of web resources, including nearly all national news institutions, as well as a number of local media offering reviews and analysis online. The increasing number of online users has triggered competition among various information portals. As a result, they are expanding their databases and adding new services, search options and links.

The first news portals appeared in Bulgaria in late 1996. These included: Bulgaria Online (www.online.bg), News.bg (www.news.bg), and Netinfo (www.netinfo.bg). These portals provided relevant news and information on a wide variety of topics of local and international interest from sources including 'conventional' media, radio, TV, and news agencies. This development was followed by an online presence of nearly all daily and weekly editions of national newspapers including *Sega, Monitor*, *Novinar*, *Standart*, and *Kapital*. Popular magazines, radio and TV stations, and national information agencies are also available online.

More recent developments have included the launch of genuine information portals – Novoto vreme (www.novotovreme.bg), Mediapool (www.mediapool.bg), an electronic news agency (www.bgnes.com), as well as specialised portals that provide economic, business and

financial news, such as Econ.bg (www.econ.bg) and Bulgarian Business Advisor (www.bba.bg).

Public administration bodies have also established a strong presence in the country's web space. Over 90% of central government agencies and public institutions have websites. In most cases however, the information they provide is static and not regularly updated. A few websites (e.g. www.taxadmin.government.bg) offer some degree of interactivity, primarily related to the downloading of forms. The enforcement of the new law on Electronic Document and Electronic Signatures is expected to create new possibilities for the processing of forms and online payments. At present, public administration websites are visited by a small number of people - about 4.3% of the population and about 6% of companies.

The majority of company websites also contain largely static information (limited to a company profile, contact information and listing of products), and are rarely updated. Websites that are fully interactive for online customer support, or those that offer products and services online, are an exception.

3.4.1. E-commerce

In the area of e-commerce, Bulgaria is still in the early stages. It is therefore difficult to determine market niches and their potential. Approximately 100 Internet-accessible virtual shops have been established. These e-retailers are usually small companies known only to tiny consumer segments. The most common categories of goods and services traded on the Internet include books (45%), prepaid Internet access cards (10%), flowers and souvenirs (10-12%), music (7-8%), and electronics and mobile phones (6-7%). Utility bills (electricity, central heating, etc.) can also be paid online. However, the number of online transactions is small, with consumers preferring cash payments on delivery. Opportunities for online business transactions are available through ePay.bg and its use is increasing at a stable rate. A second e-payment system, BGPay.bg, was launched in mid-2000. Another new service for online payments using prepaid cards, Net-Card, is rapidly gaining popularity - about 3,000 users have registered for this service in just three to four months.

To summarise, the supply of online content and services in Bulgaria is still inadequate, as is the general penetration of these technologies in everyday life. Despite some awareness of the Internet phenomenon among the public, there is still limited understanding of the real benefits associated with ICT, and even less direct experience of these technologies. Much work remains to be done in generating locally-relevant content, and helping people comprehend how to use the new technologies available to them.

3.4.2. E-government

There has been much debate on the concept of e-government over the last three years. The government has been working for two years to create a backbone network for internal communication between ministries, regional government, and municipalities. The network uses: an intranet/VPN solution, open to the public with its own security system; optic-fibre channels for high speed (T-1; T-3; OC-3); systems that support national registries with public access and support of internal document management system; and a two-way Internet

connection of at least 2 MB. This project is expected to be launched nationwide in 2002. It is already in operation in Sofia and some larger towns.

Recently, the IDC and the Council of Ministers conducted a survey among central government ministries (with the exception of the Ministry of Interior, Ministry of Defence and Ministry of Finance) on IT equipment and human resources. According to this survey, approximately 80% of workplaces in central government administration and 20% of workplaces in local government administration, are equipped with computers. Regional government has the most up-to-date equipment with 90-100% of workplaces computerised. Problems related to use of computers in public administration can be summarised as follows:

- equipment is often outdated equipment - many departments still have 16 bit PC 386, 486;
- cutting-edge technology is primarily bought through loan schemes or public procurement. Due to the high cost of this equipment it is often impossible to buy appropriate software and consumables for effective use;
- there is low inter-action between databases and specialised software.

Not all computers are networked. More than one third of respondents said that the Intranet does not cover all units or branches of a given ministry in the country.

The predominant networks in the government system are Ethernet (44% of respondents) and Fast Ethernet (39% of respondents). Only 11% responded that they had FDDI and 6% said Gigabit. Connectivity to the Internet varies from 80-100% in regional administrations, from 70 to 80% in ministries, to less than 20% in local government administration.

Web presence in public administration has developed positively over the last few years. In 1997 there were only two sites, increasing to more than 120 in 2001. More than 90% of state institutions have Internet sites. These sites still have primarily static information and are not updated regularly. Where applicable, downloading of forms is possible. It is expected that in 2002 recently-published secondary e-commerce legislation necessary for the implementation of the Law on Electronic Document and Electronic Signatures will ensure that more government sites become interactive and allow for e-payment and the electronic submission of documents.

Table 3 - Government sites

Total Ministry sites	Providing dynamic information	Allowing feedback	e-payments, B2G	Good design
15	8	15	0	12

Source: Expert assessment by Bazar.bg

Fifteen government ministry sites provide feedback possibilities through e-mail or web form. The same option is provided by three to five regional administrations (15%) and around 15 to 25 of municipalities (7 to 8% of all). The municipality of Sofia is an exception at municipal level as it provides tracking services for citizens' requests.

Public administration web pages are visited by 6.3% of the population. Government Internet sites are more often visited by the private sector due to their interest in public procurement - around 16% of companies use the public-procurement registry, Bulstat, tax administration sites or other company-related online services.

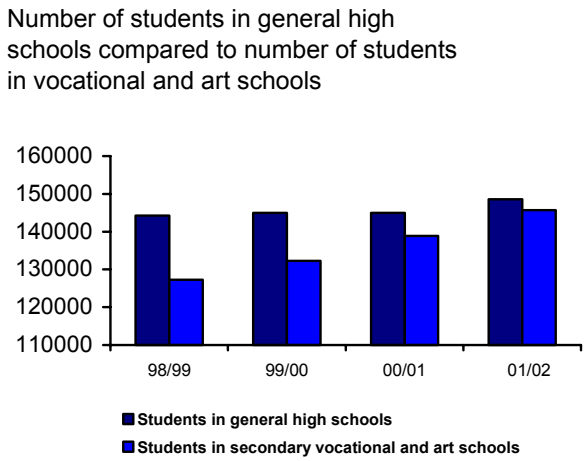
An overall assessment of e-government in Bulgaria places it mid-stage in its development. If good coordination and project management is applied, and adequate training of civil servants is provided, it will be possible to achieve at least 90% of the ambitious programme on e-government.

4. Human resources and innovation

4.1. Education

The availability of highly-qualified personnel is a fundamental necessity for the development of a knowledge-based economy. Bulgaria has a strong educational tradition in the area of high- tech at different scholastic levels.

4.1.1. Professional education



The country has established a system of secondary vocational and specialised schools that offer training in the area of computer and technical sciences. In the 2000/2001 school year, the number of specialised and vocational secondary schools was 348 with a total of 135,500[3] students. The number of students in these schools had increased by 11.2% compared to the 1996/1997 school year, primarily as a result of the number of general schools that were transformed into specialised secondary technical schools. The largest proportion (38.4%) of students in these schools majored in engineering or technologies. In addition, there were 132 secondary schools that provided professional technical training with a total of 53,000 students.

The Ministry of Education reported the availability of 12,199 PCs in Bulgarian schools in 2001. The percentage of computers capable of supporting basic Internet connections (CPU 386 or higher) is 66%. There are a total of 1,311 computer labs (in 2000/2001) with 336 schools connected to the Internet and approximately 120 with their own websites. All schools are provided with licensed software - both systems software and the most popular application in office software - through a contract worth USD 1,036,000 between the Ministry of Education and Microsoft dated July 1999.

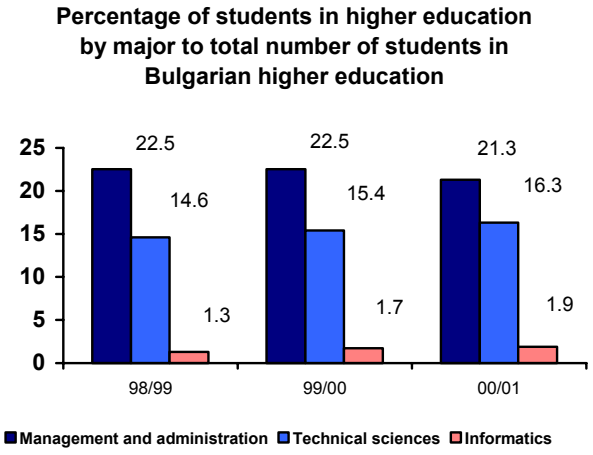
There are two primary channels to bring ICT into Bulgarian classrooms. The first is the centralised line of government support through the Ministry of Education and Science. The second channel is associated with the efforts of individual schools. According to experts from the international network (which provides funding for more than 80 schools) there are grounds for moderate optimism in the second line of development. Individual schools and local communities have become increasingly active in recent years in seeking sources of

[3] The number of students in art schools is not included

funding to equip computer labs. Research shows various forms of fund-raising – from company sponsorship to collection of "voluntary fees" from parents. Some schools have managed to raise considerable funds and secure a certain level of ICT access for students. There is significant support from the donor community with the European Commission's PHARE programme providing funding for the digitalisation of dozens of professional secondary schools and 13 regional centres for drop-out students. The Open Society Fund has also provided equipment for 12 schools and Internet access for dozens more. French language schools have received assistance from the V-FAX programmeme.

An interesting and important phenomenon for Bulgaria is the existence of Internet and computer games clubs. These establishments have enabled access to Internet services on a mass scale. As a result, students in even the smallest towns have the opportunity to use ICTs at affordable prices, despite the delayed computerisation of schools.

4.1.2. Universities



There are 41 universities in Bulgaria located in 26 cities and towns. Universities have placed a high priority on the development of ICTs. The number of students for the 2000/2001 academic year in baccalaureate, master's and doctorate courses is 44,646. The highest percentage (about 16%) majored in engineering and technologies and 2% in informatics. There is positive growth in the number of baccalaureate, master's and doctorate course students in these two majors.

Universities have managed the change from traditional majors applicable to large-scale industries towards modern majors applicable to the private sector. They have also substantially orientated themselves externally by adopting international standards. Potential for practical training is limited however as laboratories and equipment are outdated and the number of research places provided is inadequate. This leads to students having inadequate training and being ill-prepared for professional work.

The lack of modern equipment in university labs is compensated, to some extent, by the networks of training centres and certified consultants which have been created by leading ICT companies. Good examples of this are five Microsoft and 38 Cisco academies, most of

which are affiliated to academic institutions. In addition, several Bulgarian private companies[4] in the ICT sector deliver courses through their training centres, which successfully complement traditional education. The scope of this training extends beyond the purely academic community and addresses many specific sectors. Several hundred students have already taken part in courses offered by the academies and training centres of private ICT companies.

The direct participation of teams of university lecturers in international projects has had a proven positive impact. The more active academic institutions in this field include the University of Sofia, the Technical University and the American University in Blagoevgrad. In addition, the faculty of informatics and mathematics in Sofia University has created specialised companies and centres in order to undertake specific projects. One such company is VirTech Ltd. The NGO Centre on Information and Communication Technologies is particularly active in relation to the elaboration of master's programmes in the fields of e-learning and distance learning on modern information and management technologies. It is expected that companies such as VirTech will establish an entrepreneur culture in IT education. With appropriate state support for higher education institutes and support from the private sector, IT education will be able to develop successfully.

Most Bulgarian universities and colleges have a paucity of computer resources, although the necessary investment in hardware and connectivity is becoming more common. An accurate assessment of the current state of ICT infrastructure in universities is seriously impeded by the lack of reliable and up-to-date information on the availability of personal computers and Internet connection. There are many reasons for this, including the fact that the academic autonomy of schools and different management schemes make the collection of such data a very difficult task. At present, there is no government agency that collects comprehensive information on these schools. In some cases, university management is not even aware of the considerable technological resources that some of their departments have managed to secure independently. In addition, rivalries often exist between universities, and some of their more "popular" departments, for projects and hardware equipment.

Under such circumstances the number of PCs in Bulgarian universities can only be estimated on the basis of expert assessments. The approximate number is believed to be around 20,000 in a total of 48 higher education facilities, with about 50% of these being "modern" PCs. Penetration is uneven. For example, the American University in Bulgaria (AUBG) reports around 550 PCs for 700 students (almost 1:1 ratio), while other universities have one computer for over 100 students. With the exception of the AUBG, no university in the country currently offers free access to computer labs and Internet connections to its students.

Practically all universities have registered Internet sites and all are connected to the Internet. Some universities, mostly technical and engineering, have good access and fairly advanced ICT facilities. Humanitarian faculties generally lag behind the technical, mathematical, economic and management faculties in this area.

There is no doubt that one of Bulgaria's most important assets is its highly-qualified population. Bulgarian ICT experts are known throughout the world and are often sought after for their professional knowledge and willingness to work hard for low wages. Some international sources acknowledge the following:

[4] i.e. Rila Solutions, ITCE, Bora Systems, Technologica and others

- Bulgaria's secondary education is among the best in the world, ranking fifth in the world in science and 11th in mathematics (World Bank and The Economist ranking);
- Bulgarians rank second in international IQ tests (MENSA International);
- Bulgarians are among the worlds' top university students (2nd in the world in SAT scores);
- *The Global IT IQ Report* of March 2002 from Brainbench Inc. ranks Bulgaria (with 8,844 certified professionals) eighth among the top 10 countries regarding its number of certified IT professionals. According to the same report Bulgaria ranks third in Europe with over 6,800 certifications;
- *The UN 2001 Global Human Development Report* has introduced a Technology Achievement Index (TAI) based on eight indicators in four dimensions: technology creation, diffusion of recent innovations, diffusion of old innovations, and human skills. This index shows how well a country is creating and diffusing technology and building a human skills base, therefore reflecting a given society's ability to participate in the network age. The TAI ranking is led by Finland, followed by the United States and Sweden. On this index Bulgaria ranks 28th, ahead of economies such as Poland and Malaysia, and is also considered to be among the potential leaders in the field of ICT.

Major problems in the field of education, which have implications on a knowledge-based economy, are:

- poor integration of IT education into general school subjects and its lack of influence on contemporary methods of education;
- poor IT qualifications of teachers and the lack of motivation of school and university teachers to educate themselves and use IT in the education process;
- lack of funding for the development of the education system. The state budget for 2001 allocated 3.88% for secondary and university education and science. This figure grew in comparison with the year 2000 (3.22%), but is still considerably lower than the minimum allocation of 6% of GNP stipulated by the EU;
- approximately 86% of funds allocated for education is spent on salaries. In more developed countries, salaries constitute about half of all funds allotted to education;
- there is a lack of initiative on behalf of employers to invest in training and improvement of their employees' competence and skills;
- the professional qualification system is incomplete and does not relate to the academic professions;
- scientific and research teams outside of universities and colleges are poorly-integrated in the teaching process of the baccalaureate and masters courses in various branches.

Qualified employees are more mobile. This is perhaps the most liberal labour market where visa barriers are symbolic as a result of the elevated demand for highly-qualified specialists. Globalisation of the labour market in a knowledge-based economy is accompanied by a large number of job offers related to the Internet. Employees in the sector are largely young people with a good level of education and language skills. These characteristics determine the high level of emigration of specialists - is a major threat for Bulgaria. In the first six months of 2000, the number of Bulgarians (the majority of whom were highly qualified in the field of IT) who emigrated with work visas to the USA was 2,200. Another 606 emigrated to the United Kingdom and 363 to Germany. The only way for Bulgaria to retain and develop its human resources potential is by creating high-paid employment in the software industry.

The lack of qualified university professors is another serious problem facing higher education in Bulgaria. After 1990, the motivation for students and professors to stay in the education system declined significantly. According to various "brain-drain" studies, about 70% of young professors in the field of modern technologies have left the universities. The "brain-drain" works in two directions: internal migration towards the private sector and emigration to universities and private companies abroad. Enrollment in post-graduate programmes, particularly in the field of ICT, has also declined and the situation is not likely to improve in the near future.

Signs of a turnaround in the "brain-drain" situation were noticed for the first time at the end of the 1990s when many software developers returned home. Some university departments are trying to recruit these specialists by offering them attractive teaching benefits.

The emigration of highly-skilled professionals has resulted in Bulgaria being ranked last among the 59 countries participating in the World Economic Forum in Davos. The fact that it is increasingly difficult for the education system to make up for this migration is cause for concern. The lack of technical facilities and of expertise among teachers precludes students from using modern ICT. This in turn restricts the high-tech skills that can be acquired in Bulgarian universities as well as limiting participation in joint research and development (R&D) projects with the private sector. On the one hand, research institutes and organisations are left with dwindling numbers of professionals with failing expertise to pass on their knowledge and experience to college graduates and, on the other hand, graduates are to a great extent unprepared for practical work in the technological field. It is the combination of "brain drain", weak practical skills in young professionals, and the lack of close cooperation between universities, research institutes and businesses that will become the strongest threat to technological development in Bulgaria.

4.2. Innovations

The development of a knowledge-based economy is characterised by a country's potential to generate innovations and utilise new technologies. This potential depends greatly on the level of research and development expenditure that is usually generated by intensive cooperation between universities and industry.

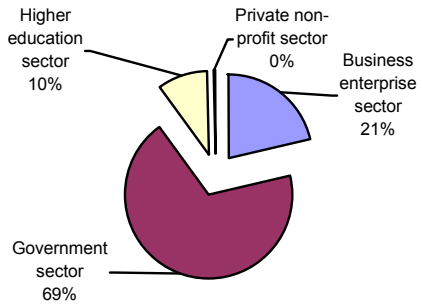
Like all other CEE countries, Bulgaria is experiencing dramatic changes in all areas of its society and is seeking to promote SMEs as the primary generator of economic growth. Unfortunately, there is still a lack of modern economic and innovative practice in Bulgarian companies, which is coupled with a lack of public support and understanding of the political and economic changes. In addition, the urgent need to turn around existing companies and at the same time create favourable conditions for emerging private enterprises, requires better knowledge of ICT, economics, business, and company management.

4.2.1. Research and development (R&D)

R&D expenditure is a common indicator of activity in the field of science and technology in the national economy. Bulgarian R&D expenditure has decreased in the past ten years. It is difficult to make a precise estimate of the real reduction of R&D expenditure, not only because of the effects of inflation but also as a result of the drastic organisational changes in science. Comparison of the volume indices at 1995 prices shows that between 1993 and 1996 R&D expenditure decreased annually from 29% to 24%. In 1997, the negative trend had dropped to 7.7% compared with the previous year, while in 1998 a growth of 17.9% was

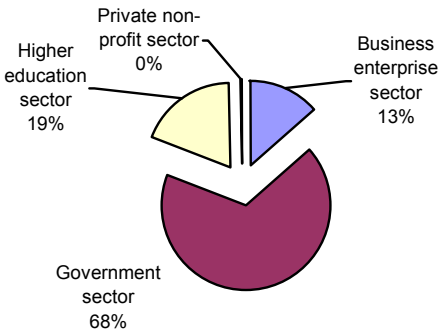
recorded. The downward trend in R&D expenditure is typical for all candidate countries for EU membership during the transition period to a market economy. Total R&D expenditure for the EU has steadily increased over the past ten years.

SHARE OF GROSS DOMESTIC EXPENDITURE ON R&D (GERD) BY SECTOR, 2000



In 2000, R&D expenditure in Bulgaria was 139 million Leva - about 70 million €, or 0.52% of GDP. The distribution of R&D expenditure by performance sector in that year shows that the largest percentage of research and technology activity in Bulgaria (68.6%) was carried out in scientific organisations and research institutes within the government sector. In the same year, 21.4% of total R&D expenditure was reported by the private sector from companies producing market goods and services, including those manufacturing technological products. This percentage is 1.5% higher than in 1997. The higher education sector reported 9.9% in total R&D expenditure and private, non-profit organisations reported 0.2%.

PERCENTAGE OF PERSONNEL ENGAGED IN R&D ACTIVITIES BY SECTOR, 2000



The distribution of R&D personnel by performance sector reflects the structure of R&D expenditure. The largest employer in 2000 was the government sector with 11,353 employed, or 67.4% of all persons engaged in R&D. The number of R&D personnel in the private sector

is considerably smaller, i.e. 2,273 or 13.5%. This can be compared to the EU average of 45%. The percentage of R&D personnel in the higher education sector is 18.8% compared with 35% on average for the EU. The disproportion between R&D in the government sector compared to the private sector has become larger in the past three years.

The low percentage of private sector involvement in R&D in Bulgaria, compared with other EU countries, results partly from a lack of innovative activity within enterprises as well as from difficulties in recording R&D expenditures since some private companies do not differentiate their R&D activities from other business activities.

4.2.2. Science

There has been a steady decrease in the number of employees in the fields of technical and natural sciences. The early 1990's saw the most dramatic decline, generated by the closing of industrial science and research organisations. A number of prominent technical science representatives (including those holding authorship certificates) were forced to change their profession or leave the country. According to research by the Bulgarian Academy of Sciences (BAS), most engineering and technical science professionals who left BAS institutes went to the private sector, whereas only a small percentage went to educational establishments or private research organisations. There was also a continuous decline in the number of technical and natural science professionals during the second half of the decade. In 1996, there were 7,421 employees in the field of technical sciences, in 1997 the number was 7,225, in 1998 it was 6,813, and by 1999 the number had dropped to 6,001. The number of employees in natural sciences exhibits much the same tendency: 5,101 in 1996, 5,054 in 1997, 5,069 in 1998 and 4,868 in 1999.

4.2.3. Cooperation between Universities and SMEs

In the former planned economy, science was part of a hierarchical and centralised innovation system. Institutions for higher education were permitted to pursue research activities only on a limited basis, and basic and applied research was carried out by the BAS and specialised branch institutes. Branch institutes were, at that time, in charge of industrial and technical research.

Reforms to develop university research have been implemented. In the last ten years, many leading Bulgarian institutes were unable to adapt to the market environment and their activity as centres for national research and development gradually came to a halt. Some have managed to transform their activities to structures similar to high-tech business incubators. Examples of this are the companies Znika, Bic "IZOT", the Micro-electronic Institute and "Elprom IEP". These establishments have existed for the past seven to eight years. All four of the above-mentioned institutes were former leading R&D centres that experienced serious problems after transition to a market economy. They were forced to share their premises and labs with emerging or already established SMEs. The experience of these institutes in marketing themselves has shown that networking, cooperation and clustering are essential to gain market access for Bulgarian hi-tech SMEs.

Services in national institutes for R&D underwent the following substantial changes in the past decade:

- state orders to these institutes have decreased to a critical minimum as a result of financial restrictions under the conditions for the creation of a stable currency board and decentralisation of the branch structure of the economy;
- the largest former branch scientific institutes, which are characterised by higher fixed costs, clumsy management and outdated equipment, cannot effectively fill specialised orders from the private sector, nor can they compete effectively with established foreign consulting companies;
- most current contracts for R&D come through international sponsors who prefer to work with western consultants. In most cases, Bulgarian institutes are involved only as sub-contractors;
- a new generation of small companies and scientific organisations, created by leading specialists in the respective field, is emerging. Their founders are generally recognised experts with long-term experience in their respective field and who have separated themselves from the larger scientific and designers' institutes. These new units are characterised by flexible management, innovative thinking and entrepreneurial spirit, but are still in their initial phase of growth.

Educational institutes suffer from a lack of financial resources for research work. One solution to this problem is to stimulate cooperation between the private sector and education. Two EU financed "Phare" projects are active in this area.

The first of these projects aims to establish high-tech business incubators and has a budget of €10.45 million. The primary goal of the project is to increase the number of technology-based SMEs in the Bulgarian economy. The project will strengthen these enterprises by providing infrastructure and support services for the start-up and growth of innovative SMEs.

In Bulgaria, the use of existing buildings as business incubators could also solve the premises problems of some entrepreneurs and small businesses. Such an initiative is supported because it:

- allows tenants to reduce their production and operating costs by providing access to common services and equipment (secretaries, accounting facilities, meeting rooms);
- has a reinforcing cluster effect as a result of the presence of a number of similarly motivated professionals;
- provides technology transfer services;
- can facilitate the delivery of business advice, information and counseling;
- promotes cooperation between tenants themselves, and between tenants and other non-tenant firms, for example in joint applied research or marketing.

This project will offer start-ups and existing SMEs the opportunity to base their businesses in suitable premises by providing support for the creation of up to six high-tech business incubators. Clients will be innovative ICT start-ups and small companies commercialising research results from Bulgarian academic research centres and European R&D programmes.

The second project, with a total budget of €9.1 million, provides SME services and a technology grant scheme. The overall objective is the improvement of SME performance through well-targeted management input and technological support. It also aims to improve the capacity of Bulgarian SMEs to cope with the pressures of competition through the promotion of innovation and technological modernisation, entrepreneurship and business culture. The project has two elements: technical assistance; and grants for upgrading

production technology. Since finance is identified as a major bottleneck, the project proposes to operate a grant scheme for production technology upgrading.

A knowledge-based economy and ICT are constantly the focus of society in Bulgaria. Round tables and seminars are organised where these issues are discussed. Often these events are organised by NGOs with representatives of the private sector, education and the state administration also contributing to them. Topics of discussion include problems that could be solved with state support. This type of communication however corresponds more to "fire-fighting", than to strategic dialogue for the development of a knowledge-based economy.

5. Major national initiatives

The Government has identified the development of communications and high-technology as a pillar of sustainable economic growth. Government policy in this area is built on the following premises:

- enhanced competitiveness and innovation will result from: the wide implementation of cutting-edge technologies, particularly in the areas of IT and telecommunications; ensuring high standards of education; modernising the economy; and, constructing a modern infrastructure;
- ICT investment is viewed as a stimulating factor for investment in other fields;
- ICT is becoming a major engine for economic growth.

The Government has set the following strategic objectives:

- to promote investments in the ICT sector and develop R&D networks;
- to create a competitive, export-oriented software industry;
- to capitalise on Bulgaria's strong educational traditions;
- to encourage SMEs in the ICT sector;
- to encourage young graduates to start their own businesses in Bulgaria.

Conclusion

As a result of the analysis conducted, it could be concluded that Bulgaria's strengths and weaknesses in moving towards a knowledge-based economy are as follows:

Strengths

- Bulgaria has a long history in the ICT sector. Until 1990, under the Council for Mutual Economic Assistance (CMEA), it was the only country in Eastern Europe that specialised in high-tech industry. Three generations of Bulgarian professionals gained recognition in western countries in the fields of fifth generation mainframes, high-speed matrix processors and parallel systems. In existing research and development institutes, a number of groups were organised to work in software development, firmware, systems hardware, and digital and analogue PC design. In the past, Bulgaria was called the Silicon Valley of Eastern Europe because of its strategic specialisation in high-tech and ICT products.

- Bulgaria has a large pool of highly qualified and experienced IT professionals with expertise in practically all areas of ICT. A global IT IQ report published by Brainbench Inc. in March 2002 ranked Bulgaria third in Europe and eighth worldwide based on the absolute number of certified IT professionals.

- Positive growth in the economy has created a favourable environment for the growth of the ICT sector. Accelerated growth in this sector has already had a positive impact on economic reforms undertaken over the last four to five years. The private sector is getting stronger. The ICT sector currently involves over 1000 SMEs, 98% of them privately owned. They cover a wide spectrum of IT development activities and services, including: software (computer system software, networking software and web-design, CAD/CAM/CAE software, telecommunications and wireless development software, application software, firmware); hardware (computer and systems assembling, digital and analogue printed circuits design, PCB manufacture, analogue mixed engineering); microelectronics (design ASIC's, front-end and back-end micro-electronic activities); and automation (systems for industrial automation). These companies are involved in developing design work, maintenance and testing, as well as fully-integrated systems and solutions. Customers of Bulgarian ICT companies include foreign government agencies (e.g. Canadian Department of Transport, Department of Environment and others), as well as global blue chip firms such as BMW, Boeing, Ford, Lockheed Martin, Nortel, Hasbro, Siemens, Pricewaterhouse Coopers, Xerox, and Telesis Technologies.

- There are several IT associations representing the major ICT players, such as the Bulgarian Association for Information Technologies (BAIT), the Bulgarian Association of Software Companies (BASSCOM), and the Bulgarian Internet Association (BAI).

- The Government generally understands the importance of ICT for economic growth. A national strategy for the development of an information society has been developed, although it is not detailed and lacks priorities. A number of government agencies have been created (in the period January-April 2002) to address ICT problems. Several important projects with Government involvement have been launched, such as the

UNICOM-B project designed to provide PCs and Internet access for all schools and universities, as well as the DISNY project on e-government. At the same time, the government is the major consumer in the ICT industry.

- The regulatory framework for ICT is good and significant parts of the relevant legislation have been harmonized with that of the EU. Internet service provision is liberalised and competitive. A recently drafted law on high-tech parks might have a significant impact on the future development of this sector.

- The Government understands the importance of its support for ICT in education. A number of universities have successfully cooperated with the private sector on specialised education and professional ICT training.

Weaknesses

- There is a need to strengthen the cooperation between the government and private sector associations as well as the internal coordination in the government and strategic coordination within the donor community.

- Although the Government is generally aware of the importance of ICT, this is not reflected at all levels of its work. Conservative attitudes are a serious obstacle to its application. The institutional structure has not until now provided adequate horizontal links between the agencies of state administration. There are insufficient resources for follow-up on the implementation of projects. Available IT resources are not efficiently used due to lack of training and skills of civil servants, obsolete equipment and problems with network access.

- University education and research is not up to the level of state-of-the-art technology. Private sector companies do not train their employees according to their needs and there is low interest from business in cooperating with universities. There is a lack of project and business management skills, marketing, entrepreneurship and knowledge of industry practices. Telecommunications infrastructure at universities, training facilities and the use of ICT in disciplines other than computing are under-developed.

- A general problem is the existence of regional disparities in the access to ICT. The government does not yet demonstrate a comprehensive vision concerning ICT as a tool of economic development. Meanwhile, few activities in the state budget aim to reduce the digital divide.

The ICT sector is a dynamic one, changing at a rapid pace. Combined with this evolution is the ubiquity of information technology across the sectors. Because information technology is a tool, defining its role in sector projects can be accomplished only after priorities for that sector have been agreed, and the means to achieve them have been set.

To select the priorities of the sector projects, the Government has developed a new approach, which is summed-up in the following table:

Table 4 -New approach

	Current approach	**New approach**
Mission	Expand and modernise telecommunication.	Extend access to a wider range of ICTs and related applications.
Sector policy	Telecommunication reform: competition, privatization, and regulation.	Facilitate convergence. Develop e-commerce/e-governance. Use posts. Build institutional capacity.
Infrastructure	Fixed and mobile voice and data networks.	Hard and soft information infrastructure, including Internet and Broadband networks. Regional solutions.
Applications	Strategic information systems.	Sector based applications. E-government/e-procurement. E-commerce. City-to-city knowledge networks.

Annex I - Benchmarking

TABLE	CATEGORY	STAGE
1	Information infrastructure	3
	Internet availability	2
	Internet affordability	3
2	Network speed and quality	3
	Hardware and software	3
	Service and support	4
3	Schools´ access to ICTs	2,5
	Enhancing education with ICTs	2
	Developing the ICT workforce	3
4	People and organisations online	3
	Locally relevant content	3
	ICTs in everyday life	3
	ICTs in the workplace	3
5	ICT employment opportunities	3
	B2C electronic commerce	3
	B2B electronic commerce	3
	e-government	3
6	Telecommunications regulation	3
	ICT trade policy	4

Annex II - Knowledge-Based Economy Indicators

1. Network Access

1.1. Information infrastructure

- Telephone penetration (number of mainlines per 100 people):
  39 per 100 people
- Mobile wireless penetration (%), growth trend:
  Mobile penetration is approximately 20% of the population. Growth trend is about 50% per annum.
- Total number of mobile telephone subscribers:
  Approximately 1,800,000.
- Total number of mobile telephone subscribers per 1000 people
  Approximately 226 per 1000 people
- Wireless penetration (percentage of the population)
  Approximately 23%.
- Growth trend
  N/A
- Total number of cable TV subscribers:
  Approximately 1,419,148 households.
- Cable TV subscribers, % of households:
  48% of households.

1.2. Internet availability

- Total number of ISP providers:
  Over 100.
- Prevailing types of ISPs' networks (microwaves/radio…):
  Dial-up.
- Percentage of unsuccessful local calls:
  Less than 10%.
- Is there competition among ISP providers?
  Yes, the market is fully liberalised.
- What are opportunities for public Internet access (libraries, Internet-cafés, etc.)?
  Public access points are widely available, mainly in the form of Internet-cafés, computer clubs, and telecentres. Public libraries are not well equipped and usually do not offer Internet access or services. Some "chitalishta" (traditional community centre) operate as Internet centres.
- Are there dedicated line lease possibilities? Are there competing providers?
  Dedicated line services are available. Competitive providers are not present due to existing monopoly of BTC.

1.3. Internet affordability

- What are the prices of Internet access (unlimited access, per minute charge)?
  Unlimited access – approximately 15USD per month. Access per hour – 0.40 USD.
- Is it affordable for the majority (compared with average salary/income)?
  Access is generally affordable, but investment in hardware (PC, modem, etc.) is still expensive for the majority of households.
- What are the rates for leasing lines?
  400 USD / 64Kbps (100% international CIR, telecom charges included).
- Are the rates affordable for small businesses or individuals?
  In general, rates are not affordable for these groups.

1.4. Network speed and quality

- What is the percentage of successful calls?
  Over 90%.
- What is the quality of voice connection?
  Satisfactory.
- How many faults are reported per year for each 100 telephone mainlines?
  Less than one per year for each 100 telephone mainlines.
- How long does it take to clear faults (48 hours, a week, month)?
  Less than 24 hours.
- Which services are supported by local telecommunications infrastructure: e-mail, high-speed modem connection, what is the maximum speed?
  E-mail 56K.
- Are there sufficient backbone facilities/networks? Even for peak demand?
  Sufficient for international connections. Local backbone facilities / networks are still insufficient.
- What is the percentage of packet loss by the network?
  Less than 1% under normal conditions.

1.5. Hardware and Software

- Are there local IT hardware/software sales points?
  Yes, retail outlets are widely available.
- Is the price of IT hardware/software affordable for majority/minority of citizens/businesses?
  Affordable to a significant part of businesses, but only a minority of the population.
- Is there software available in local languages?
  A local version of Microsoft Office is available. Some software is developed domestically, but this is not widespread.
- Is software imported or adapted locally? (Percentage of the imported, adapted, produced locally hardware or software in total number in circulation)
  Over 80% of software is imported and over 95% of hardware.
- Is there a broad variety/some/very few software business applications?
  Some business applications are present, but they are mostly imported.

- Are the IT software/hardware retail and wholesale markets competitive and vibrant?
  Yes, they can be considered competitive.

1.6. Service and support

- How long is the waiting period for telephone line instalment? (Total number of those on the waiting list; waiting period: days, weeks, months, years)
  Maximum of 80 days.
- How long is the waiting period to repair reported telephone line problems? (Minutes, hours, days, etc.)
  Less than 24 hours.
- Are there software developers, web designers, network administrators and other technical personnel, and how many (working where, employed/unemployed)?
  Yes. Most software companies work on outsourced projects for large international companies. A Global IT IQ Report by Brainbench Inc. (March 2002) reported a total of 8,844 certified IT professionals in Bulgaria..

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)?
  Primary level: no current data available. The latest data, from 1998, shows one PC per 270 pupils.
  Secondary level: the total number of secondary schools in the country is 1,023, with 1,312 computer rooms, 336 schools connected to the Internet and a total of 12,199 PCs.
  Tertiary level: approximately 20,000 PCs in a total of 48 higher education facilities, or 10 PCs for more than 100 students.
- Who has access to computers (technical staff/faculty/students)?
  Mostly technical staff. Computer labs are used primarily in It-related training. Teachers and students have limited access to computer facilities.
- What is the quality of hardware (386/486/Pentium…)?
  Hardware is generally PC 386 or higher.
- Are there LANs in schools? Regional WANs? National school networks?
  Some schools are networked. No regional WANs are available A national academic and research network has been in existence since 1997 but has limited capacity and covers only universities and schools of higher education.
- Do schools have connection to the Internet? Is it dial-up or through a leased line, wireless?
  Some schools have Internet connection, mainly through dial-up access.

2.2. Enhancing education with ICTs

- What is the percentage of students and teachers who use computers? (Universities/primary schools/secondary schools)
  N/A
- What are the computers used for? What is the level of computer literacy/skills?
  Primarily used in technical disciplines – computer science, informatics, and other sciences.
- What is the level of information and communication technologies integration in the curriculum?
  Mid-stage.

2.3. Developing the ICT workforce

- Are there training opportunities for programming, maintenance, and support?
  Yes.
- Who is offering them (public/private centers)?
  Courses are offered through the educational system and by private centres (e.g. Microsoft Academies, Cisco Networking Academies, etc.).
- Are they affordable for majority/minority of the population?
  N/A
- Is on-line training available?
  In a limited capacity.
- Do employers offer training?
  N/A

3. Networked Society

3.1. People and organizations online

- What percentage of the population:
  - is aware of the existence of the Internet?
    N/A.
  - has used the Internet recently?
    The number of Internet users has tripled since early 2000, reaching 14.2% of the population aged 18+ in April 2002.
  - uses the Internet regularly?
    Approximately 8.5% of the population uses the Internet at least once a week.
- What is the structure of users by gender, age, social and educational status?
  Most Internet users are young, well-educated and live in large cities. Fewer than 3% of Internet users are residents of small towns; access is limited in rural areas.
- What is the number of locally registered domain names (per 1000 people)?
  As of March 2002, the number of hosts in the .bg TLD was 1,860. In addition, there were an estimated 2,500 Bulgarian sites under the .com, .net and .org domains and approximately 800 companies (according to expert estimates) used free hosting services offered by Bulgarian portal sites.
- Is there advertising for online companies, and how common is it?
  Yes, there is advertising for online companies in the press, special editions and electronic media, but it is rare.

3.2. Locally relevant content

- Are there (and how many: no, few, some, many) websites:
  - Providing local topics?
    Many local websites exist – online directories; web portals; news websites, etc. The most popular sites include www.hit.bg, www.dir.bg, www.online.bg, www.bol.bg, www.search.bg.
  - In local languages?
    Approximately 90% of websites are offered in Bulgarian. Most Internet users – over 50% - prefer websites in Bulgarian.
- How often are they updated and is content static or dynamic?
  Frequently updated.
- Are the above websites created in the community?
  Yes.
- Are bulletin board systems, Usenet groups, newsletters, and/or listservs in use?
  Not very popular.

- Are there opportunities for web-related training?
  Very limited – experimental projects.

3.3. ICTs in everyday life

- Does the population include information and communication technologies (phones, faxes, pagers, computers) in everyday life?

Phones are widely used in everyday life. Computer use is still limited – 14.4% of the population aged 18+ has access to computers.

- 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.)
  E-banking and online shopping is practically non-existent. Barely 3% of all Internet users shop online, with about 10% planning their vacation through the Internet.
- Are there PCs with e-mail capability available (cyber cafés, telecenters) and are they being widely used?
  Yes, many and they are widely used.

3.4. ICTs in the workplace

- Do employees have:
  - (Un)limited access to phones?
    Yes, unlimited access in most cases
  - Personal e-mail accounts?
    Yes
  - Internet access from personal workstations?
    Yes
  - E-mail and web addresses on business cards?
    Becoming more popular.
- What percentage of businesses and government offices have computers, how many of them, how many employees use them?
  Approximately 30% of active companies in Bulgaria use computers in their daily work. About 20% of employees use computers. Computers are not evenly distributed and are not effectively used. 7.3% of workplaces have PCs installed. Around 80% of workplaces in central government and 20% of workplaces in local government administration are equipped with computers. Over 20% of the equipment is outdated.
- Are they networked?
  Not all computers are yet connected in a network. Only 20% of companies with computers have intranets. Internet connection varies from 80-100% in regional administration to 70-80% in ministries, to less than 20% in local government administration.
- Is business mostly conducted in person or by e-mail, or is there data-sharing, enterprise, reporting, transaction, and research applications? How intensively are they used?
  N/A
- Are there efficiency gains resulting from the use of ICT systems?
  N/A

4. Networked Economy

4.1. ICT employment opportunities

- Are there opportunities for technically skilled workers within the country?
  Yes, ICT employment is quite attractive. According to data for the year 2000, the average salary of ICT specialists was 220% of the average monthly salary and higher (340%) for programmers and systems administrators.
- Are companies from outside of the country investing in IT related projects?
  N/A
- What is the proportion of knowledge-workers and information-related businesses in the economy? (Percentage of labour force, percentage of GDP)?
  Approximately 45,000
- Are businesses considering IT in their strategies?
  There has been some movement towards e-business solutions to lower costs and increase efficiency. For the most part, these are still at a relatively basic level, such as integrating sales and accounting systems. A few also pursue supplier integration.

4.2. B2C electronic commerce

- Do local businesses have websites and how many? Is content current or static?
  According to expert estimates, about 5% of companies have websites. Primarily the information they provide is basic, static and rarely updated (often limited to short company profile, contact details and brief description of products services).
- Are there online B2C transactions, or are transactions mainly oral and/or paper-based, phone or fix-based?
  Very limited. E-payment systems exist (ePay.bg, BGPay.bg, Net-Card) but are used very little (1.4% of all debit-card holders are registered in e-Pay.bg). First attempts at e-banking / phone banking / PC-banking are being made.
- Is online retail a noticeable component of overall commercial activity?
  No. Around 100 virtually accessible Internet shops exist, selling books, music, electronics, prepaid Internet cards, etc. Payment of utility bills is also possible online. However, transactions are limited in number and volume. Payment generally takes the form of cash on delivery.

4.3. B2B electronic commerce

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

4.4. E-Government

- Number of government resources online? Do they include information, hours of operation, any services? Is information current and relevant?
  Approximately 150 government websites exist (including central and local government). Most central government agencies (over 90%) have websites. Information is often static and not regularly updated. Few websites provide some degree of interactivity. A survey conducted in December 2001 found that out of 15 government sites, three provided dynamic information, nine allowed feedback from users, and none offered e-payment /B2G opportunities. It is expected that in 2002, with recently published secondary e-commerce legislation necessary for the implementation of the Law on Electronic Documents and Electronic Signatures, more government sites will become interactive and will allow for e-payments and electronic submission of documents.
- Is there online interaction between government and citizens, or is interaction mainly oral, paper-based, phone or fax-based?
  N/A
- Is there online interaction between government and suppliers and contractors, or is the interaction mainly oral, paper-based, phone or fax-based?
  Interaction is primarily paper-based. Electronic procurement platforms are not yet in use. An e-government strategy is under discussion to introduce electronic services to citizens and business enterprises.
- Is it possible to download applications from the websites?
  Yes, some, such as www.taxadmin.government.bg .
- Can citizens apply for permits, licenses, and taxes on line?
  No.

5. Network Policy

5.1. Telecommunications regulation

- Is liberalisation of the telecommunications sector planned or implemented?
  The Telecommunications Law stipulates that state monopoly shall be established until the end of 2002 for the provision of ordinary telephone services (local, long distance, transit and international) between terminal points of the fixed telephone network and for the provision of leased lines under publicly announced conditions. The performance of the monopoly activities is granted to the Bulgarian Telecommunications Company Ltd (BTC Ltd.) with a license issued in February 1999. With the exception of this temporary monopoly, the telecommunications market is liberalised.
- Is there competition between telecommunications service providers?
  N/A
- Is broadband Internet access offered?
  N/A
- Is regulation set and enforced by an independent body?
  The Communications Regulation Commission is an independent specialised state body, tol regulate and supervise the provision of telecommunications and postal services. The Internet is presently a part of the telecom sector that is unregulated and does not need licensing.

5.2. ICT trade policy

- Do tariffs or other restrictions (technical standards, domestic regulation, etc.) exist?
  N/A
- Are there restrictions in the service (including information services) sector?
  N/A
- Are there disproportional taxes on electronically delivered services?
  N/A
- Is Foreign Direct Investment in IT sector existent, and is it encouraged, discouraged, restricted?
  A draft Law on High-Technology Parks and High-Technology Activities is being prepared in order to stimulate the development of the IT sector and the flow of foreign investment in high-tech production and services.

6. Media

6.1. Radio, TV and newspapers

- Number of radio and TV stations, newspapers
  N/A
- The size of audience/circulation.
  According to a survey carried out in August 2001, the audience shares of the major communications groups (public or private) were: Bulgarian National Television (public) – 67%; Balkan News Corporation (private) – 77%; News TV (private) – 32%.

6.2. Employment in the media

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

7. Intellectual Capital

7.1. Patents

- What is the number issued per annum?
  N/A
- What are the trends?
  N/A

7.2. Copyrights

- What is the number issued per annum?
  N/A
- What are the trends?
  N/A

7.3. Licenses

- What is the number issued per annum?
  Up to the end of 2001: 205 licenses for analogue terrestrial radio (two for national radio); 16 licenses for analogue terrestrial TV networks (three for national TV); 1,099 licenses for analogue cable TV networks; 298 licenses for radio content; and , 163 licenses for TV content.
- What are the trends?
  N/A

7.4. Trademarks

- What is the number issued per annum?
  N/A
- What are the trends?
  N/A

7.5. Scientific and/or technical associations

1. List with a brief profile
N/A

8. Education

8.1. Higher education

- Total number of higher education establishments (public/private).
  There are 48 colleges and universities located in 26 Bulgarian cities and towns. 23 of them have computer majors.
- Total number of students (total average per annum, in both the private and public sectors)
  N/A
- Prevailing specialisations. (distribution of students among the fields)
  N/A
- Cumulative number of population with higher education degrees (total in the fields of both science and technology)
  According to a survey in May 2001, approximately 186,000 people in the country hold college of university degrees in ICT and about 565,000 have attended some sort of computer training courses.

8.2. Distance learning

- Distance learning facilities
  The Department of Information Technologies (DIT) of the Faculty of Mathematics and Informatics in the University of Sofia has developed strong competence in distance learning via the Internet. One of the latest developments is the internal e-learning project ARCADE – Architecture for Reusable Courseware Authoring and Delivery (http://arcade.fmi.uni-sofia.bg) combines web-based tools for course and curriculum management, user management, communications, online assignments and testing.
- Number of students trained per center
  N/A

9. Labour Force

9.1. Employment in science and technical fields

- Number of employees and trends in the fields
  No figures available post 1999.
- Compensation rates in the fields (average salaries)
  N/A

9.2. Employment in the electronics industry

- Number of employees and trends in the fields
  N/A – but, the trend is negative.
- Compensation rates and trends in the fields
  N/A

9.3. Employment in telecom industry

- Number of employees and trends in the fields
  N/A
- Compensation rates and trends in the fields
  N/A

10. Research and development

10.1. Research institutions

- Number of research institutions
  N/A

10.2. Investments in research and development

- The total amount
  70 million € in 2000.
- Government and private business breakdown of total investment in research and development
  68.6% in the government sector, 21.4% in the private sector and approximately 10% in the education sector.

11. Other issues

- National initiatives regarding science and technology policy, venture capital, stimuli for students, scientists, etc.
  There are two projects to aid ICT profile within SME development. Thes are: high-tech business incubators; and, the establishment of a venture capital fund.