

WORKING PAPERS

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FACTORS AND IMPACTS IN THE INFORMATION SOCIETY A PROSPECTIVE ANALYSIS IN ESTONIA



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Preface

The present working paper has been prepared on the basis of a country monograph that was part of a wider project aiming at studying the factors and impacts of Information Society in the candidate countries.

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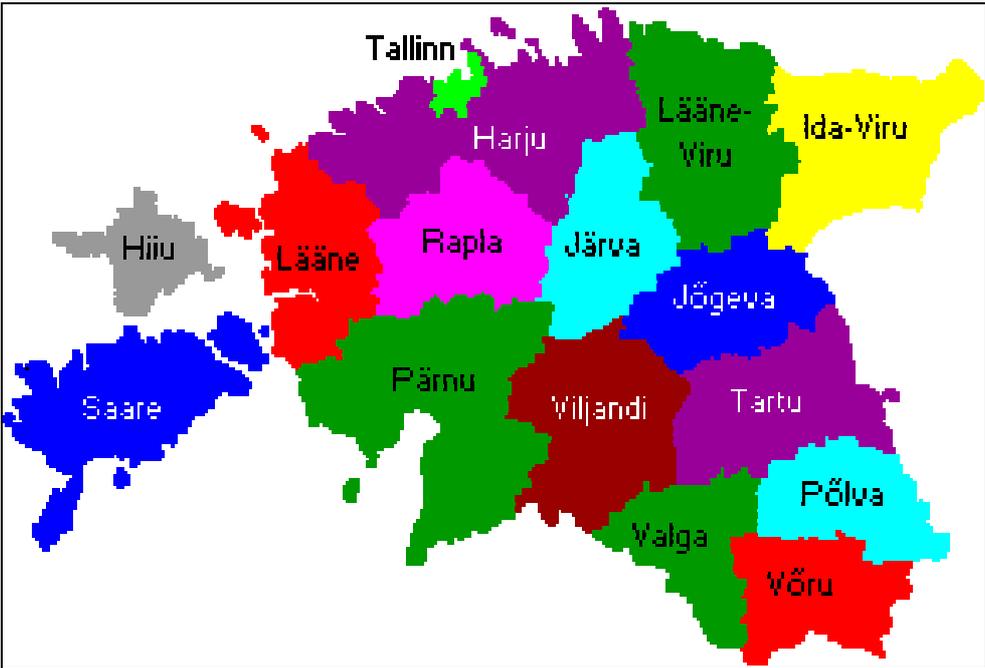
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COUNTRY PROFILE

Official name of the state	Republic of Estonia
Independence Day	24 February (1918)
Polity	Parliamentary
Capital city	Tallinn (as of 1 January 2003, 397 000 inhabitants or 29% of total population)
Official language	Estonian
National currency	Estonian kroon (1 kroon = 100 sents) <i>Estonian national currency, the kroon, was introduced on 20 June 1992. On 1 January 1999, the Bank of Estonia fixed the exchange rate between the Estonian kroon and the euro: 1 EUR = 15.6466 EEK</i>
Population	1 356 000 (as of 1 January 2003)
Ethnic composition	Estonians (67.9%), Russians (25.6%), other (6.5%) as of 2000 population census
Population density	30 inhabitants per km ²
Total area	45,227 km ²
Administrative division	15 counties, 39 cities, 8 cities without municipal status, 202 rural municipalities
Number of islands	1521
GDP per capita PPS in 2001 (EUR)	9260.0
GDP real growth rate in 2002	6.0
GDP composition in 2002 (%)	
agriculture	5.4
industry, construction	26.1
services	68.6
International trade in 2002 (MEUR)	
exports	3637.9
imports	5078.8
International reserves (MEUR)	957.7

Source: Statistical Office of Estonia, 2003

Administrative division of Estonia



I. INDUSTRIAL DEVELOPMENT AND COMPETITIVENESS

I.1. Changes in industrial and service sectors

I.1.1. Structure of industrial production

The main change in the GDP structure – growth of the contribution of services in parallel with the decline of agricultural output, was caused as mentioned above by the Russian 1998 default. Difficulties in export of foodstuffs to CIS markets squeezed demand for foodstuffs and agricultural exports. It resulted in changes in GDP and industrial output structures.

Industry contributes approximately one-fourth of Estonia's total value added (Table 1). In 1993-1999, the share of industry in value added dropped to 21.2%, but in 2000 began to increase slightly. Industry also accounted for about one-fourth of the employment rates in 2002.

Table 1.: Share of industries in value added at current prices, %

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Value added total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Industry	25.9	25.4	24.5	23.8	23.0	22.6	21.2	22.7	22.7	22.9
Mining and quarrying	1.8	1.8	1.6	1.6	1.5	1.2	1.1	1.0	1.0	1.1
Manufacturing	20.5	20.3	19.0	18.1	18.0	17.7	16.5	18.1	18.4	18.6
Electricity, gas and water supply	3.6	3.3	3.9	4.1	3.5	3.7	3.6	3.3	3.3	3.2

Source: Statistical Office of Estonia, 2003¹

The aforementioned Russian 1998 default caused a contraction in manufacturing in 1999. However, the burst of ICT bubble and decline of Nordic oriented subcontracting in 2001 and 2002 was survived rather well with smaller growth rates in manufacturing only. The contribution of manufacturing in total value added followed the U-curve. Along with the deindustrialisation and decay of CIS-oriented exports the share of manufacturing declined from 20.5% in 1993 to 16.5% in 1999 and then grew again to 18.6% in 2002. The growth of value added in transport, storage and communication as well as in real estate, renting and business activities was mainly responsible for the general GDP dynamics.

Since 1996, the feature characterising the development of industrial sector was high adaptability with external shocks, which was mainly due to successful privatisation and the ensuing active process of reconstruction that followed. Most of the large industrial enterprises in Estonia were privatised before 1997. The relative share of private sector in Estonia's GDP has exceeded 75% (Estonian, 2004²). Other distinguishing features of Estonia's industry are the high share of traditional branches (food, light and machinery and equipment) and dependence upon developments in the world business environment.

Within industry, the most important structural change was the declining contribution of foodstuffs that was simultaneous with the growing contribution of wood products. The share of food products and beverages in total industrial output declined from 37.7% in 1993 to 20.6% in 2001, but the share of wood increased from 3.5% to 10.7% in the same period (Table 2). The shift from exports of logs to processed wood products and final goods is going

¹ <http://gatekeeper.stat.ee:8000/px-web.2001/Dialog/statfileri.asp>

² <http://www.fin.ee/index.php?id=5119>

to add more value to forest resources. Nevertheless, as compared to Nordic countries, much more value might have been added to timber. There are already concerns related to over-exploitation of Estonian forests.

Table 2.: Structure of industrial production, % of output at current prices

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Economic activities total	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Energy supply	12.7	14.6	13.5	13.3	11.5	11.0	12.2	8.5	11.5
Mining	4.7	4.6	4.5	4.9	4.4	3.8	4.1	3.5	3.8
Manufacturing	82.6	80.7	81.9	81.7	84.1	85.2	83.6	88.0	84.8
.. manufacture of food products and beverages	37.7	32.8	28.9	27.2	27.0	24.5	20.2	18.9	20.6
.. manufacture of textiles	4.6	4.6	5.9	6.9	6.4	6.3	6.0	6.5	6.9
.. manufacture of wood	3.5	4.6	6.7	6.5	8.3	9.1	11.2	12.1	10.7
.. manufacture of pulp, paper and paper products	0.3	0.6	1.0	1.3	1.6	1.7	1.8	2.1	2.4
.. manufacture of machinery and equipment	2.3	2.5	2.0	2.2	1.9	2.1	2.2	2.7	2.7
.. manufacture of metals and fabricated metal products	2.7	3.1	3.8	4.5	4.8	5.9	4.9	6.2	4.9

Source: Statistical Office of Estonia, 2003³

The role of various manufacturing sectors has changed considerably. The number of rising sectors in industry is relatively bigger than that of declining sectors and the share of the rising sectors in industrial output has increased more than the share of the declining sectors has decreased (Table 3). The share of manufacture of machinery and equipment (including office machinery and computers, electrical machinery and apparatus) has increased from 3.8% to 5.4% of industrial production in 2001.

Table 3.: Share of industrial output at current prices, %

	1993	1994	1995	1996	1997	1998	1999	2000	2001
Rising									
..manufacture of wood	3.5	4.6	6.7	6.5	8.3	9.1	11.2	12.1	10.7
..manufacture of paper and paper products	0.3	0.6	1.0	1.3	1.6	1.7	1.8	2.1	2.4
..manufacture of textiles	4.6	4.6	5.9	6.9	6.4	6.3	6.0	6.5	6.9
..manufacture of rubber and plastic products	0.9	1.0	1.2	1.3	2.2	1.9	2.0	2.7	2.5
..manufacture of other non-metallic mineral products	3.7	4.7	3.8	3.8	3.9	4.6	4.2	4.4	4.2
..manufacture of metals and fabricated metal products	2.7	3.1	3.8	4.5	4.8	5.9	4.9	6.2	4.9
..manufacture of machinery and equipment	2.3	2.5	2.0	2.2	1.9	2.1	2.2	2.7	2.7
..manufacture of office machinery and computers	0.1	0.2	0.5	0.4	0.5	0.9	0.6	0.5	0.5
..manufacture of electrical machinery and apparatus	1.4	1.5	1.6	1.6	1.5	1.3	1.7	2.0	2.2
..manufacture of radio, television and communication equipment and apparatus	0.5	0.3	0.4	1.0	1.1	1.2	1.5	2.3	2.2
..manufacture of medical, precision and	0.8	0.7	0.6	0.6	1.0	1.7	1.7	2.0	1.4

³ <http://gatekeeper.stat.ee:8000/px-web.2001/Dialog/statfileri.asp>

optical instruments, watches and clocks									
..manufacture of furniture and other manufactured goods	5.0	5.0	5.3	5.4	6.4	6.5	6.8	6.6	6.9
Declining									
..manufacture of food products and beverages	37.7	32.8	28.9	27.2	27.0	24.5	20.2	18.9	20.6
..publishing, printing and reproduction of recorded media	3.0	2.5	3.6	3.7	3.5	4.5	5.0	4.3	1.6
..manufacture of chemicals and chemical products	6.7	7.6	8.0	7.2	6.1	5.2	4.2	4.6	5.3
..manufacture of motor vehicles, trailers and semi-trailers	2.4	2.1	1.8	1.6	1.7	1.3	1.6	1.6	2.1
..manufacture of other transport equipment	1.6	2.0	1.9	1.7	1.5	1.6	1.7	1.7	1.5

Source: Statistical Office of Estonia, 2003⁴

In manufacturing, a more than 9-fold output growth (at comparable prices) can be traced in the manufacture of paper and paper products (in 1993-2002), a more than 6-fold growth in the manufacture of wood, an almost 6-fold growth in the manufacture of rubber and plastic products and a 5-fold growth in the production of office machinery and computers (Table 4). Output of food products and beverages has stabilised approximately at the level of 80% of the 1993 volume, output of chemicals at about 90% of the 1993 volume.

Table 4.: Industrial production by some sectors, volume indices at comparable prices (1993 = 1)

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Economic activities total	1.000	0.969	0.989	1.017	1.164	1.212	1.172	1.342	1.434	1.499
Energy supply	1.000	0.976	0.957	1.016	0.985	0.949	0.897	0.902	0.912	0.923
Mining	1.000	0.989	0.945	1.000	0.996	0.953	0.822	0.864	0.902	1.036
Manufacturing	1.000	0.968	0.996	1.018	1.206	1.275	1.242	1.450	1.561	1.630
..manufacture of food products and beverages	1.000	0.896	0.867	0.796	0.931	0.886	0.720	0.772	0.817	0.820
..manufacture of wood	1.000	1.449	1.770	2.454	3.359	4.110	5.060	6.011	6.492	6.751
..manufacture of paper and paper products	1.000	1.667	2.437	2.782	3.839	4.609	4.908	7.149	7.743	9.315
..manufacture of chemicals and chemical products	1.000	1.133	1.228	1.197	1.203	1.006	0.950	0.958	0.932	0.881
..manufacture of rubber and plastic products	1.000	1.728	1.874	2.322	3.509	4.026	3.731	4.781	5.641	5.901
..manufacture of office machinery and computers	1.000	2.088	2.383	2.938	4.221	4.517	4.011	3.570	4.276	5.311
..manufacture of radio, television and communication equipment and apparatus	1.000	0.373	0.343	0.373	0.428	0.620	0.759	1.187	0.560	0.550

Source: Statistical Office of Estonia, 2003⁵

Subcontracting for foreign producers has important role in the development of Estonian industry. This can be characterised as follows: Estonian industry relies upon exports (approximately 50% of total production) and approximately 50% of the export of goods goes through subcontracting for contemporary machinery and equipment, mostly managed by

⁴ <http://gatekeeper.stat.ee:8000/px-web.2001/Dialog/statfileri.asp>

⁵ <http://gatekeeper.stat.ee:8000/px-web.2001/Dialog/statfileri.asp>

subsidiaries of large Nordic corporations in Estonia (Estonian, 2004⁶). Despite the importance of subcontracting in the economic development until now, some replacement of subcontracting with original Estonian production is needed. In order to change the status of cheap subcontractor, Estonia needs a comprehensive economic policy aimed at increasing technological and organisational efficiency via using of new knowledge and technologies. The most important factors of that are transparent innovation policies in strategic development plans and well-targeted education and training policies

Although concentration of industry in the Northern Estonia (Harju county including Tallinn) has decreased over last years, in 2001, still more than one-third of industrial output was produced in Northern Estonia (45.7% in 1995) and 15.9% in North-eastern Estonia (Ida-Viru county) (Table 5).

Table 5.: Structure of industrial production by counties at current prices , %⁷

	1995	1999	2000	2001
Whole country	100.0	100.0	100.0	100.0
Harju county	45.7	42.8	38.8	39.0
..Tallinn	39.2	33.4	30.3	30.5
Hiiu county	0.4	0.3	0.3	0.3
Ida-Viru county	17.0	17.5	17.8	15.9
Jõgeva county	1.2	0.8	0.8	0.9
Järva county	2.3	2.2	3.0	2.7
Lääne county	1.0	1.2	1.0	1.2
Lääne-Viru county	5.6	5.3	4.9	4.9
Põlva county	1.7	0.8	1.2	1.5
Pärnu county	5.0	5.6	5.8	5.9
Rapla county	1.7	2.1	2.3	2.2
Saare county	1.9	1.2	1.2	1.5
Tartu county	5.6	7.0	6.0	6.1
Valga county	1.5	1.7	1.5	1.6
Viljandi county	2.3	2.8	2.9	3.2
Võru county	1.2	2.2	2.0	2.2
Not divided by county	6.0	6.7	10.5	10.9

Source: Regional Statistics of Estonia, 2003⁸

The processes that most strongly affected Estonian regional economic development (Estonian, 2004⁹) can be summarised as follows:

- The re-orientation of foreign trade to the West and the increasing inflow of foreign investments have been positive, above all, for Tallinn and its hinterlands and Western Estonia (about 80% of foreign investment have been made in Tallinn), problems with the access to the Eastern market have had the most negative impact in South-Estonia and North-eastern Estonia due to the structure of economy and relatively low level of entrepreneurship development in these regions,

⁶ <http://www.fin.ee/index.php?id=5119>

⁷ Data on totally surveyed enterprises have been presented by counties. Data on enterprises surveyed by simple random sampling have not been divided by counties

⁸ <http://gatekeeper.stat.ee:8000/px-web.2001/Dialog/statfileri.asp>

⁹ <http://www.fin.ee/index.php?id=5119>

- Private business has been more active in Tallinn and other major cities (Pärnu, Tartu) and Western Estonia. Entrepreneurship has been rather low in North-eastern Estonia where the population is still mentally attached to large-scale industry and should be considered as being in a special situation both culturally and linguistically. As the relative share of Russian-speaking population amounts to 80% in this area, better access to Internet and broader use of computers should serve as the basis for development of entrepreneurship and social inclusion of Russian-speaking population in this region,
- Agricultural production and employment in agriculture have dropped drastically. This process has caused a decline of income and increase of unemployment in rural areas. In the counties where the development of other economic sectors has failed to compensate for the regression of agriculture the socio-economic situation has become rather unfavourable – especially in Põlva, Jõgeva, Valga, Võru and Viljandi counties,
- The development of transit trade has, above all, facilitated the development of the area surrounding Tallinn and a transit corridor going to St. Petersburg. The development of tourism has, above all, facilitated the development of Tallinn and West-Estonian counties,
- Development of education and culture has increased the opportunities for self-realisation and entertainment in Tallinn and other larger centres and simultaneously, the availability of high-quality education and opportunities for enjoying cultural life have become rather scarce in the outermost regions.

For better expression of disparities across counties, socio-economic indicators were transformed into a county development index (Estonian, 2004¹⁰). The development index was derived by adding up a series of numbers of net sales, revenues of enterprises, investments made into capital assets, monthly income of household member and employment rate indicators (the smaller the value of the county development index, the better the socio-economic situation in respective county). The analysis indicates that the county development index varies substantially - from 6-7 (Tartu and Harju (together with Tallinn)) to 41-43 (Jõgeva and Põlva counties).

Attempts have been made in Estonia to balance regional development with some assistance from regional policy. Since 1996, regional development programs have used to channel financial assistance to rural areas, mono-functional settlements and several outermost regions. Since 1997, the co-ordination of **regional development** in Estonia has been conducted by the Regional Development Agency (ERDA) (Enterprise Estonia, 2004¹¹). ERDA is a subunit of Enterprise Estonia (EAS) whose main purpose is to organise the targeted, flexible and co-ordinated use of state funds and other funds allocated for regional development of the country and to the **Business Support System**, based on the basic documents of the national business development policy and regional development policy. The business system network consists of the Regional Development Agency (ERDA), business support centres providing minimum services on contractual basis, and the business consultants belonging to the list of consultants of the ERDA.

While the production growth of Estonian industry has been fastest among the candidate countries, the productivity of labour is low (only 26% of the EU average), and in addition, real growth of productivity is much lower than the real growth of wages. Value added per employee in Estonian industry varied from 4.347 thousand EUR in manufacture of leather and

¹⁰<http://www.fin.ee/index.php?id=5119>

¹¹ <http://www.erda.ee>

leather products to 11.030 thousand EUR in manufacture of pulp, paper and paper products in 2000 (Table 6).

Table 6.: Industrial production, value added per employee, EUR thous. (calculated on the basis on SNA value added data and employment in industry)

Code		1994	1995	1996	1997	1998	1999	2000
D	Manufacturing	2.268	3.075	4.042	4.609	5.549	6.147	7.591
DA	Manufacture of food products,							
	beverages and tobacco	3.255	4.313	4.847	4.983	5.796	7.212	8.552
DB.17	Manufacture of textiles	1.446	2.024	4.606	6.544	4.449	5.195	6.042
DB.18	Manufacture of wearing apparel;							
	dressings and dyeing of fur	1.583	2.334	2.401	2.804	3.438	3.424	4.436
DC	Manufacture of leather and leather products	1.552	1.816	2.865	3.056	3.591	4.400	4.347
DD	Manufacture of wood and wood products	1.493	2.097	3.283	3.394	4.983	5.956	8.618
DE.21	Manufacture of pulp, paper and paper products	1.537	3.248	4.428	8.455	9.840	8.457	11.030
DE.22	Printing and publishing	2.426	4.654	5.709	5.004	7.822	7.786	10.665
DG	Manufacture of chemicals, chemical products							
	and man-made fibres	3.389	2.813	4.771	4.416	4.700	7.189	10.429
DH	Manufacture of rubber and plastic products	1.753	4.458	4.233	7.862	7.712	6.334	9.185
DI	Manufacture of other non-metallic mineral products	2.741	3.161	4.312	6.705	9.429	9.735	10.221
DJ	Manufacture of basic metals and fabricated metal products							
		2.345	3.184	4.086	4.091	6.480	7.649	8.604
DK	Manufacture of machinery and equipment n.e.c.	1.403	2.441	3.601	3.390	4.464	4.006	7.243
DL	Manufacture of electrical and optical equipment	1.427	2.382	3.261	4.841	6.215	6.317	6.923
DM	Manufacture of transport equipment	4.540	5.192	5.719	7.283	8.828	9.334	10.203
DN.36	Manufacture of furniture	1.525	2.226	2.911	3.511	3.862	4.851	5.397
DN.37	Recycling, manufacturing n.e.c.	8.111	8.057	15.306	27.206	23.348	6.345	8.184

Source: Statistical Office of Estonia, 2003¹²

During the period 1993-2001, the growth of productivity of labour was fastest in 2000 compared with 1999 (17.6%), especially in the manufacture of grain mill products (2.2 times), and in the manufacture of machinery and equipment (1.6 times) (Table 7). According to the Ministry of Economic Affairs and Communications (2002b), the stable growth in light industry has been due to the relatively high external demand. The slower growth of wood processing industry in 2001 compared with previous years was due to the decline in felling volumes and fall of sawn timber prices. The growth of furniture industry has been quite stable in recent years. Slowing down of the paper industry growth was also due to the lower external demand. The decline in external demand also curbed the engineering industry growth compared with 2000.

Table 7.: Industrial production per employee by economic activity at constant prices, previous year = 100

¹² <http://gatekeeper.stat.ee:8000/px-web.2001/Dialog/statfileri.asp>

	1994	1995	1996	1997	1998	1999	2000	2001
Economic activities total	109.4	108.4	105.8	115.4	102.2	104.2	117.6	115.3
Energy supply	186.3	97.2	110.7	99.0	84.2	95.3	144.2	137.3
Mining	100.5	99.0	107.6	105.6	100.5	97.1	123.4	108.9
Manufacturing	102.0	110.4	105.1	118.7	104.4	105.6	115.3	114.4
..manufacture of food products and beverages	90.7	103.1	96.9	114.5	98.3	98.3	114.3	118.7
....manufacture of grain mill products	107.3	95.4	81.5	104.0	142.9	81.4	220.6	214.8
..manufacture of textiles	104.7	157.8	150.6	127.2	98.1	144.2	114.8	111.2
..manufacture of wearing apparel	87.0	100.6	93.4	92.8	103.3	105.5	118.0	112.7
..tanning and dressing of leather and manufacture of footwear	105.3	110.8	101.8	120.9	116.6	103.4	114.6	101.2
..manufacture of wood	151.1	123.2	135.3	134.3	110.7	120.3	127.5	111.1
..manufacture of paper and paper products	210.9	104.4	94.8	134.9	116.1	110.5	125.3	104.5
..publishing, printing and reproduction of recorded media	104.4	95.5	89.7	105.2	105.6	113.3	114.3	121.4
..manufacture of chemicals and chemical products	148.6	127.2	100.9	110.5	99.9	101.1	99.8	116.9
..manufacture of rubber and plastic products	159.3	114.1	116.9	133.2	107.6	93.8	108.7	121.1
..manufacture of other non-metallic mineral products	113.8	98.8	101.7	129.9	106.1	93.8	109.3	106.2
..manufacture of metals and fabricated metal products	121.4	116.8	110.1	119.7	123.2	93.6	110.6	115.9
..manufacture of machinery and equipment	116.4	126.6	108.3	125.3	110.8	100.2	156.4	123.5
..manufacture of office machinery and computers	155.1	80.9	102.8	124.1	85.8	79.0	97.9	100.3
..manufacture of electrical machinery and apparatus	94.9	124.2	99.9	112.6	127.0	120.2	97.3	111.2
..manufacture of radio, television and communication equipment and apparatus	47.0	91.1	97.5	82.0	116.4	102.2	108.5	125.7
..manufacture of medical, precision and optical instruments, watches and clocks	79.8	109.4	102.1	163.5	187.7	128.9	125.1	79.9
..manufacture of motor vehicles, trailers and semi-trailers	70.4	89.0	114.2	125.7	94.5	130.1	115.7	125.4
..manufacture of other transport equipment	80.4	79.0	111.9	115.7	125.3	109.6	121.9	144.7
..manufacture of furniture and other manufactured goods	130.2	117.7	115.5	126.0	100.8	110.5	112.8	113.9
....manufacture of furniture	128.2	118.7	114.1	118.8	102.6	109.4	112.0	113.9
..other manufacturing n.e.c.	101.9	113.8	143.9	75.2	115.0	82.4	138.0	91.5

Source: Statistical Office of Estonia¹³,

According to the labour productivity indicator of Estonian industry Estonia belongs to the lowest group of EU and candidate countries (share of labour productivity indicator 20-40% of EU average) (Statistics, 2001). Among candidate countries, Estonia appears to be the laggard together with Poland by the level of labour productivity (Facchini, 2003). The labour productivity is low mostly because of insufficient product development, limited search for innovative solutions and a large number of employees with qualification not matching the changed demand of the labour market, and also because most of the industrial output is produced in labour-intensive sectors of industry. Specific factor contributing to the low

¹³ <http://gatekeeper.stat.ee:8000/px-web.2001/Dialog/statfileri.asp>

productivity in Estonia is production of electrical energy on the basis of oil shale (91% of the electricity in 2001, (Estonian, 2004¹⁴).

Tiits *et al* (2003) have classified Estonian industries belonging mostly into the groups ‘supplier-dominated activities’ (agriculture, textile industry, forestry)¹⁵ and ‘production-intensive activities’, the most significant factor to enable growth of productivity has been the introduction of new foreign technologies. However, the quality of foreign investments and technology transfer is growing to be increasingly important, and the latter largely depends on the quality of domestic industry and labour market. So far, investments in Estonia have been mainly resource intensive and low-skilled labour targeted. Mainly owing to technology transfer, but also due to organisational changes and introduction of new methods of management and reorganisation of business processes, the annual growth of productivity in manufacturing has been on average 8%. The industries with the highest productivity growth is characterised by the decreasing employment (jobless growth industries) because it is based on capital investments, which indicates that the Estonian economy is in the investment-based development phase (Tiits *et al*, 2003).

I.1.2. Structure of service sector

The most important development in the distribution of economic activity in Estonia has been the substantial increase in the share of services sector over the last decade. In a changed economic situation, services have become critical for the survival of a business. In Estonia like in all candidate countries, trade, marketing, juridical services, real estate and business services, transportation and communications, financial intermediation and insurance have become increasingly more important, providing network-like connections between producers as well as between producers and consumers. While in 1996 the share of employment in tertiary or service sector was 56.5% of total employment, then by 2001 it had increased to 60.1% (Estonian, 2004¹⁶). The share of the service sector in provision of value added increased during the same period from 61.7% to 65.4%. In the period 1993-2002, the share of transport, storage and communications in total value added increased from 12.9% to 15.9%, real estate, renting and business activities from 7.8% to 11.1% and financial intermediation from 3.8% to 4.4%, respectively (Table 8).

Table 8.: Share of service sector in total value added, %

	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002
Wholesale and retail trade of vehicles, motorbikes and personal items and home appliances	15.2	13.9	14.8	15.8	15.1	14.9	14.4	13.9	14.2	14.6
Hotels and restaurants	1.4	1.2	1.2	1.4	1.3	1.3	1.4	1.5	1.4	1.5
Transport, storage and communication	12.9	11.9	10.9	11.4	12.8	14.3	15.2	16.3	16.4	15.9
Real estate, renting and business activities	7.8	8.8	10.3	10.0	10.4	11.1	11.2	11.0	11.3	11.1
Financial intermediation	3.8	4.2	3.6	3.9	4.2	3.6	4.0	4.1	4.3	4.4
Public administration and defence; compulsory social security	3.4	4.5	4.9	4.7	4.6	4.4	5.1	4.7	4.5	4.6
Education	5.6	5.7	6.1	5.7	5.5	5.5	6.1	5.7	5.4	5.5

¹⁴ <http://www.fin.ee/index.php?id=5119>

¹⁵ see Pavitt, K. (1984). Sectoral Patterns of Technical Change: Towards a Taxonomy and a Theory. Research Policy, 13. pp. 343-373.

¹⁶ <http://www.fin.ee/index.php?id=5119>

Health and social work	2.6	3.6	4.1	4.3	3.9	3.7	4.0	3.6	3.4	3.3
Other community, social and personal service activities	3.9	3.9	4.4	4.5	5.0	4.8	4.8	4.6	4.5	4.5
Service sector in total	56.6	57.7	60.3	61.7	62.8	63.6	66.2	65.4	65.4	65.4

Source: Statistical Office of Estonia, 2003¹⁷

In the structure of total net sales, the sales of services have constituted about ¾ (Table 9). In sales of services, business services (advertising services, architecture and technical engineering consultations, security and guard services) have had the highest share (about 75%). The share of renting and particularly personal services declined to 6.2% of sales of services, but the share of computer services rose (from 9.6% to 11.5%) in the period 1994-2000. During these years, the structure of computer services changed significantly – the share of creation of databases declined from 47.3% to 12.2%, but the increase in the share of other computer services (maintenance and repair of office equipment and computers and others) was notable (from 32.4% to 73.7).

Table 9.: Changes in the structure of services (sales of renting, computer, business and personal service activities) at current prices, %

	1994	1995	1996	1997	1998	1999	2000
Sales of services total	68.5	73.4	72.6	70.9	78.9	75.1	72.8
Renting services	4.6	3.3	3.0	2.8	4.9	4.7	4.5
Computer and related services	6.6	10.7	8.9	9.6	8.0	8.2	8.4
..data processing	1.1	0.8	1.5	1.1	0.9	0.6	0.7
..creation of databases	3.1	4.8	3.9	2.4	1.4	1.0	1.0
..maintenance and repair of office equipment and computers	0.3	0.3	0.7	0.8	0.7	0.7	0.5
..other computer services	2.1	4.8	2.9	5.6	5.0	5.9	6.2
Business services	50.8	55.1	56.5	54.9	62.2	58.5	56.4
Personal services	6.4	4.3	4.1	3.7	3.8	3.7	3.6
Other sales revenue	31.5	26.6	27.4	29.1	21.1	24.9	27.2
Net sales	100.0	100.0	100.0	100.0	100.0	100.0	100.0

Source: Statistical Office of Estonia, 2003¹⁸

The development of services sector is characterised by the improved quality and rapid growth of prices – the prices of services are approaching the world market prices and in 2001, were twice as high as in 1995. The development of the tertiary sector has been encouraged both by domestic and foreign demand. In the period 1996-2001, the productivity (GDP in fixed prices per employee) of services sector increased by one-third, while the export of services increased threefold (Estonian, 2004¹⁹). The trade balance deficit was balanced by export of transport and travel services. Tourism has turned one of the more important branches of the economy. If to assess direct indicators, the share of foreign tourism in GDP comes to 8% (7% of employed) and the indicator may even total 15% if to consider the indirect impacts.

In the small and very open Estonian economy, not only output of manufacturing is tradable on foreign markets. So are transport services (Estonia earns a lot from servicing Russian transit flows and there is severe competition between ports and shipping companies to attract these

¹⁷ <http://gatekeeper.stat.ee:8000/px-web.2001/Dialog/statfileri.asp>

¹⁸ <http://gatekeeper.stat.ee:8000/px-web.2001/Dialog/statfileri.asp>

¹⁹ <http://www.fin.ee/index.php?id=5119>

flows). A similar competition goes between cities and regions for attracting tourist flows. Within the context of this study it is to be mentioned that for attracting foreign tourists (and local visitors) many Estonian hotels and restaurants offer WiFi Internet access to their customers and quite often this access is free of charge²⁰.

As many Finns have real estate in Estonia, they are customers of real estate brokers, construction companies etc. Simultaneously, several Finnish construction companies work in Estonia and Estonian companies do some works in Finland. Small Estonia cannot offer all kind of medical treatment – for some very rare diseases medical doctors have not enough experience and these patients are to be treated abroad. Simultaneously, as many medical procedures are cheaper in Estonia than in Nordic countries, these services are offered to Finnish and Swedish patients in Estonian hospitals and spas (from dental treatment to plastic or cardiovascular surgery). There is international competition between universities both for students and professors; the same applies to research grants and researchers etc. Thus, international competition is practically everywhere and almost every economic activity can be competitive in a liberal and unprotected economy. Therefore it is difficult to attribute competitiveness to the structure of economy or some activity only.

I.2. Investments and innovation activity

Investments are the main precondition for ensuring and improving competitiveness of the Estonian economy. The yearly growth rate of gross fixed capital formation has been about 10% since 1997 (except 1999) and its share has increased to 94.1% in gross capital formation, forming 1 611 MEUR in 2001 (90.7% in 1993) (Table 10). The steps to open the Estonian economy and achieve macroeconomic equilibrium in the second half of 1990s gave an impetus to a fast development of Estonia into an investment-based economy. Similarly to other countries in the same development phase, privatisation opened up a way to foreign capital inflow that signified so much for the economic growth in Estonia. Privatisation has been one of the main factors that have influenced the inflow of foreign investments: in the period 1997-1999, 60% of Estonia's privatisation proceeds were foreign capital and privatisation to foreign capital accounted for 70% of the foreign direct investments into Estonia (EBRD, 2000).

Table 10.: Changes in investment

	1993	1994	1995	1996	1997	1998	1999	2000	2001
changes in investment at current prices, MEUR									
Gross capital formation	376.4	533.2	734.3	967.2	1266.5	1366.8	1196.1	1550.0	1711.2
Gross fixed capital formation	341.4	521.5	713.7	929.8	1146.3	1378.8	1215.8	1418.4	1611.0
Change in inventories	35.0	11.8	20.6	37.4	120.1	-12.0	-19.7	131.6	100.2
changes in investment at constant prices, % change y-on-y									
Gross fixed capital formation		6.3	4.1	11.4	17.6	11.3	-14.8	13.3	9.1
Change in inventories		-72.2	41.3	53.5	225.7	-26.0

Source: Statistical Office of Estonia, 2003²¹

The Estonian industry has not been the main attraction for foreign investors, which is due to the weakness of the sector, on the one hand, and the relative strength of the transport and

²⁰ <http://www.wifi.ee/?p=area&lang=eng>

²¹ <http://gatekeeper.stat.ee:8000/px-web.2001/Dialog/statfileri.asp>

financial sector, on the other hand. By 1998, the Estonian industry had not increased much on account of new foreign investment based enterprises. The main growth had been due to the expansion of the existing foreign investments based enterprises. Estonia as a country with small contemporary industrial experience had not yet developed into a foreign capital export targeted production base. The developments in this direction have been detected only in recent years when various Scandinavian enterprises have started more extensively to transfer more labour-intensive productions from their country to Estonia. The presence of foreign capital in 1995-1999 generally provided modernisation of domestic enterprises with a positive spill-over. In most of the industrial sectors, foreign participation in sales and capitalisation is higher than in employment (Tiits *et al*, 2003).

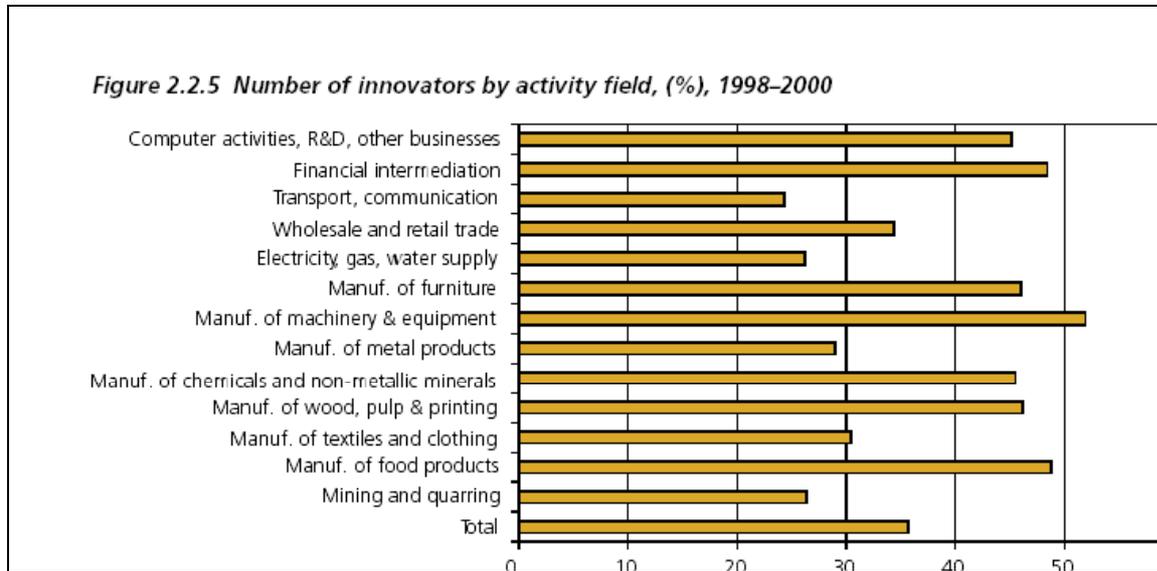
The presence of foreign capital has had different effects on Estonian enterprises. Large domestic firms work out their development plans themselves and they gain from investment into intellectual property, new equipment and human resources rather than the new technology related spill-over. Small enterprises, however, benefit a lot from the spill-over effect by demonstrating and imitating new technology and from co-operation with foreign capital based enterprises, because they are not themselves capable of increasing the advantage of the spill-over of investing into intellectual property, equipment and human capital but instead, may even lose some skilled labour force (Sinani and Meyer, 2001).

Estonia like other Central and Eastern European transition countries has a revealed comparative advantage mostly in resource-intensive wood and furniture industry, to a less extent in labour-intensive textile and oil shale industries. Capital- and technology-intensive industries (chemical industry, machinery and equipment) are at the same time relatively less competitive. Tiits *et al* (2003) has stated that openness of the economy and foreign investments do not automatically induce a change in the structure of industry toward higher knowledge and skills intensity - rather vice versa.

Due to the different innovation processes taking place in different countries, we cannot use a common indicator of innovativeness in the same way for all of them. Therefore, in international comparisons we should discuss countries in the investment and innovation phase separately as in the former, the main motive power of the technological development is introduction of new technology (technology transfer), in the latter, research and development for the elaboration of new technologies (Tiits *et al*, 2003). Rearrangements and large capital investments in the Estonian industrial and service sectors explain the high rate of innovative enterprises in Estonia, which was 36% of the total number of enterprises in 2002 (Kurik *et al*, 2002). According to this survey (based on the EU Community Innovation Survey methods), the Estonian industrial sector spent 2.3% of its turnover on innovation, the service sector only 0.8%. Innovative or modernised products for enterprises accounted for 17% of the industrial sales.

The most innovative economic sectors in Estonia (Figure 1) are financial intermediation, computer and R&D related business on the services side and manufacturing of machinery and equipment, food, furniture and wood processing in manufacturing (Kurik *et al*, 2002). Financial enterprises in general are active and expansive in Estonia and outstanding especially in implementing new ICT solutions. Also, the biggest innovators among the machinery producers are tele- and communication apparatus developers and producers of medical-optical instruments.

It can be noticed that enterprises with foreign capital are 1.5 times more innovative than enterprises without it. The enterprises that belong to a concern are almost two times more innovative than those outside the concerns. The first mentioned result is not unique as several surveys conducted in other Central and Eastern European countries have also indicated that foreign capital is the leading agent of innovation in post-socialist countries. The second conclusion is also rather logical: small enterprises are usually not capable of carrying out serious innovations on their own.



Source: Kurik *et al*, 2002

Figure 1. Number of innovators by activity field in 1998-2000, %

By the type of dominating market, enterprises with domestic and foreign orientation are almost on the same level of innovativeness (respectively 38.6% and 30.1% of all enterprises), but the share of innovators among the enterprises oriented to the local market (within 50 km radius) is by one-quarter lower (27.4%). It is surprising that enterprises oriented to Eastern (Russian and CIS) markets are even more innovative than those oriented to Western markets (41.8% and 38.7% respectively). 38% of the enterprises oriented to Eastern markets and only 30% of the Western-oriented firms made innovation expenditures in 2000. The above-mentioned empirical results are rather surprising as usually the Western markets are presumed to be more demanding compared to Eastern markets. One possible explanation could be that some enterprises working for Western oriented exports are based on rather stable products, which do not need frequent changes. And if innovations are made the innovation costs are carried by parent companies or clients. In Russian and CIS markets there have been more rapid changes and turbulence in recent years and adaptation to these changes has initiated some types of innovative behaviour. The dominantly export oriented enterprises are not as a rule very innovative, but such enterprises are mainly oriented to Western markets in Estonia. If the share of exports is over 90%, the intensity of innovation is lower than in enterprises (especially manufacturing) where the share of exports is 10%–90%.

Notwithstanding the increasing contribution of high tech manufacturing, the volume of high tech output is still quite small (Table 11). The contribution of high tech output has grown in parallel with the decline in the contribution of medium-high tech output while the share of output on lower technical levels has remained almost unchanged. Stable growth can be traced in the output of radio, television and communication equipment and apparatus (NACE code DL 32), of medical, precision and optical instruments (NACE code DL 33), while the

manufacture of office machinery and computers (NACE code DL 30) has declined after the peak in 1998.

Table 11.: Technological structure of the Estonian manufacturing²²

	1993	1994	1995	1996	1997	1998	1999	2000
Output in manufacturing, MEUR at current prices	776.5	1043.4	1444.1	1703.4	2167.8	2385.1	2252.2	2899.6
<i>From this in per cent</i>								
High tech manufacturing	1.7	1.5	1.8	2.5	3.2	4.3	4.6	5.4
Medium-high tech manufacturing	17.4	19.5	18.7	17.4	15.1	13.7	13.7	14.4
Other manufacturing	80.9	79.0	79.5	80.1	81.7	82.0	81.7	80.2
Total employment, thousand persons		692.6	656.1	645.6	617.2	606.5	579.3	572.5
<i>From this in per cent</i>								
High tech manufacturing**		0.76	0.85	0.83	0.90	0.93	1.05	1.44
Medium-high tech manufacturing**		4.01	3.80	3.53	3.30	2.88	2.56	2.56

Source: Authors calculations²³

The low contribution of high tech manufacturing is partly due to the aforementioned subcontracting. Due to the statistical methodology, subcontracting is included in output and sales with the value added only while other output is reported at current prices (that include also value of intermediate consumption).

The data on employment in manufacturing (24.8% of total employment) were calculated on the basis of output and output per employee by NACE codes. The results for 2000 matched quite well with data available from the population census of 31 March 2000. This calculation enabled to depict in Table 11 the dynamics of high tech employment in manufacturing.

Notwithstanding the declining employment in manufacturing by 17.5% during 1993-2002, the number of people employed in high tech manufacturing has increased. By calculations of authors the employment rate of activities that were classified as high tech manufacturing was 7% of total manufacturing employment.

Compared to EU-15 member states (unfortunately we do not have comparable data for other candidate countries) Estonia's percentage of employment in high-tech manufacturing in total employment (1.44% in 2000) is even slightly higher than the EU-15 average and it places Estonia between France and Sweden (Laafia, 2002).

However, we already expressed some concerns related to the content of the work in enterprises making subcontracts mainly, or whether it really classifies as high tech labour (with almost no R&D). Another problem is that employment in medium-high tech manufacturing is declining and was only 2.6% of total employment in 2000 while the EU-15 average was 6.2% of total employment. Employment in Estonia's high tech manufacturing grew by less than 3 thousand persons in 1994-2000 while more than 13 thousand jobs were lost in medium-high tech manufacturing. Medium-high tech manufacturing (machinery and mechanical appliances, articles of metal) was responsible for more than half of the total

²² Official data of the Statistical Office of Estonia are rearranged according to Eurostat's classification of activities based on the technical levels brought in the endnote of the paper

²³ Number of employees in manufacturing is calculated on the basis of industrial output and output per employee

employment decline in manufacturing. Estonian manufacturing does not seem to be an intensive IST or computer user.

According to the Estonian National Development Plan (Estonian, 2004²⁴), in order to realise the industry's potential for development, the Estonian industry should shift the focus from traditional industrial branches to manufacture of products with higher value added. It is important to apply new industrial technologies and to implement an innovative approach. The focus should be on development and establishment of technology-consuming enterprises with good potential for growth. It is important to switch from sub-contracting for foreign companies to development of original products. It would make sense to specialise in production of single products with a high potential as Estonian industry is too small to manufacture products, extending to whole branch. The potential of food processing industry is based on availability of domestic raw material supply – milk – and its conformity with EU quality requirements. Wood processing industry should advance the technological processes to manufacture complicated products, asking for higher processing level, as this is important for changing from raw material export to more profitable export of processed wooden products. Manufacture of apparatus has the best prospects as Estonia can make use of great number of researchers, engineers and relatively well-educated labour force of Estonia (Estonian, 2004²⁵). Further potential is seen in the girth and growth of completely new industries, such as microbiology, pharmacy and ICT (Estonian, 2004²⁶). The objective would be to turn from a country with low technological level and cheap labour resource into a country with high technological potential and qualified labour. Such a development can only be achieved with technological development promoting and supporting innovation. Further development has to be mostly supported by fast technological development and increased productivity. By the authors' opinion in general, institutional development with efficiently performing markets and low transaction costs combined with transparency of decision-making and credibility of economic policy may serve as cornerstones of competitiveness of Estonian industry.

I.3. The role of ICT industry

In the area of information technology, Estonia has traditionally been mainly a 'user' and less a 'producer'. From the socialist period Estonia inherited a rather highly concentrated economy with a few hundreds of state-owned industrial enterprises and several hundreds of agricultural enterprises. A majority of them had their computing centres with some kind of electronic data processing. Thus, there was some knowledge and experience in data-processing before economic restructuring and introduction of personal computers. In the result of the shift towards market economy, a completely new entrepreneurship structure was formed. New privately owned enterprises were eager to implement new information technology solutions to be more competitive. The process was also promoted by high involvement of Finnish and Swedish capital in Estonian economy. The Estonian subsidiaries of the Nordic companies tried to implement similar IT solutions as their host companies. Otherwise it would have been difficult to comply with the management and accounting culture of Nordic companies.

The development of the Estonian ICT sector has been gradual throughout the last decade, from low value added computer assembling activity to higher value added software

²⁴<http://www.fin.ee/index.php?id=5119>

²⁵ <http://www.fin.ee/index.php?id=5119>

²⁶ <http://www.fin.ee/index.php?id=5119>

production and telecom services. The ICT market is shared between a few large corporations, which consolidate a substantial economic power and account for a dominant part of the entire Estonian ICT sector, and many small IT enterprises with lower market relevance, which specialise either in subcontracting, sell hardware and software or develop niche products. Eight most influential ICT companies are *Elcoteq Tallinn*, *Estonian Mobile Telephone*, *Estonian Telephone Company*, *Radiolinja*, *Ritabell*, *JOT Estonia*, *Tarkon* and *MicroLink*. These top 8 enterprises account for up to 80% of the total Estonian ICT market and thus shape to a large extent the main trends and developments in the ICT sector.

Among the telecommunication infrastructure *AS Eesti Telefon* (Estonian Telephone Company Ltd., since summer 2003 - Elion), a company with a big market force providing telephone, leased line and interconnection services. In the early 1990s, during the restructuring of the state enterprise for providing telephone services, a private company *Eesti Telekom* was established. Under the Concession Agreement from 1993 to 2001 the company's main telephone service provider *Eesti Telefon* (ET) established a new digital telephone network (72% of all lines were digital in 2001) and fulfilled the conditions for providing sophisticated telephone and Internet services across the country. As the company had held a monopoly position for 8 years, it was able to secure its position in the market even after the market was liberalised in 2001 (IT in, 2003). In 2002, ET succeeded to keep 89.2% of the fixed telephone market and more than half of the market of international calls. ET (Elion) has also established itself as the market leader for Internet dial-up service and ADSL connections (72.8% share of leased line services market). ET is a reseller of the international telecommunication services of the Infonet Services Corporation (www.infonet.com) in Estonia, providing access to services and infrastructure in more than 60 countries all over the world and to telecommunications networks in more than 180 countries (IT in, 2003).

The main competitors for Elion (ET) are *Tele2* and *Uninet (Radiolinja Group)*. After the liberalisation of the telecom market also for fixed and basic services, new operators have entered the Estonian market. In 2001, 64 operators and 110 companies were added to the existing 47 operators and 146 service providers. The largest increase has been among the data communication service providers - 53 companies received a licence in addition to the existing 44 companies (IT in, 2003).

The mobile operators' market is divided mainly between three operators - EMT (Estonian Mobile Telephone), *Radiolinja Eesti* and *Tele2*. Today EMT struggles to maintain half of the market. The main operators have covered the entire country with mobile networks. In co-operation of EMT and ET, a joint service of wireless Internet connection was introduced in December 2002, which enables to use the Internet without limit nearly anywhere in Estonia for a fixed monthly fee (IT in, 2003).

According to the European Information Technology Observatory (EITO) (2003), the estimated market for ICT products and services in 2003 was 857 MEUR (increase 17.2% compared with 2000). The short-term ICT market growth projection (for 2004 increase of 7.2%) is positive due to a number of factors driving investment, such as upcoming EU membership in 2004, infrastructure development and rising of FDI (EITO, 2003)

Based on EITO (2003) estimations, the value of the Estonian telecommunication market was 604 MEUR in 2003 (510 MEUR in 2001 and the share of telecommunication market value 8.2% of GDP). The telecommunication market value is predicted to grow 7.6% in 2004 (EITO, 2003). The share of telecommunications in ICT market has been about 70% (Table

12). Although further developments in the ICT sector are very much dependent on how dynamic the growth in computer services and software is, the share of software and services in total ICT market has been relatively low - about 12% over the last years.

Until the year 2000, the growth of ICT market was relatively fast with the annual average of approximately 20% and higher. However, in 2001 the growth rate declined to 0.1% coping with the global ICT downturn, but in 2002 rose again to 10% (Table 12). The software products growth rate dropped from 15.0% in 2001 to 7.7% in 2003, and that of IT services even more.

The telecom market decline stopped in 2002 (increased compared with 2001 9.9%) and being the engine of the ICT sector growth, is experiencing now a gradual stabilisation and even saturation in some domains (e.g. Internet subscribers).

Table 12.: Structure and change of Estonian ICT Market in 2000-2004, MEUR

	2000	2001	2002	2003	2004	2001/00 %	2002/01 %	2003/02 %	2004/03 %
Computer hardware	10.7	11.4	11.2	11.2	15.0	6.1	7.1	6.7	6.9
Office equipment	2.6	2.7	2.6	2.5	2.4	6.2	6.4	0.7	2.7
End user communication equipment	4.7	5.3	3.1	2.6	2.4	15.9	-36.2	-11.1	0.0
Datacom and network equipment	18.4	19.6	19.5	19.8	19.9	5.7	10.5	8.2	7.6
TOTAL ICT EQUIPMENT	36.4	39.0	36.4	36.1	35.8	7.2	2.8	5.5	6.5
Software products	4.0	4.6	4.9	4.9	4.7	15.0	15.5	7.7	4.1
IT services	6.7	7.3	7.6	7.1	7.2	9.9	14.5	-1.0	9.2
Carrier services	52.9	49.1	51.1	51.9	52.3	-7.1	14.3	8.4	7.7
TOTAL ICT	100.0	100.0	100.0	100.0	100.0	0.1	9.9	6.6	7.2
TOTAL IT	27.9	30.2	30.3	29.5	29.2	8.3	10.0	3.9	6.1
TOTAL TELE-COMMUNICATION	72.1	69.8	69.7	70.5	70.8	-3.1	9.9	7.8	7.6

Source: EITO, 2003

A number of factors (EITO, 2003) influence the ICT market growth in the CEE region. Some of the most important ones for Estonia are the following:

- EU accession as the important driver of ICT market growth and importance of the EU will only increase over time as more funding is earmarked for new Member States,
- FDI remains a notable driver,
- Introduction of ICT solutions for rendering services,
- ICT market shifts away from a hardware-specific focus and demand for IT services is growing strongly,
- Internet continues to represent a key driver of ICT spending as companies invest in basic Internet-related IT infrastructure, applications and services.

Although Estonia's IT spending (excluding spending on telecommunications) share is only 2.1% of the average spending of the CEE region, the ratio of Estonian IT investments to GDP was in 2002 higher than Western European average, respectively 3.8% and 3.33% (CEE average 2.6%) (EITO, 2003). Despite that an increasing share of GDP is being allocated for IT, the per capita IT spending (162 EUR) remains quite low (higher than CEE average but only 21.5% of Western European average (755 EUR)).

As mentioned already, the Estonian economy is very open and enjoys broad international contacts. When discussing Estonia's ICT sector it is to be considered that all main ICT companies are at least partly in foreign ownership or subsidiaries of Nordic companies. Thus, Estonian ITC companies work mostly in international environment.

Estonian international co-operation is complemented through membership of different organisations. Estonia is a member of:

- *Joint High Level Committee (JHLC)*, which is comprised of EU and CEEC government representatives;
- *International Council for Information Technology in Government Administration (ICA)* (<http://www.ica-it.org/>), established to promote the exchange of knowledge, ideas and experiences between Central Government IT Authorities;
- *Council of the Baltic Sea States (CBSS)*. The aim of the council is to promote and co-ordinate co-operation between the Baltic Sea States (<http://www.baltinfo.org/>);
- *Baltic Council of Ministers (BCM)* (<http://www.bcmvs.net/>), an institution for facilitating the co-operation between the governments of Estonia, Latvia and Lithuania, formally established in 1994;
- *E-governance academy*, a regional learning centre in Estonia, set up by the Republic of Estonia, United Nations Development Program (UNDP) and Information Program of Open Society Institute (OSI). The centre aims to promote the use of ICT in the work of governments and in democratic practices. The centre provides training in e-governance and e-democracy, serves as a platform of exchange of experience and conducts related research;
- *European Environment Information and Observation Network (EIONET)*, since January 2002 a full member.

Estonia has participated in the following international projects²⁷:

- *eEurope+ 2003*, the co-operation project for EU candidate countries to implement Information Society²⁸;
- *Northern eDimension²⁹ (NeD)*, a joint project of the Baltic Sea States (Denmark, Estonia, Finland, Germany, Iceland, Latvia, Lithuania, Norway, Poland, Russian Federation and Sweden) and the European Commission. The aim of the project is to develop co-operation in IT field and accelerate transition to information society;
- *European Survey of Information Society³⁰ (ESIS)*. The survey is a part of ESIS II project, initiated and financed by the European Commission in 1999-2000. During the survey, several reports are produced, describing information society developments in Estonia and other European countries;
- *Estonian eVikings³¹*. The project (2001) aims to strengthen the links between the Estonian and European IST research and development communities, starting with the closest neighbours around the Baltic Sea, but keeping still focus on Europe as a whole. It supports

²⁷ Information of the Department of State Information Systems (<http://www.riso.ee>), 27. Nov. 2002 .

²⁸ Information on eEurope+ at <http://www.europa.eu.int/eEuropeplus> and relevant press releases together with the conclusions at http://europa.eu.int/comm/gothenburg_council/eeurope_en.htm

²⁹ NeD Action Plan and the joint statement of ministers were adopted at the ministerial meeting in Riga on 28 September 2001. Estonia is one of the leaders of the joint political initiative and leads the workgroup of action line "ICT security", <http://www.riso.ee/nordic/>.

³⁰ There is a comprehensive database of information society projects, actions and contacts established (http://www.esis.ee/index_eng.html)

³¹ Special attention is paid to updating and giving advice for better focusing of the national research and technology policies. (<http://www.esis.ee/eVikings/index.en.html>)

the strife of the Estonian R&D labs to become modern eVikings of the Information Society, through assistance to introduction of new European co-operative research and development projects;

Interchange of Data between Administrations (IDA) since March 2003 (<http://europa.eu.int/ISPO/ida/>). The aim of IDA program is to create a secure electronic data exchange between EU institutions and administrations of the member states, including facilitate communication between institutions, support the decision-making procedure in the Union and increase administrative capacity. The IDA program is supporting the objectives of e-Europe initiative, primarily development of governments' electronic services³²;

- *eContent* since September 2002. The program facilitates access to public sector information and easier handling of this information, creating of information content in different languages and for different cultures, and development of a digital information content market⁴⁹.
- *Participation in the information society (IST) program of the European Union 6th framework program for research and development* (the first project tenders were launched in December 2002)⁴⁹.

As the Statistical Office of Estonia does not produce ICT sector-specific data, we have to use various studies for characterising ICT sector more deeply: the study of the Information and Communication Technology Sector (Sectoral, 2002) undertaken by the consulting company AS PW Partners at the request of the Estonian Foundation for Vocational Education and Training Reform, several studies of the Estonian eVikings and other sources.

ICT sector comprises approximately 450 enterprises, 250 of which are small (with a staff of 1-5 persons and a turnover of less than 65 thousand EUR) (Sectoral, 2002). A majority of ICT sector enterprises are located in large cities, particularly in Tallinn (about 70% of enterprises). These enterprises are mainly active in a wide area of parallel activities, meaning that specialisation is not common practice amongst Estonian ICT related SMEs. Slightly more than half (57%) of the enterprises are Estonian-owned. Foreign owned are mainly enterprises with a turnover of more than 6 MEUR and 0.6 to 3 MEUR. Foreign partnership has been established more in the medium-sized company category and the share of foreign capital usually exceeds 50%.

More than half of the enterprises in the sector are service providers or mediators. Several enterprises are engaged in multiple activities, like manufacturing (producing) and sales. Sales of different products generate about one-third of the turnover. The next by the volume of turnover (17%) is manufacturing, production of computers/components accounting for almost 50%, the rest is production of various electronic and telephone devices and microchips. On the basis of sectoral study on ICT we can say that product development in the ICT sector is relatively underdeveloped, and in many companies (85%) it is lacking. ICT sector enterprises do not feel the need to elaborate modern solutions themselves. Many companies do not engage in product development themselves in the classical sense of the word, but they take the first opportunity to use new products and technologies developed somewhere else. ICT enterprises' product development is oriented mostly to the domestic market (about 2/3 of ICT enterprises see domestic firms as their direct competitors), which does not exactly require world class leading solutions (Tiits and Pihl, 2002). Thus, they do not deem long-term strategic planning important either. The ICT sector international innovation system is characterised by an extremely small co-operation between academic and entrepreneurial

³² Infotehnoloogia avalikus halduses 2003. Aastaraamat (Information technology in public administration 2003. Yearbook) (<http://www.ria.ee/it2003/>)

circles while only a few institutions are creating high value added (only 9% of the firms have used professional help of research institutions). Like in all economy, big risks are involved in investments in research and development in the ICT sector. Due to the currently low science intensity, the ICT sector is not capable of creating a productivity growth, neither inside the sector nor in other sectors of the economy (Tiits *et al*, 2003).

The driver segments in ICT sector are telecommunication services, telecom equipment production and computer services (Estonian eVikings³³). Telecom spans both IT hardware and software and services, produces a substantial output in terms of ICT. Computer services are a generic heading for a number of sub-activities that all embrace primarily immaterial aspects of adding value i.e. maintenance, integration etc. This is also the reason why this sector is overwhelmingly interconnected with the rest of business activities.

Estonian ICT cluster comprises IT hardware production that incorporates also electronics sector, IT software production and services, also some fields of manufacturing, banking, wholesale and retail and governmental structures as final users and is based to a large extent on the development in telecom, as telecom provides substantial input to computer services and equipment production. An important role in ICT cluster's development is also associated with governmental structures, which obviously are the target groups for several ICT sector segments such as software production (Pihl, 2001).

In the cluster framework, the main products demanded but also supplied by other sectors are telecom equipment related. Interactions are tight with manufacturing and computer services sectors.

Export of Estonian ICT goods (30.9% of special exports of commodities in 2000) increased rapidly until 2000. Most of the rise can be ascribed to Elcoteq's activity (provided 83% of total ICT export in 2000) as well as the decrease in 2001, but in 2001, first positive net exports were detected (Table 13). The service sector has played quite a marginal role (about 4% of total ICT goods and services in 2000) in ICT exports. The high share of ICT production in total exports outlines relatively high foreign demand for these products, reaffirming a potentially good starting point for sustained competitive position in the ICT cluster. The largest export partners for ICT goods are Finland and Sweden (84% of total exports) that can serve as the basis for the Estonian ICT cluster to be part of the larger Scandinavian ICT cluster (Pihl, 2001). The dynamics of ICT imports in special imports of commodities has had a slightly declining trend, the respective ratio was 25.1% for 2000. The relatively large export and import shares refer, as mentioned already many times, to a large subcontracting (imported goods are partly used for re-exports) in ICT sector.

Table 13.: Trade balance of ICT industries. Special exports and imports of ICT goods, MEUR (EU Combined Nomenclature (2002) codes and commodity groups)

	1995	1996	1997	1998	1999	2000	2001
Total of ICT special exports	120.9	133.6	271.1	427.0	443.1	1143.0	1043.2
Total of ICT special imports	234.2	281.2	443.9	607.7	601.9	1202.6	979.9
NET EXPORTS	-113.4	-147.5	-172.8	-180.7	-158.8	-59.6	63.3

Source: Foreign Trade, 2002

³³ <http://www.esis.ee/eVikings/evaluation/index.en.html>

On the basis of *Sectoral study* (2002), we can say that the financial situation in the sector as a whole is not very strong. Based on the survey results conducted within the above-mentioned research, a large proportion of the companies with the exception of market leaders are balancing at the profit/loss borderline (the opinions can be trusted because the reinvested profit is income tax free in Estonia). Investors have not regained after the worldwide depression the trust in the ICT sector. This makes it difficult for companies to engage in product development, which in turn would ensure continuous capacity for the company.

The *Sectoral study* (2002) indicates that investments of companies increased in this sector almost by one-fourth in 2001, compared with 2000. Of total investments (39 MEUR were planned for 2002) large enterprises can afford largest investments (91%) while medium-sized and small companies lack the capacity to invest sufficiently in order to remain competitive in the long-term. By field of activity, investments of companies divide as follows: telecommunications 82%, IT 15% and other enterprises 3%. Major investments are made in the procurement of new machinery and equipment, mainly servers and computers. Investments in product development and services are considerably smaller.

Divergence of actual life from Estonia's pursuits to be a successful IT country is confirmed by the fact that public sector funding for IT R&D in 2000 accounted for approximately 5% of the public sector allocations for R&D (Tiits *et al*, 2003). The extreme fragmentation of the public sector funding, large number of small projects and relatively low competition clearly show the weakness of the current system of financing. The survey conducted within the eVikings project in 2001 indicated that one of the most serious problems for the ICT sector is that 56% of ICT enterprises had a shortage of R&D specialists for concrete products or technologies, 39% were looking for project managers and sales personnel, and only 10% needed R&D specialists, 20% presumed that the need for new research R&D personnel would rise in a long term. A large number of highly qualified specialists will be needed who can manage with the development of sophisticated technologies and applications (Sectoral, 2002).

Human capital is considered to be the most important strength as well as the most serious weakness of the sector because the value of a company depends mostly on people who work there, their knowledge and skills (Sectoral, 2002). The second most disturbing weakness can be identified as poor marketing. The bad location of the company in terms of visits by few people, high costs related to the fast development and long delivery time can be mentioned as other weaknesses (Sectoral, 2002). According to the *Sectoral study* (2002), the strengths of the ICT sector are considered to be the awareness about ICT companies and good relations with regular clients.

Total number of people employed in ICT companies was estimated to be 8793 in 2002 and 10 companies with more than 100 employees provide workplaces for 4950 people, 311 companies have 1-5 employees (Sectoral, 2002). 75% of all people working in the ICT sector have higher education (Sectoral, 2002). The majority of the staff in this sector who have higher education are graduates from Tallinn Technical University (TTU) (other educational institutions where higher IT education could be obtained are the mathematics and informatics departments of national universities – Tartu University, Tallinn Technological University, IT College, Estonian Business School). TTU is the largest educational establishment in Estonia providing ICT education. 70% of the graduates from diploma studies and 69% from bachelor studies come from TTU.

Approximately 700 new ICT specialists enter the Estonian labour market annually (Sectoral, 2002). The need for ICT specialists is estimated to be 600 people per year. Enterprises of the sector need about 400 specialists, the others go to work to companies outside the sector and ca 100 people do not work in their speciality. These figures show that the demand and supply of specialists balanced. In reality, however, there is a deficit of specialists in the labour market due to the fact that employers refuse to accept vocational schools as educational establishments producing ICT specialists. Consequently, it is necessary to raise the quality of education of those graduating from vocational schools. In the long term, the need for specialists may increase (Sectoral, 2002). According to the expectations of the enterprises surveyed, the need for software specialists possessing a relevant academic qualification will be the first occupational group to be recruited.

The important employers for the IT personnel are banks and telecommunication companies. According to the *Sectoral study* (2002) Business newspaper *Äripäev* listed Estonian the important IT employers (by main field of activity) as follows (Äripäev, 2003):

Hansapank	(bank)	- 248 persons
Eesti Telefon	(communications, holding company)	- 230 “
MicroLink	(PC production, PC services, trade)	- 169 “
Ühispank	(bank)	- 139 “
BCS	(PC production, PC services, trade)	- 132 “
Eesti Energia	(electric power generation, distribution)	- 73 “
Abobase Systems	(PC production, PC services, trade)	- 60 “
Helmes	(PC production, PC services, trade)	- 40 “
EMT	(communications, mobile services)	- 40 “
Radiolinja	(communications, mobile services)	- 30 “
Ordi	(PC production, PC services, trade)	- 20 “.

Considering this allocation of IT related intellectual potential it is understandable why banking and communications are leading in Estonia’s IST development.

The key factors influencing the development of the sector are:

- the progress of the sector’s enterprises is first of all affected by qualification of the staff;
- the rapidly developing environment requires ongoing development of specialists;
- the Estonian market has a limited purchasing power. The largest enterprises of the sector do not export extensively (except for re-export), but they sell products and services in the Estonian market;
- to increase export potential, more investments in production development are necessary.

Estimates of the IT market outlooks (Viik, 2002) indicate a growth of approximately 10% a year; demand will increase in the service sector, trade and industry by 20%, in SME by 15% and in public sector will not change. The future of the ICT sector in Estonia depends on the developments and the opportunities that worldwide ICT sector offers. The purpose of ICT applications has in connection with the immense increase in using the Internet reached a new phase – from specialists (in 1970’s) and organisations (in 1980’s) to clients (since 2000), and therefore, the strategic planning of ICT must be based mainly on the external needs (Viik, 2003a). IT investments so far have been strategically focused on the organisation’s own needs rather than those of clients. These should be followed by client-oriented IT strategic action plans that would help to increase business incomes (Viik, 2003a).

For increasing the economic competitiveness, imported technology should be converted to export of products and services. As Estonia with its low volume of research and development could not be a technology exporter, neither in the world nor in the region, but has successfully implemented imported technologies, then Estonia could rather turn into a potential exporter of technology applications (Viik, 2003b). For that it must continue to implement high technology in different spheres, focusing increasingly on mapping lessons and experiences of implementations, trying simultaneously to export experiences gained here.

Conclusions

In Estonia, the economic structure is converging to that of advanced economies: the share of agriculture decreased to 3.0% while the share of services sector increased to 65.5% of value added in 2002. Industry provides approximately one-fourth of Estonia's total value added and the share of industry in employment rates also accounts for more than one-fourth. The feature characterising the development of industrial sector is high adaptability with external shocks, being mainly related to successful privatisation and active reconstruction process that followed. Other distinguishing features of Estonia's industry are the high share of traditional branches (food, timber, machinery, equipment, light industry), its dependence upon developments in the world business environment, high share of subcontracting in total exports and low level of labour productivity.

The development of the Estonian ICT sector has been gradual throughout the last decade, from low value added computer assembling activity to higher value added software production and telecom services. The ICT market is shared between a few large corporations, which consolidate a substantial economic power and account for a dominant part of the entire Estonian ICT sector, and many small IT enterprises with lower market relevance, which specialise either in subcontracting, sell hardware and software or develop niche products. The majority of Estonian ICT sector enterprises are active in a wide area of parallel activities, meaning that specialisation is not common practice among Estonian ICT related SMEs.

The driver segments in ICT sector are telecommunication services, telecom equipment production and computer services. The high share of ICT production in total exports is a potentially good starting point for sustained competitive position in the ICT cluster. Largest trade partners for ICT goods exports are Finland and Sweden, which can serve as the basis for the Estonian ICT cluster to become part of larger Scandinavian ICT cluster. As a great majority of Estonia's ICT related exports is produced on the basis of subcontracting the main R&D expenditures are made abroad keeping Estonian R&D expenditures low. Subcontracting also enables to enter the parent company's marketing networks. There is another reason for regional cohesion with the Scandinavian ICT cluster, however at a price of being a somewhat lower value adding performer in the production value chain. Notwithstanding the quite acceptable development until now, some replacement of subcontracting with original Estonian production is badly needed. In order to escape from the status of cheap subcontractor, Estonia needs a comprehensive economic policy aimed at increasing technological and organisational efficiency via using of new knowledge and technologies. In this sense, the most important factors are transparent innovation policies in strategic development plans and well-targeted education and training policies.

I.4. A SWOT analysis

<p>Strengths <u>Changed structure of economy towards market economy needs</u> <u>High share of ICT products in total exports due to the subcontracting</u> <u>Increasing contribution of high tech manufacturing</u> <u>High level of contribution of high technology exports</u> <u>Relatively high general educational level of workforce</u></p>	<p>Weaknesses <u>Regional disparities of industry and services</u> <u>Low level of high tech output</u> <u>Estonia's high tech export is vulnerable due to subcontracting</u> <u>Status of cheap subcontractor</u> <u>Decrease of employment in medium-high tech manufacturing</u> <u>Product development in ICT sector is underdeveloped</u> <u>Mass production of ICT products requires lower qualification</u> <u>Estonian manufacturing not intensive ICT user</u> <u>Shortage of skilled workers</u> <u>Little investment in ICT industry</u></p>
<p>Opportunities <u>Broad international co-operation as a precondition for economic development</u> <u>Positive spill-over of foreign capital to modernisation of domestic enterprises</u> <u>Competition of domestic enterprises with subsidiaries of Nordic companies</u> <u>Cheap labour force based comparative advantage in the short term</u> <u>High share of innovative enterprises</u> <u>Revealed comparative advantage of resource-intensive industries</u> <u>High share of ICT goods in total exports</u> <u>Regional cohesion with Scandinavian ICT cluster</u> <u>Successful implementation of imported technology</u></p>	<p>Threats <u>Low level of labour productivity</u> <u>Concentration of ICT sector mainly in the capital city may cause regional digital divide</u> <u>Dependence of ICT sector development on economic success a few large enterprises</u> <u>ICT sector depressed because lack of further investment</u> <u>Difficulties of ICT sector to increase a productivity inside or outside the sector</u> <u>SMEs have lack of capacity to invest</u></p>

The factors considered by the authors as most relevant to the IS development of the country are underlined in the above SWOT.

The changed economic structure of Estonian economy towards market economy, the increasing contribution of high tech manufacturing and the relatively high formal educational level of workforce are good preconditions for the ICT sector development. The positive spill-over of foreign capital has had remarkable importance in modernisation of domestic enterprises. Competition of domestic enterprises with subsidiaries of Nordic companies and successful implementation of imported technology has increased the domestic economic development and created conditions for regional cohesion with Scandinavian ICT cluster. In the short term, the cheap labour force has a comparative advantage. At the same time, due to the large share of subcontracting in ICT sector and ICT companies' lack of capacity to invest, the actual R&D as a knowledge-intensive part of product development is low. Consequently

the product development in the ICT sector is relatively underdeveloped. ICT sector enterprises do not perceive the need to work out contemporary solutions themselves. Many companies do not engage in product development themselves but take the first opportunity to start using new products and technologies developed somewhere else. Some replacement of subcontracting with original Estonian products is needful in order to escape from the status of cheap subcontractor. The high share of ICT production in total exports and largest trade partners from neighbouring countries can be seen as the basis for Estonian ICT cluster to become a part of a larger Scandinavian ICT cluster. On the basis of successful implementation of imported technology, Estonia can find its niche in exporting technology applications.

II. INFORMATION SOCIETY TECHNOLOGIES (IST) PENETRATION

II.1. General trends

Information society technology and especially ICT is rather broadly used in Estonia. Its main trends have been:

- the wish of an increasing number of individuals, households and enterprises to take an advantage of developing IST technologies and make expenditure on buying this technology and have more experience in using this.
- predominant investment in the development of infrastructure, i.e. buying computers, their modernisation and introduction of contemporary software programs.
- this is followed by the increasing use of Internet induced by both the public sector policies and co-operation between the public and private sector with the objective to increase the use of Internet among individuals and enterprises.
- the main trend is still the increasing use of ICT whereas enterprises use new technologies quite moderately in production and other fields.
- increasing use of faster communication facilities (e.g. broadband).
- changes in the structure of the information communication types in connection with the development of new means of communication, e.g. decrease of fixed lines in connection with an extremely fast introduction of mobile communication.
- the development of infrastructure has caused a growth in demand for services.
- the main principle of the national information policy to provide everybody with equal access to information has served as the basis for the activity of the respective structure of public administration (e.g. ministries, IT departments, councils) the aim of which is to create a favourable environment for dissemination and exchange of information (e.g. target programs).
- provision of public administration agencies with computers and the growth of their internetisation,
- supply of new services to individuals and enterprises by public administration and public sector.
- changing of the public administration and public services sector more effective and open to people and private sector, development of e-democracy.
- increase in the use of services by citizens, private sector and public sector.
- considering the EU accession, national development plans have focused on the development of eEurope 2005 core areas (e.g. e-government, e-learning, e-health and e-business services; availability of broadband and secure information infrastructure).

II.2. Penetration and diffusion of information society technologies

II.2.1. IST at enterprises

There are different sources to estimate the penetration of information society technologies at enterprises. A survey was carried out in Estonia in 2002 based on the Eurostat questionnaire: “Community Survey on ICT usage in enterprises (e-commerce)“. The purpose of this survey was to collect data about information systems in enterprises, the use of Internet, e-commerce, electronic data exchange and problems in using the Internet. The survey covered manufacturing, wholesale and retail trade enterprises, hotels, transport, storage and communication, real estate, renting and business enterprises. The survey analysis was based on the data of 5331 enterprises (using random sampling) (Statistical, 2003c).

The diffusion of information society technology is estimated in enterprises that use IT-systems for managing orders. Such systems were used by 25% of enterprises. 19% of enterprises used invoicing and payment systems, 13% of enterprises used systems for re-ordering replacement suppliers and 9% used systems managing production, logistics or service operations (Statistical, 2003c).

Internet has a growing importance in the communication between enterprises as well as between individuals. 14% of enterprises have teleworkers. Enterprises use Internet for marketing of their products³⁴. About half of the respondents (of activities chosen) had their own website, which provides a good opportunity for marketing. The website of 65% of enterprises included information also in foreign languages. 30% of enterprises used Intranet to provide access to information to their employees, 7% of enterprises made information accessible also to some selected external users via Extranet.

In 2002, 83% of enterprises (of activities chosen) used Internet, which is 18% more than in 2001. 58% had permanent Internet connection (ADSL, SDSL), 22% of enterprises had dial-up connection, 5% of enterprises had wireless connection and 4% broadband cable connection.

Enterprises are using Internet to carry out money transactions via Internet web sites of all larger banks in Estonia. Almost all enterprises used Internet for looking for information. One-fourth of enterprises used digital products (ordered music, videos, games, computer software and read online newspapers). 8% of enterprises used Internet for training and education purposes. 82% of enterprises have used Internet for obtaining information from public authorities, 75% for obtaining forms and 56% for electronic case handling.

In the same survey, enterprises evaluated barriers to using Internet: security problems (48% of answers), expenditures are too high (14%), enterprise has no need for the Internet (11%), Internet connection is technically impossible (11%). Barriers to using computer: high cost of computers (25%), employees lack the necessary qualification (10%), technology does not meet enterprise's needs (6%) (Statistical, 2003c)..

Another survey by Emor Ltd. gives information about computers and Internet usage in companies of all activities. In April 2003, 73% of the companies (about 24 000) registered in the Estonian Business Register had at least one computer and 95% of them had also access to the Internet (74% using leased lines). 45% of the companies had 1-3 computers, 26% had 4-20 computers and 2% had more than 20 computers. 36% (about 8 300) of companies had Internet websites in April 2003 (Emor Ltd³⁵).

About 3 200 enterprises had an intranet solution, and approximately 1 300 companies had both – a homepage and intranet (Baltic E-track survey, 2002).

The majority of companies have not integrated their Internet and intranet solutions with other IT systems in the company. Approximately 1 100 companies (around 4%) have integrated at least some systems and about 1 800 companies (around 6%) are planning to integrate the systems in the near future (Baltic E-track survey, Feb-March, 2002; IT in Public Administration, 2003).

³⁴ The information about using the Internet in enterprises is based on the above-mentioned Survey of Estonian Statistical Office in 2002.

³⁵ Survey by Emor Ltd. "Information technology and Internet in Estonian companies"

II.2.2. IST in financial services

The history of Estonia's financial sector goes back to 1988 only. Thus, most of the commercial banks, insurance and leasing companies, investment and pension funds are quite young. When established, these institutions were open to new technological solutions and as they offered very competitive wages on Estonia's labour market they employed the best ICT experts available. It made Estonian banks and Estonian financial sector more innovative than rather conservative European banks. All banks, insurance companies, investment and pension funds are in private ownership and in the majority of them foreign ownership prevails.

IST use in Estonian banks traditionally includes telephone banking, credit cards, debit cards, ATMs. Clients of Estonian banks are used to electronic transactions. There were 1.17 million bank cards (of which 15% credit cards) emitted by Estonian commercial banks by the end of September 2003 or more than 1 bank card per 1 person aged 15-74 years. Estonian residents made 24.4 million card transactions in 1998 (with the total value of EEK 16.1 billion) and 66 million transactions with the total value of EEK 42 billion in 2001. Thus, an adult person made 1.25 card transactions per week, on the average. About two-thirds of the card transactions were cash withdrawals in ATM-s (Automated Teller Machines) and one-fourth of the transactions were Points of Sale (POS) terminal payments³⁶.

More recent developments include Internet banking, mobile banking and digital TV banking. Electronically initiated payments are responsible for almost all of their total number (incl. Internet-bank, telebank, card payments). Estonian Internet banks are supplying a number of services for their clients, the number of Internet bank users had increased to 760 000 by July 2003. From the total number of payments intermediated by commercial banks at the end of 1997 and in the beginning of 1998 over 40% were paper-based credit orders and only about 1-2% Internet bank orders. By the end of 2002, the share of paper-based credit orders had declined to 3% and the share of Internet-bank credit orders had grown to 22% of the total number of transactions. Together with telebank credit orders (these are used by businesses and contribute 23-24% of transactions) and card payments (40-42% of payments) electronically initiated payments are responsible for 95% of their total number. Broad Internet penetration enabled to reduce the number of bank offices and tellers, electronic payments squeezed out the use of cash in circulation and reduced the share of black market.

Estonian large banks launched also an m-payment pilot project with about 1 000 test users. M-payment is an alternative to card payments and enables mobile phone holders to pay for goods and services.

According to the General Population Survey conducted by SIBIS, 34% of the population in Estonia were using online-banking or buying financial products at the beginning of 2003 (Sibis, 2003). Enterprises and institutions are more interested in using Internet banks because of the need to make a large amount of payments per day. Electronic banking facilities speed up the cash circulation and increase their performance, because of an availability of a number of cash management instruments on the banks' Internet sites (e.g. investments in overnight-, short- and long-term deposits, equities, bonds, money market funds).

The role of banks in contributing to the process of creating information society is considerable. Banks invest continuously in information technology as users facilitating

³⁶ Calculated on the basis of Bank of Estonia data (<http://www.ee/epbe/statistika/itp.html.en>)

development of customer friendly IT solutions. Estonian banks host their own departments with a good competence, which can be viewed upon as major software companies. Banks create demand for a number of services (e.g. cryptography, e-commerce solutions) and have thus a potential to promote innovation (Kerem, 2003). The banks are participating in joint projects with mobile communication operators and other specialised ICT companies. Banks possess authentication systems that have proved suitable for providing public services. The bank link services provide risk-free options for e-commerce providers, because clients pay for their goods prior to receiving goods. Therefore, one of the advantages in the development of e-commerce is the widespread Internet banking, conducing to the growth of positive attitudes towards e-commerce. Banks generate also demand for additional services and payment for services.

Estonian banks have been engaged in co-operation projects for providing electronic services to Tax Board (to submit electronic tax reports), Health Insurance Fund (view personal data, payments), mobile phone operators (viewing, paying and archiving bills), telephone company (ordering and payment bills), energy company (consumption data and bills) and vehicle insurance policy. The Public Internet Access Points network is important for increasing the number of Internet bank users. Public and private sector commitment in Look@world project is another example for the same purpose through providing computer and Internet training for persons who have not used Internet before.

The Estonian Central Depository for Securities (ECSD) was established in 1994 with an electronic registry of securities that enables electronic trading on the secondary market. The goal was to create a well-regulated and efficient environment for electronic clearing and registering of shares. Tallinn Stock Exchange (TSE) started operation in 1996 as an electronic trading environment for securities.

It is prognosticated that the number of Internet users will increase in Estonia, which presumes a growth of e-banking. It is also prognosticated that the growth will be focused rather on mobile phone-based services.

II.2.3. IST in major services sector

Improving online access and providing different services are essential for the enhancement of the development of SMEs, as the use of information and communication technology has a great potential to reduce the administrative burden of enterprises and to simplify respective procedures. E-commerce and m-commerce have developed and increased during recent years, these are also the fields for future development in Estonia.

On the basis of the information of Statistical Office of Estonia, 29% of enterprises had purchased goods/services via Internet in 2002, which is half more than in 2001. 12% of enterprises had received orders by the order form on their website. The Internet sale from business to business or to a third person exceeded the direct sale to a private consumer (Estonian Statistics, 2003). There are a number of Internet shops³⁷ offering books and publications, tools, household appliances, software and hardware, multimedia, flowers, etc. Computers and computer appliances, home electronics, books and CD-s were most often bought from Internet shops. However, one may add to traditional e-commerce also

³⁷ No statistics are available

subscriptions for newspapers and journals with payments over the Internet. According to the E-track survey by Emor, purchases/orders via the Internet included 38% books, 23% audiotapes or CDs, 14% theatre, concert or other tickets, 13% newspapers and magazines, 13% computer programs, 11% clothes, 9% computer accessories, 4% foodstuffs, 4% footwear and 21% of other goods and services (E-track survey, 2002). In Estonia, the biggest group of Internet users is persons aged less than 20 years. These people, as the world experience shows, are the least likely to buy goods and services via the Internet.

There are successful B2B (business to business) projects implemented in Estonia as well. One example is the wholesale company of medicines Magnum Medical who started to develop its Internet based ordering system already in 1997. By 2000, the share of electronic commerce of the company had grown to EUR 13 million per year; it accounted for half of the total turnover of the company (WWW indicators ..., 2001).

Little use is made of electronic data exchange (EDI) between enterprises both for purchase and sale transactions (only 4% of enterprises).

The proportion of employees who used computers and the Internet was the largest in wholesale enterprises (13 and 15% respectively), retail trade (12.5 and 9%), postal and telecommunication services (11 and 10%) and in other business activities (around 11%) (Statistical, 2002f). Most of the employees in trade and services are engaged in purchase-sale transactions and accounting; computers are used less in conducting the sale process.

Enterprises have ranked by importance the motivations for using Internet sales: enhances the business, helps to find new clients, helps to acquire good reputation for the enterprise, widens the market, reduces business operation expenses and helps to develop new products. On the other hand, the Internet does not provide the possibility to directly see the goods before purchasing in order to check the quality, people also worry about the possible misuse of their personal data (Statistical, 2003c).

There are different data by surveys characterising e-commerce users. According to the Global E-commerce Report, 74% of the Internet users in Estonia are non-shoppers, nearly 3% of Internet users were online shoppers in 2002. E-track survey shows that over 4% of the population used the Internet for buying and ordering goods and services in 2003. On the basis of the results of eEurope+ Households Survey 57% of Internet users were searched for goods and 11% purchased goods (eEurope+ 2003, 2004). SIBIS project shows on average 15% of the population in Estonia purchase products on-line in 2003. This is the highest level among CEE candidate countries, but remains lower than in EU countries (19%), and US (44%). By age groups, the most dynamic group of eCommerce users is the '25 to 49' age segment (SIBIS, 2003). The retired people use eCommerce services five times less.

The attitude towards e-commerce depends also on the general attitudes of the population towards this new way of services. The survey indicates that among the age group 15 to 74 years (Sept-Nov 2003), 60% of the respondents are not interested in e-commerce at all, 18% are generally not interested, 4% cannot say, 15% are generally interested and only 3% are very much interested in e-commerce (IT indicators, www.ria.ee). If we compare the results of different surveys, the interest in e-commerce confirms that the SIBIS results may be quite realistic.

According to the E-track survey, reasons for not using e-commerce in Estonia are not so much related with the fear of insufficient Internet security (8%), but rather the fact that it is not possible to check the quality of goods (30%) or that the traditional way of shopping is preferred and customary (41%)(E-track survey, 2002).

One of the advantages of e-commerce in Estonia is widespread Internet banking the introduction of which has been a factor that has increased the use of computers and the Internet and which makes payment for goods easier for people.

Card payments are quite popular in Estonia's retail trade, they are still quite costly (2-3 % of the paid value) for retailers. Additional investments are necessary to set up POS terminals. Therefore, POS terminals are not very widespread in small shops and instead of them, the use of mobile phones in intermediation of payments (m-commerce or m-payments) is picking up.

Mobile technology is the other most important driver of the information society. Estonia has achieved some remarkable results in the field of mobile value-added services, which go beyond the traditional phone-calls (see also Rannu, 2003):

- Estonia was the first country in the world to have mobile positioning in commercial use and one of the first to have 112-emergency calls linked to mobile positioning system to determine the origin of each call.
- Estonian system for using mobile phones to pay for parking has achieved a remarkable penetration rate of 68%. In 2002, Estonia has launched several successful mobile commerce projects. Estonia is used as a test-bed for mobile services by some leading mobile infrastructure providers.
- Mobile commerce services (started in 2002) mean that a client can make payments for goods by mobile phone when he has tied his mobile number to his bank account on the basis of a contract with bank. For banks this decreases cash circulation by providing a cheap alternative to credit card payments. This is suitable for shops where Internet connections or credit card terminals are not possible to use.
- Also, a short-text-message (SMS) has become successful.
- In 2002, 40% of total parking payments were made by mobile phones (m-parking).
- Mobile transport ticketing pilot projects were launched in 2002 in Tartu and Tallinn, which makes it more convenient for users to buy tickets for transport. The project was evaluated as successful and continued as a commercial service.
- Telematic services enable one to control various devices via mobile phone (e.g. gate control, house alarm).

E-commerce and other services are dependent on the quality and speed of telecommunication networks. According to the analyst company Point-Topic, Estonia holds 12th position in the world by ADSL/regular phone line ratio with 2.57 lines per 100 people. Presently Eesti Telefon has over 35 000 DSL lines, more than 5 000 (7%) of which are ADSL broadband Internet self-installation kits. In addition to the physical Internet access points, there are over 170 free wireless Internet (wifi) zones around the country (www.wifi.ee). According to [wifi.ee](http://www.wifi.ee), 6.8% of all wireless Internet areas in Europe were located in Estonia (May 2003). In recent years, the number of fixed phone lines has decreased, as many consumers switched from fixed phones to mobile phones³⁸. The biggest driver for the growth TC market is the mobile segment.

³⁸ http://www.vm.ee/estonia/kat_172/3364.html

Estonia has awarded 3G Universal Mobile Telecommunications Service (UMTS) licences to incumbent mobile operators in 2003.

Some other examples can be found in the private sector to characterise e-services. For example, *Integrated Learning Environment*, a portal *Miksike*³⁹ is a e-study environment which offers services to virtual assistant teachers, to schools that provide education in Estonian but are located separately (e.g. in Alutaguse, Ruhnu, New York, Washington or Sydney); to parents who wish to teach their children at home. *Miksike* gives away more than 20 000 worksheets in HTML and offers a set of collaborative learning services. In Estonia, *Miksike* servers got 80-100,000 page views per school day.

The private sector is far ahead of the public sector in offering labour market services. For instance, *CV Online Eesti* reported on their webpage that they had 93.6 thousand registered users, 60 thousand CV-s and 1.9 thousand registered clients as of 2 May 2003⁴⁰.

II.2.4. IST in public services

IST in health services

Estonia has no unified functioning health information system yet, but it has many of its components, e.g. hospitals', family doctors', emergency aid, pharmacies', Health Insurance Fund's information systems, as well as registers and databases with no exchange of information between them. The national health care and also WHO statistical databases are public and accessible via the Internet⁴¹. Almost all national registries (e.g. Cancer Registry, Mortality Database etc) were computerised in the 1990s. There are several health portals,⁴² independent health-related websites, health care institutions' web-sites providing information and professional comments on health and medicine topics and there is a possibility to consult by e-mail with doctors, pharmacists, dermatologists (E-Europe+ Progress Report, 2002). In order to make communicating easier and more convenient for clients and partners by employing the means of modern information technology, the Estonian Health Insurance Fund has foreseen that in 2004 the partners and customers will have the opportunity to settle the accounts and manage services in the range of 95% in an electronic environment. In 2005, 95% of the Fund's services and benefits settlements should be made in an electronic environment (Development Plan of the Estonian Health Insurance Fund for 2003 to 2005).

Health related services, i.e. interactive advice on the availability of services in different hospitals; appointments for hospitals are available online. Also, specialists, psychologists and pharmaceutical advisers consult citizens and answer their questions anonymously over the web⁴³.

Telemedical experiments⁴⁴ have been performed in Estonia already earlier, but the systematic use of these possibilities started in 2000 when within a year 30 teleconsultations were conducted in Estonia (Linnamägi & Asser, 2002). The new health care development plan for 15 years envisages development of a telemedicine network. For example, there has been a

³⁹ <http://www.miksike.com/>

⁴⁰ <http://www.cv.ee/cvo/stat.php?page=1&keel=inglise>

⁴¹ www.stat.ee, www.sm.ee, www.haigekassa.ee

⁴² www.kliinik.ee; www.inimene.ee

⁴³ www.kliinik.ee

⁴⁴ health care services at a distance (e.g. teleconsultation and home telemonitoring)

telemedicine network created between five health care institutions in Estonia since 2000 on home telemonitoring of patients by cardiologist using home monitoring equipment *Docobo*. The spread of extensive use of telemedicine has been restricted by the lack of data protection and relevant laws.

Box 1. A unique health monitoring project of Doc@HOME

Development of the project Doc@HOME was financed by the European Commission in the amount of 16 million kroons. This project has been estimated to be one of the most successful among Estonian innovation projects.

The Estonian capital-based international telemedicine firm Docobo Ltd. started international research in target countries where it intends to introduce a unique health monitoring program doc@HOME® that was elaborated in Estonia. A development project of Doc@HOME has by today reached a stage where first orders are coming in for the introduction of the new health monitoring system and for buying the special equipment Docobo™. An examination of the total of 220 hypertonic patients will be carried out in Germany, United Kingdom, Finland and Estonia. Doc@HOME telemedicine system enables patients to register their health indicators without leaving home and send them to the medical personnel electronically. According to various estimates, it is possible with this system to save up to 50% of the medical treatment expenses.

The Estonian Health Sector Development Project 2015, approved by the Government in May 2000, is aimed at restructuring the health care system, including the United eHealth Information System (Estonian Health Project 2015, 2000). Preparations for the introduction of electronic health cards and health information networks have started already and more intensive activities are envisaged for 2004 (Kuivjõgi, 2004)

*IST in educational services*⁴⁵

Most schools have been provided with computers and Internet connections through the financing schemes of the Ministry of Education and the *Tiger Leap* programs (IT in Public Administration, 2003). The program was launched in 1996 by the Ministry of Education and was carried out in 1997-1999. The *Tiger Leap* program set the goals of introducing ICT knowledge in schools, connecting the schools to the global computer network and training in productive application of the technology. It was also a goal of the program that schoolchildren learn to cope in the information society.

Within the *Tiger Leap* program, about 11 thousand teachers (out of 17 thousand in Estonia) upgraded their knowledge in ICT; schools were supplied with computers and 61 educational software programs (including 39 original programs in Estonian). The program was followed by the Tiger Leap Plus that was created to transform Estonian schools into schools of information society, to support teachers in their conversion into teachers of information society and to equip pupils with a compass for keeping on course.

IT infrastructure in schools has developed under the Tiger Leap programs: in 2001/2002 on average 3.4 computers per 100 pupils on the primary level and 3.7 computers per 100 pupils

⁴⁵ Information from: IT in Public Administration of Estonia Yearbook 2002. <http://www.eik.ee/english/2002/> is used for this paragraph.

at the secondary level. An example of uneven distribution of computers and leased lines can be noted to some extent across counties, in cities and rural districts (e.g. a small share - 4.9% of the total number of pupils had no leased lines) (IT in Public Administration, 2002). There is a shortage in providing high-speed connection in some schools and some computers have to be updated. The issue of replacing computers with new ones arises in order to ensure studies at the contemporary level. The target – one computer per 20 pupils – has not been achieved yet, as it has been estimated that there are ca 24 high school students per one computer now (for comparison - EU average is 10-15). The government, the private sector and the third sector have initiated projects for stimulating ICT usage among population. This means that with the economic development of society there is room for replacement and improvement of ICT infrastructure.

As the essential IT infrastructure for Estonian schools was built very fast – within 2-3 years – and already 5 years have passed since the beginning of this, the issue of replacing computers with new ones may arise in the near future.

ICT related education is also provided by other institutions besides schools and may be related to life-long learning. For instance, the program *Look@World* is funded by private sector companies (2 major banks and 2 telephone companies) (see in B). Look@World Foundation commissioned and financed the establishment of e-school (see Box 2.)

Box 2. School-Home communication interface E-SCHOOL

E-school is a solution that allows parents (and students) to see school information i.e. grades, missed classes, home assignments etc concerning their child over the Internet. It also improves parents' communication with teachers via different forums.

As e-School was commissioned and financed by the Look@World Foundation, the schools that join in do not have to cover the costs for working out the software. The schools only pay the link-up fee and make monthly payments related to application hosting in the central server the size of which depends on the number of schools joining e-School.

e-School is secure since user authentication procedures (ID card; Internet banking codes; or password) guarantee that everyone can only view the information designated to him/her.

Source: <http://www.vaatamaailma.ee>

E-education has expanded in higher schools in recent years (e.g. University of Tartu, Tallinn Technical University). In 2003, the Estonian e-University⁴⁶ was founded.

Box 3. Estonian e-University

e-University is a consortium of Estonian universities and professional higher schools. The founder members of e-University are the Estonian Ministry of Education and Research, Estonian Information Technology Foundation, University of Tartu, Tallinn Technical University, Tallinn Pedagogical University, Estonian Agricultural University, Estonian Business School and Estonian Information Technology College.

Its mission is through e-education to improve the quality of higher education in Estonian higher schools, make universities more open to new target groups, enable students and other

⁴⁶ <http://www.e-uni.ee/>

learners wider, high-quality and more flexible opportunities to study, use more economically the resources of Estonian higher education, both material and human resources, and support regional development in Estonia.

The objective of e-University is to initiate and simplify co-operation between universities in the field of e-education; popularise and develop e-education in Estonia, support co-operation of Estonian higher schools with business environment and higher schools abroad in the development of e-education; create a regional support system for e-education; support the initiative of higher schools and individual teachers in the development of e-education; develop technological infrastructure for e-education.

Source: <http://www.e-uni.ee/>

For the use of ICT in the work of governments and in democratic practices a centre of e-Governance Academy was established. The centre provides training in e-governance and e-democracy in Estonia, but it serves also as a platform for exchange of experience and conducts related research in other countries (e.g. Russia, CIS countries, etc).

*Box 4. E-governance academy*⁴⁷

(EGA) is a regional learning centre in Estonia, set up in 2002 by the Republic of Estonia, United Nations Development Program (UNDP) and Information Program of Open Society Institute (OSI). The centre aims to promote the use of ICT in the work of governments and in democratic practices. The centre provides training in e-governance and e-democracy, serves as a platform for exchange of experience and conducts related research in the home country as well as in other countries (e.g. Russia, CIS countries, etc).

EGA implements its mission through the provision of training services, organising research, facilitating networking and enabling exchange of experience in broad areas of e-governance. Located in Tallinn, Estonia, the Academy provides a platform for analysing and systematising both international and domestic experience into forms of knowledge that can be transferred to those interested both in Estonia and abroad. The target audience of the Academy's activities are senior policy-makers and governmental Information and Communication Technology (ICT) specialists, as well as researchers working on the issues of e-governance.

The primary geographical focus for training is on the countries of the Commonwealth of Independent States (CIS, particularly the Caucasus and Central Asia), Mongolia and South Eastern Europe. In the longer term, while retaining its mission of knowledge transfer to the East, they want to become a leading European Union (EU) institution in the area of e-governance.

The target audiences of the Academy's activities are top policy-makers and governments' Information and Communication Technology (ICT) specialists as well as researchers working on the issues of e-governance. The academy has a capacity for provision of training in both English and Russian.

Source: <http://www.ega.ee>

According to e Europe 2005 objectives the activities in public services have been directed for connecting public administrations, schools, health care to broadband, interactive public

⁴⁷ <http://www.ega.ee>

services, accessible for all, and offered on multiple platforms; providing online health services.

II.2.5. IST in public administration⁴⁸

Estonian public administration is relatively well equipped with contemporary computers, 93.3% of the computers are connected to Internet.

Nearly 100% of government agencies and many local government agencies have their own homepage or have documents available on respective county websites or through the Internet resources of e-county or e-government portals. According to the Public Information Act adopted in 2001, public institutions have to provide information required by citizens. This has forced all public institutions to develop their Internet homepages to make public information available pursuant to the law.

During 2000-2002, the number of public agencies providing information via their homepages increased. In 2002, 55% of primary and secondary schools, 94% of universities, 63% of hospitals and clinics, 100% of public administration agencies and 68% of local governments had their own homepage. The ten most popular homepages visited daily by more than 20 000 times in Estonia include 3 newspapers, 2 news and entertainment portals, 2 Internet banks, 2 mail service providers and 1 major search engine. Searching for certain information, news and entertainment, sending/reading e-mails, and Internet banking are the most popular activities of Internet users in Estonia.

Based on the information policy main principles and the national development policy strategies of information society, public administration activity in recent years has been targeted to develop ICT environment through elaboration and implementation of state information systems. Elaboration of new solutions for the state information systems has been facilitated by the availability of good specialists, although there is a risk that these specialists go over to conduct international projects (higher wages).

The overview of the major projects and principles of their implementation is brought in Appendix E.1. Introduction of these programs has been conducted through respective web-portals and has enabled to render services to citizens, enterprises and institutions. An example may be the main networks for data communication, which are effectively used, such as backbone networks *PeaTee* and *EEnet*:

The development of the backbone network *PeaTee* (in English *EEBone*) is directed at providing state and local government agencies as well as other state-financed institutions with data communication services. The Backbone network connects all Estonian ministries, county centres and several modes of Tallinn. It is connected to Internet and is using TP/IP technology and 16Mbps bandwidth. At present there are around 11 000 users – about 95% of state agencies are connected to the network (ICA Country Report, 2003).

The target programs *KülaTee* and Internetisation of Public Libraries, both being a continuation to the *PeaTee* project, were implemented to provide local government agencies, public libraries and municipal schools with data communication services. An infrastructure

⁴⁸ Source: IT in Public Administration, 2003

was built in rural regions to provide the above-mentioned institutions with data communication and leased line Internet connections. Local government agencies got switches to *PeaTee* network nodes; schools, libraries and other cultural institutions were connected to the EENet or commercial ISPs.

The aim of the *data communication network EENet* is to develop and organise the data communication network of educational, cultural and research institutions and to manage and co-ordinate respective activities in Estonia. EENet network that has been created with joint efforts and means, covers all counties. Every county has at least one communication centre, several counties already have several centres to which schools and other educational and cultural institutions are connected. The EENet network and external connection costs are covered from the state budget and the use of this network is therefore free of charge for institutions. As of 1 January 2003, 475 agencies had leased line connection to the EENet; there were 345 virtual homes, 930 e-mailboxes and 104 thematic mailing lists of agencies and educational, cultural and research projects in the service server www.eenet.ee. In .ee top-level domain controller, 14,965 domain names had been registered by 1 January. According to estimations, the EENet serves over 200 000 researchers, students, teachers, persons engaged in culture, etc. The EENet has acquired experience in most of the advanced technologies: ATM, fiber-optics, radio-links, etc.

*E-Government Portal*⁴⁹ is a common access point for government agencies and institutions through an Internet domain riik.ee (gov.ee), and the Virtual Estonian Web Centre was established to administer it. In addition, the portal acquired the role of an integrator and co-ordinator of national information systems. Several virtual servers and websites of state institutions and projects (e.g. e-Citizen, X-road) use the domain. The fact that the system has an average of over 100 000 visitors per day on weekdays proves the popularity of the portal. During peak hours there are over 5 visits per second, about 18% of them are made abroad. In addition to Estonian, the working languages of the portal are English and Russian. Since the beginning of 2000, every state agency and local government has been able to opt to use the modules of public services in the e-government server. The following modules are available: guest-book, voting, discussions, and questionnaires. All state and local government agencies can use these modules free of charge. These so-called communication modules can be used for organising discussions and polls on the web.

The aim of the e-government portal's website TOM or "*Täna Otsustan Mina*"⁵⁰ (in English 'Today I Make Decisions') is to enhance citizens' participation in the state's decision-making processes. In January 2003, 371 ideas that had been submitted over TOM were in the legislative proceeding in different government agencies.

He information portal eesti.ee (opened in January 2002) is a web with free access to all people to inform them about their rights and duties and is a gateway to the citizens to using e-services (incl. advises citizens on official communication with Estonian state agencies). In the portal, citizens can find relevant information from traffic, population and business register and some other databases. There are document forms, references to laws and links to useful websites, relevant phone numbers and www.services available in the portal. The state and local governments are obliged to keep the information about their respective administrative field-related life and business situations available.

⁴⁹ www.riik.ee

⁵⁰ <http://tom.riik.ee>

“*Forms in the Internet*” – the service has made document forms available for citizens to communicate with state agencies. Forms are in PDF format and can be printed out (over 400 forms) or filled in directly (ca 80). At present the citizens can personally submit forms obtained from the Internet or filled in on the screen or send them by mail to a respective state agency, which will then proceed with the forms. Thus, the service saves time for the citizen.

The service was elaborated as an independent project in co-operation with the Open Estonia Foundation, the State Chancellery and Phare public administration development program and was already launched in 1998. After the establishment of the virtual Estonian Web Centre, the service was integrated with the latter and at present it is the most frequently used service in the e-government portal (average of 5 800 visits per day in January 2003).

On 1 June 2002, a new important register was launched in Estonia – electronic *Riigi Teataja* (State Gazette). Pursuant to the *Riigi Teataja* Act, *Riigi Teataja* is the official publication for the legislation, international agreements, reasoned judgements of the Supreme Court, notices and other documents of the Republic of Estonia.

e-TaxBoard. Since 2000 it is possible to fill online personal income tax declarations. A total of 137 613 declarations (about one-third of total number of declarations) of taxable personal income and paid taxes were submitted to the Estonian Tax Board via the Internet in 2003 (Europemedia, 08/04/2003). Electronic filing of peoples’ income tax returns is possible via the portals of five banks – *Hansapank*, *Ühispank*, *Sampo pank*, *Nordea pank* and *Krediidipank*. As of February 2002, ID-card owners can enter e-TaxBoard via the Tax Board’s website (www.ma.ee) by using ID-card. If the taxpayer has not concluded an agreement for using e-TaxBoard, it will be concluded electronically at the first entering with the ID-card. In 2003, less than 10 thousand personal income tax declarations were made using ID-cards (by approximately 200 thousand ID-card owners) and authentication over Internet banks prevailed.

Social security contributions (pensions, etc.) can be transferred via Internet banking.

Corporation tax: declaration, notification

In summer 2001, the Taxation Act amendment entered into force, which requires state, rural municipality or city agencies to electronically submit declarations to the Tax Board provided that these agencies have info-technological means for that. The further aim is to make it obligatory also for large companies to communicate with the Tax Board via the Internet. In 2001, the e-Tax-Board system was expanded and supplemented by services as well as additional information for taxpayers; special service packages were elaborated for the Central Criminal Police and Public Procurement Office. Similar applications that pursue the needs of a specific agency are being elaborated for bailiffs, Police Board, Health Insurance Fund and other agencies that have been given the right by the Taxation Act and tax laws to conduct inquiries in the register of taxpayers and withholding agents.

VAT: declaration, notification

Regularly submitted to Tax Board by enterprises. According to the Tax Board Annual Report 2001, 162.3 thousand VAT declarations were made by companies electronically in 2001 or 29% of the total amount of VAT declarations (Tax Board ..., 2002). 183.5 thousand social tax and withheld income tax declarations (22% of total number) were also electronic ones. Thus, tax administration is rapidly growing electronic.

*Customs eSystems.*⁵¹ In November 2002, the IT Departments of Customs Board and Tax Board were merged in order to consolidate IT services for tax authorities (the Customs Board and the Tax Board). The purpose of the merger was to improve the quality of the IT services rendered to the tax authorities. The synergy resulting from the merger, the loss of duplication of services and the development and implementation of function-based management should facilitate the application of IT processes by the tax authorities and accomplishment of their objectives.

*Job search services.*⁵² There are job offers from employers on the website available. Development of the IT network is under elaboration in state employment offices since the end of 2003.

Citizens can find forms from the Internet *for car registration* and for checking the validity of driving license, pay taxes, get teaching materials and ask questions connected with regulations and get other information from the website of the Estonian Motor Vehicle Registration Centre.

Declaration to the police. This means the presentation of the declaration in the case of theft, where a person can turn to the police and ask help (request) for search by the police or other information. This possibility is not very frequently used by people. The system of inquiries created in the Internet makes it possible for the police to get information about all cars and driving licences during 24 hours per day. Estonia joined the EUCARIS (European Car and Driving Licence Information System) in 2001, making it possible for the police to get information from other countries.

Public libraries (availability of catalogues, search tools). Main libraries have joined the ESTER⁵³ – Estonian Libraries Catalogue that includes an electronic database of books, journal articles, periodicals and other publications. The Catalogue is operating under the ELNET Consortium, i.e. non-profit union of catalogues, archives and other institutions of information collection, which citizens can use.

The Estonian Public Information Act states that everybody must have free access to public information. By adopting this act the Government assumed a specific obligation to establish Public Internet Access Points (PIAPs) in all public libraries, where people can access via the internet free of charge. As a result of the internetisation program launched by the Ministry of Culture, over 550 public libraries had leased line Internet connection in the first half of 2003. There were 0.76 PIAPs per 1000 inhabitants (eEurope+ 2003). An integrated Internet-based information system of libraries is created, which would serve as a channel for obtaining and using information on the services of libraries. A number of PIAPs has increased in cafes, supermarkets and other public places.

A nation-wide electronic identity program *ID card* was elaborated at the beginning of 2002. By the end of 2003, over 300 000 ID-cards had been issued, which means that over 20% of the population have an ID-card. In 2003, some institutions of public services introduced digital signature in practice (e.g. TaxBoard, Ministry of Justice).

⁵¹ www.customs.ee

⁵² www.tta.ee

⁵³ <http://helios.nlib.ee/search>

A free secure signing portal has been elaborated for ID-card owners. Provided a person has an ID-card and a computer with a properly adjusted ID-card reader, it is possible to upload a document which will be digitally signed, in this portal. In addition to the person's own signature this document can be opened for signing by other people, provided they have an ID-card. It is also possible to search for persons in the catalogue. The parties can download the signed document from the portal to their computer and retain it. The portal technology is free for use by anyone. (ICA Country Report, 2003).

Currently, additional applications of the ID-card are under discussion. For instance, identification of a person with his/her ID-card in other countries (in customs, police, etc.); access to a person's medical data when abroad; submission of a letter of explanation to the police; submission of applications concerning a person's car to the Estonian Motor Vehicle Registration Centre; submission of applications concerning change of address, marriage, divorce, change of name, change of address, etc to name a few.

Submission of data to statistical offices

Submission of statistical reports via the Internet; the request for information is available from statistical databases.

*Public procurement*⁵⁴

In 1997 the elaboration of electronic public procurement information system was started. In March 2000, a strategy towards setting up a Public Procurement Information System was adopted. A new Public Procurement Act was enforced in April 2001, which represents progress in harmonising Estonian legislation with the *acquis*. In April 2001 the *State Procurement Register* was established, which became the basis for carrying out public procurement. As a result, all activities related to public procurement are Internet-based. The register was launched on 1 April 2002.

In order to be able to enter one's public procurement notice, tender or any other document in the register the purchaser has to register him/herself. The purchaser registered in the state procurement register enters preliminary notice, notice, tender or tender for design contest through the link on the register's homepage. Entered documents are checked by the employees of the register and if the information is in conformity with the Public Procurement Act, it will be confirmed and the next workday the confirmed document will be available for all Internet users on the register's homepage under "Electronic Bulletin".

Since the document is available for everyone in the Internet, all those interested in public procurement can turn to the purchaser on the basis of this information to apply for participation in the public procurement, receive the tender documents from the purchaser and make their tender. All the information in the register is public and available for everyone interested in public procurement. At present the homepage of the state procurement register is in Estonian. The website in English is under construction.

Besides essential Target Programs and Projects in public sector there are other Internet-based information systems in use for public as well as private sector or citizens such as: *Government of Ministers Session Infosystem (e-cabinet)*, *e-State Treasury*, *Centre of Registers of the Ministry of Justice*, *Services of the Court Settlements Register*⁵⁵.

⁵⁴ <http://www.rha.gov.ee/>

⁵⁵ see www.riik.ee/; www.esis.ee/.

The following e-government services were used most widely in communication with state and government agencies:

- paying for services or documents through Internet banks – 48%
- searching for information on homepages – 47%
- printing document templates (forms, applications) – 33%
- exchange of information related to oneself or one's family – 30%
- expression of one's opinion or participation in public discussion – 10%.

The user group of the e-government portal (<http://www.riik.ee/>) is still quite small – 30% of the Internet users. The respondents considered the exchange of information via the Internet:

- very secure 4%
- rather secure 23%
- rather insecure 31%
- very insecure 18%.

To conclude, the preconditions have been created to make basic public services accessible for citizens and businesses via specialised web portals as well as by government departments and agencies. Based on the eEurope 2005 action plans, the national IT architecture is under elaboration, which unites the so far separate systems into a whole to enable individuals and organisations access to a government-wide information system (IT in Public Administration, 2003). This will enable to join the European Union information system and exchange information in a common system. It is also necessary to expand the use of broadband connection for public administration. Work must go on with expansion of e-inclusion of population (e.g. PIAPs, Look@World project).

II.2.6. IT in households

The number of computer and Internet users has quickly increased in Estonia over the last years. On the basis of IBM Monitoring Reports Estonia is at the 5th place (after Cyprus, Malta, Slovenia and Czech Republic) on fixed telephone lines per 100 persons (eEurope+ 2003). The ITU statistics indicates 37% of respondents with a PC at home in Estonia and 26% of respondents with a PC at home connected to the Internet. On the basis of ITU calculations there were about 35 Internet users per 100 persons. The percentage of regular Internet users has increased in Estonia: 56% used the Internet 3 months ago (eEurope+ 2003). E-track survey by Emor Ltd indicates that people who used Internet during the last 6 months accounted for 49% (March-May 2003). 67% of the children (aged 6 to 14) had used the Internet during the last 6 months according to a spring survey of 2003. The number of people (aged 15 to 74) who have never used a computer and/or Internet was similar – 53%. As to the percentage of Internet users in total population, Estonia outstrips several EU countries and is one of the leaders among the candidate countries (SIBIS, 2003). According to the eEurope 2005 actions the broadband network is developing in Estonia (7% of all fixed lines in 2003).

The analysis shows that the cost of a PC was 184% of the monthly household income in Estonia, which is one of factors strongly influencing the decisions to buy a PC (eEurope 2003+). For comparison, in Malta the cost of PC was 47% of monthly income, which is more than 3 times less than in Estonia. Estonians spent 4.9% of their monthly incomes on telecommunication and nearly 3% on purchasing IT equipment in 2001 (IT in Public Administration, 2002).

The following reasons for reaching the present level in computer and Internet usage should be mentioned (the reasons are listed in random order) (IT in Public Administration, 2002):

- educational programs oriented to the use of computers and the Internet; realisation of the Tiger Leap Program to provide schools with computers and Internet connections;
- extensive development of Public Internet Access Points with public funds;
- extensive promotion of Internet banking services provided by banks;
- informing the public about the government's information policy and information society development trends; generating positive attitudes towards information society in the media; enactment of legislation promoting ICT development;
- joint steps and co-operation projects of the government and private companies to create convenient options to use ICT infrastructure (issuing of ID-cards and launching of necessary PKI infrastructure, development of e-government services, implementation of projects such as Look@World , etc.);
- highly developed telephone communication and networks, and the provision of alternative data communication options (wireless Internet);
- the reduction of prices of Internet usage by ISPs and provision of a variety of services for different Internet user groups;
- general fall in prices of PCs with multimedia applications;
- geographical proximity of highly developed ICT countries (Finland, Sweden, etc.) and close and good neighbourly relations; foreign investments in the development of the Estonian ICT infrastructure;
- continuous economic growth, improvement of life quality, etc.

The provision of secure Internet services is encouraging the use of ICT among population and businesses. For example the number of secure Internet servers per million inhabitants is the highest in Estonia (eEurope+ 2003). The vast majority of security problems experienced relate to computer viruses.

Surveys show that Estonians use the Internet prevalingly (Sept-Nov 2003) for sending/reading e-mails (74%), searching for concrete information (72%), using Internet banking (62%), reading Internet publications (61%) and for communication in chat rooms (33%). According to the survey, 4% of all respondents (9% of all respondents who had used the Internet during the last 6 months) used the Internet for ordering/purchasing products/services. At the same time, 21% of those who had used the Internet during the last 6 months visited Internet department stores to obtain information without purchasing anything.

Most of the Estonians use the Internet (Sept-Nov 2003) at their workplace (46%), at school/university (23%), at home (52%) but also at home or workplace of their acquaintances (25%). Since the share of home PCs has grown, the Internet usage in households has increased to 47% of people aged 15 to 74 of those who had used the Internet at least once during the last 6 months. The Internet penetration rate depends on people's possibilities either to buy a computer or use it at work or in public Internet access points, as well as the skills. 15% of the Internet users, mainly younger people, use Public Internet Access Points (PIAPs) (E-track survey, 2003).

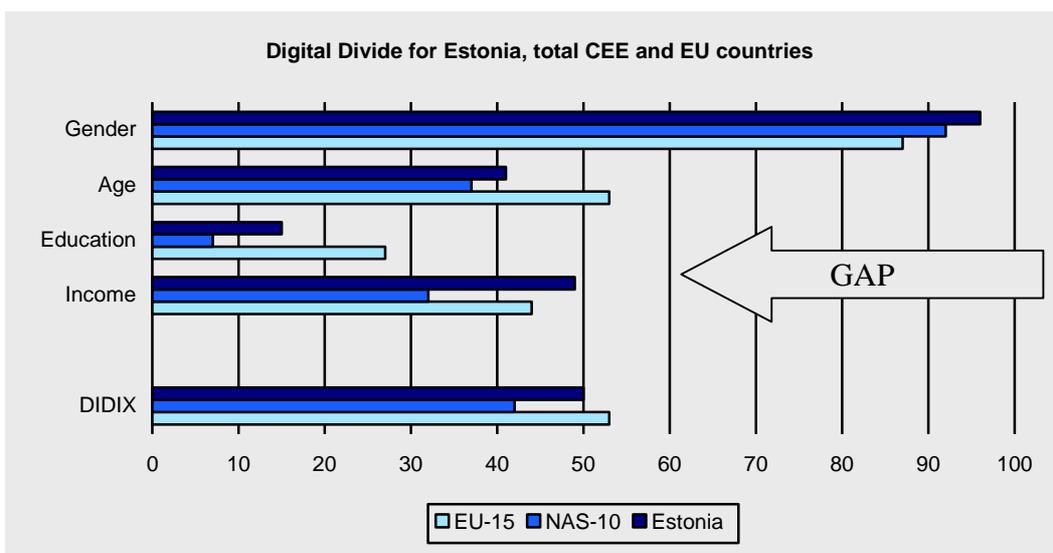
The topic of digital divide has been under discussion in various debates and seminars and a respective survey was also conducted in 2002 (<http://www.oef.org.ee/> - Kalkun & Kalvet, 2002; IT in Public Administration, 2003). As 53% of the adults in Estonia have never used a computer and never used the Internet, social factors that have prevented the application of new means of communication among this part of the population are now under scrutiny in

order to find channels and opportunities for involving everyone in further development of the information society. The survey 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, skills and access barriers, which prevent the wider use of Internet in Estonia (Kalkun & Kalvet, 2002).

To fight against the digital divide, the government has planned to establish a good infrastructure with open Internet access points, Internet connections, PKI infrastructure etc. Several new projects and initiatives have been launched (incl. ID-cards, basis for digital signature) during recent years with the aim of creating new services for the citizens and businesses. The joint project of the public and private sector Look@World (<http://www.vaatamaailma.ee/> - also in English) aims to expand Internet access to non-users by establishing new PIAPs and providing PIAPs with IT tools (up to 450 computers to PIAPs in 2002). Attention will be paid and measures are foreseen to solve the other aspects (services, R&D, education etc).

The Digital Divide Index (DIDIX, defined under SIBIS project) is a compound index that comprises four indicators: gender, age, education and income. The lower the index value is, the more severe the divide is. The lowest is the gender gap, especially in Estonia (Figure 2). The highest is the education divide, which is rather high also in EU countries. In Estonia, the education gap is two times lower than in CEE candidate countries, but higher than in EU-15. The Digital Divide Index value is not far from the EU-15 average and has in Estonia the best result among CEE countries. The low level of formal education for a small part of the population (e.g. 6.7% of population and 0.8% of labour force with no primary education) appears to be the most significant reason why these people cannot participate in the Information Society. But the generally high level of formal education of the rest of the population, which with the availability of advanced training will enable to obtain computer skills quite rapidly, will guarantee a stable development of information society and therefore it is important to tackle the problem of digital divide more than has been done until now.

Figure 2.: Digital divide for Estonia

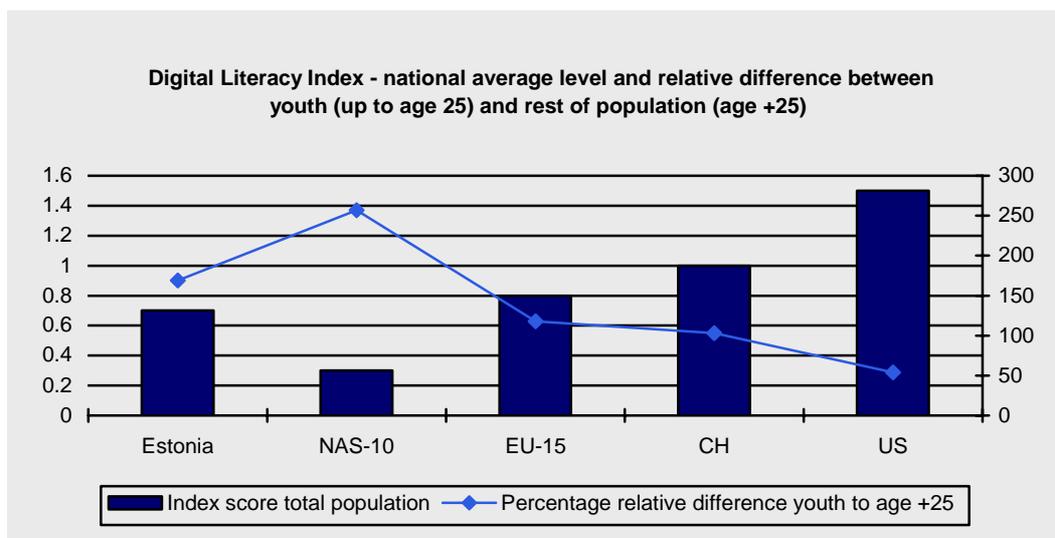


Base: All respondents, weighted column percentages
 Sources: SIBIS 2003, GPS-NAS; SIBIS 2002, GPS

In the Information Society, the ability to operate over the Internet is essential for taking part in the societal processes of living, working and learning. On the basis of the SIBIS survey, 44% of the Estonian population regard themselves as very or fairly confident in communicating with others via the Internet (i.e. feel confident in using e-mail). It is almost the same level as in EU countries (46%). In CEE candidate countries, only 20% of the population feel themselves confident in using Internet.

Digital literacy can be seen as an indication of readiness for qualified use of ICT. The digital literacy index (COQS, defined in SIBIS project) is a measure that combines four types of skills in using the Internet: communicating with others (by e-mail and other on-line methods), obtaining (or downloading) and installing software on a computer, questioning the source of information on the Internet and searching for the required information using search engines. The COQS index combines these items (based on self-assessment) with a range from 0 to 3, with '0' representing the lowest digital literacy score. Digital literacy among the youth in Estonia and Slovenia has the highest COQS index value (1,4) among CEE candidate countries. The same countries have also the highest index value for total population (0,7), which is close to EU average (0,8) (Figure 3). The relative differences between the COQS index scores among the youth and the rest of the population in Estonia are much smaller than the CEE average.

Figure 3.: Digital Literacy Index



Sources: SIBIS 2003, GPS-NAS; SIBIS 2002, GPS

According to SIBIS, usage of e-Learning and participating in work-related training was also higher in Estonia than in other CEE countries. However, security concerns are a significant component of the Internet users' environment in Estonia. The share of population willing to report security or privacy violations shows a certain awareness of the problem in the country. In the diffusion of broadband networks and services, a key objective of the eEurope 2005 plan, Estonia ranks on the second place after Slovenia among CEE countries (SIBIS⁺ – WP 5: Country Topic Report. ESTONIA, 2003).

II.3. A SWOT analysis

Traditional indicators of ICT development reveal that the infrastructure has improved in Estonia in terms of PCs and especially mobile phones in Estonia. Most of the enterprises as well as public sector institutions are provided with computers, which mostly are also connected to the Internet. However, only 22% of the households have a computer. The small number of home computers is made up for by the possibilities to use computer and Internet at work and in public Internet access points. As a result, 49% of people used the Internet (during last 6 months). As to the percentage of Internet users among the population, Estonia outstrips several EU countries and is one of the leaders among candidate countries (SIBIS, 2003). The reasons for reaching the present level in computer and Internet usage is in the opinion of citizens connected mainly with the implementation of information policy priorities, supply of services both by the public and private sector (supply of training; PIAPs, Internet banking, broadband use etc) and the continuously improving quality of the services.

The number of people (aged 15 to 74) who have never used a computer and/or Internet was 53%. The topic of digital divide has been under discussion in the country and government has established a good infrastructure with public Internet access points, Internet connections, PKI infrastructure, several new projects (e.g. ID card) to promote the interest in using ICT.

In 2002, most of the enterprises (83% of activities chosen in the survey) used the Internet, 58% had permanent Internet connection (ADSL, SDSL), 5% of enterprises had wireless connection and 4% broadband cable connection. The diffusion of information society technology is estimated in enterprises which use IT-systems for managing orders to be much lower – 25% of enterprises, incl. 9% who used IST in production management systems, logistics or service operations.

IST use in Estonian banks has grown fast (incl. telephone banking, credit cards, debit cards, ATMs; Internet banking, mobile banking and digital TV banking.). Estonian large banks launched also an m-payment system. Banks invest continuously in information technology as users facilitating development of customer friendly IT solutions. The activities of banks in IST application have been assessed to be one of the advantages in the development of e-commerce (e.g. Internet banking), conducing to the growth of positive attitude towards e-commerce among population and generating demand for additional services and payment possibilities.

The development of e-commerce indicates a growing trend. Although this possibility is today used more by enterprises (B2B - 29% enterprises) rather than individuals (B2C – 4-15% by different estimates), surveys indicate that interests in e-commerce are higher than it is actually used (18% of population). Reasons for not using e-commerce in Estonia are not so much related to the fear of insufficient Internet security (8%), but rather the fact that it is not possible to check the quality of goods (30%) or that the traditional way of shopping is preferred and customary (41%). The growth of internetisation, as well as improvement of the relevant legislation, which is on the agenda of the government, will certainly conduce to the increase of e-commerce.

Card payments are quite popular in retail trade in Estonia and mobile technology is seen as another most important driver of the information society, the penetration rate of which is 58% among individuals. Estonia has achieved some remarkable results in the field of mobile value-

added services (mobile parking, m-payments). According to prognoses, the number on Internet users will grow in Estonia, which presumes a growth of e-banking. It is also prognosticated that the emphasis will be laid rather on the growth of mobile phone-based services.

Public sector IST applications have been supported by adherence to the information policy priorities (e.g. schools' internetisation). Most of the schools have been provided with computers and Internet connections through the financing schemes of the government and foreign help. The target – one computer per 20 pupils – has not been achieved yet, as it has been estimated that there are ca 24 high school students per one computer now (for comparison - EU average is 10-15). In 2003, some institutions of public services introduced digital signature in practice (e.g. TaxBoard, Ministry of Justice). Nearly 20% of the population have ID cards for authentication.

In recent years, e-education has increased at higher schools (e.g. University of Tartu; Tallinn Technical University). In 2003, the Estonian e-University was founded, which is a consortium of Estonian universities and professional higher schools. School-home communication interface e-school was established by the aim to improve parents' (and student's) communication with school via Internet.

Estonia has no unified functioning health information system yet, but it has many of its components, e.g. hospitals', family doctors', emergency aid, pharmacies', Health Insurance Fund's information systems, as well as registers and databases between which the exchange of information is in the stage of establishment. Health related services, i.e. interactive advice on the availability of services in different hospitals; appointments for hospitals are available via online already today. The health monitoring program Doc@HOME that has been elaborated in Estonia has been introduced in Estonia and internationally. Electronic health cards and health information networks are to be introduced.

Public administration activities have been aimed at the development of ICT environment through elaboration and implementation of state information systems; many projects have been launched and networks created over the web portals, which have enabled to render services to citizens, enterprises and institutions. An example may be web-portals e-government and e-citizen, as well as services "Forms in the Internet", e-TaxBoard, Customs eSystems, Job search services, Public libraries, PIAPs etc. The main principle of the national information policy to provide everybody equal access to information has served as the basis for the activity of the respective structure of public administration (e.g. ministries, IT departments, councils) whose purpose has been to create a favourable environment for spread and exchange of information (e.g. target programs). Elaboration of new solutions for state information systems has been facilitated by the work of good specialists, but there is a risk that these specialists will leave to take up international projects abroad.

These services have caused changes in the structure and work of public administration. Besides better access to public information it makes activities of the government and municipalities more transparent and supports democracy. E-government cabinet sessions have updated the government work methods. However, a further development demands new activities and measures to guarantee security of ICT and reduce the digital divide.

Considering the EU accession, the national development plans have been focused on the development of eEurope 2005 key areas (e.g. e-government, e-learning, e-health and e-

business services; availability of broadband and secure information infrastructure). The basis has been created to make basic public services offered on multiple platforms accessible for everybody via specialised web portals as well as by government departments and agencies. There are a number of e-learning and e-health activities available via the Internet. The broadband network is developing.

<p>Strengths Developed infrastructure (computers, Internet, broadband) The high use of Internet among citizens Extensive development of ICT in schools, on all levels Supply of e-government services Fast development of different kind of Internet and mobile services attracting people to use them Creation of favourable ICT environment by government creating possibilities for service development (e.g. digital signature, ID cards, x-road) The presence of good specialists for elaboration of new solutions</p>	<p>Weaknesses Certain stagnation has occurred in ICT penetration rates (some decrease in 2000-2001). Decreasing fixed line penetration Existence of digital divide Moderate IST use in production management</p>
<p>Opportunities Development of new ICT solutions for public and private sector services (the Internet, mobile) Expected growth of e-banking Development of government-wide IT architecture</p>	<p>Threats High cost of equipment, which is not available for poorer households, thus the digital divide will remain Good specialists go over to take up international projects abroad</p>

III. NATIONAL AND REGIONAL INFORMATION SOCIETY POLICIES

III.1. Institutional settings

Institutional settings for supporting IT development in Estonia are resulting from the main principles of the Estonian information policy, the aim of which is to guarantee everybody (e.g. citizens, businesses etc) an equal access to information. The state in co-operation with the business sector and the third sector has played an important role in co-ordinating building up of the information society in Estonia (Principles ... 2004-2006). The Research and Development Council (RDC)⁵⁶, being an advisory body to the Government, is consulting the Government on issues regarding research and development, prepares documents on research and development policies of Estonia. In its activity, RDC relies on two permanent committees that focus on research, development and innovation policy (see more in subsection III.2).

IT development in public administration was initially co-ordinated by the State Chancellery, Government Department of Communications. In 2000, co-ordination of the state information systems was transferred under the governance of the Ministry of Transport and Communications – Department of State Information Systems and Estonian Informatics Centre. In autumn 2002, the Ministry of Transport and Communications and the Ministry of Economic Affairs were merged under the name of Ministry of Economic Affairs and Communications. The joining of ministries brought transition processes into the organisation of state information systems co-ordination. By the end of 2002 a new organisational structure of ICT management was created (Figure 4). The development of information systems also caused some organisational changes in 2003, for example changes in the organisation of the Estonian Informatics Centre. A councillor responsible for IT was recruited in the Ministry of Economic Affairs lately, which strengthened the level of political administration.

The co-ordination of IT development is centralised under the Ministry of Economic Affairs and Communications. The Department of State Information Systems of the Ministry of Economic Affairs and Communications is responsible for co-ordination of state IT-policy actions and development plans in the field of state administrative information systems: state IT budgets, IT legislation, co-ordination of IT projects, IT audits, standardisation, IT procurement procedures, and international co-operation in the field of state information systems. The Estonian Informatics Centre, which is a subdivision of the Ministry, is responsible for the co-ordination and implementation of the development of state registers, computer networks and data communication, standardisation, IT public procurement, monitoring of the Estonian IT situation and others (ICA Country Report, 2003).

⁵⁶ <http://www.tan.ee/tan/en/>

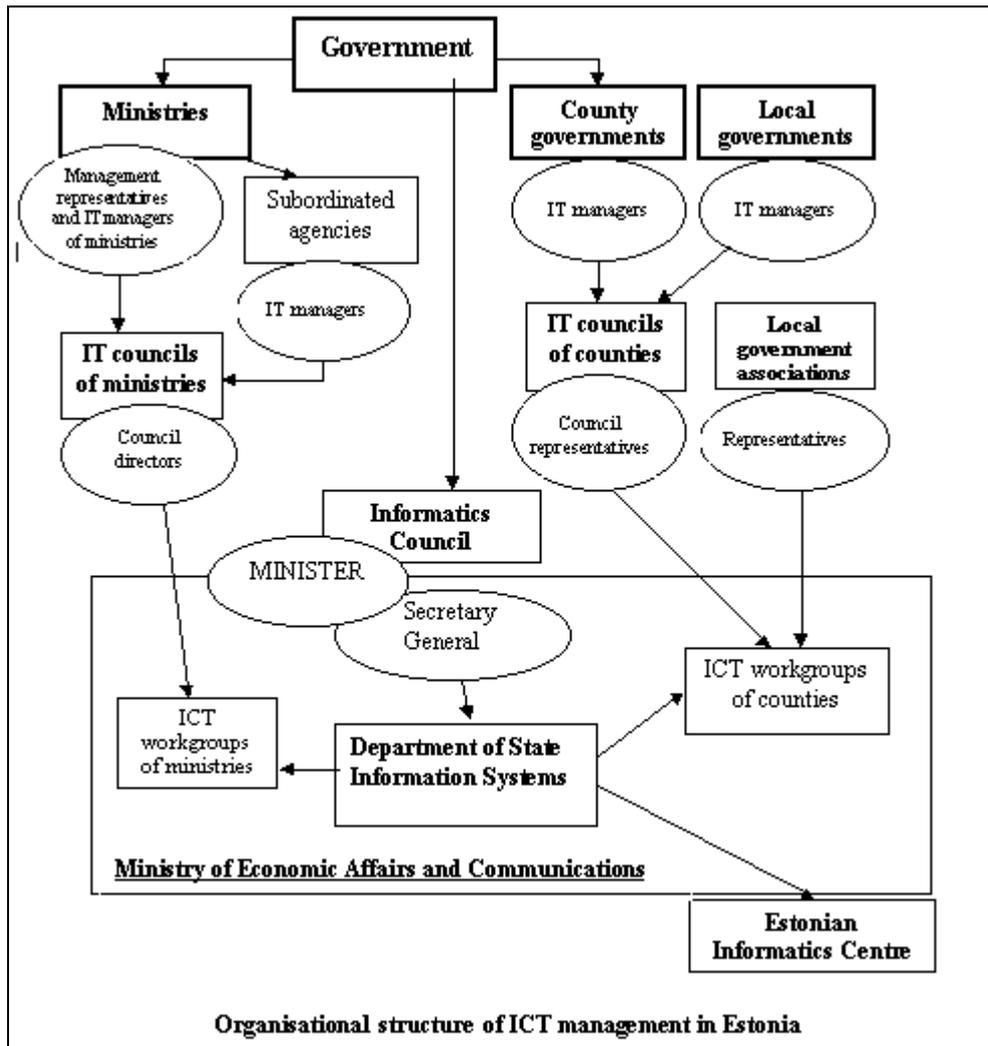


Figure 4.: Structural Scheme of ICT Management System in Estonia
 Source: IT in Public Administration, 2002

The Estonian Informatics Council, a government committee of experts (acting since 1997) is the implementing body in the horizontal co-ordination of state information policies (between the public, the private and the third sector). The representatives of all three sectors (public, private sector and third sector) have been involved in the work of the government committee of experts (Estonian Informatics Council) as well as in the activities of several working groups. The tasks of the Council are: work out the proposals for preparing general principles and strategies for informatisation of the Republic of Estonia; look through the relevant draft laws and express opinions about them; counselling of the Government in the issues of implementing informatics development plans considering the integration to the European Union; examine national development plans of the information systems. The technical maintenance of the Council is provided by the Ministry of Economic Affairs and Communications (i.e. Department of State Information Systems - RISO).

In the Ministry, the development of information and communication technology is co-ordinated by the Information Technology Council, who approves of the IT development strategies in the domain of the Ministry and envisages measures to implement these strategies, based on the information policy principles. The development of information and communication technology on the regional level is co-ordinated by the regional information technology council at the county governor. The regional IT-council organises the elaboration

of IT development strategies in the county and plans measures for implementing these strategies, based on the general principles of information policy. In order to engage the private and third sector (incl. the Association of Estonian Information Technology and Telecommunications Companies – ITL) in the implementation of the action plans, an organisational and financial mechanism will be established (according to the information policy general principles for 2004-2006) at the Estonian Informatics Centre (Principles..., 2003).

The Ministry of Economic Affairs and Communications is organising the implementation of information policies on the basis of the information policy action plans. The action plan is prepared at the beginning of every year for the next year and this aggregates the activities of the different ministries involved in the development of information society, indicating those responsible for the activities, the measurable objectives for evaluating success of the actions and estimates of the financial resources needed for implementing the action plans.

The Ministry of Economic Affairs and Communications prepares the action plans based on the purposes and priorities presented in the general principles and on the strategic documents of the European Union about information society development. Representatives of the public and private sector and research institutions are invited to join in the preparation of the action plans. The action plan aggregates the plans of the ministries for the next fiscal year, which helps to accomplish information policy objectives. The action plan is submitted for approval to the Central Government before the start of the state budget planning process and this serves as a basis for planning the IT expenditure in the state budget. The Ministry of Finance in co-operation with the Ministry of Economic Affairs and Communications work out and submit to the Government an act of law for financing the implementation of the action plan and for organising supervision.

III.2. Chronological description of national and regional IS policies

In information technology development, Estonia has already had some spectacular achievements for a long time, even in the Soviet period. The first national information development program *The Estonian Way to the Information Society* was prepared in 1994.

The Estonian Parliament approved the *Principles of the Estonian Information Policy* in 1998. This document serves as a basis for making public policy decisions concerning the development of information society and also as a basis for the action plans. The preparation of the Estonian information policy framework was concentrated on the following four fields (IT in Public Administration, 2002):

- modernisation of legislation,
- supporting the development of the private sector (e.g. through creating a favourable legal environment; liberalisation of markets; promotion of R&D etc),
- development of communication between the state and citizens,
- acknowledgement of problems related to information society (e.g. personal data protection).

A draft⁵⁷ of the new policy document – *Principles of the Estonian Information Policy for 2004-2006*⁵⁸ was completed by the end of 2002. It takes into consideration the changes in the

⁵⁷ Not yet adopted.

⁵⁸ http://www.riso.ee/et/Infopoliitika2_12_11_03.doc

development of information society, the principles fixed in the documents that discuss the development of information society (eEurope 2005) and it envisages trends and guidelines for planning new activities in sectoral development plans. According to the new document, the public authorities shall carry out their activities based on the following main principles: (1) Implementation of digital administration and e-services in all public sector, providing relevant information and training for the whole society; (2) Keep the level of ICT usage at least on the EU average level; (3) Create preconditions for the development of an export capable information technology sector (e.g. support SME export activity and development of the firms' competency). The information policy aimed at the development of information society is a subject which involves many spheres and which is therefore closely connected with other development spheres implemented on the state level, including educational strategy "Learning-Estonia", research and development strategy "Knowledge-based Estonia" and the national policy to promote small and medium-sized enterprises ("Enterprising Estonia"). The principles of information policy seek to guide and devise a framework for planning activities in sectoral development plans that are aimed at the development of information society (IT in Public Administration, 2003).

The new version of information policy principles includes supplements to previous principles, according to which (IT in Public Administration, 2003):

- development of information society is based on the co-ordinated activities and co-operation of public authorities, private sector and the third sector;
- information society is created for all Estonian citizens and supports regional development and local initiatives;
- development of information society provides an opportunity for equal access to information for all citizens;
- development of information society ensures continuity of the Estonian language and culture;
- development of information society must not decrease the security of citizens;
- development of information society is related to national research and development activities;
- activities of information society development are brought out as separate elements in the national education, culture and social policies;
- development of information society takes into account the information society building programs of the European Union;
- public authorities have equal attitude towards different hardware and software platforms and solve the issue of compatibility by establishing general standards.

The overall goal lies in the development and integration of the ICT infrastructures of the central and local governments into a common citizen-friendly service environment that would observe the principles and requirements of the development of democracy.

The National Development Plan (NDP) has IS development among its top priorities. The specific objectives are: (1) to develop e-services for enhancing the efficiency of the public sector and society as a whole, and (2) to develop information and simplify public access to information (Estonian National Development Plan..., 2003). NDP also emphasises to continue the promotion of a regionally balanced development, i.e. financing and co-ordination of co-operation between the state and local governments in developing e-services in regional programs and county governments' development functions (a common environment for administration, training of officials, standards, systems). Within the development of

information technology solutions, e.g. e-democracy, they are preparing an electronic voting system for the 2005 local government elections.

In December 1999, the State prepared the Estonian Research and Development Strategy 2002-2006 - *Knowledge-based Estonia*, which is focused on the following main areas: user-friendly Information Society Technologies; bio and gene technologies and their applications; innovative industrial and environmental technologies. The Strategy sees the future of Estonia as a knowledge-based society where the development of human capital, research and adoption of new knowledge and skills is the source of growth of the competitiveness of the economy (Knowledge-based Estonia..., 2001). For the strategy implementation, the Spinno program was launched in co-operation between *Enterprise Estonia* (the foundation of enterprise development) and in 2001-2003 the Ministry of Economic Affairs is one of the connecting mechanisms furthering liaisons between entrepreneurship and science. The objective of the Spinno program is to promote the implementation of the results of scientific research in business. The budget of the program was 29 million kroons in this period. Continuation of the program beyond 2003 will be decided on the basis of the program evaluation carried out upon the completion of the program.

The *Public Information Act* entered into force on 1 January 2001, stipulating what information should be generally accessible. Documents must be available systematically and all legislative acts can be accessed electronically. Priorities are set for two years ahead on a rolling program: Document Management in Government; Implementation of Digital Signature; ICT in Education; Service layer for state registries for both citizens and businesses. Services must be provided for Russian-speaking minorities as well.

Most of the necessary IT legislation has already been elaborated in Estonia (see Table 14). Although the laws listed in the table have been amended by today by a number of acts, the rapid development of ICT field requires further improvement of legislation. This applies, for example, to the Database Act (1997), which needs revision according to the introduction of new trends in data processing. As a future EU member state Estonia is harmonising its legislation with that of the European Union. Currently, the work on transporting the European Union's new telecom package into Estonian legislation is under way (ICA Country Report, 2003). The Telecommunications Act will be changed into a law regulating liberalised telecom market. Personal Data Protection Act has been amended during 1998-2003 and its last version entered into force on 1 October 2003⁵⁹. The Ministry of Economic Affairs and Communications is also continuing the elaboration of legislation for e-commerce to cover the missing part of information society legislation therefore to comply with the information society related package of directives of the *acquis communautaire*.

Table 14.: The list of most relevant legislation related to information society in Estonia

Name	Passed on:
Archives Act	25.03.1998
Broadcasting Act	19.05.1994
Copyright Act	06.01.2000
Cable Distribution Act	31.05.2001
Citizenship Act	19.01.1995
Consumer Protection Act	15.12.1993
Databases Act	12.03.1997
Digital Signature Act	08.03.2000

⁵⁹ RT (State Gazette) I 2003, 26, 158

Official Statistics Act	11.07.1997
Personal Data Protection Act	12.06.1996
Population Register Act	31.05.2000
Principles of Estonian Information Policy	13.05.1998
Public Information Act	15.11.2000
Public Procurement Act (new)	19.10.2000
Riigi Teataja Act (new) (Riigi Teataja = State Gazette)	20.01.1999
State Liability Act	02.05.2001
State Secrets Act	26.01.1999
Telecommunications Act	09.02.2000

Note: Texts of legal acts are translated into English by the Estonian Legal Language Centre and are available in the Internet.⁶⁰

Source: IT in Public Administration of Estonia, 2003

The *Information Policy Action Plan* was approved in June 1999. The following areas are covered: education, research and technological development, telecommunications and audio services. The Action Plan is the basis for all government agencies to make specific proposals to the Government: proposals with schedules, sources of finances, and responsibilities for the implementation of information policy programs. Every year the information policy framework has been developed further and the Government has been defining general priorities⁶¹ for implementing information policy resulting from legislative action. The priorities for implementing information policy for 2001-2003 are presented below:

For 2001 the main priorities were⁶²:

- Implementation of the tasks stipulated in the Public Information Act (creating procedures to get access to public information, e.g. registers);
- Establishment of integrated support systems for digital records management (including digital signature and ID-card);
- Document management in public administration;
- Organisation of state registers and their cross-use.
- Launching the Tiger Leap Program in higher education.

The purpose is to develop and to integrate the ICT infrastructures of the state and local governments into a general citizen-friendly service environment.

Information Policy Priorities for 2002/2003⁶³

According to the Government decision of 14 May 2002, the information policy priorities for 2002/2003 were:

- development of services for the citizens, business sector and public administration, especially elaboration of ID-card applications, also based on the list of e-government services defined in the eEurope+ Action Plan;
- improvement of skills and access of social groups in unequal position to services provided electronically;
- 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;

⁶⁰ <http://www.legaltext.ee/indexen.htm>

⁶¹ http://www.publicsectorinfo.com/summary_results/10a.html

⁶² <http://www.riso.ee/et/raamk.htm>

⁶³ <http://www.riso.ee/en/index.html>

- better provision of computers for schools to achieve the ultimate goal – one computer per 20 students;
- launching of the 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 (see financing in Chapter G).

In parallel with specifying the priorities of actions, applications shall be submitted for financing these activities from the government budget. Finances are allocated through specially targeted programs and projects and also include state institutions expenditure on information technology and relevant legislative activity.

Programs for introducing ICT in education also deserve attention (i.e. Tiger Leap; Tiger Leap+; Tiger University). The Estonian Tiger Leap+ action plan for 2001-2005 focuses on 4 fields: ICT competence, virtual learning, sustainable development of infrastructure and collaboration of all parties. These programs are available for schools in all regions.

The ICT financing from the state budget has stayed around 1 percent of the overall figure of the state budget (IT in Public..., 2003) and in absolute value it has increased together with the increase in the overall amount of the state budget (Table 15). The resources allocated for ICT in public administration include fixed costs (maintenance of ICT infrastructure components, annual fees of software licences, outsourced hardware and software services and data communication expenses) and expenses on subcontracting ICT development projects (Estonian Research and Development Strategy 2002-2006). The actual expenditures⁶⁴ on IT in public administration are larger, as the expenditure item does not include the salaries of ICT staff, grants from the state budget, training cost of ICT education and the ICT expenditures of local governments⁶⁵ (IT in Public Administration..., 2003). Therefore, Estonia's expenditures on ICT have been rather modest (compared with other countries where expenditure on IT is estimated at 2.5%-4%).

Table 15.: IT costs in State Budget

Year	MEUR	% of State budget
1999	15.1	1.3
2000	14.5	0.8
2001	17.1	0.9
2002	23.0	1.1
2003*	28.5	1.2

Note: *according to the proposal of expert committee formed by the Ministry of Economic Affairs and Communications for the co-ordination of IT development in public administration

Source: IT in Public Administration of Estonia, 2003

Other sources of finance for introducing information society technologies include local government budgets, funds and support programs (e.g. Phare, Innovation Foundation); enterprises' own funds; as well as personal income (for buying computers and paying for services). Local governments are forced to join their resources when creating information systems under national projects and programs. Private enterprises have invested into computers and computer systems⁶⁶ over 57 thousand euros, which is 4.2% of all investments

⁶⁴ Including activities for preparing the environment for supplying services for citizens and businesses.

⁶⁵The amount of these expenditures is not specified and is not available in statistics

⁶⁶ The information about other expenditures on IST development is not available.

into private sector (Statistical Yearbook, 2003). Though, people's interest in new technologies has been an advantage – they have spent nearly 6 percent of their income on telecom equipment and services⁶⁷. In addition, foreign investments have played an important role, mainly from Finland and Sweden, also support from EU programs (e.g. Phare for Tiger Leap Program).

The Informatics Council has discussed the access to broadband connection and the need to increase it as an important priority of eEurope 2005, as well as providing access to leased line Internet connection in smaller rural districts to create more value added from using the Internet (IT in Public Administration, 2003). The Council has approved the draft law of the state database systems. The perspectives of the citizen portal and development opportunities of the national information society program are still on the agenda. They have discussed the possibility of introducing the European Network and Information Security Agency (ENISA) in Estonia. The Council has supported accession to a new initiative for ICT development of the Baltic Sea region⁶⁸.

III.3. Implementation and assessment of the IS policies

The implementation of IS policies can be assessed taking into account the national strategic priorities and the actions resulting from the priorities (as objectives) (see III.2). The Estonian government has taken a leading role in co-ordinating building up of the information society. The public administration projects have had a decisive role in the development of Estonian information infrastructure and in shaping the corresponding attitudes in the society. The IS development co-ordination is centralised at the highest level (IT councillor of the Ministry of Economic Affairs and Communications, Department of State Information Systems; Estonian Informatics Centre) and the funding mechanism for actions is created partly at that level, too (central IT budget). Activities regarding co-ordination include strategic planning, defining the priority spheres and issues of providing financing for them. The central IT budget includes only direct expenditures for IT equipment, IT project design and maintenance of databases. It does not include salaries for IT staff, IT training costs, exploitation costs of information systems of public administration agencies, data communication costs etc. IT managers of the ministries, county governments and agencies are responsible for organising development activity of information systems. The IT implementation mechanism is weakly developed for regions.

Based on the strategic purposes to provide all citizens and institutions with equal access to government information, efforts have been made to realise communication with citizens, public sector, businesses and other stakeholders through the creation of a government portal (www.riik.ee). On this portal information on and links to all public administration levels (i.e. county and local governments) are provided. Another important activity has been the development of state information systems (e.g. ID cards, records management system etc) with the aim of making information equally available in all regions, while guaranteeing integrity and security at the same time. Therefore, the government's goals (priorities) for the use of IST are not only meant for the public administration and the public sector, but are aimed at the development of the whole society. Such strategy of the government in guiding the information society development inevitably increases its traditional role in the society although it has to co-operate with the private sector (IT solutions) so as to fulfil its tasks, and

⁶⁷ Calculations of the Statistical Office of Estonia

⁶⁸ "Baltic Sea – the Smart Region"

with the representatives of the citizen society (to identify mutual interests) and the state has to offer services that would lead to economic growth (use of IST, e-commerce) and would improve the life quality. It should be emphasised that the success in implementing IS policies has to a large extent been achieved with the support of the private sector, particularly in the development of infrastructure (IT in Public Administration, 2003). The government has also been innovative in introducing IS technologies to create a cabinet of e-government (see E.2.5).

Some progress should be noted regarding the implementation of IS policy priorities by the government. Hence, the IS policies can be evaluated based on the results accomplished (these estimates are presented below). Although not all objectives are directly measurable, it is possible to describe the results of the actions.

In general, the development of the Estonian information society has been estimated to be successful, which has been due to the co-operation of various institutions (Principles..., 2003). As a result:

- legislative framework of the information society, including new Telecom policy, has been developed,
- telecommunications infrastructure has been growing rapidly and the Internet has spread extensively,
- movement of public information has been regulated,
- supply of public services has been simplified,
- public administration mechanisms have been modernised with the help of information technology solutions.

Head of the department of state information systems (A. Ott) has estimated that Estonia is trending from *back-office*-oriented developments increasingly more towards *front-office* or unified service layers developments, where a computer connected to the Internet may be a terminal for many information systems (IT in Public Administration, 2003). The development of databases is trending from data collection to become services-oriented on the basis of these, and from institutional governance-oriented to become inter-institutional systems-oriented. Recent years have witnessed a clear trend from the development of infrastructure toward that of information systems. Public core infrastructure along with the rapid growth of the number of ID-card owners has created new outlooks for creating unified identification mechanisms of the users of e-services and for the introduction of digital signature. On the international level, Estonia has a leading role here — even though these possibilities are still used quite moderately. In this field, Estonia has, according to A. Ott, reached in the "race of ideas and possibilities" the same level as other advanced information society countries (IT in Public Administration, 2003).

The report of McConnell International (2001) has pointed out Estonia's success in the application of IT. The report states that the Estonian situation in the spheres of e-government, human capital and e-business environment is favourable (McConnell., 2001). The research undertaken by the World Economic Forum on the use of Information technology in 82 countries (The Global Information Technology Report 2002-2003 – The Network Readiness of Nations) also indicates a strong Estonian standing in government readiness to employ ICT (Estonia is in the 13th place) and in the use of ICT by the Government (Estonia is in the 8th place).

Considering the eEurope+ Action plan and eEurope 2005 goals, Estonia has made progress in a number of areas of eEurope benchmarking process. According to the SIBIS General Population Survey (conducted in Accession Countries in 2003), Estonia is already close to EU-15 levels in ICT diffusion: citizens' access to and use of PC and the Internet as well as mobile penetration (eEurope Benchmarking..., 2003; eEurope 2003+ Progress Report, 2002). In the areas of e-learning (e.g. digital literacy), e-health as well as in broadband access at home, Estonia and Slovenia have taken a significant lead before the rest of the accession countries. Considering the fast development of information infrastructures (e.g. record high sales of computers in 2003⁶⁹) and the development of the electronic market and electronic services we can predict convergence of Estonian benchmarking indicators to at least the European Union average level. Attention should be focused on the access of leased line Internet connection in smaller rural regions and on the development of broadband strategies.

Rapid implementation of the Internet in Estonia and the relatively high level of its use in comparison with the Central and Eastern European countries is largely due to an early application of the Internet in research and education, as well as to the existence of well-developed telecommunications network. As a result, ICT infrastructure has developed during the last ten years along with people's enthusiasm to take advantage of new technologies. Estonia has achieved one of the highest Internet (45%), mobile phones (over 60%) and PC (47%) penetration rates in CEE and can compete with a number of EU countries (see more in Chapter E). Although the penetration rate growth stopped in 2000-2001, it continued to increase slightly in 2002. This can be explained by the fact that the number of IT-users in Estonia has reached a certain level of saturation for various reasons (e.g. economic possibilities; lack of skills) (see II.2.6). However, the record high sales of computers at the end of 2003 (*Äripäev*, 22.01.2004) allow assuming the development of penetration rates. Despite of this, the issue of digital divide is one of the problems for IS policy implementation and a threat to IS development. Various political measures have been introduced to reduce this divide (e.g. see III.6).

To provide for further development of the information society and to overcome the digital divide, the implementation of new technology in Estonia must become even more convenient and effective than before. The creation of new jobs based on information technology depends on the ability to provide motivation for the non-users of today. For that purpose a suitable training system should be developed and people should be provided with various applications necessary for their everyday life. The attempts of the public sector to create e-government solutions and the activities of the banks in developing Internet banking services have been the main landmarks in the Estonian IT landscape. The improved convenience and efficiency of new IT solutions and substantial Internet services have also contributed to the spread of the Internet (Estonian National..., 2003-2006).

The development of Estonian ICT environment has been progressive. In addition to various private sector ICT services, which are based on modern data communication networks and tools, government-established and state-financed ICT structures have also developed rapidly their information technology possibilities, and the nomenclature, scope and quality of services (IT in Public Administration, 2003) (more in II.2.5). In 2003, technological development was primarily related to the fast development of web technology, which provided new opportunities for the integration and globalisation of information systems and caused a greater need for the centralisation of development of applications. This has also created a new

⁶⁹ "*Äripäev*", 22.01.2004

situation for the organisation of information systems of state agencies and for legal framework.

An ICT environment enabling mutual information exchange in the public as well as in the private sector has been developed in Estonia owing to numerous measures and activities that have been applied for the co-ordination of IT developments over years by institutions established and policy documents elaborated (more in II.2.4). It is needful to elaborate a long-term strategy and strengthen co-operation between the main actors in the future.

Short-term plans include elaboration of a framework for the government-wide IT architecture and standards (IT in Public Administration, 2003). Most of the current state information systems and registers have been established independently of each other. Insufficient attention has been paid to the interaction of the systems. The principal task of the public IT sector is to make the systems citizen- and service-oriented, to join all information systems into a whole to serve the citizens and organisations. This requires from the state fixing of clear rules and agreements in co-operation with public and private sector IT experts and using of common intermediate software. The government-wide architecture seeks to make the Estonian public sector performance more effective, improving services offered to the citizens and business sector in Estonia and in the European Union. Therefore the implementation of this framework will (IT in Public Administration):

- reduce public sector IT costs through repeated use of the centrally realised standard solutions;
- accelerate introduction of new projects with the help of centrally developed infrastructure and intermediate software (PKI, X-tee, KIT, XML project, etc);
- improve co-ordination and administration of state IT systems and elaboration of solutions.

The private sector and third sector have initiated projects for stimulating ICT usage among population. This means that along with the economic growth of society there is still room for modernisation and improvement of ICT infrastructure.

One of the reasons for rapid development of the telecommunications market may be the fact that the fast development of infrastructure was achieved because of the surrender of special rights by concession. The Government of the Republic of Estonia and *AS Eesti Telefon* (ET) signed the concession agreement in 1992. The contract provided ET with special rights for the provision of main services (provision of national and international telephone, telex and telegraph services, together with their installation and interconnection) for eight years (until 01.01.2001). Investments amounting to 4.55 billion kroons (290 MEUR) were made into the development of Estonia's telephone networks pursuant to the concession agreement (Estonian National..., 2003-2006). In January 2001, after the privatisation of the Estonian Telecom, the agreement terminating the concession agreement was passed (in Dec 2000) and market was liberalised and opened to free competition.

The increased labour productivity of the existing jobs, based on the implementation of information technology (both in public and private sector) is mostly dependent upon the capacity to develop new IT solutions and to apply these as effectively as possible. The aim of such innovation processes is the simultaneous improvement of the quality of products and services, accompanied by a decrease in expenditures related to the reorganisation of activities. Therefore, it is the task of government policy to create enterprise environment conditions that

would promote the introduction of IST technologies in production and in other spheres to increase enterprises' competitiveness.

To facilitate the implementation of information technology it is very important to improve the efficiency of training of IT specialists. Extensive implementation of IT in all stages of life, beginning from elementary education and extending to re-training and in-service training, is also very important for the maintenance of the existing jobs and modernisation of the educational system. Considering the shortage of skilled labour, a priority of IS policy is to raise the quality of advanced training and to plan this based on the practical needs.

Estonia has participated actively in the development of eEurope and Northern eDimension action plans and is very much interested in achieving the goals established. Therefore it is important for Estonia to create new, user-friendly IT solutions to be used in e-government, e-education, e-health care, e-economy, etc. to motivate people for using information technology and to provide access for people living in less-favourable conditions.

Focusing on a goal-oriented implementation of information technology can conduce to Estonia's socio-economic development and to improvement of labour productivity. As the necessary measures are designed, attention will be paid to the need to improve Estonia's competitiveness through information technology by increasing the capacity of domestic enterprises to develop innovative technological solutions that are competitive on the international level (Estonian National..., 2004-2006).

III.4. Driving motivation of IS policies

Since the reestablishment of independence in 1991, ICT infrastructure and the use of ICT in society has developed fast in Estonia. As a result, Estonia has become one of the most successful countries in the development of communication technologies in CEE (e.g. ICT penetration; e-government cabinet; see more in Chapter II). In the private sector, the driving motivation is the improvement of efficiency and competitiveness along with the reduction of transaction costs. In the public sector, the driving motivations are not so very obvious. There may be various possible motivations:

- improving ICT education to raise competitiveness of labour resources;
- raising efficiency of the public sector transactions;
- improvement of the decision-making quality of the government and the parliament;
- make the aforementioned decisions more transparent, improve public control.

IS policies elaborated and carried out by the state and government are targeted to comply with the increasing requirements of the society.

The main reasons that played a role in the development of ICT in society can be assessed from the supply as well as from the demand side. The industrial structure is most probably influenced by the proximity of technologically advanced Finland and Sweden, the large amount of foreign direct investments into Estonian companies, given the labour force with a high level of technical education. The increase of Internet users is connected with the motivation of population (as well as businesses) to use ICT and adopt modern technology as a part of one's lifestyle (Krull, 2003). This in turn has been facilitated by the ICT environment and opportunities created with the implementation of IS policies (e.g. lower prices by companies for Internet connections; increasing number of PIAPs; popularity of Internet banking).

Successful co-operation between the government, companies and non-governmental organisations should be mentioned if to assess development motivations of the information society. For example, flexible financing systems offered by the banks to purchase computers and mobile phones have improved the uptake of new technologies (increased demand for Internet connection and mobile phones, see results in Chapter II).

III.5. Commitment of private and public actors, main actors and their tasks

The parties involved in the elaboration and implementation of information policies are:

- 1) public sector, including central and local governments and academic institutions
- 2) private sector, including producers and providers of services
- 3) non-profit sector
- 4) organisations representing the public, e.g. professional, consumer protection and trade unions

The task of the *public sector* is to develop legislation and policy, to organise implementation of the projects and supervision of them, and to create declaratory documents. Estonia's developments in the public sector have been largely initiated and supported by the central government, i.e. computerising schools and public administration, generating legal bases for ID-card infrastructure and developing e-services, although the government has not invested in ICT (around 1% of the budget) as extensively as other countries of Europe.

The Ministry of Economic Affairs and Communications is responsible for information and communication (ICT) as a branch of economy as well as co-ordination of ICT activities between public administration institutions (agencies). Based on the government budgetary policy and the tax base of different government level, the central government functions include the responsibility for law enforcement, funds and public policy issues, county governments are responsible for healthcare service delivery, local governments are responsible for education services delivery. The limited budget resources of local governments have been an obstacle to using (financing) all information technology possibilities (services) on the local level.

The *private sector* is not only taking part directly in the introduction of new technologies, but also in developing policies through its representatives in expert commissions, work groups and in the elaboration of documents regulated in the form of lobby work (information policy principles, laws etc). The development of ICT in private sector⁷⁰ has been mainly driven by banks, telecommunication companies, Internet service providers, retail and wholesale traders etc. Banks introduced first electronic authentication services to enable Internet banking and also offered their customers access to Tax Board, health insurance fund, state-owned electricity provider *Eesti Energia*, to various insurance companies and others.

Availability and development of telecommunication infrastructure can be regarded as an important issue behind the policies. A growth of the use of computers and the Internet would be inconceivable without the development of relevant infrastructure. The main part of the ICT infrastructure has been developed by the private sector, e.g. *AS Eesti Telefon* (Estonian Telephone Company Ltd., since summer 2003 - Elion⁷¹), a company with a big market force

⁷⁰ There is no statistics on the costs of IST development in private sector

⁷¹ www.elion.ee

providing telephone, leased line and interconnection services (IT in Public Administration, 2003). The main competitors for Elion (ET) are *Tele2* and *Uninet (Radiolinja Group)*. After the liberalisation of the telecom market also for fixed and basic services, new operators have entered the Estonian market (see more in Chapter I). The mobile operators' market is divided mainly between three operators - EMT (Estonian Mobile Telephone), *Radiolinja Eesti* and *Tele2*. Today EMT struggles to maintain half of the market (see more in Chapter I).

Commitment of public and private actors can be described by the fact that besides the public sector programs (e-government, DMP, x-rod, e-county, e-citizens, e-enterprises, e-Tax board, Village Road) private sector runs an ambitious project Look@World.

Box 5. Look@World Foundation's Internet Teaching Project

Four private sector companies (2 major banks and 2 telephone companies) started in April 2002 to provide free of charge basic computer and Internet training for 100 thousand persons (about 10% of Estonia's adult population). During 2 years, the budget of the project - 2.9 million Euros - is fully financed by private companies. 220 teachers and nearly 200 classes were involved in the project. As of 11 March 2004 the task was accomplished and 100,000 persons had been trained to use a computer. 29% of the residents of Tallinn and 71% from other counties participated in training courses. 62% of the participants in courses were factory and office workers and specialists, 29% were pensioners, unemployed and other inactive people; by age 65% were under 50 years of age; 75% were females; 8% had basic, 68% had secondary and 24% had higher education.

The post-training studies indicated that 73% of those who had finished the courses also used computer after the courses, including 86% for looking for information, 71% for reading periodicals, 56% for communicating by e-mail and as many (56%) with Internet banks, 7% for ordering goods.⁷²

In addition to the training, priorities of the Look@World project are to increase public access to the Internet (e.g. PIAPs, price policies) and to encourage the use of Internet among non-users (e.g. easier services, raising of awareness). However, it should be considered that the same companies (banks and telecommunication companies) are also the main beneficiaries from broader IT penetration. It helps banks to attract clients (majority of bank transactions are made using ICT devices) and telecommunication companies are the main Internet service providers who gain from offering Internet access. In order to raise motivation to use computers and the Internet, Look@World has planned to participate in organising a mass campaign and to finance the development of services that are more often used (e.g. e-school, see in E.4).

Sources: <http://www.vaatamaailma.ee>; Look@World Foundations's ..., 2003; Progress Report ..., 2002.

The public institutions, private sector actors (ICT companies and infrastructure) and non-profit organisations, including universities and research centres, professional associations and other institutions representing the public intervene in the policy making process (through the mechanisms described in III.2). The main advisory and executive actors in the public sector are: *Tallinn Technical University*⁷³ and *University of Tartu*⁷⁴ in the system of higher education, which have a long-term experience in software improvement. The Research and

⁷² Koolitusprojekti vahekokkuvõte, märts 2004, www.vaatamaailma.ee

⁷³ www.ttu.ee

⁷⁴ www.ut.ee

Development Council (RDC) is advising the government, preparing documents on research and development policy of Estonia.

The task of promoting business competition in the fields of telecommunication and postal services, ensuring the quality of services and rational use of resources, is guaranteed by the *Estonian National Communications Board* (ENCB).

The private sector is represented by several professional unions. For example, *the Association of Estonian Information Technology and Telecommunications Companies*⁷⁵ (ITL), whose primary objective is to unite the Estonian information technology and telecommunications companies, to promote their co-operation in Estonia's development towards information society, to represent and protect the interests of its member companies and to express their common positions. Main activities of the association include popularisation of information and communication technology (ICT), promotion of vocational education and amendment of legislation. *The Estonian Computer Association*⁷⁶ is a non-profit professional organisation formed by the initiative of Estonian IT companies.

The enterprises' support structure includes a number of non-profit organisations, which can help find proper partners for R&D projects, or they might be themselves good partners in such projects: The Foundation Archimedes, Enterprise Estonia, The Estonian Science Foundation. The state supervisory organisations include several inspectorates like Inspectorate of Data Protection⁷⁷. *The Tiger Leap Foundation*⁷⁸ was established for improving IT knowledge in education.

*E-governance academy*⁷⁹ (EGA) is a regional learning centre in Estonia, set up in 2002 by the Republic of Estonia, United Nations Development Program (UNDP) and Information Program of Open Society Institute (OSI). The centre aims to promote the use of ICT in the work of governments and in democratic practices. The centre provides training in e-governance and e-democracy, serves as a platform for exchange of experience and conducts related research in the home country as well as in other countries (e.g. Russia, CIS countries, etc) (see more in II.2.4.).

Other organisations representing the public include *Open Estonia Foundation*⁸⁰ (AEF), which is a charitable foundation founded on 19 April in 1990 with the support of George Soros, an American businessman and philanthropist of Hungarian heritage. The Foundation seeks to create conditions for the development of an open society in Estonia. AEF was the main organisation in the third sector active in raising the awareness of people until 2000, who through project calls has financed several innovative information society projects (for example, the creation of Public Internet Access Points, development of on-line information services, organising seminars and conferences).

⁷⁵ www.itl.ee/english/general/index.asp

⁷⁶ www.afa.ee

⁷⁷ www.dp.gov.ee

⁷⁸ www.tiigrihype.ee/eng/index.php

⁷⁹ <http://www.ega.ee>

⁸⁰ www.oef.org.ee

III.6. A SWOT analysis

In conclusion, the state has played an important role in co-ordinating building up of the information society in Estonia. According to the Principles of the Estonian Information Policy, the main goal of the Estonian information policy is to provide everybody (e.g. citizens, businesses etc) with equal access to information through nation-wide projects. In performing its task of information society development co-ordination, the state has created co-operation frameworks and provided for their operation by a co-ordinated elaboration of IT legislation. In this, the government has been relying on co-operation with the private and third sector through its advisory body – a committee of experts and various work groups. This has led to the development of information society legislation, fast growth of the telecommunications infrastructure and wide penetration of the Internet, regulation of public information movements, simplification of the public services supply, modernisation of public administration mechanisms through information technology solutions.

The liberalisation of telecommunication's market has taken place in since 2001. The creation of e-government solutions and activities of the banks in developing Internet banking services have been the main landmarks in the Estonian IT landscape. The improved convenience and efficiency of new IT solutions and substantial Internet services have also contributed to the spread of Internet. The success in implementing IS policies in terms of infrastructure has been largely due to the private sector.

Although most of the necessary IT legislation has already been elaborated in Estonia, the rapid development of ICT field requires further improvement of the legislation. The accession to the EU requires transporting of the European Union's new telecom package into Estonian legislation, the elaboration of legislation for e-commerce and a number of other improvements to comply with the information society related package of directives of the *acquis communautaire*. The accession to the European Union has increased the government's co-operation with other countries and its participation in international projects.

The information technology development priorities have been financed from the state budget through targeted programs and projects that cost around 1% of the GDP, which is quite modest compared to many other countries. Other sources of finance for introducing information society technologies are local government budgets; funds and support programs (e.g. Phare, Innovation Foundation); enterprises own resources (4.2% of investments into computers); as well as personal income (5% of income for buying computers and paying for services). The limited budget resources of local governments have been an obstacle to using (financing) all information technology possibilities (especially services) on the local level.

Based on the strategic goal to provide all citizens and institutions equal access to government information, efforts have been made to perform interaction with citizens, public sector, businesses and other stakeholders through the creation of government portal (www.riik.ee). The portal joins information on and links to all public administration levels (i.e. county and local governments). Another important activity has been the development of state information systems (e.g. ID cards, records management system etc) with the aim of providing equal access to information in all regions, guaranteeing the integrity and security at the same time. Short-term plans include elaboration of a framework of the government-wide IT architecture. The main goal in Estonia is to create new, user-friendly IT solutions for e-government, e-

education, e-health care, that would motivate people to use information technology and also to provide access for people living in less favourable conditions.

Recent years have witnessed a clear trend from the development of infrastructure towards the development of information systems. Public core infrastructure along with the rapid growth of the number of ID-card owners has created new possibilities for creating unified identification mechanisms of the users of e-services and for the introduction of digital signature. In the international scale, Estonia has a leading role here. According to the eEurope 2005 goals, Estonia has made progress in a number of areas of eEurope benchmarking process. Estonia is already close to the EU-15 levels in ICT diffusion: citizens' access to and use of PC and Internet, mobile penetration. Also, progress has been made in other areas (e-learning, e-health, broadband). Nevertheless, the number of IT-users in Estonia has reached a kind of saturation for various reasons (e.g. economic, skills). Digital divide is one of the biggest problems for IS policy implementation and a threat to IS development. Various political measures have been introduced to reduce this divide. The private and the third sector have initiated projects for stimulating ICT usage among population. Along with economic growth of society, preconditions are created for modernisation and improvement of ICT infrastructure and its access.

In the private sector, most of the enterprises are provided with computers, which are used mostly for finding information, communication with clients and settling accounts with banks, but less so in production. Therefore it is the task of government policy to create in the enterprise environment conditions that would promote introduction of IST technologies in production and other spheres to increase enterprises' competitiveness. Considering the shortage of skilled labour, a priority of IS policies is to raise the quality of advanced training and its planning based on actual needs.

The main parties involved in the elaboration and implementation of information policies are the public, private and non-profit sector and organisations representing the public, i.e. professional unions, consumer protection board etc. The results achieved in the development of IS in Estonia need to be encouraged by elaborating a long-term strategy and strengthening co-operation between the main actors in the future. The reduction of the digital divide, continuous application of IST in the public and private sector and finding resources for R&D would be the important priorities in IS policy development in the future.

Strengths	Weaknesses
Government's initiative in co-ordinating building up of the information society with the aim of providing equal opportunities for all stakeholders The existence of organisational structures for co-ordination IT development A progress in elaboration of the relevant legislation and its continuous improvement Awareness and readiness of society for the implementation of contemporary technologies and experimenting new solutions Liberalisation of TC market The experience of private, public and non-	IS development is concentrated on the development of TC infrastructures, and less on the supply of services Modest financing of ICT development from the state's budget, particularly on local level Weak information policy implementation mechanism in regions Implementation of some IT systems has been slower than expected. Insufficient R&D in private sector Short-term policy priorities are prevailing

<p>profit sectors in IST development and their co-operation</p>	
<p>Opportunities Providing motivation for non-users – respective training programs are developed. Following Lisbon targets Commitment of private and public actors in IS policy elaboration, its implementation and in different actions The experience in e-government implementation is promoting the export potential (e.g. e-governance academy)</p>	<p>Threats Digital divide between the users and non-users of IT may become a problem in the implementation of IS policy goals Possible standstill in IST implementation for different reasons (e.g. economic; co-ordination etc)</p>

IV. INSTITUTIONAL CAPACITIES AND REGULATORY BACKGROUND

IV.1. Regulation of the major markets affecting IST industries

One of the important principles of the Estonian IT policy is to support demonopolisation in order to ensure competitiveness in the market. The government has approved two important acts concerning the telecommunication business – Telecommunications Act and Cable Distribution Act – to ensure fair competition and avoid creation of monopolies in the market.

Since 1991, the Estonian telecommunications sector has gone through a considerable development, driven by high levels of foreign investments. At the beginning of 1992, *Eesti Telefon* was a dominant company on the market and had a specific agreement with the government concerning the development of the national telephone network and telephone services. In return, the company was guaranteed monopolistic rights in the market for local long-distance calls and international calls.

The privatisation of Estonian Telecom took place under the rules of privatisation of the state-owned infrastructure enterprises, which became topical in 1995, where Estonian Telecom was first included into the “State property privatisation program for 1995”. The privatisation of so-called ‘strategic infrastructure enterprises’ was prepared by tenders with preliminary negotiations. Because of the complicated method of privatisation and shortage of experience in the country, the process of preparation (incl. collecting of know-how, support from foreign consultants, development of firm’s development programs etc) lasted some years. The list of infrastructure enterprises (incl. Estonian Telecom) was presented to the Parliament in spring 1998. Privatisation took place through the sales of the shares of Estonian Telecom as a holding company (where 49% of shares were already in the possession of strategic foreign investors). The sale process itself took place at the beginning of 1999. Estonia managed to carry through a complex procedure of international public offering (IPO), including the necessary “road show” and publishing of the introductory and sale conditions’ materials (Terk, 2000). The sale was timed well considering the dynamics of the international stock markets and there was much interest in the shares of the Estonian Telecom. In 1999, the direct involvement of the state in the telecommunications diminished, as the state sold its direct participation in Estonian Telecom via a public offering to a Swedish-Finnish consortium. Sonera and Telia purchased 49% of Telecom shares, the Republic of Estonia 27.3% and public investors 23.7%. In January 2001, the market was liberalised for opening to free competition. Relations between *Eesti Telefon* and the Estonian government are regulated by the Agreement terminating the concession agreement, which was passed on 29 December 2000.

The telecommunications market as a whole is regulated in Estonia by the Telecommunications Act. This Act, passed on 9 February 2000, facilitates the development of the telecommunications market, exercises pressure on the monopoly of Estonian Telephone and those operators whose market share is above 25%. The Act obligates Estonian Telephone to provide universal services at the same price all over Estonia. The main objective of the Act is consumer protection and fair distribution of restricted resources, i.e. radio frequencies and numeration. The purpose of the Act as it is to create favourable conditions for the development of telecommunications and to guarantee the protection of the users of telecommunications services by promoting free competition. The change has occurred in the

ownership structure of the main telecommunications players. The state does not have a majority in any of these operators.

Liberalisation of telecommunications continues to represent a major driver of ICT investment and produces an expansion in the Internet services market. Close competition between service providers (e.g. *Eesti Telefon, Uninet, Tele2*) has brought down data communications prices. However, Internet Service Providers (ISPs) are still dependent on networks owned by the incumbent telecommunications operators, although the issue is under discussion in the country and the situation may change with the continuous market liberalisation.

Changes to numbering were brought by the liberalisation of the fixed telephone market in January 2001. Carrier selection was introduced already in 2001, introduction of number portability is not decided and carrier preselection will be introduced in 2004. As of June 2003 there were 14 operators with allocated access codes and all of them were using the code for provision of services using carrier selection. 12% of all the allocated numbers were allocated to alternative operators. Numbering fees are set for fixed numbers, access codes and signalling points annually, no single payment is charged (IBM, 2003).

Estonia is harmonising its legislation with that of EU, for instance transportation of a new telecom package into Estonian legislation is currently under way. When the current Telecommunications Act of 2000 was aimed at liberalising the telecommunications market, then the new Act currently under elaboration will regulate the liberalised telecom market.

According to the Cable Distribution Act, a cable network shall not be an undertaking which accounts for more than 40 per cent of the turnover in the market of telephone services provided in Estonia or an undertaking which has a holding of more than 10 per cent in such company either directly or through partners, shareholders or third persons.

A company can be declared to have a significant market power (which basically means that it has too much of a market to impede competitive processes) based on many conditions, the most important of which is the company's market share. A company can attract the government's attention if it controls 25% of the market. Furthermore, if a company controls more than 40% of the market, then it is governed by the Competition Act (Estonian equivalent to Anti Trust Law).

Consumer Protection Act (came into force in 1994) defines the rights of the consumers in relations with the sellers in purchasing and using the goods, as well as obligations of the sellers, producers and mediators in protecting consumer rights, the liability for violating them and the organisation of consumer protection.

Institutional implementation capacities

The main bodies in charge of telecommunication regulatory issues are as follows: the Ministry of Economic Affairs and Communications, National Communications Board, National Competition Board.

Telecommunication services are supervised by the *Estonian National Communications Board*⁸¹ (ENCB). ENCB is a government agency in the administrative field of the Ministry of Economic Affairs and Communications subordinated to the Estonian Government.

⁸¹ <http://www.sa.ee/atp/eng/>

The main tasks of ENCB include promotion of business competition in the fields of telecommunication and postal services; ensuring the quality of telecommunications and postal services through regulations; planning and ensuring the rational use of limited resources (radio frequencies and numbering); performing surveillance over the companies operating in the field of telecommunications and postal services. The main activities of ENCB arise from various legislative acts: Telecommunications Act, Postal Act, Cable Distribution Act, Digital Signatures Act and Broadcasting Act. The most important tasks are:

- registration of telecommunication service provision and issuing of operating licences and performing of surveillance,
- registration of companies providing postal services and issuing of operating licences for universal postal services and performing of surveillance,
- fulfilment of conformity assessment procedures for telecommunications terminal equipment and performing of surveillance over the supply and use,
- planning, organising and fulfilment of the use of radio frequency spectrum, issuing of licences for radio transmission equipment and performing of surveillance over the use of radio transmission equipment and radio frequency spectrum,
- planning of the use of numbering, issuing of numbering licences and performing of surveillance,
- issuing of cable television network licences and registering of service provision - planning of broadcasting channels and frequencies and surveillance over their use,
- registration of companies providing services related to digital signature (certification and time stamp service),
- representing Estonia in the activities of international telecommunications organisations and relevant standard organisations.

The Estonian National Communications Board has been operating since 1991. Its original technical regulation functions were supplemented with regulation of the market and competition during 1998-2000. The budget of the Board is financed from the state budget. As of 30 June 2003, ENCB had 136 employees out of which 96 were handling directly the regulatory tasks. According to the plan, the number of employees should increase to 146 (EITO, 2003).

ENCB has issued licences for ten years unless the applicant requests a shorter term. The payment for the registration/licence is only one-time and insignificant. A licence is required for operation of a public telecommunications network if the operation is based on the use of allocations of radio frequency bands from the national radio frequency allocation plan. A licence is also required if a telecommunications network is interconnected with a public telecommunications network or located in the territory of a foreign country. As of 30 June there are 23 operators with a licence for provision of telephone network service and 47 service providers (the licence is not needed, registration only) for provision of public voice telephony services (22 nationwide and 31 local). Licences for mobile market have been issued for GSM and DCS. UMTS licences were granted to operators in August 2003.

The Competition Board has the right to impose sanctions in order to secure the enforcement of the Competition Act.

IV.2. Regulation in the main services and infrastructure sectors

For the creation of a good environment for e-services a number of projects have been launched and legislation elaborated (see also II and III). One of the most significant breakthroughs for the development of e-commerce in Estonia was the enactment of the Digital

Signature Act on 8 March 2000, which became effective on 15 December 2000. This Act provides for the legal validity and enforceability of digital signatures. Additionally, the Act delineates the requirements for a valid certificate, as well as who is able to issue these certificates. The Act also addresses Time-stamping Services and Service Providers, and discusses the supervision of necessary Certification and Time-stamping Service Providers (Cybernetica Ltd.)

Box 6. The implementation of digital signature

In order to make the implementation of digital signature easier, the *DigiDoc* project (<http://digidoc.sk.ee>) was initiated. This project comprises agreed file formats as well as program libraries and applications for handling them. The program libraries are meant for everyone to use, either as a direct library or as samples of a useful code. This helps to follow the common format in the applications of all parties. For example, a certificate issued by a bank must be suitable for submission and use in the Tax Board and vice versa.

DigiDoc-Client applications allow to sign documents and check signatures in the workplace computer. The documents need not be printed out for signing – it can be done directly in the computer. These documents can be forwarded by e-mail and loaded in records management systems. The *DigiDoc*-portal and the *DigiDoc-Client* are freely applied in whatever relations – whether the party being a state agency, a company or a private person. The party must only have an ID-card and a computer with a card reader (in order to sign). In addition, the message gate of *DigiDoc*-portal has been launched. Through the message gate it is possible to digitally sign also faxes and calls. The gate enables to save fax or voice messages in the *DigiDoc*-portal and afterwards it is possible to sign them with the ID-card.

Source: ICA Country report, 2003

The EU eCommerce directive (Directive 2000/31/EC on certain legal aspects of information society services, particular electronic commerce, in the internal market) is being transposed into a new law (ICA Country Report, 2003).

Authentication can be carried out by using the ID-card. The authentication with an ID-card functions securely and it is convenient to use the card wherever user names, passwords, code cards, etc. have so far been used – whether it be Internet banking services, internal applications of a company, intranets or public portals. ID-card is suitable wherever a person needs to be authenticated or when documents have to be digitally signed. The authentication with ID-card functions securely as the card-owner is responsible for his/her ID-card and the usage of it. ID-card can be used also for signing and encrypting e-mails. Every authentication certificate includes the person's e-mail address surname.XXXX@eesti.ee (XXXX is the random number assigned to the person). The person can register his/her daily e-mail address in the mail server and respective e-mails will be forwarded to that address.

Use of Internet is regulated by Personal Data Protection Act and Databases Act. Legislation protecting privacy of Estonian citizens is summarised in the *Personal Data Protection Act*⁸² that was enacted in 1996, but was regularly amended during 1998-2003 and its last version entered into force on 1 October 2003⁸³. This Act regulates the usage of personal data of individuals by the third parties. Generally, the Act was designed to fit within the European Union regulatory environment. Under the Act, non-sensitive individual data can be used without a specific permission of a person. At the same time, to use sensitive personal data,

⁸² <http://www.legaltext.ee/text/en/X1032K4.htm> (Estonian Legal Translation Centre)

⁸³ RT (State Gazette) I 2003, 26, 158

such as religion, political opinions, and similar other information, the third party must obtain permission of an individual whose data is to be used. There are various exceptions, of course. Both Estonian citizens and legal permanent residents are protected by the Act. Processed personal data are protected by organisational and technical measures that must be documented. Chief processors must register the processing of sensitive personal data with the data protection supervision authority, which is the Data Protection Department of the Ministry of Internal Affairs. The Legal Committee of Parliament exercises supervision over the Data Protection Supervision Authority.

The *Databases Act*⁸⁴ was proclaimed by the Estonian president on 1 April 1997, and the law was enacted on 19 April of the same year. This is an untraditional law in terms of the Estonian legal system, as it is one of the least general laws in the country. The Databases Act is a procedural law for the establishment of national databases. The law sets out the general principles for the maintenance of databases, prescribes requirements and protection measures for data processing, and unifies the terminology to be used in the maintenance of databases. Section 5 of the law specifies that state and local governments establish databases pursuant to the procedure that is described in the act. As the Databases Act is a general law for databases, the act governs the maintenance of databases in any area that is not governed by other legislation or acts. The legality of the maintenance of databases is supervised by a Data Protection Supervision Authority.

Standards help to create information and means for its procession available to everybody, and reduce their cost. Information technology would not have such a big impact and wide range of distribution without standards. Standards have opened technology and through this rendered further innovation possible. Standardisation in Estonia on the whole and the IT standardisation committee (EVS/TK4) has an important role to play here. *The Estonian IT Standardisation Committee* is working on adapting a variety of international software quality standards.

Institutional implementation capacities

Estonian Data Protection Inspectorate. Supervision regarding data protection is regulated by two laws: Personal Data Protection Act and Databases Act. The processing of data and liability are also regulated by Health Protection Act, Archives Act, State Secrets Act, Accountancy Act, Statistics Act, Criminal Code, Code of Administrative Offences, Public Information Act etc. Personal Data Protection Act obliged the Government of the Republic to form a data protection supervision authority by 1 January 1997. From 1 January 1997 till 1 February, 1999, the data protection supervisory authority in Estonia was the Department of Data Protection under the Ministry of Internal Affairs. An independent supervising authority - Data Protection Inspectorate - started operation in February 1999. According to Article 17 of the Databases Act, the Legislation Committee of the *Riigikogu* controls the activities of the inspectorate. According to Article 28 of the Personal Data Protection Act, the head of the data protection supervision authority is, in the performance of his or her functions, independent and shall act pursuant to Personal Data Protection Act, other Acts and legislation established on the basis thereof. The main task of the Data Protection Inspectorate is to implement independently the supervision over the legality of processing personal data and keeping databases, as well as organise data protection activities. The issue of precepts to the responsible and authorised personnel dealing with databases, and the administrative

⁸⁴ <http://www.legaltext.ee/text/en/X1060K4.htm> (Estonian Legal Translation Centre)

penalisation for violating the order of keeping and processing of personal data will also fall within the competence of the Data Protection Inspectorate.

In addition to the rights provided for in the Personal Data Protection Act and the Databases Act, the data protection supervision authority has the right to inspect at all times the compliance of the maintenance of state and local government databases with Acts and other legislation; to issue, in the cases provided by law, licences provided by law for the processing and interpose cross-usage of data and for the combination, expansion and liquidation of databases; to resolve disputes arising from data processing and, pursuant to the procedure provided by law, to impose punishments for unlawful data processing or violation of the procedure for maintenance of databases. However, too severe data protection regulation may limit the use of databases.

The important functions of the Inspectorate are the improvement of legislation, the consultation and education of officials and more efficient supervision. The Inspectorate participates in the work of different work groups preparing legislative acts as well as arranges know-how of the officials and exercises on-the-spot control. In the practical work of legislative proceeding, registering, and supervision, medicine has been in the main focus - at first to get the overview of databases kept in Estonian medical institutions and now to organise the supervision of requirements of medical institutions as to processing sensitive personal data. Besides this, problems of correspondence of many national and private sector databases to legislation have been dealt with systematically. The security of state databases has also been dealt with as much as possible.

By now, the supervision activities of the Data Protection Inspectorate have more or less started, but Estonia needs a separate data security agency, which is common in many other countries. The future plans of the Data Protection Inspectorate are closely connected with the aspiration to develop from the status of a national supervision authority to a supporting agency of information security co-ordination.

In December 2000, Estonia ratified the Convention for the Protection of Individuals with regard to Automatic Processing of Personal Data (Strasbourg, 1981). The Convention was signed in Strasbourg in January 2000.

The inspectorate must turn into an institution that is able to systematically supervise and develop data security activities. Besides supervision and development, one of its priorities should be to function as a consultation body. For that, constant and updated overview of training possibilities and needs is necessary, as well as their planning and establishing in case of need. By now it is clear that there is an urgent need for support activities in the field of security during the whole life cycle of state information systems.

Specific attention will be paid to processing of sensitive personal data (concerning persons' private life, medical information and legal aid). Taking into account the present processes in the world, it is definitely IT (including information security) that should be one of the main priorities of most countries - the successful or unsuccessful development of it will be probably determined in the next ten or twenty years in the new top list of countries and their division into developed and developing countries. It would be necessary that data security activities - especially the support activities - in Estonia would achieve enough attention at the highest level of the Estonian state apparatus, as well as necessary systemic position, level and respective funds in the state budget.

The Estonian legal system adequately protects the property rights, including intellectual copyrights, trademarks, trade secrets and industrial design. Estonia adheres to the Bern Convention, WIPO and TRIPS, the Rome Convention and the Geneva Convention on the Protection of the Rights of Producers. Estonian legislation fully complies with EU directives granting protection to authors, performing artists, record producers, and broadcasting organisations. In 2002, Estonia withdrew its reservation on Article 12 of the Rome Convention, thus extending equal treatment to domestic and foreign phonogram producers. (Note: However, because the U.S. is not a member of the Rome convention, equal treatment is not extended to U.S. phonogram producers under this agreement). Estonia signed a bilateral agreement with the United States in 1994.

As for new start-up IT companies, especially those developing software, a major problem to deal with in Estonia would be software piracy. Even though the government is taking measures against counterfeit software manufacturers and its exporters/importers, and Estonian software companies have been doing much better lately as a result of that, the problem still remains. This requires more attention to the regulation of Intellectual Property Protection (IPR).

The *Permanent Copyright Committee* was established at the Ministry of Culture in June 1999. According to the Copyright Act, one of the tasks of the Committee is to improve the copyright situation in Estonia and make relevant suggestions to the Government. For raising the administrative capacity, the Media and Copyright Department at the Ministry of Culture was created in 2000. A special unit was formed at the Tallinn Police Department in order to fight piracy in the market more efficiently. The Estonian Organisation for Copyright Protection was also formed. Training courses are continuously arranged for the police, customs authorities and judges.

IV.3. Regulation in the IST-based public information and services sector

*Public Information Act*⁸⁵ - guarantees the citizens' constitutional right for information; regulates what information on the administrative apparatus and its activities is offered to the public; asserts that all information is accessible also through the Internet (entered into force on 1 January 2001).

A digital archive is being launched for the introduction of digital document management in the public sector, which attempts to organise electronic communication and exchange of information between the state and local governments. It is regulated by the *Archives Act*. Also, databases and information systems are further developed to guarantee the quality, availability and access to information.

Box 7. The modernisation program of national databases

Estonia has started to develop systems that guarantee the maintenance of public administration databases, which is a complex activity and demands changes in both legislation and in the activity of institutions. Special systems harmonise the maintenance of databases and enable more effective exchange of information between databases and information systems⁸⁶. The requirement of establishing the systems guaranteeing the maintenance of databases was stipulated in the Databases Act Amendment Act adopted on 31

⁸⁵ <http://www.legaltext.ee/text/en/X40095K1.htm> (Estonian Legal Translation Centre)

⁸⁶ Source of the description of the development of databases system: IT in Public Administration, 2003

January 2003. According to this Act, all databases of the state and local governments are obliged to use these systems for maintaining the databases by law. The current Databases Act focuses on the establishment of databases and stipulates the rules for that, but leaves out extremely important components of information systems: the use and services of databases, or *front-office* regulation. The current Databases Act established the state register of databases, but for various reasons, it has not worked (undefined target group of users of the databases, narrow administration-oriented approach, diffused, low efficiency).

Hence, to implement new solutions for the maintenance of databases, the Databases Act needs amendments in several important points to bring the Act into line with the contemporary possibilities and needs. The purpose is to make the present bureaucracy-oriented law to be citizen-oriented. A new law must take direction to dealing with the state information system as a whole. The databases register planning must take into account how to make the data available for other state agencies, private firms and individuals. The main purpose is to create an integrated system of registers. Information important for public administration should be available either from one place or an integrated cross-use system. Hence, the primary purpose is to have all databases service-oriented, where the creation of services is based on the need of civil servants and the citizens. In parallel, they have started to work out a new concept of databases state register. Notification of the available services is also important, e.g. for citizens there is the e-citizen portal where the citizens should find information on all public sector services that they are entitled to.

The systems providing for the maintenance of databases are: the information systems data exchange layer X-tee, address information system, system of classificators, information systems' security measures system and geodetic system.

There is no common security measures system for the state information systems now. Thus, the specification of the security needs and requirements of information systems is based on different principles, neither are there any common rules for establishing security standards and measures. Therefore, different security measures are used, some information systems should have, considering their content, a higher security standard, e.g. personal data or delicate personal data, while some systems that do not contain so important data in terms of security are so-called over-secured. A catalogue of standard security measures will be worked out and the choice must be made from these, based on the nature of concrete information system. The purpose is to guarantee on equal basis the security of information systems according to the confidentiality level of data processed in the information system.

Source: IT in Public Administration, 2003

The co-ordination of the IT development in both public and private sector is centralised under the Ministry of Economic Affairs and Communications. The Department of State Information Systems of the Ministry of Economic Affairs and Communications is responsible for co-ordination of state IT-policy actions and development plans in the field of state administrative information systems. The Estonian Informatics Centre is responsible for the co-ordination and implementation of the development of state registers, computer networks and data communication, standardisation, IT public procurement, monitoring of the Estonian IT situation.

For further amendment of the legislative framework to conduce to the development of information society, the following tasks have been underlined in the new information policy principles (Principles..., 2004-2006):

- Protection of the citizens against information society hazards. An information rights charter shall be established to regulate the relationships of individuals with various

information. The legislative bodies will keep watching that all principal human rights are continuously granted with the transition to e-environment.

- Legislative provision of new applied solutions of public sector activity. An e-country regulative environment will be established and the system of public sector registers and databases will be organised.
- Provision for the security of information systems. Creation of a regulative environment for a systemic implementation of information systems' security measures.
- Continuing harmonisation of EU information society and ICT *acquis*; for harmonisation of information society legislation and for sharing the best experience with other countries, joining with the European Council convention No 180.

IV.4. A SWOT analysis

In the process of regulating the markets, the telecommunications market has been liberalised since 1 January 2001 in order to open it to free competition. The liberalisation of telecommunications represents a major driver of ICT investment and produces an expansion in the Internet services market. However, Internet Service Providers (ISPs) are still dependent on networks owned by the incumbent telecommunications operators, although the issue is under discussion in the country and the situation may change together with a continuous market liberalisation.

The telecommunications market as a whole is regulated in Estonia by the Telecommunications Act. This Act was passed on 9 February 2000. Estonia is harmonising its legislation with that of EU, for instance transportation of a new telecom package into Estonian legislation is currently under way. While the current Telecommunications Act of 2000 was aimed at liberalising the telecommunications market, the new Act currently under elaboration will regulate the liberalised telecom market.

According to the *Cable Distribution Act*, a cable network shall not be an undertaking that accounts for more than 40 per cent of the turnover in the market of telephone services provided in Estonia or an undertaking which has a holding of more than 10 per cent in such company either directly or through partners, shareholders or third persons.

A company's market power (e.g. company's market share) is governed by the *Competition Act* (Estonian equivalent to Anti Trust Law) and the Estonian Competition Board.

The *Consumer Protection Act* (came into force in 1994) defines the rights of the consumers in relations with the sellers in purchasing and using the goods, as well as obligations of the sellers, producers and mediators in protecting consumer rights, the liability for violating them and the organisation of consumer protection.

The main bodies in charge of telecommunication regulatory issues are as follows: the Ministry of Economic Affairs and Communications, National Communications Board, National Competition Board. The institutional capacity has been estimated to be sufficient, which is expected to increase in the future in connection with new information technology applications.

In the main services sector, one of the most significant breakthroughs for the development of e-commerce was the enactment of the Digital Signature Act (became effective on 15 December 2000). This Act provides for the legal validity and enforceability of digital signatures. Additionally, the Act delineates the requirements for a valid certificate, as well as

who is able to issue these certificates. The Act also addresses Time-stamping Services and Service Providers, and discusses the supervision of necessary Certification and Time-stamping Service Providers.

The EU eCommerce directive (Directive 2000/31/EC on certain legal aspects of information society services, particular electronic commerce, in the internal market) is being transposed into a new law (ICA Country Report, 2003).

The use of Internet is regulated by Personal Data Protection Act and Databases Act. Legislation protecting privacy of Estonian citizens is summarised in the *Personal Data Protection Act* that was enacted in 1996, but was regularly amended during 1998-2003 and its last version entered into force in 1 October 2003. The *Databases Act* (enacted on 19 April 1997) sets out the general principles for the maintenance of databases, prescribes requirements and protection measures for data processing, and unifies the terminology to be used in the maintenance of databases.

The Estonian Data Protection Inspectorate - its main task is the implementation of independent supervision over the legality of processing personal data and keeping databases, as well as organising data protection activities. By now, the supervision activities of the Data Protection Inspectorate have more or less started but Estonia needs a separate data security supporting agency, which is common in many other countries. The future plans of the Data Protection Inspectorate are closely connected with the aspiration to develop from the status of a national supervision authority to a supporting agency of information security co-ordination.

The Estonian legal system adequately protects property rights, including intellectual copyrights, trademarks, trade secrets and industrial design. Estonia adheres to the Bern Convention, WIPO and TRIPS, the Rome Convention and the Geneva Convention on the Protection of the Rights of Producers. Estonian legislation fully complies with the EU directives granting protection to authors, performing artists, record producers, and broadcasting organisations. Estonia signed a bilateral agreement with the United States in 1994.

The Permanent Copyright Committee was created at the Ministry of Culture in June 1999. A special unit was formed at Tallinn Police Department in order to fight piracy in the market more efficiently. The Estonian Organisation for Copyright Protection was also formed. Training courses are continuously arranged for the police, customs authorities and judges.

The IST based public administration and services sector is regulated by the Public Information Act, which guarantees the citizens the constitutional right for information; regulates what information on the administrative apparatus and its activities is offered to the public; asserts that all information is accessible also through the Internet (entered into force on 1 January 2001).

The requirement to establish systems for guaranteeing the maintenance of databases was stipulated in the Databases Act Amendment Act that was adopted on 31 January 2003. There is a new database law under elaboration, which will be focused not only on *back-office*, but primarily on *front-office*. The objective is to make all databases service-oriented.

Strengths	Weaknesses
Creation of competition among suppliers in telecommunications market	Improvement of legislation is needful for the introduction of e-commerce and other

<p>Regulations and institutional capacities have made available the progress in ICT development</p> <p>Development of government-wide information systems (e.g. databases system)</p> <p>Estonian legal system adequately protects property rights and security matters</p> <p>Development of secure authentication systems</p>	<p>new solutions in practice</p> <p>Internet Service Providers (ISPs) are still dependent on networks owned by the incumbent telecommunications operator</p> <p>Institutional capacities need to be improved in connection with new information technology applications</p>
<p>Opportunities</p> <p>Implementation of new information policy based on new development needs of information society</p> <p>Improvement of institutional capacities</p> <p>E-citizen system development using personal authentication systems</p> <p>Modernisation program of national databases and development of other new solutions</p>	<p>Threats</p> <p>Deceleration of the adoption and enforcement of laws</p> <p>Too severe data protection regulations may limit the use of databases and hence the development of national information system</p>

V. DIAGNOSIS OF FACTORS AND IMPACTS IN THE INFORMATION SOCIETY IN ESTONIA

The stable macro-economic framework and market economy reforms have developed a favourable economic environment in Estonia, providing for a considerable progress made in the process of convergence towards the EU countries.

Since 1994, Estonia has enjoyed rather high economic growth rates that in recent years have exceeded those of EU15 and the Eurozone. Nevertheless, if compared by GDP per capita at PPS, the Estonian level is only 40.3% of the EU average and also below many accession countries.

The liberal and competitive economic environment had a remarkable impact on Estonia's economic growth. Economic freedom indices show that Estonia indeed offered a good business environment to local and foreign investors. As Estonia's domestic saving rate is far too low for funding necessary investments, the inflow of foreign capital has remarkably contributed to investments. Swedish and Finnish capital prevails in the cumulative stock of foreign direct investments in Estonia. Foreign capital flows from highly IST ready Sweden and Finland mainly supported technology transfer, improved management culture and promoted IST penetration in Estonia. Swedish and Finnish capital in the Estonian economy has obviously implications on IST development. Partly or fully Swedish or Finnish owned enterprises are the main IST sector enterprises in Estonia. Domestic enterprises kept in line with foreign owned ones and some even run ahead.

An increasing convergence of the structure of Estonian economy towards the industrial countries could be noticed in the 1990s. The most common characteristic of the structural changes has been the decreasing importance of agriculture and post-Soviet industries, while rapid development has taken place in the number of new industries and in the services sector. The share of the primary sector in GDP dropped to 5.4% in 2002 and the total number of people employed in the primary sector decreased more than threefold in 1991-2002. The share of services sector in GDP has grown fast and was 68.6% in 2002.

Industry provided approximately one-fourth of Estonia's total value added in 2002. The processing industry makes up a large share of the traditional branches of the economy and is heavily dependent on external developments. The most important branches are food, timber, machinery, equipment and light industry. Industry relies upon exports and there is a high share of exports through subcontracting for contemporary machinery and equipment, mostly managed by subsidiaries of large Nordic corporations. So far, the main problem has been the low value added content of Estonian exports.

To realise the industrial development potential, the focus should be on development and establishment of technology-consuming enterprises with a good potential for growth. It is important to switch from sub-contracting for foreign companies to development of original products and to specialise in production of single products with a high potential, because Estonian industry is too small to manufacture products extending to whole branch. The potential of food processing industry is based on availability of domestic raw materials. Wood processing industry should advance the technological processes to manufacture complicated products with a higher processing level, as this is important for changing from raw material

export to more profitable export of processed wooden products. Manufacture of apparatus has the best prospects as Estonia can make use of a great number of researchers, engineers and well-educated labour force in Estonia. A further potential is seen in the birth and growth of completely new industries, such as microbiology, pharmacy and ICT. The objective would be to turn from a country with a low technological level and cheap labour into a country with a high technological potential and qualified labour.

While the production growth of Estonian industry has been fastest among the candidate countries, the productivity of labour is rather low. According to the labour productivity indicator of Estonian industry, Estonia belongs to the lowest group of EU and candidate countries. The labour productivity is low mostly because of insufficient product development, limited search for innovative solutions and a large number of employees with qualification not matching the changed labour market demand, and also because most of the industrial output is produced in labour-intensive sectors of industry. Specific factor contributing to the low productivity in Estonia is production of electrical energy from oil shale (91% of the electricity in 2001). In order to increase the efficiency of electricity production from oil shale, reconstruction of the whole sector has been launched, during which process the hazardous waste emissions into the environment will be reduced to the minimum and the labour productivity will grow. In reference to the opening of the electricity market, an open market gives an opportunity to Estonia to participate as a partner in the Baltic and Nordic electricity markets and to control (or influence) electricity prices in the market.

Until 2000, the tendency of decreasing employment, increasing unemployment and inactivity was dominating. In 2001, the trend of employment and unemployment changed – the employment rate started to rise (the share of employed people in the population aged 15-64 increased to 61.7% in 2002) and unemployment to fall (the unemployment rate declined to 10.3% in 2002). The share of industry in employment accounted for more than one-fourth in 2002. The share of employment in services sector of total employment increased to 61.7% in 2002. The formal educational level of the labour force is relatively high. The proportion of educational level of the population aged 15-74 has been stable: about one-quarter have lower than upper secondary, half have upper secondary and the remaining quarter has tertiary education.

The relatively low-cost labour resources have been one of the attractive features of Estonia (the average wage level in Estonian industry is 26% of the average in EU). At the same time, the real wages have risen much quicker than the overall productivity of the Estonian economy. Although Estonia will still enjoy some cheap labour related competitive advantages in the short term, this may lead to the loss of this competition advantage. There are already cases of re-location of high tech manufacturing from Estonia to cheaper labour cost areas, e.g. to Russia. The increasing labour costs as a result of the rapid rise of wages probably cause a decline in subcontracting in Estonia and ultimately, also a decline in ICT sector exports, because subcontracting contributes a high share in this sector. Therefore, in the medium and long term, the Estonian industry will be probably locked in the activities of low technological and low income level if the current trend of specialisation continues.

In a changed economic situation, services have become critical for the survival of a business. In Estonian trade, marketing, juridical services, real estate and business services, transportation and communications, financial intermediation and insurance have become increasingly more important, providing network-like connections between producers as well as between producers and consumers. In sales of services, business services (advertising

services, architecture and technical engineering consultations, security and guard services) have had the highest share (about 75%). The share of computer services of sales of services has risen and the structure of computer services changed significantly – the share of creation of databases declined from 47.3% to 12.2%, but the increase in the share of other computer services (maintenance and repair of office equipment and computers and others) was notable (from 32.4% to 73.7). Tourism has turned one of the more important branches of the economy. Assessing direct indicators, the share of foreign tourism in GDP comes to 8% (7% of employed) and the indicator may even total 15% if we consider the indirect impacts.

There are regional differences in economic development within Estonia that could hinder IST development to some extent despite the small territory of the country and the relatively high share of urban population. Regional differences in GDP per capita levels in Estonia are to a large extent caused by differences in economic structures. Large regional differences in the level of employment and unemployment may be inherited from the past or/and introduced during economic restructuring after the beginning of the transition. There is still a relatively higher incidence of unemployment in the former agricultural and industrial regions. However, these have started to diminish gradually, facilitated by accelerating entrepreneurship development in many counties. Due to the greater concentration of population and ICT sector businesses in Tallinn, better ICT services are offered there and some evidences of regional digital divide can be found. Nevertheless, Internet and mobile phone services are quite well accessible in all towns and countryside as well.

Expenditures on research and development activities are very low in Estonia. The research intensity of the Estonian economy during the period of 1995-2001 fluctuated between 0.6% and 0.7% of GDP, which amounts to only about 37% of the average for EU member states. The public sector is the largest investor (78%) in research and development activities. Nevertheless, the public sector expenditures on R&D are still lower than the EU average. The share of IT budget in the state budget during 1995-2001 has been about 1%. Investments in computers increased in 1996-2001 nearly twice faster than general investments in tangible fixed assets. Estonian enterprises' expenditure on R&D amounted to only 0.26% of GDP in 2001. Though R&D development in the sphere of IT is one of the key directions of increasing the competitiveness of Estonian economy, the public sector allocated for IT R&D activity only 5% of the public sector allocations for R&D in 2000.

The development of the Estonian ICT sector has been gradual throughout the last decade, from low value added computer assembling activity to higher value added software production and telecom services. According to the European Information Technology Observatory (EITO), the estimated market for ICT products and services in 2003 was 857 MEUR (increase 17.2% compared with 2000) and increase for 2004 of 7.2%. Based on EITO estimates, the value of the Estonian telecommunication market was 604 MEUR in 2003 (510 MEUR in 2001 and the share of telecommunication market value 8.2% of GDP). The telecommunication market value is predicted to grow 7.6% in 2004. The share of telecommunications in ICT market has been about 70%. Although further developments in the ICT sector are very much dependent on how dynamic the growth in computer services and software is, the share of software and services in total ICT market has been relatively low - about 12% over the last years.

Until the year 2000, the growth of ICT market was relatively fast with the annual average of approximately 20% and higher. However, in 2001 the growth rate declined to 0.1% coping with the global ICT downturn, but in 2002 rose again to 10%. The software products growth

rate dropped from 15.0% in 2001 to 7.7% in 2003, and that of IT services even more. The telecom market decline stopped in 2002 (increased compared with 2001 9.9%) and being the engine of the ICT sector growth, is experiencing now a gradual stabilisation and even saturation in some domains (e.g. Internet subscribers).

The ICT market is shared between a few large corporations, which consolidate a substantial economic power and account for a dominant part of the entire Estonian ICT sector. In 2001, ICT sector comprised eight large enterprises (generated 85% of total turnover) and many small (250 with staff 1-5 persons) IT enterprises with lower market relevance, which specialised either in subcontracting, sold hardware and software or developed niche products. A majority of ICT sector enterprises are located in larger cities, particularly in Tallinn where about 70% of the enterprises are concentrated.

More than half of the enterprises in the sector are service providers or mediators. Several enterprises are engaged in multiple activities, like manufacturing (producing) and sales. Selling of different products generates about one-third of the turnover. The next by the volume of turnover (17%) is manufacturing, production of computers/components accounting for almost 50%, the rest is production of various electronic and telephone devices and microchips. Product development is relatively underdeveloped in the ICT sector, in many companies (85%) it is lacking. Due to the currently low science intensity, the ICT sector is not capable of creating a productivity growth, neither inside the sector nor in other sectors of the economy.

The driver segments in ICT sector are telecommunication services, telecom equipment production and computer services. Telecom spans both IT hardware and software and services, produces a substantial output in terms of ICT. Computer services are a generic heading for a number of sub-activities that all embrace primarily immaterial aspects of adding value, i.e. maintenance, integration etc. This is also the reason why this sector is overwhelmingly interconnected with the rest of business activities. The performance in ICT cluster (comprises IT hardware production that incorporates also electronics sector, IT software production and services, also some fields of manufacturing, banking, wholesale and retail and governmental structures as final users) is based to a large extent on the development of telecom, as telecom provides substantial input to computer services and equipment production. An important role in the ICT cluster's development is also associated with governmental structures, which obviously are the target groups for several ICT sector segments such as software production.

The high share of ICT production in total exports outlines the relatively high foreign demand for these products, reaffirming a potentially good starting point for sustained competitive position in the ICT cluster. The largest export partners for ICT goods are Finland and Sweden that can serve as the basis for the Estonian ICT cluster to be part of the larger Scandinavian ICT cluster. The dynamics of ICT imports in special imports of commodities has had a slightly declining trend. The relatively large export and import shares refer to high subcontracting (imported goods are partly used for re-exports) in ICT sector.

As a great majority of Estonia's ICT related exports is produced on the basis of subcontracting the main R&D expenditures are made abroad keeping Estonian R&D expenditures low. Subcontracting also enables to enter the parent company's marketing networks. There is another reason for regional cohesion with the Scandinavian ICT cluster, however at a price of being a somewhat lower value adding performer in the production value

chain. Notwithstanding the quite acceptable development until now, some replacement of subcontracting with original Estonian production is badly needed. In order to escape from the status of a cheap subcontractor, Estonia needs a comprehensive economic policy aimed at increasing technological and organisational efficiency via using new knowledge and technologies. In this sense, the most important factors are transparent innovation policies in strategic development plans and well-targeted education and training policies.

The ICT sector is primarily determined by the quality of local workforce and an advantage of Estonia in ICT implementation has been the presence of qualified ICT experts already in the stage of economic transition. The total number of employed in ICT companies was estimated to be 8793 (1.5% of total employment) in 2002, of which 56.3% were engaged in 10 companies with more than 100 employees. 75% of all people working in the ICT sector have higher education. One of the most serious problems for the ICT sector is that more than half of ICT enterprises had a shortage of R&D specialists for concrete products or technologies, 39% were looking for project managers and sales personnel, and only 10% needed R&D personnel, 20% presumed that the need for new research R&D personnel would rise in a long term.

About 700 new ICT specialists enter the Estonian labour market annually. The need for ICT specialists is estimated to be 600 people per year. Enterprises of the sector need about 400 specialists, the others go to work to companies outside the sector and ca 100 people do not work in their speciality. There is a deficit of specialists in the labour market due to the fact that employers refuse to accept vocational schools as educational establishments producing ICT specialists. Consequently, it is necessary to raise the quality of education of those graduating from vocational schools. In the long-term, the need for specialists may increase. According to the expectations of the enterprises surveyed, the need for software specialists possessing a relevant academic qualification will be the first occupational group to be recruited.

A factor that has been influencing and continues to influence the socio-economic development of Estonia, especially its educational system is the declining birth rate in the 1990s. The decreasing number of students at different levels of education has a direct impact on the schools network and teacher training.

Although the number of students indicated growing trends in the period of 1995-2001 for all levels of education (most significantly for higher education), a worryingly large number of young people leave school before completing even basic education. This can be treated as a sign of broadening educational stratification - while more and more young people continue in higher education, there has also been an increase in the drop-out rates at the upper level of basic education. The situation where, on the one hand, the share of people with high educational level is increasing and on the other hand, the share of those with only basic education is also increasing, is a cause for the increasing inequality in society based on income and other economic and social differences depending on the educational level.

Due to the very low reputation of vocational education in the society, an increasingly higher share of graduates from basic education continue education in general secondary education and less graduates go to vocational education. At the same time, the labour market situation indicates the necessity to obtain vocational education because of the relatively high unemployment among graduates from general secondary schools. Vocational education schools have introduced changes to the programs offered, but these changes are not sufficient

to comprehensively respond to changes in the labour market and enhance employability also of vocational education graduates. The shortage of highly qualified skilled workers is the most important reason of structural unemployment. Though the introduction of the modular system of curricula in the educational system has provided an opportunity to continue studies in any age for people with different educational level, there is no stable state training and retraining system. Considering the rather high level of formal education of Estonian population, the creation of a training and retraining system should quite effectively raise the level of their knowledge and skills and increase competitiveness on the labour market. Despite the vocational education reform measures, rearrangements of vocational education have not yet yielded results that satisfy labour market demand.

Pupils in Estonia acquire very basic computer knowledge already at primary and secondary school. The success of The National Tiger Leap Program for computerisation of Estonian schools was a precondition for continuing the program under the name of Tiger Leap Plus Program to develop further ICT in Estonian schools (in 2001-2005).

The number of ICT related students has increased fast during the period of 1995-2001, but over the last years, the proportion of ICT students in secondary vocational education has decreased and in tertiary education has increased, which is in accordance with the demand for ICT graduates in the labour market. As the admittance to ICT diploma, Bachelor and Master courses in computer sciences has risen significantly, the number of graduates is expected to increase in the next years. But the share of ICT graduates with higher education is low (constituted 16.4% of all ICT graduates). In the academic year 2000/2001, ICT graduates constituted 6.9% of all graduates in Estonia: 10.1% in vocational secondary education and 2.6% in higher and higher professional education. As ICT students in tertiary level have good opportunities to find employment already during studies, therefore graduation is not of primary importance for them. Such a situation diminishes the efficiency of the educational system and is also limiting the development potentials of the ICT sector, which needs qualified and constantly upgrading highly educated specialists. So, the large number of ICT graduates from vocational training and the relatively low number of ICT specialists, programmers and engineers creates a danger of falling into a circle with low-skilled IT labour hired by companies producing low value added products and services with practically no innovation or R&D at all. The initiation of the IT college kind of joint efforts for upgrading qualification of the ICT enterprise personnel is a good example, as well as eLearning, providing opportunities for continued life-long learning.

The annual average population of Estonia decreased by more than 210.5 thousand in 1990–2002. The population decrease resulted from two factors: negative balance of external migration and negative natural increase of the population. Due to the fall in fertility and rise in life expectancy, the population of Estonia is ageing. Population projections indicate that if the current demographic trends continue, the total population will be declining and ageing quite rapidly. Changes in the demographic situation have an indirect impact on ICT-related dynamics.

Demographic factors like the increasing life expectancy combined with labour market developments have posed challenges for the pension and health insurance systems. Over the last decade, the labour market factors have been more important, causing a rapid decline in the number of contributors. To comply with the continuing squeeze in labour supply, changes and policies of more efficient use of scarce resources are badly needed. ICT developments

may offer some prospects for the future, notwithstanding the fact that actual changes in employment have been rather small up till now.

The main social problem is the increasingly high stratification of the population. The number of those who live in poverty or on the edge of poverty is still high. In Estonia, the Gini coefficient was stable between 0.37 and 0.38 in 1997–2002. The ratio of decile X and decile I was 9.4 times in 1996 and increased to 11.0 times in 2001. The average nominal disposable income of a household member in 1999 was 6.6 times as high as in 1992 (in real terms, the income had increased only 1.2 times).

In 2001, 17% (more than 230,000 persons) of the Estonian population lived with income below the poverty line. It means with monthly income less than 76 EUR per household member (60% of the national median income as a poverty line criterion). In the 15 member states of the EU, the average share of population living below the poverty line was 17% in 1996. During the period 1996-2001, the share of men living below the poverty line was one percentage point higher than the share of women - 18% of men and 17% of women were living with income below the poverty line in 2001. In the EU, the share of men (16%) living below the poverty line was lower than the share of women (18%) in 1996.

Children have the highest risk of poverty in Estonia. Every fourth child lives below the poverty line (in EU every fifth child). Poverty of children is more dangerous than the poverty of elderly people. Due to poverty the development of child's potentials is inhibited and child's competitive ability will be lower in the future – he/she will find it harder to get a job and earn a decent living. Therefore, the poverty of children threatens the quality of the whole society not only now but also in the future.

In recent years, the consumption structure showed some stabilisation. A positive development in the consumption structure – a fall in the share of compulsory expenditure (food and housing) from 60% in 1996 to 46% in 2001 can be noticed. So have increased possibilities of people to spend a larger proportion of the expenditure on items of their own choice. But the average level of consumption expenditure is low (146 EUR per household member in a month) - it is limited by the low level of income.

Competitiveness of Estonia as a future EU member state can be assessed on the basis of an economic, social and demographic analysis.

Strengths

- Stable macroeconomic framework (the currency board system, the principle of balanced budget, a favourable investment environment),
- The structure of the economy has adjusted to international competition,
- Success in attracting direct foreign investments,
- Good relations with Nordic and other countries in the Baltic Sea Region;
- Production inputs are relatively cheap,
- The relatively high general educational level of the population,
- The number of ICT services available and rather fast development of the telecommunication system,
- Large number of users of such services that create good opportunities for moving towards IS, also for enhancing business.

Weaknesses

- High structural unemployment combined with social exclusion,

- Lack of qualified labour force,
- The educational system does not provide people with training essential for working life,
- Flexibility of the labour force in the labour market is low,
- Fewer opportunities and low willingness of population for life-long learning,
- Low level of productivity,
- The level of development and implementation of new technologies in companies is poor,
- Existence of Regional socio-economic disparities.

Opportunities

- Fast development and implementation of new technologies, including ICT,
- New export markets for Estonian goods and services to be opened after the accession to the EU,
- Increasing co-operation between Estonian and EU companies and research institutions after the accession to the EU.

Threats

- Estonian economy is strongly dependent on the situation in the Nordic and Russian markets,
- Increased competitiveness resulting from the membership in EU.

Assessment of competitiveness of Estonia on the basis of economic, social and demographic trends in the last decade provides a background for the development of IS-related issues.

Policy for active use of IT has developed fast in Estonia since the *Principles of the Estonian Information Policy* were approved by Parliament in 1998. A strategic document “Knowledge-based Estonia” defines the development of human capital, research and adoption of new knowledge and skills as the source of growth for the competitiveness of the economy, labour force and life quality.

Estonia is adjusting to a new technological-economic paradigm, which consists of widespread implementation of ICT in different areas of life and economic growth based on technological innovation. The private sector ICT services are developed mainly in banking, transport and communications sector, and trade. Government policies in the area of IST development are mainly targeted at creation of necessary institutional environment (legal basis, necessary regulation and supervision), IST development in the public sector and promoting improvement in IST knowledge of the population.

These tasks presume legislative, as well as organisational changes. Estonia has been successful in adopting regulations needed for various information society applications and the government has defined general priorities for implementing information policy for the coming year. A needful organisational structure for ICT development was created. Against the background of IS policy tasks, the purpose is to develop and integrate the ICT infrastructures of the state and local governments into a general citizen-friendly service environment that would observe the principles and requirements of the development of democracy.

There are a number of programs in public administration targeted at broad use of ICT in state agencies and local government as well as in interaction with citizens and businesses. As a result of these activities, Estonian ICT infrastructure is well developed and attracts a large part of the population to take an advantage of the information technology. Estonia has achieved one of the highest Internet (45%), mobile phones (68%) and PC (49%) penetration rates among CEE countries. The analysis of last years shows that the implementation of regulations

in some fields has been slower than expected, the IS policy needs an elaboration of long-term strategies and to increase the financing of R&D.

The high readiness of society for the implementation of contemporary technologies and experimenting new solutions has been assessed as one of the driving motivations of the IS policies. This has been supported by a positive influence of Nordic countries through investments into ICT sector, government initiative, high educational level of population and positive developments in the economy (e.g. banking, telecom).

The development and implementation of national IS policies in Estonia has been successful in the short run and good results have been achieved. Nevertheless, a large part of the population has still never used a computer or Internet (53% in 2003). The main goal in Estonia is to create new, user-friendly IT solutions for e-government, e-education, e-health care, widen the broadband access and secure information infrastructure that would motivate people to use information technology and will provide access for people living in less favourable conditions. This needs to be supported by development of education and training system, and enterprises' technological competitiveness. Although several programs and projects have been carried out to reach the broad use of ICT in the country, a certain standstill has occurred in penetration rates in last years. Hence, to guarantee stable development of information society in Estonia, it will be paramount to tackle the problem of digital divide more than has been done until now.

One of the important principles of the Estonian IT policy is to support demonopolisation in order to ensure competitiveness within the industry. The government has approved important acts concerning the telecommunication business and to ensure fair competition and avoid creation of monopolies in the market. Liberalisation of the telecommunications market has led to an increase in competition among service providers and reduction of prices for consumers of services.

Institutional structures and regulations for directing IT development in Estonia and primarily in public administration have been developed and capable to offer services for public and private sectors as well as create relevant IT environment for development of IS. The most important objective has been creation of a legal framework for ICT development and government-wide IT architecture. A progress has been achieved in elaboration of the relevant legislation, although rapid ICT development and changes require further improvement of the legislation (e.g. TC and Databases Act, e-commerce). The Estonian legal system adequately protects property rights, including intellectual copyrights, trademarks, trade secrets and industrial design. Estonian legislation fully complies with the EU directives granting protection to authors, performing artists, record producers, and broadcasting organisations. Development of secure authentication systems (ID-card, digital signature) guarantees the development of e-services.

Institutional implementation capacities seem to be more or less appropriate. Estonia was included among the group of the states with high e-government capacity (Global Index compiled by UNDPEPA and ASPA). The national development plan of information systems envisages to continue promotion of a regionally balanced development, i.e. financing and co-ordination of co-operation between the state and local governments in developing e-services in regional programs and county governments' development functions (a common environment for administration, training of officials, standards, systems). In the development

of information technology solutions, e.g. e-democracy, they are preparing an electronic voting system for the 2005 local government elections.

A SWOT analysis-IS

<p><u>Strengths</u> Stable and supporting economic environment Government initiative in co-ordinating IS development with the aim of providing equal opportunities for all Supply of e-government services and creation of government-wide information systems The existence of organisational structures for co-ordinating IT development A progress in elaboration of relevant legislation and its continuous improvement The commitment of private and public actors, incl. local governments Public awareness and motivation about ICT usage is high Developed infrastructure; high penetration rates (PC, Internet, mobile) Liberalisation of telecommunication market and creation of competition in TC market High professional level ICT specialists Relatively cheap production inputs There is a legal system that adequately protects property rights and security matters Development of secure authentication systems</p>	<p><u>Weaknesses</u> IS development has concentrated on the development of ICT infrastructure and less on the supply of services Implementation of some IT systems has been slower than expected Modest financing of ICT development from the state's budget, particularly on local level Short-term policy priorities are prevailing Insufficient R&D in private sector Certain stagnation has been occurred in ICT penetration rates Existence of digital divide Limited purchasing power of local market Moderate IST use in production management Improvement of legislation is needful for the introduction of e-commerce and other new IT solutions in practice Institutional capacities need to be improved in connection with new information technology applications Low share of exports in products and services by ICT sector enterprises High share of subcontracting in ICT sector High costs related to the fast development</p>
<p><u>Opportunities</u> Extensive implementation of IT in all stages of life, starting from elementary education (computerisation of schools) Providing motivation for non-users – respective training programs are developed Commitment of public and private actors in IS policy elaboration, its implementation and in different actions The experience in e-government implementation is promoting the export potential (e.g. e-governance academy) Development of new ICT solutions for public and private sector services (the Internet, mobile) Development of government-wide IT</p>	<p><u>Threats</u> Digital divide between the users and non-users of IT may become a problem in the implementation of IS policy goals (i.e. access for all) Possible standstill in IST implementation for different reasons (e.g. economic; co-ordination etc) Good specialists leave to take up international projects Deceleration of the adoption and enforcement of laws Too severe data protection regulations may limit the use of databases and also the development of national information system</p>

<p>architecture and modernisation program of national databases Following eEurope action plans in IS development E-citizen system development using personal authentication systems IST development in industry (production development)</p>	
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References

- Adamson, Ü., Kaarli, K. (2001): Mobile Payments in the Baltic States. ePSO-Newsletter – No. 9– September 2001, <http://epso.jrc.es/newsletter/vol09/7.html>.
- Ahn, S., Hemmings, P. (2000): Policy Influences on Economic Growth in OECD Countries: An Evaluation of the Evidence. OECD Economics Department Working Paper, No. 246.
- Altman, M. (2001): Culture, Human Agency, and Economic Theory: Culture as a Determinant of a Material Welfare. *Journal of Socio-Economics*, 30 (2001), pp. 379-391.
- Antila, J., Ylöstalo, P. (2003): Working Life Barometer in the Baltic Countries 2002. Ministry of Labour of Finland, Helsinki.
- Barbone, L., Zalduendo, J. (1996): EU Accession and Economic Growth. The Challenge for Central and Eastern European Countries. The World Bank. Policy Research Working Paper, No. 1721.
- Barro, R.J., Lee, J-W. (1994): Sources of Economic growth. *Carnegie-Rochester Conference Series on Public Policy*, 40, pp. 1-57.
- Bassanini, A., Scarpetta, S. (2001): Does Human Capital Matter for Growth in OECD Countries? Evidence from Pooled Mean-group Estimates. OECD. Economics Department Working Paper, No. 282.
- Bassanini, A., Scarpetta, S. (2002): Does Human Capital Matter for Growth in OECD Countries? - *Economics Letters*, 74 (2002), pp. 399-405.
- Bassanini, A., Scarpetta, S., Hemmings, P. (2001): Economic Growth: The Role of Policies and Institutions. Panel Data Evidence from OECD Countries, *OECD*. Economics Department Working Paper, No. 283.
- Bassanini, A., Scarpetta, S., Visco, I. (2000): Knowledge, Technology and Economic Growth: Recent Evidence from OECD Countries. OECD. Economics Department Working Paper, No. 259.
- Bayoumi, T., Haacker, M. (2002): It's Not What You Make, It's How You Use IT: Measuring the Welfare Benefits of the IT Revolution across Countries. IMF Working Paper. WP/02/117, <http://www.imf.org/external/pubs/ft/wp/2002/wp02117.pdf>.
- Berde, E., Petro, K., Venesaar, U., Viies, M., Maldre, R. (1999): Prospects of the Students from Intermediate Education on the Labour Market in Estonia and Hungary. Harmonisation with the Western Economics: Estonian Economic Developments and Related Conceptual and Methodological Frameworks. Ennuste, Ü. And Wilder, L. (Eds.) Tallinn, pp. 191-223.
- BIT NET Project. Baltic International Telemedicine NETwork (2002): Completion Report, <http://www.bitnet.promotor.telia.se>.
- Braliev, A. and Kalvet, T. (2002): Country Reports. .ee. in the Global Information Technology Report 2001-2002: Readiness for the Networked World. Oxford University Press, <http://www.cid.harvard.edu/cr/profiles/Estonia.pdf>.
- Coyle, D., Quah, D. (2002): Getting the Measure of the New Economy. *ISOCIETY MAYO*, http://theworkfoundation.co.uk/pdf/New_Economy.pdf.
- De La Fuente, A. and Donénech, R. (2000): Human Capital in Growth Regressions: How Much Difference Does Data Quality Make? OECD Economics Department Working Paper, No. 262.
- De Melo, M., Denizer, C., Gelb, A. (1997): From Plan to Market: Patterns of Transition. *Macroeconomic Stabilization in Transition Economies*, Eds. M. Blejer, M. Skreb. Cambridge University Press, Cambridge, pp. 17-22.

- Development Plan of the Estonian Health Insurance Fund for 2003 to 2005, http://www.haigekassa.ee/in_english/developmentplan.htm.
- Doppelhofer, G., Miller, R. I. and Sala-i-Martin, X. (2000): Determinants of Long-term Growth: A Bayesian Averaging of Classical Estimates (BASE) Approach. *OECD Economics Department Working Paper*, No. 266.
- Durlauf, S. N. and Quah, D. T. (1998): The New Empirics of Economic Growth. NBER Working Paper, No. 6422.
- Economic and Social Changes in the Baltic States in 1992 – 1994 (1995): Institute of Economics Estonian Academy of Sciences, Tallinn.
- Bank of Estonia (2002): Annual Report 2001.
- Department of State Information Systems (2002): November 27, <http://www.riso.ee>.
- EBRD (2000): Transition Report 2000.
- Eesti Päevaleht, 15. July 2003.
- eEurope Benchmarking: Key Figures for NAS 10 Countries (2003): The project funded by the European Community under the “Information Society Technology” programme (IST-2000-26276).
- eEurope+2003
- eEurope+ 1st Progress Report – Estonia, March 2002, http://www.riso.ee/et/eEurope+_1stprogressreport.htm.
- European Information Technology Yearbook (EITO) 2003. (2003), <http://www.telearbeit.at/fr/eito/eito2003inhalt.html>.
- Ennuste, Ü., Kein, A., Rajasalu, T. (2002): Institutional Determinants of Convergence: Conceptual Frameworks and Empirical Studies of Estonian Institutional Harmonisation and Socio-Economic Convergence with the EU. CERGE-EI GDN Program project No. 34, http://www.cerge-ei.cz/pdf/gdn/RRCII_34_paper_01.pdf
- E-readiness Assessment: Who is Doing What and Where, Bridges.org – Version 3.6, 23 March 2002.
- Estonian Educational and Research Network (EENet), <http://www.eenet.ee/EENet>.
- Estonian Government of Ministers Session Infosystem. (2000): <http://www.riik.ee/valitsus/viis/viisengl.html>.
- Estonia Hospital Master Plan 2015 (2000): <http://www.sm.ee/gopro30/Web/gpweb.nsf/pages/indexeng.html>.
- Estonian Informatic Centre (2002): IT in Public Administration of Estonia. Yearbook 2001, <http://www.eik.ee/atp/eng/index.html?id=292> (in Estonian).
- Estonian Informatic Centre (2003): IT in Public Administration of Estonia. Yearbook 2002. <http://www.eik.ee/english/2002/> (in Estonian).
- Estonian Informatic Centre (2003): IT in Public Administration. Yearbook 2003 (in Estonian).
- Estonian Investment Agency, <http://www.eia.ee/pages.php3/020215>.
- Estonian Ministry of Foreign Affairs, http://www.vm.ee/eng/kat_130/
- Estonian National Development Plan for the Implementation of the Single Programming Document 2004-2006 (2004), <http://www.fin.ee/index.php?id=5119>.
- Estonian RTDI Strategy for 2002-2006.
- eVikings, http://www.esis.ee/eVikings/evaluation/eVikings_ICT_cluster.pdf.
- European Commission (2001): Real Convergence in Candidate Countries – Past Performance and Scenarios in the Pre-Accession Economic Programmes, ECFIN/708/01-EN.
- European Commission (2002): European Innovation Scoreboard 2002.
- Europemedia, 08/04/2003.
- Eurostat, http://europa.eu.int/comm/eurostat/Public/datashop/printcatalogue/EN?catalogue=Eurostat&collection=02-Statistics%20in%20Focus&product=KS-NS-02-003-_-N-EN
- Eurostat, <http://europa.eu.int/comm/eurostat/Public/datashop/print-product/EN?catalogue=Eurostat&product=1-eb011-EN&mode=download>.

- Eurostat, <http://europa.eu.int/comm/eurostat/Public/datashop/print-product/TableDesMatiere#TableDesMatiere>.
- Eurostat, European Commission (2002): The Social Situation in the European Union 2002, <http://europa.eu.int/comm/eurostat>
- Facchini, G., Segnana, M. L. (2003): Growth at the EU Periphery: the Next Enlargement. The Quarterly Review of Economics and Finance, 43, pp. 827-862.
- Forms in the Internet, <http://www.riik.ee/blanketid/>.
- Freedom House. Freedom in the World Country Ratings 1972-73 to 2000-01. <http://www.freedomhouse.org/research/freeworld/FHSCORES.xls>.
- Havrylyshyn, O. and Rooden, R. (2000): Institutions Matter in Transition, but so do Policies. IMF Working Paper, WP/00/70.
- Heinlo, A. (2001): Education. Social Trends 2. Statistical Office of Estonia, Tallinn.
- International Center for economic Growth European Center (ICEG EC) (2003): News of the Month Nr.11, June 2003.
- International Council for Information Technology in Government Administration (2003): ICA Country Report 2003.
- Index of Economic Freedom. The Heritage Foundation, <http://www.heritage.org/research/features/index/>
- Innovation Policy in Six Applicant Countries: the Challenges. National Policy Frameworks for Innovation (2001). Stand-alone paper No 1.
- Integrated Learning Environment Miksike, <http://www.miksike.com/>
- Kalvet, T, Pihl, T., Tiits, M. (2002): Analysis of the Estonian ICT Sector Innovation System. Executive Summary. Estonian eVikings. Archimedes Foundation, Tartu.
- Kaufmann, D., Kraay, A., Zoido-Lobaton, P. (1999): Governance Matters. The World Bank Policy Research Working Paper, No. 2196.
- Kaufmann, D., Kraay, A., Zoido-Lobaton, P. (2002): Governance Matters II. Updated Indicators for 2000/01. The World Bank Policy Research Working Paper, No. 2772.
- Knack, S., Keefer, P. (1995): Institutions and Economic Performance: Cross-country Tests Using Alternative Institutional Measures, Economics and Politics, Vol. 7, No. 3, pp. 207-228.
- Knowledge-based Estonia (2001): Estonian Research and Development Strategy 2002-2006. RTI, 97, 606.
- Kerem, K. (2003): Internet Banking in Estonia. PRAXIS Centre for Policy Studies.
- McConnell International report Ready? Net. Go! Partnership Leading the Global Economy
- Krull, A. (2003): ICT Infrastructure and E-readiness Assessment Report: Estonia. Praxis Center for Policy Studies.
- Kurik, S., Lumiste, R., Terk, E., Heinlo, A. (2002): Innovation in Estonian enterprises 1998-2000. Community Innovation Survey 3, 2002, <http://www.mkm.ee/dokumendid/Innovation%20in%20Estonian%20Enterprises%201998-2000,%20full%20text.pdf>
- Laafia, I. (2001): R&D expenditure and personnel in Europe and its regions. Eurostat. Statistics in Focus, theme 9, 3/2001.
- Laafia, I. (2002): National and regional employment in high tech and knowledge intensive sectors in the EU. Eurostat. Statistics in Focus, theme 9, 3/2002.
- Laur, A., Soosaar, S., Tenno, K. (2003): Development of Electricity Markets – Options for Estonia. Essays in Estonian Transformation Economics. Edited by Ü. Ennuste and L. Wilder. Tallinn, pp. 211-244.
- Linnamägi, Ü., Asser, T. (2002): Mida võimaldab telemeditsiin. Horisont 3/2002, 35-39.
- Look@World Foundation's Internet Teaching Project. Progress Report as October 2nd 2003. Look@World, Tallinn.

- Ltd. Trainator, <http://edukas.ee/index.php?go=7&lang=eng>.
- McConnell International's Risk E-business: Seizing the Opportunity of Global E-readiness, (<http://www.mcconnelliinternational.com/ereadiness/default.cfm>).
- Ministry of Economic Affairs and Communications (2002a): Research, technological development and innovation measure for the Estonian SPD 2003-2006.
- Ministry of Economic Affairs, Ministry of Finance (2002b): Estonian Economy 2001 in Review.
- Ministry of Education and Research of Estonia, <http://www.hm.ee/eng/>.
- Ministry of Education and Research of Estonia, http://www.sekr.ee/www/seirekeskus/kutseharidus_keskus_main.php
- Ministry of Education and Research of Estonia, http://rajaleidja.ee/pathfinder/about_pathfinder/index.htm.
- Ministry of Social Affairs (2000): Estonian Health Project 2015. Development Project, <http://www.tervishoiuprojekt.ee>.
- Murrell, P. (1996): How Far Has Transition Progressed? *Journal of Economic Perspectives*, Vol. 10, No. 2, pp. 25-94.
- North, D. (1990): *Institutions, Institutional Change, and Economic Performance*. Cambridge University Press.
- North, D. (1994): Economic Performance through Time. - *American Economic Review*, Vol. 84, No. 3, pp. 359-368.
- OECD Centre for Co-operation with Non-Members (2001): *Reviews on National Policies for Education: Estonia*.
- Piazolo, D. (1999): The Credibility and Growth Effects of EU Institutions on Eastern Europe. *EIB Economic and Financial Reports*, No. 99.
- Pihl, T. (2001): *Analysis of Estonian IT Sector Innovation System: Estonian ICT Cluster: Present State and Future Outlooks*. Estonian eVikings, Archimedes Foundation.
- Pohjola, M. (2002): *New Economy in Growth and Development*. UNU WIDER, Discussion Paper, No. 2002/67.
- Porter, M. E. (1998) *The competitive advantage of nations: with a new introduction*. New York: Free Press.
- Principles of the Estonian Information Policy for 2004-2006 (draft in Estonian). *Infopoliitika põhialused aastateks 2004-2006 (draft)*.
- Progress Report as December 12th 2002. Look@World Foundation. (http://www.vaatamaailma.ee/pls/VM/docs/FOLDER/VAATA_MAAILMA2/DOKUMENDID/PROJEKTID/L@W_TRAINING_PROJECT_PRESENTATION_2002-12-12.PDF)
- Püss, T. and Viies, M. (2002): *Social Convergence and Socio-Demographic Trends in the European Union*. Estonian Institute of Economics at Tallinn Technical University, Tallinn, 76 p. (in Estonian).
- Quah, D. T. (1998): A weightless economy. *The UNESCO Courier*, December 1998. (http://www.unesco.org/courier/1998_12/uk/dossier/txt11.htm)
- Rajasalu, T. (2001): *Convergence in the European Union and Some Guidelines for Institutional Reforms in Estonia. Factors of convergence: A Collection for Analysis of Estonian Socio-Economic and Institutional Evolution*. Eds. Ü. Ennuste and L. Wilder, Tallinn, pp. 3-36.
- Rajasalu, T., Laur, A. (2003): *Contribution of the New Economy to Estonia's economic growth and convergence with the European Economy. The 'New Economy' and Postsocialist Transition*. WSPiZ, Warsaw, April 10-11, 2003.
- Rannu, R. (2003): *Mobile Services in Estonia*. Praxis Centre for Policy Studies, Tallinn.
- Regional Development Agency, <http://www.erd.ee>.

- Rodrik, D., Subramanian, A., Trebbi, F. (2002): Institutions Rule: The Primacy of Institutions Over Geography and Integration in Economic Development. NBER Working Paper, No. 9305.
- Saarniit, K. (2002): Medical Information Centre of Tartu University Clinics, www.utlib.ee/ekollekt/raamat/trykivaljaandest_digitaalseni.
- Sala-i-Martin, X. X. (1997): I Just Ran Two Million Regressions. American Economic Association papers and Proceedings, 87 (2), pp. 178-183.
- AS PW Partners, Estonian Foundation for Vocational Education and Training Reform (2002): Sectoral Study in the Information and Communication Technology Sector in Estonia, <http://www.sekr.ee>.
- SIBIS Pocket Book 2002/2003 (2003): Measuring the Information Society in the EU, the EU Accession Countries, Switzerland and the US.
- Sinani, E., Meyer, K. (2001): Identifying Spillovers of Technology Transfer from FDI: The Case of Estonia. Copenhagen Business School.
- SINE (2000): Statistical Indicators for the New Economy. European Commission, Directorate-General Information Society, Statistical Office of the European Communities.
<http://europa.eu.int/comm/eurostat/research/index.htm?http://europa.eu.int/en/comm/eurostat/research/retd/currentcall.html&1>
- Social Sector in Figures 2002 (2002): Ministry of Social Affairs of Estonia.
- Social Sector in Figures 2003 (2003): Ministry of Social Affairs of Estonia.
- Spagat, M. (2002): Human Capital, Growth and Inequality in Transition Economies. CEPR. Transition Economics, Discussion Paper, No. 3556.
- Statistical Office of Estonia (2001): Research and Development 2000. Yearbook.
- Statistical Office of Estonia (2002a): Education 2001/2002. Yearbook.
- Statistical Office of Estonia (2002b): EU Phare 1997-1999: Land Information System Development in Estonia. Estonian Statistics 11/2002.
- Statistical Office of Estonia (2002c): Foreign Trade 2001.
- Statistical Office of Estonia (2002d): Household Living Niveau 2001.
- Statistical Office of Estonia (2002e): Information Technology 2001. Estonian Statistics 11/2002.
- Statistical Office of Estonia (2002f): Statistical Yearbook 2002.
- Statistical Office of Estonia (2003a): Adult Education, <http://www.stat.ee> .
- Statistical Office of Estonia (2003b): Foreign Trade 2002.
- Statistical Office of Estonia (2003c): Information Technology. Estonian Statistics 11/2003.
- Statistical Office of Estonia (2003d): Labour Force 2002.
- Statistical Office of Estonia (2003e): Regional Statistics of Estonia 2002.
- Statistical Office of Estonia (2003f): Statistical Yearbook 2003.
- Statistics in Focus 2001 (2001). No 13, Eurostat.
- Tax Board Annual Report 2001 (2002): <http://www.ma.ee/ajalugu/MAANNUAL.pdf>
- Terk E. 2000. Privatisation in Estonia. Ideas. Process. Results, Tallinn.
- The Global Information Technology Report 2001-2002: Readiness for the Networked World (2002). Oxford University Press; for Estonian evaluation results, see Braliev, A. and Kalvet, T. (2002). Country Reports. .ee. in the Global Information Technology Report 2001-2002: Readiness for the Networked World (2002). Oxford University Press <http://www.cid.harvard.edu/cr/profiles/Estonia.pdf>
- The Heritage Foundation (2002): Index of Economic Freedom, <http://www.heritage.org/index/>
- The Mosaic Group, <http://som.csudh.edu/fac/lpress/gdiff>

- The Social Situation in the European Union 2003 (2003): Eurostat, European Commission, [http:// europa.eu.int/comm/employment](http://europa.eu.int/comm/employment)
- The Tiger Leap Foundation (2002): Yearbook.
- The Tiger University Program, http://www.itcollege.ee/inenglish/tigeruniv_program.php
- The World Bank (2002a): Knowledge Assessment Matrix 2002, http://www1.worldbank.org/gdln-scripts/programs/kam2002/kamscript.exe/show_page
- The World Bank (2002b): Transition: The First Ten Years. Analysis and Lessons for Eastern Europe and the Former Soviet Union.
- Tiits, M., Kattel, R., Kalvet, T., Kaarli, R. (2003): Eesti majanduse konkurentsivõime ja tulevikuväljavaated. Teadus- ja arendustegevuse ja innovatsioonipoliitika ülevaade (Competitiveness and future prospects of Estonian economy. A survey of research and development and innovation policy), Tallinn.
- Tiits, M., Pihl, T. (2002): IST R&D and Innovation in Estonia. Working Paper. Estonian eVikings. Archimedes Foundation, <http://www.esis.ee/eVikings/>.
- Toots, A., Idnurm, T. (2001): Tiger under Magnifying Glass. Study on Information and Communication Technology in Estonian Schools in 2000, http://www.tiigrihype.ee/eng/publikatsioonid/tiigerluup_eng/tiigerluup_eng.html
- Uljas, H. (2001): Hilton loob Eestis keeleoskajaile töökohti. (Hilton creates jobs for language knowing). Postimees, 20.12.2001.
- UNDP, University of Tartu (1999): Poverty Reduction in Estonia: Background and Guidelines.
- UNU/WIDER-UNDP. World Income Inequality Database 2002. (<http://www.wider.unu.edu/wiid/wiid.htm>).
- United Nations Division for Public Economics and Public Administration (UNDPEPA) and American Society for Public Administration (ASPA) “Benchmarking E-government: A Global Perspective”, <http://unpan1.un.org/intradoc/groups/public/documents/un/unpan003984.pdf>
- Valdlo, T. Telework in Estonia: preconditions and use.
- Valdlo, M. (2003): 3rd World Telecommunication/ICT Indicators Meeting. International Telecommunication Union, Geneva.
- Viies, M., Kukk, A., Kreitzberg, M. (2001): Household income and consumption. Social Trends 2. Statistical Office of Estonia, Tallinn, pp. 59-78, <http://www.stat.ee>.
- Viik, L. (2002): Kui perspektiivikas on Eesti IT turg (What are the perspectives of Estonian IT market), <http://www.aripaev.ee/temp/seminar/03092002/01.pdf>
- Viik, L. (2003a): IT strateegiad, mis lähtuvad klientidest (Client-oriented IT strategies), <http://www.aripaev.ee/temp/seminar/28082003/06.pdf>
- Viik, L. (2003b): Tehnoloogia impordi peab muutma oskusteabe ekspordiks (Technology imports must develop into skills exports), <http://www.aripaev.ee/konverents/foorum/programm.html>
- Voigt, S., Engerer, H. (2002): Institutions and Transformation - Possible Policy Implications of the New Institutional Economics. *Frontiers in Economics*, Ed. Klaus F. Zimmermann, Berlin: Springer Publishing Company, pp. 127-184.
- Wilder, L., Benedict, M. E., Viies, M. (1999): A Demographic Analysis of Income Distribution in Estonia. *Comparative Economic Studies*, XXXXI, No1.
- World Competitiveness Yearbook 2002, IMD, <http://www02.imd.ch/wcy/>
- WWW indicators. Estonia. (2001): (<http://www.eu-esis.org/esis2www/EEwww7.htm>)

List of used abbreviations

AEF: Open Estonia Foundation
ACC: 10 EU accession countries (in 2004)
ATM: Automated Teller Machines
BCM: Baltic Council of Ministers
BSCV: Basic Support of Co-operative work
CA: Current Account
CBSS: Council of the Baltic Sea
CC: Candidate Countries in process of joining the European Union: Bulgaria, the Czech Republic, Cyprus, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Romania, Slovakia, Slovenia, Turkey
CIS: Commonwealth of Independent States
CPB: The Estonian Consumer Protection Board
CPI: Consumer Price Index
CSC: Centre for Strategic Competence (Tartu)
DIDIX: Digital Divide Index
EBRD: European Bank for Reconstruction and Development
ECDS: Estonian Central Depository for Securities
EENet: Estonian Educational and Research Network
EIF: Estonian Innovation Fund
EIONET: *European Environment Information and Observation*
EITO: European Information Technology Observatory
EITF: The Estonian Information Technology Foundation
EITS: The Estonian Information Technology Society
EKI: Estonian Institute of Economic Research
EMT: Estonian Mobile Telephone
ENCB: The Estonian National Communications Board
EPO: Estonian Patent Office
ERDA: Regional Development Agency
ERDF: Regional Development Foundation
ESIS: European Survey of Information Society
ESTAG: Estonian Technology Agency
EstSF: The Estonian Science Foundation
EU: European Union
EU15: The present 15 member states of the European Union
GDP: Gross Domestic Product
HEX: Helsinki Stock Exchange
ICA: International Council for Information Technology in Government Administration
ICEG EC: International Center for Economic Growth, European Center
ICT: Information and Communication Technology
IDA: Interchange of Data between Administrations
IMD: International Institute for Management Development
IMF: International Monetary Fund
IPO: International Public Offering
IPTS: Institute of Prospective Technological Studies
IS: Information Society
ISCED: International Standard Classification of Education
ISP: Internet Service Providers

IST: Information Society Technology
ISTAG: Information Society Technologies Advisory Group
ITL: Association of Estonian Information Technology and Telecommunications Companies
JHLC: Joint High Level Committee
KIS: Knowledge-Intensive Services
KredEx: Credit Guarantee and Export Insurance Foundation
MEUR: million EUR
NeD: Northern eDimension
OSI: Open Society Institute
PAA: Public Administration Agencies
PIAP: Public Internet Access Points
POS: Points of Sale
PPS: Purchasing Power Standard
RIA: Estonian Informatics Centre
RISO: Department of State Information Systems of Estonia
RTDI: Research Technological Development and Innovation
SIBIS: Statistical Indicators Benchmarking the Information Society
TSE: Tallinn Stock Exchange
TEKES: Finnish Technology Agency
UNDP: United Nations Development Program