PRAXIS Working Paper No 5

PRAXIS

ICT Infrastructure and E-readiness Assessment Report: ESTONIA

Andre Krull

Aprill 2003

Table of Contents

Executive Summary

E-Readiness is generally defined as the degree to which a society is prepared to participate in the digital economy with the underlying concept that the digital economy can help to build a better society. Estonia has been previously assessed by various E-readiness reports as one of the most successful adaptors and uptakers of new communication technologies in CEE countries. In addition to regular benchmarking and comparative graphs, this report also tries to explain why certain developments have taken place and what lays ahead.

Current assessment analyzes the main developments that have effected Estonian E-Readiness and ICT infrastructure during the last decade, explaining why some decisions have led to certain developments. The report gives an overview of the developments in the following areas: Network Society, Network Access, Network Education, Network Economy and Network Government. In addition to regular benchmarking and comparative graphs, this report also tries to explain why certain developments have taken place and what lays ahead.

In 2003, information and communication technologies (ICT) have become the major factors of growth and development throughout the World. Estonia, having used the potential to upgrade the society to a modern information society rather well, has to face the question whether it has the capacity to sustain growth and continue developing the information society.

The crucial factors for developing information society in Estonia have been 1) building up modern infrastructure; 2) Tiger's Leap Project in computerizing schools and universities; 3) adopting regulations for information society; 4) government IT-programs; 5) collaboration between the government, private sector and non-governmental initiatives; and last but not least 6) luck.

The number of computer and Internet users in Estonia has grown steadily over the years, reaching 47 and 39 per cent of the population (15-74 years old), respectively. Estonian Internet penetration rate is comparatively high when comparing with other Central and Eastern European countries. Estonia is almost catching up with the average Internet penetration rate of European Union member states.

The main reasons why people use Internet in Estonia are sending/reading e-mails (70%), searching certain information (66%), occasional surfing (62%), using Internet banking (57%) and reading Estonian Internet issues (54%). Most of the Estonians use Internet at their workplace (53%), at home (40%) or at school (29%).

The most popular Estonian Internet issues are electronic versions of newspapers, communication portals and chat-rooms, and homepages about computer games. Out of 10 most visited Estonian homepages, there are 3 newspapers, 2 news portals, 2 internet banks, 2 mail service providers and 1 search engine.

Estonians are not interested in shopping online. Only 12 % of the respondents were interested or very interested as opposed to 83 % of the respondents who were not interested or generally not interested.

According to the latest official penetration rates by the Statistical Office of Estonia, the penetration rate for mobile phones was 54%, for fixed lines 38%, for home PCs 17%, and for Internet connections at homes 10%.

ICT equipment and services have become more affordable. The fixed costs for call services have dropped over the years, while the price for local calls has stayed the same or even has increased. Average one minute local or international call costs 0.0287 EUR. The prices for international calls have dropped enormously – in many cases more than ten times. The price of a brand new low-end computer starts from 500 EUR. The monthly fee for a dedicated Internet connection starts from 10 EUR.

In educational sector, Tiger's Leap Program has been important to start the virtuous circle of making IT popular first among children and through them among the whole society. Almost all children (93%) have access to the Internet either at school, in the neighborhood or at home. Pupils use the Internet mainly at school (79%). In 2000, there were no basic or upper secondary schools without computers in Estonia, 75% of schools had online Internet connections. Still, on the average Estonian schools have only 3 PCs per 100 pupils connected to the Internet.

The number of ICT specialists entering the labor market annually is estimated to be approximately 700. The survey conducted among IT-companies revealed their need only for 300 new people in the next 3 years, but due to the need for IT-specialists outside the IT-sector companies, the annual need for ICT specialists might be around 600 new people. Almost all Estonian companies in electronics have currently shortage of ICT specialists with appropriate university education.

The estimated value of Estonian telecommunication market in 2001 was 0.34 billion (approximately 5.6% of GDP). The turnover of the telecommunication market accounted for a little less than 1 billion Euro in 2001, up 14 per cent from 2000. There are estimated to be 451 companies in Estonian ICT sector. Most of the companies in the field are very small, with 1-5 employees and an annual turnover under 64 000 EUR. Still, the 8 largest companies make up 85 per cent of turnover of the whole sector. These 8 companies are: Elcoteq Tallinn, Estonian Mobile Telephone, Estonian Telephone Company, Radiolinja Estonia, Tele2, JOT Estonia, Tarkon and Microlink.

The leading exporter Elcoteq and few others in the telecom equipment sub-sector export 20 times more than all the other ICT sub-sectors in total. Telecom services and computers and office machinery sub-sectors rely practically only on the domestic demand. The major employers are also software and components of electronics sub-sectors in addition to the telecom equipment, computers and office machinery and telecom services sub-sectors.

The key areas that Estonia has decided to focus on, are user-friendly information technology, bio-medicine and material technologies. To develop those areas, Estonia needs to first solve several problems associated with unproportional composition of Estonian R&D expenditure, low level of R&D expenditure of Estonian companies, low level of co-operation of scientists and entrepreneurs, low patenting activity and shortage of high qualification engineers.

The overall impact of government actions has been crucial in the development of Estonian information society. From creating favorable legal environment and leading the way with computerizing the whole public administration, some of the major e-services were developed for the public sector which have been useful to attract people to the Internet. However, there has not been a single strategic document for the development of Estonian information society.

If the co-ordination of the ICT development in Estonia will not be improved and the attention regarding its importance in country's future competitiveness will not be paid, there is a strong doubt if Estonia could continue its fast development.

Estonian public administration is relatively well equipped with computers, as the estimated need for computer-equipped workplaces exceeds the number of existing computer-equipped workplaces with just 3.6 per cent. The Internet connection is present at almost four-fifths of the workplaces.

Estonian Parliament Riigikogu has been successful in adopting regulations needed for different information society applications, such as digital signature, public key infrastructure and state registries.

Regarding e-government, Estonia needs to create the capacity for citizens to interact with the government, purchasing goods, or utilizing services and paying for them online. Currently, many of these developments are in progress and as the plans for the next few years show, many more of citizen-oriented services are being developed. Many services have already been developed such as e-Tax Board, portal Today I Decide and e-Citizen Portal. More than 150 000 ID-cards as an important part of digital signature infrastructure have already been issued.

From 1996 to 2003, the ICT financing from the state's budget has stayed around 1 per cent – 1.3 per cent at its peak in 1999 and 0.8 per cent in 2000. However, the resources allocated to ICT financing have grown almost 4 times – from 7.66 million EUR in 1997 to estimated 28.44 million EUR in 2003.

Some findings of the report:
1. The Government needs to address the issue of emerging digital divide;
2. The establishment of the citizen-centered e-state and development of the framework for customer-friendly business-to-consumer and business-to-business services should be a strong priority;
3. It is important to learn from the success of the Nordic countries. The Finnish success has been descirbed with the following key developments:
  - Liberalization of telecommunications market
  - A well functioning regulatory environment
  - A high level of national education
  - Heavy R&D investments (public and private)
  - Good national dialogue and cooperation among actors.

Estonian developments to the direction of information society have been adequate concerning the initiatives started by the public sector. The level and quality of ICT infrastructure and the access to it has gone through a major improvement during the last decade. The role of ICT in the society and Internet's growing role in providing

information, business transactions, interaction between the state and citizens allows to assume that the e-readiness of Estonia is improving with every essential application and service delivered through the Internet. An emphasis made on computerizing the schools and providing vocational education to grown-ups has been essential and should be continued even more strongly. With the creation of public-private partnership in developing services and applications needed in the information society, and paying more attention to the R&D activities in the companies, sustainable economic development could be achieved.

Today, by most indicators assessed and benchmarking systems applied, Estonia is a runner-up to the most e-ready societies in the world. Still, in some aspects and penetration rates it is even difficult to reach the average level of European countries, as the GDP per capita is only 40 per cent of the European Union's average level. In the next few years the political decisions made and the developments chosen will show if Estonia will continue chasing the world's leading countries or the European Union average.

1. Introduction

1.1. General introduction to Estonia

Official name: Republic of Estonia

Area: 45 227 sq km

Administrative divisions: Estonia is divided into 15 counties, 202 rural municipalities, and 39 towns. The capital is Tallinn (population 0.4 million)

Population: 1 361 242 (2001)

Households: 582 089 (2001)

Ethnic divisions: Estonians (68%), Russians (26%), Ukrainians (2%), Belarussians (1%) and Finns (1%)

Languages: Estonian (official), Russian, and others

State system: The Constitution adopted by referendum in 1992, established the principles of the rule of law. Estonia is a democratic parliamentary republic.

Graph 1.1. Map of Northern Europe.
Source: REGIO

The people elect the Riigikogu (parliament) and executive power rests with the government. The head of State of Estonia is the President of the Republic.

Currency: National currency is Estonian kroon (1 kroon = 100 sent) The kroon was issued on June 20, 1992 and it is pegged to Euro at the fixed rate 1 EUR = 15.6466 EEK.

International Organizations: Member of United Nations and OSCE since 1991, member of the Council of Europe since 1993 and WTO since 1999. Invited to the membership talks with NATO and the European Union. It is highly likely that Estonia will join both organizations in 2004.

Short overview of history: Estonia declared its independence on February 24th in 1918. In 1940, Estonia was incorporated by the Soviet Union. Only in August 1991, Estonia managed to restore its independence.

Key macroeconomic indicators:

Indicator	Value	Reference year
GDP, billion EUR	**6.09 (96.5 mEEK)**	2001
GDP per capita, EUR	**4524.6**	2001
GDP real growth, %	**5.0**	2001
Purchasing Power Parity per capita, EUR	**10020**	2001
Economic structure, %	**Services: 60% Industry: 26% Construction: 7% Agriculture: 7%**	2001
Telecom industry turnover, billion EUR	**0.96**	2001
Unemployment rate (ILO, %)	**13.4**	2002
Productivity (real growth %)	**5.2**	2001, Q1

Sources: Statistical Office of Estonia; Ministry of Finance; World Development Indicators database[1]; Krediidiinfo[2].

Major telecommunication penetration rates:

	Total number	Percentage	Reference year
Fixed lines	512 000	37.6%	2001
Mobile subscriptions	738 700	54.3%	2001
Internet users	455 000	43 %	2002

Sources: Statistical Office of Estonia, EMOR E-Track Sept-Nov 2002, Estonian Mobile Telephone, Radiolinja Ltd.

Estonia's positions in some Indexes:

2002 World Economic Forum country competitiveness list: 26th (29th in 2001)
2002 UN Human Development Index: 42nd (48th)
2002 Transparency International corruption index: 29th (28th)
2003 World Economic Freedom: 6th (4th in 2002)
2002 UNDPEPA and ASPA E-government index: 32nd

More information on Estonia to be found at:

The Ministry of Foreign Affairs – http://www.vm.ee/estonia/
Estonian Tourist Board – http://www.visitestonia.com
Estonian Institute – http://www.estonica.org
High Technology Estonia – http://www.hightechestonia.com

---

1 World Bank, August 2002, http://www.worldbank.org/data/databytopic/GNIPC.pdf
2 in PW Partners Report 2002, http://www.krediidiinfo.ee/

1.2. Introduction to the report

1.2.1. General context

In the last decade, information and communication technologies (ICT) have become the major factors of growth and development throughout the World. Similarly to other technological innovations (e.g. cotton, coal and iron, steel, oil and plastic) that historically have had major influence in the production sphere since the Industrial Revolution in England, ICT is leading the vast technological revolution based on electronic computers, software, microelectronics, the Internet, and mobile telephones[3].

ICT has formed the core of the new techno-economical paradigm and centered itself to becoming new techno-economical paradigm leader. In 2003, despite the recent dotcom market collapse accompanied by even larger decline in the value of global telecommunication companies, the world's adoption to ICT is constantly growing. The adoption to ICT and the avoidance of the emergence of digital divide has become critical for both developed and developing world. Finding the ways to make ICT part of the solution rather than part of the problem is challenging the nation states and international organizations[4]. It is widely believed that ICT carries enormous potential in establishing technical and organizational innovations, to reduce costs and change the quality of capital equipment, labor, and products. Innovations, naturally, are the essential basis for higher productivity and growth in major value-adding industries[5].

World Bank claims that:

> *"To put ICT to effective use, a country must be "e-ready" in terms of infrastructure, the accessibility of ICT to the population at large, and the effect of the legal and regulatory framework on ICT use. If the digital divide is to be narrowed, all of these issues must be addressed in a coherent, achievable strategy that is tailored to meet the local needs of particular countries[6].*

E-Readiness is generally defined as the degree to which a society is prepared to participate in the digital economy with the underlying concept that the digital economy can help to build a better society. *"Regardless of a country's level of development, readiness is assessed by determining the relative standing of its society and its economy in the areas that are most critical for its participation to the networked world. However, e-Readiness can be a relative concept and it could be defined differently depending on each country's priorities and perspective"[7].*

Thus, generally e-readiness assessments help country's leaders to measure and plan for ICT integration, focus their efforts and identify areas where further attention is

---

[3] Chris Freeman and Francisco Louçá "As time goes by : from the industrial revolutions to the information revolution" Oxford : Oxford University Press, 2001, p. 301.

[4] Infodev Annual Report 2001, p. 3, http://www.infodev.org/

[5] Tarmo Kalvet "ICT, Innovations and Innovation policy: The Case of Estonia" Working paper, Tartu, 2001, pp. 4-6.

[6] bridges.org, http://www.bridges.org/ereadiness

[7] GeoSINC International, e-Readiness Guide, p.5

required. "*One cannot forget that an assessment alone is insufficient, and decision makers face two key challenges in making effective use of this tool. First, they need to understand how ICT can help their countries achieve economic and social benefits, and to set realistic goals accordingly. Second, they must take concrete steps toward effective and sustainable ICT use that will help their countries realize development goals*"[8].

1.2.2. Previous assessments

Over the years, Estonian e-readiness has been assessed by 4 major international assessment models[9]:

- the Knowledge Assessment Matrix by the World Bank[10],
- an assessment by McConnell International[11],
- a questionnaire based assessment by the Mosaic group[12], and
- "The Global Information Technology Report 2001-2002" by the Center for International Development (CID) at Harvard University and World Economic Forum[13].

Additionally, Estonian e-readiness and capacity of ICT infrastructure has been evaluated in 1999-2000 by the European Commission. The project European Survey of Information Society (ESIS II) was launched by the Information Society Promotion Office of the European Commission (ISPO)[14]. Also, quite recently, a joint research on e-governance was conducted by UNDPEPA program of United Nations and ASPA[15].

In Appendix 1, the reader will be introduced to the main findings of the assessments conducted previously.

The main findings of the previous assessments would refer that these reports do not place their main emphasis only on statistics of connectivity and the penetration rates for information technology infrastructure, but also on describing extensively government policies, efficient institutional framework and human development. As Estonia is one of the most successful adaptors and uptakers of new communication technologies in CEE countries, it is even more important for Estonia to be aware how the penetration rates for using various technologies hold against the most advanced technologies in North America and Western Europe.

---

[8] Infodev Annual Report 2001, p. 5, http://www.infodev.org/

[9] E-readiness Assessment: Who is Doing What and Where, Bridges.org - Version 3.6, 23 March 2002

[10] World Bank, Knowledge Assessment Matrix 2002, http://www1.worldbank.org/gdln-scripts/programs/kam2002/kamscript.exe/show_page

[11] McConnell International's Risk E-Business: Seizing the Opportunity of Global E-Readiness, http://www.mcconnellinternational.com/ereadiness/default.cfm

[12] The Mosaic Group, http://som.csudh.edu/fac/lpress/gdiff/

[13] The Global Information Technology Report 2001-2002: Readiness for the Networked World, Oxford University Press 2002; for Estonian evaluation results, see Braliev, A. and T. Kalvet. 2002. Country Reports. .ee. in The Global Information Technology Report 2001-2002: Readiness for the Networked World. pp. 200-201. Oxford University Press

[14] For ESIS Estonian reports, see http://www.esis.ee.

[15] United Nations Division for Public Economics and Public Administration (UNDPEPA) and American Society for Public Administration (ASPA) "Benchmarking E-government: A Global Perspective" pp.15-56, http://unpan1.un.org/intradoc/groups/public/documents/un/unpan003984.pdf

The global information technology report and the UN e-Government Index indicate that Estonia has used its potential to upgrade the society to a modern information society rather well. Still, the question remains of its viability and sustainability, as Estonian ICT growth rates have started to slow down and countries with more resources might leave Estonia further behind.

1.2.3. Main Conclusions

The assessments describing Estonia's ICT development have been beneficial to keep track of the changes and developments in infrastructure and legislation of Estonian telecom and IT-sector. Thus, the reports have concentrated mainly on offering good coverage of statistical indicators, and benchmarking the presence of ICT equipment.

eEurope+ Monitoring and Benchmarking Report states that ICT actions should be benchmarked not only using technical indicators, but also be judged by checking their contribution to achieving economic, social and environmental objectives[16]. The same is true with assessing Estonia's ICT development. The penetration rates have reached to the level where rapid growth is not possible since socio-economical constraints.

Thus, indexes should not measure only the present state of infrastructure and penetration rates, but also countries' capability to sustain growth and development. That is why it becomes important to consider ICT developments in line with other societal developments. The same is essential the other way round – ICT potential should be considered while solving the problems currently facing Estonia. Only following these principles, it becomes possible to enhance country's overall competitiveness.

Explanation of the grown usage and improved access to ICT in the region makes comparing only the quantitative data useless. Certain qualitative indictors need to be addressed as well (how 'digital divide' affects the relationship between citizens and the state; improved productivity of human capital). In spite of the numerous ICT surveys in Estonia, there is still a lack of profound analyses (lack of background studies, analytical materials, research-based policy recommendations).

1.3. Main Objectives and Methodology

For reasons mentioned above, it is obvious that the scope of the E-readiness assessment in Estonia should not be just benchmarking; its **objective is to provide a uniform coverage of all relevant aspects contributing to country's E-readiness leading to policy recommendations and action plans.** Thus, while understanding the importance of comparative statistics on connectivity and penetration rates for the Estonian ICT infrastructure, we also identify the growing need for a deeper analysis of the problems hindering the development of a relatively advanced information society, such as Estonia has become.

To meet the objective of providing a more profound analysis of Estonian E-readiness, we propose that in addition to the conventional E-readiness report delivered according to the methodology of major assesment models, assessing primarily quantitative data; we also provide the analysis of the developments in Estonia based mainly on

---

[16] eEurope+ Monitoring and Benchmarking Report, p.5

qualitative data, providing comparative basis for other countries; and the case studies of Internet Banking, m-services, and Digital Divide in Estonia.

Thus, Estonian E-readiness report will be based on the most well-known and used international assessment models.

According to McConnell International, a good E-Readiness assessment should introduce clear indicators to measure capacity and benchmark progress on the Connectivity, E-Leadership, Information Security, Human Capital, and E-Business Climate necessary for any program to succeed.

However, Infodev Toolkit argues that e-readiness can be defined differently depending on country's perspectives and priorities. An e-readiness assessment first defines the objectives the country is pursuing[17]. For Estonia, these are most clearly stated in Knowledge Based Estonia, Estonian Research and Development Strategy 2002 – 2006. It sees the future Estonia as a knowledge-based society where the development of human capital, research and adaptation of new knowledge and skills is the source of growth in the competitiveness of the economy, labor force and in the quality of life.[18]

The selected methodology should be successful in measuring the relevant components of country's ICT infrastructure and define the level of country's e-readiness to determine the success of building a better society through digital economy and state.

1.3.1. Specific goals

More specifically, the current report's goals are:
- to give an overview of the latest developments in the Estonian ICT sector;
- to give an explanation why some choices and decisions have led to certain developments;
- to provide comparative data for foreign experts and institutions on the current situation of Estonian e-readiness and the level of ICT infrastructure;
- to draw attention to the main problems facing Estonian ICT development in the future.

The areas to be assessed in this report are the following:

- Network Society
- Network Access
- Networked Education
- Networked Economy
- Networked Government

---

[17] Infodev Toolkit 5.0, http://www.infodev.org
[18] Riigikogu, Knowledge-based Estonia, Estonian Research and Development Strategy 2002–2006, RTI 2001, 97, 606, 2001,
http://www.tan.ee/tan/en/doc/Documents/1018442944.46/Estonian%20R%26D%20strategy.pdf

2. Networked Society

2.1. General description of Estonia's Situation

In the end of 2002, Estonia enjoys Internet penetration rate close to 40 per cent of the whole population and mobile phone penetration rate more than 60 per cent. Most of the workplaces in public administration are equipped with computers, the government itself being one of the first in the World to develop a functioning e-government system. Estonians spend 5% of their income on telecommunication services (3 % on IT) every month, which is among the highest in the world in relative terms. Considering Estonian GDP per capita (only 4524.6 EUR in 2001) is definitely a remarkable figure[19].

On regaining independence in August 1991, Estonia was a relatively backward country technologically. State infrastructure (institutions and people) was absent and had to be built up from scratch, monetary reform in 1992 established the stable currency. Heavy industry machinery and infrastructure established during the Soviet era found almost no use after the privatization and technological upgrading by the new owners. The access to Russian market was increasingly more difficult due to the politically set trade barriers by the Russian Federation, and the quality of Estonian products was not good enough to compete in the Western markets.

In spite of these unfavorable conditions, Estonian industrial structure started to depart from the factor-driven stage into the investment-driven economy in the early 1990s (More on this in Estonian eVikings I[20]). The main reasons that played a crucial role here are most probably (1) the proximity of technologically advanced Finland and Sweden, (2) large amount of foreign direct investments into Estonian companies, (3) a population with high level of technical education (in the Soviet era (only hard sciences were ideologically free), and (4) a large part of the population ready to consume and adopt modern technology as a part of one's lifestyle.

Lucrative high returns of transitional economy and favorable factor input prices for export attracted foreign direct investments mainly from Finland, Sweden and Denmark into Estonia. In cumulative FDI-inflows per capita (1989-2000) Estonia only lagged behind Czech Republic and Hungary among the CEE countries (Kalvet, Kattel & Tiits, Estonian Economy's Competitiveness and Future Prospects, 2002, pp. 16-18). Now that the Baltic enlargement to the European Union is highly likely, Nordic countries have become even more active buying out their competition in the Baltic states.

There are several reasons behind the increase of Internet users. During the last year the number of PCs at home as well as those connected to the Internet has increased. In addition, ISPs (both telephone service and cable companies) have lowered their prices for dedicated connections, at the same time the prices for dial-up services practically have not changed. During previous years the number of Public Internet Access Points

---

[19] Monitoring and Benchmarking E-Europe+ Action Plan, November 2002
[20] Estonian eVikings (eVikings I) Tarmo Kalvet, ICT, Innovations and Innovation policy: The Case of Estonia, October 2001

has grown drastically and these are especially popular among youngsters. An important reason to start using Internet has been the popularity of Internet banking, which is being used by more than half of Internet users. In January 2003 Estonian banks had more than 650 000 Internet banking clients[21].

In light of all these developments, what have been the crucial factors supporting the development of Estonian information society and the growth of ICT centered activities both in public and private sector?

First of all, building up the modern infrastructure. According to the **Concession Agreement** signed in 1992 between Republic of Estonia and Estonian Telephone Company, the latter was granted monopoly for 8 years to provide basic services but was also responsible for digitalizing the existing network and was obliged to cover rural areas with telephone lines. After the start of competition from January 2001 (2000 in data connections), the monopoly is losing slowly its market share but it is still dominating the market. Data services is a rapidly growing market, DSL connections has been an extremely popular Internet connection type in Estonia. Either through fixed line, mobile, or WLAN Internet is accessible practically on 100% of Estonian territory. Prices for subscriptions fell dramatically in Q3 of 2002..

Since 1995 Estonia has had 3 operators providing mobile phone subscriptions. Their fierce competition to extend coverage and to lower prices, has generated high penetration rates and allowed people to give up fixed lines. In 2003, additionally 2 operators have promised to enter the market.

Secondly, the Tiger's leap project and the establishment of EENet (Estonian Educational and Research Network, founded in 1993) have proved to be crucial for the further developments. Providing schools with computers generated a virtuous circle, as children brought their interest for the modern technology home to their parents and made having a computer practically a norm in the society. EENet provided dial-up and dedicated Internet connections for schools and universities – a large number of students and teachers continued to use e-mail service also after leaving the educational sphere.

Thirdly, Estonia has been successful in adopting regulation for information society. Already in 2001, most of the necessary regulations needed for information society were in place. Overview of the adopted regulation may be read in the chapter discussing Networked Government.

Fourthly, government programs, such as e-government system, Village Road and x-Road, issuing ID-cards, etc. have been widely promoted to bring ICT solutions to the public administration and introduce them to general public.

Fifthly, the collaboration between government, companies and non-governmental initiatives. Tiger's Leap Program, Look@World Foundation and several non-governmental organizations have successfully worked together with ICT companies and governmental organizations. Also, flexible financing systems offered by the

---

[21] Postimees, February 7, 2003

banks to purchase computers and mobile phones in advance without paying all the money at once, has improved the uptake of new technologies.

And finally, even though different initiatives have helped Estonia to become one of the most successful EU candidate countries to prepare for the information society, Estonia has had a good portion of luck. In spite of the guidance of the Principles of Information Policy, the Information Policy Action Plan and the activities of National Advisory for IS strategy and policy there has not been a clear executive IT leadership in the government (only IT Advisor to the Prime Minister in 1999-2001) nor a long term action plan. Estonian Information Center and the Department of State Information Systems have tried to play the coordinating and executive role in information society projects financed by the public sector.

As already mentioned, the fortunate developments have been rather supported by the willingness of Estonian inhabitants to purchase new ICT equipment and actively use it. The spending of an average Estonian on telecommunication services is very high – around 4.9 per cent of income in 2001[22]. This could possibly be explained by the so-called Scandinavian temper (some explanations refer that people tend to communicate more from a distance than face-to-face; scarce daylight during a relatively long winter-period, prices for dedicated Internet connection are less expensive than in southern part of Europe).

The results of the cluster analysis of Estonian ICT sector[23] show that the state has played the most important role in building up the information society in Estonia. Business sector and the third sector have followed when in line with their own objectives. According to the analysis, private enterprises and ISPs took little risk in providing dedicated Internet connections before 1995 as they started investing into building the networks only when a critical mass of users could be recognized.

Despite the successes, rapid development in Internet penetration rate almost stopped in 2000 to 2002. It grew only by 6 per cent, from 26 per cent of all respondents who had used Internet in last 6 months in Q1 2000, to 32 per cent in September-November 2001. In 2002, the penetration rate has boosted up again to 39 per cent in March-May 2002[24].

However, it has become clear that human and social capital will be critical for further development of ICT in Estonia. Capacity to sustain growth is already a component of some indexes (Benchmarking E-government: A Global Perspective) measuring country's readiness for information society. Growing penetration rates do not really show the quality of actual usage and the purpose of use. Thus, it is important to analyze what people really use Internet for, do they use it for work or just for entertainment, do they use e-government applications, do they shop online. The most productive use of Internet for any country or company is naturally its usage for productive purposes, to facilitate economic growth through enhanced efficiency or to boost efficiency of production factors through the use of ICT.

---

[22] Statistical Office of Estonia
[23] eVikings, Estonian ICT Cluster: Present State and Future Outlooks, http://www.esis.ee/eVikings
[24] EMOR E-track, March-May 2002

The effect appears in a situation where users start using the computers and Internet for something productive, creating new knowledge, saving time, making something more efficient and convenient. Most of the Internet users in Estonia or anywhere else in the world do not shop nor work with the help of Internet. Achieving efficiency gains, making one's work more productive, and growing life quality by using the Internet - this should be the result of grown Internet usage, not only mere penetration numbers.

In Estonia, despite the high penetration rate of Internet users, e-commerce is practically nonexistent, only Internet banking services are extensively used. The global E-Commerce Report 2002 reveals that only 7 per cent among Estonian Internet users are online shoppers as opposed to 74 per cent of non-shoppers[25]. In leading information societies, such as in United States or Finland, the rate of non-shoppers is 36 and 54 per cent, respectively. However, it is clear that in smaller countries, such as in Estonia, the advantages of postal services in delivering products ordered via Internet are less evident than in the USA, since the retail-market is closer to consumers.

A report published by PRAXIS and EMOR in September 2002[26], revealed the extent of digital divide in Estonia. The report distinguishes retired persons and workers as the main groups of Internet non-users who have not found enough motivation to start using the Internet. Additionally, there are several motivational, skill and access barriers, which prevent the wider use of Internet in Estonia.

2.2. People online

2.2.1. Current Level of Computer Usage

The network society without terminals (computers connected to Internet, phones, mobiles) is a goal not possible to achieve. The number of people having a computer at home has grown from 7.4 per cent of all households in 1999 (Statistical Office of Estonia) to 30% of all people in May 2002 (EMOR). The penetration rate for mobile phones has grown even more rapidly – 17.2 per cent in the end of 1998 (SOE) to 54.3 per cent in 2001(SOE). The penetration rate for conventional lines has stabilized around 37.6 per cent of all people (SOE). In 2001, there were already 13 % of households who had a mobile phone but did not have fixed line. The monthly fee of keeping a fixed telephone line has already exceeded the price of an average monthly mobile subscription fee.

---

[25] Global E-Commerce Report 2002, http://www.tnsofres.com/
[26] Report "Digital Divide In Estonia and How to Bridge It", Mari Kalkun (Emor), Tarmo Kalvet (PRAXIS), PRAXIS 2002
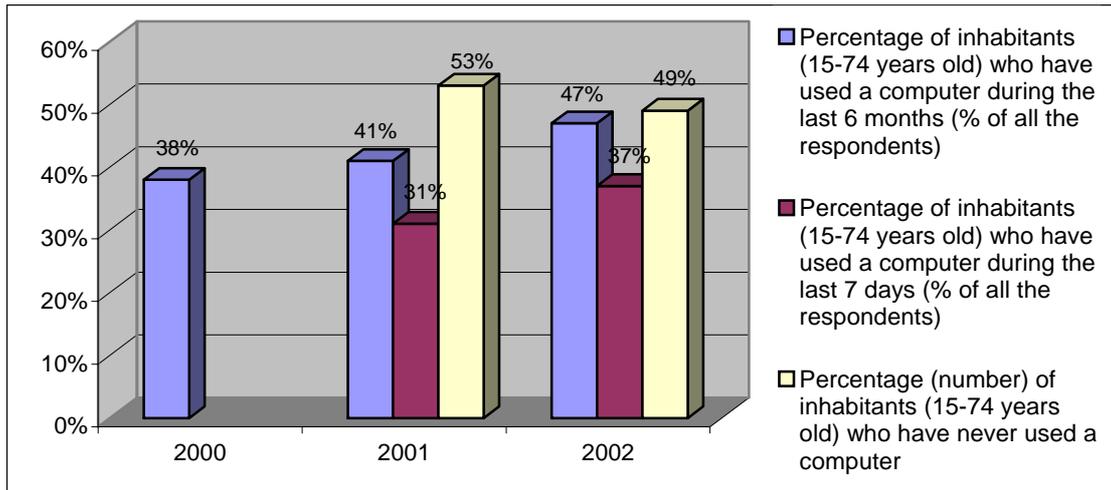
Graph 2.1. Users of computers.
Source: E-Track Survey, March-May 2002, Emor Ltd.

Even though that 51 per cent of the total population has used a computer at least once in their lifetime, 49 per cent of the population has never used a computer, according to EMOR E-Track survey (see Graph 2.1). The share of people having used a computer in past 6 months has risen from 38 per cent in 2000 to 47 per cent in 2002. Despite almost every second respondent had not used a computer in one's lifetime, the share of people who had used a computer in past 7 days is relatively high - 37 per cent.
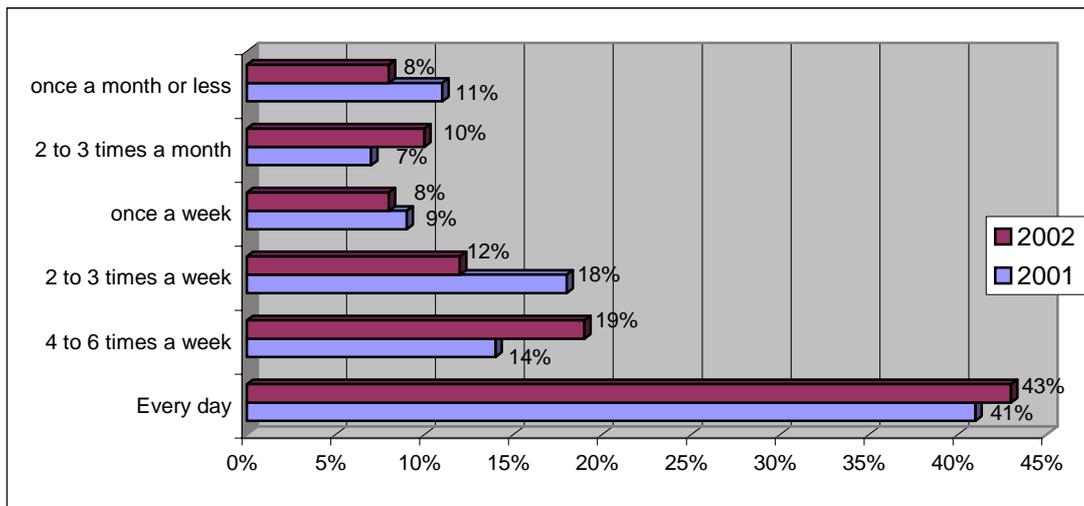
Graph 2.2. Frequency of using a computer in the age group from 15 to 74 years (Percentage of inhabitants who have used a computer during the last 6 months).
Source: E-Track Survey, March-May 2002, Emor Ltd.

In Graph 2.2, it is possible to monitor the frequency of use among computer users. As also evident in Graph 2.1, those using computers most extensively form the largest group – 43 per cent of those who have used a computer in last 6 months. Compared to the level of 2001, the groups using computer once a month, once a week or 2 to 3 times a week have started to lose ground, while groups using computer 2 to 3 times a month, 4 to 6 times a week and every day have grown bigger.

2.2.2. Current Level of Internet Usage

The number of Internet users in Estonia grew very rapidly in 1999, where the penetration rate of 10.3 per cent in the end of 1998 almost doubled by the late 1999 to 19.3 per cent[27]. After reaching 28 per cent in September 2000, the growth has been steady – 32 per cent in May 2001 and 39 per cent in May 2002.

Not surprisingly, differences in usage of Internet among population are becoming more evident. The number of heavy users (those having used Internet at least on 5 days during a week) is growing extensively. Out of 11 per cent of all respondents in May 2001, the share of heavy users has grown to 18 per cent. Out of all people having used Internet in past 6 months, heavy users account now for 44 per cent[28].
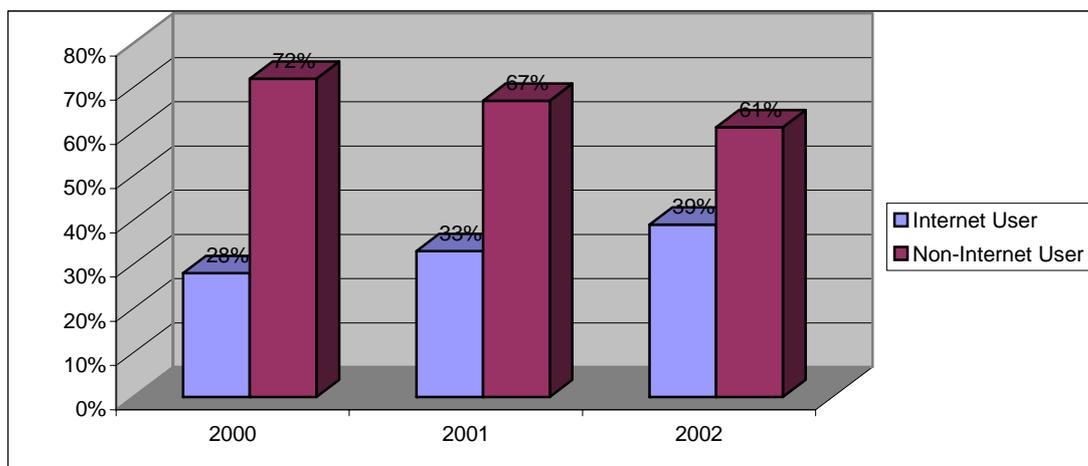
Graph 2.3. Percentage of population who are Internet users (Percentage of inhabitants who have used Internet during the last 6 months)
Source: Global E-Commerce Report 2002, Survey "Use of online services offered by state and government agencies, Spring 2002" Emor Ltd.

Again, Internet usage pattern follows the pattern of computer usage – entirely 28 per cent of people have used Internet during the last week. Graph 2.4 shows that Internet usage is very different among different age groups – from the penetration of 81 per cent among people under 20 years-old to 6 only per cent of people over 60 years of age. Women are more active users of Internet in Estonia than men, according to the Global E-Commerce Report 2002. According to EMOR E-Track Survey, by average there are more computer and Internet users among people of Estonian nationality, people up to 34 years of age, students, employed people, people with higher education and people with higher than average income[29].

---

[27] Baltic Media Facts Estonia
[28] EMOR E-track, March-May 2002
[29] EMOR E-Track March-May 2002, p.6
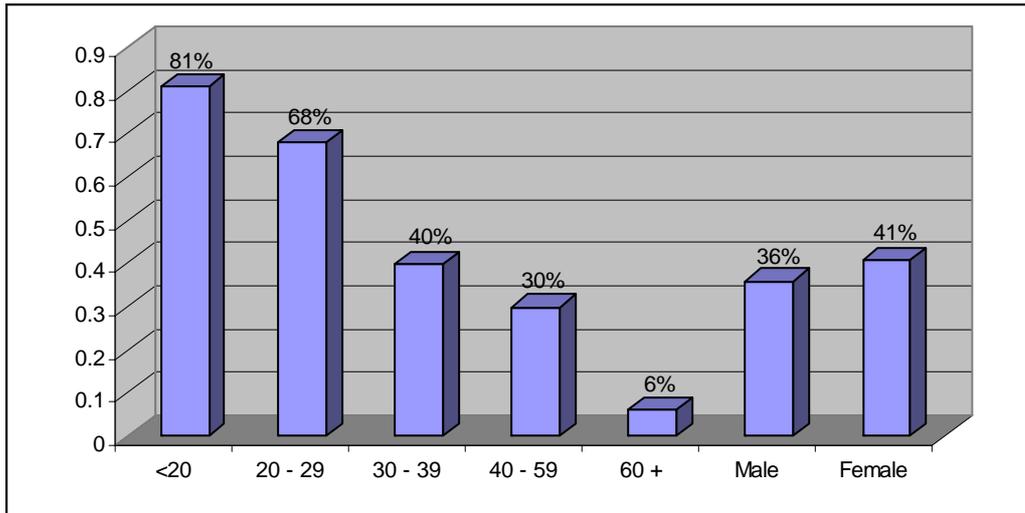
Graph 2.4. Percentage of specific age groups and sexes who are Internet users.
Source: Global E-Commerce Report 2002

Internationally, Estonian Internet penetration rate is comparatively high when comparing with other Central and Eastern European countries. Estonia is almost catching up with the average Internet penetration rate of European Union member states. However, the gap to the countries with the most wide-spread Internet usage in Europe – Denmark, the Netherlands, Finland and Norway (63, 61, 59 and 58 per cent, respectively) is still more than 20 per cent (see Graph 2.5 for more details). Well-advanced countries such as Germany and Belgium, which were trailing Estonia in 2000, have passed Estonian penetration rate in 2002, since Estonia has not been able to keep up the growth of the penetration rate. Also, France, Italy and Great Britain might pass Estonia in early future if Estonia cannot sustain the level of growth of previous periods.
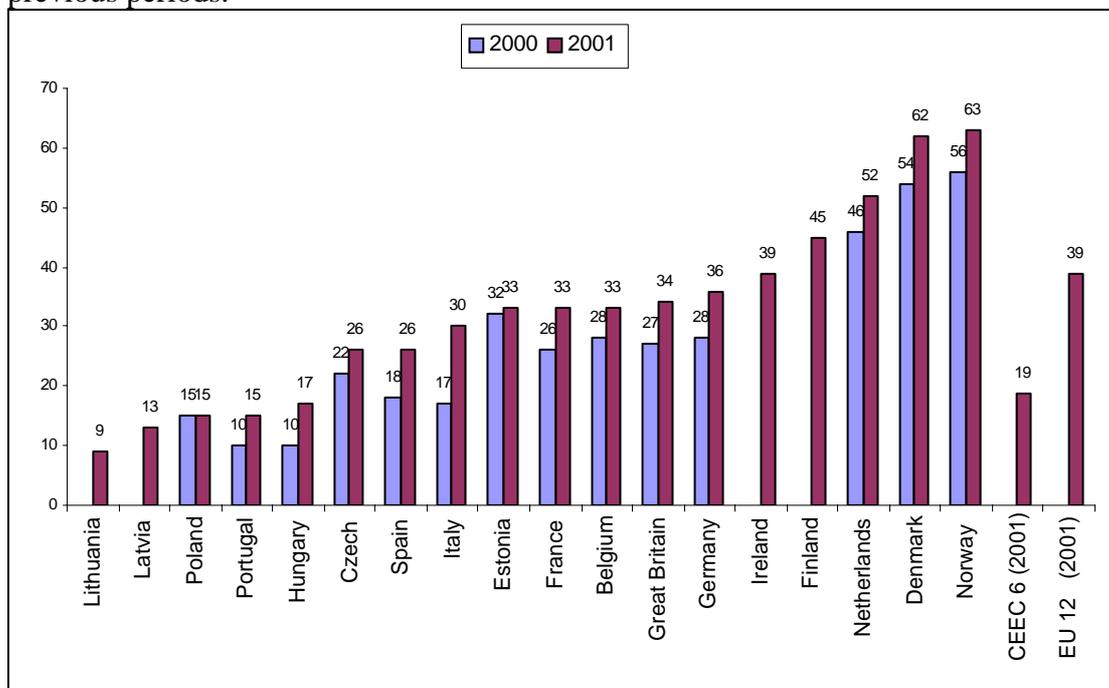
Graph 2.5. Internet use per 100 inhabitants aged 15–74, 2000-2002.
Source: Global E-Commerce Report 2001 & 2002, EMOR in Leppik Baltic IT&T Review 2002

Most of the Estonians use Internet at their workplace. Since the share of home computers has grown to 30 per cent of people[30], the usage of Internet has also grown at homes. The total breakdown of Internet usage may be seen in Graph 2.6. Compared to the international level (24 per cent at home, 13 per cent at work, 5 per cent at school/university), 15 per cent of Estonians use Internet at home, 18 per cent at work and 12 per cent at schools/universities.[31] Fortunately, the **Internet connection has become more available as the prices for dedicated connections have lowered.** But still, one of the access barriers to Internet mentioned in digital divide report was the absence of computer at home due to the high cost of equipment and Internet connection.
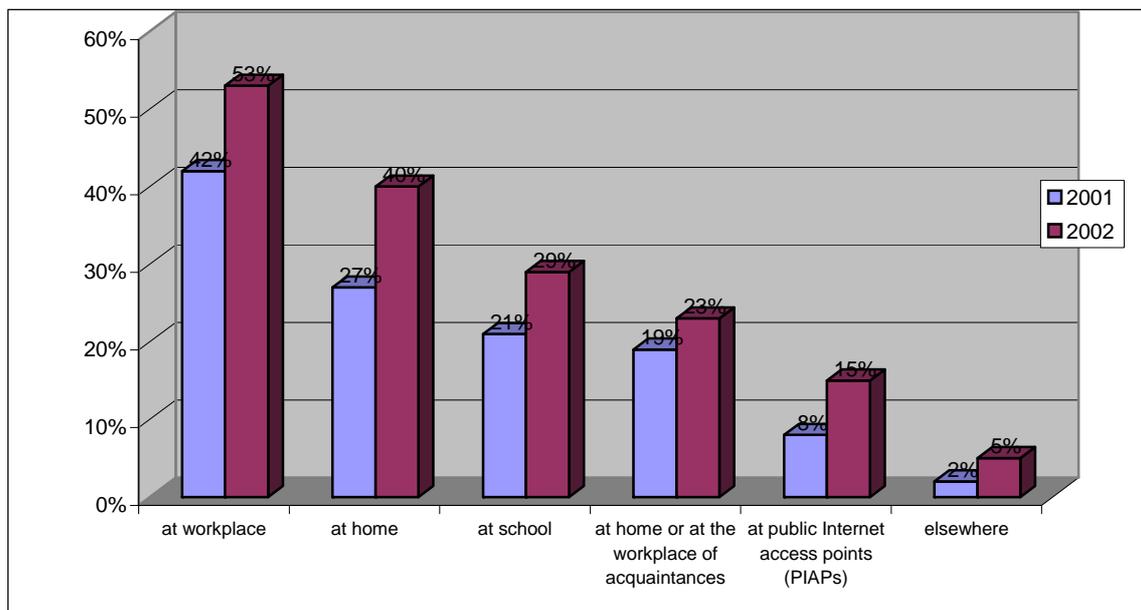
Graph 2.6. The place where the Internet is used (% of inhabitants who have used the Internet during the last 6 months).
Source: E-Track Survey, March-May 2002, Emor Ltd.

People use Internet for different reasons in Estonia. As shown in Graph 2.7, over two thirds of inhabitants use it for sending and reading e-mails and for searching certain information. 62 % use Internet for occasional surfing and 54 % for reading Estonian Internet issues. Little over one quarter of Internet users in Estonia are active users of chat-rooms and newsgroups and read actively foreign Internet issues. Thus, Internet is mainly used for communicational purposes, searching information and entertainment. Only 9 % of users purchase or order goods and services online, 14 % of Internet users visit Internet storehouses for window-shopping. The only exception being, that Estonian Internet users like to do besides communicating with their friends, reading news and searching for information is knowing where their money is – 57 % of Internet users use Internet also for Internet banking.

---

[30] EMOR E-Track March-May 2002
[31] Global E-Commerce Report 2002, please note that EMOR respondents were among people who had used Internet in last 6 months, while GER respondents were among the whole population.
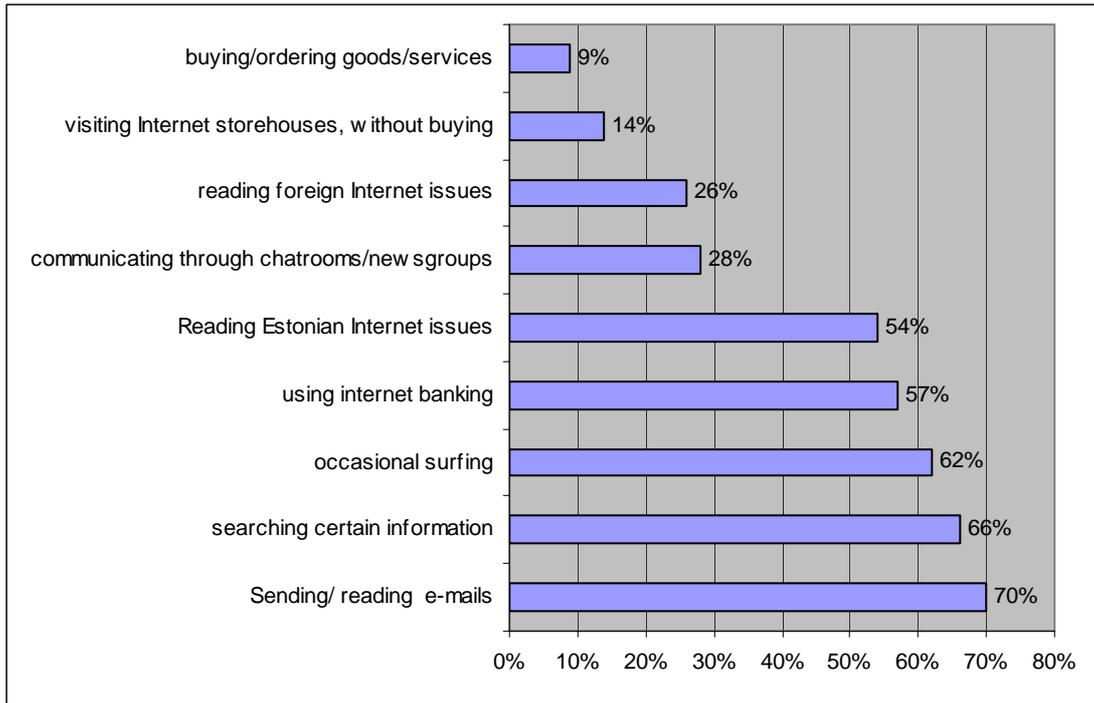
Graph 2.7. The reasons for using the Internet (% of inhabitants who have used the Internet during the last 6 months).
Source: E-Track Survey, March-May 2002, Emor Ltd.

The future for online shopping in Estonia does not look very bright as Graph 2.8 may also tell. Furthermore, despite the low rate for online shopping among Estonian Internet users, 65 % of all respondents (both Internet users and non-users) are even not interested in e-commerce. 18 % of the respondents are generally not interested, and 6 % have no opinion of it. Only 2 % of respondents are very interested in e-commerce and 10 % are generally interested.
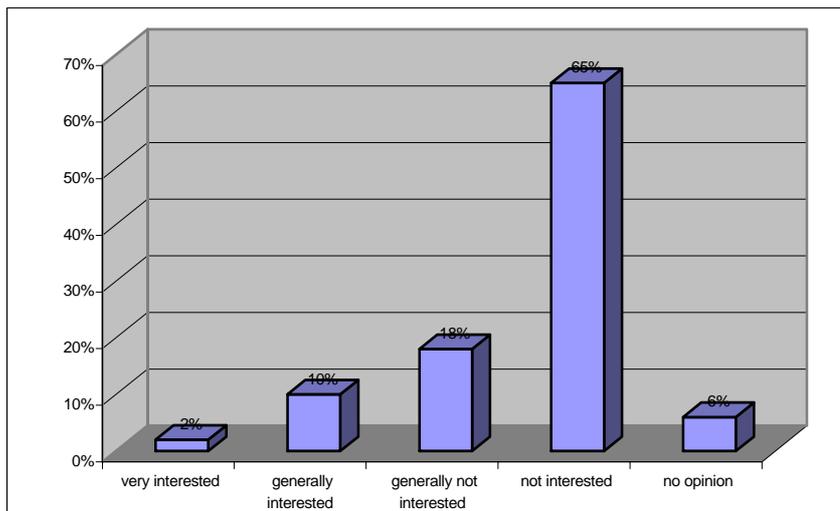
Graph 2.8. Interest in e-commerce (% of all the respondents).
Source: E-Track Survey, March-May 2002, Emor Ltd.

2.3. Popular Internet Content

As already shown in Graph 2.7, the main reasons for Estonians to use Internet are sending/ reading e-mails, searching certain information, using internet banks, reading Estonian Internet issues and occasional surfing.

The analysis of the most visited web-pages proves the point - out of a hundred most popular web-sites, 27 are electronic versions of newspapers, 14 communication portals and chat-rooms and 10 about computer games (Please see Graph 2.9 for more details).
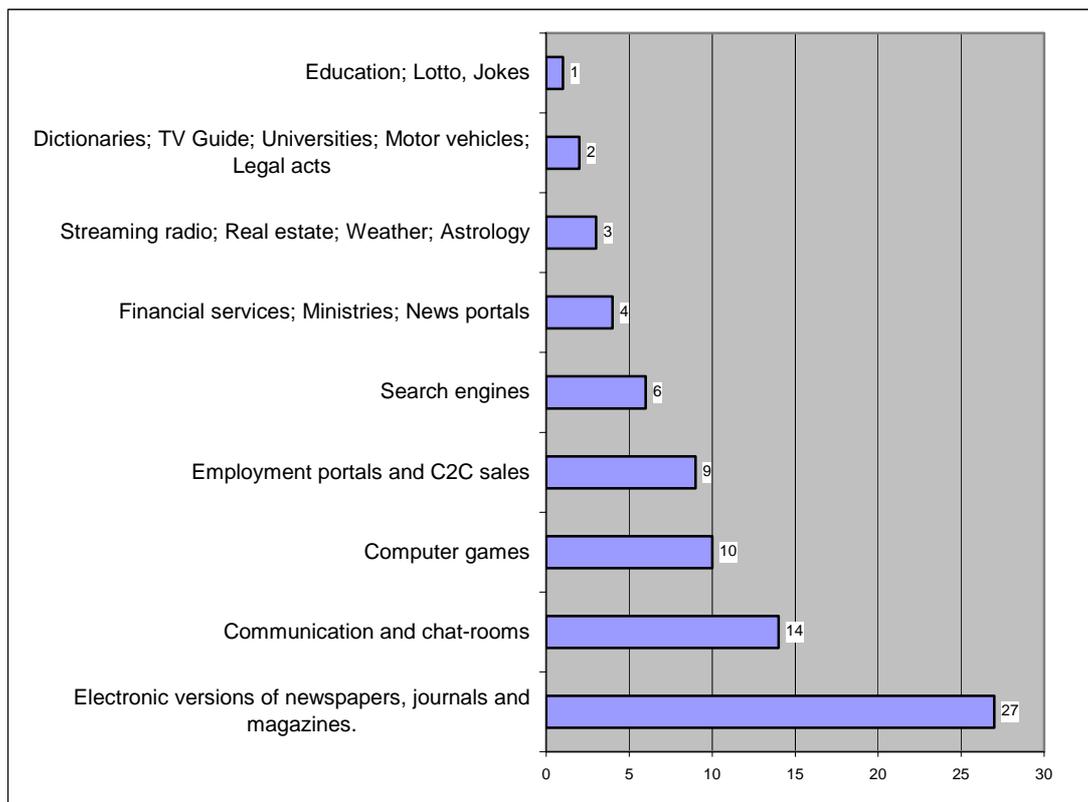
Graph 2.9. Locally relevant content.
Source: Author's calculations, November 11, 2002

GER 2002 provides convincing data that Estonians very rarely use Internet for e-commerce. Thus, it is clear that despite the relatively high Internet penetration rate, most people use it only for searching information, communication, reading news and entertainment. The breakdown of the most popular web-pages can be found below.

The most popular search engine in Estonia (www.neti.ee) collects information about the most popular sites viewed through this search engine. In this report, the first 100 most visited homepages are categorized:

According to the Public Information Act adopted in 2001, public institutions have to provide information required by citizens. That has forced all public institutions to develop their Internet homepages to provide the information to the public that has been granted by the law.

From 2000 to 2002, the number of public institutions providing information via their homepage has increased. In 2002, 55 % of primary and secondary schools, 94 % of universities and 63 % of hospitals and clinics have their own homepages, 20 to 60% of the institutions have managed to create their web page since 2000. All national ministries have a homepage as in 2000, but the number of regional and local authorities that have a homepage has practically stayed on the same level as in 2000 (see Graph 2.10 for more details).
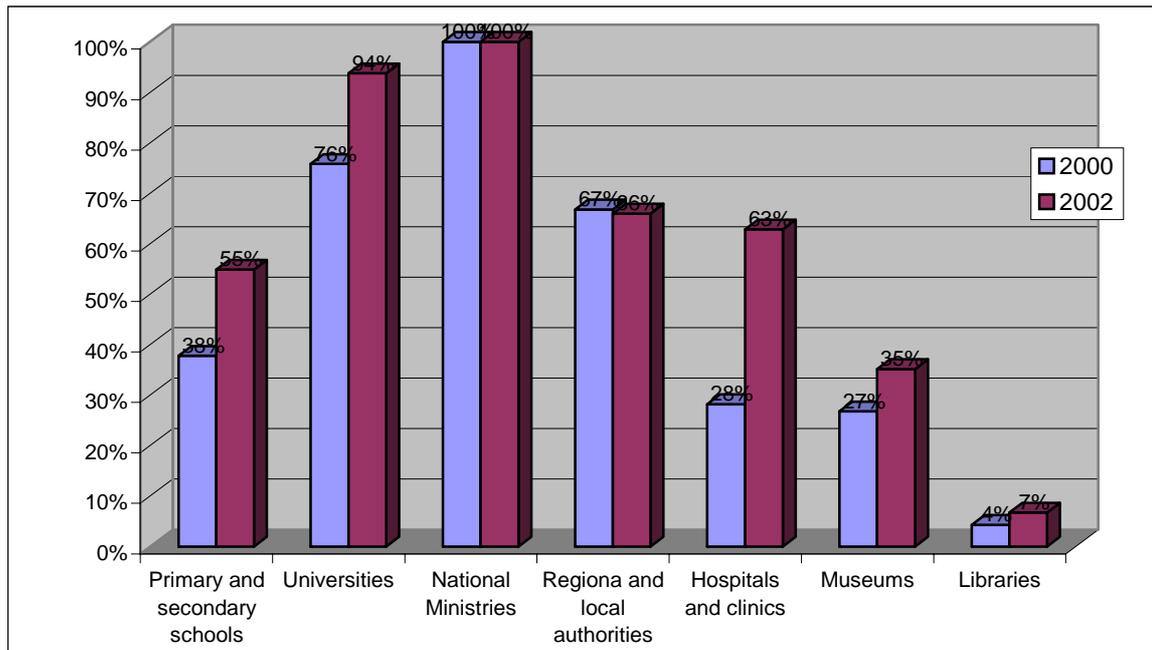
Graph 2.10. WWW count.
Source: ESIS, Author's own calculations

Table 2.1. lists 10 most popular Estonian Internet homepages visited daily. These include 3 newspapers, 2 news portals, 2 internet-banks, 2 mail service providers and 1 major search engine. As already mentioned before – searching for certain information, news and entertainment, sending/reading e-mails and internet banking are the most popular activities by the people using Internet in Estonia.

Table 2.1. Most popular Estonian Internet homepages, daily hits.

	Field of activity	**Daily Hits**
1. NETI (www.neti.ee)	Search engine	121 000
2. Delfi (www.delfi.ee)	News and entertainment portal	67 000
3. Hanza.net (www.hanza.net)	Internet Bank	53 000
4. HOT (www.hot.ee)	E-mail service	52 000
5. Everyday.com (www.everyday.ee)	News and entertainment portal	52 000
6. Mail.ee (www.mail.ee)	E-mail service	38 000
7. SL Õhtuleht (www.sloleht.ee)	Newspaper	30 000

8. Postimees (www.postimees.ee)	Newspaper	28 000
9. Eesti Päevaleht Online (www.epl.ee)	Newspaper	27 000
10. U-Net (www.unet.ee)	Internet Bank	19 000

Source: EMOR "Gallup e-Ratings. June - August 2002"

3. Network Access

3.1. General description of Estonia's Situation

Many international indexes of technological development have given Estonia credit for a solid ICT infrastructure and decent online environment. The United Nations Development Report 2002 places Estonia on the 30th place in the domain of general technological achievement. McConnell International report sets Estonia ahead of not only the most Central and Eastern European Countries (CEEC) but also many highly industrialized Western European countries. The Global Information Technology Report 2001-2002 ranks Estonia 29th in Network Access component index[32]. That estimation is confirmed even more strongly by the World Competitiveness Yearbook (IMD, Lausanne), where Estonia is placed 9th in online environment development, and in 21st place in the overall competitiveness, the Global Competitiveness Index places Estonia 14th in its technology sub-index[33]. Estonia is the leading telecommunication investor among 49 countries represented in World Competitiveness Yearbook 2002 (by investments/GDP)[34].

In this section, the reader will be introduced to the current situation in Estonia regarding the access to Internet and telecom services. The main indicators, such as the numbers and penetration rates of various technologies present in Estonia, will be given. Also, the provision of main services and the outlook of growth potential is considered. And last, but not least, international comparisons will be drawn.

In the early 1990ies, the infrastructure for telephone services and the provision of the service in Estonia was fairly inadequate. 363 thousand fixed lines were installed around the country by 1990 (Statistical Office), but tens of thousands of people had waited for the installation of their telephone line for many years without any sign of success. The analogue network built during the Soviet era was not the most quality-driven – frequent disconnections and over-hearing other telephone conversations during one's own was often the case.

By restructuring the state enterprise for providing telephone services, private company Eesti Telekom was established. Under the Concession Agreement from 1993 to 2001, Estonian Telephone Company established a new digital telephone network (72 % of all lines were digital in 2001). ETC practically eliminated any queuing for telephone services even in rural areas, and fulfilled all the conditions to provide sophisticated telephone and Internet services across the country. In 2002, Estonian Telephone Company was successful in organizing the worldwide live Internet broadcast for the Eurovision Song Contest held in Tallinn in May 2002.

However, building up the high-quality telephone network has also raised the prices of telephone services for the consumers. Protests were organized when company instituted a call starting fee in 1999. As the company held a monopoly position in 8 years, they were capable of securing their position in the market even after the market

---

[32] Global Technology Report
[33] World Economic Forum "Global Competitiveness Report 2002-2003", http://www.weforum.org
[34] Ivar Odrats "E-Policy Development in Transition Economies 2002

was liberated in 2001. Today, Estonian Telephone Company has succeeded to keep close to 90 per cent of the fixed telephone market and more than half of the market of international calls. Estonian Telephone Company has also established itself as the market leader for internet dial-up service and DSL connections. Main competitors, Tele 2 and Uninet, first challenged ET with cheaper Internet dial-up calls, lowering also the prices for international calls after the market liberalization. The consumers have seen the fruits of competition – e.g. the prices for calling to North America have dropped almost 10 times: from 1.5 Euros to 0.19 Euros for a minute. In spite of the drop in the prices of international calls, the situation in the market of local calls has practically stayed the same – many people have gave up the fixed connection line because of relatively high monthly subscription fee (around 5 Euros) after prepaid mobile subscriptions with no monthly fee became available. Estonian Telephone Company still holds the advantage of using its local networks established under the Concession Agreement, other companies do not find it lucrative enough to establish their own networks in rural areas. The price for the local calls is largely set by the inter-connection fee paid to Estonian Telephone Company for using its network.

Also, the market leader among mobile operators, Estonian Mobile Telephone (EMT), has managed to stay in the leading position. However, the lead in 1997 from its two competitors – Radiolinja and Tele2 – has started to diminish. In 1997 the clients of the two competitors made up barely a quarter of the market. Today, Estonian Mobile Telephone struggles to keep half of the market. Again, competition has had a strong impact on the market – the prices have dropped and two of the three operators are very active in developing value-added services to their clients. The coverage of the mobile network has been extended to the entire country. Also, all three operators have finally managed to become profitable to their owners. Both runners-up managed to do so only in 2002. The mobile phone penetration rate is currently around 60 phones per 100 people in Estonia. Two virtual mobile operators have promised to enter the market in 2003.

Because of the relatively low GDP per capita, personal home computer was seen as a luxury in Estonia for quite a long time. Only persons with higher income could afford them. Flexible financing programs offered by the banks made it possible to pay for the computer over the stretch of two-three years. Today, a home computer is owned by 30 per cent of the people (EMOR March-May, 2002) and computers are still one of the most desired gifts by the younger ones. The price of a brand new low-end computer starts from 500 Euros.

Despite the rapid growth of the home computer market, the high cost of Internet access kept more than half of these computers offline. Only in 2002, dedicated connections offered via cable models with fixed rent became affordable (with the prices starting from 20 Euros per month) for home users. Before that, the only solution for masses was the dial-up service by using one's phone line – for 20 Euros one could use approximately 15 hours of Internet in a month. Regardless of its expensiveness, half of the home computer owners have sticked to the dial-up service as it is more flexible and with no monthly fee.

3.2. Infrastructure availability

To evaluate the developments in the last ten years, one must admit that the quality of both fixed and mobile networks has been improved dramatically. Today, one can communicate via a phone line or a mobile and access Internet (Dial-up and DSL for fixed networks, GPRS and WLAN for mobile networks) almost everywhere in Estonia.
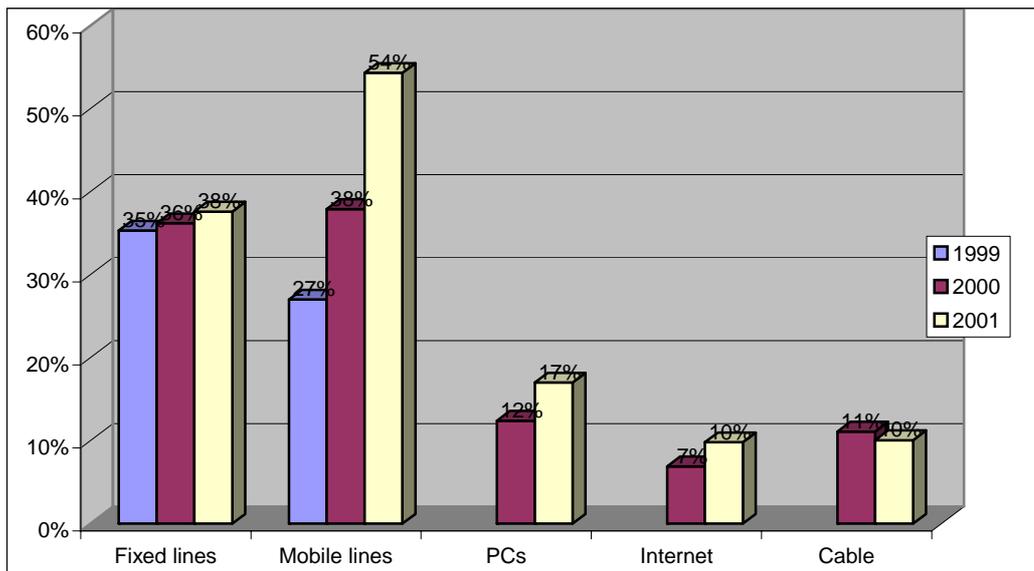
Graph 3.1. Penetration rates for the main telecom services in Estonia (percentage of the whole population).
Source: SOE

Graph 3.1. indicates that the penetration rates for mobile phones have practically doubled from the level of 1999. The penetration rate for the fixed lines has lingered at the same level during the last three years – from 35 to 38 per cent in 2001. Both PC' and Internet penetration rates have grown rapidly, in 2001 the rate was 17 per cent for PCs and 10 per cent for Internet.
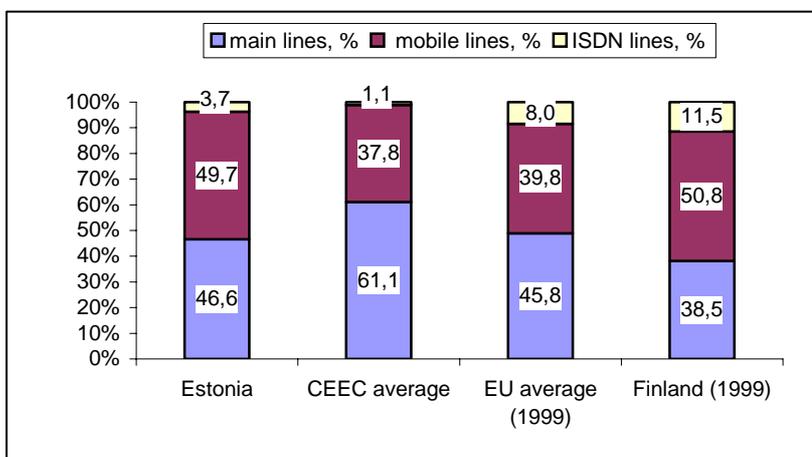
Graph 3.2. Structure of effective communication lines per 100 inhabitants, 2000.
Source: ESIS, Author's own calculations

For the next few years, it can be estimated, that the penetration rates for mobiles, PCs and Internet will continue rising and try to reach the Nordic levels (see Graph 3.2) where the share of mobile phones will go up among the total effective lines in the expense of fixed lines. The number of fixed lines and cable penetration rate changes slightly upwards or will remain at the current level.

3.2.1. Telephone lines

During the Concession Agreement, Estonian Telephone Company improved the quality of fixed network and customer service. The basic characteristics may be found in Table 3.1.

Table 3.1. The characteristics of Estonian fixed telephone service, 2001

	Number / %
Total number of telephone main lines	512 000
Telephone main lines per 100 inhabitants	37.6 %
Number of ISDN lines	46 358
Total number of DSL lines (channels)	17 210
Digitalization rate of Fixed Networks	72%[35]
Initial connection time	6.7 days[36]

Source: Estonian Informatics Centre

Estonia is quite extraordinary in the aspect of network availability – all penetration rates (main telephone lines, mobile subscribers and Internet users) fell within 31 to 38 per cent, while all other countries have a major advantage of one carrier over the other (please see Graph 3.3). Today, this peculiarity is vanishing – penetration rates for fixed lines has stayed on 38 per cent, while the penetration rate for mobiles is pushing 60 per cent and the Internet penetration rate has grown to 43 per cent (EMOR 2002, Sept-Nov).

---

[35] PriceWaterHouseCoopers Monitoring of EU Candidate Countries (Telecommunication Services Sector), July 2002
[36] ibid.
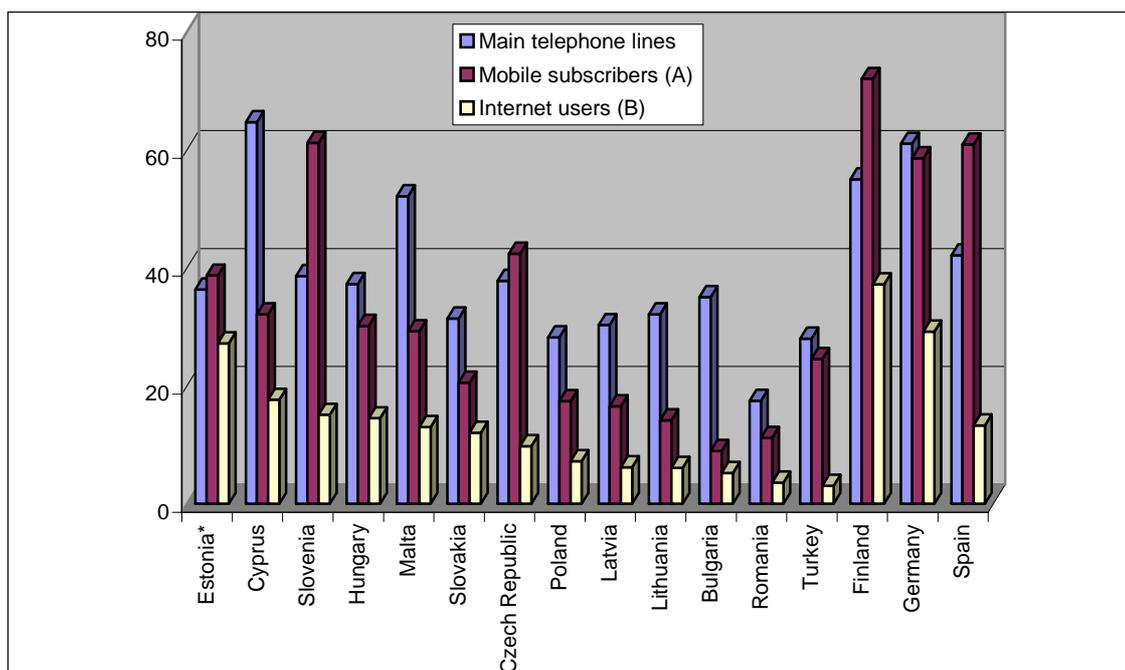
Graph 3.3.Network availability, per 100 inhabitants, 2000.
Source: http://www.itu.int/ITU-D/ict/statistics/

The total number of mobile subscribers exceeds more than half of the population; it is most likely to exceed two thirds of the population in 2003.

Table 3.2. Estonian mobile phone operators and subscriptions.

	Number / %
Total number of mobile subscribers	738 700
Number of subscribers per 100 inhabitants (2001, SOE)	54.3 %
Percentage of households that have a mobile phone (connection)	47.9%
those having only mobile telephone (no fixed phone)	13%

Source: SOE

3.2.2. Personal Computers and Internet

Table 3.3. reveals that Estonian homes are not that well equipped with PCs and Internet connection since the main computer usage still takes place at work and also at schools as already witnessed in Graph 2.6. However, there is a strong growth potential for these numbers as the prices for PCs and Internet connections in Estonia are now much more affordable when compared to the purchasing power parity of individuals than 10 years ago.

Table 3.3. Home computers with Internet connections and intentions of getting Internet connection.

	2000	2001	2002
% of inhabitants having home computer (PC) (EMOR E-track, March-May 2002)	30 %		
% of inhabitants having Internet connection (SOE, 2001)	9.8%		
	2000	2001	2002
Home computer has Internet connection (% of those having a computer at home)	51%	56%	59%
Intention of getting Internet connection (% of those not having Internet connection at home and of those who intend to buy a computer in a year)	56%	64%	68%

Source: E-Track Survey, March-May 2002, Emor Ltd., SOE

For a long time the main type of Internet connection has been dial-up networking. In 2002 that trend was reversed by all major telecom and cable-TV companies offering various types of dedicated Internet connections. Table 3.4. shows that the share of online connections has grown 12 % per cent mainly in the expense of dial-up connections. Dedicated connections are about to challenge dial-up connections even more, as also wireless and GPRS Internet connection products are already out on the market in Estonia.

Table 3.4. Type of connection at home computer.

	2001	2002
Dial-up	46%	37%
Online connection	6%	18%
Don't know what type of connection	4%	4%
Don't have a connection	41%	38%

Source: E-Track Survey, March-May 2002, Emor Ltd.

3.2.3. Various Equipment

Table 3.6. breaks down the availability of various ICT-related services and devices in Estonian households.

Table 3.6. The provision of Estonian households with ICT equipment and connections[37] (Per cent of households which have).

Service/device	Percentage of households that have
Telephone (fixed telephone)	70.6%
Mobile (cellular) telephone	47.9%
those having only fixed telephone (no mobile phone)	36%
those having only mobile telephone (no fixed phone)	13%
those having both - mobile and fixes phones	35%
Color TV-set	91.6%

---

[37] The household budget survey 1998 -2002 by Statistical Office of Estonia

Radio set	89.6%
Hi-Fi audio system	29.7%
Video tape recorder	30.8%
Home Cable TV Subscribers	26%[38]

Source: SOE

3.3. Infrastructure affordability

In this section, the affordability and the change in price of call services and Internet connection in Estonia is demonstrated. As seen from the following tables and graphs, the fixed costs for call services have dropped over the years, while the price for local calls has stayed the same or even has increased. The prices for international calls have dropped enormously – in many cases more than ten times.

3.3.1 Call services

Table 3.7. Fixed and variable costs of call services 2000 - 2002

	December 2000	December 2002
Fixed costs (EURO)		
Installation for main line [1]	192 / 53	52.66
Rental per month for main line [1]	7.7 / 4.8	6.71 / 5.36[1]
Variable costs (EURO)		
Local call per minute [2,3]	0.015 / 0.012[3]	0.021 / 0.017[1]
Long Distance call per minute [2,3]	0.043 / 0.033[3]	0.021 / 0.017[1]
Average of International call per minute [4]	0.49	0.189 / 0.175[1]
Average mobile rate per minute	N/A	0.25 / 0.25

[1] Private customer / Business customer, [2] Call setup fee is 0.03 EUR, [3] Basic Tariff/ Reduced Tariff
[4] Avarage based on main trade partners (Denmark, Finland, France, Germany, Great Britain, Italy, Japan, Latvia, Lithuania, Netherlands, Norway, Russia, Sweden, USA)

From more than 8 times difference in average local and international call in 1996 (see Graph 3.5), the price has been unified by 2001. The price for local mobile calls often exceeds the price of most often used international calls.

---

[38] PriceWaterHouseCoopers Monitoring of EU Candidate Countries (Telecommunication Services Sector), July 2002
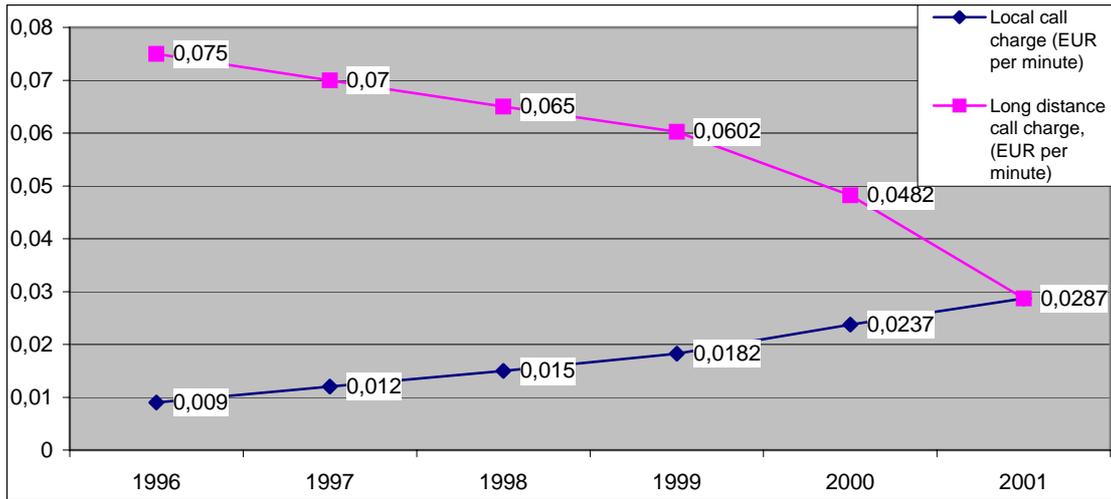
Graph 3.5. Local and long distance call charges developments 1996-2001
Source: Liivar Leppik, BNS, ETC

The local call charge in Estonia is among the average level of call charges of CEE countries, being at the same level with Slovenia, Romania and Poland (see Graph 3.6).
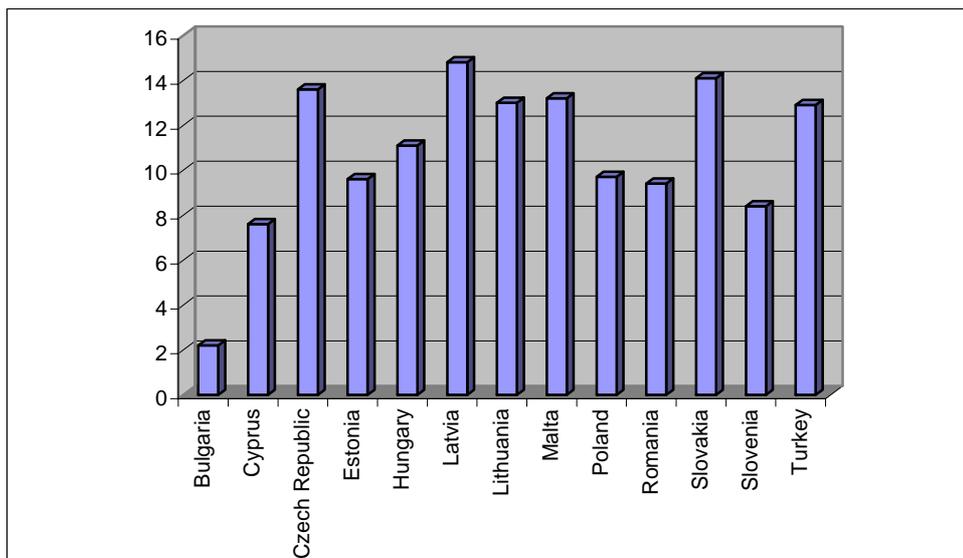
Graph 3.6. Local call charge, 3 minutes (E-cents). Price for a 3 minute local phone call as of 31 March 2002.

3.3.2. Internet access cost

The prices for dial-up Internet connections have gone up together with the increasing prices of local calls. Monthly fees of the most often used dedicated connections differ more than 4 times depending on bandwidth of the connection.

Table 3.8. Cost of dial-up and dedicated connections.

Dial up:

	Monthly fee	Minute Fee	Limit
ET Atlas Dial Up	-	0.021 / 0.0089	-
Tele 2 Dial Up	-	0.014 / 0.0057	-
Atlas Surf 10	4.79	-	5 h / month
Atlas Surf 20	14.38	-	20 h / month

Dedicated Connection:

	Installation fee	Monthly fee	Limit
ET ADSL Home (256k download / 128k upload)		28.12	-
ET Atlas Homework (512k download/ 256k upload)	31.95	37.7	-
Starman Mini (64k download/ 32k upload)	18.85	9.52	-
Starman StarNet (1Mbit download/ 320k upload)	31.63	31.63	

Source: Estonian Telephone Company

Comparatively, Estonian Internet access costs relatively less than in other CEE countries as shown in the following Graph 3.7.
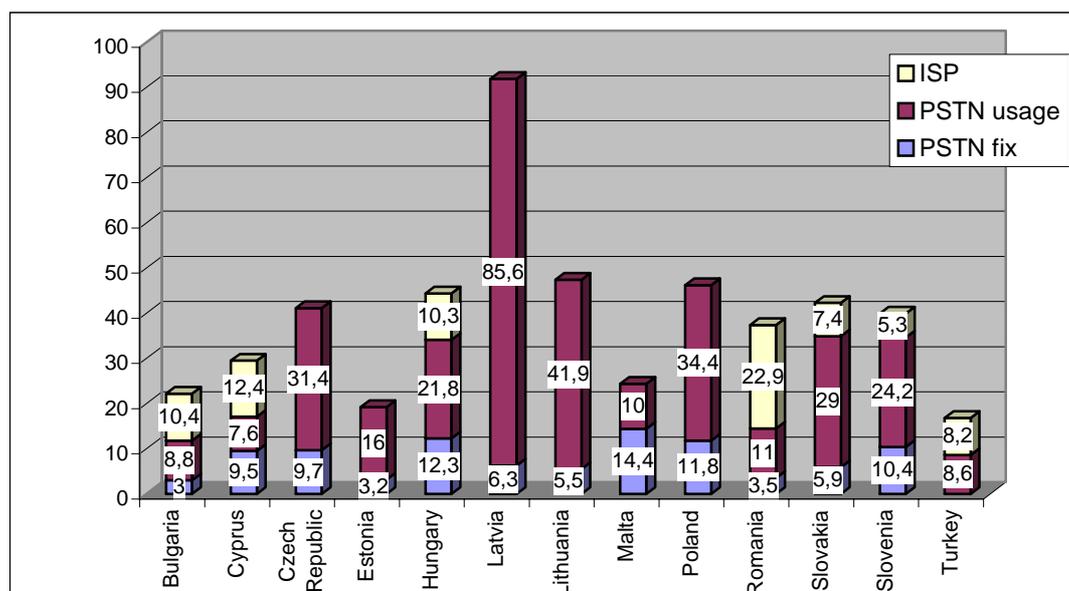
Graph 3.7. Internet access costs – 20 hours, peak time. Source: PriceWaterHouseCoopers Monitoring of EU Candidate Countries (Telecommunication Services Sector), July 2002

Key: 1) PSTN fixed charge: the monthly rental of a fixed line for a residential user; 2) PSTN usage charge: the price of the local telephone calls to an ISP for residential users; 3) ISP charge: the price of Internet access charged by the incumbent telecommunications operator acting as an ISP

4. Networked Learning

4.1. General description of Estonia's Situation

The state's readiness to provide education compatible with the needs of information society and satisfying the demand for skilled workforce in the private sector is more important than the number of mobile phones and home PCs. Only qualified work-force can secure country's global competitiveness and help to create high value products and services.

Estonian secondary school education system is aimed at educating students ready to enter universities. However, the rush for higher education institutions will not be a success for every applicant – the places are limited. In spite of the upspring of private higher education institutions in the beginning of 90-ies, still not all applicants qualify for the studies program. Unfortunately, the secondary school education system is designed primarily for continuing one's studies in a university, not entering the job market directly after graduation.

It is also obvious that some schools are more successful in educating their pupils for entering the university – almost all urban elite school's graduates are capable of obtaining state's financed position in a university while rural schools as an average are not doing so well.

Estonian vocational education system is still suffering from the transformation process after the collapse of Soviet system. Low prestige of the institutions and the inability to meet the needs of the job market accompany the problem of poor financing.

Thus, it all raises the question if Estonian children receive a competitive education for competing in the job market as the students in Finland, Sweden or anywhere in the world.

In 1995, the schools were rarely equipped with modern information technology equipment, such as personal computers, printers and scanners or the Internet connection. The national Tiger Leap Program for computerisation of Estonian schools, launched in 1996 by President Lennart Meri, started the ICT revolution in education if not in the whole society. The program set the following goals:

- help local governments to develop the IT infrastructure of schools, including support for establishment of Internet connections in schools;
- help Estonian teachers to acquire basic computer skills and guide them to utilisation of up-to-date resources of information and communication technology in subject teaching;
- support updating of curricula by means of an interactive learning environment, promoting learning skills;
- encourage creation of original software dealing with Estonian language, culture, history and nature in compliance with the national curriculum. *(from Tiger Leap project overview 1996-2000, www.tiigrihype.ee)*

With only 10.5 mEUR of allocated resources from the national budget in 1997-2000 supported by the local governments by 5 mEUR, efficient and operational financing plan for computer procurement was developed, more than half of all 17,000 teachers in Estonia were trained on the elementary level in computer skills, and the creation of 39 new original education software packages and 172 development and training projects were financed and supported (from Tiger Leap project overview 1996-2000, www.tiigrihype.ee).

All this helped to bring computers into education and made IT popular among children, creating also a positive spillover effect to their homes.However, the once successful start has not been enough to hold the computerization level of Estonian schools close to European levels. In the year of 2000 – Estonian schools were furnished with the means of information and communication technology to the following extent:

- twenty-five pupils per computer on the average (15 in Hiiumaa and 48 in Tallinn); there are no upper secondary schools nor basic schools without computers.
- 75% of all the schools have got online Internet connections and the remaining schools have a dial-up option.
- These resources are mainly used in Informatics classes, but with each year also more and more are being used in other subjects. According to the national curriculum, Informatics is an optional subject, yet in the majority of computerised basic schools and upper secondary schools it is already being taught at the basic school stage of study[39].

Another important step in providing higher IT-education was the establishment of IT College in Tallinn. A private vocational higher educational institution provides a 3-year program in IT systems development and in administering IT systems. Currently, the college has 188 students. Other places where higher IT education could be obtained are with the mathematics and informatics departments of national universities - Tallinn Technological University, Tartu University and privately owned Estonian Business School.

A research conducted by PW Partners reveals that altogether the number of IT specialists entering the job market from the universities and vocational education institutions is around 700 specialists, half of those together with a higher education degree. The estimate for the demand of IT specialists after 3 years is 600 people – 400 hundred going to the ICT sector, 100 to the companies outside the immediate sector (not ICT sector, but relying heavily on the use of ICT) and 100 of them not choosing to continuing outside the ICT or immediate sector. The numbers would imply that Estonia has already started a slight over-production of IT-specialists. On the other hand, Estonian eVikings report reveals that almost 90 per cent of Estonian electronics companies feel the need for specialists with university education (Estonian ICT cluster: Present State and Future Outlooks[40], p.37). To achieve the goals set in Estonian Research and Development Strategy 2002-2006 (for more details please see Section 6.1.), the output of IT specialists with higher education should double by the

---

[39] Survey "Tiger Under Magnifying Glass" 2001

[40] Tarmo Pihl, Analysis of Estonian IT Sector Innovation System: Estonian ICT cluster: Present State and Future Outlooks, Tartu 2001

year of 2006. Thus, the output of server administrators and programmers by vocational education institutions might be close to the level of overproduction, but the growth of demand in the immediate (such as service and production companies that take advantage of the ICT applications) and ICT sector might well be much higher than predicted.

OECD Outlook 2002 describes that "*by its nature, IT work requires individuals to master codified and tacit knowledge and technical and abstract concepts, which are acquired through various formal (education) and non-formal (work experience) channels. Even for non-IT workers, ICTs are affecting the skills required and the nature and organisation of work. Overall, the rapid growth of ICT industries and the wide diffusion of ICTs are radically changing skill sets and occupations, and it is important to gain a better understanding of the employment patterns of this new IT workforce, including new types of compensation, new types of jobs and new motivations*" (OECD Outlook, p.8).

Even in the face of such dramatic changes in the organization of work, it is clear that following the highest standards and best practices in transforming the education system is the key to success. No successful economic policy can substitute for non-existing or not-sustainable R&D activities which are closely connected to the competitiveness of the education system and the finances allocated to the sector. Today, Estonia is still in the process of establishing a solid foundation for future development by strengthening its education system in the network era.

Tiger's Leap Plus Program should now lead the way. The program focuses on ICT competencies, virtual learning, sustainable development of infrastructure, and on collaboration between the state, local governments, schools, parents and organisations. Some courses have been taught via Internet in Estonia, but extensive e-learning programs for universities are still in the phase of planning and analysis. A working group has been formed recently to provide a platform for e-learning in Estonian universities.

4.2. Schools' and universities' access to ICT

Large[41] majority (90%) of children have used computers in school, at home or elsewhere during the year 2000. Regionally there were no major differences, but access to computers for pupils in Russian schools was 9% lower than the same indicator for Estonian schools (84% and 93%, respectively).

Almost all children (93%) have access to the Internet either at school, in the neighborhood or at home. Pupils use the Internet mainly at school (79%). Russian schools in NE Estonia and Tallinn are an exception here with 55% and 37% of pupils with access to the Internet at school, respectively.

88% of children in the countryside claim they can use the Internet at school. Concerning pupils' access to the Internet in the countryside, the role of the public sector is important, in urban areas the access is also supported by the private sector and the access is also provided at the workplaces of the parents. For example,

---

[41] Large part of this section based on the survey "Tiger under magnifying glass" 2001.

children in the countryside use libraries for Internet access above average (39%) as well as public access points, among children living in towns there are more than average of those who are surfing the Internet at home (34% of Estonian town children) or at parents' workplaces (39% of Estonian town children). In the country, only 17% of the respondents surf the Internet at home.

Table 4.1. Computers in education, reference time October 2001

	Number / %
Number of pupils at primary and secondary levels (by ISCED)	243 345
Number of computers used by pupils of primary and secondary levels	8 642
Number of computers connected to the Internet for pupils of primary and secondary levels	7 993
Number of computers per 100 pupils at primary level	3.4*
Number of computers per 100 pupils at secondary level	3.7*
Number of computers connected to the Internet per 100 pupils at primary level	3.0*
Number of computers connected to the Internet per 100 pupils at secondary level	3.5*

Source: Ministry of Education, *calculated

Computer use in subject classes is far from extensive. With the exception of informatics, only 8% of pupils on the average study with computers in different subject classes, while 16% have not used computers in subject classes at all. None of the subjects can be singled out as positive example, although Biology and Estonian classes make somewhat more use of computers in the sophomore year of primary education. However, computers are not used more in the 11th grade compared to grade 8 for subject teaching, in some subjects even regression has been detected[42].

4.3. Comparison to other countries

In 2000, there were no basic or upper secondary schools without computers in Estonia, 75% of schools had online Internet connections. Still, on the average Estonian schools have only 3 PCs per 100 pupils connected to the Internet (see Graph 4.1.).

---

[42] Survey "Tiger under magnifying glass" 2001
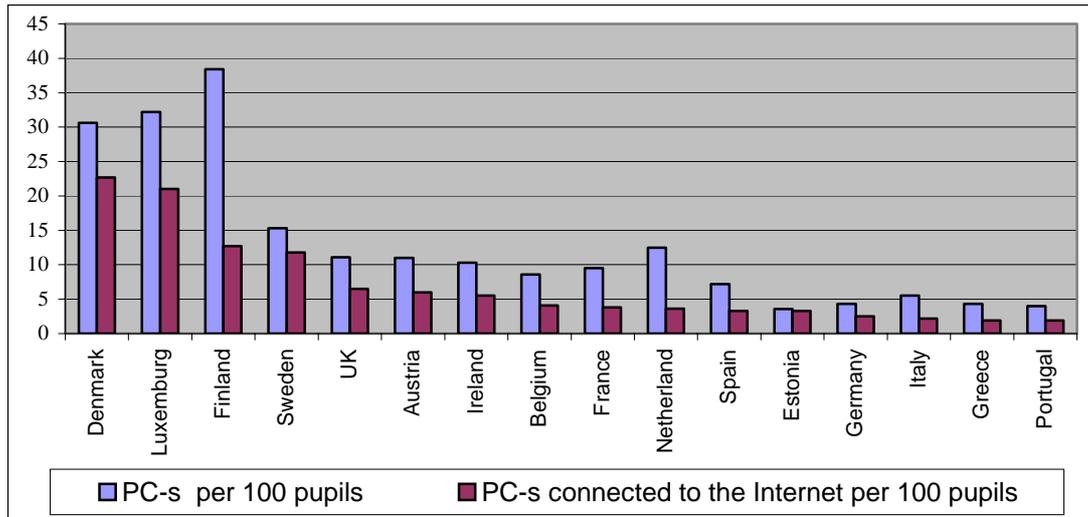
Graph 4.1. ICT equipment in primary and secondary schools in EU-15 and Estonia, 2001 Source: Flash Eurobarometer 101.0, June 2001; Statistical Office of Estonia, Oct. 2001

4.4. WWW count

All the web-pages of Estonian educational institutions in Estonia were counted in October 2002, to assess how many schools are able to provide information to the students, teachers parents and to general public. The results can be found in Table 4.2.

Table 4.2. WWW count.

	Total number	Total number of web sites	% of web site/ total number of „population"
Primary and secondary schools	654	359	54,89
Vocational education institutions	76	51	67,11
Universities	16	15	93,75
Vocational higher education institutions	23	17	73,91
Adult education	30	5	16,66

Sources: Statistical Office of Estonia; Foundation Vocational Education and Training Reform in Estonia http://www.sekr.ee/www/seirekeskus; Ministry of Education and Science, NETI http://www.neti.ee; http://www.edu.ee/koolid.

4.5. Educating ICT workforce

In 2001, there were 1100 graduates from ICT specialties. Most of them (565) obtained the program "The foundations of IT". 134 graduates finished a program called "Information Technology"[43]. Both of these programs were taught as vocational training programs. Interestingly, 6 out of 10 graduates were females in these programs. As a matter of fact, these programs do not really produce IT specialists, but rather just advanced users. The fields such as system programming and programming

---

[43] Report by PW Partner 2002, p.98

for electronic computers and automated systems had only 13 and 40 graduates, respectively.

A report by PW Partners claims that the number of ICT specialists entering the labor market annually is estimated to be approximately 700. The survey conducted among IT-companies revealed their need only for 300 new people in the next 3 years, but due to the need for IT-specialists outside the IT-sector companies, the annual need for ICT specialists might be around 600 new people. Unfortunately these figures are only bold predictions. Almost all Estonian companies in electronics have currently shortage of ICT specialists with appropriate university education.

ICT sector has already experienced a shortage of workforce in 1997-1998 when the banks expanded their IT-departments, now the need for new people has become stable, it has even reduced somewhat.

Even though that the report by PW Partners suggests that one should be worried about the surplus of ICT specialists in the labor market in the near future, it is the large number of advanced users produced mainly by vocational training institutions and low numbers of IT-specialists, programmers and engineers that are more worrisome. There is a danger in falling into a vicious circle with low-skilled IT labor being hired by companies producing low value-added products and services with practically no innovation or R&D at all (Estonian eVikings I).

Extensive lifelong learning programs have not been introduced in Estonia. Look@World Foundation, which started educating 100 000 people by giving a basic computer and Internet training for free, is an important initiative, but will not change the lifestyle of people who cannot afford or are not motivated enough for using a computer and Internet.

5. Networked Economy

5.1. General description of Estonia's Situation

The competitiveness of a country's economy among others and the general quality of life are primarily dependent on the productivity of the economy of that country. As most of the Central and Eastern European countries inherited an extensive industrial sector after the collapse of the Soviet Union, Estonia was no exception. Low productivity and the need for restructuring both production and service sector caused a dramatic fall in industrial output. As the traditional export markets were closed because of the deteriorated relationship with Russia and the on-going changes in the former Russian Empire, rapid economic liberalization reforms, and changed macroeconomic policies powered the downward trend even more severely. The index of industrial output was still at the level of 65.2 points, down more than 30 % from 100 in 1990 (Statistical Office of Estonia).

By 1995, the Estonian industrial sector had still not achieved the level of production as in 1989. Even though, with privatization and technological upgrading, the Estonian industrial structure started to depart from the factor-driven stage in the early 1990s. The dependence on the primary factors, such as land, labor and capital, decreased. However, higher quality FDI, venture capital and other factors move the economic system into investment-driven economy, where national competitive advantage is based on the willingness and ability of a nation and its firms to invest aggressively. Financial capital is invested into modern facilities and into complex foreign products as well as process technology; products incorporate typically more sophistication and the economy is concentrated on manufacturing. Competitive advantages are drawn from improving factor conditions as well as firm strategy, structure, and rivalry. (Estonian eVikings; Report on Estonian economy's competitiveness and future prospects).

Still, even today, for most part, the sophistication of goods is low; whilst the main economic activities consist of assembly, labor intensive manufacturing and resource extraction. Technology is assimilated through imports, FDI and imitation.

In most CEE countries the foreign direct investments have been mainly directed to the industrial sector. However, in Estonia, the larger proportion of FDI has been absorbed by the transport and finance sector. According to EBRD, Estonia has received more than 1750 $ worth of FDI and privatization revenues per capita in 1989-2000 (EBRD, *Transition Report 2000*, London: Hyway Printing Group, 2000, p.84). Interestingly enough, by 1998, most of the economic growth had not resulted from the new companies in industrial sector but from the existing companies with extensive FDI capital included (TAI, p.16). At the same time, FDI does not necessarily contribute to the innovative capabilities of the local industry and thus to the changes in technological trajectories. This way the quality of FDI is more important for growth and competitiveness than the quantity alone (Estonian eVikings).

At the current stage Estonian adoption to the new techno-economic paradigm (elaborated in section I) is mainly associated with the use of the new technologies in society (especially Internet and mobile communications).

In the beginning of 2001, the share of electronics in Estonian total exports accounted for almost 40 per cent of total exports, as the assembling of mobile phones in two Elcoteq production facilities in Tallinn helped to support the high share of electronics in the total exports. After closing down one of the Elcoteq plants, the share of electronics has dropped back to 20 per cent of the total export value of 0.9 billion Euros in Q2, 2002 (Statistical Office of Estonia).

According to the reports by eVikings and PriceWaterHouse Coopers, the estimated value of Estonian telecommunication market in 2001 was 0.34 billion (approximately 5.6% of GDP)[44]. The turnover of the telecommunication market accounted for a little less than 1 billion Euro in 2001, up 14 per cent from 2000 (PW Partners).

In western Europe, the ICT sector was worth 643 billion euro in 2001 or 7.5% of GDP. It grew by 5.1% in 2001 thanks to a 3.9% growth in IT and 6.4% growth in telecommunications, according to the European Information Technology Observatory[45].

However, the direct money allocation to ICT equipment by the IT budget of the government or by private companies reflects the influence of ICT in a given society only in small extent. According to SPRU, investments in intangibles, which consist of investments in R&D, education and training, software, royalties and licenses, and marketing, have grown faster than tangible investments in the 1980s and 1990s[46].

In the OECD area, ICT intensity (total ICT markets/GDP) increased, driven by strong growth in telecommunications services, to an average 8.3% in 2001 for goods and services combined. Software still represents less than 10% of the total ICT market, but is growing fast, at almost 16% a year since 1992 (OECD Outlook, p.13).

> *When looking at the ICT manufacturing in Estonia, it follows, that foreign orders are very important for the Estonian ICT sector - 73% of the subcontracting activity originates from abroad (eVikings survey May 2001). Typically, subcontracting involves assembly of various communication equipment and software outsourcing. As a result, subcontracting revenues constituted 60–100% of the Estonian turnover of telecommunications equipment production, industrial automation, consumer electronics and components, and about 15% of the computers and office machinery sub-sector in 2000. Due to high foreign demand, the export of the Estonian ICT industry has increased rapidly. On the downside, most of the rise can be assigned to a single company's activity – Elcoteq Ltd provides 83% of the total Estonian ICT exports and 96% of telecommunications equipment exports as the statistics for the year 2000 indicates. Of domestic industries, manufacturing, the telecommunications sector, banking, wholesale and retail trade, and governmental structures are the important drivers of the emerging Estonian ICT cluster, as they demand most of the production generated by the ICT sector. (Estonian eVikings I)*

---

[44] PriceWaterHouseCoopers, p. 8
[45] Towards a knowledge-based Europe. The European Union and the information society October 2002 Eeurope+ benchmarking indicators, p.5
[46] NewKind

Thus, Estonian companies, whether owned by local or international capital, are today primarily subcontractors to foreign corporations, and only few of them are able to sell high-value added products and services on their own.

Furthermore, Estonian government has so far been following the so-called "no-policy policy" in the decisions regarding innovation in economy. The goals to: 1) spend 1.5 percentage of GDP on R&D in 2006; 2) to strengthen the collaboration of academic research institutions and private companies; and 3) to give incentives to the companies to increase their spending[47] on R&D, cannot be achieved without a real national innovation strategy.

For more information on Estonian economic development analysis, see:
Estonian eVikings – http://www.esis.ee/evikings
Estonian economy's competitiveness and future prospects – http://www.tan.ee

5.2. ICT sector in Estonia

As already mentioned, the estimated value of Estonian telecommunication market in 2001 was 0.34 billion Euro out of 25.9 billion Euro total among European Union Candidate countries[48]. There are estimated to be 451 companies in Estonian ICT sector. Their classification by their main activity and turnover is presented below:

Table 5.1. Main Activities of Estonian ICT companies.

Main activity	Per cent
Software development	24 %
Manufacturing computers and components	19 %
Information systems	15 %
Data and voice communication	15 %
Sales	11 %
IT-support	6 %
Data processing	5 %
Program engineering	2 %
Training	1 %
Other	2 %

Source: PW Partners, EMTAK

Most of the companies in the field are very small, with 1-5 employees and an annual turnover under 64 000 EUR. Still, the 8 largest companies make up 85 per cent of turnover of the whole sector.

Table 5.2. Turnover of Estonian ICT companies.

Turnover	Companies	Approximate turnover
- 64 000 EUR	257	8.18 mEUR
64 000 – 192 000 EUR	76	9.71 mEUR

---

[47] Knowledge Based Estonia 2001-2006
[48] PriceWaterHouseCoopers Monitoring of EU Candidate Countries (Telecommunication Services Sector), July 2002, p.8

192 000 – 639 000 EUR	68	31.73 mEUR
639 000 – 1.28 mEUR	17	16.3 mEUR
1.28 – 3.2 mEUR	19	41.86 mEUR
3.2 – 6.39 mEUR	6	26.84 mEUR
Total	443	125.27 mEUR
More than 6.39 mEUR	8	723.48 mEUR
Total	451	848.75 mEUR

Source: PW Partners

5.2.1. Major ICT companies in Estonia

There are 8 major companies in Estonian ICT sector: Elcoteq Tallinn, Estonian Mobile Telephone, Estonian Telephone Company, Radiolinja Estonia, Tele2, JOT Estonia, Tarkon and Microlink. For more information on these companies please see Appendix 2.

Estonian leading business newspaper Äripäev annually compiles a chart of the most successful companies in Estonia. In 2002, the time was ripe for the invasion of telecommunication companies to the top places. Tele 2 was the most successful leading the whole chart, EMT was holding the 4th position (up 8 places from 12th position in 2001), Siemens took the 9th position, and the most successful local IT-systems developer Adobase Systems finished the top ten (64th in 2001).

In spite of the success of the companies in top ten, there are only 3 IT companies present in the latter part of the table – IT-systems developers Microlink Systems in the 65th, Cell Network in the 98th, and a computer manufacturer Ordi in the 83rd position.

Table 5.3. Estonian ICT sector in figures (year 1999/2000).

Indicator/ sub-sector	Market size MEUR	Exports MEUR	Employment
Telecom equipment	125	1000	3850
Industrial automation	31	28	600
Consumer electronics	1.9	1.7	150
Components of electronics	13	6	850
Computers and office machinery	105	5	1100
Software	13	3	1200
Telecom services	220	3.9	4500
Multimedia content	0.65	0.04	100
Total	**509.55**	**1047.64**	**12350**

Source: Estonian eVikings.

The overall structure of the Estonian ICT sector is characterized rather well in Table 5.3. The leading exporter Elcoteq and few others in the telecom equipment sub-sector export 20 times more than all the other ICT sub-sectors in total. Telecom services and computers and office machinery sub-sectors rely practically only on the domestic

demand. The major employers are also software and components of electronics sub-sectors in addition to the telecom equipment, computers and office machinery and telecom services sub-sectors.

The total number of the people employed in the 450 ICT companies in Estonia is estimated to be 8793 in 2002 (12 350 in 1999/2000 was calculated using different methodology. Thus, the figures are not comparable). 10 companies with more than 100 employees provide workplaces for 4950 people, 311 companies have 1-5 employees[49].

According to PW Partner, only 72 per cent of the total ICT workforce is directly related with the field, and (as 13 per cent of labor is engaged with assembling computers and electronic equipment) only 59 per cent of the total ICT workforce is engaged directly with the activities of information and telecommunication sector.

5.2.2. Computers in companies

	2001	2002
Number of companies (involved in survey)[50]	28417	33 248
Percentage (number) of companies having at least one computer	64%	75%
of them having server computers	N/A	18%
of them having lap-tops	17%	17%
Percentage of companies having access to the Internet (% of firms having computers)	95%	89%
of them using dial-up connection	67%	40%
Percentage of companies having 1 -3 computers	35%	50%
Percentage of companies having 4 - 20 computers	27%	21%
Percentage of companies having over 20 computers	2%	3%

Table 5.4. Computers in companies. Source: Survey by Emor Ltd. "Information technology and Internet in Estonian companies", April 2002

The survey[51], conducted by EMOR in April 2002, shows that 31 per cent of retail and wholesale companies and 51 per cent of education, health and social services companies do not own a computer. Also, smaller companies, 29 per cent of those with up to 9 employees are less likely to own a computer, also 53 per cent of the companies with annual turnover under 64 000 Euro do not own a computer.

7 700 companies have a homepage; it comprises 35 per cent of these companies who have an Internet connection. About 3200 enterprises have an Intranet solution. Approximately 1300 companies in Estonia have both homepage and Intranet. Based on the increase of companies with intranet it can be claimed that companies turn more

---

[49] Krediidiinfo
[50] Business register 2002
[51] The following section largely based on the survey by Emor Ltd. "Information technology and Internet in Estonian companies", April 2002

attention to interactive communication inside company. 4900 companies plan to develop homepage and 900 intranet system in near future**.**

The majority of the companies have not integrated their Internet and intranet solutions with other IT systems in the company. However, 3% or approximately 1100 companies in Estonia have integrated at least some systems. Around 1800 companies planned to integrate the systems in 2002.

To answer the question for what purpose do the companies use Internet in Estonia, EMOR survey came up with the following results:

Obtaining information	95%
For financial transactions	90%
For communicating with clients	70%
For selling the services/products of the company	37%
For communicating inside the office	15%
For communicating with the affiliates	14%
For sales system/stock accounting/logistics	15%
For group work (document and resource administration, planning the time)	13%
For communicating with partners	2%
Purchased/ordered products	1%

Table 5.5. Reasons for using Internet among companies. Source: Survey "IT and internet in Estonian companies", Emor Ltd.

As shown in the table 5.5. Estonian companies are heavy users of Internet banking and eagerly sell their services and products over the Internet, but only a fraction of the companies have purchased or ordered products themselves. Graph 5.4 breaks down the distribution of goods and services that companies have ordered or purchased via Internet.
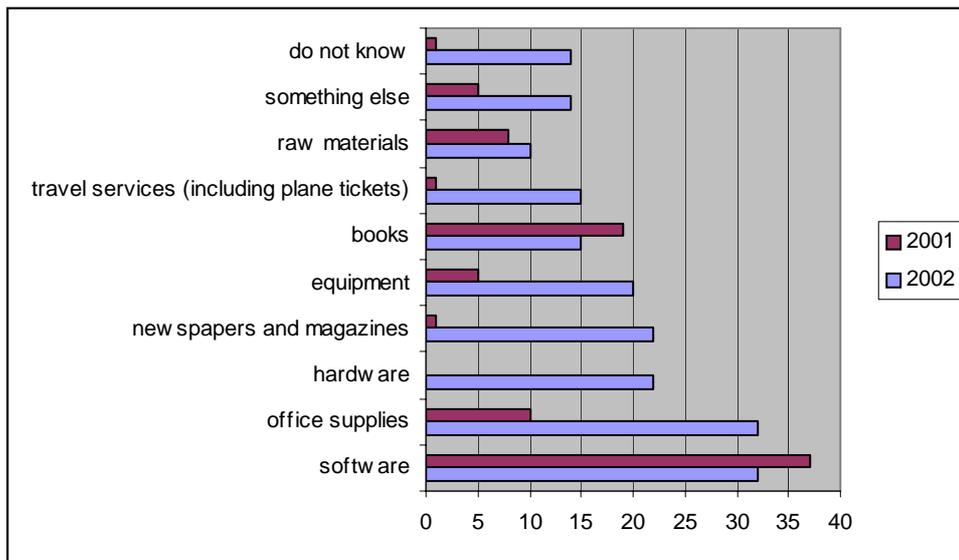
Graph 5.4. Products/services that have been purchased/ordered via Internet (% of companies that have ordered/purchased via Internet). Source: Survey "IT and internet in Estonian companies" Emor Ltd.

5.3. Market volumes

5.3.1. Fixed operators market and Internet providers

Even though many service providers have entered market after liberalization of the telecom market in 2001, Estonian Telephone Company has managed to keep 89.2 per cent of telephone services market, 72.8 per cent of online lines and 59 per cent of interconnection market[52]. The international calls market has been the most difficult one to keep due to very tight competition by Tele2 and Uninet (Finnjet Group). Uninet has managed to grow its share to 9% of all calls, including 10% interstate calls, 25% of calls from fixed to mobile and 30% of international calls. Small operators account for about 5 % of the market volume.

The dial-up market is estimated to have 65 000 clients in total, Estonian Telephone Company with 41 000 clients. Internet connection through DSL-modem is growingly more popular - in September 2002, Estonian Telephone had 24 100 DSL clients (over half of them individuals).

The major operator to provide Internet by cable, Starman, has 8000 clients, 90 per cent of those individuals.

According to EMOR[53], main Internet service providers among companies having an Internet connection, were Atlas (brand of Estonian Telephone Company) 59%, Tele2 10%, MicroLink 8%, Uninet 4% and KPNQwest 3%.

---

[52] Estonian Telephone Annual Report 2001
[53] EMOR
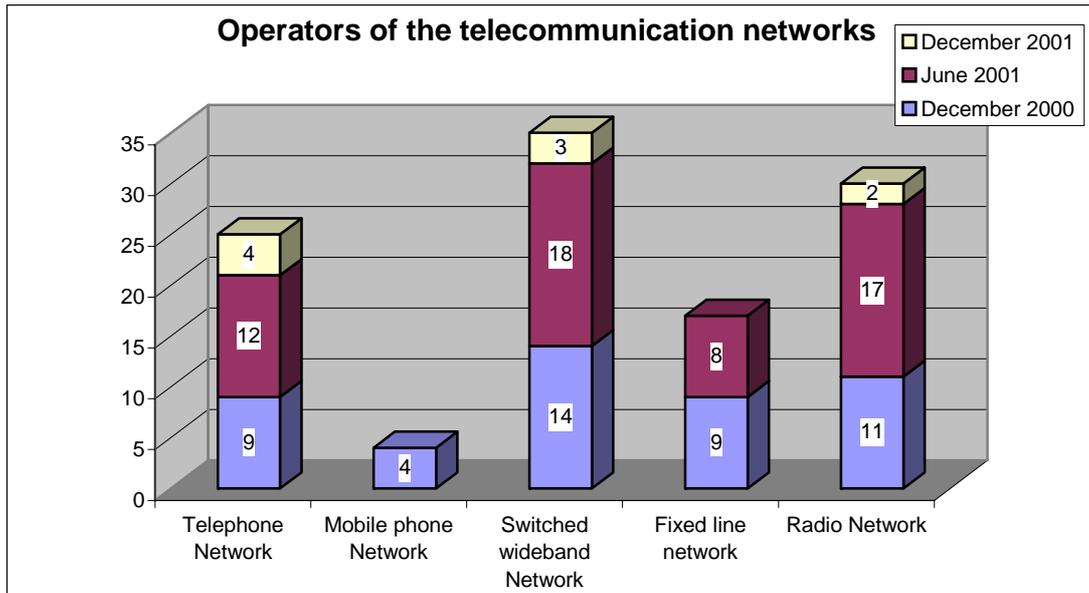
Graph 5.5. Operators of the telecommunication networks. Source: Estonian National Communications Board, p. 5

After liberating the telecom market also for fixed and basic services, new operators have started operating in Estonian market. In 2001, 64 operators and 110 companies providing the service were added, to the existing 47 operators 146 service providers, respectively.
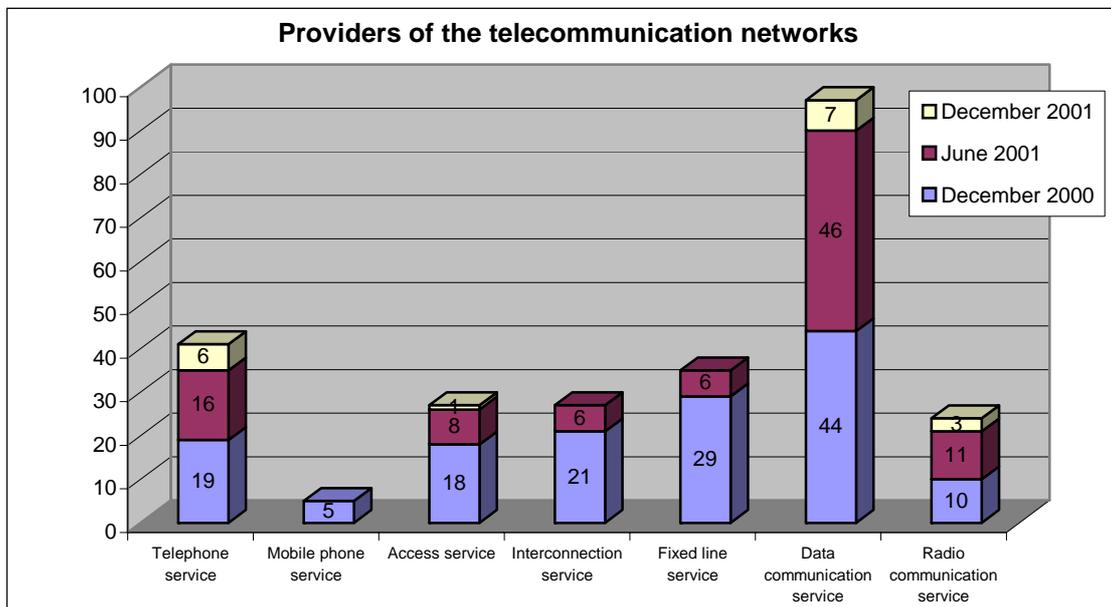
Graph 5.6. Providers of the telecommunication networks. Source: Estonian National Communications Board, p. 6

The growth among service providers has been the largest in data communication service sub-section – 53 companies have received license in addition to the existing 44 companies. The licenses for providing telephone services, radio, communication and access services have been more attractive to the entrepreneurs than others.

5.3.2. Mobile operators market

Estonian Mobile Telephone has succeeded in holding its market share on 66 per cent of the total revenue of the mobile communications market, but the share of its client subscriptions has fell down to 51 per cent.

Its two competitors, Tele2 and Radiolinja have worked hard to decrease the loss to the market leader – today Tele 2 and Radiolinja have 30 and 18 per cent of the client subscriptions, respectively.
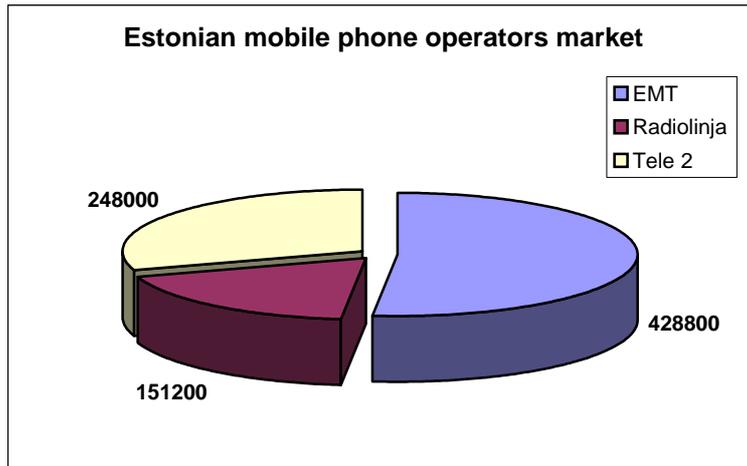
Graph 5.7. Estonian mobile phone operators market. Source: EMT, Radiolinja, Äripäev.

5.3.3. Computer market

Hardware

Estonia has always had its own computer manufacturers, even if most of the parts (if not all) are being imported and the computers are just assembled here. The most successful domestic computer manufacturers are the following companies:

	Computers manufactured in 2001
MicroLink Arvutid	13560
Ordi	10288
Klisseran	2756
Datagate	2162
PT Mikro	1558

Table 5.6. Computers manufactured in 2001. Source: Äripäev

The market has grown more than 25 per cent in 2002. The total number of computers manufactured in 2002 was 43 154 compared to 34 674 in 2001 according to the business daily Äripäev (January 9, 2003). It is estimated that three-quarters of the computers sold in Estonia are also assembled in Estonia; the rest comes from the

foreign countries. Also, the demand for laptops has grown from 4000 in 2001 to 8000 in 2002 (Äripäev, GNT)

Software

According to EMOR Survey, in addition to the operation systems and office software, the majority of Estonian companies use virus scan software, and back-up software. Two-thirds of the companies use business application software (financial software, CRM, manufacturing software, etc.).

Larger companies own also business and application software (group work, document administration, design software and other special software), development software (programming-software and modeling devices etc)

Microsoft Windows and Microsoft Office are the most popular software titles used in Estonia.
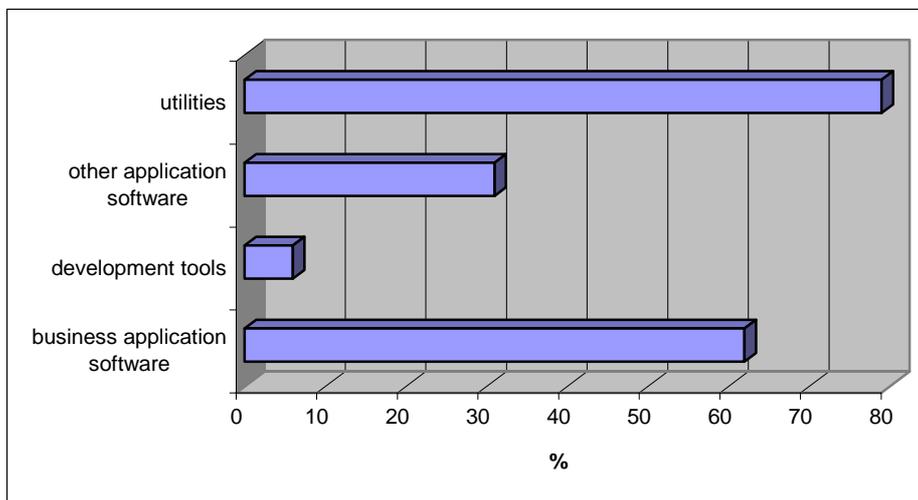
Graph 5.8. Usage of different software in companies. Source: Survey "IT and internet in Estonian companies" Emor Ltd.

According to the Business Software Alliance, the use of illegal software at homes might be as high as 95 %. The rate of piracy in companies is 53 %.
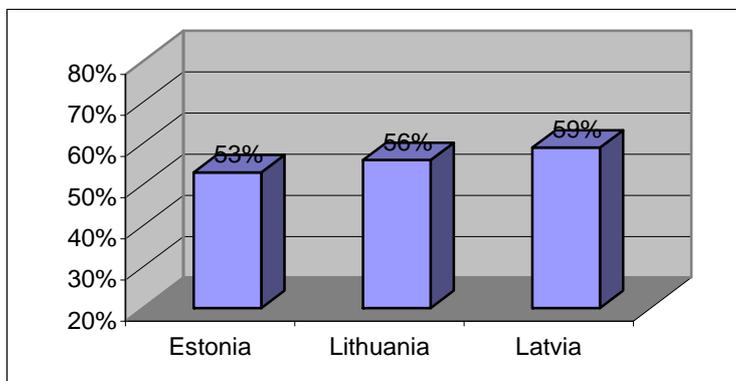
Graph 5.9. Rate of piracy. Source: Data Monitoring and Microsoft

5.4. E-commerce

Estonia has been a favorable ground for various innovative ICT solutions[54]:

- Internet banking – one of the strongest advantages in the development of e-commerce is the widespread Internet banking, which favors the rise of positive attitude towards e-commerce.
- Internet shopping – number of Internet shops available offering books and publications, tools, household appliances, software and hardware, multimedia, flowers, etc.
- On-line tourism and booking systems – it is possible to book and buy air and ferry tickets on-line.
- Secure servers – Estonia has achieved a solid position in secure servers domains, which is essential for e-commerce and trust.
- Mobile services – mobile parking has in two years grown to be extremely popular, in Tallinn and some other towns it forms almost 50% of parking payments. M-parking is the first of a long list of services implemented through mobile phones, eg. Estonian can purchase public transport and other tickets, buy drinks, get information from the business register, check their bank accounts by mobile phone etc. Such a wide range of mobile services tends to be quite unique in the world. M-Payment system for small shops, taxis and other places, which do not accept debit and credit cards is offered by the banks and telecom companies.
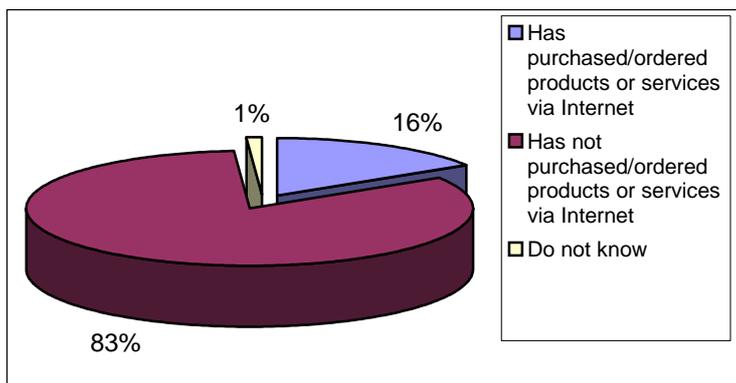
Graph 5.10. Companies and e-commerce 2002. Source: "IT and internet in Estonian companies" Emor Ltd.

Online shopping is not widespread among individuals in Estonia, both because of the small supply and demand reasons - several online shops have been closed as the potential clientele is too few. According to the Global E-commerce Report, 74 per cent of Internet users in Estonia are non-shoppers, 8 per cent are online dropouts, and 7 per cent offline shoppers, Only 7 per cent of individuals are online shoppers and 8 per cent are future online shoppers.

---

[54] Largely based on the writings of Ivar Odrats
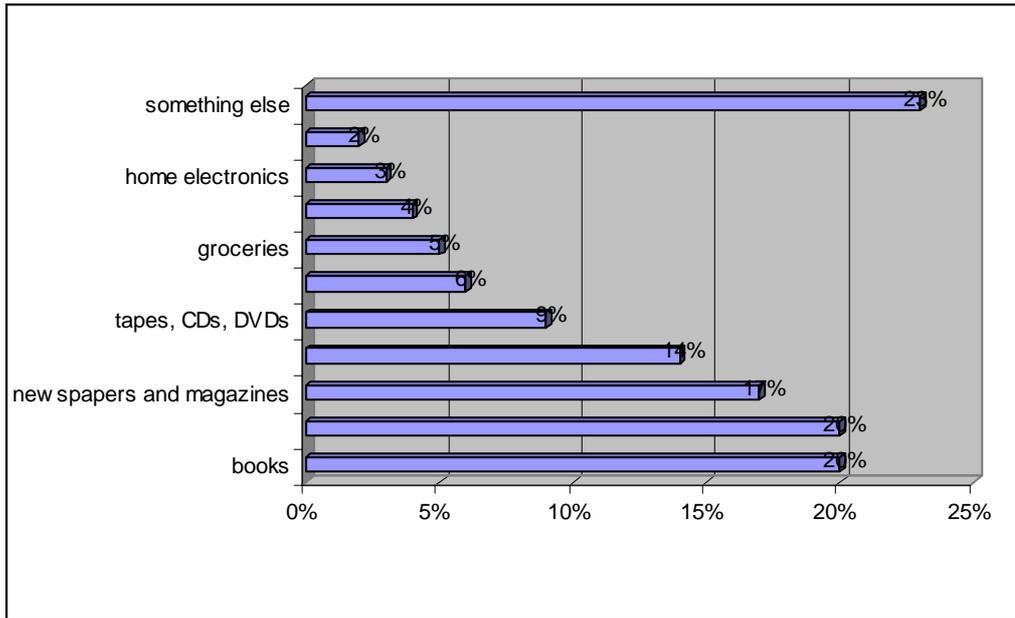
Graph 5.4. Goods ordered/purchased via Internet (% of those having purchased/ordered goods in last 6 months). Source: E-Track Survey, March-May 2002, Emor Ltd.
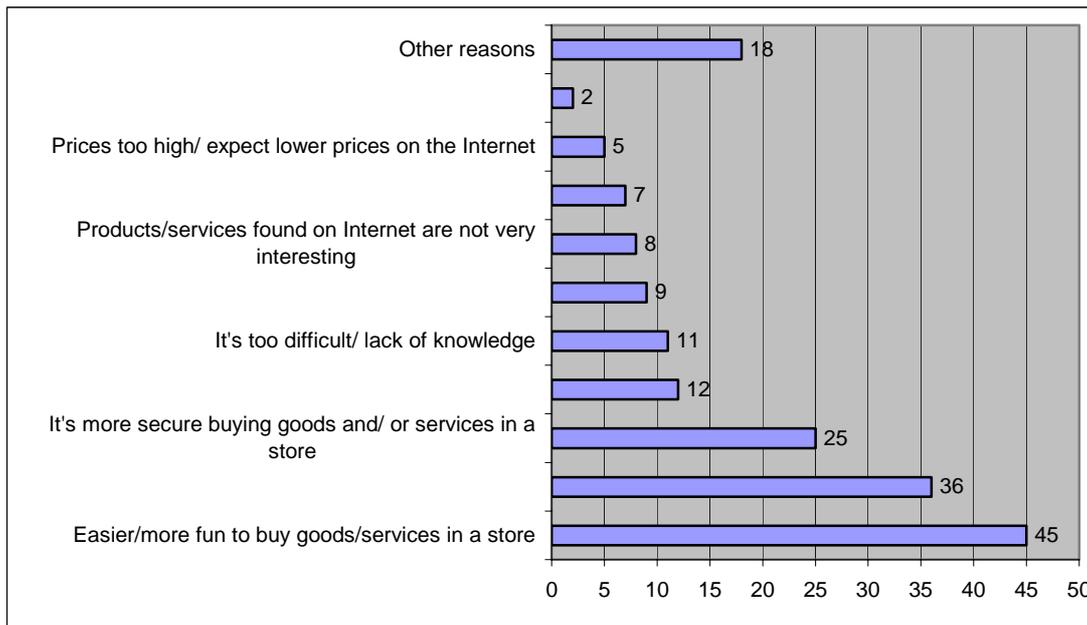
Graph 5.5. Reasons for not purchasing goods and services online. Source: Global E-commerce Report 2002

5.5. Internet Banking

The most popular electronic service in Estonia is definitely Internet banking. Hansabank has indicted to have 411,000 Internet banking clients and Ühispank 187,000 (Estonian Informatics Center 2003). Even though, that to some extent the clientele basis is overlapping, the total number of Internet banking users most probably exceeds 650,000, covering almost half of total Estonian population. The

factors of success have been simple-to-use software, free of charge transactions when entering the market and the impact of Nordic countries IT culture on Estonia.

Table 5.7. Internet Banking clients.

Number of internet-banking clients (users):	**Number /%**	**Reference time**	**Source**
- Hansabank	411 548	Jan 2003	Postimees
- Ühispank	187 347	Jan 2003	Postimees
- Nordea Bank	3 630	August 2001	Eesti Päevaleht
- Sampo Bank	47 992	Jan 2003	Postimees
- Krediidipank	2 389	March 2002	Krediidipank
Number of WAP-clients in Hansabank (Est)	10 952	sept.01	Hansabank

Source: Estonian Informatics Centre, Postimees

6. Networked Government

6.1. General description of Estonia's Situation

Concerning IT-systems, Estonian government has certainly been one of the most innovative cabinets in Europe, if not in the whole world. In 2000, e-government system "VIIS" was developed to enable paperless government sessions and allow ministers to participate in the meetings via Internet from distant locations.

The overall impact of government actions has been crucial in the development of Estonian information society. From creating favorable legal environment and leading the way with computerizing the whole public administration, some of the major e-services were developed for the public sector which have been useful to attract people to the Internet (e.g. filling tax-returns in Internet).

All cabinets, led primarily by liberals, national and right wing coalitions, have so far prioritized the development of Internet in Estonia, by money allocation for ICT on a separate line in state's budget, and have adopted the necessary regulations to enable the use of digital signature, smart cards and the creation of digital registries. However, there has not been a single strategic document for the development of Estonian information society, as the Principles of Estonian Information Policy (a document with suggestions, adopted by the parliament in 1998) was too general and all other documents passed have been too specific. To meet the objective of creating a better online environment for the citizens, the synergy from the co-operation of different institutions and sectors is needed. This can only be achieved by establishing a clear vision, strategy and a work plan.

At the time being, social problems have moved to the forefront of Estonian political discussion, and ICT, regarded, as a relatively well-developed field does not receive much attention. There is no cabinet member who would be solely responsible for the ICT affairs in Estonia. After the two ministries – Ministry of Economic Affairs and Ministry of Transportation and Communication were joined into one - the Ministry of Economic Affairs and Communications – the responsibility for the ICT field have been very much delegated to RISO (Department of State Information Systems, a department of the Ministry of Economic Affairs and Communications) and Estonian Informatics Center (state agency).

If the co-ordination of the ICT development in Estonia will not be improved and the attention regarding its importance in country's future competitiveness will not be paid, there is a strong doubt if Estonia could continue its fast development. As the leading ICT analyst in Estonia, Linnar Viik, has said, the government has done a good job piling up good things into a cup. But the threat is always there, that when constantly adding new things to the cup, you might flush out the ones already there.

Estonian e-government has been rated 32nd in a global index compiled by UNDPEPA and ASPA[55]. Estonia was included among the group of states with high e-government

---

[55] United Nations Division for Public Economics and Public Administration (UNDPEPA) and

capacity. The different components of the index show that Estonian governments e-services are rated as 'Interactive Presence' (Level 3 out of 5) –

> *Country's presence on the internet expands dramatically with access to a wide range of government institutions and services. More sophisticated level of formal interactions between citizens and service providers is present like e-mail and post comments area. The capacity to search specialized databases, download forms and applications or submit them is also available. The content and information is regularly updated.*

Still, the countries with the most advanced e-services belong to the 'Transactional Presence' group (Level 4 out of 5), where the category embodies the citizen-centric approach as content, information and services come in the form what people expect rather than what governments prefer to offer.

To reach the 'Transactional Presence' level, Estonia needs to create the capacity for citizens to interact with the government, purchasing goods, or utilizing services and paying for them online. Currently, many of these developments are in progress and as the plans for the next few years show, many more of citizen-oriented services are being developed.

According to the Government decision of 14 May 2002 the information policy priorities for 2002/2003 are as follows[56]:

- *development of services for citizens, business sector and public administration, especially the elaboration of ID-card applications, proceeding also from the list of e-government services defined in the eEurope+ Action Plan;*
- *improvement of skills and access of social groups in unequal position for using electronically provided services;*
- *elaboration and introduction of systems for digital document management and archival processing;*
- *development of the system and infrastructure of state registers, including the development of systems that ensure the maintenance of databases and the introduction of the data exchange layer (project "X-Road") of information systems;*
- *better provision of schools with computers to achieve the ultimate goal – one computer per 20 students;*
- *launching of Tiger University program to support the development of information and communication technology (ICT) infrastructure and academic ICT staff, and the infrastructure for post-graduate training.*

In the background of these tasks, which are mainly aimed at developing ICT infrastructure, the main goal of the government is to develop and integrate the ICT infrastructures of the state and local governments into a general citizen-friendly service environment. This would establish the pillars for the development of e-democracy and enhanced economic competitiveness by the use of ICT devices.

American Society for Public Administration (ASPA) "Benchmarking E-government: A Global Perspective" pp.15-56, http://unpan1.un.org/intradoc/groups/public/documents/un/unpan003984.pdf
[56] The website of the State Information Systems, http://www.riso.ee

The strategy for Estonia to move closer to a true knowledge based society, was expressed in the Estonian Research and Development Strategy 2002-2006[57]:

- *It sees the future Estonia as a knowledge-based society where the development of human capital, research and adaptation of new knowledge and skills is the source of growth in the competitiveness of the economy, labor force and in the quality of life.*
- *Specifies the goals, opportunities and principles of R&D and serves as a basis for organizing the development of R&D in Estonia. The strategy fixes the framework and the quantity of the support-mechanisms of the public sector until 2006.*
- *Is the basis for developing annual plans and concrete programs to develop R&D according to the set goals.*

The key areas that Estonia has decided to focus on, are user-friendly information technology, bio-medicine and material technologies. To develop those areas, Estonia needs to first solve several problems associated with unproportional composition of Estonian R&D expenditure, low level of R&D expenditure of Estonian companies, low level of co-operation of scientists and entrepreneurs, low patenting activity and shortage of high qualification engineers[58].

6.2. ICT in Public Administration

Estonian public administration is relatively well equipped with computers, as the estimated need for computer-equipped workplaces exceeds the number of existing computer-equipped workplaces with just 3.6 per cent. The Internet connection is present at almost four-fifths of the workplaces. For more details please see Table 6.1.

Table 6.1. ICT in public administration.

	Number / %
Number of Public Administration Agencies (PAA-s – state agencies, government agencies and other constitutional institutions included)	62
Number of staff in PAAs	20 066
Estimated need for computer-equipped workplaces (PCs) in PAAs	14 836
The existing computer-equipped workplaces (PCs)	14 300
Percentage of computer-equipped workplaces (PCs) connected to the Internet	78%

Source: Estonian Informatics Center, http://www.eik.ee/atp/index.html?id=379

6.3. Adopted regulations

Estonian Parliament Riigikogu has been successful in adopting regulations needed for different information society applications, such as digital signature, public key infrastructure and state registries.

---

[57] Estonian Research and Development Strategy 2002-2006,
http://www.tan.ee/tan/en/doc/Documents/1018442944.46/Estonian%20R&D%20strategy.pdf
[58] ibid.

The two most important regulations influencing the developments of Estonian information society have been the Principles of Estonian Information Policy, passed in May 1998, and the Public Information Act, passed in November 2000.

Principles of Estonian Information Policy is a high-level source document on IS development. The government information policy takes into account the goals set up in regulating different spheres of social life and introduces the opportunities for presenting innovative solutions. The framework of the Estonian information policy was concentrated on the following four fields: modernization of legislation, assistance in the development of the private sector, development of communication between the state and the citizen, and acknowledgement of problems related to information society[59].

All the government agencies make their specific proposals with schedules, sources of finances, and responsibilities for implementation of information policy programs to the Government every year according to the Information Policy Action Plan. The government defines general priorities for implementing information policy for the coming year

Public Information Act ensures that the public and every person has the opportunity to access information intended for public use, based on the principles of a democratic and social rule of law and an open society, to create opportunities for the public to monitor the performance of public duties. After it entered into force in January 2001, it has made public institutions to provide more information on their web pages and thus has made the whole public sector more transparent.

The enactment of the law of Public Information Act also became the basis for several national ICT programs and projects. The most extensive of them is the document management program of government agencies, which was initiated in 2000 and which also brought along the supplementation of several other ICT acts[60].

Table 6.2. The List of adopted legislation related to ICT[61].

Name of act/policy	Passed on:
Archives Act	25 March, 1998
Broadcasting Act	19 May,1994
Copyright Act	11 November, 1992
Cable Distribution Act	31 May, 2001
Citizenship Act	19 January, 1995
Consumer Protection Act	15 December, 1993
Databases Act	12 March, 1997
Digital Signature Act	8 March, 2000
Official Statistics Act	11 July, 1997
Personal Data Protection Act	12 June, 1996
Population Register Act	31 May, 2000

---

[59] Estonian Informatics Centre, http://www.eik.ee
[60] Ivar Odrats "ICT Development in Public Administration of Estonia 2001, pp. 9-12
[61] ibid.

Principles of Estonian Information Policy	13 May, 1998
Public Information Act	15 November, 2000
Public Procurement Act (new)	19 October, 2000
Riigi Teataja Act (new) (Riigi Teataja = State Gazette)	20 January, 1999
State Liability Act	2 May, 2001
State Secrets Act	26 January, 1999
Telecommunication Act	9 February, 2000

Full text of regulations can be found at http://www.legaltext.ee/indexen.htm

6.4. ICT Financing

From 1996 to 2003, the ICT financing from the state's budget has stayed around 1 per cent – 1.3 per cent at its peak in 1999 and 0.8 per cent in 2000. However, the resources allocated to ICT financing have grown almost 4 times – from 7.66 million EUR in 1997 to estimated 28.44 million EUR in 2003. These costs include fixed costs (maintenance of ICT infrastructure components, annual fees of software licenses, outsourced hardware and software services and data communication expenses), and expenses on contracting out ICT development projects.
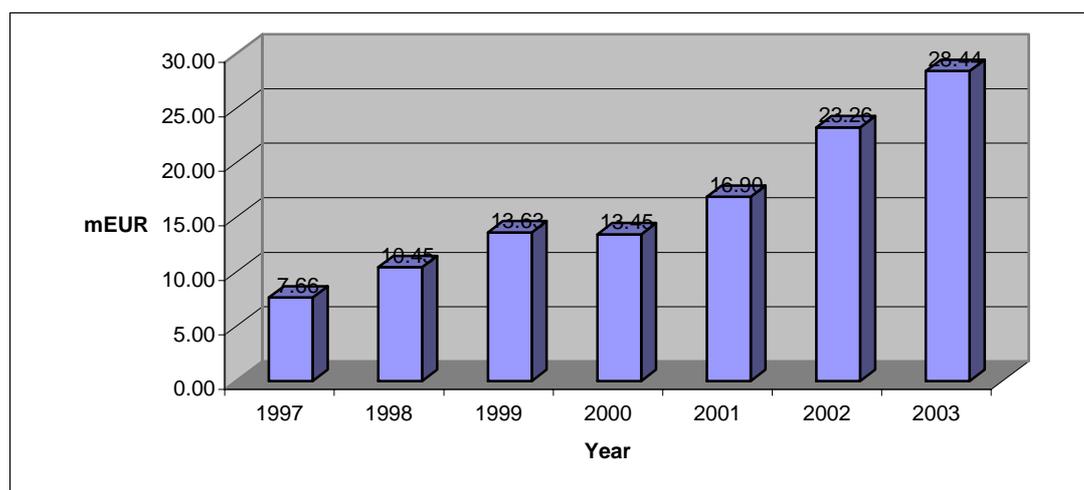
Graph 6.1. Estonian public sector ICT costs (mEUR) in state budget.
Source: RISO, Ivar Odrats.

The actual expenditure on ICT in public administration is larger, as salaries of ICT staff, ICT expenditures of agencies receiving only grants from the state budget, training cost of ICT education and the ICT expenditures of local governments are not included here[62].

Still, Estonia's expenditures on ICT have been rather modest, as many other countries spend 2.5-4 % of the state budget on similar costs.

---

[62] ibid. p. 9
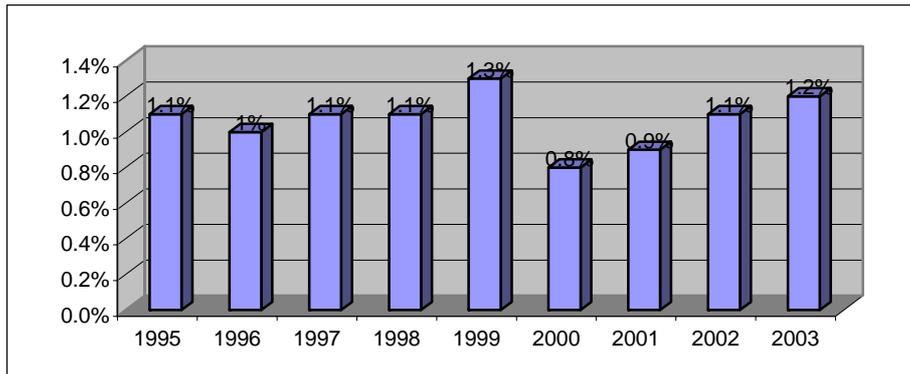
Graph 6.2. Estonian public sector ICT costs as a percentage of state budget.
Source: RISO, Author's own calculations

The greatest ICT expenditures in 2003 will be made by Ministry of Agriculture (4.8 mEuro – the money allocated to the ministry for the fiscal year 2003 exceeds the sum of all ICT allocations from 1996-2002 by twice, Ministry of Internal Affairs (3.7 mEuro) and Ministry of Economic Affairs and Communications (3.8mEuro).

6.5. Organizational structure of Estonian ICT Leadership[63]

In 2000, the Government transferred the responsibilities and co-ordination of IT development in the public administration to the *Ministry of Transport and Communications*.

Its department, *RISO* (the *Department of State Information Systems)*, in the area of government of the Ministry of Transport and Communications increased its staff, while several large and significant ICT development projects were transferred under the organization and responsibility of this department.

The *Estonian Informatics Center*, a state agency providing ICT services to the ministries and other government agencies, was also transferred to the area of government of the Ministry of Transport and Communications and the Estonian Informatics Council, a government committee of experts.

However, in November 2002 two ministries – the Ministry of Economic Affairs and the Ministry of Transport and Communications were reorganized by joining into one – the Ministry of Economic Affairs and Communications. The Department of State Information Systems continued its existence as a department under the new ministry; the Estonian Informatics Center was allocated directly to the Department of State Information Systems.

The private sector has been also involved in the activities of several work groups of the Department of State Information Systems. The implementation matters of digital signature, were discussed together with representatives of banks, *Eesti Telekom* and IT companies. Even though, in the interviews carried out in June 2002, many representatives of the ICT companies were worried about the weak leadership of the ICT field in the government, as different ministries and local governments run similar projects without co-operating, thus spending extra resources. Stronger co-operation of

---

[63] Largely based on Ivar Odrats "ICT development in Public Administration of Estonia"

state institutions would help to carry out national ICT projects, such as e-citizen portal and other electronic services much faster.

```
                            ┌─────────────────┐
                            │   Government    │
                            └─────────────────┘

┌──────────────┐                          ┌──────────────┐  ┌──────────────┐
│  Ministries  │                          │   County     │  │    Local     │
│              │                          │ governments  │  │ governments  │
└──────────────┘                          └──────────────┘  └──────────────┘

            ┌──────────────────┐
            │   Subordinated   │          ┌──────────────┐  ┌──────────────┐
            │     agencies     │          │ IT councils  │  │    Local     │
            └──────────────────┘          │ of counties  │  │ government   │
                                          └──────────────┘  │ associations │
                                                            └──────────────┘

┌──────────────┐
│ IT councils  │
│ of ministries│              ┌──────────────┐
└──────────────┘              │  Informatics │
                              │   Council    │
                              └──────────────┘

                    (  MINISTER  )

        ┌──────────────────────────────────────────────────────────┐
        │           (  Secretary  )                                 │
        │           (  General   )                                  │
        │                                          ┌──────────────┐ │
        │  ┌──────────┐   ┌───────────────────┐    │ICT workgroups│ │
        │  │   ICT    │◄──│ Department of State│    │ of counties  │ │
        │  │workgroups│   │Information Systems │    └──────────────┘ │
        │  │of minis- │   └───────────────────┘                     │
        │  │ tries    │                                             │
        │  └──────────┘                                             │
        │  Ministry of Economic Affairs and Communications         │
        └──────────────────────────────────────────────────────────┘

                                          ┌──────────────┐
                                          │   Estonian   │
                                          │ Informatics  │
                                          │    Centre    │
                                          └──────────────┘
```

Graph 6.3. Simplified Organizational structure of ICT management in Estonia.
Source: Ivar Odrats, ICT development in Public Administration of Estonia

6.6. Essential government initiatives

The two government initiatives that have had the most impact on the development of Estonian information society have been the *Concession Agreement* between the Republic of Estonia and Estonian Telephone Company signed in 1992 (see more details in Section 2.1) and the start of the *Tiger's Leap* program in 1996 (see more details in Section 4.1). Both of these events marked the turning point in Estonia's development – the Concession Agreement helped to establish digital telephone network infrastructure and the Tiger's Leap program made the computer and Internet essential tools for every child.

In addition to these two programs, there are also other remarkable initiatives carried out in the public sector. These are mainly dealing with the modernization of the communication within the government, or provision of services to companies and individuals on digital databases (e.g. e-Citizen project, electronic ID card initiative[64]).

The purpose of *Estonian ID-Card* program is to use nation-wide electronic identity and develop a new personal identification card that would be a generally acceptable identification document and contain both visually and electronically accessible information. On 28 January 2002 the first ID-cards were issued to Estonian citizens. In March 2003, more than 150 000 ID cards were issued already.

The implementation of ID-card actually means establishing new nation-wide infrastructure in Estonia as well as useful applications. The structure includes certification service provider (certification center and its subunits), who issues certificates, and catalogue service provider, who takes care of making these certificates available for everyone. In addition, other services and their providers are needed which would provide the opportunity to use certificates.

Steps towards modernizing the governmental information exchange system were taken starting year 2000, at the initiative of the pilot project X-road (cross-road). *X-Road* is the modernization program of national databases with the aim to change national databases into a common public, service-rendering resource, which would enable agencies, legal and natural persons to search data from national databases over the Internet, provided they are entitled to do so. At the same time, the system will ensure sufficient security for the treatment of inquiries made to databases and responses received. The aim of the X-road program is to develop software, hardware and organizational methods for standardized usage of national databases.

The county data communication target program "KülaTee" (Village Road) is an information technology program initiated in cooperation of county governments, the Estonian Informatics Centre, and the Department of State Information Systems (RISO). KülaTee is one of Estonian Information Policy framework programs. The aim of the project is to establish data communication services in the counties and join the information systems of local governments with those of public administration.

The Document Management Program (DMP) of government agencies is a cooperation program for the transition to inter-agency digital document management.

---

[64] Largely based the website of the Department of State Information Systems

Therefore the aim of DMP is to digitalize the state's records management and bring it into conformity with information society requirements.

In order to enable sending electronically sealed documents, the *Digital Signature* Act entered into force on December 15, 2000, which created legal effect for the implementation of digital signature. The law provides an opportunity to use digital signature equally with the hand-written signature. According to that act, state and local government agencies must reorganize their management by June 1, 2001 so that it would also be possible to treat digitally signed documents.

IT College, providing 3-year program in higher IT-education, was launched in 2000 combining government resources, foreign donors (Sweden), private companies providing funds (Estonian Telekom and Telia) and scholarships.
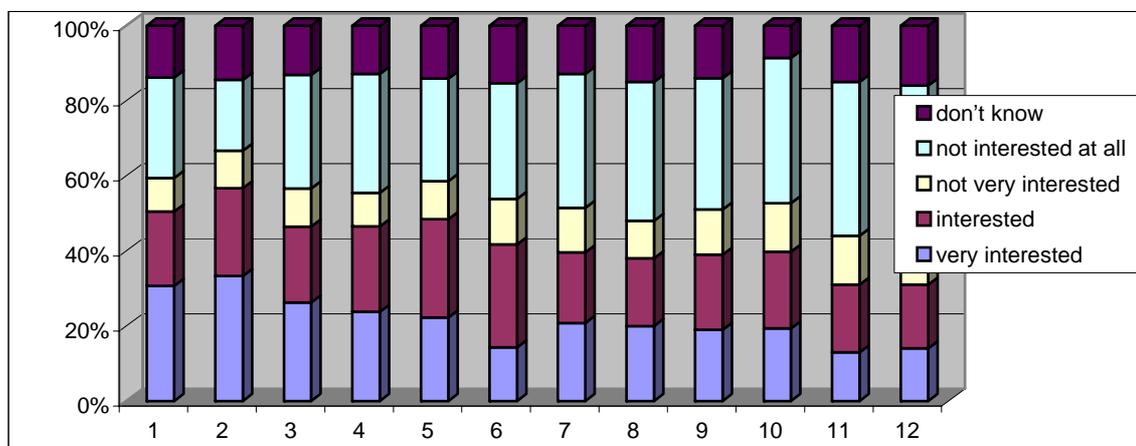
 Graph 6.4. Interested in using the following services.
Source: EMOR "Usage of online services provided by the state and government institutions", June-July 2002
Key: 1 - Filling tax declarations; 2 - Using online career-portals; 3 - Using search engines in libraries; 4 - Applying for personal documents and identification cards; 5 - Social insurance related; 6 - Health related; 7 - Reporting to the police; 8 - Sending application to the university/high school; 9 - Registering motor vehicle; 10 - Registering change of address; 11 - Applying for birth and marriage certificate; 12 - Applying for construction permit

6.7. E-services provided by government
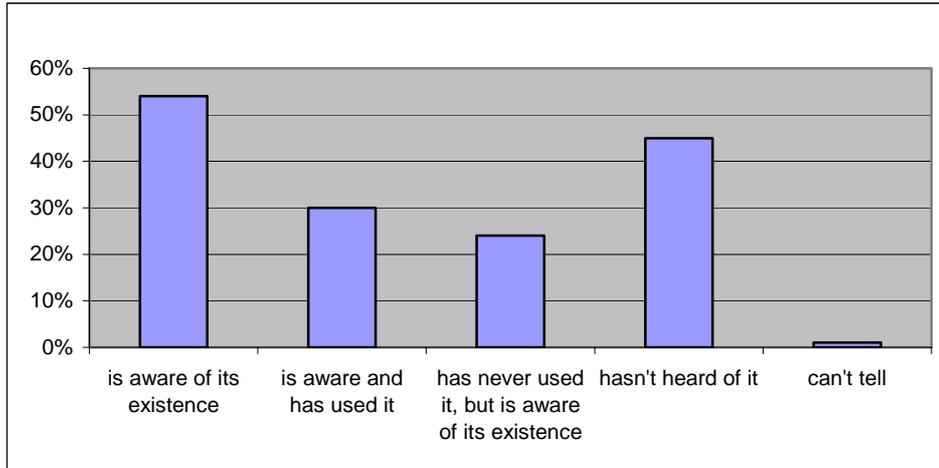
Graph 6.5. Usage of riik.ee among Internet users. Source: EMOR "Usage of online services provided by the state and government institutions", June-July 2002

In 1998 in the course of the project "Vahetu Riik" ("Direct Government") a common access point for Estonian government agencies and constitutional institutions was created through an Internet domain riik.ee (gov.ee) and virtual Estonian Web Center was established for administrating it. Together with the powerful development of Internet services the domain riik.ee has in four years become an inseparable part of Estonian e-government and the symbol of Estonia in the Internet (see Graph 6.5).
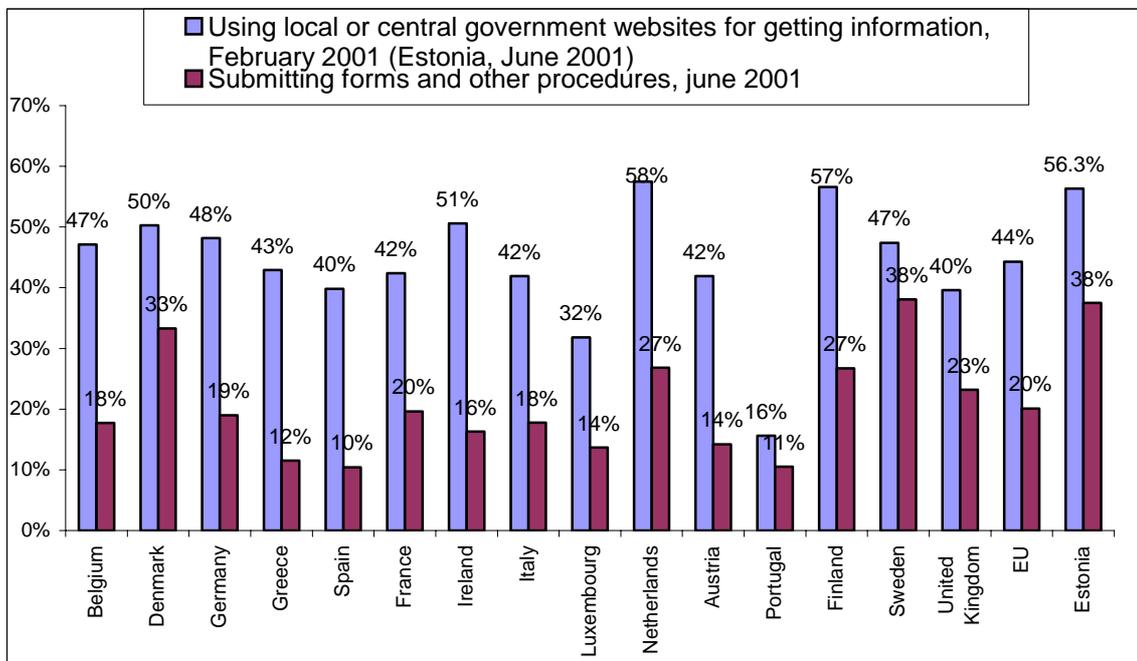
Graph 6.6. Internet users using government online services. Source: EC: Eurobarometer 103, Emor Ltd., Liivar Leppik

The **e-TaxBoard** application launched in October 2000 enables the taxpayers to communicate with the Tax Board quickly, easily and safely. Using the e-Tax Board application, the taxpayers or their authorized representatives can file, view and correct their VAT returns; file, view and correct their social tax and withheld income tax returns; submit their VAT refund applications; view their tax account balances; view their taxpayer account cards; make inquiries about other persons' outstanding tax debts; file their personal income tax returns; view their social tax calculated, paid by employers and transferred to the Social Insurance Board etc. To access the data, one can use either the Tax Board's website www.ma.ee, or the Internet banks of Ühispank (U-Net) or Hansapank (hanza.net). As of February 2002 ID-card owners can enter e-TaxBoard via the Tax Board's website (www.ma.ee) by using ID-card.

From June 2001 a **citizen portal "Today I Decide"** was launched. The project aims at engaging citizens more actively into policy decision processes, as well as motivating public debates concerning nation-wide and important initiatives. The citizen portal encourages submitting ideas, visions, directions etc. as well as comment on bills released by ministries already during the process of bill drafting.

e-services of National Land Information System
The National Land Information System (LIS) makes the administration of information related to Estonian lands easier and conveniently available and usable over the Internet. The creation of cadastral information system laid a foundation for LIS, which made the development of public services possible. Access to the public services of LIS is available on the website of the Land Board at http://www.maaamet.ee (in Estonian).

e-State Treasury
e-State Treasury is an Internet application for agencies maintained by the State Treasury, which provides an opportunity for the agencies to communicate with the State Treasury via the Internet. Agencies can make payments, reservations, send notices, and receive statements of payments and returns. All this is performed quickly and safely by using the authentication services offered by banks.

Table 6.3. Use of online services provided by the government (age group 15 - 74 yrs, % from the group that have used Internet in the previous year).

Online activities	%
- paying for services or products/documents via Internet banking	48%
- gathering information from homepage	46%
- printing out documents (application forms, etc.)	33%
- sending/changing information about oneself or one's family	30%
- publishing one's opinion or participating in a public debate/forum	10%

Source: EMOR "Usage of online services provided by the state and government institutions", June-July 2002

Project eCitizen is a nation-wide project for developing cooperation between Estonian citizens and the public sector through the Internet. In the course of the

project e-citizen environment will be created, which would enable the citizen to conveniently obtain information about the services provided by the state and the citizen's rights and obligations to use direct and procedural services and to be an "active" citizen. In March 2003, it was opened for public use, providing the opportunity for the citizens to communicate with different state agencies through one portal.

If all goes according to the plan, then in 2004, all state and local government agencies will be providing services through the Internet. By estimate 60% of the population will be using the Internet on a daily basis (today 23 %[65]). There will be a citizen portal in function, which would include the following:

- Situation layers (citizen's manual)
- Services layer (standard services)
- Direct services (access)
- Procedural services (access)
- E-democracy systems (access)
- Citizen's document management system, e-mailbox
- My portal

Project e-Citizen is related to other programs, such as X-Road and ID-card, and systems that develop e-democracy; e-elections, TOM (Today I Decide), e-County, etc.

---

[65] EMOR E-Track, Sept-Nov 2003

7. Conclusions

7.1. Main conclusions

As the current ICT infrastructure and e-readiness report shows, Estonian ICT infrastructure developed during the last ten years together with the willingness of most of the Estonians to take advantage of the new emerging technologies, has paid off – Estonia enjoys one of the highest Internet, mobile phones and PC penetration rates in Central and Eastern Europe. Until recently, when Western European states realized the full potential of ICT and started to invest heavily into their ICT sectors, Estonia could also compete with the leading ICT countries in per capita terms.

Undoubtedly, Estonian developments in the ICT sector have been initiated and largely financed by the public sector. Most of the major projects, such as computerizing schools and public administration in Estonia, generating ID-card infrastructure and developing e-services have all been initiated from the public sector. The investments into ICT made by the government, even if not in the proportion as many would desire, have at least started the process. Since 2001, the private sector had only been a moderate supporter of information society developments.

At last, it seems that the public-private partnership has started to develop – with the founding of Look@World Foundation, private sector companies made a decisive move in helping the people who have so far not taken up the habit of using a computer and Internet. 100 000 people should receive a basic computer and Internet training for free. In the long run, the companies should get back their money donations by the increased market volumes of the Internet banks, computer manufacturers and telecoms, but for the time being, this an important investment into the people's competitiveness for the coming information age.

Thus, the conditions for public-private partnership are already in place, companies are strong enough to support the developments in the society. Unfortunately, not all growth is development. R&D is very weak in Estonian companies for the time being. The main share of investments to R&D comes from the public sector, which is opposite to the case in European level.

In an article about the Look@World program Alar Ehandi, the manager of Look@World, and Linnar Viik, put down a list of preconditions for the creation of a private-public partnership, which the program aims to be focused at:

- Competition in the telecom market
- Critical mass of local internet content
- IT awareness among both adults and the younger generation
- Innovation valued in business culture
- Business sectors using the Internet consolidated with just a few strong players
- The initiators of the project have big enough market share to gain enough from the project to make it worthwhile for them
- The state has a clear interest in developing an information society and e-services

- Internet penetration has achieved a critical mass (25% according to subjective estimates)
- There are cases of successful application of ICTs encouraging both service providers and users

As the analysis of the ICT expenses in the state budget showed, the government has not invested into ICT that extensively as the other countries in Europe, keeping the percentage of ICT expenses close to 1 per cent. With scarce resources, the investments made, have been generally objective and rational. Also, the smallness of the country might be an advantage – local governments are forced to join their resources when creating information systems. A co-operation between the two biggest cities in Estonia – Tallinn and Tartu – was signed in 2002, to co-operate in creating necessary e-services to their citizens. A situation, over which many countries with large administrative bodies could only dream of.

Also, people's interest in new technologies has been an advantage. In spite of the low GDP, people were ready to spend 5 per cent of their income on telecom services. In the middle of 1990ies, a new mobile phone was often worth an average month salary. Still, people bought the phones and the growing penetration numbers attracted more and more people among mobile phone subscribers. A few years ago, the cost barrier with computers, and just in 2002, with the Internet connection was broken. Today, most of the people receiving average salary, should be able to afford a computer and an Internet connection.

But why is this 'golden rush' to Internet necessary? If the only activities in Internet would be only entertainment, reading the news and e-mails and, there would not be much sense in it for anybody – the users nor the content and connection providers. The effect lies in the situation in which users turn using the computers and Internet into something productive, creating new knowledge, saving time, making something more efficient and convenient. Today, most of the Internet users in Estonia do not shop nor work with the help of Internet. Achieving efficiency gains, making one's work more productive and growing life quality by using the Internet should be the goals of growing Internet usage in Estonia, not only the mere penetration numbers.

Evidence of the benefits of ICT use have to become more visible, as already stated in Monitoring and Benchmarking E-Europe+ Action Plan[66]. There is a need for studies addressing the link between using ICT-technologies on the one hand, and growth, quality of work, social cohesion on the other hand.

7.2. Areas that need to be addressed

1. The Government needs to address the issue of emerging digital divide. The growth of the group of people using Internet practically stopped for almost 2 years in 1999-2001. Separating groups of people who have different competence levels for the information society is a threat. Following the general trend of business and public services provided only by the Internet, access to the relevant information and the productivity gains, it may well happen that two different groups (haves and have-nots)

---

[66] European Science and Technology Observatory, "Monitoring and Benchmarking the eEurope+ Action Plan 2002"

take up different attitude towards the state as the services provided and information received differs more and more from the perceptions of the other group.

The solutions to relieve the tension could be expressed by creating motivation (by providing interesting and essential content), overcoming individual barriers (providing training, education and improving skills) and providing easier access (through telecom market regulation and competition). On the other hand, the importance of the ability to sustain growth cannot be overstated. There is not much reason in investing heavily into ICT, if the society cannot keep up with the economic growth nor strengthen the social bondages by the help of these investments.

2. The establishment of the citizen-centered e-state and development of the framework for customer-friendly business-to-consumer and business-to-business services should be a strong priority. All the preconditions are already there - the regulatory framework is in place, the infrastructure established (Internet connections, ID-cards, Public Key Infrastructure), the public sector already having started with the e-citizen portal project, and people are being taught the basic skills to use Internet by the Look@World Foundation. All these preconditions should be taken advantage of to create convenient e-services for citizens regarding their taxes, health issues, retirement benefits, educating their youth and applying for permits and certificates. The same practice should be the case in interaction between the private sector and the state bureaucracy.

3. It is very ambitious for Estonia to try to follow the developments of the Nordic countries, as these countries are among the group of countries leading ICT developments in the world. However, it would be foolish not to learn from their success. Marja Heinonen, ministerial adviser for Ministry of Transport and Communications in Finland, describes the Finnish success with the following key developments[67]:

- Liberalization of telecommunications market
- A well functioning regulatory environment
- A high level of national education
- Heavy R&D investments (public and private)
- Good national dialogue and cooperation among actors.

Analyzing similar developments in Estonia all through this report, it can be concluded that the liberalized telecommunications market and a well functioning regulatory environment are practically at the same level as in Finland. Still, other developments in Estonia have been less successful: education reform is still under way, R&D investments and activities in the private sector are practically missing and national dialogue is still about to emerge.

Thus the main conclusion of this report – Estonian developments to the direction of information society have been adequate concerning the initiatives started by the public sector. The level and quality of ICT infrastructure and the access to it has gone through a major improvement during the last decade. The role of ICT in the society and Internet's growing role in providing information, business transactions, interaction between the state and citizens allows to assume that the e-readiness of

---

[67] Marja Heinonen, Baltic IT&T Review

Estonia is improving with every essential application and service delivered through the Internet. An emphasis made on computerizing the schools and providing vocational education to grown-ups has been essential and should be continued even more strongly. With the creation of public-private partnership in developing services and applications needed in the information society, and paying more attention to the R&D activities in the companies, sustainable economic development could be achieved.

Today, by most indicators assessed and benchmarking systems applied, Estonia is a runner-up to the most e-ready societies in the world. Still, in some aspects and penetration rates it is even difficult to reach the average level of European countries, as the GDP per capita is only 40 per cent of the European Union's average level. In the next few years the political decisions made and the developments chosen will show if Estonia will continue chasing the world's leading countries or the European Union average.

Appendixes.

Appendix 1. Previous E-Readiness Assessments conducted on Estonia.

The Knowledge Assessment Matrix 2002 by the World Bank is statistical assessment of country's preparedness for information economy and society using a set of 69 structural and qualitative variables benchmarking variables of performance, variables of economic regime, variables of governance, variables of innovation systems, variables for education and human resources, and variables for ICT[68].	**Evaluation:** Concentrating on the variables for ICT, Estonian numbers for telephones, mobile phones, TVs and computers come close to the levels of Western Europe. Estonia exceeds Western Europe in E-Government variable (WEF 2001). However, the numbers for Information Society index (IDC), ICT expenditure as % of GDP (WDI) and investment in telecom as % of GDP (IMD) are missing for Estonia's part.
In assessments[69] conducted by **McConnell International** and the World Information Technology and Services Alliance (WITSA), countries are rated in the five categories including infrastructure and access, government policies, ICT education, and business climate, on a scale of one to three ('blue,' 'amber,' and 'red').	**Evaluation:** Being one of the most successful of the transition and developing countries assessed, Estonia is rated amber for connectivity and information security and blue for e-leadership, e-business climate and human capital. In the latter one, the report identifies also an existing public-private partnership.
Mosaic's Global Diffusion of the Internet Project is a questionnaire based assessment by the **Mosaic group**. It measures the diffusion of the Internet by it's a) pervasiveness (per capita usage); b) geographic dispersion; c) sectoral absorption (usage within major sectors of the economy); d) connectivity infrastructure; e) organizational infrastructure (the state of the Internet service market); and sophistication of use (comparison).	**Evaluation:** N/A
The Global Information Technology Report 2001-2002" by the center for International Development (CID) at Harvard and World Economic Forum. This recent book provides two-page "country profiles" for 75 countries, which include the networked readiness index	**Evaluation:** Estonia is positioned 23rd in the networked readiness index among the chosen 75 countries. The rankings for network use component index and the components of enabling factors component index (network access, network policy, networked society, and

---

[68] "Who is doing what and where", http://www.bridges.org/ereadiness/where.html

[69] Risk E-Business: Seizing the Opportunity of Global E-Readiness and Global E-readiness Summary in May 2001 http://www.witsa.org/papers/

(NRI) ranking (based on network usage, access, policy, economy, and society), and a summary of key IT issues in the country.	networked economy) vary from 5th rank (for e-government) to 44th (general infrastructure under networked economy).
The project **European Survey of Information Society (ESIS II)** conducted regular surveys in European Union countries as well as in Central and Eastern European (CEE) countries. The surveys were based on basic facts and indicators of ICT and telecom infrastructure and market, followed closely regulatory developments, and mapped relevant Information Society Projects together with key persons and organizations.	**Evaluation:** Last report and collection of e-readiness indicators published in November 2001, argues among other things that the total density of Estonian connection paths is becoming increasingly similar of the level attained by EU; Estonia has been a successful country in CEE launching new communication technologies; and Internet usage structure reflects clearly the differences between CEE and developed countries[70].
UN e-Government Index, a joint research on e-governance conducted by UNDPEPA program of United Nations and ASPA. The composite global index considers e-services provided to citizens by government, ICT infrastructure and the potential of human capital.	**Evaluation:** Estonia is ranked 32nd in the index, only 2 places behind of Czech Republic, the most successful Eastern European country in the e-government index. The indicators show that Estonia has done relatively well on web presence measure (3.75 out of 4) and Internet hosts per 10 000 (248.25). Unfortunately, incorrect penetration rate of TVs per 1000[71], comparatively low numbers in penetration rates for PCs, mobiles and Internet, and also lower value for Human Development Index constrain Estonia's chances to compete for the highest places.

---

[70] Estonian E-Readiness Main Indicators, November 2001, http://www.esis.ee
[71] Only 48! This report shows that the colour-TV penetration rate for households in Estonia is 91.6 per cent.

Appendix 2. Major ICT companies in Estonia.
Source: Estonian eVikings.

Elcoteq Tallinn	A subsidiary of Elcoteq Networks Corporation with headquarters located in Finland. Elcoteq Tallinn manufactures primarily electronic subassemblies such as mobile phone's electronic parts and accessories, but also provides engineering and after sales services. As majority of the production is subcontracting work to Ericsson Corporation and Nokia, sales and performance of Elcoteq Tallinn has been substantially reliant on the large scale subcontracting orders. Moreover, as Elcoteq is by far the most influential actor on Estonian ICT landscape, it accounted for 83% of total Estonian ICT exports in 2001, and has direct impact on the growth rates of the whole ICT sector. In the year 2000, Elcoteq witnessed almost threefold export growth to approximately 1 billion EUR. However, global slowdown on telecom markets in 2001 has vigorously affected Elcoteq's business, which has resulted in unused capacities such as conserved new plant in Tallinn and remarkable downsizing in personnel. At the beginning of 2000 Elcoteq employed as much as 3600 persons, while in August 2001 the number of employees has dropped to 2000. In December 2002, the market situation has slightly improved, but the number of employees is still around 2000.
Estonian Mobile Telephone (EMT)	The largest Estonian mobile operator EMT is fully owned by Estonian Telekom, where the ownership is divided between Telia Corporation (49%) and Estonian State (27,3%).The rest of shares belong to other private and corporate investors and are traded on Tallinn Stock Exchange. EMT's main field of activity is the establishment and maintenance of mobile communication networks and systems, and the sale and management of related services. As for 2000, the turnover of Estonian Telecom was 253 MEUR and the number of subscribers exceeded 409 000 at the end of 2002. This figure gives EMT strong leadership as compared to other telecom operators, with subscribers based market share close to 50%.
Eesti Telefon (ET)	ET is another company belonging to Estonian Telekom holding group. The ownership structure is analogous to that of EMT. ET as a private company was established in 1993 and has operated most of the time under the concession agreement conditions stipulated with Estonian government in 1992. Year 2001 marked the end of the concession, when free access to the market was enabled. ET is primarily specialized on offering data communication, internet and telephone solutions to companies and households. Eesti Telefon has also established itself as the market leader for internet dial-up service and ADSL connections. ET is a substantial employer – in 2000 total of 2900 persons were employed by the company. However, the inner restructuring

	process has had an effect on the number, as in 1998 the company employed 3700 persons. Total turnover of 171 MEUR in 2000 makes ET the largest company on domestic ICT market, accounting for 32% of total ICT market and 46% of telecom market.
Radiolinja Estonia	Radiolinja is a private capital based international telecommunications company founded in 1994 by Elisa Communications, Finland. Radiolinja offers a variety of telecom services with main orientation on mobile communication solutions. As for the end of 2002 Radiolinja Estonia had 163 000 subscribers, which comprise around 20% of total number of mobile communications subscribers. By turnover, with 16 MEUR in 1999 Radiolinja Estonia had 7% of entire Estonian carrier services market. Radiolinja is the one of the fastest growing telecom companies in Estonia, gaining both high new subscribers rate as well as turnover growth rates. In 2001, revenues increased by 60% as compared to the same period in 2000, amounting already 40 MEUR.
Tele2 (Levicom Broadband Ltd.)	TELE2 is a telecommunication company providing telephone, Internet and cable TV services. Owners of Tele2 are TELE2 AB and Levicom International Holdings BV. TELE2 entered Estonian mobile communication market in 1999 by acquiring ownership in Q-GSM, operated by Levicom Broadband. In addition to involvement in mobile communications market, Tele2 has been actively fought for the position in distance call market. As for the end of 2002 TELE2 had 248 000 subscribers, which comprise around 30% of total number of mobile communications subscribers. In 2002, TELE2 finally succeeded to become profitable to its owners – a fact many did not believe at the start of the company.
JOT Estonia	JOT Estonia is a company established in 1997 via foreign direct investment from JOT Automation Group (51%) and JOT Robotics (49%). Main field of activity of JOT Estonia is embedded in industrial automation production, which is entirely channeled to exports. JOT Estonia relays much on subcontracting work to telecom companies, though presently a reorientation on automotive electronics devices production is pursued. Export revenues and turnover of JOT Estonia amounted in 2000 for 37 MEUR5. JOT Estonia is one of the largest Estonian ICT exporters, and leading company in industrial automation domain. JOT Estonia employs altogether 200 people as for 2001.
Tarkon	Majority of shares owned by Swedish capital Hallbergs-Sekrom Fabriks AB as a result of privatization in 1996. Formerly, Tarkon was a military control apparatus plant and manufacturer of black boxes. Today Tarkon performs relatively important role in Estonian electronics industry. Likewise most of other local electronics plants, Tarkon is also orientated on subcontracting. Most of the subcontracting is done to Scandinavia, while largest partners are Elcoteq and Ericsson. Tarkon's turnover for 2000

	exceeded 11 MEUR and export 7 MEUR. Tarkon is an employer for 600 people.
MicroLink	The company was founded in August 1991. Up to 1995 MicroLink's activities were concentrated on PC assembly and wholesale and retail distribution of computer equipment in Estonia. Over the years the Company built an extensive resellers' and maintenance network across the Baltic countries. In 1995 MicroLink expanded its activities into system integration and Internet businesses, which soon became the core activities of the Company.
	Due to increasing competition and diminishing margins the Company decided to exit from wholesale operations by selling it to global distribution firm CHS Electronics in the end of 1996.
	Presently, Microlink is the largest Estonian IT company in the domain of retail distribution of computer equipment. In the PC assembly market Microlink holds leading position in Baltic states with 20% of market share. Annual turnover of Microlink is around 60 MEUR, including Baltic transactions. Total number of employees in Microlink is around 650 people.

Appendix 3. Various Internet benchmarks in Estonia

	Number / %	Reference time	Source
Number of real hosts by RIPE DNS hostcount	88 138	25 June 2002	RIPE NCC
People per host	15.4	June 2002	Calculated
Number of hosts per 1000 inhabitants	63.4	August 2002	Calculated
Number of domestic Internet access providers	109	Feb.2002	National Communications Board (NCB)
Number of households using dial-up connections to access the Internet	99 700	Feb. 2002	NCB
Number of clients using cable-TV lines to access the Internet	4 000	Feb.2002	Äripäev 15.03.02
Number of computers per 1000 inhabitants connected to the Internet	307	Feb. 2000	ESIS
Percent of private households with Internet connection	10%	2001	SOE
Number of Public Internet Access Points (PIAPs)	487	June 2002	Postimees, V@rav, 06.02.2002 http://www.regio.ee /ipunktid/
Number of PIAPs per 1000 inhabitants	0.36	June 2002	calculated
Percentage of public libraries providing Internet access to public	33%	2001	SOE