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TOWARDS A KNOWLEDGE-BASED ECONOMY – EUROPE AND CENTRAL ASIA: INTERNET DEVELOPMENT AND GOVERNANCE

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UNITED NATIONS

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Towards a Knowledge-based Economy – Europe and Central Asia: Internet Development and Governance

ABSTRACT

The diversity and socio-economic differentiation of the real world prevents the full-scale cultivation of Information and Communication Technologies (ICT) to the benefit of all. Furthermore, the lack of determination and political will in some countries and slowness of responses to new technological opportunities in some others are responsible for the creation of another social divide – a digital one.

The above problems were fully acknowledged by the World Summit on the Information Society (WSIS). The Summit called for a joint international effort to overcome the digital divide between and within the United Nations Member States under the Digital Solidarity umbrella.

This report was prepared as a follow-up to the Summit and represents a brief review of the status and trends in the area of ICT and Internet development in the UNECE region and provides background information on the state of the art in some relevant ICT subsectors in the Member States.

The report focuses on the state of the Internet critical resources and, consequently, on the ICT and Internet penetration across countries and social groups. It also looks into existing Internet governance arrangements and makes some recommendations. The report contains three parts and conclusions.

The first part, "Towards a Knowledge-based Economy: Progress Assessment", highlights the situation in the region with regards to the digital divide, both between and within countries, and national strategies and actions aiming at overcoming barriers to accessing the Internet. The second part, "Internet Development: Current State of Critical Internet Resources in the UNECE Region", concentrates on reviewing the physical Internet backbone, interconnection and connectivity within the Internet in the UNECE member States. The third part, "Governing the Evolving Internet in the UNECE Region", focuses on the issues of Internet governance in the countries of the region, challenges faced by the countries and participation of key stakeholders in ICT and Internet policy formulation and implementation. The final part contains conclusions and recommendations.

FOREWORD

The "Information Society" proposes a vision of an inclusive society, where all citizens "without distinction of any kind", share the right "to seek, receive and impart information and ideas through any media and regardless of frontiers". Therefore, any strategy, be it national or international, aimed at achieving the peace, security and development goals of the international community for the 21st century must include in a prominent position the full exploitation of the new opportunities as well as a clear response to the threats of new divisions arising out the use of Information and Communication Technologies (ICT).

The Information Society inevitably will change the traditional role of government. We can already see the effects of the Internet and other information and communication technologies. These new technologies can be used to improve good governance principles and achieve public policy goals. Public administration can make use of these tools to enhance transparency, to increase efficiency in the use of public funds and to improve the delivery of services to citizens.

In this process, reforms must focus on the citizens and technology should be seen as a means to support governance development rather than as a tool in itself. The availability of, and access to, public administration for citizens should be increased, and the interactive services enlarged. Similarly, new economic models based on ICT can contribute to economic growth.

This report shows that all countries in the region have benefited from the new technologies of the information society – which is very positive! However, the report also indicates that the "digital divide" has not closed. Thus, there is the obvious danger that less developed countries, which do not have the necessary ICT infrastructure and technical and managerial expertise, will have difficulties in catching up with the major developed countries, which are increasingly moving ahead with sophisticated ICT technologies. This risk conserves a "divide", with the less technologically developed nations being seriously disadvantaged.

We at the United Nations Economic Commission for Europe (UNECE) have been supporting knowledge-based development of our member States, in particular for the countries with economies in transition. It is our wish to contribute narrowing existing digital divide and to support building an inclusive Information Society.

I sincerely hope this publication will be useful for the ICT policymakers, bringing better understanding of the current status of the Information Society in the region and providing a sound basis for future policy discussions.

Marek Belka
Executive Secretary
United Nations Economic Commission for Europe

PREFACE

Information and communication technologies (ICT) have been rapidly transforming human activities by allowing natural barriers like time and distance and the limitations of the human mind and body to be overcome. ICT have enabled societies to extend their social and economic ties and networks beyond the borders of sovereign States and create a new space of human interaction – a virtual one. They have provided humanity with a new set of opportunities, including an opportunity to learn through a direct dialogue between individuals and groups of people separated from each other by distance, cultural and political walls.

However, the entry to this virtual space requires certain capabilities and capacities to be in place. These include:

- Physical ICT infrastructure
- Internet infrastructure
- ICT equipment
- ICT and Internet services provision
- Affordability of equipment and service
- Accessibility of equipment and service
- E-literacy and e-skills
- Common e-rules and e-regulation
- E-security and e-protection of rights and freedoms
- E-law enforcement
- Common e-standards
- A common e-language

Yet the diversity and socio-economic differentiation of the real world prevents humanity from full-scale cultivation of cyberspace to the benefit of all. Furthermore, the lack of determination and political will in some countries and slowness of responses to new technological opportunities in some others are responsible for the creation of another social divide – a digital one. Humanity as a whole has been lagging behind the technological revolution. Various social divides are evidence of failure to design social mechanisms allowing a rapid spread of new technologies, which could benefit the entire population of the world.

The above problems were fully acknowledged by the World Summit on the Information Society (WSIS). The Summit called for a joint international effort to overcome the digital divide between and within the United Nations Member States under the Digital Solidarity umbrella.

In response to the recommendations of WSIS, both the representation at and the agenda of Internet global governance have been changed in order to identify bottlenecks and barriers to participation in online socioeconomic and cultural activities, as well as risks and threats facing cyberspace inhabitants, and make recommendations on possible solutions, means and methods of overcoming them.

This report was prepared as a follow-up to the Summit and in response to the recommendations of the first Internet Governance Forum held in Athens, Greece, from 30 October to 2 November 2006. It represents a brief review of the status and trends in the area of ICT and Internet development in the UNECE region and provides background information on the state of the art in some relevant ICT subsectors in the member States.

The report focuses on the state of critical Internet resources and, consequently, on ICT and Internet penetration across countries and social groups. It also looks into existing Internet governance arrangements and makes some recommendations. The report contains three parts and conclusions.

Chapter 1, "Towards a Knowledge-based Economy: Progress Assessment", highlights the situation in the region regarding the digital divide, both between and within countries, and national strategies and actions aimed at overcoming barriers to accessing the Internet.

Chapter 2, "Internet Development: Current State of Critical Internet Resources in the UNECE Region", concentrates on reviewing the physical Internet backbone, interconnection and connectivity within the Internet in the UNECE member States.

Chapter 3, "Governing the Evolving Internet in the UNECE Region", focuses on the issues of Internet Governance in the countries of the region, the challenges faced by countries and the participation of key stakeholders in ICT and Internet policy formulation and implementation.

Chapter 4 provides conclusions and recommendations.

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SYMBOLS AND ABBREVIATIONS USED

€	Euros
£	United Kingdom pounds
$	United States Dollars unless otherwise specified
ADSL	Asymmetric Digital Subscriber Line
AFNIC	l'Association Française pour le Nommage Internet en Coopération
AS	Autonomous System
ASCII	American Standard Code for Information Interchange
ASN	Autonomous System Number
ATM	Asynchronous Transfer Mode
BGP	Border Gateway Protocol
BGPv4	Version 4 of the Border Gateway Protocol
CCITT	International Telegraph and Telephone Consultative Committee
ccTDLs	country code Top-level Domain Names
CEEC	Central and Eastern European Countries
CENTR	Council of European National Top-Level Domain Registries
CERN	European Organization for Nuclear Research
CIS	Commonwealth of Independent States
CJSC	Closed Joint Stock Company
DENIC	German registry of Internet domain names
DNS	Domain name system management
DSL	Digital Subscriber Line
DWDM	Dense Wavelength Data Multiplexing
EC	European Community
EEA	European Environment Agency
EECCA	Eastern Europe, Caucasus and Central Asia
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
EU	European Union
FMS	Fixed to mobile substitution
GAC	Government Advisory Committee
GEANT	National Research and Educational Networks of the European Union
gTLD	generic Top-Level Domain names
IANA	Internet Assigned Numbers Authority
ICANN	Internet Corporation for Assigned Names and Numbers
ICT	Information and communications technologies
ICT OI	Information and communications technology Opportunity Index
IDNs	Internationalized Domain Names
IDNA	Internationalizing Domain Names in Applications
IEC	International Electro technical Commission
IGP	Interior Gateway Protocol
IP	Internet Protocol
IPv4, IPv6	Internet Protocol version 4 and Internet Protocol version 6
ISDN	Integration Services Digital Network
ISP	Internet Service Provider
ISO	International Organization for Standardization
ISOC	Internet Society of Chapters
ITS	Intelligent transportation systems
ITU	International Telecommunication Union
IXP	Internet Exchange Point
Km	Kilometers
LAN	Local Area Network
LIR	Local Internet Registry

MMS	Multimedia messaging services
n.a.	Not available
NAP	Network Exchange Point
NAT	Network Address Translation
NGO	Non-governmental organization
NIR	National Internet registry
NORID	Norwegian registry of Internet domain names
OI	Opportunity Index
OECD	Organisation for Economic Co-operation and Development
OSCE	Organization for Security and Co-operation in Europe
PC	Personal computer
RESTENA	Réseau Téléinformatique de l'Education Nationale et de la Recherche
RIPE	Réseaux IP Européens
RIPE NCC	RIPE Network coordination center
RIR	Regional Internet registry
SIDN	Stichting Internet Domeinregistratie Nederland (the Foundation for Internet Domain Registration in the Netherlands)
SDH	Synchronous Digital Hierarchy
SME	Small and medium-sized enterprise
SMP	Significant market power
SMS	Short Message Service
SPECA	United Nations Special Program for the Economies of Central Asia
TIR	Transport routier international
UNECE	United Nations Economic Commission for Europe
UN/CEFACT	United Nations Centre for Trade Facilitation and Electronic Business
UNCITRAL	United Nations Commission on International Trade Law
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
UNESCO	United Nations Educational, Scientific and Cultural Organization
WAP	Wireless Access Protocol
WCO	World Customs Organization
Wi-Fi	Wireless Fidelity
Wi-MAX	Worldwide Interoperability for Microwave Access
WIPO	World Intellectual Property Organization
WSIS	World Summit on the Information Society
WTO	World Trade Organization

EXECUTIVE SUMMARY

1.1 The digital divide between countries

Over the period 2000-2005, practically all the member countries of the UNECE made progress in advancing national capacities and capabilities necessary for participation in the emerging global knowledge economy. However, the speed of progress has been uneven across the countries. An ITU/UNCTAD (International Telecommunication Union/United Nations Conference on Trade and Development) survey of the ICT economy implies that the digital gap between the countries of the UNECE region has not yet been eliminated although it has certainly narrowed.

In the Commonwealth of Independent States (CIS), the gap between the Russian Federation and the rest of the CIS suggests that the countries of the subregion have been advancing at the same speed. In Eastern and Central Europe, the situation appears similar to that in the CIS, although this subregional grouping is more advanced on the average than the CIS.

The digital divide within UNECE member States, including some of the most advanced ones, has also not vanished, although it has been gradually shrinking due to effort undertaken both by Governments and civil society groups.

The rural-urban digital divide is considerable in some of the European Union (EU) Member States. As of the 1 January 2005, broadband, for example, was available to more than 90 per cent of EU 15/European Environment Agency (EEA)-urban population but only to 62 per cent of its rural population. Furthermore, only 12 of the 88 regions of the Russian Federation may be considered well equipped to uptake the knowledge economy. Most of the Russian Internet users are located in the European part of the country. The combined share of the eastern regions (beyond the Urals) is only 16 percent, less than that of Moscow.

Apart from geographic location and nationality or ethnicity, gender, age and social status also play an important role in shaping the profile of the digital divide in the Russian Federation and other CIS countries. Available data suggest that the gender and age digital divides are much more prominent in the CIS than in the EU Member States. They provide evidence that the most important factors constraining the participation of social groups in the emerging knowledge economy are age and the level of income. Thus, as an example, in 2005, the average price of a basic computer in the Russian Federation was €420 (or 14,420 roubles), or about 17.25 per cent of the average salary. And in Ukraine, the cost of a personal computer was two times the average monthly salary.

Only a few countries reached the point of closing the gender digital gap: Iceland – with a proportion of Internet users among males and women, respectively, 86 per cent and 82 per cent, Denmark, correspondingly, – 80 per cent and 76 per cent, Sweden – 84 per cent and 76 per cent, and Norway – 80 per cent and 73 per cent.

The diffusion of new technologies and, particularly, of ICT could be impeded by various factors: economic, social, cultural, political, as well as geographic. In this context, the Member States of the UNECE represent a diverse group of countries differing from each other in many respects. From the perspective of the Information Society, the recent historic experience of a large group of the UNECE member countries, particularly the Eastern and Central European countries and the CIS, should not be disregarded. This historic experience left an imprint on the social fabric of these countries, which interplays with other factors and, therefore, impacts the development process.

The legacy of absolute State control over knowledge production and dissemination and an ICT infrastructure designed to provide support for the state monopoly in these countries continue to constrain the uptake of ICT, even in the countries which have implemented formal liberalization reforms. In some

instances, the patterns of relationship, behaviour and attitudes that were shaped in the past continue operating informally, resulting in the monopolization of the access to market opportunities and control over the access to resources by groups with vested interests, thus preventing the emergence of new ICT service providers and new consumer services.

However, advanced countries of the UNECE region also are not free of barriers constraining the access to and utilization of ICT and Internet potential benefits. Some of them, for example United Kingdom, Germany, France, Spain and Portugal have social groups significantly lagging behind the mainstream society in terms of ICT usage. These are recent immigrants, racial and ethnic minorities, children from poor families and disadvantaged communities, disabled and long-term unemployed people, the population in remote areas, among others. Hence, it is not surprising that e-Inclusion strategy is viewed as one of the means to achieve a larger objective – a strengthening of the social solidarity and social cohesion in the EU Member States.

1.2 Critical Internet resources

The ICT infrastructure in the Western European subregion is highly developed, with fixed line teledensity above 50 per cent on the average. Mobile penetration rates are also very high with several countries achieving the penetration rate of over 100 per cent. The situation in Eastern and Central Europe is more diverse with some countries rapidly catching up with the leading Western European countries and some others lagging behind. Unevenness of ICT development across the CIS is even greater, mirroring disparities in distribution of ICT infrastructure, capacities and capabilities inherited from the Soviet past.

The rapid proliferation of affordable mobile telephony causing the substitution of mobile for fixed-line service in many countries of the region has been among the factors constraining further expansion of the main line infrastructure. This was an especially noticeable phenomenon in Eastern and Central Europe and in some countries of the CIS, where, on the one hand, the shortage of funding undermined the ability of national telecoms to extend their traditional services to the regions with a low telephony penetration. On the other hand, the aging and relatively low quality of the fixed line infrastructure prevented them from producing and diversifying their services that could meet consumers' expectations. Gradual liberalization of the ICT sector and privatization of national telecoms in the new EU Member States, as well as in those in line for an EU membership and in some of the CIS member-sates, led to the establishment of an institutional framework conducive to competition and, hence, to the emergence of alternative (to fixed line) providers, but also of new telecommunication companies. The process of liberalization, however, has been patchy across the region with some countries still retaining a Government control over national telecoms. In these countries, state-owned and/or -controlled fixed line incumbents with a significant market power have resisted new and/or alternative incumbents' entry into the market.

Telecoms in many EU countries are now moving beyond voice and data and entering the world of interactive video and digital TV. At present, they are investing in Asymmetric Digital Subscriber Lines (ADSL), a technology through which converged services can be or already are being offered.

Demand for digital television in Europe will reach a record number of customers this year. Nearly 19 million homes were estimated to have bought digital TV for the first time in 2007, an increase of 20 percent. However, the newest entrant, TV through Internet (IPTV), is also beginning to make inroads and take its share away from established satellite TV and cable providers. It is predicted that 16 million homes will subscribe to IPTV by 2010.

Satellite communications have not been widely used in Europe and CIS to provide Internet access services due to a number of economic and technical reasons. Firstly, in most European countries, mainland alternatives are cheaper and more readily available. Secondly, terrestrial alternatives are generally more powerful and reliable. This situation seems to be changing slowly, driven by political commitments to provide high-speed access to Internet for all, and targeting the households and businesses located in remote and/or underdeveloped areas.

Wireless networks Wi-Fi and WiMAX have been playing an increasingly important role in the countries and/or country regions experiencing a deficit of basic terrestrial ICT infrastructure and/or where economic costs of extending fixed lines are too high due to remoteness or sparse settlement. In the CIS, wireless technologies are gaining momentum. A number of large Wi-Fi network projects are currently underway in Russia and other CIS countries.

The growth and penetration rate of Internet usage has surpassed that of Internet subscription in all the subregions, suggesting that a significant proportion of the Internet users have been accessing the World Wide Web from other places rather than home. The impressive growth of broadband Internet subscription in the UNECE region hides, however, the sharp unevenness of the broadband Internet penetration throughout the region. The gap remains significant between and within subregions in terms of the household connection to the Internet and PC penetration. In 2005, the average DSL Internet access penetration rate in Central and Eastern European countries was four per cent of the population, while in the Western European countries it was 12 per cent.

Some researchers have noted that extremely high costs of the Internet connection and services (in terms of per capita income or average monthly wage) in some CIS and Eastern and Central European countries has been hindering the growth of Internet subscription and usage. For example, in Kazakhstan the unlimited dial-up Internet connection package offered by Kazakhtelecom costs about €86 per month; the unlimited ADSL connection – from €102.45. Taking into consideration that the average monthly salary in Kazakhstan was €292 (January 2007), it is not surprising that most of Internet users have been accessing the Internet at their workplaces.

In the EU, liberalization and harmonization policies and policy actions targeting ICT markets have brought about noticeable benefits to all the stakeholders: ICT users, ICT manufacturers, network operators and service providers. These include: reduction of barriers to market entry; harmonization of national regulatory frameworks; public support and encouragement of research and development in the area of ICT; launching and implementation of public projects that had a strong effect on the ICT market as a whole. Further, regulatory changes and policies to promote network interconnection and, hence, application of technologies allowing for interoperability between different devices and equipment, encouraged a convergence of markets and the emergence of new generation telecommunication networks and technologies. Policies and programmes aiming at overcoming digital divides and gaps, such as e-education, e-accessibility, e-health, e-governance, e-justice and e-environment, among others, provided incentives for electronic equipment producers, network operators and service providers to invest in upgrading and/or development of new products and services.

The implementation of the EC Interconnection Directive together with a new licensing regime permitted a large-scale market entry of new operators. In 2004, 20 Member States of the EU transposed a new regulatory framework. The market response to the new regulatory regime in the area of interconnection was an increased competition, resulting in a 14 per cent reduction of the fixed-to-mobile termination rate for operators with significant market power.

In the CIS, most of the countries have undertaken some reform of their telecommunications markets, albeit with different degrees of consistency, but these are still far from being fully developed. These reforms eased the entry of new telecommunications services providers and encouraged the development of new services, mainly, mobile telephony. Many public telecoms diversified by adding new services, such as Internet services, mobile telephony and/or wireless interconnection.

The distribution of Internet traffic is extremely uneven in the UNECE region with the main volume falling on the Internet Exchange Points (IXPs) in the Netherlands and the United Kingdom. A serious technical problem at these two exchanges might severely hamper the entire regional Internet traffic routing. Further, some studies indicate that part of the region's network is already overloaded and suffers from loss of data. The risk of congestion may also increase with intensifying Internet penetration in Europe and Central Asia. In addition, with the growing uptake of multimedia there will likely be an increasingly large traffic

asymmetry between content-heavy networks and end user-heavy networks. Forthcoming massive traffic inflows from Asia and Africa may exacerbate the vulnerability of the regional internet infrastructure. In view of this development present traffic handoff policies might need to be adjusted.

Internationalizing Domain Names in Applications (IDNA), the report notes, would allow local communities to utilize opportunities and capture benefits, which are available at the local markets, by bringing business online, extending the reach and reducing costs of public and private services providers. To overcome the technical hurtle, which is that the ICANN standard for domain names does not allow letters with diacritics that are used by many European languages, requires a political consensus be reached on further developing and implementing internationalized domain names.

Six of the ten leading languages of Internet users in the world are European languages. Facilitating the development of national language content and putting in place technical conditions (IDNA) to facilitate the presence and use of all world languages on the Internet should be a priority for the UNECE region.

The transition countries' choice of priorities and emphasis differ to some extent from that of the EU. The analysis of ongoing conceptual debates and current situations in the CIS countries allow assuming that in the nearest future most CIS Governments will be focusing on:

(a) Creating and/or perfecting ICT legislation;
(b) Building up and/or extending ICT infrastructure;
(c) Human resources development (e-education, e-literacy);
(d) Improving information security; and
(e) E-Government.

1.3 Constraints for Internet development

A number of constraining factors appear to be responsible for the lack of **demand**, affordability and access for ICT and Internet and, ultimately, for the digital divide:

(a) Differences in the availability of ICT/Internet physical infrastructure and, therefore, differences in the level of ICT and Internet penetration;
(b) Differences in per capita income;
(c) Unequal distribution of income, discrimination and/or mental barriers (as in the case of the elderly);
(d) High costs of the ICT equipment (hardware and soft ware) and services;
(e) Lack of awareness of the potential benefits associated with the ICT and the Internet usage;
(f) Lack of trust in the security of online economic transactions;
(g) Reluctance of businesses to uptake informatization of their business operations;
(h) A relatively low level of e-literacy and e-skills among the population.

The most important impeding factors for **supply** were identified as follows:

(a) Monopolization of the ICT sector, and, consequently, the lack of competition;
(b) Loopholes in and/or an underdeveloped ICT institutional regime;
(c) Lack of and/or restricted access of businesses to public financial resources;
(d) Insufficient and unstable level of public and private investment in the ICT/Internet infrastructure development;

(e) Bureaucratization of the decision-making process and implementation of e-development strategies and plans of action;

(f) A relatively high level of the ICT market entry costs.

1.4 The role of UNECE

In conclusion, it appears that all the countries in the UNECE region have made progress on a national level towards a knowledge-based economy. However, a large divide still remains between most transition economies and the western developed countries. It seems that the digital divide has narrowed to some extent, but there is no conclusive catching up from the less advantaged countries. In order to close the divide and change the relative positions between the countries, concerted efforts have to be made both on policy as well as practical levels. It is clear that the transition economies made good level of investment on ICT equipment and infrastructure like many other developing countries.

An additional constraint is the legacy of the centrally planned economies over knowledge production, dissemination and the ICT infrastructure, even in the countries which have implemented formal liberalization reforms. Here an exchange of views and experiences and knowledge of legislative reform could provoke a shift in behaviour and attitudes enabling the creation of new ICT services providers and new consumer services.

UNECE could draw on its expertise in the transition processes, linking experience from developed and former transition countries to those that have still not finalized their transition process. This could be achieved through a policy dialogue facilitated by the UNECE and by sharing know-how from countries encompassing the knowledge-based economy.

UNECE could further facilitate regional cooperation in the area of ICT and Knowledge-based development under the existing framework of the UN Special Program for the Economies of Central Asia (SPECA). In cooperation with the United Nations Economic and Social Commission for Asia and the Pacific (ESCAP), ECE has been contributing capacity-building of ICT policymakers, and created a forum for information exchange among senior policymakers.

Finally, UNECE should contribute to the informatization process in the region by further developing ICT in the work of its sectoral committees.

Chapter 1

TOWARDS A KNOWLEDGE-BASED ECONOMY: PROGRESS ASSESSMENT

Since 2000, there has been a dramatic acceleration of the accumulation and/or build-up process of all the necessary components constituting the foundation of knowledge economy in the UNECE region. Even the poorest countries of the region have undertaken remarkable efforts to catch up with leading countries at least in some areas vital for the development of a knowledge economy.

1.1 Is the digital divide narrowing?

1.1.1 The digital divide between countries

From 2000 to 2005, practically all of the member countries of the UNECE made progress in advancing national capacities and capabilities necessary for participation in the emerging global knowledge economy. However, the speed of progress has been uneven across countries. According to a joint ITU/UNCTAD report presenting the ICT Opportunity Index (ICT OI), a newly developed measure of the digital divide, some countries were able to jump over 6-7 or even 10 ranks in the regional ranking; for example, Israel, the United Kingdom, Latvia and Luxembourg (table 3).[1] Some others, on the contrary, have slowed down their pace: for instance, Canada and Austria.

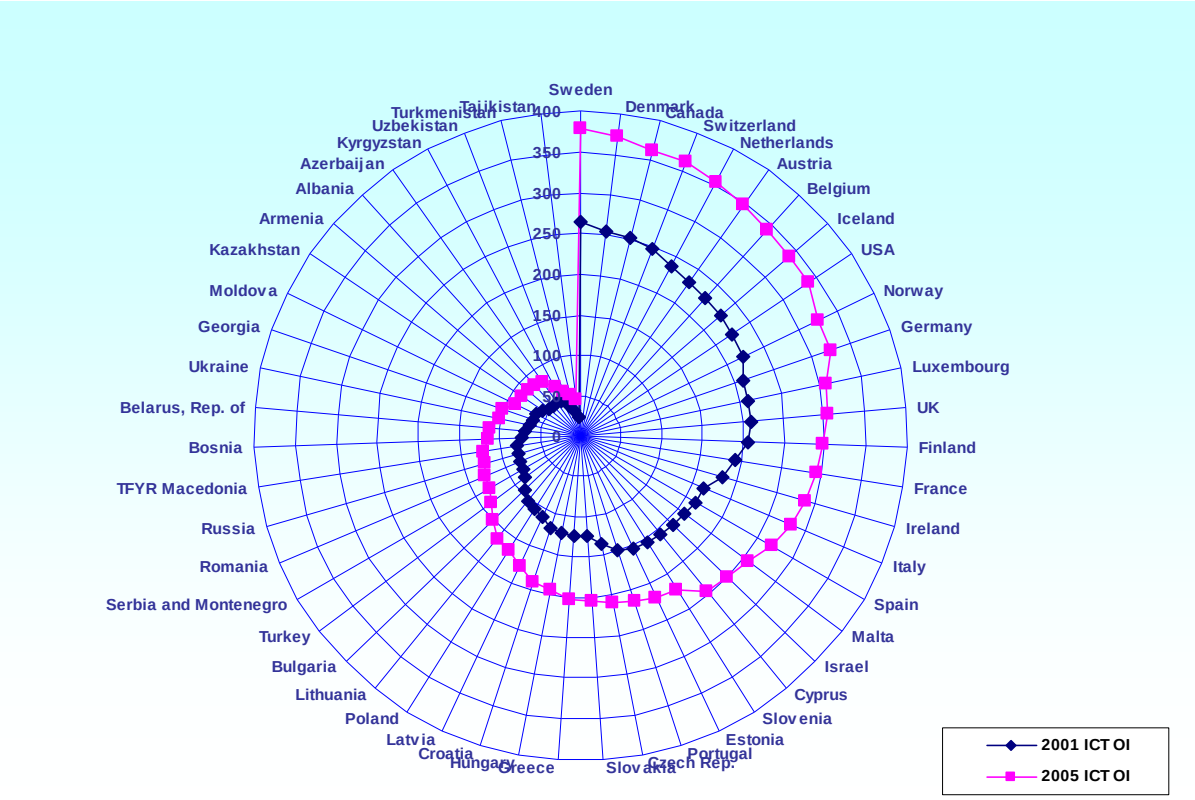
The overall results of the ITU/UNCTAD survey of the ICT economy imply that the digital gap between the countries of the UNECE region has certainly narrowed (figure 1). The difference in the ICT OI score of Sweden (the top performer) and that of Tajikistan (the bottom performer) was reduced from 1:11 to 1:8.

The digital divide also exists at the subregional level. Thus, for example, in the CIS, the gap between Russia (the top subregional performer) and Tajikistan remained practically unchanged (1:3), as well as between Russia and the rest of the CIS (figure 2). This suggests that the countries of the subregion have been advancing at the same speed. However, they have shown marked differences in performance. For example, Tajikistan, one of the poorest countries of the region, practically doubled its ICT OI score, increasing it by 92 per cent (table 3). Kyrgyzstan, Uzbekistan and Turkmenistan, on the other hand, have a very modest increase in their scores, allowing them to preserve their 2001 ranks.

Georgia has moved one rank down, switching place with Moldova. Ukraine and Kazakhstan gained a modest increase in their scores, respectively, by 58 and 53 per cent. Belarus, the Russian Federation, Moldova and Armenia significantly improved their average scores, respectively, by 76, 71, 71 and 69 per cent, during 2001-2005. None of the CIS, however, were able to move out from the group of medium average performers.

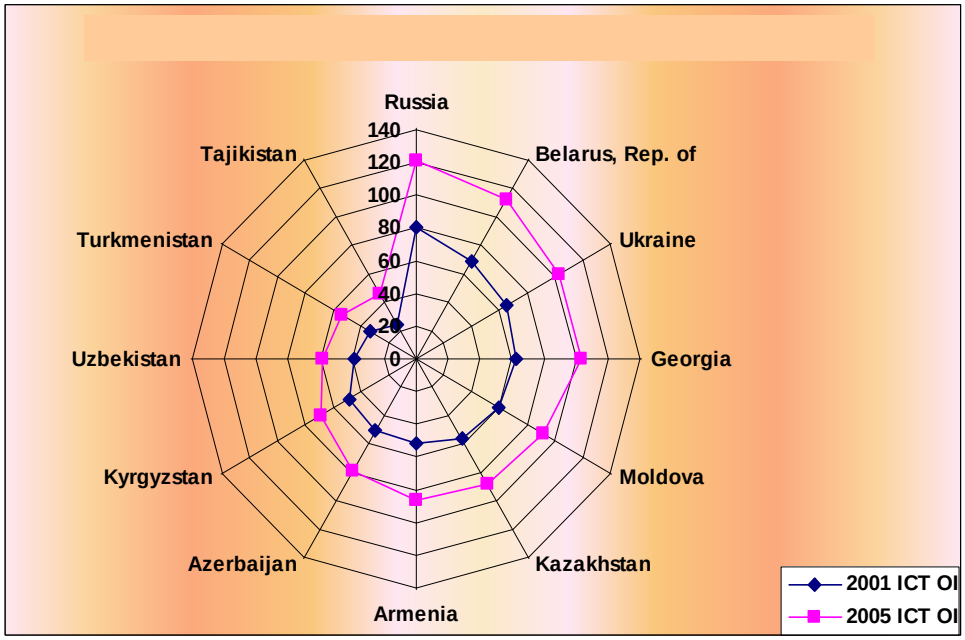
[1] ICT OP measures access to and usage of ICT by individuals and households in an inclusive sense. Conceptually, it is based on the dual nature of ICT: ICT as a productive asset and ICT as a consumer good. Therefore, it incorporates indicators reflecting (a) a country's overall capital as well as labor stocks to evaluate a country's productive capacity (supply side), and (b) those that capture the consumption flows of ICT. All these indicators are aggregated; first, to produce two sub-indexes: Infodensity sub-index and Infouse sub-index, which then are used to generate a country's ICT OP (See: ITU/UNCTAD. *2007 World Information Society Report. Beyond WSIS*, Geneva, June 2007).

Figure 1. The digital gap in the UNECE region: Changes in the ICT Opportunity Index, 2001 and 2005



Source: ITU/UNCTAD. *2007 World Information Society Report: Beyond WSIS*, Geneva, June 2007.

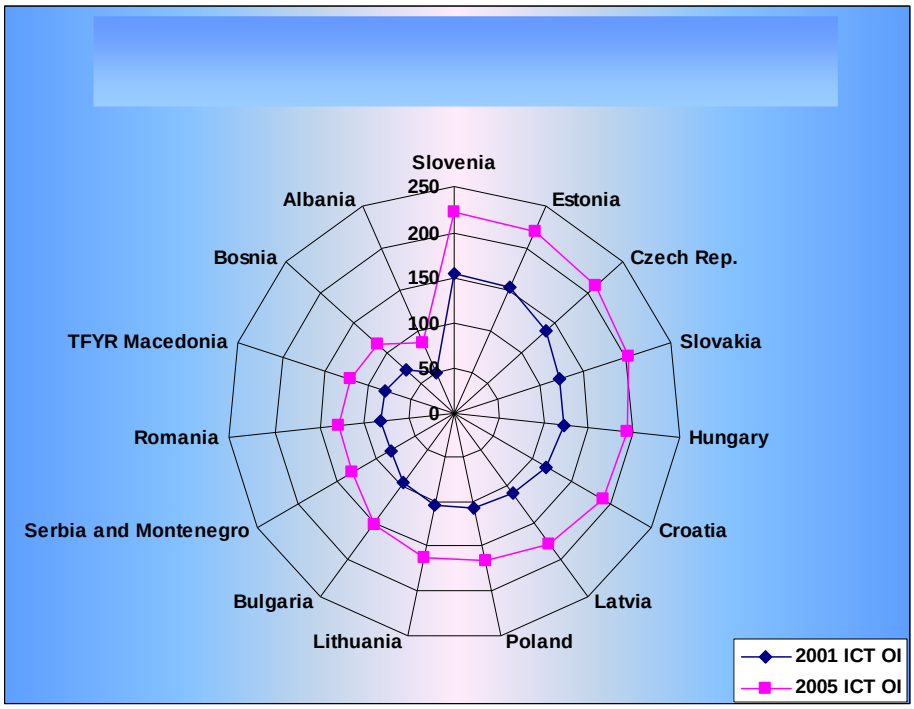
Figure 2. The digital gap in the CIS subregion, 2001 and 2005



Source: ITU/UNCTAD. *2007 World Information Society Report: Beyond WSIS*, Geneva, June 2007.

In Eastern and Central Europe, the situation appears similar to that in the CIS, although this subregional grouping is more advanced on the average than the CIS (figure 3). In 2001 the digital gap between Slovenia (the top subregional performer) and Albania (the bottom subregional performer) was 1:3. It has not changed since then, although in 2005 Estonia became the top subregional performer. Estonia and Slovenia continue outperforming the rest of the countries of the subregion. Estonia moved five ranks up, reaching the eighteenth position in the UNECE regional ranking outpacing Slovenia. Latvia is another showcase of the subregion. It was the only one of the 27 countries with the ICT OI score below the 2001 regional average, which made it to the upper performers' group. Lithuania has also accelerated its pace; climbing five ranks in the UNECE Member States' ranking, and Romania gained 86 per cent in its score and moved three ranks up (table 3). The smallest increase of the ICT OI score was registered for Bulgaria (30%) and Serbia and Montenegro (36%), resulting in the loss of their previous position in the regional ranking, respectively, three and five ranks down.

Figure 3. The digital gap in the subregion: Central and Eastern Europe, 2001 and 2005



Source: ITU/UNCTAD. *2007 World Information Society Report: Beyond WSIS*, Geneva, June 2007.

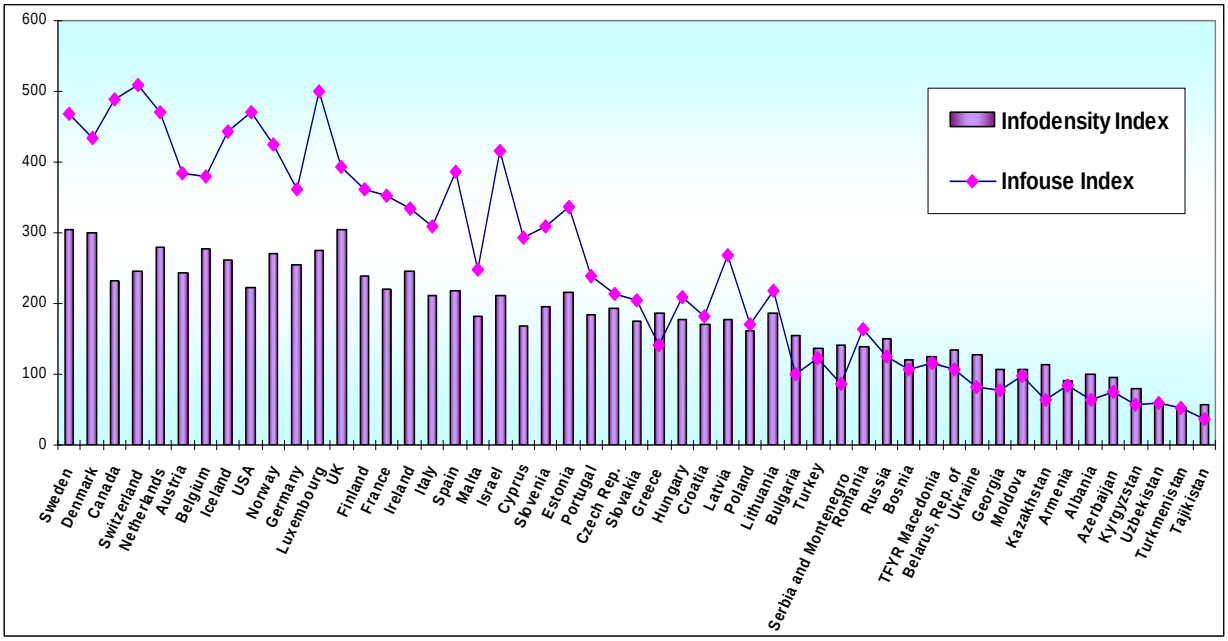
A more detailed analysis of the UNECE member States' ICT OI allows factors to be identified which are responsible for differences in performance among the countries of the region (table 4). Highly developed ICT networks (in terms of fixed and mobile telephony and international Internet bandwidth penetration) have been one of the key factors behind a rapid evolvement of a knowledge economy in Western European countries, United States, Canada, but also in Estonia, Lithuania and Israel. While educational achievements of population (adult literacy rates and primary, secondary and tertiary gross enrollment rates) constitute an important precondition for development of a knowledge economy, they may remain largely under-utilized, if the ICT infrastructure is not sufficiently developed, thus constraining the access to and use of information and knowledge by the population. This seems to be the case in the majority of the CIS and in some Balkan countries.

Other components of the ICT OP, particularly the uptake and intensity sub-indexes, bring to light other aspects of the digital divide in the UNECE region. There is a large gap between the UNECE member States in terms of Internet usage, computer and TV availability (uptake sub-index). Taking into

consideration existing disparities in the size and level of development of the ICT infrastructure, it is not surprising to note such significant differences in the intensity of ICT use (intensity sub-index) as well.

In some countries with a low uptake index, the use of information flows has been relatively high: for example, in Tajikistan, Uzbekistan, Turkmenistan, Kyrgyzstan and Albania. This could be explained by two factors: a recent leap in mobile telephony penetration and a large outflow of temporary migrants to neighboring countries. In more advanced countries, high intensity of information usage could be attributed to the latest technological advancements, particularly, to the diffusion of broadband Internet. Significant differences that exist across and within countries between the infodensity (national capacities and capabilities to generate and deliver knowledge and information) on the one hand, and the infouse (the intensity of usage of ICT products and services) on the other, suggest that other factors than technology alone play a certain role in determining the development patterns and pace of a knowledge economy in the UNECE region (figure 4).

Figure 4. Infodensity and infouse ICT opportunity index sub-indexes



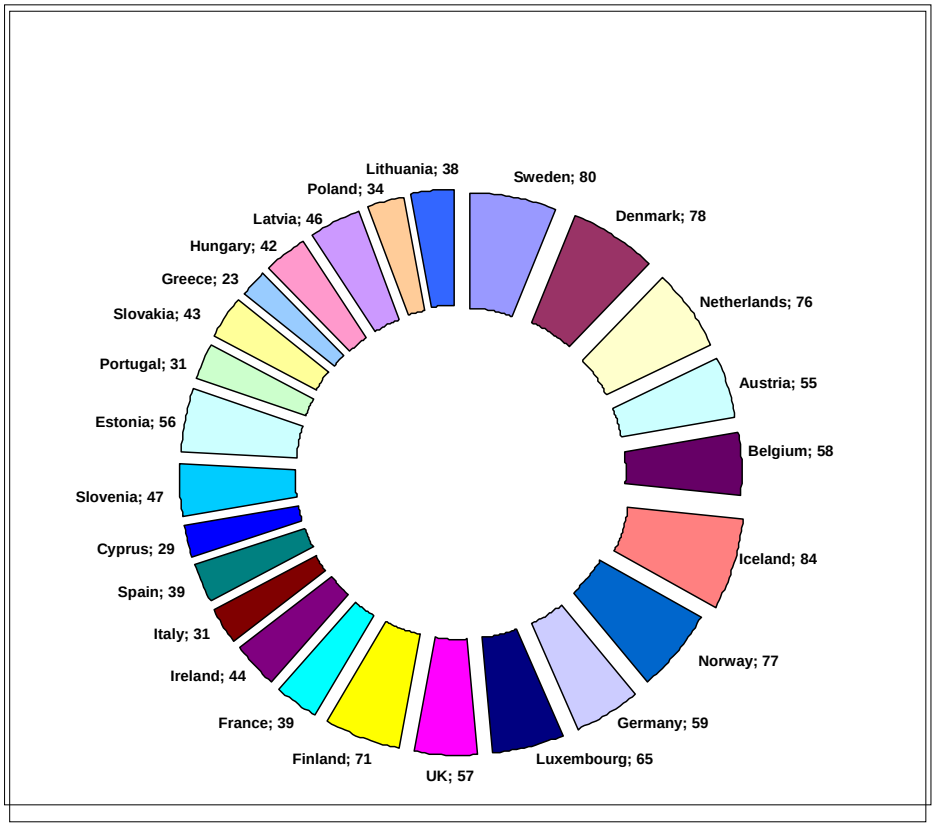
Source: ITU/UNCTAD. *2007 World Information Society Report: Beyond WSIS*, Geneva, June 2007.

1.1.2 The digital divide within countries

The digital divide within UNECE member States, including some of the most advanced ones, has also not vanished and continues to endure, although it has been gradually shrinking due to efforts, undertaking both by Governments and civil society groups. The digital divide, according to various definitions, has several dimensions: social (gender, age, health status, ethnicity, education level), economic (income, employment, size of business), geographic (rural vs. urban, territorial location). According to the EUROSTAT, among the EU Member States, the proportion of households with Internet access in 2006 ranged from 23 per cent in Greece to 80 per cent in the Netherlands, the proportion of individuals using Internet at least once a week – from 23 per cent in Greece to 84 per cent in Iceland (tables 5 and 6, and figure 5).

The Internet users in all the EU countries are overwhelmingly males. Only a few countries reached the point of closing the gender digital gap: Iceland – with a proportion of Internet users among males and women, respectively, 86 per cent and 82 per cent; Denmark, correspondingly, – 80 per cent and 76 per cent; Sweden – 84 per cent and 76 per cent; and Norway – 80 per cent and 73 per cent.

Figure 5. Proportion of individuals using Internet at least once a week in the EU 25, 2006



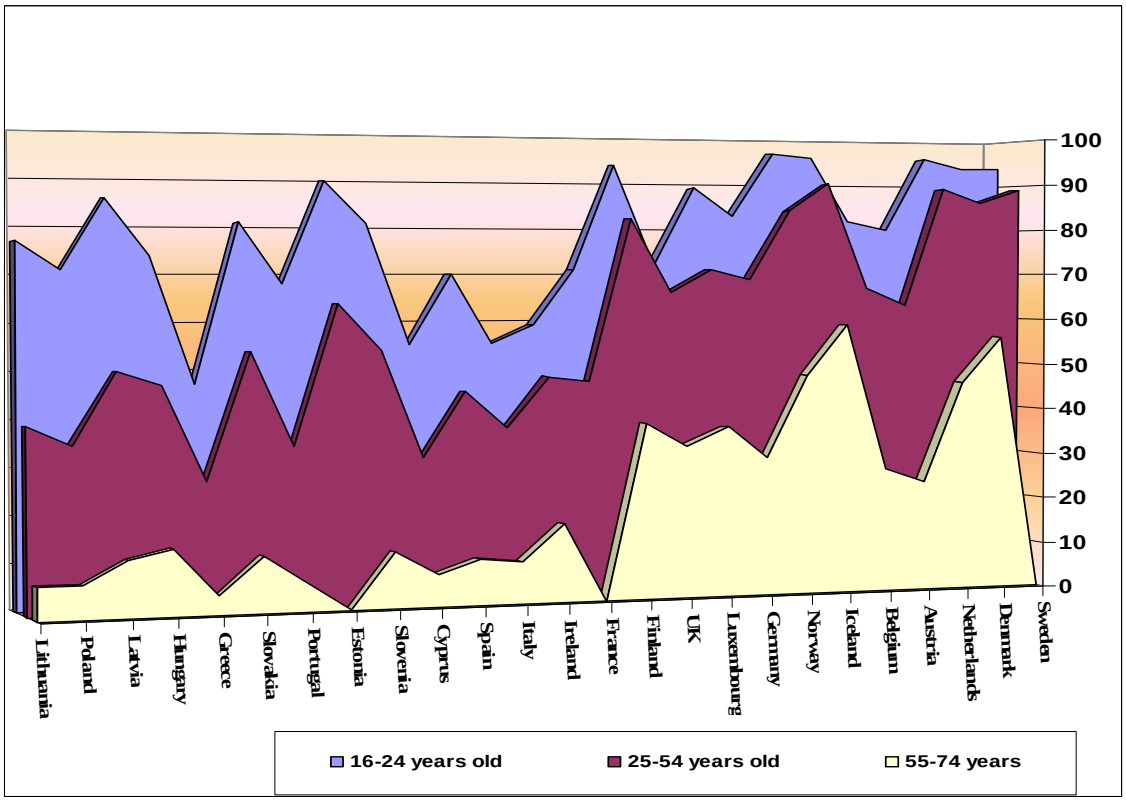
Source: EUROSTAT Press release, "Internet Usage in the EU25", 10 November 2006, STAT/06/146.

As seen from figure 6, the digital age gap is rather pronounced in all EU Member States. The highest incidence of Internet use is among the youth (16-24 years old), and the lowest among the age group of 55 to 74 years old. However, the situation differs from country to country. Iceland achieved outstanding results in narrowing the digital age gap. The incidence of Internet use in each of the age groups was, respectively, 96 per cent, 90 per cent and 59 per cent (table 6). Impressive progress was also made in this respect by Denmark with corresponding results, 94 per cent, 86 per cent, 56 per cent; and Sweden – 94 per cent, 89 per cent, 56 per cent. Greece, Cyprus and Italy have been significantly lagging behind the rest of the EU 25, including new member States (Estonia, Hungary, Latvia, Lithuania, Poland, Slovakia, and Slovenia).

The rural-urban digital divide is also considerable in some of the EU Member States (table 7 and figure 7). As on 1 January 2005, broadband, for example, was available to more than 90 per cent of EU 15/EEA-urban population but only to 62 per cent of its rural population. Only in few countries, Belgium, Denmark, Luxembourg and the Netherlands, the Digital Subscriber Line (DSL) coverage of rural and urban population was equal in 2005. But in Slovakia and Slovenia the coverage of rural population was less than 30 per cent. According to some estimates, at least 4.7 million people in remote and rural regions of the EU 25 will be excluded by commercial rollout in 2013 due to high cost of deployment caused by distance and population scarcity.[2]

[2] Source: Commission of the European Communities. *i2010 – Annual Information Society Report 2007*, Vol. 3, Brussels, 30.3.2007, SEC(2007) 395; IDATE Consulting and Research. Broadband Coverage in Europe, Final Report, 2006 Survey, November 2006.

Figure 6. Internet use by individuals in each age group in the EU 25, 2006
(percentage)



Source: EUROSTAT Press release, "Internet Usage in the EU25", 10 November 2006, STAT/06/146.

The patterns of digital division are practically the same throughout the entire UNECE region. However, the corresponding digital divides and gaps in most of the CIS are wider and deeper due to the overall shortage of and/or aging of the ICT infrastructure. Vast territory, disperse population settlement and low population density in some countries (Russian Federation, Kazakhstan and Turkmenistan, for example), in combination with a relatively lower than in most European countries per capita income and average wages further constrain the evolution of knowledge economy in this subregion. This is especially true with regard to the Russian Federation. Its gigantic territory, severe climatic conditions in most of the regions, low population density, uneven geographic distribution of capital assets and production capacities, including those of the ICT, human resources and economic opportunities present a formidable challenge. This could be seen, at least in part, from digital disparities across Russia's regions. According to the 2005 e-readiness assessment carried out by the Russian Institute of the Information Society (IIS), only 12 of the 88 regions of the Russian Federation may be considered well equipped for the knowledge economy uptake (table 8).[3] These are, first of all, two largest Russian cities – Moscow and Saint Petersburg (with the index score, respectively, 5.65 and 4.86), followed by Khanty-Mansi Autonomous Okrug (Area), Yamal-Nenets Autonomous Okrug, Tomskaya, Samarskaya and Murmanskaya oblasts, Chukchi Autonomous Okrug (Area), Nenets Autonomous Okrug, and the Autonomous Republic of Karelia.

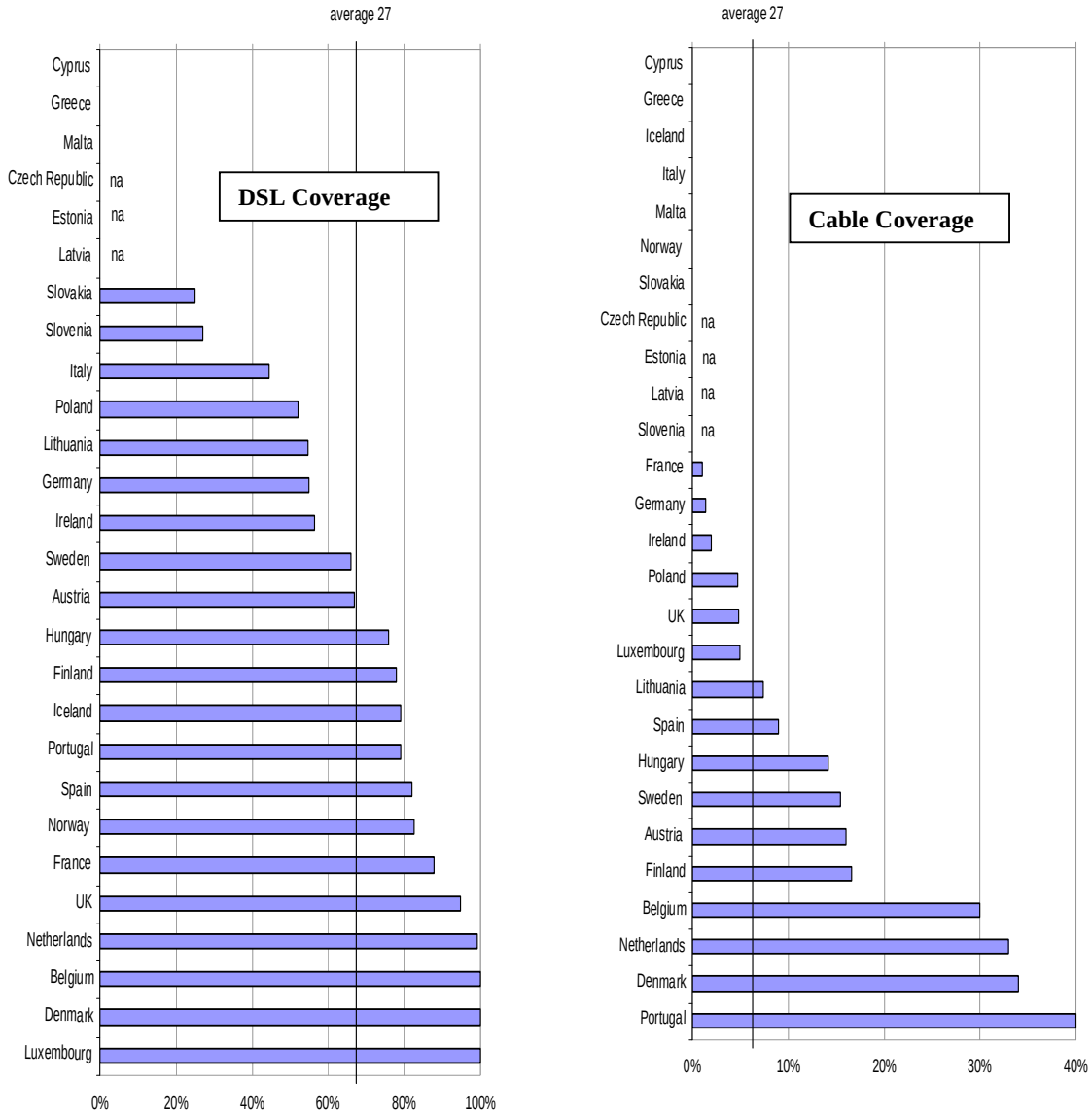
The IIS study reveals the magnitude of the developmental and politically sensitive problems facing the Russian Federation and its regions. The ICT imbalances between Russia's 31 autonomous republics and *okrugs* are as significant as those on the nation-wide scale. Thus, the national average of the e-readiness index score was 2.98, and it ranged between 1.96 (the Ingush Autonomous Republic) and 5.65 (Moscow).

[3] The methodology applied for assessing the e-readiness of the Russian regions was similar to that of the Networked Readiness Index (NRI) constructed for the World Economic Forum. For more information see: http://www.iis.ru.

The average of the index scores of the 31 autonomous republics and autonomous okrugs was 2.83 spanning from 1.96 (the Ingush Autonomous Republic) to 4.41 (the Khanty-Mansi Autonomous Okrug). Hence, the territorial digital divide in Russia has also a distinct ethnic characteristic. To solve this problem and equalize ICT opportunities for each and every nationality and ethnic group would require from Russia a significant investment not only in furthering the development of regional ICT infrastructures but also in creating conditions which could ensure that spatial, linguistic and/or economic barriers are not preventing individuals from participation in and/or capturing the benefits of knowledge economy.

Figure 7. DSL and cable coverage in rural areas at the end of 2005

(percentage of inhabitants)



Source: IDATE Consulting and Research. Broadband Coverage in Europe. Final Report, 2006 Survey, November 2006.

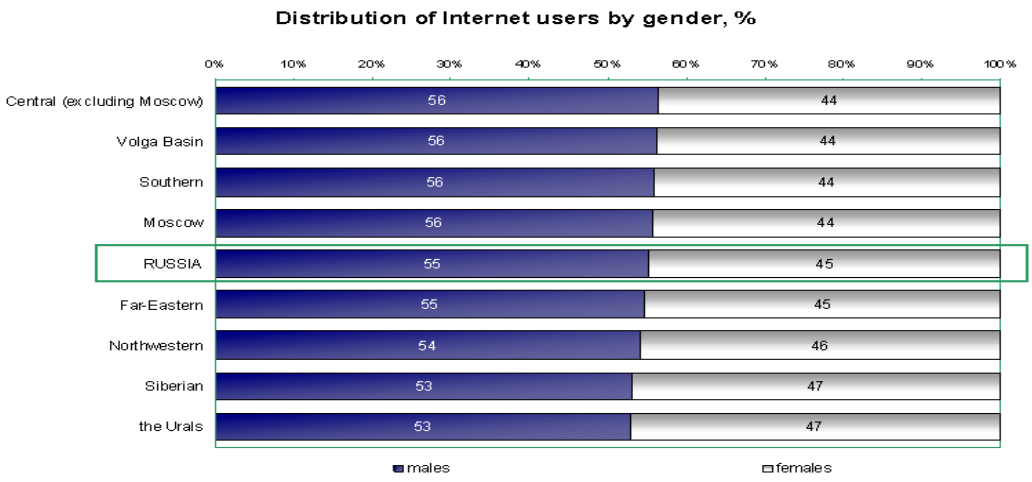
The regional distribution of Russia's Internet users is a reflection of regional infrastructural disparities. Most of the Russian Internet users are located in the European part of the country. The combined share of the eastern regions (behind the Urals) is only 16 per cent, less than that of Moscow. The above data

conceals another important digital divide – the divide between rural and urban population. Almost all of the Internet users as well as fixed and mobile telephone in Russia are urban inhabitants.

Apart from geographic location and nationality/ethnicity, gender, age and/or social status also play an important role in shaping the profile of the digital divide in Russia and other CIS. Available data suggest that the gender and age digital divides are much more prominent in the CIS than in the EU Member States. Figures 8 to 11 below attest a current situation in Russia. They show that the most important factors constraining the participation of social groups in emerging knowledge economy are age and level of income. Limited data on other CIS countries point to the same underlying causes of the digital divide. Thus, in 2005, the average price of a basic computer in Russia was €420 (or 14,420 roubles), or about 17.25 per cent of the average salary.[4] In Ukraine, the cost of a personal computer was twice the average monthly salary. In Armenia, where the average monthly wages in the public and the private sector were, respectively, €50 and €125, the cost of Internet connection in Yerevan (the capital) ranging from €20 to €35 per month for a dial-up connection and from €60 to € 100 per month for a shared xDSL connection at 128 Mbps, the ownership and use of a personal computer at home was a luxury for the majority of the city population.[5]

The gender digital divide, according to available data, was similar to that of Russia in Kyrgyzstan and Kazakhstan, where the percentage of females among Internet users was 45 in 2005. It was, however, larger in Belarus (only 17.5% of Internet users are women), Azerbaijan (30%) and Tajikistan (7 to 10%).[6]

Figure 8. The gender digital divide in selected regions of the Russian Federation



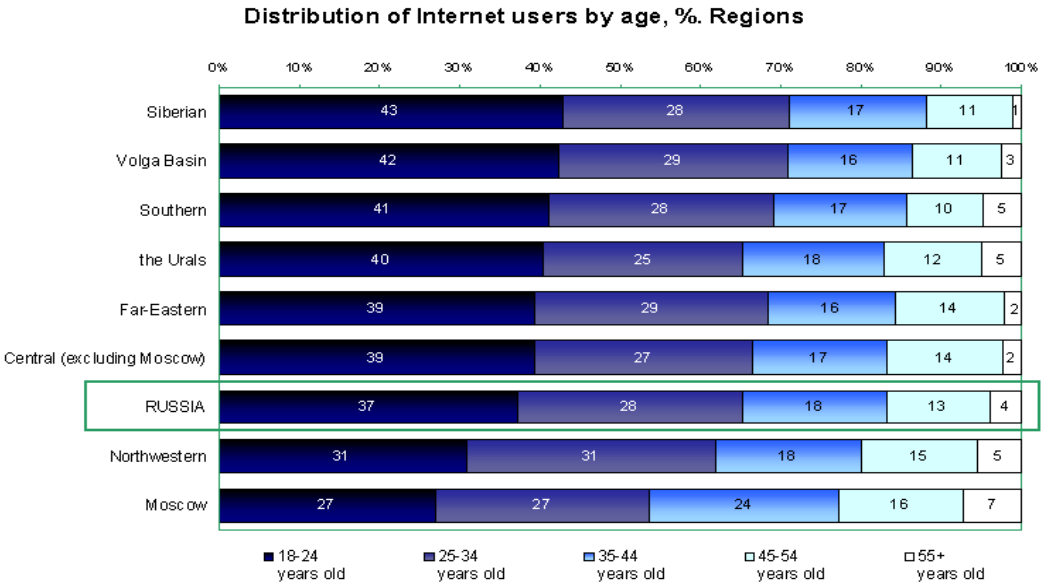
Source: The Public Opinion Foundation. Project, The Internet in Russia/Russia on the Internet. Eighth release. Winter 2006-2007.

[4] Political Intelligence. Final Report: Monitoring of Russia and Ukraine (priority 1), and Armenia, Azerbaijan, Georgia, Kazakhstan and Moldova (priority 2): Telecommunications and the Information Society. Commission contract No: 30-ce-0009814/00-41, December 2006.

[5] Ibid.

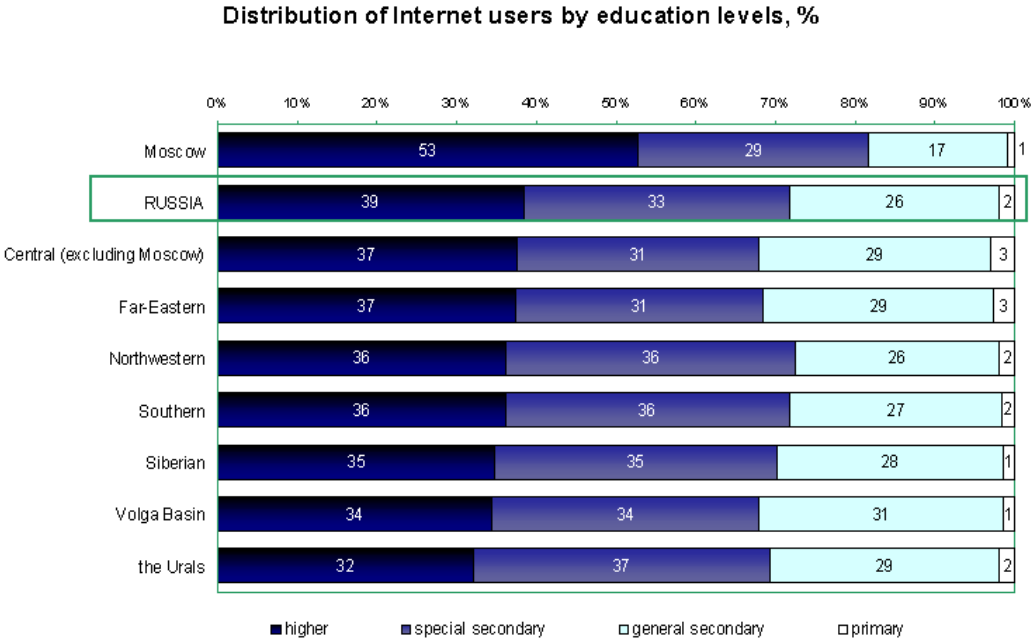
[6] ITU database and other sources.

Figure 9. The age digital divide in selected regions of the Russian Federation



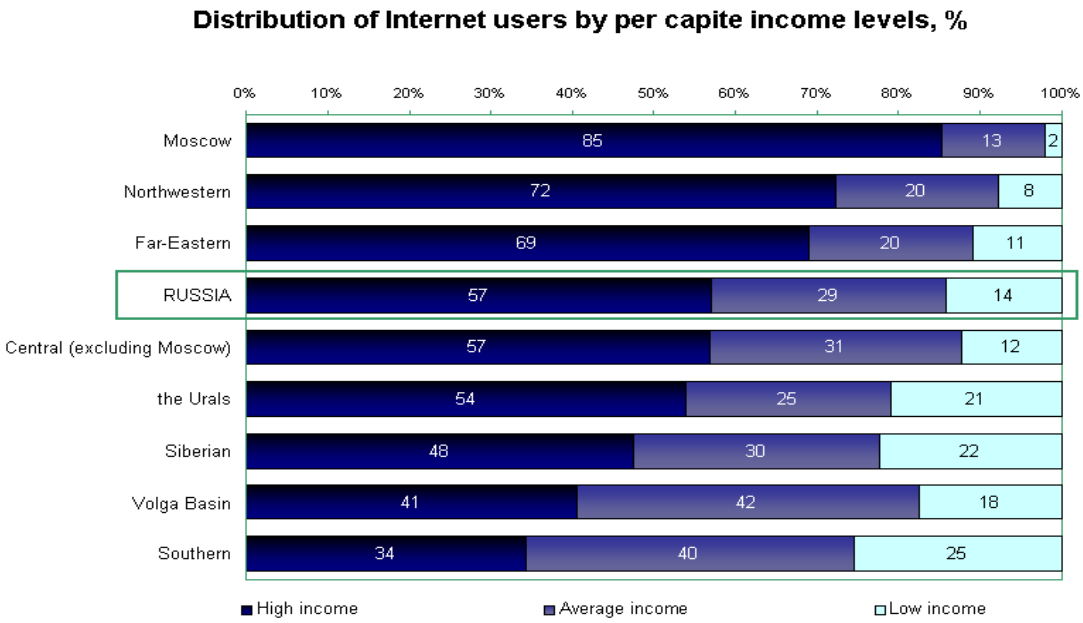
Source: The Public Opinion Foundation. Project, The Internet in Russia/Russia on the Internet. Eighth release. Winter 2006-2007.

Figure 10. The digital divide by level of education in selected regions of the Russian Federation



Source: The Public Opinion Foundation. Project, The Internet in Russia/Russia on the Internet. Eighth release. Winter 2006-2007.

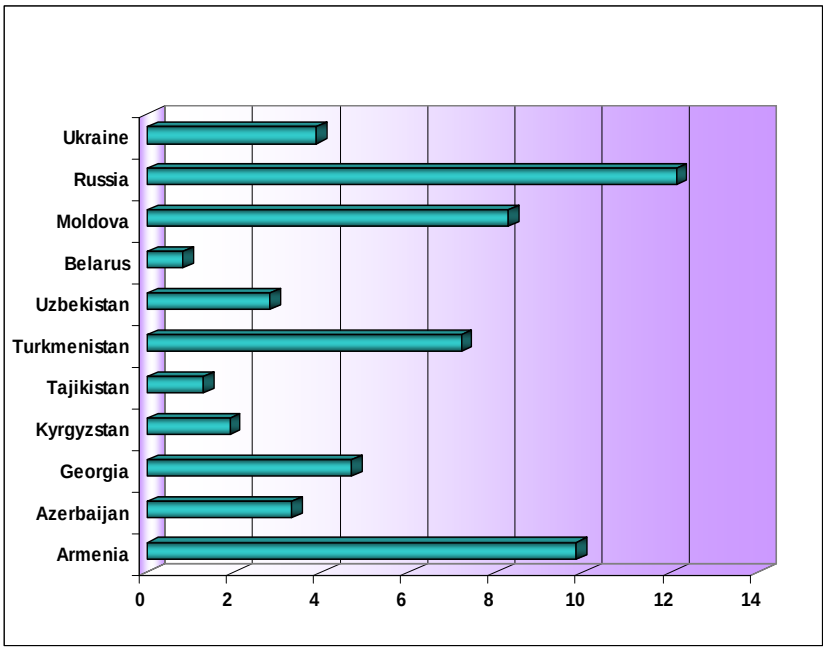
Figure 11. The digital divide by level of income in selected regions of the Russian Federation



Source: The Public Opinion Foundation. Project, The Internet in Russia/Russia on the Internet. Eighth release. Winter 2006-2007.

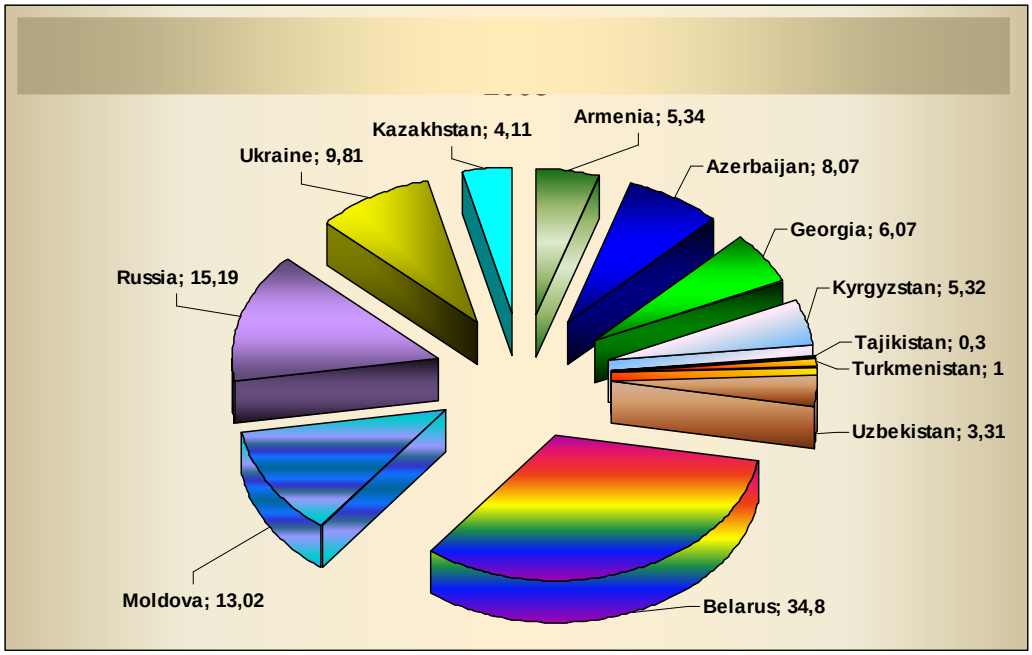
On the whole, according to ITU data, Internet and personal computer penetration rates are comparatively lower in most of the CIS than in the majority of the EU Member States (figures 12 and 13, and table 7).

Figure 12. Personal computers per 100 inhabitants in CIS, 2005



Source: ITU database. Data reproduced with the kind permission of ITU.

Figure 13. Internet users per 100 inhabitants in CIS, 2005



Source: ITU database. Data reproduced with the kind permission of ITU.

The above measurements may not capture the true picture due to a widespread practice of sharing access to personal computers and/or the Internet.

1.1.3 Underlying causes of the digital divide

Since the mid- of the 1990s numerous studies and surveys have attempted to highlight the underlying causes of the digital divide. Most findings could be grouped as follows:

(a) *Global and regional levels*: Unevenness of the global development process; differences in the level of economic development; differences in the human resources development; differences in the adopted development model; differences in the political regime, differences in culture etc.

(b) *Macro (national) level:* Monopolization of the ICT market and consequent lack of competition; inefficient and/or week institutions; lack of financial resource; lack of or underdevelopment of the ICT infrastructure; sizable poverty and pronounce income inequality (affordability issues); relative lack of skills among the labor force; lack of the key stakeholders' awareness; lack of government commitment to ICT development; systemic corruption; ineffective public policies etc.

(c) *Micro level (enterprises, NGOs, individuals)*: Constrained access to the ICT market due to either monopolization of the market and/or corruption; absence of ICT services provision in the geographic area (connectivity and access issues); lack of knowledge and understanding of the potential benefits of using ICTs among individuals and small and medium-sized enterprises (SMEs); lack of ICT skills; high costs associated with acquisition of computer skills, PC and equipment, and with the usage of the Internet (affordability issues); risks associated with the use of the Internet (security issues); unclear regulatory environment with regards to access to information, privacy, dispute settlement, web content, IPRs and other; specific barriers to the usage of the Internet being faced by disabled, elderly, and some other social groups (accessibility issues).

Therefore, the diffusion of new technologies and, particularly, of ICT could be impeded by various factors: economic, social, cultural, political, as well as geographic. In this context, the member States of the UNECE represent a diverse group of countries differing from each other in many respects. From the perspective of the Information Society, the recent historic experience of a large group of the UNECE countries, particularly, the Eastern and Central European countries and the CIS, should not be disregarded. This historic experience left an imprint on the social fabric of these countries, which interplays with other factors and, therefore, impacts on the development process in these countries. It reveals itself in various forms such as, for example, a tendency to ignore intellectual property rights or the right to privacy, or a tendency to impose centralized control over sources of information and to exclude some of the key stakeholders from the decision-making process regarding e-development strategies and policies. In some countries, a revival of nationalistic sentiments coupled with a resurgence of discriminatory practices based on gender, age, health status and/or ethnicity also impose artificial barriers to accessing new skills and technologies. The legacy of the absolute State control over the knowledge production and dissemination and the ICT infrastructure designed to provide support for the state monopoly in these countries continue to constrain the ICT uptake even in the countries, which implemented formal liberalization reforms. In some instances, the patterns of relationship, behavior and attitudes that were shaped in the past continue operating informally resulting in the monopolization of the access to market opportunities and control by groups with vested interests over the access to resources, thus, preventing the emergence of new ICT services providers and new consumer services.

As was highlighted above, advanced countries of the UNECE region are not free of barriers constraining the access to and utilization of the ICT and Internet potential benefits. Some of them, for example, the United Kingdom, Germany, France, Spain and Portugal have social groups significantly lagging behind the mainstream society in terms of the ICT usage. These are: recent immigrants, racial and ethnic minorities, children from poor families and disadvantaged communities, disabled and long-term unemployed people, and population of remote areas. Hence, it is not surprising that e-Inclusion strategy is viewed as one of the means in achieving a larger objective – a strengthening of the social solidarity and social cohesion in the EU Member States.

1.2 Strategies and policies to bridge digital divides

Since 2000, practically all countries of the UNECE region have adopted national e-strategies. Depending on developmental problems facing a country, the major emphasis of e-strategy could vary focusing on either of the directions:

- Sustaining wealth creation process by improving and strengthening the competitiveness of national producers in the globalizing world;
- Catching up with advanced economies of the region;
- Further improving quality of life of the population;
- Equalizing opportunities for different social groups to participate in and benefit from Post-industrial economy and Information Society.

Most countries of the UNECE region follow the lead of the EU Member States which have embarked on implementing an e-Inclusion initiative attempting to bring all relatively marginalized social groups into the mainstream economic and social activities (box 1). This new policy complements both the Lisbon Council agreement of 2000 and i2010 strategy "A European Information Society for growth and employment" aiming at the creation of a Single European Information Space, strengthening innovation and investment in ICT research and achieving an inclusive European information and media society.

Box 1. E-Inclusion policy of the European Union

The Lisbon Council in 2000 agreed to make a decisive impact on the eradication of poverty and social exclusion by 2010 in the EU. Through the Open Method of Coordination Member States are encouraged to set out concrete steps in their National Action Plans against poverty and social exclusion and to improve access to the new ICTs and opportunities new technologies can provide. The Riga Ministerial Declaration on e-Inclusion of June 2006 demonstrated the commitment of EU Member States. It has identified six themes which the European Commission uses to foster e-Inclusion. Overall objectives of the thematic areas include:

E-accessibility - make ICT accessible to all, meeting a wide spectrum of people's needs, in particular any special needs.

E-ageing - empower older people to fully participate in the economy and society, continue independent lifestyles and enhance their quality of life.

E-competences - equip citizens with the knowledge, skills and lifelong learning approach needed to increase social inclusion, employability and enrich their lives.

Socio-cultural e-inclusion - enable minorities, migrants and marginalized young people to fully integrate into communities and participate in society by using ICT.

Geographical e-inclusion - increase the social and economic well being of people in rural, remote and economically disadvantaged areas with the help of ICT, and

Inclusive e-government - deliver better, more diverse public services for all using ICT while encouraging increased public participation in democracy.

"E-inclusion" means both inclusive ICT and the use of ICT to achieve wider inclusion objectives. The initiative focuses on participation of all individuals and communities in all aspects of the information society. E-inclusion policy, therefore, aims at reducing gaps in ICT usage and promoting the use of ICT to overcome exclusion, and improve economic performance, employment opportunities, quality of life, social participation and cohesion.

By implementing e-inclusion policies EU Member States intend to reduce the current differences in Internet usage (between current average use by the EU population and the use by older people, people with disabilities, women, lower education groups, unemployed and "less developed" regions) by half by 2010.

Source: Economic Commission website:
http://ec.europa.eu/information_society/activities/einclusion/index_en.htm.

A strong underpinning of the EU e-inclusion initiative is equality of opportunity understood as a human right. The e-inclusion initiative is based on the belief that each member of society is entitled to full participation in the mainstream social and economic activities, and that new technologies underlying and/or driving the transformation process towards Information Society can be used to support and further increase social cohesion. Conditions enabling each and every citizen of the EU Member States to take part in and reap benefits of the emerging information society and knowledge economy should also incorporate those, which make it possible for individuals to exercise their right to information. He or she should be equipped, in terms of capability (skills, knowledge etc.) and in terms of capacity (accessibility to or ownership of PC or other technological devices, access to Internet, information and to other telecommunication services). To achieve the goals and targets lay down by the Riga Declaration the EU

Member States must formulate and implement policies and programmes, which are tailored to specific needs of underrepresented and/or excluded groups (box 2). The e-Europe + action plan is designed in a way that allows for meeting relevant goals in a number of areas (institutions, ICT infrastructure, employment, education, health etc.) by mainstreaming ICT into all the EU sectoral programmes.

A review of the situation in the EU, including the EU Member States in Central and Eastern European subregions, indicates that most of the countries have adopted an e-inclusion strategy tailored to their needs, which differ significantly from country to country. Many of the new EU Member States considerably lag behind the EU 15 with regard to ICT penetration and usage. Furthermore, some of the composite indexes imply that the EU Member States do not constitute a homogeneous group and could be clustered into distinct country-groupings. For example, one study, using the ICT Maturity Index, identifies five distinct country groupings among the EU 25:

(1) Laggard CEEC;
(2) Frontrunner CEEC;
(3) Laggard EU 15;
(4) Follower EU 15,
(5) Frontrunner EU 15 (table 1).[7]

Table 1. The European Union ICT frontrunners and laggards

Laggard CEEC	Latvia	Lithuania	Hungary	Poland	Slovakia	Bulgaria	Romania
Frontrunners CEEC	Czech Republic	Estonia	Slovenia				
Laggard EU15	Greece	Spain	France	Italy	Portugal		
Follower EU15	Belgium	Germany	Ireland	Luxembourg	Austria		
Frontrunner EU 15	Denmark	Netherlands	Finland	Sweden	United Kingdom		

Source: Empirical/World Research Centre/University of Bath. Thematic Study to Analyse policy measures to promote access to information technologies as a means to combating social exclusion. Final Report, Bonn, February 2006.

The countries that form the laggard group within the new EU Member States share some common characteristics, including a sizeable rural population and unfinished regulatory reforms. They are relatively poorer than the rest of the group. Therefore, it is not surprising that these countries have been lagging behind in terms of ICT availability and accessibility. Within the EU 15, some of the Southern European countries (Spain, Portugal and Greece) were the latecomers to the EU. By many parameters, they are still behind the most advanced Member States of the EU 15.

Another composite index, the World Economic Forum Networked Readiness Index (NRI), which depicts a nation's degree of preparation to participate in and benefit from new ICT developments, largely confirms the existence of distinct country clusters in the EU (and in the UNECE region as a whole). It further spotlights the existing gaps and divides between and within the countries, particularly, in the institutional area. The index also reflects advancements and failures, which, in some instances, could be a direct result of policies (table 2).[8]

[7] The ICT Maturity Index is a composite index based on six variables: Internet users, computer users, people with Internet home access, PIAP users, regular e-commerce users, and owner of mobile phones (source: Empirica/World Research Centre/University of Bath. Thematic Study to Analyse Policy Measures to Promote Access to Information Technologies as a Means to Combatting Social Exclusion. Final Report, Bonn, February 2006).

[8] The Networked Readiness Index is a composite of three components: the environment for ICT offered by a given country or community, the readiness of the community's key stakeholders (individuals, businesses, and governments) to use ICT, and finally the usage of ICT amongst these stakeholders (World Economic Forum 2004, p. 4).

Table 2. The Networked Readiness Index score in UNECE member States, 2002-2007

Country	*NRI 2002-2003*	*World rank*	*Regional rank*	*Country*	*NRI 2006-2007*	*World rank*	*Regional rank*
Finland	5.92	1	1	Denmark	5.71	1	1
United States	5.79	2	2	Sweden	5.66	2	2
Sweden	5.58	4	3	Finland	5.59	4	3
Iceland	5.51	5	4	Switzerland	5.58	5	4
Canada	5.44	6	5	Netherlands	5.54	6	5
United Kingdom	5.35	7	6	United States	5.54	7	6
Denmark	5.33	8	7	Iceland	5.50	8	7
Germany	5.29	10	8	United Kingdom	5.45	9	8
Netherlands	5.26	11	9	Norway	5.42	10	9
Israel	5.22	12	10	Canada	5.35	11	10
Switzerland	5.18	13	11	Germany	5.22	16	11
Austria	5.01	16	12	Austria	5.17	17	12
Norway	5.00	17	13	Israel	5.14	18	13
France	4.97	19	14	Estonia	5.02	20	14
Ireland	4.89	21	15	Ireland	5.01	21	15
Belgium	4.83	22	16	France	4.99	23	16
Estonia	4.69	24	17	Belgium	4.93	24	17
Spain	4.67	25	18	Luxembourg	4.90	25	18
Italy	4.60	26	19	Malta	4.52	27	19
Luxembourg	4.55	27	20	Portugal	4.48	28	20
Czech Republic	4.43	28	21	Slovenia	4.41	30	21
Hungary	4.30	30	22	Spain	4.35	32	22
Portugal	4.28	31	23	Hungary	4.33	33	23
Slovenia	4.23	33	24	Czech Republic	4.28	34	24
Latvia	3.87	38	25	Italy	4.19	38	25
Poland	3.85	39	26	Lithuania	4.18	39	26
Slovakia	3.85	40	27	Slovakia	4.15	41	27
Greece	3.77	42	28	Latvia	4.13	42	28
Lithuania	3.65	46	29	Croatia	4.00	46	29
Croatia	3.62	48	30	Greece	3.98	48	30
Turkey	3.57	50	31	Turkey	3.86	52	31
Bulgaria	3.03	68	32	Romania	3.80	55	32
Russian Federation	2.99	69	33	Poland	3.69	58	33
Ukraine	2.98	70	34	Russian Federation	3.54	70	34
Romania	2.66	72	35	Azerbaijan	3.53	71	35
				Bulgaria	3.53	72	36
				Kazakhstan	3.52	73	37
				Serbia and Montenegro	3.48	74	38
				Ukraine	3.46	75	39
				The former Yugoslav Republic of Macedonia	3.41	81	40
				Bosnia and Herzegovina	3.20	89	41
				Moldova	3.13	92	42
				Georgia	3.12	93	43
				Armenia	3.07	96	44
				Kyrgyzstan	2.90	105	45
				Albania	2.87	107	46

Source: World Economic Forum (See http://www.weforum.org).

As the comparison of the NRI scores for the periods 2002-2003 and 2006-2007 indicate, between 2002 and 2007, some improvement has been observed in a number of the new EU Member States, as well as in some of the Southern European countries. Among the Central and Eastern European countries, Estonia and Slovenia continue outperforming the rest, but Romania has also markedly improved its score. Lithuania outpaced Latvia and climbed three ranks up in the regional ranking. The performance of Poland and Czech Republic in terms of the NRI has somewhat worsened. Both countries moved down in the regional rankings.

In Southern Europe, the NRI scores of Spain and Portugal have been eroded, while the score of Greece has gained some weight. It appears that the most important constraining factors have been economic ones. All the countries of this sub-group have a per capita income, which is lower than the average per capita income of the world high-income country group (by the World Bank classification). In 2005, Spain's per capita income ($25,250) was 71.6 per cent of the average per capita income of the world high-income country group ($35,264). Portugal's per capita income was only 48.7 per cent of the average per capita income of the world high-income country group, and Greece's per capita income was 56 per cent. At the same time, according to the World Bank data, the price basket for Internet in Spain and Portugal was almost twice the average price basket for Internet of the world high-income country group.[9] Consequently, both the PC and Internet penetration rates were significantly lower the average penetration rates in the world high-income country group. For instance, the PC penetration rate in Greece was only 15.4 per cent of that of the world high-income country group. In Portugal and Spain, it was, respectively, 23 per cent and 52.6 per cent of the average PC penetration rate in the world high-income country group.[10]

A review of the national e-Inclusion strategies and policies of the EU Member States indicates that most of the Central and Eastern European countries focus on the provision of an affordable access to the Internet at public places (Poland, Lithuania, Latvia, Estonia, Romania and Bulgaria), improvement of computer literacy with the emphasis on school children and long-term unemployed (all the countries of the group), and on improvement of public services (e-services). Some of the countries specifically target the rural population (Lithuania, Bulgaria, Hungary and Romania). For example, Poland sets a goal to facilitate access to knowledge for people in small villages and towns, and also in areas distant from academic and cultural centres by providing a broadband Internet access to all rural schools and libraries. However, only a few countries target disadvantaged groups (Poland, Hungary and Slovakia). Hungary and Slovakia give high priority to integration into the Information Society of Roma, people with disabilities, and the elderly. Poland also targets people with disability.

Southern European countries adopted a similar approach to implementing e-Inclusion policy. They also focus on achieving a mass effect in terms of e-Inclusion, therefore, most of their programmes and projects aim at raising higher computer literacy of the population, improving ICT skills of the labour force, widening the access to the Internet and integrating rural population in Information Society. Spain's programme "Internet for all", for example, envisages the establishment of new Public Internet Access Points (PIAPs) throughout the country. Furthermore, in order to improve the ICT skills and computer literacy of the working population, Spain intends to introduce ICT training programmes and to promote the use of new technologies in training and educational process at all public centres of education. Considering that NGOs could reach most disadvantaged groups and assist in spreading of digital literacy, the Government of Spain intends to implement a number of measures to provide ICT training to NGOs. To encourage their participation in promoting digital literacy, NGOs will be granted laptop computers.[11]

Countries belonging to the region's frontrunners focus on deepening the ICT diffusion by concentrating their efforts on bringing disadvantaged and at high risk groups into the Information Society. This goal is to be achieved by varying methods. Some countries such as Austria and Belgium envisage introduction of special allowances for certain groups to help purchase ICTs and Internet access. Some other countries, for

[9] The World Bank. ICT at a Glance (http://web.worldbank.org/WBSITE/EXTERNAL/STATISTICS/).

[10] Ibid.

[11] Empirica/World Research Centre/University of Bath. Thematic Study to Analyse Policy Measures to Promote Access to Information Technologies as a Means to Combating Social Exclusion. Final Report, Bonn, February 2006.

example, Germany, have allocated public funds to finance the design and construction of special web sites that could be easily accessed and used by disabled people. Another important priority of this group of countries is the improvement of public services by employing ICT and the Internet (e-Government).

CIS Member States have been following similar patterns in addressing the problem of the digital divide, although only a few countries target social groups with special needs (Belarus, Moldova and Ukraine). Shortage and underdevelopment of the ICT physical infrastructure, on the one hand, and lower per capita incomes and the size of territory in need of connectivity, on the other hand, have made the task of building up an Information Society much more challenging in comparison with the EU Member States. With the exception of the South Caucasus countries and Moldova, most country members of the CIS focus on extending their Internet physical backbone to geographic regions experiencing a teledensity deficit and on improving their countries' connectivity with global Internet networks. Some of the CIS countries (Russian Federation and Kazakhstan, in particular) envisage undertaking measures aiming at narrowing the rural-urban digital divide by implementing large-scale public projects. Efforts have been made to raise the ICT literacy of the population by introducing computer training at schools and universities, connecting educational establishments to the Internet and promoting ICT research by encouraging networking within and between academic communities of the CIS. As of September 2007, almost 90 per cent of Russian's schools and universities were connected to the Internet. Therefore, at present, the emphasis of most of the CIS member States has been on actions which could allow expanding rather than deepening the base of their future Information Societies.

From the perspective of the Information Society development, the situation in this group of countries is complicated by the overall weakness of their civil societies in terms of organizational capacity, resource availability and experience and, consequently, their limited ability to influence the decision-making process regarding the content of national and regional e-development strategies. Furthermore, there is also lack of interest on the side of business communities, especially, small and medium enterprises due to the lack of funding, but also lack of understanding of the potential benefits associated with the use of the Internet, although newly developed companies in the ICT areas have been rapidly networking and developing their own mechanisms of mobilization and lobbying. An important contribution in raising the ICT awareness among local stakeholders has been made by the international community (bilateral and multilateral donor organizations, including the World Bank, European Bank for Reconstruction and Development, Asian Development Bank, United Nations Development Programme and Non-Governmental Organizations (NGOs).

Networking among the CIS NGOs has been steadily promoted and supported by United Nations agencies and the United Nations regional commissions (UNECE and ESCAP). These actions have also brought some positive results in terms of NGO participation in setting up a national Information Society agenda.

1.3 The UNECE contribution to the Information Society and to narrowing the digital divide in the region

In the past several years, the UNECE, together with the other regional commissions, has cooperated very successfully in the preparation, participation and follow-up of the World Summit on the Information Society (WSIS, Geneva 2003 and Tunis 2005). In the follow-up, the regional commissions have organized side-events to sessions of the Commission on Science and Technology for Development (CSTD) and the Internet Governance Forum. UNECE has been innovative in mobilizing stakeholders' contribution to trade facilitation, protection of environment, improvement of transportation, energy efficiency, housing and some other areas. As a standard-setting body, the UNECE has been heavily focused on environmental democracy using electronic information tools, simplification and standardization of international procedures, documentation, data terminology and transmission. At present, UNECE provides a forum for policy dialogue and continues dealing with issues related to ICT in its subprogrammes.

1.3.1 Environmental democracy

The broad aim of the environment activities of UNECE is to safeguard the environment and human health, and to promote sustainable development in its member countries in line with Agenda 21. The practical aim is to reduce pollution so as to minimize environmental damage and avoid compromising environmental conditions for future generations. To this end, UNECE has adopted a four-pronged approach:

(a) Its Committee on Environmental Policy brings together Governments to formulate environmental policy and support its implementation by organizing seminars, workshops and advisory missions and providing a forum for sharing experiences and good practices;

(b) UNECE also takes a very active role in certain regional and cross-sectoral processes, especially: the "Environment for Europe" Ministerial process; Environment, Transport and Health; and Education for Sustainable Development;

(c) Through its environmental performance reviews, UNECE assesses individual countries' efforts to bring down pollution levels and manage their natural resources, and makes recommendations to improve their environmental performance;

(d) Adoption of multi-lateral environmental agreements.

UNECE has negotiated five environmental treaties, all of which are now in force:

- The Convention on Long-range Transboundary Air Pollution;
- The Convention on Environmental Impact Assessment in a Transboundary Context;
- The Convention on the Protection and Use of Transboundary Watercourses and International Lakes;
- The Convention on the Transboundary Effects of Industrial Accidents;
- The Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (Aarhus Convention).

In many countries of Eastern Europe, Caucasus and Central Asia (EECCA), the use of up-to-date information technologies by environmental monitoring authorities needs to be expanded. These technologies may substantially improve environmental data handling, exchange and supply to public authorities and the public.

The Working Group on Environmental Monitoring and Assessment has established a task force, with the Russian Federation as lead country, to review the collection of meta information on available sources of environmental information and activities in EECCA countries and to develop practical tools and instruments, using modern information technologies, to improve the use and exchange of information in these countries, and to harmonize their approaches with those applied within European Environment Agency (EEA) networks. With the support of EU/Tacis funds the implementation activities of the UNECE include:

- Creation of national reference institutions on electronic tools in EECCA countries;
- Provision of national reference institutions with computer equipment and access to Internet;
- Creating a harmonized meta-database with data sources and datasets, institutes, reports and other information products;
- Training of national experts of EECCA countries on methodologies, standards and formats for environmental information exchange developed by EEA;
- Development or expansion of national metadata bases on sources of data and data sets, institutes, reports and other information products in EECCA countries;

- Development of national websites on the basis of EEA guidelines and uploading the national meta information.

The Aarhus Convention grants the public rights and imposes on Parties and public authorities obligations regarding access to information and public participation and access to justice. In order to achieve this, effectively electronic tools should be used, and the Parties to the Aarhus Convention adopted in 2005 the *Recommendations on the more effective use of electronic information tools to provide public access to environmental information* (ECE/MP.PP/2005/2/Add.14[12]).

The capacity-building activities on electronic information tools targeting Government and NGO representatives in the EECCA region[13] have been emphasized, and together with the Organization for Security and Co-operation in Europe (OSCE) a network of Public Environmental Information (Aarhus) Centres in the South Caucasus, Central Asia, and South and Eastern Europe serving as community access and training points for citizens and entrepreneurs, have been established.[14]

In the area of environment protection the tasks of raising public awareness of the environmental situation and early warning are among the most important. In fulfilling these tasks the UNECE in collaboration with UNESCO has collaborated on promoting education for sustainable development[15] as well as environmental education, including dissemination of information on the state of environment in the region via the Internet and networking with local partners (both governmental and non-governmental organizations). The activities associated with environmental education include the development and provision of multilingual contents for interactive websites throughout the region.

Thus, in pursuing its environmental objectives the UNECE has also provided leadership in the field of e-environment, e-access, and e-governance, and produced several important normative instruments.

1.3.2 Trade facilitation and electronic business

Economic development is important for all countries and reducing these unnecessary costs by implementing simpler trade procedures is a crucial element. Simplified trade procedures could save millions for one single company.

The emergence of electronic means of data exchange and storing has opened new opportunities for trade facilitation – to replace traditional methods of information handling and transmission in the form of paper by alternative teletransmission methods. Even though the required technology and services are available, this does not, however, suffice to make data interchange of this type an operational reality. There is an equally important requirement to develop and agree on standards, procedures, and other essential elements of data handling methodologies to ensure intelligible communications between different systems used by trade and transport operators.

In 1996, the United Nations Centre for Trade Facilitation and Electronic Business (UN/CEFACT) was established. Its principal focus is on facilitating national and international transactions, through the simplification and harmonization of processes, procedures and information flows, and so to contribute to the growth of global commerce.

The development of e-business standards and trade facilitation recommendations is carried out in the UN/CEFACT Forum which is the concurrent meeting of all permanent UN/CEFACT Expert Groups. The Forum is the operational entity of UN/CEFACT where the work of around 1000 technical experts is coordinated. It convenes twice a year in different parts of the world to allow all five Groups, their sub-groups and project teams to meet for one week in the same location.

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[12] See http://www.unece.org/env/documents/2005/pp/ece/ece.mp.pp.2005.2.add.4.e.pdf.

[13] See http://www.unece.org/env/pp/electronictools/documents/REC_workshop_prospectus_2006_10_26.pdf.

[14] See http://www.osce.org/publications/eea/2005/07/15634_429_en.pdf.

[15] See http://www.unece.org/env/esd/welcome.htm.

The most recognized international standards developed by UN/CEFACT are:

- The UN Layout Key for Trade Documents, which is the foundation for the EU Single Administrative Document (SAD);
- UN/EDIFACT, the international standard for electronic data interchange and numerous trade facilitation recommendations[16].

The UN/CEFACT Forum has focused on improving the delivery of its outputs including a wide range of trade facilitation and best practice recommendations, electronic business standards and technical specifications.[17]

In addition, an important extrabudgetary project for a Trade Facilitation Guide and its Capacity-Building programme, funded by the Government of Sweden, is in the process of being implemented.

1.3.3 Transport

In order to further improve the efficiency, safety, environmental performance and security of its transport system work, UNECE has focused, inter alia, on the computerization of the Customs Convention on the International Transport of Goods under cover of TIR (transport routier international) Carnets in order to eliminate the use of paper TIR Carnets.

The World Forum for Harmonization of Vehicle Regulations (Working Party 29) has an informal group which is studying how intelligent transportation systems (ITS) can improve the safety and environmental performance of vehicles. Some intelligent systems have already been incorporated into UNECE vehicle regulations.

The Transport, Health and Environment Pan-European Intersectoral Programme (the PEP) Clearing House[18] is an Internet-based portal for user-friendly access and exchange of information in English and Russian on transport, health and environment in the pan-European region.

1.3.4 Statistics

The Statistics subprogramme is naturally oriented towards information management, and therefore is making information available through the use of modern ICT, particularly through its statistical database[19] and the Database on International Statistical Activities (DISA-IP), and its Web-based documents library.

1.3.5 Energy

The ICT projects of energy include two separate websites in addition to maintaining webpages on the main UNECE website.

While the Energy Efficiency 21 Project website[20] has been used mainly for communications so far, in the next phase of the project, it will be used for more substantive purposes, including projects proposals and assessment of energy resources.

The Gas Centre Database and website[21] provide the 22 participating companies in the UNECE Gas Centre with information about Gas Centre activities, electronic publishing of Gas Centre reports, a forum of

[16] See http://www.unece.org/cefact/about.htm.

[17] See http://www.unece.org/cefact/.

[18] See http://www.thepep.org/CHWebSite/.

[19] See http://www.unece.org/stats/stats_h.htm.

[20] See http://www.unece.org/ie/se/eneffic.html#ee21.

[21] See http://www.gascentre.unece.org/.

information exchange and a database on the legal, policy, regulatory and structure of national gas markets and the European gas market as a whole.

ICT will make it possible to achieve new political objectives in the gas market. The liberalization of the gas market requires detailed tracking and monitoring of volumes and billing data. Without the new ICT this would have been very difficult to attain. The new ICTs have provided and will provide the necessary technical solutions to serve industrial objectives.

1.3.6 Gender and ICT

ICT have a great potential as a tool to enhance women's economic, political, and social empowerment. Women entrepreneurs in particular can benefit from these to improve their access to information and to increase competitiveness and market outreach of their businesses.

At the same time, a "gender divide" within the digital divide is apparent in all the regions, including the UNECE region. It is reflected in the lower numbers of women users of ICT, compared to men, as well as in the persistence of gender-specific structural inequalities that constitute barriers to access. Therefore, mainstreaming gender aspects into ICT policy debates and decision-making processes is necessary to ensure adequate access to and utilization of ICT by women entrepreneurs.

Improving access to ICT for women requires a multidimensional approach that addresses the immediate barriers preventing women's access to ICT, as well as the underlying structural forces creating these barriers. The gender-specific barriers include high access costs, time constraints, lack of networks, cultural barriers, and traditional views that technology is a "male" domain. Educational background and access to training opportunities as well as cultural and social norms constitute other significant barriers for women to ICT use.

A dialogue on how to close a "gender divide" within the digital divide is thus very relevant to countries in the UNECE region. That is why raising awareness on gender aspects of ICT in the context of the knowledge-based society, developing gender disaggregated ICT data and analysis, training and access to low-cost ICT infrastructure and building partnership among stakeholders to change stereotypes and traditional social climate should be particularly considered to address the problem.

UNECE promotes a regional dialogue on gender and information society through:

- Providing a regional platform for dialogue and mainstreaming gender into the discussion on ICT strategy and action plans at regional and subregional levels. The regional discussion on Building an Information Society within the WSIS process provides a good framework to incorporate gender issues from the outset. UNECE organized in cooperation with partners a number of round tables on gender and ICT, including at WSIS (Geneva, 2003 and Tunis, 2005) as well as at regional preparatory meetings in Bishkek (2003) and Bucharest (2003);
- Supporting national efforts for mainstreaming gender into ICT policies concerning SMEs. UNECE promotes the exchange of good practices and building networks among women entrepreneurs through UNECE forums (Geneva, 2001 and 2003) and publication of good practices in access to ICT and financing;[22]
- Contributing to capacity-building through training workshops for policymakers at national and local level responsible for SME policies, representatives of women's business associations, members of academia and NGOs from the SPECA member countries. The objective of the workshops was to address issues, such as the support systems for women in small business and the use of ICT for SMEs. In total, 110 people were trained. Four such training workshops, each consisting of 14 days, were organized in 2006 and 2007, and two more training workshops have been planned for 2008;

[22] See http://www.unece.org/gender/news.htm and http://www.unece.org/gender/pubreps.htm).

- Providing methodology and supports capacity building within National Statistical Offices to develop gender disaggregated data related to ICT.

1.3.7 Digital divide

The UNECE efforts aiming at narrowing the digital divide between the UNECE member States have been centered on countries in transition, particularly on Central Asian and South Caucasus countries. During 2002 and 2003, the UNECE organized an assessment of 14 countries in transition in terms of their readiness for the knowledge-based economy (Armenia, Azerbaijan, Belarus, Bulgaria, Georgia, Kyrgyzstan, Latvia, Lithuania, Russian Federation, Slovakia, Tajikistan, Yugoslavia, Ukraine, and Uzbekistan).[23] A number of regional studies were also prepared, including: "Towards a Knowledge-based Economy. Regional Assessment Report" (2002), "Information Economy Report – E-Policy Development in Transition Economies 2002-2003", "Internet Infrastructure Development in Transition Economies" (2000).

The UNECE organized two regional forums of women entrepreneurs in 2001 and 2003, at which the main focus was on the role of ICT in ensuring the development and survival of women-led and women-owned enterprises. In 2002, the UNECE held its First Regional Forum on Youth: "Security, Opportunity and Prosperity", at which various remedial options to combat youth unemployment and poverty were considered, including youth entrepreneurship and ICT. Following this event, the Government of Ukraine in cooperation with the UNECE, CIS Executive Committee and other United Nations agencies organized the CIS Youth Forum "Youth of the 21st Century: Realities and Perspectives" held in Kiev in September 2003. The CIS Youth Forum devoted much attention to developing youth entrepreneurship in the ICT area as well as to such issues as: youth e-education, youth teleworking and venture enterprising.[24]

1.3.8 Facilitating regional cooperation and integration with special reference to Central Asia

Within the framework of SPECA[25], which is jointly supported by the UNECE and ESCAP, a Project Working Group (PWG) – the Project Working Group on ICT for Development was established in 2004 with the aim to facilitate cooperation in implementing the initiatives related to knowledge-based economy development. During the period of 2004 to 2007, The PWG on ICT for Development served as a forum for discussion and knowledge sharing among ICT policymakers of SPECA member countries.

For example, the PWG facilitated organization of regional capacity-building activities under the technical cooperation project on "Capacity-building for ICT Policymaking", financed by the United Nations Development Account. In cooperation with the Ministry of Transport and Communications of Kyrgyzstan, the two United Nations regional commissions organized the Regional Seminar on Capacity-building for ICT Policymaking in Central Asia in Bishkek from 11 to 14 July 2006. The seminar supported Central Asian countries in building the capacity in the area of legal aspects of ICT policymaking, development of ICT policy and strategy integrating ICT into national development programmes.

The PWG also facilitated national capacity-building activities in the area of ICT policy formulation and on legal issues on ICT policy development These are the National Seminar on Capacity Building for ICT Policymaking held in Baku from 27 to 28 November 2007 in cooperation with the Ministry of

[23] All the reports were prepared by national experts and published by UNECE (see: http://www.unece.org/pub_cat/topics/ict.htm; http://www.unece.org/operact/enterp/assesreport.htm).

[24] The contribution of participants and UNECE to the work of forums were published by UNECE. *Youth in the UNECE Region: Realities, Challenges and Opportunities* (United Nations publication, Sales No. E/R.03.II.E.47; *Youth of the XXI Century: Realities and Perspectives* (United Nations publication, Sales No. E/R.04.II.E.18); *Women's Entrepreneurship in Eastern Europe and CIS Countries* (United Nations publication, Sales No. E.03.II.E.3); *UNECE. Access to Financing and ICT for Women-Entrepreneurs in the UNECE Region. Challenges and Good Practices* (United Nations publication, Sales No. E.04.II.E.11).

[25] SPECA member countries are: Afghanistan, Azerbaijan, Kazakhstan, Kyrgyzstan, Tajikistan, Turkmenistan and Uzbekistan as of 2008.

Communication and Information Technologies of the Republic of Azerbaijan; and the National Capacity-building Seminar on Information and Communication Technology Policy and Legal Issues held in Dushanbe from 30 to 31 October 2007 in cooperation with the Ministry of Transport and Communications and the Ministry of Economy and Trade of Tajikistan.

With reference to the issues on Broadband and ICT Development, the UNESCAP and UNECE organized the Regional Workshop on Broadband and ICT Development for Improved Communication in Central Asia in Tashkent from 21 to 22 June 2007 jointly with the Communication and Information Agency of Uzbekistan, ESCAP, Asia-Pacific Telecommunity, the United Nations Development Programme and the Information Technology Association of Uzbekistan. It contributed to an increased awareness and knowledge on broadband and ICT development issues among policymakers of Central Asia, served as a multi-stakeholder discussion forum on the issues and adopted Tashkent Statement on Broadband and ICT Development for Improved Communication in Central Asia.

At the request of the PWG on ICT for Development, UNECE produced a publication on Information and Communication Technology Policy and Legal Issues for Central Asia – Guide for ICT Policymakers in October 2007. The Guide examines legal issues related to the sound development of eCommerce on five distinct areas such as legal infrastructure, legal certainty, legal security, legal protection and legal deterrence. The Russian version of the publication will be published in the first half of 2008. It will also be used in the future UNECE capacity-building activities in the SPECA member countries such as in Uzbekistan and Azerbaijan envisaged through 2008.

With reference to the issue of the ICT access, UNECE prepared an assessment review of the ICT access points in selected countries in Eastern Europe and Central Asia. The review analyses the current status of the community ICT access points and identifies good practices. The review will be used in future capacity-building activities to be organized in the SPECA member countries in 2008-2009.

It has been decided that the SPECA PWG on ICT for Development will be transformed into a new Project Working Group on Knowledge-based Development (PWG on KBD) in 2008. This transformation will enable UNECE and ESCAP to work wider range of issues related to the knowledge-based development for the SPECA member countries. The ICT related works, which have been covered by the PWG on ICT for Development, such as the capacity-building activities on ICT policymaking and the field implementation of the UN Development Account project on knowledge-networks through ICT access points for disadvantaged communities in Central Asia, will continue to be carried out under the new PWG on KBD.

Table 3. ICT opportunity index, regional ranking in UNECE member States, 2001 and 2005

Country	*2001 ICT Opportunity Index*	*2005 ICT Opportunity Index*	*Change in Index score (% -points)*	*2001 UNECE Regional rank*	*2001 UNECE Regional rank*
Top Performers					
Sweden	263.16	377.69	+43	1	1 (0)
Denmark	253.95	360.79	+42	2	4 (-2)
Canada	252.19	337.16	+34	3	9 (-6)
Switzerland	246.82	353.60	+43	4	5 (-1)
Netherlands	237.07	362.82	+53	5	3 (+2)
Austria	230.02	305.60	+33	6	12 (-6)
Belgium	228.68	324.21	+42	7	10 (-3)
Iceland	226.11	340.57	+51	8	7 (+1)
United States	224.63	323.85	+44	9	11 (-2)
Norway	223.07	338.53	+52	10	8 (+2)
Germany	211.61	303.42	+43	11	13 (-2)
Luxembourg	209.43	371.10	+77	12	2 (+10)
United Kingdom	208.74	346.37	+67	13	6 (+7)
Upper Performers					
Finland	204.36	293.51	+44	14	15 (-1)
France	190.44	278.34	+46	15	17 (-2)
Ireland	180.71	286.32	+58	16	16 (0)
Italy	163.60	255.68	+56	17	19 (-2)
Spain	161.65	249.29	+54	18	20 (-2)
Malta	160.31	212.27	+32	19	24 (-5)
Israel	158.92	296.71	+87	20	14 (+6)
Cyprus	155.43	221.95	+43	21	22 (-1)
Slovenia	154.69	246.13	+59	22	21 (+1)
Estonia	151.51	269.81	+78	23	18 (+5)
Portugal	147.39	209.57	+42	24	25 (-1)
Regional average	**136.53**	**208.51**	**+53**		
World average	**100.00**	**147.56**	**+47**		
Upper Average Performers					
Czech Republic	135.19	202.72	+50	25	26 (-1)
Slovakia	123.14	188.92	+53	26	29 (-3)
Greece	122.29	162.34	+33	27	32 (-5)
Hungary	120.89	192.41	+59	28	28 (0)
Croatia	118.20	176.41	+49	29	30 (-1)
Latvia	109.98	218.77	+99	30	23 (+7)
Poland	105.16	166.36	+58	31	31 (0)
Medium Average Performers					
Lithuania	103.29	201.63	+95	32	27 (+5)
Bulgaria	94.89	123.46	+30	33	36 (-3)
Turkey	86.35	128.53	+49	34	35 (-1)
Serbia and Montenegro	81.46	111.23	+36	35	40 (-5)
Romania	80.74	150.45	+86	36	33 (+3)
Russian Federation	80.14	137.27	+71	37	34 (+3)
The former Yugoslav Republic of Macedonia	79.05	120.36	+52	38	37 (+1)
Bosnia	71.92	113.44	+58	39	39 (0)
Belarus	68.30	120.09	+76	40	38 (+2)
Ukraine	64.82	102.26	+58	41	41 (0)
Georgia	62.43	90.28	+44	42	43 (-1)
Moldova	59.59	102.19	+71	43	42 (+1)
Kazakhstan	55.86	85.32	+53	44	45 (-1)
Armenia	51.57	87.30	+69	45	44 (+1)
Albania	50.32	79.25	+57	46	47 (-1)
Azerbaijan	49.90	83.90	+57	47	46 (+1)
Kyrgyzstan	47.83	67.72	+42	48	48 (0)
Low Average Performers					
Uzbekistan	38.27	58.54	+53	49	49 (0)
Turkmenistan	33.85	53.29	+57	50	50 (0)
Tajikistan	23.54	45.20	+92	51	51 (0)

Source: ITU/UNCTAD. *2007 World Information Society Report: Beyond WSIS*, Geneva, June 2007.

Table 4. Composition of the 2005 ICT OI: infodensity (networks and skills) and infouse

(uptake and intensity)

Country	*Networks Index*	*Skills Index*	*Infodensity Index*	*Uptake Index*	*Intensity Index*	*Infouse Index*
Top Performers						
Sweden	605.1	153.8	305.1	464.5	470.59	467.56
Denmark	616.5	145.8	299.8	390.2	483.22	434.22
Canada	398.5	136.0	232.8	422.1	565.06	488.36
Switzerland	548.7	110.3	246.0	417.8	618.51	508.32
Netherlands	555.6	141.6	280.5	472.6	466.09	469.35
Austria	449.1	131.8	243.3	365.1	403.75	383.94
Belgium	498.0	153.3	276.3	304.5	475.09	380.37
Iceland	486.2	141.4	262.2	411.5	474.50	442.36
United States	346.7	143.3	222.8	443.6	499.37	470.64
Norway	492.8	147.4	269.5	387.7	466.27	425.20
Germany	496.0	131.2	255.0	355.9	366.09	360.97
Luxembourg	675.5	112.0	275.1	412.6	607.37	500.61
United Kingdom	590.4	156.9	304.4	391.1	397.26	394.17
Upper Performers						
Finland	371.3	154.0	239.1	347.9	373.18	360.33
France	354.4	137.3	220.6	341.4	361.42	351.26
Ireland	440.4	137.5	246.1	308.8	359.46	333.15
Italy	332.4	135.0	211.8	305.7	311.60	308.63
Spain	331.9	142.3	217.3	255.2	320.37	385.92
Malta	298.3	111.1	182.0	202.0	303.39	247.55
Israel	335.4	133.7	211.7	358.2	482.61	415.77
Cyprus	233.6	121.3	168.3	279.1	307.04	292.72
Slovenia	261.8	146.0	195.5	332.2	289.02	309.86
Estonia	229.6	137.2	215.9	346.2	328.50	337.24
Portugal	253.4	134.8	184.9	184.3	306.29	237.57
Regional average	**277.0**	**130.3**	**182.0**	**235.3**	**258.9**	**246.9**
World average	**164.4**	**102.6**	**129.9**	**147.5**	**190.60**	**167.66**
Upper Average Performers						
Czech Republic	295.8	125.0	192.3	231.5	197.35	213.74
Slovakia	249.2	122.4	174.7	274.6	152.06	204.36
Greece	252.2	139.2	187.4	140.2	141.11	140.65
Hungary	232.6	133.7	176.3	192.4	229.06	209.96
Croatia	241.5	121.3	171.2	217.8	151.75	181.79
Latvia	228.7	138.5	178.0	262.1	275.85	268.90
Poland	190.7	137.5	162.0	211.6	137.94	170.86
Medium Average Performers						
Lithuania	245.9	140.3	185.7	219.2	218.66	218.90
Bulgaria	185.5	127.8	154.0	128.7	76.15	99.01
Turkey	158.6	116.0	135.6	109.6	135.32	121.80
Serbia and Montenegro	165.1	121.3	141.5	95.9	79.75	87.43
Romania	158.3	120.8	138.2	165.1	162.38	163.72
Russian Federation	161.9	139.2	150.1	144.7	108.89	125.53
Bosnia	118.3	121.3	119.8	117.9	97.96	107.46
The former Yugoslav Republic of Macedonia	137.6	115.3	126.0	140.6	94.10	115.01
Belarus	133.5	134.4	134.0	148.9	77.82	107.65
Ukraine	118.0	135.3	126.4	85.4	80.14	82.75
Georgia	93.3	121.3	106.4	75.4	77.84	76.63
Moldova	101.2	111.2	106.1	114.2	84.82	98.44
Kazakhstan	98.9	131.5	114.1	55.1	73.90	63.81

Country	*Networks Index*	*Skills Index*	*Infodensity Index*	*Uptake Index*	*Intensity Index*	*Infouse Index*
Armenia	69.6	118.0	90.7	92.8	76.17	84.07
Albania	91.8	109.9	100.0	53.9	73.29	62.83
Azerbaijan	83.0	108.5	94.9	74.9	73.42	74.16
Kyrgyzstan	51.6	122.5	79.5	43.9	75.72	57.68
Low Average Performers						
Uzbekistan	30.4	113.6	58.8	46.8	72.56	58.27
Turkmenistan	25.0	113.6	53.3	39.2	72.35	53.28
Tajikistan	29.6	109.7	57.0	18.1	71.1	35.86

Source: ITU/UNCTAD. *2007 World Information Society Report: Beyond WSIS*, Geneva, June 2007

Table 5. Internet access by households, individuals and enterprises: the digital divide within the EU Member States, 2006
(percentage)

	Proportion with Internet Access		*Proportion with Broadband Connection*		*Internet Use by Individuals (at least once a week)*	
	Households	*Enterprises*	*Households*	*Enterprises*	*Total*	*Men/Women*
Sweden	77	96	51	89	80	84/76
Denmark	79	98	63	83	78	80/76
Netherlands	80	97	66	82	76	82/71
Austria	52	98	33	69	55	61/49
Belgium	54	95	48	84	58	62/54
Iceland	83	99	72	95	84	86/82
Norway	69	94	57	86	77	80/73
Germany	67	95	63	83	59	65/54
Luxembourg	70	93	44	76	65	76/55
United Kingdom	63	92	44	77	57	63/51
Finland	65	99	53	89	71	72/70
France	41	94	30	86	39	42/37
Ireland	50	94	13	61	44	45/42
Italy	40	93	16	70	31	36/28
Spain	39	93	29	87	39	44/35
Cyprus	37	86	12	55	29	32/27
Slovenia	54	96	34	75	47	51/42
Estonia	46	…	37	…	56	57/56
Portugal	35	…	24	…	31	35/28
Slovakia	27	93	11	61	43	47/39
Greece	23	…	4	…	23	27/18
Hungary	32	…	22	…	42	43/40
Latvia	42	80	23	59	46	47/45
Poland	36	89	22	46	34	36/32
Lithuania	35	88	19	57	38	38/37
EU25*	52	94	32	75	47	51/43

Note: *EU 25 excludes member States for which data was not available.
Source: EUROSTAT Press release, Internet Usage in the EU 25, 10 November 2006, STAT/06/146.

Table 6. Internet access by individuals (by age): the digital divide within the EU Member States, 2006
(percentage)

	Internet Use by Individuals (at least once a week)		
	16-24 years old	*25-54 years old*	*55-74 years old*
Sweden	94	89	56
Denmark	94	86	56
Netherlands	96	89	46
Austria	80	63	24
Belgium	82	67	27
Iceland	96	90	59
Norway	97	84	48
Germany	83	69	30
Luxembourg	89	71	37
United Kingdom	72	66	33
Finland	94	82	38
France	71	47	…
Ireland	59	48	17
Italy	55	37	9
Spain	70	45	10
Cyprus	55	31	7
Slovenia	81	54	12
Estonia	90	64	…
Portugal	68	34	6
Slovakia	81	54	12
Greece	47	27	4
Hungary	74	47	14
Latvia	86	50	12
Poland	71	35	7
Lithuania	77	39	7
EU 25*	73	53	20

Note: *****EU 25 excludes member States for which data was not available.
Source: EUROSTAT Press release, Internet Usage in the EU 25, 10 November 2006, STAT/06/146.

Table 7. National versus rural coverage and penetration: broadband in the EU Member States, 2003-2005

Country	*Total DSL coverage (% of total population) 25-54 years old*		*DSL coverage in rural areas (as % of total)*		*Broadband penetration (as % of population)*		*DSL penetration (as % of population)*	
	2003	*2005*	*2003*	*2005*	*2003*	*2005*	*2003*	*2005*
Sweden	95.0	93.5		66.0	10.2	24.5*	5.9	16.0*
Denmark	95.0	100.0		100	11.2	29.4*	7.8	18.1*
Netherlands	94.0	99.0		99.0	10.7	29.8*	5.2	18.3*
Austria	86.2	86.0		67.0	6.9	15.8*	3.0	9.5*
Belgium	100.0	100.0		100.0	11.0	21.8*	6.6	13.6*
Czech Republic		75.0		…	1.7**	9.6*	0.6**	4.3*
Germany	86.1	92.0		55.0	5.2	16.4*	5.1	15.7*
Luxembourg	100.0	100.0		100.0	2.8	19.7*	2.4	17.9*
United Kingdom	85.0	99.5		94.9	4.4	20.4*	2.3	15.5*
Finland	87.6	90.4		78.0	6.4	26.0*	5.2	21.1*
France	79.3	96.4		87.9	4.9	19.0*	4.3	17.9**
Ireland		82.3		56.5	0.5	10.3*	0.3	7.6*
Italy	82.0	87.0		44.6	3.2	13.6*	2.8	13.1*
Malta	95.0	99.0		0.0	3.8**	13.2*	3.2**	8.1*
Spain	85.0	89.0		82.0	4.6	13.9*	3.4	11.0*
Cyprus		69.7		0.0	0.9**	7.4*	0.9**	7.3*
Slovenia		55.0		27.0	5.3**	12.6*	3.2**	8.6*
Estonia		90.0		…	8.6**	17.2*	4.2**	8.4*
Portugal	84.0	92.6		79.0	4.1	13.5*	1.4	8.4*
Slovakia	18.3	60.7		25.0	0.6**	4.4*	0.5	2.9*
Greece	2.0	12.0		0.0	0.0	3.3*	0.0	3.3*
Hungary	58.0	85.0		76.0	2.9**	8.6*	1.9**	5.3**
Latvia		85.0		…	2.4**	9.3*	1.4**	4.0**
Poland	55.2**	62.3		51.9	0.6**	4.5*	0.3**	3.4*
Lithuania		82.2		54.6	3.1**	9.3*	1.2**	4.6*
EU25		87.4		65.9		15.7		12.8

Note: *2006, **2004
Source: Commission of the European Communities. *i2010 – Annual Information Society Report 2007*, Vol. 3, Brussels, 30.3.2007, SEC (2007) 395.

Table 8. E-readiness regional index in the Russian Federation, 2005

Rating	*Region*	*Index score*
1	Moscow	5.65
2	Saint Petersburg	4.86
3	Khanty-Mansi Autonomous Okrug	4.41
4	Yamal-Nenets Autonomous Okrug	4.27
5	Tomskaya oblast	4.06
6	Samarskaya oblast	3.80
7	Murmanskaya oblast	3.75
8	Chukchi Autonomous Okrug	3.63
9	Nenets Autonomous Okrug	3.62
10	Republic of Karelia	3.58
11	Tyumenskaya oblast	3.55
12	Taimyr Autonomous Okrug	3.51
13	Khabarovskiy kray	3.45
14	Moscovskaya oblast	3.43
15	Yaroslavskaya oblast	3.39
16	Irkutskaya oblast	3.38
17	Primorskiy kray	3.35
18	Novosibirskaya oblast	3.33
19	Kamchatskaya oblast	3.32
20	Permskaya oblast	3.32
21	Sakhalinskaya oblast	3.30
22	Arkhangel'skaya oblast	3.29
23	Magadanskaya oblast	3.28
24	Sverdlovskaya oblast	3.27
25	Kaluzhskaya oblast	3.26
26	Republic of Sakha	3.25
27	Kaliningradskaya oblast	3.18
28	Novgorodskaya oblast	3.15
29	Nizhegorodskaya oblast	3.12
30	Chelyabinskaya oblast	3.11
31	Republic of Komi	3.10
32	Vologodskaya oblast	3.08
33	Omskaya oblast	3.07
34	Rostovskaya oblast	3.03
35	Republic of Tatarstan	3.02
36	Voronezhskaya oblast	3.01
37	Leningradskaya oblast	3.01
38	Kemerovskaya oblast	3.01
39	Krasnodarskiy kray	2.97
40	Krasnoyarskiy kray	2.96
41	Saratovskaya oblast	2.95
42	Evenk Autonomous Okrug	2.94
43	Republic of Udmurtiay	2.93
44	Vladimirskaya oblast	2.93
45	Chuvash Republic	2.91
46	Republic of Khakassia	2.89
47	Astrahanskaya oblast	2.89
48	Volgogradskaya oblast	2.89

Rating	*Region*	*Index score*
49	Republic of Mari El	2.86
50	Pskovskaya oblast	2.84
51	Republic of Bashkorstan	2.82
52	Tulskaya oblast	2.82
53	Stavropol'skiy kray	2.81
54	Republic of Adygeia	2.81
55	Orenburgskaya oblast	2.80
56	Altayskiy kray	2.80
57	Ryazanskaya oblast	2.79
58	Belgorodskaya oblast	2.78
59	Republic of Mordovia	2.77
60	Lipetskaya oblast	2.76
61	Koryakskiy Autonomous Okrug	2.68
62	Orlovskaya oblast	2.64
63	Penzenskaya oblast	2.64
64	Ulyanovskaya oblast	2.63
65	Amurskaya oblast	2.60
66	Smolenskaya oblast	2.60
67	Ivanovskaya oblast	2.58
68	Republic of Buriatia	2.57
69	Kurganskaya oblast	2.57
70	Jewish Autonomous Okrug	2.56
71	Tverskaya oblast	2.56
72	Republic of Altai	2.56
73	Kostromskaya oblast	2.54
74	Tambovskaya oblast	2.47
75	Bryanskaya oblast	2.46
76	Kirovskaya oblast	2.45
77	Republic of North Ossetia	2.40
78	Chitinskaya oblast	2.36
79	Aga-Buriat Autonomous Okrug	2.32
80	Kabardino-Balkarian Republic	2.29
81	Republic of Kalmykia	2.27
82	Kurskaya oblast	2.27
83	Republic of Karachai-Cherkess	2.26
84	Komi-Permiak Autonomous Okrug	2.20
85	Republic of Daghestan	2.13
86	Ust'-Orda Buriat Autonomous Okrug	2.10
87	Republic of Tuva	2.08
88	Ingush Republic	1.96
Regional average		**2.98**

Source: The Russian Institute of the Information Society (http://www.iis.ru).

Chapter 2

INTERNET DEVELOPMENT: CURRENT STATE OF CRITICAL INTERNET RESOURCES IN THE UNECE REGION

Countries of the UNECE region are among the forerunners and today's leaders in the level of Internet development in terms of both innovation and penetration. This success is attributable to several factors, including:

- High density of and constant modernization of ICT infrastructure;
- On-going liberalization of ICT markets;
- Accumulation of significant capital stocks, both tangible and intangible, including highly developed human resources;
- High adaptability and flexibility of institutions;
- Efficient corporate sector;
- Political commitment to and public support of the innovation process.

The region, however, is not free of socio-economic disparities, which have affected the pace and pattern of Internet penetration across the UNECE region. At the same time, strong political commitments to modernization, especially in the former socialist countries, and stakeholders' cooperation at all the levels, national, subregional and regional, have been contributing to narrowing these disparities.

2.1. ICT infrastructure

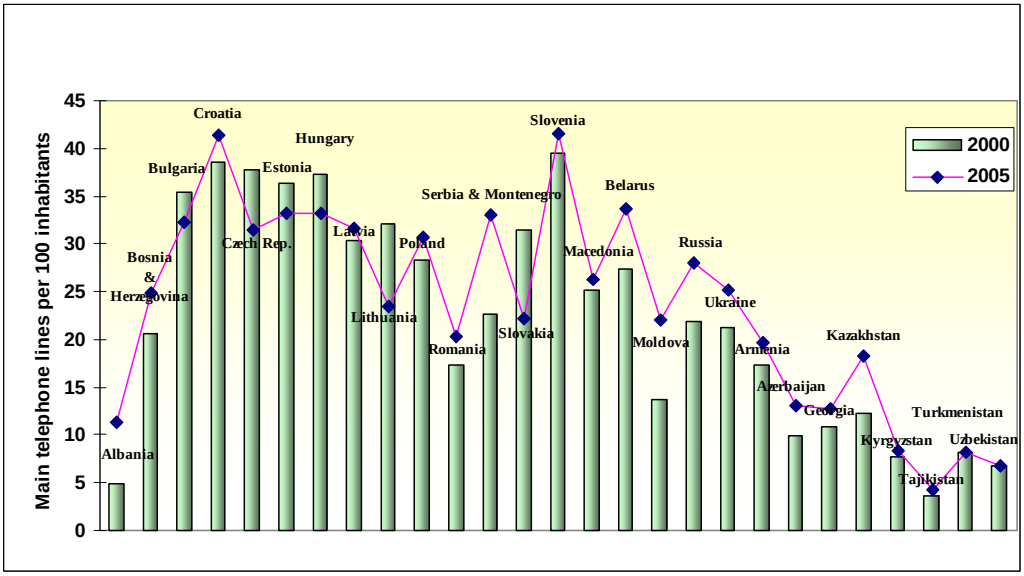
In comparison with the other world regions, the UNECE region is more advanced in terms of ICT density and penetration although actual rates vary greatly from subregion to subregion and from country to country. The ICT infrastructure in the Western European subregion, for example, is highly developed, with fixed line teledensity above 50 per cent on average. Mobile penetration rates are also very high with several countries achieving the penetration rate over 100 per cent. The situation in the Eastern and Central Europe is more diverse with some countries rapidly catching up with the leading Western European countries while others lagging behind. Unevenness of ICT development across the CIS is even greater, mirroring disparities in distribution of ICT infrastructure, capacities and capabilities inherited from the Soviet past.

2.1.1 Main (fixed) telephone lines

Despite the continuous introduction of new technologies, fixed lines remain an important means of accessing Internet in the region, although their growth has been somewhat stagnant over the past decade in most countries of the region. The total number of terrestrial telephone lines has not increased significantly since the mid 1990s. Actually, since 2001 the growth of main lines has been negative in several countries. However, in the CIS and some Balkan states, there was an impressive upsurge in main telephone line deployment, resulting in a teledensity increase (figure 14). Albania, for example, augmented its main telephone lines by 8 times the level of 1995 and, consequently, teledensity – by 11 times. In the majority

of the countries presented in figure 14 table the teledensity remained either at the same level or even declined.

Figure 14. Main telephone lines availability in UNECE economies in transition



Source: ITU database. Data reproduced with the kind permission of ITU.

In a number of countries of the region, stagnation in the main line segment of the communication sector was partly due to saturation. In Western European countries, for example, the overall fixed penetration rate reached over 50 per cent with most households owning a telephone line (over 90 per cent in France, Netherlands, Spain, Belgium, Finland and United Kingdom, for example).[26] Fierce competition from mobile telephony and alternative (cable) providers was another factor behind a growth contraction in the main line segment.

A rapid proliferation of affordable mobile telephony causing a fixed to mobile substitution (FMS) in many countries of the region has been among the factors constraining further expansion of the main line infrastructure. This phenomenon was especially noticeable in Eastern and Central Europe and in some countries of the CIS, where, on the one hand, the shortage of funding undermined the ability of national telecoms to extend their traditional services to the country regions with a low telephony penetration, and, on the other hand, the aging and a relatively low quality of the fixed line infrastructure prevented them from producing and diversifying their services that could meet consumers' expectations. Gradual liberalization of the ICT sector and privatization of national telecoms in the new EU Member States, as well as in those in line for an EU membership and in some of the CIS member-sates, led to setting up an institutional framework conducive to competition and, hence, to the emergence of alternative (to fixed line) providers, but also of new telecommunication companies. The process of liberalization, however, has been patchy across the region with some countries still retaining Government control over national telecoms. In these countries, state-owned and/or -controlled fixed line incumbents with significant market power have resisted new and/or alternative incumbents' entry to the market, e.g. in Belarus and Azerbaijan. According to EU data, in October 2005, a combined fixed line market share of only one operator was 90 per cent in each of the five new EU Member States (Cyprus, Latvia, Lithuania, Slovakia and Slovenia). In each of three countries (Czech Republic, Estonia and Poland), three operators captured more than 90 per cent of the fixed line market in terms of revenues.[27]

[26] ITU database.

[27] EU database.

Responding to competition pressure, fixed line operators particularly in Central and Eastern European countries have embarked on modernization in an attempt to improve the quality and the bundle mix of communication services. A strategy adopted by most of the telecoms in the subregion has been as follows: (a) upgrading and extending basic infrastructure; (b) introduction of new technologies, which could improve the quality, volume and diversity of services, such as broadband, wireless and digitization; (c) integrating various services; and (d) widening consumer choice by offering a variety of packages of services. These efforts have been translated into growing digitization of the fixed line infrastructure, as well as wireless and broadband connectivity. Consequently, there was an increase in the Digital Subscriber Line (DSL) coverage throughout the region (figures 15 and 16). By the end of 2006 in 15 of the 27 EU Member States including Estonia, the DSL coverage rate reached above 90 per cent. This also allowed telecoms in many Central and Eastern European countries and in the CIS to provide a relatively low-cost but significantly enhanced access to Internet.

In some of the CIS Member States with comparatively low teledensity and significant rural-urban and geographical divides, telecoms have undertaken efforts to upgrade and extend their basic infrastructures by deploying fibre-optic lines and New Generation Networks. For instance, Kazakhtelecom, a key fixed line incumbent of Kazakhstan, has been constantly improving its capacity. It recently completed the construction of the main ring of the National Information Super Highway (NISH) by launching the North segment of the network, which connected Petropavlovsk, Kostanai and Aktobe. The NISH now consists of over 11,000 km of fibre-optic lines that link up regional (oblast) centers, Almaty and Astana (in total 14 large cities) and 116 smaller cities and towns.[28] Over the period 2000-2005, Moldtelecom (Moldova) had been focused mainly on extending the digitization of its telephony networks. As a result, the overall capacity of installed digital lines reached 67 per cent by 2006. The company also devoted significant resources to construction of a state of the art fibre-optic network that connects all urban centres in Moldova.[29]

Telecoms in many EU countries are now moving beyond voice and data and entering the world of interactive video and digital TV (box 2). At present, they are investing in Asymmetric Digital Subscriber Lines (ADSL), a technology which is viewed as a means of reducing fixed to mobile substitution and as a channel through which future converged services can be or already are being offered. As a result, ADSL networks have been steadily growing throughout the UNECE region.

Box 2. Telecoms throughout the UNECE region are entering a new world – the world of interactive video and digital TV

The reason why European Telecoms should want to do something 'different' is crystal clear. Like many other national telecoms around the world, their traditional voice service is in decline. A solution to this problem appears to be found in the so-called triple play package - an IP platform capable of delivering high-speed internet access, voice and a range of TV-based services to broadband customers (IPTV).

In Europe, telecoms who have publicly announced trials of IPTV services include Swisscom, Telekom Austria and Telecom Italia (France Telecom already offers a video-on-demand service, while Iceland Telecom launched a commercial IPTV service late last year).

[28] Political Intelligence. Final Report: Monitoring of Russia and Ukraine (priority 1) and Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan and Moldova (priority 2): Telecommunication and the Information Society, London-Brussels-Madrid, 2006, p. 17.

[29] See http://www.moldtelecom.md/about/repports/en.html.

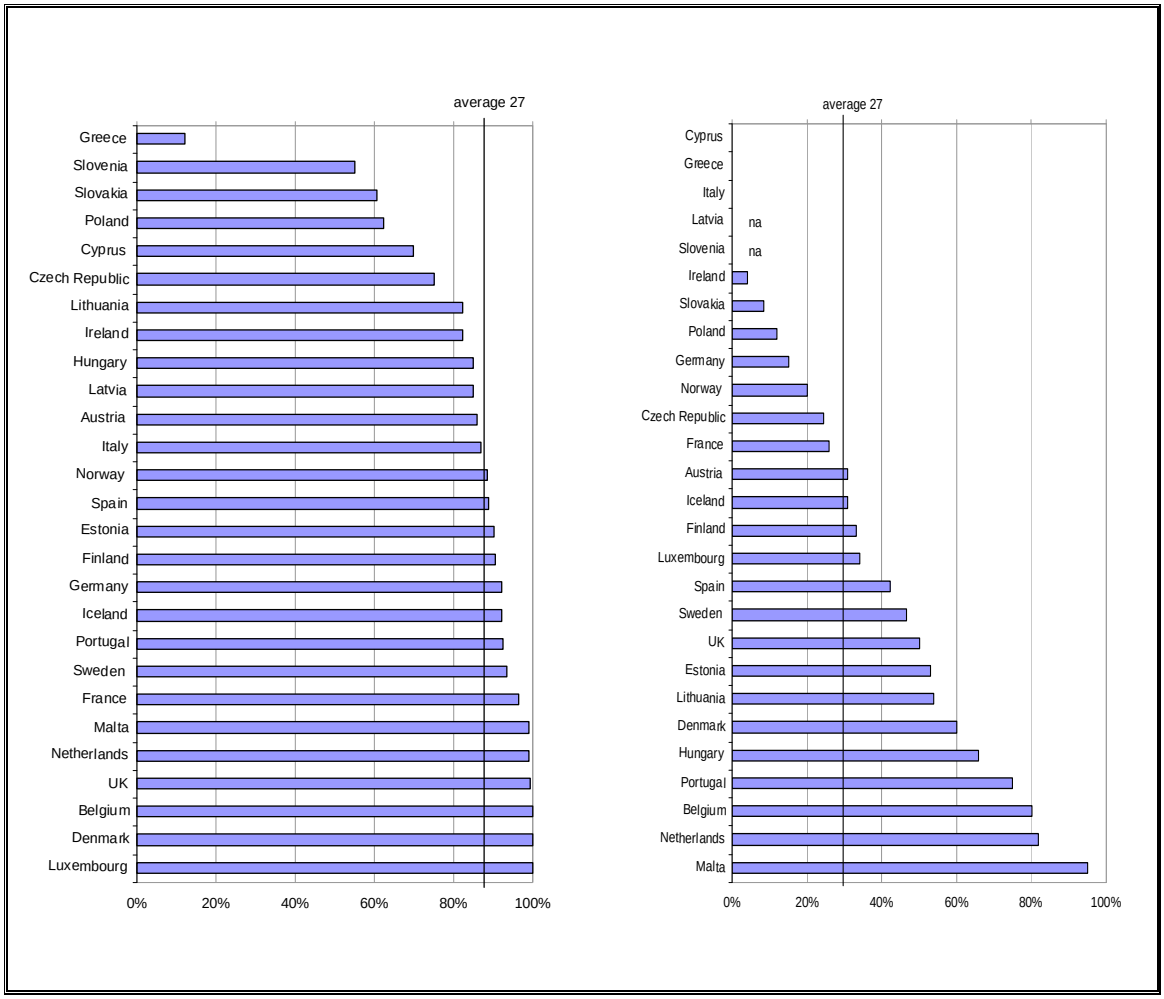
Faced with mature cable and satellite competition in the TV space, telecoms are going to find it hard to develop and market unique selling points (USPs) for their own triple-play offering.

Swisscom, which conducted a trial of the Microsoft TV platform from November 2004 to February 2005, appears to have more straightforward IPTV ambitions--at least in the short term. "Our main concern is that the picture and sound quality is at least as good as what the cable operators can provide," says Felix Graf, triple-play manager at Swisscom. "Without that, we can't compete. Network-based applications and functions, such as e-mail and caller ID on the TV, are not priorities right now for us."

Source: Horizon House Publications.

Figure 15. National DSL coverage in EU Member States at the end of 2005 (% of inhabitants)

National cable modem coverage in EU Member States at the end of 2005 (% of inhabitants)



Source: IDATE Consulting and Research. Broadband Coverage in Europe. Final Report. 2006 Survey.

2.1.2 Mobile networks

The UNECE region is also among the world leaders in terms of mobile penetration (table 21 and table 9). In many countries, the penetration rate has reached 90 to 100 per 100 inhabitants. As it is seen from table 9, in 20 of the 40 countries more than 80 per cent of population own one or more mobile contracts. In Portugal and Italy – 90 percent of population own a mobile contract. However, in Uzbekistan, Kazakhstan and Moldova, this indicator is significantly lower with, respectively, only 13 per cent, 16 per cent and 19 per cent of the population owning a mobile contract.

The mobile network is rather extensive in many countries of the region, thus allowing for a further proliferation of mobile telephony particularly in those countries where the penetration has not yet reached its limit (table 22). At the same time, the mobile telephony market appears to have crossed over and/or is approaching a theoretical saturation point in most countries of the region. In 14 of the 49 countries presented in table 21, the penetration rate was far above 100 per cent in 2005. The mobile network has overtaken fixed lines in a number of the region's countries, including the Russian Federation, Kazakhstan and Azerbaijan.

Table 9. Percentage of population who owns one or more mobile contracts

	Country	*Penetration rate (%)*	*Date compiled*
1	Albania	39	2005
2	Andorra	85	2005
3	Austria	86	2005
4	Belarus	82	2005
5	Belgium	86	2005
6	Bosnia and Herzegovina	32	2005
7	Bulgaria	70	2005
8	Croatia	62	2005
9	Czech Republic	87	2005
10	Denmark	76	2005
11	Estonia	83	2005
12	Finland	85	2005
13	France	82	2006
14	Germany	88	2006
15	Greece	80	2005
16	Hungary	78	2005
17	Iceland	78	2005
18	Ireland	77	2005
19	Italy	91	2006
20	Kazakhstan	16	2005
21	Latvia	67	2005
22	Lithuania	82	2005
23	Luxembourg	86	2005
24	Malta	71	2005
25	Moldova	19	2005
26	Netherlands	89	2006
27	Norway	84	2005
28	Poland	62	2005
29	Portugal	90	2006
30	Romania	69	2006
31	Russia	78	2006
32	Slovak Republic	67	2006

	Country	Penetration rate (%)	Date compiled
33	Slovenia	83	2006
34	Spain	86	2006
35	Sweden	85	2005
36	Switzerland	78	2005
37	Turkey	62	2006
38	Ukraine	67	2006
39	United Kingdom	85	2006
40	Uzbekistan	13	2005

Source: Worldwide Mobile Penetration Rates, Wireless World Forum 2006. (See www.w2forum.com/i/Reports).

The mobile telephony market differs from that of the fixed line market. Firstly, the intensity of competition is much higher. Secondly, the total number of mobile operators is significantly larger. Thirdly, it is less strained by regulation. Such market conditions have been conducive to innovation in pricing, product and services. In order to stay in the market, mobile providers have been forced to constantly search for new business and technology solutions. Apart from mobile voice services they are now focusing on data transmission, particularly on mobile Internet, and various media, such as: audio, video, mobile TV, games, among others. SMS/MMS (Multimedia messaging services) messaging still accounts for the largest share of mobile data revenues due to several advantages (affordability, accessibility, practicality and easy access). With the introduction of new technologies/applications (new platforms, mobile Public Key Infrastructure (PKI), mobile digital broadcasting (DVB-H), third generation handsets and etc.), mobile network virtual operators have been slowly gaining a market share in the Internet services provision.

Despite some concerns associated with the saturation of the mobile telephony market, it is precisely mobility and portability that makes this mode of interconnection so attractive and effective, especially in such areas as: e-Government, e-services (e-health, e-education, e-advertising and e-commerce) and e-business. It is not surprising that such impressive growth of the mobile segment raised the idea that one of the possible dimensions of the Information Society may be a mobility dimension. According to ITU, the combination of mobile with Internet and IP-based technologies and the integration of fixed and mobile technologies open a host of possibilities for innovative applications and new modes of interaction:

- Wireless applications of pervasive or ubiquitous technologies conjure up images of intelligent homes and always-on human monitoring;
- Location-based technologies can help police and individuals protect themselves and their family members from various forms of crime. Combined with customized advertising, such technologies can benefit retailers wishing to promote their products to potential buyers passing by ;
- MMS and streaming mobile video are opening up more person-to-person services and customized entertainment[30].

Therefore, these new technologies, enabling the mobility of individuals, businesses and civil workers everywhere and anytime, will unavoidably impact on the shape and direction of the future information society.

[30] ITU. Shaping the Future Mobile Information Society: The Case of the United Kingdom and Norway, February 2004.

Box 3. In Moldova, users are turning to WAP and mobile Internet access

In the first quarter of 2006 the number of mobile telephony users in Moldova grew by 44.5 thousand and is now one million 134 thousand. As a result, the mobile penetration rate per 100 residents increased to 33.5 per cent, as shown in a Report of the National Regulatory Agency in Telecommunications and Informatics on the evolution of this market segment.

In the same period JSC VOXTEL connected 30.5 thousand subscribers to its network, while JSC MOLDCELL – 10 thousand. According to the number of subscribers, the market share of VOXTEL was 60.82 per cent, and MOLDCELL – 39.18 per cent. According to the statistical reports submitted to the Agency by the two mobile operators, at the beginning of April 2006 the number of subscribers to WAP (Wireless Access Protocol) access services and mobile access to the INTERNET reached 222.5 thousand, of which 154.2 thousand are VOXTEL subscribers and 68.3 thousand - MOLDCELL.

The Agency experts consider that this evolution confirms the fact that mobile telephony operators realize the advantages of the services mentioned above and use them more and more often to access the INTERNET over a mobile phone. The multiplication in the number of mobile offerings, they expect, in particular WAP access and mobile access to the INTERNET will become the main development trends on this market in 2006.

WAP access service offers the possibility to access the INTERNET by means of a mobile phone on basis of GPRS and EDGE technologies. The service of mobile access to the INTERNET allows accessing the INTERNET by means of a mobile phone and a computer. MOLDCELL launched these services in January, and VOXTEL in September 2005.

Source: ANRTI Press Service. 18 May 2006.

2.1.3 Cable networks

Cable networks have been an important alternative to fixed lines in providing a modem access to Internet.[31] New technologies, such as: broadband, digital and wireless, have enabled cable providers to diversify and enhance their services, including data transmission.[32] As a result, total number of cable modem subscribers in 27 EU Member States increased from 3.8 million to 10.2 million.[33] The average cable modem coverage grew from 23 per cent in 2002 to 35 per cent of inhabitants in 2005, and the average penetration rate – from 1.2 per cent to 2.8 per cent, respectively. The highest cable penetration rate in the EU in 2005 was in the Netherlands (9.6%) followed by Denmark (8.6) and Belgium (6.8%).

In Eastern and Central Europe, Estonia (3.7% penetration rate) and Slovenia (3.2%) were ahead of the rest of the countries of the subregion in terms of penetration. However, in terms of coverage, Hungary had a rate of more than 66 per cent in 2005, and Lithuania and Estonia had respective rates of 54 per cent and 53 per cent (table 24). In the CIS, according to available information, in 2005 the cable penetration rate was the highest in Moldova followed by Ukraine.

At present, the cable network subsector is undergoing a digital revolution led by the United Kingdom, Norway, Ireland and Sweden (table 10 and box 4). About 20 per cent of EU homes now have digital TV,

[31] A cable modem is a type of modem that provides access to a data signal sent over the cable television infrastructure. Cable modems are primarily used to deliver broadband Internet access, taking advantage of unused bandwidth on a cable television network.

[32] The proliferation of cable modems, along with DSL technology, has enabled broadband Internet access.

[33] IDATA. Broadband Coverage in Europe. Final Report. 2006 Survey.

including 11 per cent in Germany and 57 per cent in Britain, while 24 per cent have broadband Internet, including 23 per cent in Britain and 44 per cent in the Netherlands.[34]

In 2006, the leading cable providers in the EU were German companies, Kabel Deutschland and Unity Media, with a total number of TV subscribers of more than 14 million. The top Internet Protocol Television (IPTV) providers in Europe were: France Télécom, Telefónica, Free, Neuf Télécom, Fastweb, Belgacom and Tiscali UK. Their combined number of TV subscribers was almost 2 million at the end of 2006.[35]

Table 10. Top 10 digital TV European countries, 2006

Ranking	*Country*	*Digital TV Penetration Rate June 2006 (%)*
1	United Kingdom	70
2	Norway	53
3	Ireland	52
4	Sweden	51
5	Finland	49
6	Italy	43
7	France	41
8	Spain	33
9	Germany	28
10	Austria	22

Source: e-Media Institute 2006 - © e-Media Research Ltd.

Box 4. European digital TV to soar

Demand for digital television in Europe will reach a record number of customers this year, according to research from Strategy Analytics and its Broadband Media and Communications service.

Nearly 19 million homes will buy digital TV for the first time this year, an increase of 20 per cent, according to the report, "Digital TV Subscriber Market Forecast Europe". The most popular option for new subscribers is still digital terrestrial television, with more than 10 million homes that could be added this year, the company said.

However, the newest entrant, IPTV, also is beginning to make inroads and take a share from established satellite TV and cable providers. The Strategy Analytics report predicts 16 million homes will subscribe to IPTV by 2010.

The report also predicts 75 million European homes, or 47 percent of the total, will have at least one digital television service by the end of the year, a third higher than last year. By 2010, digital TV penetration will have reached 77 percent, or 127 million homes, says Strategy Analytics.

The United Kingdom, with 94 percent penetration, will remain Europe's leading digital TV market in 2010, with Ireland, Austria and Sweden next in line. Digital terrestrial TV will overtake satellite to become Europe's largest digital TV platform by 2008, says the firm.

Source: Strategy & Analytics. 16 October 2006.

[34] See http://technology.guardian.co.uk/.
[35] Source: e-Media Institute 2006.

2.1.4 Wireless networks

Wireless networks have been proliferating at the highest speed in the UNECE region, especially in some of the CIS countries (boxes 5 and 6) where the fixed line teledensity is lower than in other subregions of UNECE. At present, the wireless networks are mainly represented by: satellite telecommunications systems, Wi-Fi and WiMAX.[36]

Satellite communications have not been widely used in Europe and the CIS to provide Internet access services for a number of economic and technical reasons. Firstly, in most European countries mainland alternatives are cheaper and more readily available. Secondly, terrestrial alternatives are generally more powerful and reliable. This situation seems to be slowly changing driven by political commitments to provide a high-speed access to Internet for all, targeting the households and businesses located in remote and/or underdeveloped areas. In the EU, one of the major satellite service providers is Europe Online (owned by Europe Online Investments S.A.), which since 1999 is also one of the world's first and largest broadband Internet via satellite operators. Europe Online has been using the ASTRA satellite system to provide "Direct-to-Home" satellite television to European households since the 1980s. Since 2003, Europe Online has begun operating the Eutelsat satellite system, which allowed for widening its geographic coverage and, bringing its services to Eastern and Southern Europe, Turkey, North Africa and the Middle East.[37]

Box 5. Wireless broadband is the next big thing in the Russian Federation

The IKS Consulting analytical and market research agency reports that the 61 per cent growth rate achieved by the Russian wireless broadband market in the first half of 2006 will most likely remain constant in the second quarter of 2006.

The market size is estimated at $33 million, representing approximately a 5 per cent share of the total Russian Internet market, and about an 8 per cent share of the domestic broadband market. It is expected that the current growth trend will continue and that the market will grow to $80 million by the end of 2006, thus accounting for a 6 per cent share of the Russian total Internet market size.

The wireless broadband networks are concentrated in the greater regions of Moscow and St. Petersburg. Most of the existing broadband networks (about 220) are built on Radio Ethernet (IEEE 802.11), but from now on, the networks will be built on WiMAX.

The number of Internet users directly connected to broadband networks grew by eight thousand in the second quarter of 2006 to reach 35,000 in total.

Source: C*News, 31 August 2006.

In 2004, Europe Online was granted the European Patent for "Integrated High-Speed Terrestrial and Satellite Communications Systems for Internet and Other Uses". (The patent had first been applied for on 8 April 1999. The invention related to systems and methods for managing the delivery of a plurality of types of data content to data users, and more particularly, to systems and methods for managing the allocation of bandwidth resources for the transmission and delivery via a satellite telecommunications network. The key objectives of this invention were to:

[36] Wi-Fi (wireless fidelity) is a technology enabling a PC, laptop and/or cell phone to access the Internet; WiMAX is another enabling technology, which could provide a high-speed broadband Internet connection to home, corporate and roaming users over wireless connection. Both technologies can be bridged and routed with the wired or wireless LAN.

[37] See www.europeonline.net.

- Provide systems and methods that take advantage of the broadband resources available in satellite telecommunication network systems to deliver Internet Protocol (IP) data content to data users at rates of speed that may not be available in traditional terrestrially-based Internet communication networks;
- Provide systems and methods that are able to deliver non- IP data content, such as films and video on demand as well as MPEG streams of audio or video digital content;
- Provide systems and methods that take advantage of the multicasting capabilities of satellite communication network systems to be able to simultaneously deliver data content to a multitude of data users with a single transmission of data content;
- Take further advantage of the multicasting capabilities of satellite telecommunication networks, methods for queuing the delivery of digital data content to data users;
- Provide an integrated communications system manager, bi-directional control and signaling capability interconnecting a plurality of diverse bandwidth-originating communications networks, an integrated high-speed data content manager and a distribution network, in order to facilitate the delivery of a plurality of types of data.[38]

Europe Online has become one of the largest Satellite Internet/Multimedia networks in the world. Its user base for E-DSL Broadband Internet via satellite and service complete with video on demand, MP3, games, software and films was estimated at 60,000 in 2003.[39]

Satellite communication services in the CIS have been provided by NTV+ (Russia), Armentel (Armenia), Kazakhtelecom and Nursat (Kazakhstan), Egrisi (Georgia), Lucky Link and Thuraya (Ukraine), Delta Telecom, Aztelekom and AzEuroTel (Azerbaijan).

In Belarus, Beltelecom and Intersputnik recently conducted negotiations on the establishment of a joint stock company which could provide modern multimedia satellite communication services in the country.[40] Apart from its own satellite systems, the Intersputnik has more than 150 ground base stations for long-distance communications and more than 1500 ground base stations in VSAT and television distribution networks.

In Russia and Kazakhstan, whose large territories pose a challenge in terms of teledensity, satellite telecommunication services have been regarded as one of the key means of meeting this challenge. Therefore, both countries have been keen to cooperate and advance satellite telecommunication technologies. In 2006, Kazakhstan launched its own satellite lowering the costs of satellite telecommunication services.

Wireless networks Wi-Fi and WiMAX have been playing an increasingly important role in the countries or regions experiencing a deficit of basic terrestrial ICT infrastructure, and/or where economic costs of extending fixed lines are too high due to the remoteness or sparse population. In most instances, however, they have been used to fill the connection gap bridging local networks. In Europe, Wi-Fi services have been provided by the fixed line operators, alternative fixed line operators and/or mobile operators. The top three broadband providers in France, France Telecom (now known as Orange), IPO candidate Neuf Cegetel and Iliad have started rolling out services that allow cellular phone customers to use mobile and Wi-Fi networks with the same handset. Such efforts have turned France into one of the world's most advanced markets for dual-mode Wi-Fi mobile services, which could profoundly change operators' business models in the months to come.

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[38] Europe Online Investments, S.A., The RTL Center.
(See http://www.europeonline.com/en/company/press_releases/anniversary.shtml).

[39] See http://www.europeonline.com.

[40] Intersputnik provides services to telecommunication operators and corporate clients using LM-1 (Lockheed), Express-A and Express-AM (Russia) satellites. It also manages the marketing and provision of Eutelsat satellite telecommunication system services (23 satellites) and Gazkom system (Jamal-200 satellites) services (source: www.interspitnik.com).

Box 6. Closing the territorial digital divide: Satellite telephony in the Russian Federation

Aimed at solving the problem of digital deficiency, FSUE Russian Post arranges the service using satellite technologies in localities lacking a telephone communications system.

In July 2004, within the framework of pilot project, 100 call offices for long-distance communication based on satellite terminals of the Russian operator Globalstar - JSC "GlobalTel" - were opened at post offices. Call offices were created in difficult-to-access localities lacking telephone communication. Presently the telephone services are provided in 36 regions of Russia covering all the federal districts. In 2005, the number of call offices exceeded 300. The majority of public call offices included Siberian and Far East federal districts.

The success of the project proved that the services were popular in the regions, thus by the end of 2006 the number of public call offices was increased to 500.

CJSC "GlobalTel" is an exclusive provider of the global mobile satellite communications system Globalstar in Russia. CJSC "Rostelecom" and Globalstar L.P. are the founders of the company. In May 1997, Globalstar L.P. and CJSC "GlobalTel" signed an Agreement providing that CJSC "GlobalTel" has exclusive rights to grant Globalstar services within the territory of Russia. Since November 2000, full commercial exploitation of the Globalstar system was put into practice in the whole territory of the Russian Federation and a number of CIS countries. Presently Globalstar serves over 21 thousand subscribers.

In 2004, within the framework of the "Program on the Provision of Telephone Communication to the Underpopulated Localities by Installing the Universal Call Boxes in Post Office of the North-West Federal District" approved by the Ministry of Information Technologies and Communications of the Russian Federation, JSC "National Call Boxes Net" set up 800 universal call boxes at post offices in the Siberian and Far-East federal districts.

In the first half of 2005, inter-regional companies of JSC «Sviazinvest» upgraded over 3400 call boxes in the post offices of the FSUE Russian Post. JSC "National Coin-box Net" (NCN) was established in 2000 to modernize the call box industry in Russia and grant people high-quality profitable call box services based on a single card.

To expand the range of the provided services, FSUE Russian Post implemented a project to create a multi-service satellite network. Within the framework of the project, a contract with the manufacturer of satellite equipment Gilat Satellite Networks Ltd. was contracted to supply and install over 500 small ground-based stations in the Siberian and Far-East Federal Districts.

The implementation of this communication system will provide the most advanced high-level telecommunications, financial, banking and insurance services at the remotest post offices.

Source: http://www.russianpost.ru/portal/en/home/public/telephony.

France has also become one of the least expensive places in Europe for high-speed Internet. Paris is one the capitals with the most Wi-Fi hotspots in cafes, airports, train stations and homes. While some Wi-Fi hotspots are free, others charge or can only be used by members of Wi-Fi sharing communities.

Wi-Fi hotspot approaches are to be found in many networks and some of the more recent include a network in Turku, Finland. Extending over a broad continuum are variants on a Wi-Fi mesh model. Networks such as United Kingdom-based Telabria use these, as does BT with its 5-city trial and "The Cloud," a city network planned for 10 cities in the United Kingdom (box 7). AWA of Spain also uses mesh Wi-Fi technology. Many countries in Western Europe (Germany, Italy, Spain, Finland among

others) adopted or are about to adopt the dual-mode technology. The German Deutsche Telekom's fixed-line unit T-Com, for example, introduced a dual-mode Wi-Fi mobile phone service early 2007.

Box 7. A major new initiative to bring wireless Internet access to Britain's city centres

The Cloud announced a major initiative to deploy widespread wireless broadband networks in city centers throughout the United Kingdom. The plan to have "clouds" of wireless broadband internet access over the United Kingdom's major centers of population will begin with nine city centre areas. This is the first major initiative to bring coverage to multiple cities simultaneously since mobile phone networks were built in the early 1990s and will allow more than four million people to connect to the Internet without wires.

The first phase was to be completed by March 2006. Hundreds of Wi-Fi hot zones were rolled out in the city centres of Edinburgh, Leeds, Manchester, Birmingham, Nottingham, Oxford, Cambridge, Liverpool and the three London Boroughs of Kensington and Chelsea, Camden and Islington. More cities will follow.

Each Wi-Fi hot zone turns broadband-speed internet into radio signals which can then be accessed by laptops, PDAs, handheld games consoles and Wi-Fi-enabled mobile phones to allow quick and easy Internet access. This means in these city centres it is possible to access the Internet wherever you are by simply turning on your device and logging on. People are able to send e-mails, surf the Internet, access work networks, play games online and make cheap phone calls over Wi-Fi and more from wherever they are within the city centre.

The Cloud's networks are open to any service provider who would like to provide advanced wireless services to their customers. In some countries city networks have been built by a single service provider, who then has a monopoly on the provision of Wi-Fi. The Cloud's wholesale network approach means this will not happen. The new city networks will immediately be available to people using BT Openzone, O2, SkypeZones and Nintendo Wi-Fi. The networks can also be quickly available to other companies such as T-Mobile, NTL/Virgin, BSkyB/EasyNet, TalkTalk, Sony, Vonage, iPass and other ISPs and network operators who may want to offer services to government, consumers and business customers.

The Cloud is no stranger to creating large metro Wi-Fi zones, having executed a similar programme in Canary Wharf in London to make it Europe's largest Wi-Fi-enabled financial area. In addition, the company has Wi-Fi-enabled Old Trafford, Royal Festival Hall and the British Library, as well as numerous airports, railway stations, hotels, coffee shops, pubs and restaurants.

Source: http://www.thecloud.net/.

A growing trend, according to some analysts, has been the promotion of Wi-Fi by non-telecom operators, especially in Eastern and Central Europe.[41] The city council of Prague, for example, offers users a 12-hour Wi-Fi access for free through a pilot Wi-Fi network. As a result of efforts by various social agents to ensure an affordable access to Internet for as many citizens as possible, Europe became a leader in establishing public Wi-Fi hotspots (table 11). According to some estimates, at present there are about 57 thousand hotspots throughout Europe.[42]

[41] Budde Paul. Europe (Eastern) Telecoms, Mobile & Broadband Overview and Analysis 2006-2007. (www.budde.com.au).

[42] See http://www.telecom.compulenta.ru/ and www.iwireless.ru/news/.

Table 11. Wi-Fi hotspot world leaders, the beginning of 2006

Country	*Total number of Wi-Fi Hotspots*
United States	37073
United Kingdom	12668
South Korea	9415
Germany	8614
Japan	5951
France	3886
Italy	1767
Netherlands	1703
Canada	1397
Switzerland	1295

Source: JiWire, 2006.

In the CIS, wireless technologies are gaining momentum. A number of large Wi-Fi network projects are currently under way in the Russian Federation and other CIS countries. In the Russian Federation, there are already 1000 Radio-Ethernet systems in operation. More than 200 ICT providers in 126 Russian cities have been involved in developing wireless networks based on this technology. Three wireless networks are already been deployed in Moscow. Large wireless networks have been established in Yekaterinburg, Surgut, Tyumen, and Krasnodar. The networks in Novosibirsk, Samara, Irkutsk, Kurgan and Rostov are already functioning. Radio-Ethernet has been used in Ukraine, Belarus, Kazakhstan, Moldova, Georgia, Armenia and Uzbekistan. In Armenia, about five per cent of the connections are wireless. In Georgia, a Wi-Fi network was established in Tbilisi.

There are already 285 Wi-Fi hotspots in Moscow, mostly at hotels. Another 400 hotspots will be added in the nearest future. In Belarus, there were ten public Wi-Fi spots, mostly in Minsk, in mid-2005.

In August 2007, Golden Telecom Incorporated, the leading provider of integrated telecommunications and Internet services in the largest population areas throughout the Russian Federation and other CIS countries, announced that it had signed an agreement to provide Wi-Fi equipment and services to McDonald's company. In accordance with the agreement, Golden Telecom will provide the chain of Russia's McDonald's restaurants with Golden Wi-Fi services. The Wi-Fi Internet access will be available to all the restaurants visitors in Russia. McDonald's now operates 175 restaurants in Moscow, the Moscow region, St. Petersburg, Nizhny Novgorod, Yaroslavl, Samara, Kazan, Voronezh, Volgograd, Krasnodar, Sochi, Nizhnekamsk, Almetievsk, Saratov, Rostov-on-Don, Ufa and Orenburg.[43]

Wi-Fi technology has been challenged by WiMAX in the CIS. This technology could be employed by both fixed line and mobile telephony providers, but it also can be used for setting up an independent WiMAX network. This distinct characteristic makes the technology especially attractive in the countries like Russia and Kazakhstan. WiMAX networks, which are currently being deployed in the Russian Federation, aim at providing broadband Internet access rather than mobile Internet access. Summa Telecom, the Russian company holding the sole nationwide license for WiMAX**,** plans to invest almost $1 billion to develop WiMAX networks in 330 cities of Russia by 2010. In 2007, the company intends to deploy WiMAX networks in six to seven cities.[44]

[43] See http://www.goldentelecom.com.

[44] See http://www.cnews.ru, 27 July 2007.

2.2. Connectivity

Differences in the physical Internet backbone infrastructure coupled with differences in per capita income between and within the UNECE Member States have been translated into disparities in terms of connection to and usage of the Internet.

Connection to the Internet in the UNECE region has been provided by different platforms. Available ITU data suggest that the most widespread type of access to the Internet in the EU Member States has been *a wired access* and, first of all, an Internet access via DSL (tables 25 and 26). In 2005, in the 26 countries presented in table 25, there were more than 48 million DSL and 10 million cable modem Internet subscribers. More than 16 million in 23 EU Member States were dial-up subscribers (table 26).

In the CIS, the situation has been similar to that in the EU. For example, in Moldova, dial up Internet access subscribers constituted 83 per cent of the total number of Internet subscribers, while cable Internet access subscribers – 5.4 per cent and DSL Internet access subscribers - 11.1 per cent in 2005. In Russia, the total number of dial up Internet subscribers was 11 million by 2005, cable Internet access subscribers – 1.2 million and DSL – only 0.5 million.[45] In Armenia, about 60 thousand households were connected to Internet (mainly via dial-up and cable modem).

The CIS and Eastern and Central European subregions have been lagging behind the most advanced countries of the EU in terms of Internet connection, including broadband, although the situation has been rapidly changing due to national efforts and foreign capital penetration. In 2005, the average DSL Internet access penetration rate in Central and Eastern European countries was four per cent of the population, while in the Western European countries, 12 per cent with Iceland having almost 26 per cent penetration rate and Finland, 10 per cent (figure 16 and table 27).

Apart from DSL providers, other operators also supply broadband access to Internet, including via cable modem, Wi-Fi and/or WiMAX. On the whole, the total number of subscribers to broadband has been growing at amazing speed, especially in Central and Eastern European countries and in some of the CIS (figure 16 and table 28). In Latvia and Lithuania, for example, the total number of broadband Internet subscribers increased, respectively, by 800 per cent and 1070 per cent between 2002 and 2005. Over the same period, in the Russian Federation, the total number of broadband Internet subscribers grew by 144 times, reaching the penetration rate of 3.5 per cent of the total number of households in 2006.[46]

But the broadband Internet access remains extremely uneven in the Russian Federation. Access is concentrated in large cities, mainly in Moscow and Saint Petersburg. According to estimates made by J'son & Partners and iKS-Consulting, the total number of the broadband Internet users in Moscow had grown to 1.01 to 1.1 million people (or 60% of the Moscow households and almost 50% of the total broadband Internet users of the country) in 2006.[47]

In Azerbaijan, Belarus, Kazakhstan and Kyrgyzstan, the total number of broadband Internet subscribers has also grown very fast, increasing by 200 times in each country between 2002 and 2005 (table 28).

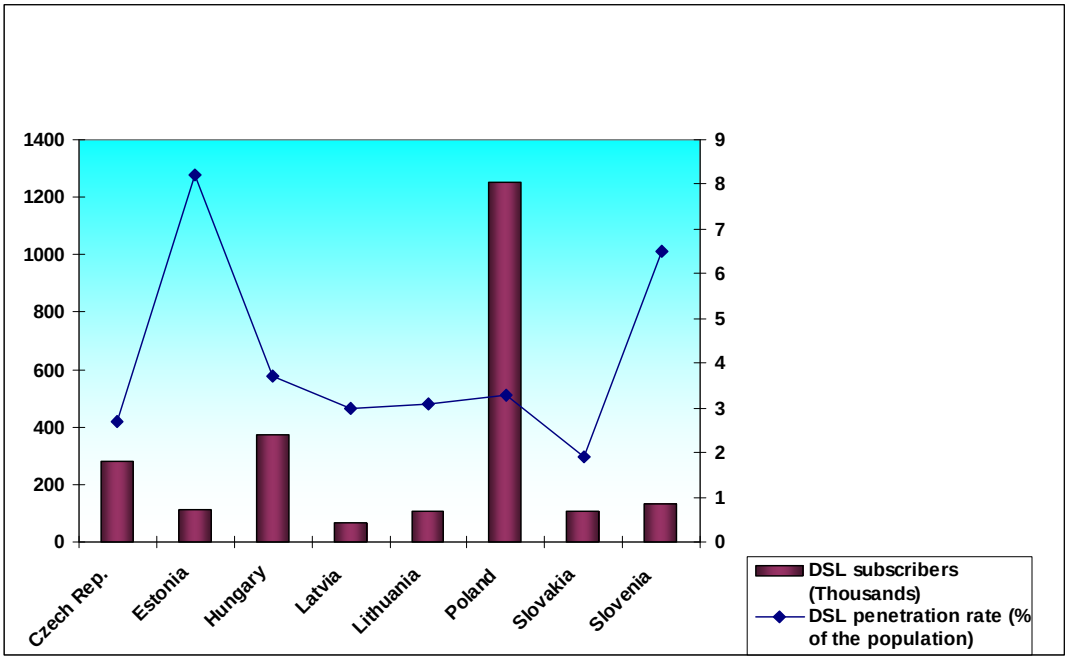
In Georgia, connection to the Internet has been provided from different platforms: cable, satellite, dial-up, Wi-Fi and WiMAX and ADSL. Two companies, Telenet and ICN (the Caucasus Network), dominate the Internet services market (60%) in the country, including the provision of broadband Internet access. Despite a comparatively favorable situation (to other CIS countries) in terms of the basic ICT infrastructure availability, low per capita income constitutes an important barrier to Internet penetration in

[45] ITU database.

[46] Some analysts suggest that their total number may increase up to 10 millions by the year 2010. (source: CNews. Broadband access: a new locomotive?) (See www.cnews.ru).

[47] CNews. (Broadband access: a new locomotive?) (See www.cnews.ru).

Figure 16. Broadband (DSL) connection to Internet in selected Central and Eastern European countries, 2005



Source: IDATE. Development of Broadband Access in Europe, November 2006.

Georgia, where it remains at four per cent (in terms of the Internet usage). One of the solutions to this problem has been the creation of public Internet access places. With financial assistance from international donors, 12 PIAPs were constructed in Tbilisi, Kutaisi, Batumi, Gori, Poti and some other cities.[48]

The impressive growth of the broadband Internet subscription in the UNECE region hides, however, the sharp unevenness of the broadband Internet penetration throughout the region. Secondly, the gap between and within subregions in terms of household connection to the Internet and PC penetration remains significant (tables 12 and 13). Thirdly, the growth and penetration rate of Internet usage has surpassed that of Internet subscription in all the subregions (table 29). This discrepancy suggests that a significant proportion of the Internet users have been accessing the World Wide Web from other places rather than home.

Some researchers also noted that extremely high costs of the Internet connection and services (in terms of per capita income or average monthly wage) in some CIS and Eastern and Central European countries has been hindering the Internet subscription and usage growth. Thus, for example, in Kazakhstan, the unlimited dial-up Internet connection package offered by Kazakhtelecom cost about €86 per month, the unlimited ADSL connection – from €102.45 (at 64 Kbps) to €3278.57 (at 2048 Kbps) per month, and the unlimited cable Internet connection – from €9,163.09 (at 3 Mbps) to €24,432 (at 10 Mbps) per month. Taking into consideration that the average monthly salary in Kazakhstan was 292 euros (as of January 2007), it is not surprising that most of Internet users have been accessing the Internet at their workplaces.[49]

[48] Political Intelligence. Final Report: Monitoring of Russia and Ukraine (priority 1) and Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan and Moldova (priority 2): Telecommunication and the Information Society, London-Brussels-Madrid, 2006, pp. 23-24.

[49] Governing the Internet: Freedom and Regulation in the OSCE Region, Vienna, 2007, pp. 119-131.

Table 12. Percentage of homes connected to Internet, 2000-2006

Country	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*	*2006*
Austria	33	42	47	51	55	47	52
Belgium	..	28	43	..	..	50	54
Bulgaria	20	..	..	..	10	..	
Cyprus	14	19	24	29	53	32	37
Czech Republic	..	..	..	15	19	19	
Denmark	46	59	56	64	69	75	79
Estonia	..	..	14	17	31	39	46
Finland	30	36	41	47	51	54	65
France	16	23	23	31	34	..	41
Germany	25	35	46	54	60	62	67
Greece	..	10	12	16	17	22	23
Hungary	3	6	8	..	14	22	32
Iceland	..	62	..	..	81	84	83
Ireland	20	34	..	36	40	..	50
Italy	15	..	34	32	34	39	40
Latvia	..	..	..	..	15	42	42
Lithuania	..	..	4	7	12	16	35
Luxembourg	30	..	40	45	59	65	70
Netherlands	..	..	58	61	65	78	80
Norway	49	56	..	60	60	64	69
Poland	21	..	..	..	26	30	36
Portugal	9	13	15	22	26	31	35
Romania	..	4	..	..	6	..	
Slovak Republic	2	2	..	..	23	23	27
Slovenia	21	..	..	..	47	48	54
Spain	..	..	17	28	34	36	39
Sweden	48	53	68	..	..	73	77
The former Yugoslav Republic of Macedonia	..	..	..	..	11	..	
Turkey	7	..	..	..	7	9	
United Kingdom	30	45	42	50	57	60	63

Source: ITU database and EUROSTAT Press release, Internet Usage in the EU25, 10 November 2006, STAT/06/146. Data reproduced with the kind permission of ITU.

With regards to the Internet connection of the business community, a recent review of ten business sectors (food and beverages, telecommunications, hospitals, construction, shipbuilding, tourism, pulp and paper, footware, consumer electronics, ICT manufacturing) in 10 EU Member States (Czech Republic, Finland, France, Germany, Hungary, Italy, the Netherlands, Poland, Spain and the United Kingdom) found that nearly all companies (93%) which used computers and had at least ten employees were connected to the Internet.[50] The companies with the Internet connection had been using mainly a broadband access to Internet (about 70% of the surveyed firms) via DSL or some other technologies (cable, direct fibre or wireless broadband). Significant differences in the use of ICT and Internet among the surveyed enterprises and across the sectors were also observed. Thus, the Internet penetration rate was found to be the highest among enterprises with more than 250 employees (99%) and the lowest among the micro-enterprises with one to nine employees (89%). Among the business sectors, shipbuilding and telecommunications were the leaders in terms of broadband Internet access, with respective rates 100 per cent and 99 per cent. In the

[50] The European e-Business Report, 2006/2007 edition, EU publication, Bonn, January 2007.

traditional sectors like footware and food and beverages, where small firms prevail, Internet use was relatively low, as only 20 to 30 per cent of the workers needed Internet access to perform their tasks.[51]

Table 13. PC penetration rate: PCs per 100 inhabitants, 1990-2005

Country	*1990*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Albania	..	..	1	1	1	..	..	..
Armenia	..	..	1	1	2	3	7	..
Austria	7	16	36	42	48	55	58	61
Azerbaijan	..	..	..	..	..	1	2	2
Belarus	..	..	..	..	..	..	..	1
Belgium	9	18	22	23	27	32	35	38
Bosnia and Herzegovina	..	..	..	..	..	..	..	..
Bulgaria	..	2	4	5	5	6	6	..
Croatia	..	2	11	14	17	18	19	..
Cyprus	1	6	22	25	27	30	31	..
Czech Republic	1	5	12	15	18	21	24	..
Denmark	11	27	51	54	58	61	65	..
Estonia	..	..	15	17	21	44	46	49
Finland	10	23	40	42	44	46	48	..
France	7	15	30	33	35	42	50	58
Georgia	..	..	2	3	3	4	4	5
Germany	9	18	34	38	43	48	55	60
Greece	2	3	7	8	8	8	9	..
Hungary	1	4	9	9	11	13	15	15
Iceland	4	21	39	42	45	46	47	48
Ireland	9	18	36	39	42	46	50	..
Italy	4	8	18	19	23	27	31	37
Kazakhstan	..	..	..	..	..	..	..	..
Kyrgyzstan	..	..	1	1	1	1	2	2
Latvia	..	1	14	15	17	19	22	..
Lithuania	..	1	6	7	11	13	15	..
Luxembourg	..	..	46	52	59	62	62	62
Moldova	..	0	1	2	2	2	3	8
Netherlands	9	20	39	43	47	51	68	..
Norway	..	27	49	51	53	55	57	..
Poland	1	3	7	9	11	14	19	..
Portugal	3	6	10	12	13	13	13	..
Romania	0	1	3	4	8	10	11	..
Russian Federation	0	2	6	8	9	9	10	12
San Marino	..	..	76	76	76	82	89	90
Slovak Republic	..	4	14	15	19	24	30	36
Slovenia	..	10	28	28	30	33	36	41
Spain	3	6	17	22	19	22	25	28
Sweden	10	25	51	56	62	69	76	..
Switzerland	9	28	65	68	71	74	82	86
The former Yugoslav Republic of Macedonia	..	..	..	4	5	6	7	22
Tajikistan	..	..	..	..	..	..	0	1
Turkey	1	1	4	4	4	5	5	..

[51] Ibid.

Country	1990	1995	2000	2001	2002	2003	2004	2005
Turkmenistan	..	..	..	..	..	..	..	..
Ukraine	0	1	2	2	2	2	3	4
United Kingdom	11	20	34	37	41	44	60	..
Uzbekistan	..	..	..	..	..	..	1	1
Yugoslavia	..	1	2	2	4	4	5	..

Source: ITU database. Data reproduced with the kind permission of ITU.

Analogous patterns were observed in the use of internal computer networks. The use of ICT to connect computers internally to a company network (LAN or Wireless LAN) varied with the size of the firm. At the same time, the use of LAN was rather widespread. As far as the Wireless LAN is concerned, it was mainly used within the Telecommunications and ICT manufacturing sectors, respectively, 44 per cent and 34 per cent of the surveyed firms. The use of other advanced technologies, such as: VoIP (Voice-over-IP) or VNP for remote access was mainly concentrated in two sectors: telecommunications and consumer electronics.

Table 14. Enterprises with broadband Internet access in the EU 10

	Small firms	Large firms
Total (small firms)	75	84
Food and beverages	62	83
Footware	73	91
Pulp and paper	77	86
ICT manufacturing	86	83
Consumer electronics	81	100
Shipbuilding	82	
Construction	73	87
Tourism	82	75
Telecoms	87	79
Hospitals	71	86
Czech Republic	61	77
Germany	76	81
Spain	83	93
France	84	91
Italy	76	94
Hungary	66	96
Netherlands	76	70
Poland	76	90
Finland	83	100
United Kingdom	72	75

Source: The European e-Business Report, 2006/07 edition, EU publication, Bonn, January 2007.

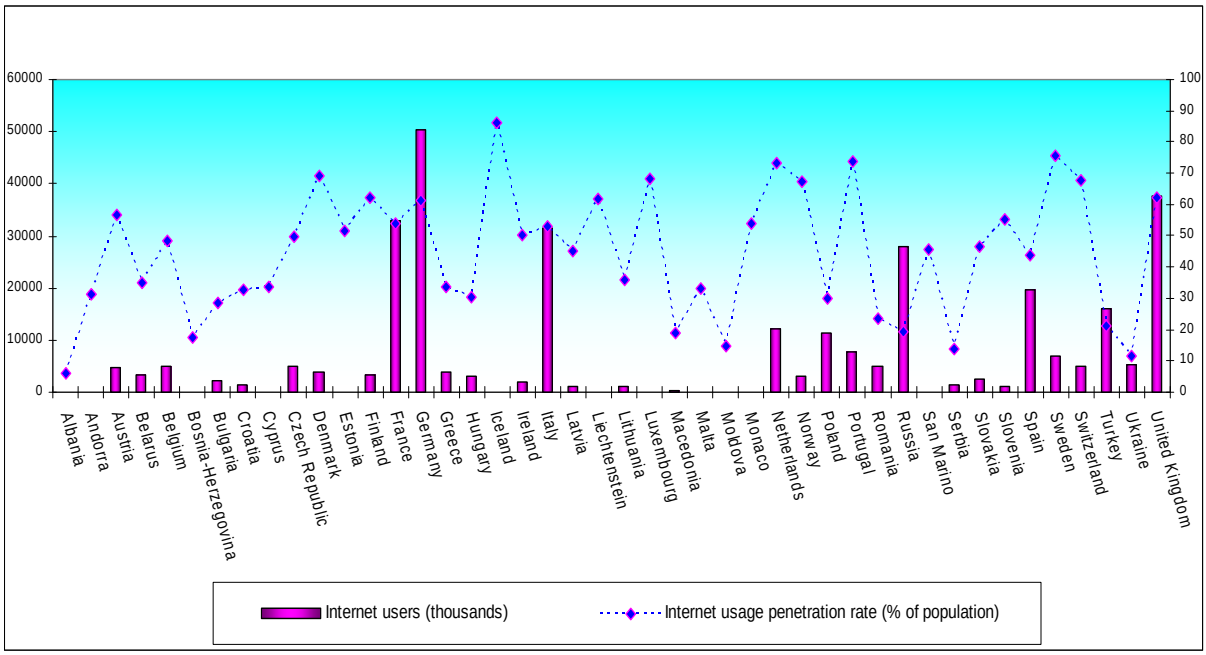
These differences in the use of Internet, LAN and other connecting technologies among the enterprises become even more pronounced when a geographical location is added. Thus, in Hungary and the Czech Republic, the percentage of small firms with an Internet access was lower than the EU 10 average, while the percentage of large companies with an access to Internet was close to the EU 10 average in the Czech Republic and bigger than the EU 10 average in Hungary (table 14).

The surveyed companies in the EU 10 had been increasingly conducting their business operations online. More than 10 per cent of the total orders to suppliers were placed online by 15 per cent of the small

companies and by 32 per cent of the large firms. Respectively, 11 per cent of the small companies and 11 per cent of the large companies received more than 10 per cent of orders from customers online. Eight percent of the small companies and 21 per cent of the large ones had their ICT system linked with suppliers.[52]

The available data on CIS countries imply that prevailing trends in the usage of the Internet and ICT in general by businesses are identical to those in the EU business sector; although the penetration rate of the Internet and ICT is lower on the average. Thus, in Moldova 64.9 per cent of all companies used computers in their operations and 35 per cent planned to purchase ICT equipment. Of all the companies with computers, 76.5 per cent used local networks and 29.4 per cent used teleworking services via the Internet.[53]

Figure 17. Internet usage in the UNECE region, 2007



Source: http://www.internetworldstats.com/.

In the Russian Federation, according to some studies, companies in key production and services sectors are in the process of modernizing their own ICT infrastructure and/or developing their own corporate telecommunication networks. Almost half of the total expenditure on ICT of the Russian businesses, or about $2.5 billions, was invested in telecommunications (equipment and services) in 2005. Some industrial holdings and public transportation companies like Gazprom and the Russian Railways, for example, successfully upgraded their ICT infrastructure and became significant providers of ICT services to other businesses through their own operators. Gazprom set up Gazcom to provide ICT services to their holding partners. The Russian Railways set up TransTeleCom to meet the communication needs of railway transportation (box 8).

[52] Ibid.

[53] Political Intelligence. Final Report: Monitoring of Russia and Ukraine (priority 1) and Armenia, Azerbaijan, Belarus, Georgia, Kazakhstan and Moldova (priority 2): Telecommunication and the Information Society, London-Brussels-Madrid, 2006.

Box 8. TransTeleCom fibre-optic network in the Russian Federation

Fibre-optic lines of the TransTeleCom fibre-optic network run along all the mainline railways, which are over 50,000 km in length, cover all the densely populated areas of the Russian territory and link up western and eastern parts of the country. The Backbone Digital Network has over 900 resource allocation points in 71 regions of the country which account for 90 per cent of the population and accommodate all the main production facilities of the Russian Federation.

The high reliability of the network is ensured by the reservation of fibre-optic communication lines for geographically spread routs and by the efficient operation system for line-cable structures. Connection points with the networks of foreign operators (Finland, the Baltic States, Poland, Ukraine, Kazakhstan, Mongolia and China) create an effective environment for the exchange of international operators' traffic.

These services are rendered by the TransTeleCom Company network comprised of the Backbone Digital Communications Network of the Russian Railways built up and operated by TransTeleCom, as well as MPLS IP network based on BDCN resources, the ATM network, and access networks all integrated into one interlinked multiservice network system.

SDH technology (Synchronous Digital Hierarchy) has been chosen as the basis for installing the backbone primary network; it ensures the required scalability (2 – 10,000 Mbps) both in terms of capacity and zone coverage and enables the most effective operation of optical channels.

The network uses SDH multiplexers provided predominantly by Lucent Technologies; they are capable of multiplexing the standard PDH and SDH signals to 2.5 Gbps level (STM-16). A wide range of covered distances, high capacity and connection flexibility make the SDH equipment the key component of effective and economical backbone networks.

The combination of the equipment used with the SDH technology increases the primary traffic network reliability by integrating its units into ring configurations, which allows the network control system automatically to switch from a main channel to an alternate channel in case of deviations of the main channel quality parameters from the standard. Switching the channel in the network takes no more than 50 ms which means no interruption for the user.

Currently TranTeleCom is in the process of implementing Dense Wavelength Data Multiplexing (DWDM) technology into its network. Due to that improvement, in the near future the network capacity will grow from 2.5 Gbps to 40 Gbps. However with the further traffic growth, the capacity may be increased up to 400 Gbps.

MPLS IP Network

The multiservice MPLS IP network built by TransTeleCom on the basis of its BDN, with its nodes spread throughout the Russian Federation, is this country's first MPLS network boasting such territorial span and capacity.

The MPLS (Multiprotocol Label Switching) IP-network based on the promising state-of-the-art technology, has a two-level hierarchical architecture, which includes the core of MPL-switching of IP-traffic, and the border layer responsible for serving subscribers. The latter is often referred to as the network's "intellect."

The IP network uses the channels of the primary STM-1 network as the main transport environment, with the prospect of developing them to the level of STM-4 and STM-16.

The IP network core includes highly productive switching routers supplied by Cisco Systems. The border layer also uses Circo Systems routers, which ensure the aggregation of subscriber traffic, and Fast Ethernet switchboards responsible for the integration of the node's infrastructure and the connection of subscriber equipment. The IP network also includes a devices-and-services management system, and a set of servers ensuring traditional Internet services such as DNS, SMTP, and WWW.
The MPLS IP network lays the foundation for the most important services offered by TransTeleCom, primarily IP VPN, access to the Internet.

The modern MPLS IP infrastructure is the basis for multi-service operator and corporate networks, facilitating infocommunications services and integrating telecommunications and information services.

The MPLS IP network expansion and development of innovative services on its basis is the company's priority.

Asynchronous Transfer Mode (ATM)-based Network

The multiservice ATM-switched network is built on top of SDH digital paths and is based on a packet-oriented asynchronous transfer mode in accordance with the hierarchical principle. Two levels are distinguished within its architecture – the backbone level (the network's core) and the access level. The core includes backbone switches supplied by Lucent Technologies, which are connected by SDH network channels of the STM-1 level. Client access is ensured by concentrators connected to the backbone network core by STM-1 digital paths. The access concentrators allow for the use of the following connection interfaces: STM-1 chan, STM-1 ATM, A3, E1, serial, and Fast Ethernet. To provide the clients with the ATM network access even in the nodes with no ATM equipment in place, dedicated channels of the primary network are used.

The technology used makes it possible to build a multiservice packet network capable of voice, video and data transmission, and ensures excellent quality management tools.

The dynamic distribution of the communication channels' capacity, characteristic of the ATM, and different classes of data streams servicing (QoS) available, improves the network's cost-effectiveness by optimizing its channels' employment.

Access Networks

To attract a broader scope of users in remote regions as well as those close to the TransTeleCom BDN, we build access networks to the trunk network. These networks are a necessary addition to the company's trunk networks, as they help develop and provide a whole range of communications products and services. Access networks will help us provide our services in places of greater concentration of potential users, and to expand the zone covered by the Backbone Digital Network. The access networks are based on access nodes, through which end users are connected; the nodes are also responsible for traffic concentration and routing and delivering it to the end users. The nodes can be either combined with the trunk network ones, or deployed separately. There are plans to build access nodes of two types:

- territorial (urban) access nodes
- provincial nodes or remote access nodes

Territorial nodes are deployed in cities and towns. Remote access nodes are built in places of higher concentration of users, inside a big city or in small towns, in order to directly connect specific customer premise equipment to a territorial node, that is, to extend the service channel to reach the customer.

The DWDM Network of TransTeleCom

The DWDM technology increases the capacity of fibre-optic backbones by hundreds of times. TransTeleCom began to implement the DWDM technology in all the main lines of the backbone. In the near future, the capacity of the network will grow considerably for the most popular telecommunication routes, which will allow TransTeleCom to completely satisfy the requirements of all clients.

The construction of the DWDM network consists of three phases:

	Phase 1 was finished in the early 2005 with the DWDM system installed on the 8700-km-long route through Kamennogorsk, Saint Petersburg, Moscow, Ekaterinburg, Novosibirsk, Irkutsk, and Zabaikalsk.
	Phase 2 was finished on 1 July 2005. TransTeleCom started commercial exploitation of the line between Kamennogorsk (Leningrad region) and Karymsky (Chita region). Completion of this stage increased the DWDM network length to 12,700 km and provided redundancy for the most important routes.
	Phase 3 was finished on 15 November 2005. This stage ensured the full redundancy of the DWDM network. Its total length reached 18,925 km.

TransTeleCom continuously develops the DWDM network:

	In February 2006, the line between Moscow - Kursk - Voronej - Rostov-on-Don - Volgograd - Saratov - Syzran - Samara, so-called South Way, was put into work. The length of the new DWDM line reaches 3,500 km.

At present, TransTeleCom is developing a project to increase the network capacity in the Far East region. The project envisages the construction of the 2,200 km long DWDM line between BAM station and Vladivostok.

Source: TransTeleCom (http://www.transtk.ru/www/nsf/netmap.nsf/eng!open).

Most active in the ICT infrastructure modernization have been heavy industry (in the energy, mining, metallurgical and chemical industrial sectors) and those in machinery and equipment production. A significant proportion of the Russian banks and insurance companies is connected to the Internet, and these entities have their own internal communication networks. Companies in food, lighting and pulp and paper industries are, however, less active in upgrading their ICT infrastructure. Practically all Russian telecoms offer a broadband Internet connection to corporate clients via either DSL or cable modem and, in some instances, satellite Internet access (for example, Gazcom offers an Internet access via satellite to their corporate clients).

There were more than 50 million Internet hosts in the EU in 2006. In terms of total Internet hosts, Germany was ahead of the rest with almost 12 million. The Netherlands and the United Kingdom occupied respectively the second (8 million) and the third places (6 million).[54] In Central and Eastern Europe, Czech Republic was the leader with more than 1.2 million Internet hosts (table 15). Among the CIS, Russia had the largest number of Internet hosts, almost 2 million. However, in terms of the penetration rate, it is far from being sufficient.

2.3. Interconnection

Two trends dominate the present development of the ICT sector in the UNECE region:

(1) A growing network interconnection;
(2) A convergence of different means of transmission of data and voice.

Both trends have been heavily intertwined as ICT producers, network operators and service providers have had to cope with growing competition, on the one hand, including from Asian NICs, and with the saturation of the domestic consumer electronics market. While technological advances and competition were among the key drivers of these development trends, the impact of public policies aiming at accelerating the convergence and transition of the economies into the information age should not be underestimated.

In the EU, conscious liberalization, harmonization policies and policy actions targeting ICT markets have brought about noticeable benefits to all the stakeholders: ICT users, ICT manufacturers, network operators and service providers. These benefits include: reduction of barriers to market entry, harmonization of national regulatory frameworks, public support and encouragement of research and development in the area of ICT, launching and implementation of public projects (community-wide and/or national) that had a strong effect on the ICT market as a whole. On the supply side, regulatory changes and policies to promote network interconnection and, hence, production and application of technologies allowing for and improving interoperability between different devices and equipments installed within existing telecommunication networks, encouraged a convergence of markets and the emergence of new generation telecommunication networks and technologies. On the demand side, policies and programmes aiming at overcoming digital divides and gaps like: e-Education, e-Accessibility, e-Health, e-Governance, and others, provided incentives for electronic equipment producers, network operators and service providers to invest in upgrading and/or development of new products and services improvement.

[54] CIA. *The World Factbook*, 2006 and 2007. (See http://www.cia.gov/library/publications/the-world-factbook/index.html).

Table 15. Internet hosting in Europe and Central Asia, 2005-2006

Country	*Total number of the Internet hosts, 2005*	*Total number of the Internet hosts, 2006*
Austria	1,812,776	2,062,000
Albania	749	430
Armenia	8,852	8,163
Azerbaijan	460	880
Belarus	20,973	33,641
Belgium	2,238,900	2,871,000
Bosnia and Herzegovina	8,525	31,490
Bulgaria	95,539	184,975
Croatia	19,369	18,825
Czech Rep.	819,773	1,267,000
Cyprus	46,863	67,589
Denmark	2,110,002	2,416,000
Estonia	50,440	52,241
Finland	1,503,976	1,634,000
France	2,922,040	3,149,000
Georgia	8,942	10,752
Germany	7,657,162	11,859,000
Greece	414,724	587,717
Hungary	261,294	608,085
Iceland	190,140	212,897
Ireland	238,706	238,191
Israel	1,069,088	1,252,000
Italy	1,246,253	1,731,000
Kazakhstan	20,327	21,187
Kyrgyzstan	18,539	18,928
Latvia	53,251	65,858
Liechtenstein	7,491	4,697
Lithuania	136,346	148,675
Luxembourg	70,465	88,661
Malta	10,739	14,025
Moldova	30,861	58,886
Netherlands	6,781,729	8,363,000
Norway	1,342,667	1,364,000
Poland	366,898	358,476
Portugal	845,980	845,980
Romania	56,188	57,470
Russian Federation	1,306,427	1,980,000
San Marino		3,140
Slovakia	135,991	210,758
Slovenia	59,090	61,735
Spain	1,380,541	2,521,000
Sweden	2,701,456	2,958,000
Switzerland	1,823,012	2,443,000
The former Yugoslav Republic of Macedonia	3,541	3,716
Tajikistan	63	98
Turkmenistan	557	585
Turkey	753,394	1,313,000
Ukraine	167,501	229,110
United Kingdom	4,688,307	6,065,000
Uzbekistan	7,124	9,058,000
United States	195,138,696	195,139,000
Canada	3,525,392	3,934,000
European Union	22,000,414 (2004)	50,500,000

Source: CIA. *The World Fact Book*, 2006 and 2007.

The initial EU regulatory reform package introduced at the end of the 1980s was based on article 86 of the Treaty, which requires the removal of special or exclusive rights granted to national economic agents (in this case public telecoms) by Member States. In a series of directives the European Community specified measures to be implemented by the Member States in order to bring the ICT sector in compliance with the Treaty:

- Removal of special or exclusive rights to ensure that any operator is allowed to supply telecommunication services;
- Separation of regulator from incumbent to ensure that the historic regulatory functions of telecommunications organizations were removed and placed with independent regulatory bodies;
  - ✓ Establishment of objective, non-discriminatory and transparent conditions for granting licenses and access to networks together with the right to appeal.[55]

The above directives have been complemented with a number of harmonization measures adopted under articles 95 (internal market), 47 and 55 (freedom to provide services). A compliance with these articles stipulates the upholding of the following principles:

- Open Network Provision (ONP), which implies that the conditions for access and use of publicly available networks and services are harmonized (in terms of standards for technical interfaces of networks) and ensure universal services; [56]
- Significant Market Power (SMP) stipulates that operators with a market share of more than 25 per cent shall be subject to heavier regulation than other operators because of their market power;
- Fixed/Mobile. This principle calls for a differentiation in the level of regulation applicable to the fixed and mobile sectors taking into consideration that the mobile sector is subject to much more competition pressure than the fixed one. [57]

The reforms of the telecommunications sector in the EU Member States were carried out in several stages, but the interconnection framework was among the first, providing new entrants to the market with an opportunity to concentrate on services by using the readily available public physical ICT infrastructure. In the absence of such a framework, there would be little incentive for incumbent operators to conclude interconnection agreements with new entrants or they would do so under the terms reflecting their market position. Directive 97/33/EC of the European Parliament and of the Council Interconnection in Telecommunications specifies that rights and obligations to negotiate interconnection fall on any organization providing public telecommunications networks and/or publicly available telecommunications services controlling access to customers. Therefore, they apply to:

- Organizations providing fixed and/or mobile public switched telecom networks or services where they control access to one or more network termination points to one or more unique numbers;
- Organizations providing leased lines to user's premises;
- Organizations authorized in a member-sate to provide international telecoms circuits between the EU and third countries, for which they have specific and exclusive rights;
- Organizations providing telecommunications services which are permitted to interconnect under national licensing provisions (table 16).[58]

[55] Commission Staff Working Document. Europe's Liberalized Telecommunications Market – A Guide to the Rules of the Game, p. 7. (See http://europe.eu.int/comm/dg04/).

[56] Council Directive 90/387/EEC of 28th June 1990 on the establishment of the Internal Market for telecommunications services through the implementation of Open Network Provision. Directive 97/51/EC of the European Parliament and of the Council of the October 1997 amending Council Directives 90/387/EEC and 92/44/EEC for the purpose of adaptation to a competitive environment in telecommunications Directive 90/387/EEC, 28 June 1990.

[57] Commission Staff Working Document. Europe's Liberalized Telecommunications Market – A Guide to the Rules of the Game, p. 8 (http://europe.eu.int/comm/dg04/).

[58] Commission Staff Working Document. Europe's Liberalized Telecommunications Market – A Guide to the Rules of the Game, p. 25 (http://europe.eu.int/comm/dg04/).

The implementation of the Interconnection Directive by the EU Member States had not been smooth due to a number of reasons. Firstly, interconnection is one of the most complicated areas to regulate due to technical challenges. There are a wide range of technical possibilities for interconnection and new types of interconnection products are being developed constantly. Secondly, even small changes in the terms for interconnections may lead to serious financial implications. Therefore, it is crucial that the terms for interconnection are specified in detail. The latter is especially important for small operators, which depend on access to incumbent operators' network facilities. The above complexities have been one of the major reasons behind the reluctance of most regulators to directly interfere into interconnection arrangements. That is why, in most of the EU countries, interconnection agreements are commercial agreements between the operators. The regulation of interconnection mainly focuses on the definition of procedures for establishing interconnection agreements along the guidelines prepared by the regulator.

However, the implementation of the Interconnection Directive together with a new licensing regime permitted a large-scale market entry of new operators. As a result, between 1999 and 2001 the value of telecommunications services in Europe increased by 24 per cent. The number of infrastructure-based fixed access operators grew by 42 per cent between August 2001 and August 2002. Prices charged by new entrants to the market were significantly lower than those of incumbent operators (up to 56% for national calls and 65% for international calls in some member countries). Competition in the retail mobile market brought monthly average consumer charges down by 23 per cent over the period 2000-2002.[59]

Table 16. Obligations under the EC Access and Interconnection Directive

Type of operator	*Obligations*
All operators offering publicly available telephone services and controlling access to end-users	• The right and obligation when requested by another operator to negotiate interconnection with each other • Must provide sufficiently detailed financial information to NRA (National Regulatory Authority) on request, and submit financial reports to an independent audit
All operators with SMP	• Meet all reasonable requests for access, including at point other than network termination points offered to majority of end-users • Requirement to act in a non-discriminatory manner; make available all necessary information to organizations considering interconnection • Make available interconnection agreements to NRAs who must make parts of them available to interested third parties
Mobile operators with SMP on national market for interconnection	• Offer cost-oriented interconnection; NRAs may require full justification and adjustment of charges if not satisfied
Fixed operators with SMP	• Offer cost-oriented interconnection • Required to publish a reference interconnection offer • Interconnection charges should be unbundled • Maintain separate accounting of their interconnection and other activities

Source: Commission Staff Working Document. Europe's Liberalized Telecommunications Market – A Guide to the Rules of the Game. (See http://europe.eu.int/comm/dg04/).

[59] The Eighth report on the implementation of the telecommunications regulatory package – European telecoms regulation and markets 2002 . COM(2002) 695 final.

In 2002, the EU initiated another wave of liberalization of the telecommunications market, particularly, its electronic telecommunications segment, aiming at establishing a harmonized regulatory framework for electronic communications networks and services (Directive 2002/21/EC of the European Parliament and of the Council of 7 March 2002). The Framework Directive was complemented with four others:

(a) Directive on the authorization of electronic communications networks and services (the "Authorization Directive");
(b) Directive on access to, and interconnection of, electronic communications networks and associated facilities (the "Access Directive");
(c) Directive on the universal service (the "Universal Service Directive");
(d) Directive on the processing of personal data (the "Privacy and Electronic Communications Directive").

The Access Directive established rights and obligations for operators and for undertakings seeking interconnection and/or access to their networks. The objective was to set up a framework which will encourage competition by stimulating the development of communications services and networks, and also ensure that any bottlenecks in the market do not constrain the emergence of innovative services benefiting users. The approach adopted was technologically neutral, i.e. the Directive was not intended to introduce rules which could be adapted to technological progress but, instead, to establish a modus operandi to address market problems.

The Directive applied to all forms of communication networks carrying publicly available communications services. These included fixed and mobile telecommunications networks, networks used for terrestrial broadcasting, cable TV networks, and satellite and Internet networks used for voice, fax, data and image transmission.

The national regulatory authorities were responsible for carrying out regular market analyses in order to determine whether one or more operators have significant power on the market in question and then impose certain obligations on that operator, according to the circumstances, which could include:

(a) Obligations of transparency in relation to interconnection and/or access requiring operators to make public specified information such as accounting information, technical specifications or network characteristics;
(b) Obligations of non-discrimination to ensure that operators apply equivalent conditions in equivalent circumstances to undertakings providing equivalent services;
(c) Obligations of accounting separation in relation to specified activities concerning interconnection and/or access;
(d) Obligations of access to, and use of, specific network facilities. Operators may be required inter alia:
    - To negotiate in good faith with undertakings requesting access;
    - Not to withdraw access to facilities already granted;
    - To grant open access to technical interfaces, protocols or other key technologies that is indispensable for the interoperability of services;
    - To provide co-location or other forms of facility sharing, including duct, building or mast sharing;
(e) Obligations relating to cost recovery and price controls, including obligations for cost orientation of prices and obligations concerning cost accounting systems.

By the year 2004, 20 member States of the EU, including some of the new EU Member States, transposed the new regulatory framework. The market response to the new regulatory regime in the area of

interconnection was increased competition resulting in a 14 per cent reduction of the fixed-to-mobile termination rate for operators with SMP.[60]

Major EU telecoms are now offering a wide range of interconnection products and services, including:

(a) **Switched interconnection products** (fixed network products: wholesale of end-user products, such as subscription and traffic; origination (local, single and double) and termination (local, single and double transit); transit and exchange of international traffic; and mobile network products: wholesale of end-user products; origination and termination; and roaming (national and/or international);

(b) **Unbundled network components** (network access lines: raw copper, shared access, bit stream access, fibre, coax, mobile; transit lines: fibre, coax, radio links, satellite, submarine cables and other infrastructures; switching functions: local and tandem switching; network management, directory service functions and etc.: subscriber listening, operator services, directory assistance, others);

(c) **Interconnection of packet switched networks** (interconnection of IP networks: bilateral peering, public peering, hierarchical peering; interconnection of other packet switched networks: ATM, SDH, Ethernet);

(d) **Co-location and sharing of common facilities** (installation of telecom local facilities, sharing ducs and mast);

(e) **Interconnection of application** (Web browsing, instant messaging services, VoIP and other applications).

For example, *British Telecom* provides network services within the United Kingdom to more than 400 communications companies, network operators and service providers. Its assets in the United Kingdom include fibre-optic cable and copper networks, the core telecommunication network and local exchanges. The BT services include: ADSL, Internet Protocol, private circuits, frame relay and Integration Services Digital Network (ISDN). Its subsidiary BT Ignite provides the whole range of connectivity services from Frame Relay, IP, LAN switches, WAN routers, voice switches, among others, to equipment services.[61] *TeliaSonera International Carrier* provides wholesale international IP, capacity and voice services to selected high volume destinations in Europe and across the Atlantic. *Telecom Italia Mobile* has roaming agreements with 49 GSM operators in more than 32 countries. *Koninklijke PTT Nederland (KPN)*, the largest and oldest supplier of fixed-network telecommunications services in the Netherlands, heavily invested in the construction of a new fibre-optic network, Lambda, which interconnects major urban districts in the Netherlands. The network was a stepping stone for the company intending to further develop as a provider of services to other Internet service providers and telecom operators active in the Netherlands.[62]

In the CIS, most of the countries have undertaken some reforming of their telecommunications markets albeit with different degrees of consistency. These reforms eased the entry of new telecommunications services providers and encouraged the development of new services, mainly, mobile telephony. The interconnection regulation was introduced in Moldova (The Regulation on Interconnection in 2002), and at present Moldtelecom has concluded 13 interconnection agreements with other fixed line operators, including SC RISCOM, EUROSTOK LLC , SICRES LLC, Telcom Technologies LLC, Telemedia Group JSC among others.[63] In Armenia, the interconnection issues are covered by the Law on Electronic Communications of 8 July 2005. In Kyrgyzstan, the interconnection and tariff regulation legislation prepared with the EBRD assistance is currently under consideration by authorities. In Ukraine, the interconnection has been heavily regulated (especially regarding tariff-setting for calls from fixed to

[60] Commission communication of 2 December 2004: "European Electronic Communications Regulation and Markets 2004. COM(2004) 759 final.

[61] See http://www.btignite.com.

[62] See http://www.kpn.com.

[63] See http://www.moldtelecom.com.

mobile phones, which are subject to Government intervention) under Chapter IX of the 2003 Law on Communications. The Law requires operators to provide other operators willing to conclude an interconnection agreement with exhaustive information and to offer interconnection terms that are at least equivalent to those proposed to other operators (Article 58). The Ukrainian Interconnection regulation is currently in the process of revision by the National Regulatory Authority in response to loud complaints of operators about the procedures as being non-transparent and, in some instances, discriminatory.[64] In Azerbaijan, the interconnection is regulated by the 1997 Communications Law, the 1988 Information, Informatization and the Protection of Information Law and the 2005 Law on Telecommunications. Tariffs of the state-owned operators (Aztelekom and Baktelekom) are set up and overseen by the Government agencies (by the Inter-Ministerial Tariff Council, in particular). All telecom operators are required by the Law to mutually facilitate interconnection through formal commercial agreements. At present, a new interconnection regulation is being drafted in order to further elaborate interconnection procedures. In Belarus, the interconnection is governed by four laws (Law on Communications of 2005, Regulation on Communications Operators' Interconnection of 1999, Regulation on Supervision Procedures for Telecommunications Networks Connected to General Use Networks of 1997, and Regulation on Land Mobile Radio Communications Network Creation of 1995).[65] In Georgia, the Law on Electronic Communications of 2005 (Articles 41 and 42) establishes procedures on interconnection agreements. Each operator is required to publish standard conditions and tariffs for interconnection and to provide interconnection to other operators at any technically feasible point. The regulation requires implementation of interconnection within 3 months from the date of submission of application to the interconnection provider.[66]

In the Russian Federation, a new interconnection regime was established by the 2003 Law on Communications. It finally abolished the monopoly of the state-owned agencies and opened the access to public infrastructure. The Law specifically underscores that "refusal by the operator having significant market power to conclude a network interconnection agreement is prohibited, except for cases wherein the network interconnection and interaction contradict the network operator license conditions or regulatory acts determining the establishment and functioning of the unified electronic communications network in the Russian Federation".[67] In January 2006, a new regime for mobile-fixed interconnection was established. Under the new regime, mobile operators are permitted to terminate domestic calls from the fixed line network without incurring charges, which, in the past, were passed on to the users.

It should be noted that liberalization of the telecommunications market has brought unexpected results in many countries of the region, especially in the CIS. Firstly, many public telecoms diversified themselves by adding new services, such as Internet services, mobile telephony and/or wireless interconnection. Secondly, through numerous internal restructuring measures, mergers and acquisitions, partial privatization, among others, they converted themselves into large holdings, which are now offering full-range telecommunication services. For example, Svyazinvest was set up as a holding company of Russian Federation's 80+ regional telecom operators in 1995. It was drastically restructured in 2002. As a result, it now holds stakes of over 50 per cent in most of the mega-regional operators (figure 18). All regional telecoms now offer interconnection to other service providers. For example, *OJSC CenterTelecom***,** one of the largest telecommunication operators in Russia and Eastern Europe, serves over 6 million access lines and offers PSTN interconnection to other operators. The company owns telecommunication infrastructure in the most densely populated Central Federal district of Russia. CenterTelecom is licensed to provide a wide range of telecommunication services from POTS and Internet access to air-broadcasting and cable TV.[68]

[64] See http://www.nkrz.gov.ua/ua/docs/pravila_v3.zip.

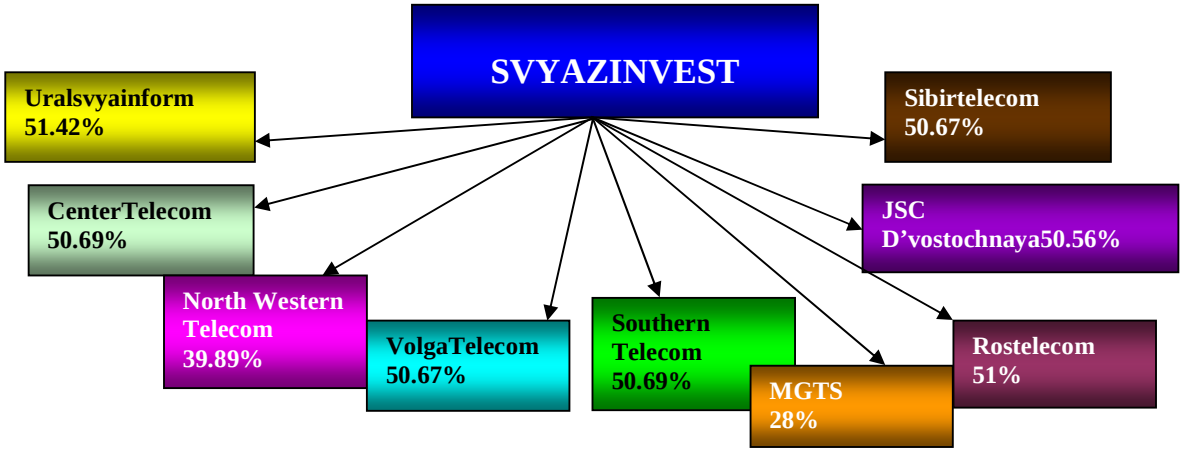
[65] See http://www.mpt.gov.by/new/modules/about/.

[66] See http://www.gncc.ge/files/7050_3555_376651_elegtr.eng.pdf; Georgia: Structural Reforms Support Project Regulatory Development, GNCC, DETECON-WB-GNCC, August 2003.

[67] See http://www.minsvyaz.ru/ministry/documents/.

[68] See http://www.geneva-telecom.ru/index.cfm?id=5.

Figure 18. Svyazinvest holding structure



2.4. Connectivity within the Internet

The ceaseless operation and growth of the Internet in the UNECE region is now critically dependable on the effectiveness and cohesion of policies relating to the interconnection of the component networks both within national and region administrative domains and between the world regions on the global scale. Moreover, as the total number of networks within Administrative Domains (AD) and the total number of ADs themselves increases, and the risk of destabilization grows, the issue of sustaining the stability of the Internet and its ability to provide reliant and ubiquitous interconnection becomes crucial and needs to be addressed collectively.

So far, the existing system of the Internet management both at the global and regional levels, which are organized as a non-profit voluntary participation of ISPs, has been able to cope with a growing complexity of the Internet utilizing the IP suite. Each network wishing to interconnect with other intra- and inter-regional networks, directly or indirectly, has been able to do this following a rather simple procedure, assuming that it is equipped with the necessary capacity and capabilities in terms of hardware and applications. The overall hierarchy of the Internet networks, traffic arrangement and regulation also seemed straightforward. All the networks (or ISPs) were classified by three tiers taking into consideration the nature of their connection to other networks. Large ISPs, both global and regional, which have self-owned operating infrastructures, including the routers, switches and other intermediate devices, form tier 1.[69] They interconnect with other tier 1 ISPs via *public or private peering* for exchanging traffic.[70] Other ISPs are dependent on the capabilities of the tier 1 ISPs to manage the peering infrastructure, although these boundaries have begun blurring over the last decade. Global tier 1 ISPs like AboveNet, AT&T, Global Crossing, MCI EMEA, NTT Communications, among others, usually have their own Internet backbones with international coverage. Therefore, they have large traffic volume, a large customer base and a large number of routers. Such a capacity allows them to support a large number of Autonomous Systems (AS).

Some of the 2 tier ISPs were able to extend their operations to more than one continent, while some of the tier 1 ISPs have been using circuits provided by alternative carriers. Finally, tier 3 ISPs cover local retail and consumer markets and provide local access to the Internet. Usually, the traffic of tier 2 and tier 3

[69] Tier 1 ISPs are further broken into 2 categories: global tier 1 ISPs and regional tier 1 ISPs.

[70] Public peering refers to an implementation of a BGP-4 peering session between NSPs through an exchange point (IX or NAP). The interconnection supports for public peerings are not dedicated. Direct peering refers to an implementation of dedicated bandwidth between the larger Network Service Providers ("NSPs") to reduce inefficiencies related to scaling interconnections between the large Internet backbones. Traffic is exchanged on a bilateral basis via local BGP-4 peering sessions.

needs several router hops to get out to a URL and their users have to share a common gateway to higher-tier ISPs.

2.4.1 Peering

The *public peering* in the UNECE region is taking place either at Network Access Points (NAPs) and/or Internet Exchange points (IXPs). There are 250 IX points around the world today. The largest NAP/IXs in the UNECE region in terms of traffic are: Amsterdam AMS-IX and London Internet Exchange (LINX). These large exchange points bring together hundreds of tier 1, 2 and 3 ISPs for access to multiple networks over a shared connection. *Private peering* is conducted on the basis of a bilateral agreement between two ISPs with similar network capacity and traffic level, and involves a direct connection over a Layer 1 or Layer 2 link. It should be noted that a significant share of the Internet traffic volume has been exchanged via a private tier 1 peering system.

In comparison with public peering, private peering entails significant costs, making this model of the Internet traffic arrangement very exclusive and affordable only to the highest tier ISPs. Private peering is bilateral and restrictive whereas public peering enables multiple streams.

In Europe and the CIS, many public peering IXPs have been operated by various academic and government research networks or by non-profit organizations like, for example, National Research and Educational Networks of the European Union (GEANT), CIXP - CERN eXchange for Central Europe, or NORDUnet. However, the proportion of non-profit IXs declined from 100 per cent in 1993 to 64 per cent in 2006. At present, most countries of the UNECE region have at least one IXP (table 17).

Table 17. Number of IXPs per country in Europe, 2006

Country	*Total number of IXPs*
France	13
Germany	12
United Kingdom	12
Sweden	7
Spain	6
Netherlands	5
Poland	5
Russian Federation	5
Italy	4
Romania	3
Switzerland	3
Belgium	2
Estonia	2
Finland	2
Norway	2
Austria	1
Croatia	1
Cyprus	1
Czech Republic	1
Denmark	1
Greece	1
Hungary	1
Iceland	1
Latvia	1
Luxembourg	1
Malta	1
Portugal	1
Slovakia	1
Slovenia	1
Ukraine	1
31 countries	**99**

Source: European Internet Exchange Association. 2006 Report on European IXPs. October 2006. (See http://www.euro-ix.net).

At the same time, the total number of IXPs increased from 3 in 1993 to 99 in 2006 and, consequently, the traffic volume increased as well. In 2006, it reached 631.43 Gbps.

Distribution of the Internet traffic is extremely uneven in the UNECE region, with almost 45.5 per cent of total volume falling on the IXPs located in the Netherlands (mainly on the Amsterdam IXs) and the United Kingdom (mostly the London IXs). More than 47 per cent of the total traffic falls on the IXPs situated in Germany (12.83%), Spain (10.04%), Sweden (9.8%), Italy (4.15 %), Hungary (3.77%), France (2.43%), Czech Republic (2.36%) and Norway (1.9%). Therefore, total 92 per cent of the Internet traffic in the UNECE region has been relying on the support of the Internet Exchange point infrastructure of ten countries (table 18).[71] Furthermore, 53 per cent of European IXP participants have been peering at more than one European IXP, while the remaining 47 per cent only peer at one European IXP. Of all the European IXP participants (3401), 66 per cent have been peering at the IXPs located in ten European countries and almost half of the participants peering at 12 IXPs located in Amsterdam, London, Frankfurt, Moscow, Riga, Paris, Vienna, Kiev and Oslo (tables 18 and 19).

Table 18. Peak aggregated IXP traffic: ranking per country/city, 2006

Country	*Per cent of total traffic*	*Ranking*	*Total number of IXP participants per country*		*City*	*Per cent of total traffic*	*Ranking*
Total 23 Countries	**100.00**		**Total 31 Countries**	**3401**	**Total 38 Cities**	**100.00**	
Netherlands	28.65			461	Amsterdam	28.41	1
United Kingdom	15.89	1		506	London	15.82	2
Germany	12.83	2		365	Frankfurt	11.56	3
Spain	10.04	3		66	Madrid	10.11	4
Sweden	9.80	4		125	Stockholm	6.36	5
Italy	4.15	5		127	Budapest	3.73	6
Hungary	3.77	6		50	Milan	3.21	7
France	2.43	7		398	Paris	2.43	8
Czech Republic	2.36	8		60	Prague	2.36	9
Norway	1.90	9		88	Oslo	1.90	10
Total 10 countries	**91.82**	**10**	**Total 10 countries**	**2246**	**Total 10 cities**	**85.89**	
The rest of the region's countries (13 countries with IXPs)	**8.18**		**The rest of the region's countries (21 countries)**	**1155**	**The rest of the cities (28 cities with IXPs)**		**14.11**

Source: European Internet Exchange Association. 2006 Report on European IXPs. October 2006.

The above situation causes some concerns:

- A high concentration of Internet traffic at the Amsterdam and London IXPs elevates the risk that any serious technical problem at these two exchange points could have a paralyzing effect on the entire regional Internet system and traffic routing. With a continuous growth of traffic and participating ISPs in the regional network, the risk of a system-wide breakdown will be amplifying;
- The risk of traffic congestion and loss of packets may also increase with intensifying Internet penetration in Europe and Central Asia. According to some studies, many public peering points in the region are already overloaded and suffer from packet loss.[72] Proliferation of broadband access, convergence of communication media and the emergence of multimedia rendering

[71] European Internet Exchange Association. 2006 Report on European IXPs. October 2006 (See http://www.euro-ix.net).

[72] Winther, Mark. Tier 1 ISPs: What They Are and Why They Are Important. IDC White Paper, May 2006.

combined data, voice and image services to the users over one platform in the UNECE region will unavoidably and dramatically augment traffic loads;

- Current peering practices are based on the assumption of symmetry in traffic streams. However, with growing uptake of multimedia the traffic asymmetry will increase. For example, there will be a large traffic asymmetry between content-heavy networks and end user-heavy networks as content providers will have to send a large amount of data in response to consumers' short queries. This means that one peering party will bear more of the cost as a result of peering;
- Considering that businesses also have been adopting broadband, present traffic handoff policies need to be adjusted. The problem lays in the fact that most DSL providers tend to hand off traffic at the nearest peering point. From that moment, the traffic may be handled by several upstream providers, none of which has a responsibility for performance monitoring and trouble resolution. Such a situation bears a number of risks for businesses which are much more sensitive to latency and packet loss than consumers;
- Considering the international significance of the largest Europe's IXPs in terms of global Internet interconnection and their role in ensuring traffic transit between the world regions, forthcoming massive traffic inflows from Asia and Africa to and through Europe, may exacerbate the vulnerability of the regional Internet infrastructure;
- Compliance challenges push a growing proportion of enterprises towards few gateway connections that aggregate traffic and, hence, provide more secure connections, monitor and audit according to compliance guidelines. This trend indicates a need for more centralized and controlled network operations, but also a defragmentation of the Internet environment.

Table 19. IXP rankings by number of participants, 2006

Ranking	*IXP name*	*City*	*Participants*
1	AMS-IX	Amsterdam	253
2	LINX	London	233
3	DE-CIX	Frankfurt	189
4	MSK-IX	Moscow	184
5	NL-IX	Amsterdam	132
6	FreeIX	Paris	109
7	LIX	Riga	104
8	VIX	Vienna	87
9	UK6x	London	79
10	PaNAP	Paris	76
11	UA-IX	Kiev	75
12	NIX	Oslo	71
13	SFINX	Paris	63
14	NIX.CZ	Prague	60
15	FreeBIX	Brussels	59
16	Swissix	Zurich	59
17	MIX	Milan	58
18	LIPEX	London	57
19	TIX	Zurich	57
20	BIX	Budapest	50
21	BNIX	Brussels	48
22	LONAP	London	48
23	WIX	Warsaw	45
24	SIX	Bratislava	44
25	PARIX	Paris	42

Source: Radovcic Serge. Euro – IX Report. VIX Technical Meeting. "Ten years of VIX", Vienna, 23 November 2006.

2.4.2 ASN assignment

The binding element of the Internet is that independent networks share a common IP addressing and a global Border Gateway Protocol (BGP) routing framework allowing all the networks to interconnect with each other directly or indirectly.

Internet routing architecture represents a two-level hierarchy: *domains* and *interdomains*. The Internet space is partitioned into domains with each domain using an internal routing environment based on Interior Gateway Protocol (IGP). IGP maintains a mapping set for the current topology of the domain together with the set of best paths between any two points within the network domain. The second level, interdomain routing space, is maintained using Version 4 of the Border Gateway Protocol (BGPv4), which describes how domains interconnect. A routing path to an address in the interdomain space is represented as a sequence of domains that must be transited to reach the domain that originates that particular address prefix. As each domain has its own set of routers under a single technical administration and common metrics to determine how to rout packets within its space, it is independent and autonomous. Therefore, within the overall routing architecture such a domain is termed an Autonomous System (AS).

In the interdomain space, data packets are being routed using two components: address prefixes and AS numbers (ASNs), the latter being used for identifying domains. Since 1998 the responsibility for coordinating the allocation of the ASNs at the global level lies with the Internet Corporation for Assigned Names and Numbers (ICANN), an internationally organized, non-profit corporation that has the overall responsibility for Internet Protocol (IP) address space allocation, protocol identifier assignment, generic (gTLD) and country code (ccTLD) Top-Level Domain name system management, and root server system management functions. The Regional Internet Registries (RIRs), independent, not-for-profit membership organizations, are responsible for managing, distributing, and registering public Internet Number Resources within their respective regions. There are currently five RIRs operating at the regional level. In Europe and Central Asia, these functions have been performed by the Réseaux IP Européens (RIPE) Network Coordination Centre (RIPE NCC). As a Regional Internet Registry, the RIPE can allocate and assign Internet Resources (IPv4 and IPv6 address space, Autonomous System (AS) Numbers and Reverse DNS delegations) to its members – Local Internet Registries (LIRs).

The ASN consumption at the regional level and among the regions has not been stable. Since 2005, the ASN consumption has been the largest in the RIPE area. The ASN consumption growth has been driven by Russia, where the total number of participating ASs/ISPs reached 672 in 2006 surpassing the United Kingdom (565) and Germany (529).[73] On the whole, from 1999 to 2007, the RIRs assigned a total of 33758 ASNs.

2.4.3 Internet Domain Names assignment

Another key function of the present Internet Governance has been the domain name system management (DNS), also called the "root," that consists of 264 suffixes. These include .com, .net, .org and country codes. Since 1998, the Internet Corporation for Assigned Names and Numbers (ICANN) has been responsible for the overall coordination of the management of the technical elements of the DNS. In order to ensure universal resolvability ICANN has been overseeing the distribution of unique technical identifiers used in the Internet operations, and the delegation of Top Level Domain names. It fully controls the assignment of generic Top Level Domain names (gTLDs) and authorizes the organizations responsible for the country code Top Level Domain names (ccTLDs).

The ICANN master database of domain names is preserved in 13 "mirrors" - servers that automatically copy any changes made to the original database. The duplication makes the system robust in cases of attack or failure.

[73] RIPE NCC. Annual Report 2006 (See http://www.ripe.net/ripe/docs/ripe-407.html#activities).

Regarding the ccTLD accreditation, ICANN is responsible for identifying and setting minimum standards for the performance of the domain name registries. The latter may take various forms. In some countries, domain name registries have been run by universities or research centers, in some other countries, by industry associations or independent authorities.

Theoretically, ICANN is an independent non-profit corporation consisting largely of Internet Society Members. However, the fact that ICANN is based on authority given to it by the United States Department of Commerce and located in the United States and, therefore, is subject to the United States law, causes some uneasiness among Internet community members perceiving that there is a strong interdependence between ICANN and the United States Government. Moreover, ICANN ten of the 13 mirror servers are located in the United States (the others are in Amsterdam, Stockholm and Tokyo). This also contributes to tension over the existing DNS management arrangements.

To some extent, the creation of the Government Advisory Committee (GAC), in which the representatives of 35 countries, including the United States and a number of the international organizations are participating, helped to counterbalance but not entirely resolve this issue.[74]

The GAC adopted principles and guidelines for delegation and administration of ccTLDs that stress the national responsibility for ccTLDs.[75] According to GAC, every country or distinct economy should be able to ask for an appropriate country code in order to be represented as a ccTLD and to designate the registry:

> "Country code top level domains are operated in trust by the Registry for the public interest, including the interest of the Internet community, on behalf of the relevant public authorities including governments, who ultimately have public policy authority over their ccTLDs, consistent with universal connectivity of the Internet."[76]

This approach has also been challenged by some members of the Internet community who are fearful that too much government intervention in distribution of this critical Internet resource may undermine the evolution of the Internet. Attempts have been undertaken to set up an alternative rooting system (for example, the creation of "F-root" by Paul Vixie in 1994), which could neutralize politically motivated actions of ICANN and/or Governments aiming to restrict or exclude some countries or social groups from participating in the global NET.

There are other issues associated with the DNS management that are currently debated. These include:

- Domain names internationalization;
- Dilution and massive duplication of domain names;
- Cybersquatting;
- Stability and reliability of the existing DNS;
- Congestion in the domain name space;
- Trademark conflicts;
- Transition to IPv6 and associated problems.

The UNECE member States are among the leaders in terms of the base of domain name registrations. According to the VeriSign Report, there were more than 240 ccTLDs in the world with total base registrations of 51.5 million by August 2007. Of these, as figure 48 shows, 66 per cent were contributed by the top ten ccTLDs , including *.de* (Germany), *.uk* (United Kingdom), *.nl* (Netherlands), *.eu* (European

[74] More information on GAC may be found on: http://gac.icann.org.

[75] Government Advisory Committee. GAC principles and guidelines for delegation and administration of ccTLDs, 2000.

[76] See http://gac.icann.org/web/home/GAC_Operating_Principles.doc.

Union), *.it* (Italy), *.ch* (Switzerland).[77] In terms of absolute volume growth, ccTLDs of Germany, United Kingdom and the Netherlands surpassed all the ccTLDs of Europe and Central Asia, but in terms of growth rate, it was *.ru* (the Russian Federation) that outstripped the rest of the region's ccTLDs and reached a double-digit rate. The German and the United Kingdom ccTLDs remain the largest, both at the world and regional levels. Their combined share was 33 per cent of all the world ccTLD base registrations in August 2007.

Table 20. Geographic distribution of gTLD registrations, August 2007

Million	*Country*
56.5	United States
4.8	Germany
3.2	United Kingdom
3.0	Bahrain
2.8	Canada
2.6	China
1.9	France
1.7	Hong Kong
1.6	Australia
1.1	Japan
1.0	Spain
0.9	Korea
0.8	Italy
0.7	Netherlands
0.6	Turkey
0.5	New Zealand
0.4	India
0.4	Cayman Islands
0.4	Russia
0.3	Denmark

Of the overall TLD base of domain name registrations (138 million), 86.5 million constituted the gTLD domain name registrations (table 14). More than 65 per cent of the total gTLD domain name registrations were in the United States. The combined share of the European countries (including Turkey) was 15.8 per cent. Among all gTLDs most demanded were .COM and .NET domains. Their total base of domain name registrations reached almost 73 million by August 2007.

In the UNECE region the national institutional arrangements underlying the assignment of domain names are ranging between the public and private governance. Some organizations responsible for national domain administration are just governmental departments, for example, in Norway (NORID, *.no* registry, supervised by the Norwegian Post and Telecommunications Authority), Belarus (The State Centre of Security Information of Belarus, the Office of the President), Moldova (MolData), Uzbekistan (Uzinfocom) and Tajikistan (The State Center of Information Technologies, the Office of the President). Some others are cooperatives or associations of ISPs, for example, in Germany (DENIC).

In a relatively large number of the region's countries these functions have been carried out either by academic institutions such as RESTENA Foundation in Luxembourg or other non-profit organizations (companies or foundations) such as, for example, NOMINET, a non-profit company in the United Kingdom, or SIDN (the Foundation for Internet Domain Registration), a non-profit organization, in the Netherlands. In some countries, the national domains have been managed by private companies such as, for example, Internet an Islandi hf., ISNIC, in Iceland. In 2005, 18 of 27 national domain administrations, members of the Council of European National Top-Level Domain Registries (CENTR) were private

[77] The VeriSign Domain Report. The Domain Name Industry Brief. Volume 4, Issue 5, August 2007.

entities by their legal status, of which nine were private foundations, one cooperative and three associations. Of the remaining nine administrations seven were departments of research centers and/or universities, including Croatia, Islamic Republic of Iran, Latvia, Lithuania, Poland, Romania, and Slovenia. The domain administration of Spain and Finland were under Government control.[78]

The policies of these institutions also vary. Some impose restrictions on access of non-citizens to national domains. For example, the rules of domain names registration in Germany (*.de*) require the registrant or administrative contact to reside in Germany. Similar rules are applied by AFNIC (France) as well as by national registries of Albania, Bosnia and Herzegovina, Belarus, Estonia, Hungary, Moldova, Norway, Slovakia and Slovenia. Few countries in the region allow non-nationals to register their domains in ccTLDs (Austria, Czech Republic, the Netherlands, Poland, Romania, Russian Federation and the United Kingdom). It should be noted that a new *.eu* TLD also restricts the participation of non-EU organizations and individuals.

Some national domain administrations limit the number of domain names per juridical person (Cyprus, Hungary, Israel, Norway and Slovenia); some others do not allow domain name registration by individual (natural) persons (Hungary and Slovenia).

In some countries of the region national domain administrative and operational functions are separated. Most of the ccTLD administrations, including the Coordination Center for TLD .RU, are responsible for developing rules of registration and the provision of technical and administrative support of registrars, while the registrars actually manage the domain name registration and all other transactions associated with domain names. However, eight domain administrations (Croatia, Cyprus, Iceland, Israel, Latvia, Luxembourg, Malta and The Holy See) register domain names directly.[79]

One of the major challenges facing national domain administrations is *cybersquatting***,** a phenomenon of storing domain names in order to profit by re-selling them later on at prices higher than the prices at which they were initially bought. According to the United States federal law known as the Anti-Cybersquatting Consumer Protection Act of 1999, cybersquatting is registering, trafficking in, or using a domain name with bad-faith intent to profit from the goodwill of a trademark belonging to someone else. Commercial domain names are obtained from one of several registries, companies authorized to ensure that a domain name you want is unique (no one else already has it) and issue it to you if it is. However, these registries make no attempt to determine whether the domain name is one that rightfully ought to go to someone else. The principle is "First come, first served." For this reason, a number of enterprising individuals and companies have applied for and reserved domain names, either new or expired, that they think someone else will want, either now or in the future.

Many cybersquatters reserve common English words, reasoning that sooner or later someone will want to use one for their websites. Examples of words sold by cybersquatters to companies developing significant websites include *drugstore.com*, *furniture.com*, *gardening.com*, and *Internet.com*. Cybersquatters may also regularly comb lists of recently expired domain names, hoping to sell back the name to a registrant who inadvertently let their domain name expire. eBay, the auction site, sometimes lists domain names for sale. Several cybersquatter companies offer their wares at their own websites.

It should be noted that only 46 domain name registrations throughout the world have been applying the World Intellectual Property Organization (WIPO) Uniform Domain Name Dispute Resolution Policy (UDRP Policy), adopted by the ICANN on 26 August 1999, and the Rules for Uniform Domain Name Dispute Resolution Policy (UDRP Rules), approved by ICANN on 24 October 1999. In addition to the ICANN Policy and Rules, the WIPO Center has developed its Supplemental Rules for the Uniform Domain Name Dispute Resolution Policy (UDRP) that entered into effect on 1 December 1999. In Europe and Central Asia, with the exception of a few countries (Latvia and Tajikistan, for example), most countries have not yet adhered to the WIPO UDRP Rules due to contradictions between the UDRP and

[78] RU- center, Domain names registration in national domains. 07.08.2007 (See http://info.nic.ru/st/12/out_26.shtml).

[79] See https://www.centr.org/members/.

existing local legislation.[80] In the majority of the UNECE member countries, extrajudicial dispute settlement procedures are absent with the exception of the United Kingdom and Israel.

In many countries of the UNECE region national domain administrations cooperate and/or consult with local Internet societies regarding rules and procedures that govern the domain names registration process. Many have established special committees and/or boards in which most of the local stakeholders are represented, including ISPs, business associations, independent legal professionals, national patent bureaus and respective ministries and government agencies. For example, the Consultative Committee of AFNIC (Association Française pour le Nommage Internet en Coopération) include representatives of ISPs, INRIA (French National Institute for Research in Computer Science and Control), and the Ministries of Telecommunications, Industry and Research. The AFNIC intends to open up more widely to Internet users in order to be more responsive to the current and future needs of its members and to have the kind of flexible management structure that would not be possible in a research institute. With this purpose in mind, it created some new membership categories: (a) user members; (b) subscriber members; (c) correspondent members: international or national organizations. These membership categories receive a range of information services from the AFNIC. Recently, a second "Users legal/corporate entities" consultative committee was set up to ensure that the "end user" was not excluded from discussions on the development of *.fr* domain names.[81]

In some of the CIS Member States (Belarus, Kazakhstan, Tajikistan and Uzbekistan) and countries of Central and Eastern Europe (Albania, for example), representation in the national domain administration is decided by the Government, and, although the Governments undertake occasional consultations with other stakeholder groups on strategic issues regarding the implementation of national e-strategies, the decisions are taken by the Government. In most instances, Internet users have to use online charts and/or forums to express their attitude towards domain names registration practices.

2.4.4 IPv4 and IPv6 allocation

IP addresses are another critical resource of the Internet. Currently, there are two types of IP addresses in active use: IP version 4 (IPv4) and IP version 6 (IPv6), although routing over the Internet is done via IPv4 addressing scheme. IPv4 was initially deployed on 1 January 1983 and is still the most commonly used version. IPv4 addresses are 32-bit numbers often expressed as 4 octets in "dotted decimal" notation (for example, 192.0.32.67). Deployment of the IPv6 protocol began in 1999. IPv6 addresses are 128-bit numbers (four times larger than IPv4) and are conventionally expressed using hexadecimal strings.

Both IPv4 and IPv6 addresses are assigned in a delegated manner. Users are assigned IP addresses by Internet service providers (ISPs). ISPs obtain allocations of IP addresses from a local Internet registry (LIR), a national Internet registry (NIR), or from their appropriate Regional Internet Registry (RIR).[82]

The allocation of the IP addresses has been carried out in the same fashion as that of ASNs. The RIRs receive IP address blocks from the IANA and then distribute them through a system of Internet Registries. In Europe and Central Asia, it is the RIPE NCC who is responsible for allocation of IP address space. It does that through its members – LIRs. The LIRs then assign IP addresses to end-users and to their own network infrastructure.

For IPv6 address allocations, the United Kingdom and Germany acquired the largest address spaces in 2006; respectively, 16 per cent and 14 per cent of the total allocations made by the RIPE. Of the countries of Eastern and Central Europe, Estonia and Poland were most active. Their respective shares in total allocations of IPv6 were four per cent and three per cent.[83]

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[80] See https://www.centr.org/members/.

[81] See http://www.afnic.fr/.

[82] IANA (http://www.iana.org/ipaddress/ip-addresses.htm).

[83] Ibid.

However, few countries of the UNECE region have initiated the transition to IPv6. The delay is caused by relatively high costs associated with transition, especially for small ISPs. Another problem hampering the introduction of IPv6 is that it is not interoperable with IPv4. It is not possible to address a host that only knows IPv4, although it is possible to use both protocols simultaneously on the same host. This means that any host on the Internet needs to use both Internet protocols until all the Internet switches to IPv6.

In the meantime, the shortage of IP addresses has been growing, and ISPs have been experiencing difficulties in obtaining IP addresses from the registries. Temporary solutions to this problem were found in dynamic IP allocation by giving end-users a different IP address on each connection or using Network Address Translation (NAT), a technique that allows connecting end-users to the Internet by a proxy or an address translating server. Both techniques, however, contribute to asymmetry in the Internet because they make it harder for end-users to run their own web servers and many type of peer-to-peer Internet applications.

From a technical point of view, transition to IPv6 is a good thing, but so far the rewards in economic terms have not been very obvious. Some experts believe that it will take more time for the entire Internet community to totally shift to IPv6.[84]

2.4.5 Internationalized Domain Names

Since the end of the 1990s, many in the Global Internet community have been concerned with the issue of deepening the Internet penetration by bringing more people on line. The online predominance of languages based on the Latin alphabet was seen as one of the most important economic and social obstacles.

Thirty-two per cent of all the Internet users in 2007 were using English, and 58 per cent of the users were employing languages based on the Latin alphabet. At the same time, the largest increase of the users by language over the period 2000-2007 was at the expense of those using the Arabic language (more than 940 %). The estimated world population for language and respective Internet penetration rate imply that there is an enormous potential of the Internet user growth. Even in the case of the English-speaking population, the Internet penetration rate was only 18 per cent in 2007.[85] In order to release this potential, language barriers to access the Internet must be removed. Therefore, it is not surprising that this issue has become an important item on the international agenda of the WSIS.

One of the objectives of the WSIS, which focused on the need to develop an inclusive Information Society, was "to promote the inclusion of all peoples in the Information Society through the development and use of local and/or indigenous languages in ICT" by encouraging the development of content and putting in place technical conditions to facilitate the presence and use of all world languages on the Internet.[86]

It should be noted, however, that the implementation of this goal faces a technical challenge. The standard for domain names does not allow letters with diacritics, as required by many European languages, or characters from non-Latin scripts such as Arabic or Chinese. Traditionally, the computers at the heart of the DNS only recognized a limited range of Roman letters, or to be more precise, a subset of US-ASCII (American Standard Code for Information Interchange) characters. Much work has to be done to find a way around this, either by changing the standard, or by agreeing on a way to convert internationalized domain names into standard ASCII domain names while preserving the stability of the domain name system.

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[84] IDC White Paper 'Tier 1 ISPs: What they are and why they are important", Mark Winther, May 2006.

[85] Internet World Statistics. See http://www.internet worldstats.com/stats7.htm.

[86] The World Summit on the Information Society. Tunis Commitment. Document, WSIS-05/TUNIS/DOC/7-E, paragraph 32. 18 November 2005.

The introduction of Internationalized Domain Names is changing this. Internationalizing Domain Names in Applications (IDNA) was designed for maximum backward compatibility with the existing DNS system. An IDNA-enabled application is able to convert between the restricted-ASCII and non-ASCII representations of a domain, using the ASCII form in cases where it is needed (such as for DNS lookup), but being able to present the more readable non-ASCII form to users. Applications that do not support IDNA will not be able to handle domain names with non-ASCII characters, but will still be able to access such domains if given the (usually rather cryptic) ASCII equivalent.[87]

The idea of introducing IDNs caused some controversy in the Internet community. Many feared that the fundamental unifying role of the Internet would be undermined, and the global Net would be partitioned into a mosaic of domains, which could only be accessible by local (language) communities, therefore, keeping them isolated from the global community and depriving them of economic and social benefits associated with the use of the global Internet.

While the argumentation of the opponents of IDNs is not without grounds, so is the reasoning of those supporting the introduction and promotion of IDNs. The latter allow local communities to utilize opportunities and capture benefits, which are available at the local markets, by bringing business online, extending the reach and reducing costs of public and private services providers.

Since 2001, the deployment of IDN ccTLDs as well as second level domain names within ccTLDs has intensified. In Europe and Central Asia, the domain names and websites in the following languages and corresponding scripts were found to be deployed; namely, Russian (Cyrillic) and Israeli (Hebrew).[88]

[87] ICANN. Guidelines for the Implementation of Internationalized Domain Names. Version 1.0, 20 June 2003; Internationalising Domain Names in Applications, Network Working Group. RFC: 3490, March 2003.

[88] MINC. De-Fragmenting the Internet Namespace. June 2006, and see http://www.itu.int/ITU-T/worksem/multilingual/presentations/S1-Tan.pdf.

Table 21. Mobile cellular telephone subscribers per 100 inhabitants, 2000-2005

Country	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Albania	1	13	28	36	39	49
Armenia	1	1	2	4	7	11
Austria	76	81	83	89	97	106
Azerbaijan	5	9	10	13	17	27
Belarus	0	1	5	11	23	42
Belgium	55	75	78	83	87	90
Bosnia and Herzegovina	2	12	20	28	36	41
Bulgaria	9	20	33	45	61	81
Croatia	23	40	53	58	64	80
Cyprus	32	46	58	77	79	86
Czech Republic	42	68	84	95	106	115
Denmark	63	74	83	88	95	100
Estonia	39	46	65	78	94	109
Finland	72	80	87	91	96	100
France	49	62	65	70	74	79
Georgia	4	6	11	16	19	33
Germany	59	68	72	79	86	96
Greece	56	75	85	78	84	92
Hungary	30	49	68	79	86	92
Iceland	76	86	90	97	99	103
Ireland	65	77	76	88	95	103
Italy	74	88	96	98	108	124
Kazakhstan	1	4	7	9	19	33
Kyrgyzstan	0	1	1	3	6	10
Latvia	17	28	39	53	67	81
Liechtenstein	30	33	34	73	74	79
Lithuania	14	29	47	63	99	127
Luxembourg	69	93	106	119	141	155
Moldova	3	5	8	11	18	26
Netherlands	67	76	75	81	91	97
Norway	72	79	83	89	98	103
Poland	17	26	36	45	60	76
Portugal	66	77	83	96	98	109
Romania	11	17	23	32	47	62
Russian Federation	2	5	12	25	51	84
San Marino	54	59	62	63	63	64
Slovak Republic	23	40	54	68	79	84
Slovenia	61	74	84	87	93	89
Spain	60	72	82	87	89	100
Sweden	72	81	89	98	97	101
Switzerland	64	73	79	84	85	92
The former Yugoslav Republic of Macedonia	6	11	18	38	49	62
Tajikistan	0	0	0	1	2	4
Turkey	24	28	33	39	48	60
Turkmenistan	0	0	0	0	1	..
Ukraine	2	5	8	14	29	37
United Kingdom	73	77	83	91	101	112
Uzbekistan	0	1	1	1	2	3
Yugoslavia	12	19	34	45	58	64

Source: ITU database. Data reproduced with the kind permission of ITU.

Table 22. Mobile cellular coverage of population, 2000-2005

(percentage)

Country	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Albania	..	84	90	90	89	91
Armenia	..	38	..	83	84	88
Austria	98	98	98	98	99	99
Azerbaijan	94	94	95	95	97	99
Belarus	..	..	87	87	88	88
Belgium	99	99	99	99	99	99
Bosnia and Herzegovina	60	80	90	93	95	97
Bulgaria	95	95	96	99	99	100
Croatia	98	98	98	98	99	100
Cyprus	99	99	100	100	100	100
Czech Republic	99	99	99	99	100	100
Denmark	..	..	..	..	..	100
Estonia	99	99	99	99	99	99
Finland	99	99	99	99	99	99
France	99	99	99	99	99	99
Georgia	..	79	..	..	94	95
Germany	99	99	99	99	99	99
Greece	99	100	100	100	100	100
Hungary	95	96	99	99	99	99
Iceland	99	99	99	99	99	99
Ireland	98	98	99	99	99	99
Italy	100	100	100	100	100	100
Kazakhstan	..	94	..	..	..	94
Kyrgyzstan	..	..	..	..	70	90
Latvia	89	92	97	97	98	98
Liechtenstein	..	90	90	..	..	96
Lithuania	100	100	100	100	100	100
Luxembourg	98	98	98	98	98	99
Moldova	70	76	77	79	90	97
Netherlands	100	100	100	100	100	100
Norway	96	97	..	..	..	99
Poland	95	..	..	99	99	99
Portugal	99	99	99	99	99	99
Romania	97	98	98	98	98	98
Russian Federation	..	..	..	..	..	96
Slovak Republic	98	98	98	99	99	100
Slovenia	98	98	99	99	99	99
Spain	99	99	99	99	99	99
Sweden	..	99	99	99	99	99
Switzerland	98	99	99	100	100	100
The former Yugoslav Republic of Macedonia	90	..	..	..	98	99
Turkey	50	88	88	95	95	96
Ukraine	..	..	75	..	92	96
United Kingdom	99	99	99	99	99	99
Uzbekistan	..	..	75	..	..	..
Yugoslavia	77	83	92	..	95	99

Source: ITU database. Data reproduced with the kind permission of ITU.

Table 23. Mobile cellular telephone subscribers, 1990-2005

(in thousands)

Country	*1990*	*1995*	*2000*	*2001*	*2002*	*2003*	*2004*	*2005*
Albania	0	0	30	393	851	1 100	1 260	1 530
Armenia	0	0	17	26	71	114	203	320
Austria	74	384	6 117	6 541	6 736	7 274	7 992	8 650
Azerbaijan	0	6	420	730	794	1 057	1 457	2 242
Belarus	0	6	49	138	463	1 118	2 239	4 098
Belgium	43	235	5 629	7 697	8 102	8 606	9 132	9 460
Bosnia and Herzegovina	0	0	93	445	749	1 075	1 407	1 594
Bulgaria	0	21	738	1 550	2 598	3 501	4 730	6 245
Croatia	0	34	1 033	1 755	2 340	2 537	2 836	3 650
Cyprus	3	44	218	314	418	552	641	719
Czech Republic	0	49	4 346	6 947	8 610	9 709	10 783	11 776
Denmark	148	822	3 364	3 960	4 478	4 767	5 167	5 449
Estonia	0	30	557	651	881	1 050	1 256	1 445
Finland	258	1 039	3 729	4 176	4 517	4 747	4 988	5 270
France	283	1 302	29 052	36 997	38 585	41 702	44 544	48 088
Georgia	0	0	195	301	504	711	841	1 459
Germany	273	3 725	48 202	56 126	59 128	64 800	71 300	79 200
Greece	0	273	5 932	7 964	9 314	8 936	9 324	10 260
Hungary	3	265	3 076	4 967	6 886	7 945	8 727	9 320
Iceland	10	31	215	248	260	280	290	304
Ireland	25	158	2 461	2 970	3 000	3 500	3 860	4 270
Italy	266	3 923	42 246	51 246	54 200	56 770	62 750	72 200
Kazakhstan	0	5	197	582	1 027	1 331	2 759	4 955
Kyrgyzstan	0	0	9	27	53	148	314	542
Latvia	0	15	401	657	917	1 220	1 537	1 872
Liechtenstein	0	..	10	11	11	25	26	28
Lithuania	0	15	524	1 018	1 646	2 170	3 422	4 353
Luxembourg	1	27	303	409	473	539	646	720
Moldova	0	0	139	225	338	476	787	1 090
Netherlands	79	539	10 755	12 200	12 100	13 200	14 800	15 834
Norway	197	981	3 224	3 593	3 790	4 061	4 525	4 754
Poland	0	75	6 747	10 005	13 898	17 401	23 096	29 166
Portugal	7	341	6 665	7 978	8 670	10 030	10 362	11 447
Romania	0	9	2 499	3 845	5 111	7 040	10 215	13 354
Russian Federation	0	89	3 263	7 750	17 609	36 135	73 722	120 000
San Marino	0	2	15	16	17	17	17	17
Slovak Republic	0	12	1 244	2 147	2 923	3 679	4 275	4 540
Slovenia	0	27	1 216	1 470	1 667	1 739	1 849	1 759
Spain	55	945	24 265	29 656	33 531	37 220	38 623	42 694
Sweden	461	2 008	6 372	7 178	7 949	8 801	8 785	9 104
Switzerland	125	447	4 639	5 276	5 736	6 189	6 275	6 834
The former Yugoslav Republic of Macedonia	0	0	116	223	365	776	986	1 261
Tajikistan	0	0	1	2	13	48	135	265
Turkey	32	437	16 133	19 573	23 323	27 888	34 708	43 609
Turkmenistan	0	0	8	8	8	9	50	..
Ukraine	0	14	819	2 225	3 693	6 498	13 735	17 214
United Kingdom	1 114	5 736	43 452	46 283	49 228	54 256	60 676	66 856
Uzbekistan	0	4	53	128	187	321	544	720
Yugoslavia	0	0	1 304	1 998	2 750	3 635	4 730	5 229

Source: ITU database. Data reproduced with the kind permission of ITU.

Table 24. Cable networks in selected EU Member States, 2002 and 2005

Country	*Cable modem penetration (as % of inhabitants)*		*Cable modem coverage (as % of inhabitants)*		*Total number of subscribers (in thousands)*	
	2002	*2005*	*2002*	*2005*	*2002*	*2005*
Austria	3.4	5.9	25	31	179.6	685
Belgium	3.4	6.8	55	80	348.5	699
Czech Republic	1	1.3	2	24	50	133
Denmark	2.5	8.6	25	60	133.5	462
Estonia	2	3,7	20	53	25	49,5
Finland	1	2,8	20	33	54	149
France	0.5	0.9	24	26	283	566
Germany	0.1	0.3	5	15	45	240
Hungary	0.3	1.9		66	31.2	192
Iceland	0.2	0.1	31	31	0.5	0.4
Ireland	0.1	0.6	4	4	2.3	25
Latvia	0	0.7				16
Lithuania	1	2.8	25	54		97
Luxembourg	0.1	1.5	25	34	0.6	6.9
Malta	2	5.2	81	95	8	21
Netherlands	4.9	9.6	82	82	796	1562
Norway	1.4	3	20	20	64	138
Poland	0.2	1	9	12	200	371
Slovenia	0.4	3.2			8	64
Slovakia	0.1	0.5	0	13	3.5	26
Portugal	3	4.9	56	75	315.6	509
Sweden	1.7	3.7	38	47	156.4	333
Spain	0.9	2.9	38	42	366.2	1176
United Kingdom	1.3	4.5	42	53	769	2663

Source: IDATE Consulting and Research. *Broadband Coverage in Europe. Final Report.* 2006 Survey.

Table 25. Access to Internet in selected UNECE member States, 2005

(total number of subscribers, in thousands)

Country	*Internet subscribers (DSL)*	*Internet subscribers (Cable modem)*
Austria	682	477
Belgium	1247.5	757.4
Bulgaria	39.4	51.9
Croatia	109.8	4.5
Czech Republic	279.8	133
Denmark	826.4	389.6
Estonia	84.8	49.5
Finland	1018.7	149
France	8902	563
Germany	10380	240
Greece	158	0
Hungary	412.9	212
Iceland	76	0.4
Ireland	239	32.5
Italy	6480	40.1
Liechtenstein	6.2	2.4
Lithuania	104.8	49.6
Luxembourg	64	6.2
Moldova	6.8	3.3
Netherlands	2500	1562.5
Norway	802	137.1
Poland	695	234
Portugal	697	511.5
Romania	7.3	249
Russian Federation	437	1152
San Marino	1.1	0
Slovak Republic	104.5	21.5
Slovenia	129.3	65.5
Spain	3814	1170
Sweden	1207	355
Switzerland	1132	499
The former Yugoslav	8.3	1
Turkey	1539	50.3
United Kingdom	7220	2666
Total	**51411.6**	**11835.8**

Source: ITU database. Data reproduced with the kind permission of ITU.

Table 26. Dial-up access to Internet in selected UNECE member States, 2005

(total number of subscribers, in thousands)

Internet subscribers (Dial-up)	*2005*
Austria	598
Belgium	273
Bosnia and Herzegovina	176
Bulgaria	9
Croatia	838
Czech Republic	1616
Denmark	468
Estonia	18
Greece	725
Hungary	256
Iceland	9
Latvia	12
Lithuania	23
Luxembourg	49
Moldova	51
Norway	429
Poland	669
Portugal	271
Romania	1328
San Marino	4
Slovak Republic	113
Slovenia	201
Spain	1199
Sweden	1372
Switzerland	915
The former Yugoslav Republic of Macedonia	84
United Kingdom	5539
Total	**17245**

Source: ITU database. Data reproduced with the kind permission of ITU.

Table 27. DSL subscribers and DSL penetration rate, 2005

Country	*DSL subscribers, 2005 (in thousands)*	*DSL penetration rate, 2005 (% of the population)*
Austria	684.6	8.5
Belgium	1294	12.5
Denmark	836.8	15.5
Finland	1018.7	19.5
France	8777.2	14.6
Germany	10380	12.6
Iceland	75.9	25.9
Ireland	202.2	4.9
Italy	6674	11.9
Luxembourg	63	14.2
Malta	30	7.5
Netherlands	2551	15.6
Norway	820.6	17.8
Portugal	708.5	6.8
Sweden	1227	13.6
United Kingdom	2663.4	12.1
Spain	3876.4	9.4
Greece	158	1.4
Cyprus	43.5	5.6
Czech Republic	279.8	2.7
Estonia	110.6	8.2
Hungary	372.5	3.7
Latvia	68.5	3
Lithuania	104.8	3.1
Poland	1254	3.3
Slovakia	104.9	1.9
Slovenia	130.6	6.5

Source: ITU database; IDATE Consulting and Research. Development of Broadband Access in Europe, November 2006. Data reproduced with the kind permission of ITU.

Table 28. Broadband Internet subscribers (all wired and wireless networks): total number of subscribers

(in thousands)

Country	*2002*	*2005*
Armenia	0	1
Austria	457.8	1178
Azerbaijan	0	2
Belarus	0	2
Belgium	869	2011
Bosnia and Herzegovina		14
Bulgaria	0	1
Croatia	12	116
Cyprus	6	43.5
Czech Republic	5	709
Denmark	442	1431.6
Estonia	46	205
Finland	274	1174
France	1694.7	9471
Germany	3272	10700
Greece	0	160
Hungary	63.2	652
Iceland	25.3	78
Ireland	10.6	270.2
Italy	1110	7036
Kazakhstan	0	2
Kyrgyzstan	0	2
Latvia	10	90
Liechtenstein	1	9
Lithuania	20	234
Luxembourg	7.4	70
Moldova	0	10
Netherlands	1136	4173.6
Norway	205	1003.7
Poland	122	1637
Portugal	263	1212
Romania	16	751
Russian Federation	11	1589
San Marino	1	1
Slovak Republic	0.6	139
Slovenia	24.7	198
Spain	1333	5076
Sweden	711.6	1918
Switzerland	455	1658
The former Yugoslav Republic of Macedonia	0	12
Turkey	21	1590
United Kingdom	1359	9894
Uzbekistan	0	3
Malta	18	51

Source: ITU database; IDATE Consulting and Research. Development of Broadband Access in Europe, November 2006. Data reproduced with the kind permission of ITU.

Table 29. Internet usage in Europe, 2000-2007

Country	*Total number of Internet users (in thousands)*	*Internet usage penetration rate (% population)*	*Usage growth 2000-2007 (%)*
Albania	0.20	6.10	7420.00
Andorra	0.22	31.50	338.00
Austria	4650.00	56.60	121.40
Belarus	3394.00	35.10	1785.80
Belgium	5100.00	48.50	155.00
Bosnia and Herzegovina	0.80	17.30	11420.00
Bulgaria	2200.00	28.70	412.00
Croatia	1472.00	32.90	636.00
Cyprus	0.30	33.60	172.00
Czech Republic	5100.00	50.00	410.00
Denmark	3762.50	69.20	93.00
Estonia	0.70	51.80	88.00
Finland	3286.00	62.30	70.50
France	32926.00	53.70	287.40
Germany	50426.00	61.10	110.00
Greece	3800.00	33.50	280.00
Hungary	3050.00	30.40	326.60
Iceland	0.30	86.30	53.60
Ireland	2060.00	50.20	162.80
Italy	31482.00	52.90	138.50
Latvia	1030.00	45.20	586.70
Liechtenstein	0.02	61.80	144.40
Lithuania	1221.00	35.90	443.00
Luxembourg	0.30	68.00	215.00
Malta	0.20	33.00	218.00
Moldova	0.50	14.80	2100.00
Monaco	0.02	53.80	157.10
Netherlands	12060.00	73.30	209.20
Norway	3140.00	67.40	42.70
Poland	11400.00	29.90	307.10
Portugal	7783.00	73.80	211.30
Romania	4940.00	23.40	517.50
Russian Federation	28000.00	19.50	803.20
San Marino	0.01	45.40	472.00
Serbia	1400.00	13.90	250.00
Slovakia	2500.00	46.50	284.60
Slovenia	1090.00	55.50	263.30
Spain	19765.00	43.90	266.80
Sweden	6890.00	75.60	70.20
Switzerland	5098.00	67.80	138.90
The former Yugoslav Republic of Macedonia	393.00	19.10	1208.90
Turkey	16000.00	21.10	700.00
Ukraine	5278.00	11.50	2539.10
United Kingdom	37600.00	62.30	144.20
Total Europe	**321853.00**	**39.80**	**206.20**

Source: World Internet Statistics.

Chapter 3

GOVERNING THE EVOLVING INTERNET IN THE UNECE REGION

As the Internet penetration is deepening, and its impact on communities is becoming more apparent, new issues are surfacing challenging communities throughout the UNECE region. These are, among others:

- How to mitigate risks and threats associated with online activities without undermining the Internet development;
- How to maximize the benefits brought about by the Internet;
- How to bring everybody online;
- How to raise the effectiveness of the use of the Internet.

3.1 The challenges

Internet Governance is a challenging and controversial issue. For some, it should be left to ICT specialists who are best equipped to manage the production of technical norms for the network, the distribution of unique identifiers, data exchange and trafficking and other technical aspects of the Internet operation. Therefore, Internet Governance should be purely technical. For others, who view the Internet as a public good, the Internet Governance should be broadened to encompass the issues of public concern and to insure that those who operate and interact online are in compliance with the Law. As more people move online, it becomes apparent that realities, good and/or bad, of our terrestrial life are rapidly acquiring their cyber life-forms. In the absence of an effective cyberspace legislation based on shared moral and social norms and, consequently, an adequate (for the Internet) enforcement mechanism, there is a real danger that the evolution of the Internet could come to a halt before we reap all the benefits.

The Internet differs from other media in many respects, but the most important are the following:

- It is borderless;
- It is decentralized;
- It does not have a central point of control;
- Its participants are plural and diverse;
- It is in perpetual transformation;
- The space of social agents' interaction it provides is not fully institutionally framed.

These very characteristics of the Internet were the reasons behind the failure of the earlier regulatory attempts of the States and the emergence of a regime of self-regulation set up by the private sector. While the private sector self-regulatory regime has been successful in resolving technical problems, it has not been able to respond to public concerns. On the other hand, the formal regulatory efforts aiming, for example, to bring online behavior of Internet participants in compliance with moral and social public norms were also unsuccessful precisely because of the borderless and global nature of the Internet. Neither corporations nor States alone proved able to impose and enforce the behavior rules on Internet participants worldwide. This situation brings in other problems, such as:

- Abuse of privacy of users, both by corporations and individuals;
- Abuse of human rights, such as inciting hatred and racism;
- Informatization of criminal activities (theft, money laundrying, human trafficking, child pornography and others);
- Abuse of consumers' trust (fraud, selling bad quality goods, cheating, spamming and phishing);
- Abuse of the Internet and fair competition (data leakage, spyware, malware, virus distribution, hacking, cybersquatting, piracy, among others).

The economic damage of online violation of public norms borne by the end-users is enormous. Thus, according to the 2007 Consumer Reports, the likelihood and impact of four leading online hazards in the United States are the following: [89]

	SPAM	*VIRUSES*	*SPYWARE*	*PHISHING*
United States incidence	1 in 2	1 in 5	1 in 11	1 in 81
Average cost per incident	n.a.	$100	$100	$200
Total damage	n.a.	$3.3 billion	$1.7 billion	$2.1 billion

On the whole American Internet users spent almost $8 billions over the last two years on computer repairing and part replacement as a result of virus infection and spyware.

With growing reliance of companies on digital information and technology, security-related business disruptions are becoming a major concern. Businesses such as banking, retail, civil aviation, digital television and radio, online music sales, VoIP telephony systems and many others can be completely shut down by security attacks. The same goes for Web advertising and digital media distribution. In these businesses, service disruption translates directly into loss of customers and revenue. According to the Computer Crime Research Center, in May 2006, alone, more than 20,109 e-mails and 11,976 phishing web sites, representing 137 hijacked brands were reported and tracked by the Anti-Phishing Working Group of the Center (APWG). In the United States, it was estimated that between May 2004 and May 2005, 1.2 million Internet users were victims of phishing, totaling approximately $929 million. In the United Kingdom, losses from phishing almost doubled to £23.2 million in 2005, from £12.2 million in 2004.[90]

The vulnerability of national infrastructure has also increased due to digitization and computerization. Computerized floodgates, power grids, confidential data of State strategic organizations are at risk, especially in the face of a terrorist attack. Security experts identified several full-scale attacks through the Internet following 11 September: one general onslaught that shut down 300,000 computer servers in just 15 minutes, disabling 911 systems and automated tellers; and one aimed at the White House. The unleashing of a so-called worm the week after the 11 September attacks that blitzed corporate computers caused damage of $3 billion.[91] In 2006, in the United Kingdom there were a staggering 3,237,500 cybercrimes committed, according to a new report from online identity specialists Garlik in collaboration with leading criminologists. This means that every 10 seconds one cybercrime was committed in the United Kingdom alone.[92]

Computer crimes are increasingly prone to have international dimensions. Some of the challenges faced on the international front include: the need to harmonize countries' criminal laws; locating and identifying perpetrators across borders; and securing electronic evidence of their crimes so that they may be brought

[89] ConsumerReports.org. 2007 State of the Net.

[90] The Computer Crime Research Center (See http://www.crime-research.org/about/).

[91] The Computer Crime Research Center (See http://www.crime-research.org/about/).

[92] One cyber crime every ten seconds, September 9, 2007 (daniweb.com).

to justice. Complex jurisdictional issues arise at each step. Hence, in developing a new model of the Internet Governance this challenge needs to be taken into consideration too.

Furthermore, in order to ensure the compliance of Internet participants with public social and moral norms, representatives of individual Internet users need to be given an opportunity to express their concerns and to influence the development of an institutional framework for cyberspace. The issues, such as the content of online materials, the quality of goods and services provided by Governments and companies, personal data protection and security of financial and other transactions conducted by consumers online represent only a short list of issues of concern to some groups of the Internet users.

Therefore, the challenges posed by the evolving Internet cannot be met by applying technical methods alone and without participation of all the parties concerned: the State, the private sector and the civil society. This implies the need to develop *a tripartite partnership* upon which a new Internet Governance model could be designed. However, for the Internet survival it is also crucial to identify a proper role and function of each of the parties to Internet management.

3.2. The stakeholders

Since leaving the premises of research laboratory, the evolving Internet has been increasingly affecting the lives and activities of different social groups (civil servants, businessmen, youth and children, parents, researchers and educators, cultural communities, among others). Progressively, the ranks of those having vested interests in the Internet development have grown, bringing new issues to the agenda of global Internet Governance.

3.2.1 Governments

Contrary to a prevailing perception, the role of Governments in the development of the Internet in the UNECE region has been remarkable and multifaceted. Firstly, Government in many countries of Europe has heavily invested in and made public funds available for both research activities and the Internet physical infrastructure development (table 15)[93]. Secondly, Governments have been proactive in setting up an institutional regime conducive to development of the ICT sector. Thirdly, Governments have subsidized or fully financed programmes and projects, which have encouraged and accelerated the access and usage of ICT and the Internet, in particular, by various social groups. Fourthly, Governments have undertaken targeted efforts to narrow digital divides both within and between the countries of the region, initiating and supporting various programmes and projects tailored to specific needs and requirements of people with disabilities, the elderly, the long-term unemployed, women and other social groups. At the subregional level, Governments have cooperated in removing obstacles to transborder business operations and cultural networking via the Internet. They have contributed to the development and promotion of uniform ICT standards to improve interoperability and, thus, enabling the seamlessness of information transmission. They have provided various incentives to encourage research and innovation in the ICT area. At the same time, Governments in a significant number of countries have been trying to precisely define their role and set limits of public intervention in the process of development of the Information Society.

The experience of the EU represents an example of successful consecutive intervention of the Government in the ICT market operation in the UNECE region. Starting with an information research project (Esprit), one of the specific subprogrammes within an integrated programme of industrial R&D projects, technology take-up measures and liberalization of the ICT market paving the way for the emergence of new ICT products and services, the EU moved to a second stage. This stage entailed a coordinated and comprehensive policy aiming to accelerate economic growth, improve competitiveness and generate new jobs by focusing the efforts on five priority directions: (a) diffusion of the principles of effective ICT

[93] Information and Communications Technologies. OECD Communications Outlook 2007.

usage and development of ICT applications; (b) creation of a legislation stimulating and encouraging private initiative; (c) development of trans-European telecommunication infrastructure; (d) organization and promotion of ICT training; and (e) development of new ICT sectors and technologies. The results transformed the EU into an e-Europe.

Table 30. Public telecommunication investment (excluding spectrum fees) in selected European countries

(in US$ millions)

Country	Average annual			1997	1998	1999	2000	2001	2002	2003	2004	2005
	1988/ 1990	1991/ 1993	1994/ 1996									
Austria	965	1308	1283	996	1662	2002	2619	1620	905	411	436	509
Belgium	614	779	927	719	670	746	952	591	754	890	1006	1187
Czech Rep.	…	226	818	1421	1164	854	471	599	455	1267	512	538
Denmark	490	431	612	890	1077	986	1116	1324	970	851	955	1137
Finland	670	510	632	835	595	572	629	657	475	483	511	758
France	4548	6081	6175	6423	6153	6286	7194	8198	5376	6109	6784	7840
Germany	9263	15808	12717	11896	8000	8298	9083	10268	6698	6180	7037	8162
Greece	291	808	751	843	1552	1398	1346	1534	1291	1263	1358	813
Hungary	216	456	754	764	662	812	820	750	713	625	653	768
Iceland	12	23	30	29	52	56	69	37	24	44	80	90
Ireland	174	202	260	462	515	460	704	443	575	575	639	684
Italy	7365	8657	5065	5555	5959	7187	6226	7208	8936	8962	8746	8609
Luxembourg	39	72	96	79	30	55	15	30	49	44	73	56
Netherlands	1144	1572	1511	3274	5900	10418	3174	2671	1564	1821	1930	1340
Norway	500	483	361	541	477	541	578	597	707	524	1024	1142
Poland	140	489	896	1006	1365	1862	2434	1965	2326	1363	1492	1539
Portugal	562	973	938	1078	1216	1233	1146	1229	947	645	838	911
Slovakia	…	…	287	384	343	1050	1359	1405	641	345	425	461
Spain	4517	4265	3220	2654	2952	6572	9346	7313	5242	5103	5760	5797
Sweden	1079	1164	1197	1404	1159	1014	1637	1714	1423	1452	1577	1182
Switzerland	1597	1786	1761	1637	1275	2034	2245	1643	1653	1580	1661	1604
Turkey	548	787	500	553	4225	3777	3541	2949	2159	2204	368	1389
United Kingdom	4830	3738	4887	9971	8987	12800	14122	14159	10185	10933	11963	13205

Source: Information and Communications Technologies. OECD Communications Outlook 2007.

At present, the EU is in the process of implementing "i2010 – A European Information Society for Growth and Employment" initiative adopted in 2005, which is seen as a renewed Lisbon strategy. In this initiative, three policy priorities are outlined:

(1) The creation of an open and competitive single market for information society and media services within the EU. To support technological convergence with "policy convergence", the Commission will propose: an efficient spectrum management policy in Europe; modernization of the rules on audiovisual media services; updating of the regulatory framework for electronic

communications; a strategy for a secure information society; and a comprehensive approach for effective and interoperable digital rights management.

(2) The increase of the EU investment in research on ICT by 80 per cent.[94] The i2010 initiative identifies steps to put more into ICT research and get more out of it, e.g. by trans-European demonstrator projects to test promising research results and by integrating small and medium sized enterprises better in EU research projects.

(3) The promotion of an inclusive European information society in order to close the gap between the information society's "haves and have-nots".[95]

The important characteristic of the EU policy in the area of ICT and the Internet development has been ***a strong reliance on partnership*** with businesses and civil society groups, although there are differences in this respect between the EU countries. Efforts have been undertaken to develop and set up channels and mechanisms allowing on-going consultations with all the stakeholders in order to ensure their involvement in the EU policy formulation and implementation regarding the ICT sector development. The EU has also paid much attention to ***the build-up of capacity and capabilities of civil society groups***, which constitute a necessary precondition of their effective and constructive participation in the Internet Governance.

In CIS member States and in Eastern and Central European countries, the Governments' role in the ICT sector development has also been profound. Most of the ICT infrastructure and research capacity and capabilities currently in place were built up during the Soviet period. Over the period of 2000-2005, total annual investments in telecommunications were relatively unstable and far below the level needed to remove infrastructural bottlenecks (figures 19 and 20).

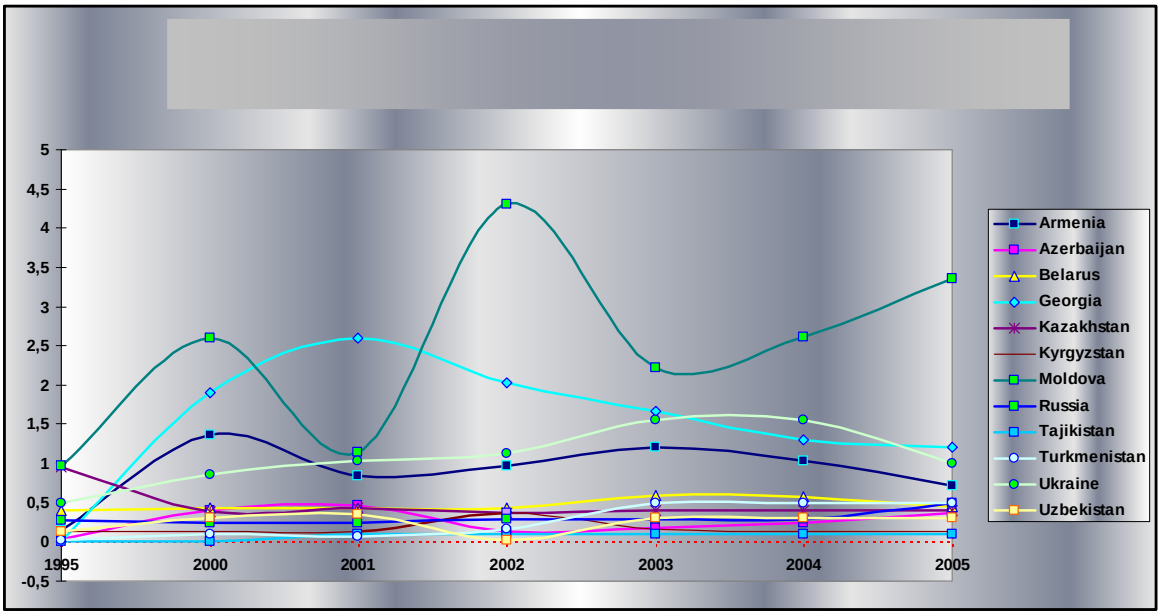
Although in some CIS countries public companies like the Russian Railways or Rostelecom continue to play a leading role in developing and modernizing ICT, new and alternative ICT companies are slowly gaining economic power (and expertise) and beginning to look for new investment opportunities in the sector. Therefore, they are increasingly competing with public or semi-public ICT companies and are anxious to utilize chances provided by public nation-wide e-programmes and projects.

Practically all the CIS countries adopted e-strategies and action plans, which are a result of learning and continue being adjusted in response to pressure of the above-mentioned groups. Some government agencies have been innovative in designing mechanisms of interaction with other stakeholders. In some of the CIS countries, in the Russian Federation in particular, regional and local governments have been active and effective in promoting ICT usage among SMEs, educational establishments and government agencies. However, the framework of local initiatives varies from country to country due to a number of reasons, among which the availability of financial resources has been the most important one. Therefore, it is not surprising that capitals and the largest cities are most advanced in terms of the ICT teledencity and Internet penetration. As in the EU, some CIS Governments adopted e-Government, e-education and e-health programmes (Ukraine, Russian Federation, and Azerbaijan, Armenia, Belarus, Georgia, Moldova, Kazakhstan, Kyrgyzstan, Uzbekistan), which are viewed as a catalyst of the informatization process.

[94] Europe lags behind in ICT research, investing only €80 per head as compared to €350 in Japan and €400 in the United States.

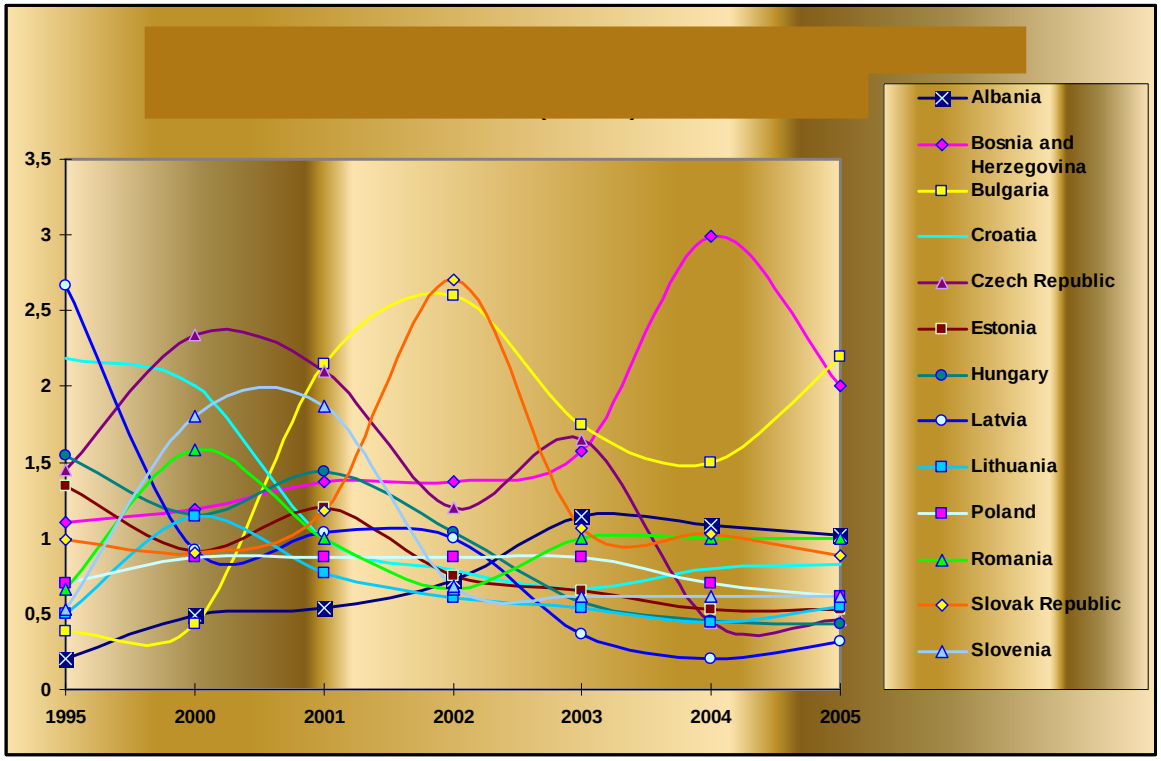
[95] The Commission will propose: an Action Plan on e-Government for citizen-centered services; three "quality-of-life" ICT flagship initiatives (technologies for an ageing society, intelligent vehicles that are smarter, safer and cleaner, and digital libraries making multimedia and multilingual European culture available to all; and actions to overcome the geographic and social "digital divide", culminating in a European Initiative on e-Inclusion.

Figure 19. Annual total investment in telecommunications in selected CIS countries, 1995-2005
(% GDP)



Source: ITU. Data reproduced with the kind permission of ITU.

Figure 20. Annual total investment in telecommunications in selected Eastern and Central European countries, 1995-2005
(% GDP)



Source: ITU. Data reproduced with the kind permission of ITU.

The ICT regulatory regime in most of the CIS Member States is far from being fully developed (table 31). In some of the CIS it is at the initial stage of formation (Tajikistan, Turkmenistan, Georgia). In some others it still needs further perfection.

Table 31. The emerging regulatory regime in selected CIS countries

Country	*Regulatory environment for electronic communications*						
	Inter-connection	*Numbering*	*Facility sharing and collocation*	*Tariff policy*	*Leased lines*	*Licensing and authorization*	*Spectrum regulation*
Armenia	x	x	x	x	x	x	x (limited)
Azerbaijan	x	x		x	x	x	x
Belarus	x	x		x		x	x
Georgia	x	x	x				
Kazakhstan	x	x	x			x	x
Moldova	x	x	x	x	x	x	x
Russian Federation	x	In the process of change	x	x	x	x	
Ukraine	x	x	x	x		x	x
Uzbekistan	x	x		x	x	x	x
Country	*Regulatory environment for online services*						
	Digital signature	*Payment systems*	*Taxation issues*	*Conditional access*	*Data protection*	*Illegal content*	*ISP rights protection*
Armenia	x	x					
Azerbaijan	x	x					
Belarus	x	x				x	
Georgia	x						
Kazakhstan	x						
Moldova	x	x					
Russian Federation	x				x	In process	x
Ukraine	x						
Uzbekistan	x				x		x

Source: Based on information collected from Government web sites.

Although CIS countries have been trying hard to catch up with their European neighbors, they were forced to prioritize their efforts to cope simultaneously with other cardinal challenges associated with the process of transition and the build-up of a market economy. The role of the State in the CIS countries has been transformed, albeit to a different degree. Its direct involvement in the management of the economy has been significantly curtailed in most of the countries of the subregion. As a result, the public sector in the ICT area has been drastically reduced and a vibrant private sector was born. These distinctive development conditions and incompleteness of transition coupled with the unevenness of development between and within CIS countries predetermined a choice of priorities and emphasis, which differs to some extent from that of the EU. The analysis of ongoing conceptual debates and current situations in the CIS countries allows assuming that in the nearest future most CIS Governments will be focusing on:

(a) Creating and/or perfecting ICT legislation;
(b) Building up and/or extending ICT infrastructure;
(c) Human resources development (e-education, e-literacy);
(d) Improving information security;
(e) E-Government.

3.2.2 The private sector

The outstanding contribution of the private sector to Internet development is well recognized and appreciated. Until recently it was able to provide technical and business solutions to most of the problems arising in the course of the Internet evolution, including some problems of a moral nature (for example, online abuse of minors). However, today the private sector needs partnering with other stakeholders in order to ensure fair competition in the cyberspace, access to emerging cyber markets, security and predictability – all the conditions that enable wealth creation activities.

Because of the very nature of the private sector and its focus on profit maximization, it would be naïve to expect that the private sector alone could solve societal problems which are at the root of digital divides. But it can provide technical ideas and contribute to solving such problems, in partnership with the public sector or if the right incentives are in place.

In many countries in transition of the region, ICT businesses are reluctant to the idea of collective bargaining and action, although in some countries the creation of business and/or professional associations has accelerated (table 32). Factors impeding the self-mobilization of the business community in countries in transition include:

- Lack of organizational experience;
- Lack of mutual trust;
- Predominance of small and medium-sized firms among the ICT enterprises;
- Absence of formal channels of public-private dialogue;
- Monopolization and high concentration of real market power in the hands of few companies (in some instances);
- Attitudinal problems (reliance on support of friends or relatives; underestimation of the value of consulting and advising services);
- Corruption;
- High costs of self-organization and peering activities, both in terms of time and money.

In Ukraine, Russian Federation, Kazakhstan, Kyrgyzstan, ISPs and other professional and business groups, such as programmers, ICT engineers and others set up professional associations and forums at which they have been trying to work out common strategies regarding current development trends in the area of ICT. Their aim is to reach a consensus on technical issues relevant to the development of the Internet and the Information Society, and to contribute to the formulation of national e-strategies and the implementation of national action plans. Nonetheless, it is necessary to underscore that the potential of the private ICT sector to contribute to the development of an Information Society is far from being fully utilized in most countries in transition, although in some countries the situation has been rapidly changing.

SMEs in most countries of the region have been lagging behind in the ICT uptake and, therefore, have not been active in pursuing their interests in the area of informatization. Such a situation affects the overall demand for ICT and Internet services in the region and, therefore, results in the loss of market opportunities due to a lower competitiveness of SMEs.

SMEs make up the vast majority of businesses in all the countries of the region. In the EU alone there are 23 million SMEs. They account for 99 per cent of all enterprises and provide 75 million jobs. In some industrial sectors they contribute to up 80 per cent of employment (for example in textiles, construction and furniture).[96]

[96] EU ICT Task Force Report 2006. Fostering the Competitiveness of Europe's ICT Industry.

Table 32. Major representative business associations, forums and/or business groups in the ICT sector in selected CIS countries

Country	*Representative business association, forum and lobbying group*
Russian Federation	- GSM Association - Association of Telephone Operators - Cable Television of Association; - Electronic Data Interchange Association - The Union of Internet Operators - AFK Systema - Alfa-Group/Altima - Telecominvest ***Business groups with significant lobbying power***
Ukraine	- Ukrainian Union of Entrepreneurs and Industrialists (USPP) - Internet Association of Ukraine - Ukrainian Wireless Association
Azerbaijan	- Azerbaijan ISP Association (AziSPA) - annual business forum – dialogue with the President and Government representatives
Belarus	- Infopark (an association of IT companies, mainly software developers)
Georgia	- Telecommunication League - Broadcasters Association - Cable TV Association - Internet Association
Kazakhstan	- National Telecommunications Association - Consultative Council of the Agency on Informatisation and Communications - Council of Operators
Uzbekistan	- Association of IT Companies and Organizations (2005) - Association of Business Incubators and Technology Parks in Uzbekistan (ABIT)
Tajikistan	- Association of ISPs
Moldova	- Union of Communications Sector of Moldova - Association of Patronage of Telecommunications and Informatics (APOTIM) - Association of Private Operators
Armenia	- Union of Information Technology Enterprises - Government IT Development Supporting Council

Source: Various publications and Internet sources.

There are a number of factors that hold back the ICT uptake by SMEs in the UNECE region:

- Lack of ICT awareness;
- Lack of financial resources;
- Lack of ICT skills and digital literacy;
- High costs of ICT services.

In many countries of the region specific programmes aiming to accelerate the ICT uptake by SMEs have recently been put in place. In Russia, for example, such programmes have been launched by various stakeholders at the local level. For example, St. Petersburg Foundation for SME Development provides ICT training within four modules:[97]

(1) "Using ICT for increasing effectiveness of SMEs";
(2) "Information technologies in business";
(3) "Introductory training course on e-commerce";
(4) "Keys to online trade information".

A great number of programmes (both at the national and region-wide levels), whose specific purpose is to enable SME acquisition of ICT capabilities and capacities exist in the EU region. Promoting SME use of ICT involves:

- Improving technical and management skills (Digital literacy initiative);
- Making appropriate e-business solutions available for SMEs;
- Addressing the high cost of ownership of ICT equipment;
- Tackling security and privacy issues (Privacy Enhancing Technologies initiative);
- Making available SME-specific information on e-business (e-Business Support Network for SMEs initiative);
- Promoting e-Government: reducing administrative overheads and creating an incentive to engage in e-business (e-Government).

3.2.3 Civil society groups

In most countries in transition, NGOs representing Internet end-user groups are too few (table 33). A similar situation exists in other countries in transition of the region. Their organizational capacity and financial resources are extremely limited to generate a noticeable impact on ICT policies and/or to effectively contribute to the Internet Governance. Furthermore, most of the existing civil society groups (except for ICT professional and research associations) lack capability to formulate realistic policy recommendations due to the knowledge and expertise gap. This lack of knowledge and understanding of the Internet as a new and unique medium in its turn increases the risk of excessive politization of the issues which are purely technical in nature and could be solved by technical rather than political means.

There are other factors constraining the participation of civil society groups in the Internet Governance in the region. A significant proportion of the population in many countries is not familiar with the Internet. At the same time the participation of representative civil society groups in ICT policy formulation is crucial for maximizing economic and social benefits associated with effective utilization of the Internet potential (for example in the areas of medicine; agriculture; public services; wholesale and retailing; travel and tourism; access to new markets and clientele, particularly, for micro and small businesses, among others).

[97] http://www.fbd.spb.ru/index.php?option=com_content&task=category&sectionid=3&id=17&Itemid=58.

Table 33. Major civil society groups/NGOs active in the area of informatization and the Internet governance in selected CIS countries

Country	*Civil society group/NGO*
Russia	- Association of Protection of Consumer Rights - E-Development Partnership (multistakeholder organization)
Ukraine	- Internet Association of Ukraine - Ukrainian Internet Community - Virtual Internet Society
Armenia	- Armenian Internet Society, Armenia's chapter of ISOC
Azerbaijan	- Azerbaijan Internet Society
Kazakhstan	- Association of Protection of Consumer Rights - National League on Protection of Consumer Rights
Georgia	- Internet Society, Georgia's Chapter of ISOC - Internet Academy

Source: Online resources.

While NGOs with special interests in the ICT development are not numerous, other civil society groups (educators, parents, social movements, youth organizations, organizations of people with disabilities, rural associations, medical professional associations and others) have shown a growing interest in utilizing the Internet in their activities. Many of these organizations have set up their own websites, containing databases and information pools needed for networking, activities support, advocacy and action mobilization. Some are offering ICT training courses to improve e-literacy and e-skills of their members.

Chapter 4

CONCLUSIONS AND RECOMMENDATIONS

The above analysis of the situation in the UNECE region demonstrates that the development of the Internet has been extremely uneven across the UNECE member States. Even in the most advanced countries of the region various digital gaps persist between urban and rural regions and between social groups.

4.1 Conclusions

On the **demand side**, a number of constraining factors appeared responsible for the lack of affordability and access to ICT and Internet and, consequently, for digital differentiation between and within countries:

(a) Differences in the availability of ICT/Internet physical infrastructure and, therefore, differences in the level of ICT and Internet penetration;
(b) Differences in per capita income;
(c) Unequal distribution of income, discrimination and/or mental barriers (for instance in the case of the elderly);
(d) High costs of the ICT equipment (hardware and software) and services;
(e) Lack of awareness of the potential benefits associated with the ICT and the Internet usage;
(f) Lack of trust in the security of online economic transactions;
(g) Reluctance of businesses to uptake informatization of their business operations;
(h) A relatively low level of e-literacy and e-skills among population.

On the **supply side**, the most important impeding factors were identified as follows:

(a) Monopolization of the ICT sector, and, consequently, the lack of competition;
(b) Loopholes in and/or an underdeveloped ICT institutional regime;
(c) A lack of and/or restricted access of businesses to public financial resources;
(d) Insufficient and unstable level of public and private investment in the ICT/Internet infrastructure development;
(e) Bureaucratization of the decision-making process and implementation of e-development strategies and plans of action;
(f) A relatively high level of the ICT market entry costs.

The exact combination of the demand and supply constraining factors varies from country to country and from subregion to subregion, resulting in differences in e-development priorities, means and methods of implementation of national e-development strategies. By applying these as criteria, the following country-groups could be distinguished:

(a) ***Advanced countries*** (Western European and Northern European countries mainly) with a high level of ICT development and penetration. Their main focus at this stage is to accelerate effective usage of ICT and the Internet by businesses and consumers and deepen the Internet

penetration in order to gain in competitiveness of national produce and quality of life of the population;

(b) ***Countries with an upper medium ICT development level*** (some Baltic, Central and Southern European countries). Their main focus is on extending the Internet outreach horizontally and vertically by means of e-Governance, e-education and targeted e-Inclusion program;

(c) ***Countries with a lower medium ICT development level*** (some Central, Eastern, Southern European and Balkan countries, including Kazakhstan, Ukraine, Belarus and the Russian Federation). Their main focus is on horizontal extension of the ICT and Internet physical infrastructure, furthering and improving the institutional regime, digitization of public agencies and services, and investing in ICT education and research facilities;

(d) ***Countries with the lowest level of ICT development and Internet uptake*** (most of the Central Asian, South Caucasus and some Eastern and Southern European countries). Their main focus is raising awareness of ICT and the Internet, establishing an enabling institutional environment, and widening the access to the Internet by means of PIAP.

Some countries (Kazakhstan and the Russian Federation, for example) cannot be placed neatly into the above classification. The Russian Federation possesses enormous potential in terms of capabilities and investment resources, which, under the right institutional conditions and by means of effective e-development policies and instruments, could bring the country back to the club of leaders in the area of ICT research and development. Kazakhstan with its huge territory and small population needs to invest heavily in both human capital and physical infrastructure in order to overcome a significant rural-urban and geographic digital divides.

With regard to Internet Governance, in many countries of the region, especially the CIS, some Southern European and Balkan countries, either the Government agencies alone or the Government with a very modest private sector involvement have been making decisions regarding the Internet. Attempts by some professional or civil society non-for-profit groups to gain influence in the decision-making process concerning various ICT and Internet development issues have not been very successful.

4.2 Recommendations

4.2.1 At the national level

(a) It is obvious that many countries in the region need to bring together all the interested parties into the process of decision-making and implementation of national e-development strategies and plans of action. To meet this task, dialogue channels and negotiation mechanisms need to be designed and put in place within the framework of e-Government programmes;

(b) Various public-private partnership schemes should be considered as a means of overcoming financial constraints and as a means of implementing national e-programmes and projects;

(c) Technoparks, ICT business incubators and free trade zones could be more widely and actively employed as a means of accelerating the ICT and Internet penetration;

(d) Public funding of ICT projects and programmes should be made equally accessible to large and small businesses, and procedures including tendering should be made transparent;

(e) International cooperation in the form of outsourcing, contracting out, joint ventures and full foreign ownership could be considered as an alternative source of financing for overcoming the lack of domestic investment resources;

(f) Business "angels" supporting venture enterprising, especially, among special social groups should be publicly recognized and encouraged, including by fiscal incentives;

(g) Large companies with their own backbone ICT networks could be encouraged to cooperate more actively with local small and alternative ICT firms and ISPs in implementing local e-development projects. Central and local Governments could stimulate such cooperation by bringing big and small companies into public ICT projects and programs;

(h) Establishing local chapters of the Internet Government could be considered as a means to bring all the stakeholders into the decision-making process. They could be instrumental in identifying effective and efficient solutions to local e-development bottlenecks;

(i) The Governments should focus on ensuring a high level of protection of the ICT and Internet critical resources, online business transactions and privacy. Effective solutions could be identified by the private and civil society groups;

(j) The Governments should also take additional steps to raise Internet awareness of the population. The possibility of employing mass media channels (public TV, for example) and public ICT affordable training courses, including long-distance courses could be considered among the available awareness-raising instruments.

4.2.2 At the regional level

(a) The UNECE region has established a dense cross-country cooperation and interaction network, including in the area of ICT and Internet development. Further efforts are needed to bring these interdependent relations to a higher level. In the area of ICT and Internet development, cross-border cooperation programmes and projects could contribute to furthering ICT development in the countries which are regional ICT development laggards. The experience of Estonia could serve as an example of how a country with a low initial level of ICT development could benefit from inclusion in the ICT network of a more advanced country. Other examples of successful cross-border cooperation can be found (for example, between the Russian North-West region and the Nordic countries), which could be replicated by others;

(b) At the regional level it would be useful to set up a network of the national Internet Governance Chapters as well as an annual Forum of the national chapters in one of the region's countries. This could serve as a consultation channel and/or mechanism of the Global Internet Governance and provide the region and its stakeholders with an opportunity to participate in the Global Internet Governance.

4.2.3 At UNECE

(a) The UNECE could further mainstream ICT into its current programmes and projects. In particular, implementation strategies to exploit the benefits of ICT should continue in such areas as trade, especially tools for electronic business; collection and dissemination of statistical information; encouraging digital democracy to promote public participation in environmental decision-making; intelligent transport systems; and measures to promote a gender-sensitive Information Society;

(b) The UNECE could contribute to Internet development and governance through cooperation with the follow up process to the World Summit on the Information Society and, in particular through cooperation with the United Nations Regional Commissions.

(c) UNECE under the SPECA framework could further contribute knowledge-based development of the SPECA member countries and facilitate regional cooperation in Central Asia. It could continue its support on capacity-building activities on ICT policy development as well as the ICT access point project financed by the United Nations Development Account under the new Project Working Group on Knowledge-based Development (PWG on KBD).

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