VI. E-EDUCATION

Systematic computer education and use of computers in Bulgaria's educational system first started in the 1986/1987 school year with the introduction of a course on informatics to the secondary schools' curriculum. After the initial comparative saturation of secondary schools with Bulgarian-made 8-bit PCs "Pravetz-8" and partially with 16-bit "Pravetz-16", at the beginning of the 1990s, due mostly to financial difficulties, centralized procurement of computer equipment to secondary schools was terminated.

In 1996 – 1997 an analysis of the state of education on informatics and information technologies was carried out. It became evident from this study that 1,159 schools (out of a total of 3,803 schools operating at the time) had an average of 10.45 operating 8- and 16-bit PCs and 1.47 printers. There was an average of 27 students working on a single 8- or 16-bit PC, or 70 students, if only the 16-bit or higher-class computers were counted. About 120 of the schools covered by the study had Local Area Networks (LANs) and around 50 (in 1998) were connected to the Internet. Ninety-five percent of the software used in these schools was unlicensed software. The situation in the primary schools was even worse.

Taking into account this state of affairs, the Bulgarian Ministry of Education and Science developed a **National Education Strategy on Information and Communication Technologies (ICT)** in 1998. This strategy outlines the principles and goals of modern ICT education in Bulgarian schools. It describes the relevant educational content, the means for ICT's integration in other academic disciplines, the organizational forms of ICT use, the provision of technical equipment and software for the needs of the learning process, the training and qualification of teachers, among other aspects. In 1999, a detailed **Program** and financial plans for the implementation of the this strategy were developed. Part of the program envisages the modernisation of education – i.e. development of standards, adaptation of curricula and syllabuses, etc. – and it is already being implemented. However, financial resources have not yet been released for the procurement of computer equipment and Internet connections in schools. In late 2000 the previous government pledged $15 million[14] for PCs and Internet access to secondary schools. Tender procedures were held and suppliers of equipment and internet services were selected. After the parliamentary elections in June 2001, however, in became clear that these funds were not available in the budget.

Despite such impediments, there has been an increased interest in ICT and more consistent efforts – both by the Ministry of Education and by individual schools and local communities – for computerization of the schools since 1998.

VI.1. Schools' Access to ICT

Lack of adequate funding is one of the key constrains to meeting the requirements for computer equipment in the educational system. The period 1990-1998 saw a sharp decline in public spending on education – from 6.06% of GDP in 1992 to merely 3.2%

[14] Later this amount was "corrected" to $10 million.

in 1998. [15] A slight improvement has been observed with the economic stabilization in the country after 1997 and especially during the last couple of years. The budget dedicated to education was 3.88% of GDP in 2001 and reached 4.13% in 2002. Despite this positive development, the public spending on education remains way below the EU average. The economic hardships accompanying the country's transition to market economy seriously impair the penetration of ICT in the educational system.

1.1. Schools of Secondary Education

Data from the Ministry of Education points to the availability of 12,199 PCs in all Bulgarian schools in 2001. The number of "modern" (CPU 386 or higher) computers capable of supporting Internet connections is 8,077. There is a total of 1,311 computer labs (in 2000/2001); 336 schools are connected to the Internet and around 120 have own websites.

TABLE: 6.1. AVAILABILITY OF PCS AND INTERNET ACCESS IN BULGARIAN SCHOOLS BY REGION[16]

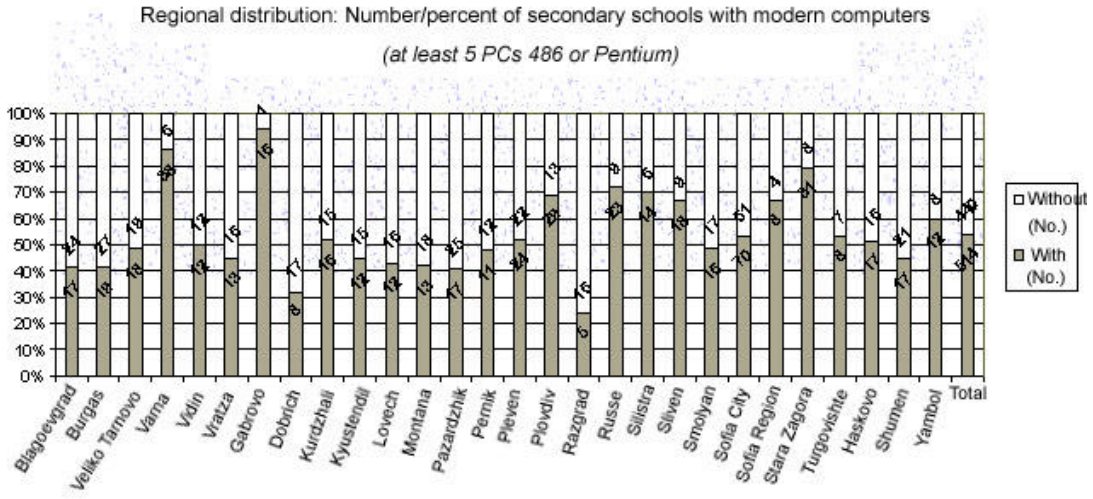
	Region	*No. of computer labs*	*No. of PCs*	*Pravetz 8 or 16*	*Higher class*	*No. of students per high-class PC*	*No. of schools with Internet Access*
1.	Blagoevgrad	76	339	68	271	***74,7***	***24***
2.	Bourgas	51	483	65	418	***58,7***	***19***
3.	Varna	104	946	396	550	***32,3***	***28***
4.	Veliko Tarnovo	57	616	69	547	***40,8***	***21***
5.	Vidin	22	437	289	148	***34,4***	***3***
6.	Vratza	37	642	480	162	***54,1***	***9***
7.	Gabrovo	30	313	22	291	***22,0***	***9***
8.	Dobrich	21	589	437	152	***37,1***	***1***
9.	Kardjali	40	279	25	254	***33,5***	***4***
10.	Kyustendil	42	382	152	230	***43,3***	***4***
11.	Lovech	30	301	112	189	***41,3***	***9***
12.	Montana	40	268	122	146	***19,2***	***4***
13.	Pazardjik	45	903	558	345	***50,6***	***18***
14.	Pernik	26	281	22	259	***48,8***	***4***
15.	Pleven	49	376	135	241	***47,5***	***5***
16.	Plovdiv	79	651		651	***36,8***	***15***
17.	Razgrad		240	126	114	***69,9***	***6***
18.	Rousse	43	424	41	383	***41,3***	***19***
19.	Silistra	22	229		229	***33,3***	***7***
20.	Sofia city	200	490		490	***40,6***	***53***
21.	Sofia region	42	589	284	305	***78,9***	***10***
22.	Sliven	36	263		263	***40,6***	***9***
23.	Smolyan	36	231		231	***220,8***	***8***

[15] According to various estimates Bulgaria's GDP declined between 30% and 55% during the same period.
[16] Data from MES.

24.	Stara Zagora	49	467	52	415	***39,0***	***16***
25.	Targovishte	32	465	312	153	***73,8***	***6***
26.	Haskovo	47	536	288	248	***62,7***	***8***
27.	Shoumen	26	198	67	131	***28,9***	***9***
28.	Yambol	30	261		261	***53,2***	***8***
	TOTAL	**1312**	**12199**	**4122**	**8077**	**66,4**	**336**

As of January 2001, around 50 percent of the secondary schools (514 out of of 1023) were equipped with at least a single computer laboratory with at least 5 PCs (with PCU 486 or Pentium processors). An interesting observation is that the availability of computer equipment and computer labs does not dependent on the demographic or economic profile of the regions. (see Table 6.1. and Graph 6.1)

Figure 6.1. Secondary schools with modern computers



Source: Ministry of Education and Science

All schools are provided with licensed software – both system software (Operating Systems) and the most popular application office software, through a contract worth $1,036,000 between the Ministry of Education and Microsoft dated July 1999.

At the same time, the Ministry of Education has no data on the number of computers used in primary and elementary schools. According to the international survey SITES carried out in late 1998, only 3% of the country's primary schools had computer labs. On average the schools had one computer for 270 pupils. Fragmented data from more recent studies indicate that, although the situation might have improved, real access to ICT is not yet available. This could become possible only after ICT is introduced as an obligatory discipline in the primary schools' curriculum.

Overall the **penetration of ICT in Bulgarian schools is still relatively low**. Expert assessments suggests that the ratio students to computers is 66 students per

PC. For comparison, a Eurobarometer survey conducted in February 2001 found that on average, for educational purposes, 94% of European schools were equipped with computers and 79 % were connected to the Internet. The average school in the EU had a computer for every 10 studnets and an Internet-enabled computer for 22 students .

There are two main channels of bringing ICT into Bulgarian classrooms. The first one – the centralized line of government support through the Ministry of Education and Science, and the second one – associated with the efforts of individual schools. According to experts of the international network I*?ARN (that provided funding for more than 80 schools) there is ground for moderate optimism in the second line of development. Individual schools and local communities have become increasingly active in recent years in seeking various funding possibilities to equip computer labs in the schools. The current study has come across various forms of fund-raising – from company sponsorship to collection of "voluntary fees" from parents. Thus some schools have managed to raise considerable financial resources and secure a certain level of ICT access to their students.There is a significant support from the donor community – PHARE program provided funding for digitalization of dozens of professional secondary schools and 13 regional centers for drop-out students, Open Society Fund provided equipment for 12 schools and Internet access for dozens. French language schools received assistance from V-FAX program.

Finally, the assessment of ICT access in schools should necessarily consider an interesting and very important phenomenon for Bulgaria – the existence of computer games clubs. Following the launch of network games in 1998 the country has experienced a real boom in computer clubs. With time these establishments have also enabled access to Internet services on a mass scale. As a result students in even the smallest towns have been given the opportunity to use ICTs despite the delayed computerization of the schools.

1.2. Schools of Higher Education

Most Bulgarian universities and colleges have a paucity of computer resources, although the necessary investments in hardware and connectivity are 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 connections. The reasons for this are many-fold: the academic autonomy of the schools and different management schemes make the collection of such data a very difficult task. As it stands now, no government agency collects comprehensive information on these schools. In some cases, the university managements are not even aware of considerable technological resources that some of their departments have managed to secure on their own. Often there are strange rivalries between the universities and some of their more "popular" departments for projects and hardware equipment..

In such circumstances the **number of PCs at the universities in Bulgaria** can only be approximated based on expert assessments. This number is believed to be

around 20,000 PCs in a total of 48 schools of higher education[17]. About 50 % of these are "modern" PCs. Penetration is highly uneven. For example, the American University in Bulgaria (AUBG) reports around 550 PCs for 700 students (an almost 1:1 ratio), while other universities have one computer for over 100 students.

In many cases this equipment is used only in administration (e.g. in accounting) and not for education or research. With the only exception of AUBG no other university in the country currently offers free access to computer labs and Internet connections to its students.

Practically all universities (45 out of 48) have registered Internet sites and all of them are connected to the Internet. Approximately 40% of the state universities were connected until recentely through the National Educational and Research Information Network UNICOM-B that was recently closed down and each university used and uses a variety of commercial ISPs to secure additional bandwidth. Some universities , mostly technical and engineering ones, have good access and fairly advanced ICT facilities but humanitarian faculties still lack behind the technical, mathematical and economics and management faculties.

Limited as it is, the current level of access to ICT in Bulgarian higher education is possible thanks to funding from abroad or donations from private sponsors as university budgets do not allow sufficient ICT spending. ICT resources are dispersed and used inefficiently due to a serious increase of the number of students and campuses together with a decrease of spending on education. There is not sufficient use of ICT in subjects other than those directly related information technology which represents a major brake on progress in most academic disciplines. In such circumstances, Bulgarian universities run the risk of seriously falling behind their counterparts in the rest of Europe if they do not bring innovation both to the educational curricula and teaching and learning methods.[18]

In addition to the limited access to technologies, the qualification of university professors is one of the most serious problems facing higher education in Bulgaria. After 1990 the motivation of students and professors to stay in the educational systems has declined significantly. According to various "brain-drain" studies[19] 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 programs, particularly in the field of ICT, has also declined and the situation is not likely to improve in the near future.

Some signs of a turnaround in the "brain-drain" situation were noticed for the first time by the end of the 1990s when many software developers returned to the

[17] There is ? total of 48 universities in Bulgaria, located in 26 towns and cities. There are 8 private schools of higher education, 4 of which are independent colleges. The total number of students at the beginning of 2001-2002 was 215,926.

[18] From "IT for Development Issues Paper", UNDP and Center for the Study of Democracy, Sofia, 2001.

[19] Brain Drain in Easter Europe, 1994-1995,CSD,

country. Some university departments are trying to recruit such specialists by offering them attractive teaching schemes.

1.3. Digital Libraries

According to June 2001 statistics, more than 30 classical libraries in Bulgaria are available online. Most of them offer own or international databases. However, a quick review shows that only 13 of them offer real access to their own electronic catalogues. Three other have indicated such services but in practice they are unavailable.

The library at the University of Architecture, Civil Engineering and Geodesy in Sofia is the only one presenting online its whole librarian fund. Others, like the central division library of the Bulgarian Academy of Sciences, offer only access to international databases included in the "EIFEL" project.

The Open Society Fund (i.e. the Soros Foundation in Bulgaria) has played a critical role in the digitisation of Bulgarian libraries – the National Automated Library Information Network – NALIM. In its 10-year history in Bulgaria, OSF has donated computers, established local area networks, purchased library automation systems and educated librarians.

VI.2. ICT Education and Training

2.1. Schools of Secondary Education

Since July 1999, Bulgaria has a new **Law on Educational Degrees, Educational Minimum and Syllabus**. "Mathematics, Informatics and Information Technologies" is one of eight educational areas defined in this law. On August 30, 1999 the Syllabus Regulations were enforced and two obligatory academic disciplines relating to ICT were featured for the first time – ***Informatics*** and ***Information Technologies (IT)***. They were to be taught at secondary education level at all schools nationwide. On September 1, 1999 the new state-designed curriculum was first introduced to ninth graders.

In May 2000 the state standards (requirements) for the educational content of all disciplines, including Informatics and IT, developed by Ministry of Education, were published. The educational content was elaborated on two level: first level – general education minimum, and second level – relating to specialized education. They outline the necessary knowledge, skills and value orientation of all disciplines that students graduating from the relevant educational degree are to obtain.

On this basis, the new curricula on Informatics and IT for 9^{th} to 11^{th} grades, and specialized education at 12^{th} grade of secondary schools, were developed. The new curricula comply with the contemporary requirements for computer and technological literacy and provide for development of problem-solving skills using ICT, work in a networked environment, the use of Internet and contemporary operating systems and different office applications.

By the end of year 2005 obligatory ICT training will be introduced at primary education level as well. In this way computer and Internet literacy will be added to the set of skills acquired by Bulgarian students at school in an attempt to prepare the workforce of the information age.

Currently, however, classes at the secondary school level do not integrate ICT meaningfully in the lesson plans. Computers and Internet – where they are available at all – are rarely used in subjects other than those directly related to ICT. The technology has very low or now impact on the methods and forms of education. In many schools IT continues to be taught mainly as a theoretical class with no real access to PCs and Internet.

The qualification of teachers is yet another challenge facing ICT in education. Most instructors who currently teach IT and Informatics at schools have not been specifically trained in these disciplines. The majority of them come from a background in mathematics or some fields of electronics which are taught at technical universities in the country. Their knowledge of Internet, network technologies and contemporary software is largely the result of self-training or randomly selected ICT training courses. Due to lack of previous experience in teaching ICT at secondary education level, and because of the dynamic development of this field, there is presently a lack of uniform evaluation system to guarantee the quality of ICT teaching practice in schools.

Another challenge is the integration of new technologies in the overall education process – all disciplines not only Informatics and Computer Sciences. This need requires a governmental strategy for continuous training of teachers in use of new ICT.

In respond to that need the Ministry of Education is organizing training-of-trainers type of seminars with the support of foreign educational institutions but due to serious financial constraints such programs cannot cover all schools in the country.

Finally, a serious problem for secondary schools (as well as in higher education levels) is the fact that once teachers become better qualified they generally migrate to the private sector often attracted by much higher salaries. At the same time a policy of permanent employment in schools does not allow the involvement of instructors from outside the school system. Thus, despite the existence of qualified professionals in the country, the schools are denied outside (often voluntary) assistance due to a centralized teaching policy at primary and secondary school levels.

As a conclusion, which is valid beyond the scope of the education system, there are many dispersed initiatives, duplicating efforts without added value and lack of coordination that leads to cost inefficiency.

2.2. Higher Education

Bulgaria has had a tradition of excellence in science and technology education. But many technically educated Bulgarians emigrated after the onset of political and economic transition in 1989, drawn by better employment opportunities in other countries. Some proportion of teachers has also joined to emigrating aboard. There is a sense that Bulgarian higher education is declining somewhat in quality and is subject to further erosion. This is likely to be felt mostly in science and technology, where the skills are easily marketable across national boundaries.[20]

Information technology skills are among the skills most demanded today. Most countries currently (and in the future) suffer from insufficient supply of people qualified to fill all the IT jobs that exist. The supply of IT professionals in Bulgaria will be seriously threatened whenever the shortage becomes acute in the developed world. Germany and the U.S. (among others) are already raising the number of visas available to people with these skills, and Bulgarians are among those attracted to emigrate. The long-run solution to this problem is to raise the domestic investment in such skills to the level where the imbalance between supply and demand is tolerable from a competitive point of view.

Currently, 29 Bulgarian universities offer programs in fields related to ICT . The number of students in this area of study is currently 6,485[21] (about 3% of the total number of students). An additional 221 students are enrolled in post-graduate education programs. The number of doctoral students at the research institutes of the Bulgarian Academy of Sciences is only 59.

Different surveys indicate that 90% of the students in Bulgarian universities use ICTs and about 50% are enrolled in some sort of ICT training. Experts believe this considerable number of ICT-trained students constitutes a pool of human resource which could guarantee the adaptability of Bulgarian industry in the future.

A number of universities have achieved successful cooperation with the private sector on specialized education or professional training programs but, due to the general economic situation in the country and the existence of certain legislative barriers, the private sector has little interest in cooperating with universities or supporting university research programs in the field of ICT.

There are some schools (particularly IT and/or informatics departments at Sofia University or Technical University – Sofia) where practically all students with ICT skills have access to international programs and research projects. In such departments it is common practice that "qualified students" are recruited by their professors. According to international companies recruiting ICT specialists in the country, the personal motivation and access to international projects are the two decisive conditions for the good level of qualification of Bulgarian students.

[20] Mission report "The IT Industry in Bulgaria" by George Sadowsky http://www.competitiveness.bg/sadowsky.doc

[21] Students in ICT fields at the New Bulgarian University not included

2.3. Professional Training

In addition to the number of traditional college and university programs available, there are many other opportunities for study in fields related to information technology. There is a variety of certification programs offered through professional training institutes, such as Cisco Networking Academy or Microsoft Academy.

There are 5 Microsoft and 38 Cisco academies acting in the country at present – most of them affiliated with academic institutions. The scope of their training extends beyond the purely academic community and addresses much broader social segments. Currently several hundred students already take part in courses offered by the academies. Thus, for instance, Cisco's networking academies provide training to a total of 509 people in 2001.Another 1,200 are being trained by Microsoft and about 400 participants are certified annually. At the moment, about 400 database specialists, 70 developers and 70 Microsoft-certified engineers are already employed on the market.

An important goals of these academies is to identify suitable partnerships with government and educational institutions, business and industry. For instance, there is already successful cooperation with the Ministry of Defense in the context of a Program for Social Adaptation for people who are expected to lose their jobs in the next 3 years (about 20,000 military servants) because of the restructuring of the Bulgaria army. Another successful collaboration exists between big IT companies and the Bulgarian Chamber of Commerce on projects providing training to SMEs to prepare them for the coming age of digital economy in the next few years.

Several of the bilateral and multinational donor agencies also develop a few projects connected with ICT training and education. For instance in late spring 2000, USAID funded a PC3 Telecenter project (**http://www.usaid.gov/info_technology/ied/bulgariaied.html**). The Public Computer and Communication Center (PC3) project is a pilot two-year $800,000 project implemented on behalf of USAID by the Academy for Educational Development (AED) through LearnLink. PC3's objective is to increase public access to computers and the Internet by helping small Bulgarian businesses open telecenters, and bring the Internet and its opportunities to smaller under-served Bulgarian towns viewed as unattractive by the for-profit sector. As one of its components, the PC3 project also trains local users and grants free or subsidized access to specifically targeted social groups, women, minorities, and the unemployed, in an effort to address specific community needs and create the customer base for the telecenters.

The World Bank is also working on Bulgaria's participation in the Global Development Gateway project through a Bulgarian country gateway.

Another project, "Chitalishta", is financed on collaborative basis by UNDP, USAID and the Dutch government. The project is developed and supervised by the Bulgarian Ministry of Culture and aims at encouraging the sustainability and the cultural and educational role of these traditional institutions. According to an

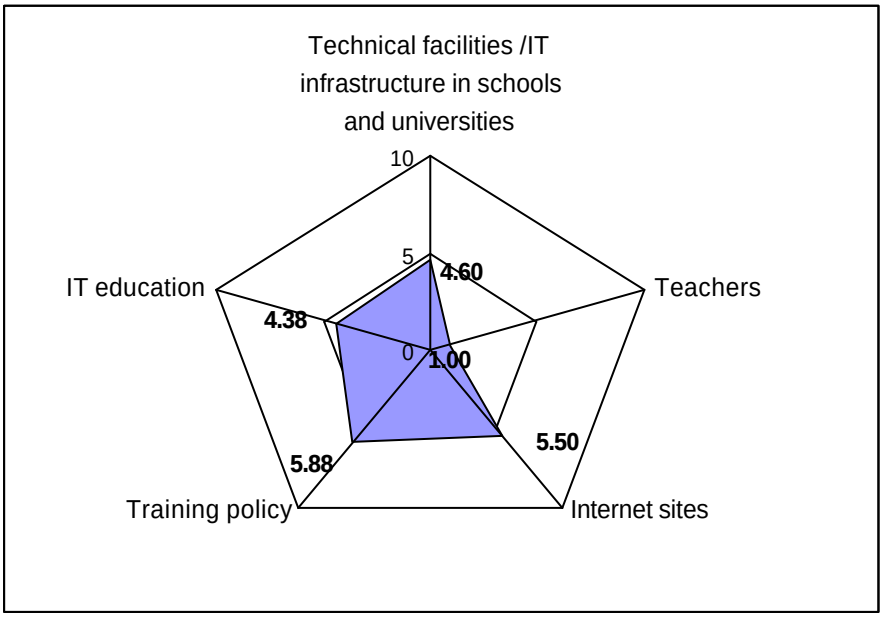
agreement between UNDP and Cisco Systems, ICT education and special qualification programs will be implemented in a total of 25 Bulgarian chitalishta (i.e. community centers) and in 3 regional centers nation-wide. The educational program itself is valued at 90,900 USD and is granted for free by Cisco Systems.

VI.3. Quantitative Assessment

Lack of adequate computer equipment, Internet access and qualified teachers at the early stages of educational development (there is quite inadequate computerization at some universities too) is one of the crucial problems to the quick penetration of ICT in the country. Most of the students are not even aware of the big potential of this technology and realize it much later, after their graduation from school. In order to achieve IT competitiveness Bulgarian society needs much earlier awareness about the advantages of the digital economy.

ICT implementation in Bulgarian education is still at one of the lowest levels in Europe. Even though there are already successful experiments in some universities with distance learning courses, the general perception among Bulgarian society is that computers are still a big expense for an ordinary household or a workplace. This perception is more or less reflected in the state educational system. Even according to the optimum program of the Bulgarian government for computerization of the schools, there will be just one-two computer labs per school, which is highly insufficient for implementing ICT and massive penetration of new information skills in areas other than informatics itself. The average use of Internet in the area of education and science is a little above the average percentage for the country. Presumably there are some research laboratories and "islands of excellence" which rely exclusively on Internet in their daily work and have a number of successful international projects. However the relatively high cost of Internet access remains a huge obstacle to the massive penetration of Internet and communication technologies.

FIGURE 6.2. E-LEARNING



Average value: 4.27