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Marja Nissinen

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as a Business Location for

Information Technology and Electronics Industries

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Abstract

This study examines the current state of the ICT and electronics industries in the three Baltic States. In doing this, it implicitly highlights the opportunities for co-operation between Baltic and Finnish firms. The study consists of three parts: 1 a sector analysis of the industry, 2 a review of the education and research system in the field under consideration, and 3 an analysis of the business culture and the business environment.

The first section is based on extensive surveys among ICT and electronics enterprises in Estonia, Latvia and Lithuania. It sheds light on the following areas: the size and the growth prospects of the ICT and electronics industries, their focus of production and core competence, the significance of exports and subcontracting as well as the prevailing interest in Finland. Higher education is examined from the perspective of the availability of workforce; research from that of innovation capacity. Finally, the report discusses the qualities of Baltic employees, specialities of the local business culture and appropriate ways to approach a Baltic company.

The ICT and electronics industries in the Baltic States have differentiated profiles with their own specific strongholds. To cite examples, mobile technologies and electronics subcontracting are advanced in Estonia, software outsourcing and optical technologies in Latvia, television electronics and laser technologies in Lithuania. As for IT, the wages are lowest and the availability of qualified specialists is best in Lithuania. Latvia is the strongest exporter of software service in the Baltics. Estonia's business environment is slightly better developed than that of its southern neighbours.

Despite their buoyant development, the Baltics face a serious challenge as they are pressed to steer their industrial development in a more innovation-driven direction. The lack of funding for universities and research institutes is currently so alarming that it is starting to threaten the future of science. Due to low salaries, an academic career does not appeal to young, talented graduates, which has led to the ageing of the researcher pool. Corporate R&D and contract research are marginal, patenting activity is meagre, and the number of innovative enterprises is small.

Preface

IT co-operation is recognised in various regional and EU initiatives as one of the priority areas to be promoted in the Baltic Sea area. The project, which gave an impetus to this report, was designed to contribute to preconditions for further intensifying business relations and productional co-operation between Baltic and Finnish ICT and electronics enterprises. Small and medium-sized enterprises that plan an international opening are expected to benefit especially from the study.

The report is intended to serve as an information tool to prepare those who are entering the Baltic market. By reviewing the state of the Baltic ICT and electronics industries, the system of higher education in these fields and also the business culture and environment, it illuminates the opportunities and the constraints in these countries. It pays specific attention to factors that indicate indirectly local know-how and project capacity. The content rests on extensive fieldwork in the Baltic countries, combining different methods of collecting information: surveys, expert interviews and document materials.

The underlying premises of the study can be derived from a more general frame: on the one hand, western companies are externalising their functions and searching for skilled specialists from Eastern Europe; on the other hand, the Baltic States are attempting to internationalise their ICT sector and attract foreign clients. At first hearing the situation sounds like a perfect match but the question is more complicated than it appears. First, what are the resources backing the Baltic ambitions? Second, what is the role that international companies reserve for their subcontractors?

From the very beginning of the study, it was considered important to base the approach on the principle of mutual interest by looking for contacts with Baltic actors. The following organisations are reckoned among the project's supporters and partners in the Baltics:

- *Estonia*: Estonian Investment Agency and Archimedes Foundation
- *Latvia*: Latvian Development Agency, Business Innovation Centre of the Latvian Electronic Industry, and Latvian Information Technology and Telecommunications Association
- *Lithuania*: Lithuanian Development Agency and Infobalt Association
- Ministries of Economy in all the three Baltic States

The study was financed by the funds of the Government of Finland for neighbouring area co-operation and the private sector: the Ministry for Foreign Affairs of Finland, the Ministry of Trade and Industry of Finland, Developing Organisation “PrizzTech Ltd” and the Federation of Finnish Electrical and Electronics Industry. The study was carried out at VTT Technology Studies during 2001–2002. To conduct the surveys in the Baltic countries, VTT Technology Studies contracted local marketing research companies. AC Nielsen was responsible for the Estonian survey, SKDS for the Latvian and Baltijos Tyrimai for the Lithuanian one.

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Appendices:

Abbreviations

ADSL	Asymmetric digital subscriber line
ASIC	Application specific integrated circuit
ASP	Application service provider
ATM	Automated teller machine
B2B	Business-to-business
B.Sc.	Bachelor of Science
CASE	Computer aided software engineering
CH	Switzerland
CIMO	Centre for International Mobility (in Finland)
CIS	Commonwealth of Independent States
CRM	Customer relations management
D	Germany
D.Sc.	Doctor of Science
Dr.Habil.	Habilitated Doctor
DSL	Digital subscriber line
EBRD	European Bank for Reconstruction and Development
EC	European Commission
ECDL	European Computer Driving License
ECTS	European credit transfer system
EE	Estonia
E&E	Electronics and electrical engineering (industry)
EEK	Estonian crown
Ele	Electronics
EMS	Electronic manufacturing services
ERP	Enterprise resource planning
ESTAG	Estonian Technology Agency
EU	European Union
F	France
FDI	Foreign direct investment
FIN	Finland
FSU	Former Soviet Union
GDP	Gross domestic product
GPRS	General packet radio service
GSM	Global system for mobile communication
HUT	Helsinki University of Technology
I	Italy
ICT	Information and communication technologies
IMF	International Monetary Fund
IP	Internet protocol
IS	Information system
ISO	International Standardisation Organisation
ISP	Internet service provider
IST	Internet software technology
IT	Information technology
JAP	Japan

KTU	Kaunas University of Technology
LAN	Local area network
LDA	Latvian Development Agency
LDA	Lithuanian Development Agency
LETERA	Latvian Electrical Engineering and Electronics Industry Association
LIIS	Latvian Education Information System
LITTA	Latvian Information Technology and Telecommunications Association
LT	Lithuania
LTL	Lithuanian litas
LUT	Lappeenranta University of Technology
LV	Latvia
LVL	Latvian lats
MEUR	Million euros
M.Sc.	Master of Science
OECD	Organisation for Economic Cooperation and Development
PC	Personal computer
PCB	Printed circuit board
Ph.D.	Doctor of Philosophy
PIAP	Public internet access point
PR	Public relations
R&D	Research and development
RISO	Department of State Information Systems (in Estonia)
RITI	Riga Information Technology Institute
RTU	Riga Technical University
RUS	Russia
S	Sweden
SCM	Supply chain management
SME	Small and medium-sized enterprises
SMS	Short messages service
SMT	Surface mounting technology
SWOT	Strengths, weaknesses, opportunities and threats
TTU	Tallinn Technical University
TUT	Tampere University of Technology
UK	United Kingdom
UMTS	Universal mobile telephone system
UN	United Nations
UNCTAD	United Nations Conference on Trade and Development
UNDP	United Nations Development Programme
USA	United States of America
US$	United States dollar
USSR	Union of Soviet Socialist Republic
UT	University of Tartu
VGTU	Vilnius Gediminas Technical University
VPN	Virtual private networks
VTT	Technical Research Centre of Finland (Finnish abbreviation)
VU	Vilnius University
WAN	Wide area network
WAP	Wireless application protocol

1 INTRODUCTION

1.1 Background

1.1.1 The Baltics in the Midst of Global Trends

Information and communication technologies (ICT) form the driving force behind the economic growth and are an engine of change in many spheres of life. In parallel, the opening of a **digital divide** between winners and losers of the economic race both within individual societies and the international community threatens to deepen the developmental cleavage. The term 'digital divide' refers to a gap between individuals, households, businesses and geographical areas at different socio-economic levels with respect to their access to ICT and the internet[1].

The Baltic States - Estonia, Latvia and Lithuania - are firmly determined to successfully comply with global challenges, bridge the existing gaps and keep up with the pace of development. All three countries are pressing ahead with the creation of an **information society** as part of their integration into the European Union (EU). The eEurope and eEurope+ initiatives, the Northern eDimension Action Plan as well as various other European programmes, touching upon the information society development, guide the goal-setting of the Baltic governments.

The shaping of an information society is not at a zero level in the Baltics but well underway. The Baltic governments have been promoting modern ICT infrastructure, setting up a pertinent legislative framework, reforming public administration and raising the issue onto the political agenda in the attempt to encourage and accelerate the formation of an information society. They have initiated or supported a number of e-skills, e-learning, e-government, e-democracy and e-business programmes in order to catch up with the EU Member States. Simultaneously they keenly follow benchmark indicators of the information society while monitoring their progress record. Concrete

[1] Kalkun & Kalvet 2002, 28.

efforts and accomplishments in the way of building information societies in the Baltics are described more in detail in the next chapter.

The shaping of an information society is accompanied by a restructuring of the economic base into a **knowledge economy**. The latter endeavour forms the second major building block in the economic strategies of the Baltic States. These strategies prioritise active use of knowledge and high technologies, since they aim at shifting the emphasis from labour intensive industries to knowledge intensive, high value added activities. Such an economic strategy is justified by a reference to the countries' lack of natural resources, small populations, limited capacity of national economies and small market sizes. Sometimes the industrial tradition of high tech products in the area is also referred to. Highly skilled, well educated people are conceived of being the main asset of the Baltic countries in accordance with this line of reasoning. The approach has direct implications for the industrial policies of the Baltic States, as the governments emphasise technology and research intensive branches of industry. Accordingly, the governments identify sectors with the best developmental potential in terms of international competitiveness and the existing science base[2]:

Estonia
- User-friendly information society technologies
- Biomedicine
- Material sciences

Latvia
- Information technologies
- Biotechnologies and pharmaceuticals
- New materials

Lithuania
- Information technologies
- Biotechnologies
- Nanotechnologies
- Laser technologies
- Mechatronics

The Baltic States hold ambitions to become players in the international information technology market. In promoting this sector for international customers and investors, the Balts use such slogans as "Latvia - THE Competitive Location for IT Services" and "Estonia - Your New Source for IT Solutions". Latvia wishes to become a leading software exporter in Eastern Europe by the year 2010. At the same time as the ICT sector is promoted, considerably less attention is paid to the electronics industry, which is not prioritised to the same extent at all. Yet historically, these countries, Latvia and Lithuania particularly, used to have large, in relative terms advanced electronics sectors, but nowadays their significance has drastically diminished.

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[2] Avotins 2002, *Innovation Policy in Six Candidate Countries* 2001, 17; Milius 24.10.2001.

This knowledge-based economic strategy leads to a necessity to envisage the **innovation and R&D system** as well as higher education. The Baltic States have approved innovation policy documents and put in place innovation system structures (Appendix 1), but the resources devoted to the process have been scarce so far. The implementation of effective innovation policies is thus at an embryonic level. Recently, however, the issue has started to attract increasing attention at government level. Co-operation with EU Member States and EU financing play an important role in the development of the Baltic innovation systems.

To conclude, ICT is not only a prioritised industrial sector, which has experienced a dynamic growth, but it also has a more a far-reaching economic and social significance. The Baltic States rely on it for their future in many respects.

1.1.2 Information Society Development in the Baltics

Estonia[3]

Estonia has advanced furthest in the development of an information society among the Baltic States, being a frontrunner. The steps taken in Estonia are similar in principle to those in Latvia and Lithuania.

In 1998, the Estonian parliament approved the **Principles of Information Policy,** which forms the value basis for an action plan for establishing an information society. The government's **Information Policy Action Plan** outlines for government institutions a general strategy, which constitutes a base for concrete proposals. Estonia has carried out among others ID, public key infrastructure, state register reform and document management programmes as well as a project concerning the information system of government sessions. The nation-wide eCitizen project is designed to reinforce co-operation between citizens and the public sector through the internet.

The setting up of the state's data communication infrastructure was started with the successful **EEBone** project (Pea Tee in Estonian), which built up a backbone network connecting Estonian government agencies. EEBone was one of the catalysts for a county-based data communication project called **Village Road** (Küla Tee in Estonian). The Village Road project created a country-wide communication network linking together all county governments and provided them with an internet connection. The ongoing **Internetisation of Public Libraries** project aims at connecting all the country's libraries with the internet.

Establishment of **public internet access points** (PIAP) started in the spring of 1997 under the auspices of an UNDP aid programme. Later on, the Open Estonia Foundation and some big firms also contributed to the endeavour. The objectives of the PIAP

[3] Ehandi 2002, Laanpere 2002, Pruuden 2002; perso.worldonline.fr/gguillotin/project_estonia, www.american.edu, www.eik.ee/english/policy, www.riso.ee; Ott 25.2.2002, Tammemäe 25.2.2002

initiative are 1) to offer an opportunity to use internet services free of charge, 2) provide necessary training, and 3) encourage the publishing of local information on the internet.

Look@World (Vaata Maailma in Estonian) is a private sector initiative that is continuing the establishment of new public internet access points. It offers internet and computer training free of charge to non-users. The educational goal is to provide training for 100,000 people over two years, starting from April 2002. The ultimate target is to exceed Finland's internet penetration level within three years' time. The Look@World Foundation is an umbrella organisation bringing together ten business enterprises that are willing to invest in the development of the information society and engage in a close collaboration with the state. Hansapank initiated the project, and major banks, telecommunication companies and IT firms joined it: Union Bank of Estonia, EMT, Estonian Telephone Company, IBM, Oracle, MicroLink, Baltic Computer Systems and the IT Group.

Estonia's school computerisation programme **Tiger Leap** was carried out between 1997 and 2000. The goals of the programme were four-fold: 1) to provide schools with a modern ICT infrastructure, that is, with computer hardware and internet connections, 2) to train teachers, 3) to support curriculum development and educational innovations by introducing IT-based teaching methods, and 4) to buy, translate and develop educational software which meets the requirements of the national curriculum. When the Tiger Leap programme was completed at the end of 2000, computers with internet connections were available at every school (an average of 25 pupils per computer), 65 per cent of all teachers had been trained in basic computer skills, one hundred educational software packages had been either purchased or produced, and a multifunctional educational portal called Teachers NetGate had been launched.

Despite the Tiger Leap programme's success, a need for a follow-up project existed. The new programme for 2001–2005, called "ICT in Estonian Schools", is colloquially known as **Tiger Leap Plus**. It focuses among other things on the modernisation of learning methods and teacher training. Hence, it promotes the development of electronic learning resources and virtual learning environments as well as the establishment of virtual schools. Another priority concerns the setting of ICT competence standards for graduates and teachers and redesigning curricula in accordance with those standards. The main co-ordinating body for the Tiger Leap and the Tiger Leap Plus programme is the Tiger Leap Foundation, set up by the Ministry of Education in 1997.

The **Estonian Information Technology Foundation** is a partly public, partly private consortium which consists of Tallinn Technical University, Tartu University, the Ministry of Education, Eesti Telekom, and the Association of Estonian Information Technology and Telecommunications Companies. Tallinn's **IT College** is one of the Foundation's projects. Estonia, just like Latvia and Lithuania, has introduced the European Computer Driving License (ECDL).

Examples of laws:

- Law on Public Information
- Law on Digital Signature
- Law on Databases
- Law on Personal Data Protection
- Law on Telecommunications

The main co-ordinating bodies in the information society and ICT sector development are the following:

- Department of State Information Systems (RISO) under the Ministry of Transport and Communications
- Estonian Informatics Centre under the State Chancellery
- Estonian Informatics Council (an advisory committee to the Government)
- IT councils of the ministries and the county governments
- Look@World Foundation
- Tiger Leap Foundation
- Estonian Information Technology Foundation
- Association of Estonian Information Technology and Telecommunications Companies
- Archimedes Foundation
- (Open Estonia Foundation)

Latvia[4]

The eEurope initiative of the European Commission is serving as guidance in the development of the information society in Latvia. The main target programmes, which lay the foundations of policies to be followed, are the National Programme "Informatics", approved by the Cabinet of Ministers in 1999, and the Socio-economic Concept eLatvia, approved by the Cabinet of Ministers in 2000.

The fundamental goal of the **National Programme "Informatics"** is to create an information society in Latvia and integrate Latvia into global development. The National Programme "Informatics" consists of 13 subprogrammes and more than 120 concrete projects to be implemented during 1999–2005.

The **Socio-economic Concept eLatvia** aims at ensuring for every resident the possibility of participating in the new economy. It stresses both the skills of acquiring information and the availability of information. It envisages improving internet access, increasing computer literacy through training and accelerating the development of the environment for e-commerce and e-government.

One significant project, which has been designed in accordance with the principles of the National Programme "Informatics" and the Socio-economic Concept eLatvia, is the **Latvian Education Informatisation System (LIIS)**, launched in 1997. LIIS provides

[4] Avotinš 2002, Berzinš 2001, Bičevskis et al. 2001, Gorbunovs 2001; ww.lza.lv/viesturs/innov.htm; Erkmane 10.4.2001, Lukstina & Šlihta & Miezeris 12.4.2001.

the technical and ideological base for computerisation of schools as well as introduces e-administration principles in the administration of educational institutions. LIIS deals with computerised learning materials, training of teachers and facilitation of internet connections to schools. It covers several aspects, such as content production, supply of computers, installation of school networks and maintenance of information services for the educational community.

Other examples of Latvian information society projects:

- Integrated Information System of the State Significance (Megasystem) and participation in the Baltic Government Data Communication Network
- Common System of Electronic Documentation in the Public Administration
- Integrated Information System in the Transport Sector (EDITRANS)
- Informatisation of the State Social Security System
- Informatisation of Latvian Library System
- Public Internet Access Points (PIAP), supported by the Soros Foundation
- European Computer Driving License (ECDL)
- Regional initiatives, like those in the Vidzeme region, Saldus, Ventspils and Riga

Examples of laws and government provisions:

- Law on Electronic Documents and Digital Signatures
- Law on State Information System
- Law on Copyrights (including a provision on the legal protection of data bases)
- Law on Telecommunications
- Concept on Electronic Commerce
- Concept on ID Cards
- Concept on Electronic Purchase of State and Local Governments

The main co-ordinating bodies in the information society and ICT sector development are the following:

- National Board of Information Society, Prime Minister as Chairman
- Co-ordination Board of the National Programme "Informatics", Minister of Transport as Chairman
- National Economy Council under the Ministry of Economy
- Latvian Information Technology and Telecommunications Association (LITTA)
- Latvian Development Agency (LDA)

Lithuania[5]

The Lithuanian government has declared the development of the information society to be a key priority. The year 2001 brought a breakthrough in the process. Many important legal acts were passed to regulate the development of the information society and to stimulate economic growth based on information and communication

[5] Information Society Development Committee under the Government of the Republic of Lithuania 2002, Numgaudis 2002, Stonkutė 2002, Zalatorius 2002; Babravicius 9.11.2001, Brazdeikis 6.11.2001, Saudargas, Tamulevicius 7.11.2001, Zidonis Evaldas 5.11.2001.

technologies. The main documents which plan activities related to the information society are the following ones:

- The **National Concept of Information Society Development**, approved in 2001. In accordance with the eEurope initiative, the Concept defines the tasks and the objectives for Lithuania.
- The **Strategy on Information Society Development**, approved in 2001. The Strategy focuses on four priorities: 1) improvement of citizens' IT skills, 2) modernisation of public administration through IT, 3) creation of favourable conditions for e-business, and 4) promotion of Lithuania's cultural and linguistic heritage.
- The **Detailed Plan for Information Society Development**, approved in 2002.
- The **Measures for the Implementation of the Government Programme for the Years 2001–2004** approved in 2001. Section Three of the document - Information and Knowledge Society Development - specifies the main measures for state institutions in the area of information society development.

The computerisation of Lithuanian schools started as early as 1986 under Soviet rule. After independence, a number of projects were carried out to computerise schools with modern equipment and to train teachers. In 2001–2002, the most important programme was called **Education for the Information Society**, also known as the E-School Project. The E-School Project was aimed at ensuring that within three years' time all school graduates of general education would have acquired IT competence. The student-to-computer ratio should be 10:1 in grades 9–12 at general education schools.

Examples of major endeavours in 2002–2003:
- A regional pilot project *Digital Community*
- Building an infrastructure for electronic payment and electronic signature
- Creating an interactive system of state registers and databases as well as implementing other e-government projects
- Encouraging the use of free open code software
- Establishing public internet access points
- European Computer Driving License (ECDL)

The **Window to the Future Alliance** was set up in 2002 to accelerate the development of the information society by bringing computer technologies and making the internet available to wide layers of society all over the country. The aim is to achieve the European Union's level of internet penetration in Lithuania over the next three years. The Alliance hopes to open 65 public internet access facilities in 54 different locations by the end of 2002. Free public education is an essential component of its activities. The Window to the Future Alliance is an example of a public-private partnership, which involves business and local governments. Local governments provide the premises for the internet access points, handle the administration and pay half of the monthly subscription fees for servers. The Alliance installs the internet connection, donates computers and provides technical services. The telecommunications companies Lietuvos Telekomas and Omnitel, the largest banks Hansa-LTB and Vilniaus Bankas, as well as the leading IT companies Alna and Sonex form the Alliance.

The main co-ordinating bodies in the information society and ICT sector development are the following:

- Information Society Development Committee under the Government
- Information Society Development Committee under the Parliament
- Knowledge Society Council under the President of the Republic
- Infobalt Association
- Knowledge Economy Forum
- Window to the Future Alliance
- (Open Society Fund)

The Lithuanian Infobalt Association and the Latvian LITTA have been pro-active in putting forth public initiatives to promote the information society. Infobalt is an important primus motor in these questions in Lithuania.

1.1.3 A Variety of Viewpoints

The previous chapters have outlined how the situation looks officially on paper in the Baltics, where ICT is declared in glowing terms to be a national priority. The picture becomes however more diversified as soon as one talks to people on these issues, since there are also critical tones to be heard. Usually the critics point out a gap between talk and action, which manifests itself in the insufficient resources allocated to the cause. In other words, too little is done in proportion to plans made. Some persons even question the whole knowledge economy strategy. The quotations below illustrate polemical arguments given by the cynics.

N.N. from Latvia: "I do not agree with the government when it says that IT is our priority. The resources devoted to it are so limited, and I do not see any drastic changes in the immediate future at least. The first problem is our education. We should not only expand IT education but also change its content."

N.N. from Latvia: "The government lies when it claims that we have government financed higher education. The number of university students is higher than ever before in Latvia, but only one third of those students are state budget financed. University staffs are partly financing their students because they do not have normal salaries."

Various persons from Lithuania:

- "We have many parliament acts, strategies, programmes, etc. but nothing important is implemented from the government's side. The main development comes from the private sector, while the government is very slow in implementation. It has only populistic notions."
- "On the paper they have captured the idea; they have understood that IT means progress and the information society is our future. But when the question is about money, they think: 'Maybe tomorrow?'"
- "Officially the information society, knowledge economy, etc. are priorities. If you look at practical indicators, I don't think they are. The country's top leadership is not IT oriented. If we get somebody who knows IT, he will move forward after a while and then we get another man who understands nothing about it."

- "People in the government do not always understand what such an information society means, because it is a new sphere. It is rather difficult to understand the situation for those who are over 60 years old."

Kalvet et al. (2002a) characterise the Estonian ICT sector innovation policy as *no-policy policy* in their research report. According to them, the government's main innovation policy documents were never actually implemented in practice[6]. Other economic policy documents propose neither explicitly nor implicitly industrial or innovation policy measures. They are mostly composed for international organisations or are written for specific reasons, but they do not have within them a long-term vision, a systematic approach or an implementation mechanism.

N.N. from Estonia: "Low productivity, accompanied by high unemployment rates, belongs to Estonia's severest problems. The index of overall productivity in Estonia is perhaps one third of the EU average and one fifth of the Northern European average. The secondary sector has not invested in new technology. -- Simple technology transfers would help increase productivity. Small biotech companies and such, by contrast, do not solve either productivity nor unemployment problems. They do not create jobs for the masses but re-employ people who already have a good post, like professors who return from abroad. Besides, biotech companies are not tied to any location. You can easily move those five people, working in a given company, to Belgium, Switzerland or the United States."

Irrespective of their validity or invalidity, these subjective viewpoints raise questions requiring investigation. How does the reality behind proclamations look in the Baltics? What are the true premises on which the Baltic States are building their image as knowledgeable societies? What is the potential of the Baltic ICT sector? Are there differences between the Baltic States?

One optional approach to the last question is to examine the role of political strategy and political process in explaining the pace of information society and knowledge economy development. To cite a few examples for illustration: in Estonia, strictly neo-liberal economic policies have treated market failure as the main concern, neglecting active industrial policies; in Latvia, frequent government changes have sometimes postponed decision-making and caused disruption; in Lithuania, competing political priorities have tended to overshadow the measures for fostering the new economy. Preparation for Lithuania's Nato membership, the large agricultural sector and pressures to reform the pension system swallow a substantial share of the state budget. These issues are politically sensitive, they concern large segments of the electorate and call forth interest group activity, which keeps them at the top of the priority list.

For the purposes of this study, it is hardly meaningful to go deeply into underlying political currents, but awareness of their existence helps understand the multifaceted nature of the process. Namely, it is not only about technology, economy or administrative capacity. Politics also forms an element of the business environment in the broad sense.

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[6] Kalvet et al. refer to another source, i.e. Hernesniemi 2000, in this statement.

1.2 Research Task

This study highlights the current state of the ICT and electronics industries in the three Baltic States, Estonia, Latvia and Lithuania. The aim is to provide a picture of the supply in the Baltics as well as available opportunities for co-operation with Baltic businesses, especially in the form of productional project co-operation and joint ventures. Special attention is paid to factors that indicate indirectly local know-how and project capacity. The exclusive focus on industry means that socio-economic aspects of the developing information society are not covered. Since the commission for the study came from outside the Baltic States, the subject is treated from the angle of foreign businesses interested in familiarising themselves with the Baltics as a location for ICT and electronics industries.

Two tendencies are notable: on the one hand, western companies are externalising their functions and searching for skilled specialists from Eastern Europe; on the other hand, the Baltic States are attempting to internationalise their ICT sector and attract foreign clients. At first hearing the situation sounds like a perfect match but the question is more complicated than it appears. First, what are the resources backing the Baltic ambitions? How much can they really offer? Second, what is the role that international companies reserve for their subcontractors? Does that role support the industry's indigenous development and technology transfer or does it simply exploit cheap labour transiently?

The three parts of the report attempt to answer these questions from the following perspectives: 1. a sector analysis of the industry, 2. a review of the education and research system in the field of ICT and electronics, and 3. an analysis of the business culture and the business environment. The first part sheds light on the following characteristics of the Baltic ICT and electronics industries:

- Industrial profile in terms of subsectors, core businesses and technologies used
- Size and strength of the industry, growth rates, structure of the industry by company size
- Markets and customers
- Exports, facilities for going international, experience in co-operation with foreign firms
- Foreign ownership
- Research and development activities, product development capacity
- The impact of the Soviet past
- Manpower

A vital factor in assessing the robustness and prospects of any industry is the availability of a skilled workforce. In the case of the ICT industry, specialists with a higher education are of specific importance. Simultaneously the development of the ICT sector poses a tremendous challenge for the educational system. The future of higher education in the Baltics is currently a highly topical issue. Therefore the system of higher education in the Baltic States is reviewed. The review presents the main building blocks of the entire system but concentrates primarily on higher education in the fields

of ICT and electronics. It illuminates both quantitative and qualitative aspects of this education.

A closely related subject, which is relevant also from the point of view of the knowledge-based economic strategy, concerns the R&D and innovation system. This topic is examined only within strict limits without being absorbed in it, because otherwise the focus of this report would become too divided. Besides, there are already reports highlighting the Baltic innovation systems.

Finally, since the objective is to encourage foreign businessmen to get to know the Baltics, the business culture and the business environment are analysed. The main emphasis is placed on business culture, because it is typically ignored in publications, although it raises a lot of questions among newcomers. The business environment, by contrast, is well presented in various sources.

The leading principle in defining the boundaries of the study - that is, in selecting what to include or exclude - was the assessment as to whether previous materials on the subject matter exist or not. This book ought to bring added value by complementing rather than overlapping with the available literature. Accordingly, a specific "niche" was defined for it, instead of composing an ABC-book of the Baltics with very general information. This motive explains why many central themes dealing with the economy, the business environment and EU integration are not covered here. International organisations (e.g. the EU, the OECD, UNCTAD), international financial institutions (e.g. the World Bank, the IMF, the EBRD), banks (e.g. Nordea, SEB, Hansabank, central banks), chambers of industry and commerce, large enterprises, national authorities (e.g. investment and export promotion agencies, ministries, statistical offices, embassies), research institutes and consultants have produced plenty of excellent presentations about the basics. Many of these materials are easily accessible through the internet. Therefore it does not make sense to copy and rewrite them.

The study is by no means an evaluation of the Baltic industries or any other areas discussed in this report, and it does not intend to rank the countries. It rather shows that all three countries have interesting things to offer, while on the other hand it also points out critical aspects, when necessary. Implicitly the report structure entails a comparative - though not an evaluative - approach in that it tries to apply a uniform format in presenting country information as far as possible. However, as the miscellaneous information sources were of mixed character, varying from country to country, it was impossible to follow the standardised scheme rigidly, because sticking to it would have reduced the substance too much or forced the author to rely on old materials. Finally, it is interesting to compare the inherent potential of the ICT and electronics industries with one another, remembering that one of the sectors is highly prioritised, the other less fashionable.

In its essential parts, the present study is mainly based on first-hand primary materials gathered by the author or her contractors in the Baltics during 2001–2002. The two principal methods of collecting the information were 1) quantitative company-level surveys carried out in all three countries and 2) qualitative face-to-face interviews with experts. This ensures incorporation of micro-level information, instead of just relying

on macro indicators of the national statistics. Most written documents were likewise purchased directly from the Baltics.

As Latvia and especially Lithuania are less well known by Finnish companies than Estonia, where Finnish business has established itself firmly, it was decided to stress the two first mentioned countries. This emphasis manifests itself among others in the order in which country analyses are presented. Usually people are accustomed to enumerating the Baltic States so that they start with Estonia, then move to Latvia and finally to Lithuania. In the present study, the order is deliberately reversed: Lithuania - Latvia - Estonia.

A terminological note: Strictly speaking, the attribute 'Balt' refers to Latvians and Lithuanians exclusively, if this qualifier is treated as a characterisation of the language group and the origin of a nation. Many people in the Baltics understand it exactly in this way, underscoring that Estonian is a Finno-Ugric language. Outside the Baltics, however, the colloquial use often attributes the term to the region and nations living there, and thus includes Estonians too. This report follows the latter practice so that the attribute 'Balt' is used to refer to Lithuanians, Latvians *and* Estonians.

2 SECTOR REVIEWS BY COUNTRY AND INDUSTRY

2.1 Lithuanian Information and Communication Technology[7]

2.1.1 Size of the ICT Market

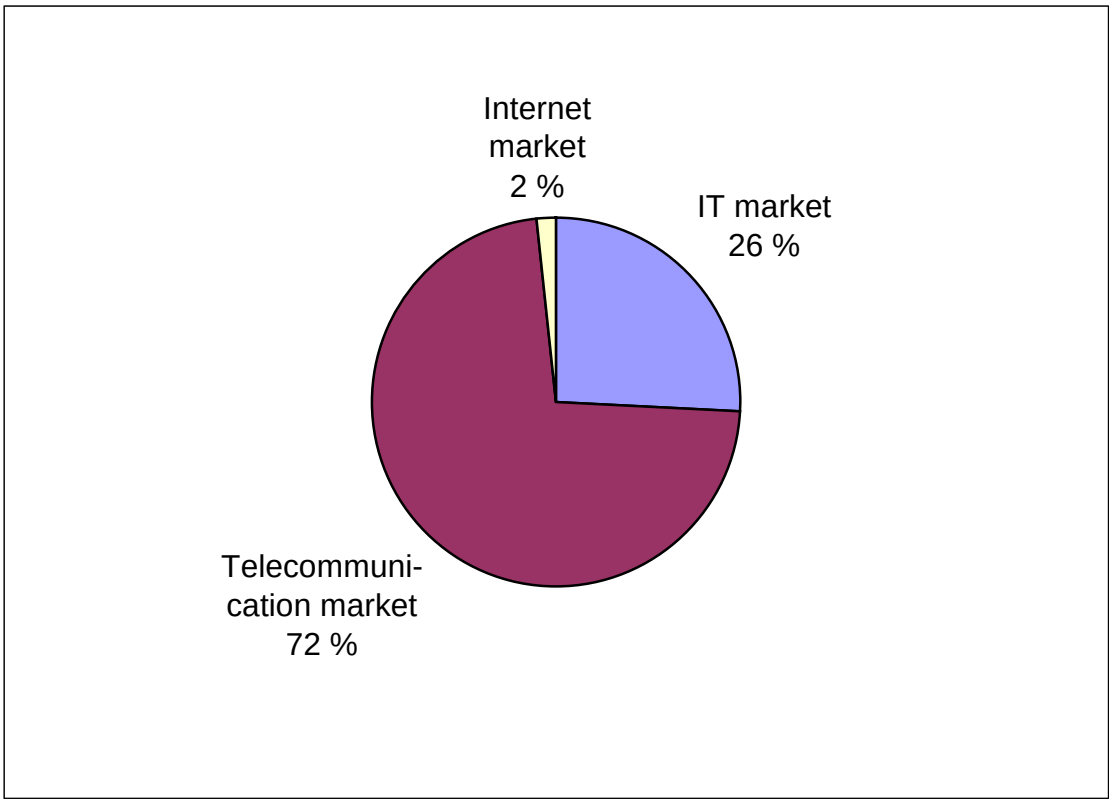
Between 1994 and 2000, the Lithuanian ICT market expanded nearly five times. The telecommunications sector grew almost sixfold and the information technology sector doubled. In 2001, the size of the ICT market grew by 28 percent and its annual turnover reached 4,099 million litas (1,187 million euros). The growth was influenced by several factors. The first was the mobile user boom: in 2001 mobile penetration doubled from 13 per cent to 27 per cent, which enabled the mobile market to increase by 45 per cent. Secondly, Lithuanian GDP growth in 2001 exceeded all forecasts and reached nearly six per cent. This, in turn, resulted in increased investment in IT both in the enterprise sector and the fast developing household consumption market. Hardware and software sales surged by 30 per cent. The largest IT service providers benefited from this growth in particular, increasing their revenue considerably. The market for portable computers and mobile technologies expanded notably, too. Total PC sales amounted to 75,000–80,000 units during 2001, which demonstrated an increase of 50 per cent compared to 2000. At the end of the year 2000, there were approximately 280,000 new computers in Lithuania.

[7] Infobalt 2001, Lietuvos taupomasis bankas 1999, Matulevičius 2001, Matulevičius 2002, Prime Investment 2000, Prime Investment December 2001, Prime Investment May 2002, *Statistical Yearbook of Lithuania 2001*, Vitkauskas 2002, www.infobalt.lt; Celutka 25.10.2001; Kekkonen 25.10.2001, Kirsis 9.11.2001, Milaknis 12.11.2001, Tamulevicius 7.11.2001, Ulevicius 6.11.2001.

Table. Annual Turnover and Growth of the Lithuanian Information Technology and Telecommunication Market by Segment, 2001.

Market segment	Annual turnover (*in million litas*)	Annual turnover (*in million euros*)	Growth of turnover from the previous year (%)
IT	1,075	0.311	23
Telecommunications[8]	3,024	0.876	32
Total	4,099	1.187	28

Figure. Structure of the Lithuanian Information Technology and Telecommunication Market, 2001 (in per cent).



[8] **According to the IT magazine Naujoji Komunikacija, the Lithuanian telecommunication market grew by 26 per cent, reaching 836 million euros**.

Figure. Growth Rate of the Lithuanian Information Technology and Telecommunication Market by Segment, 2000–2001 (in per cent).

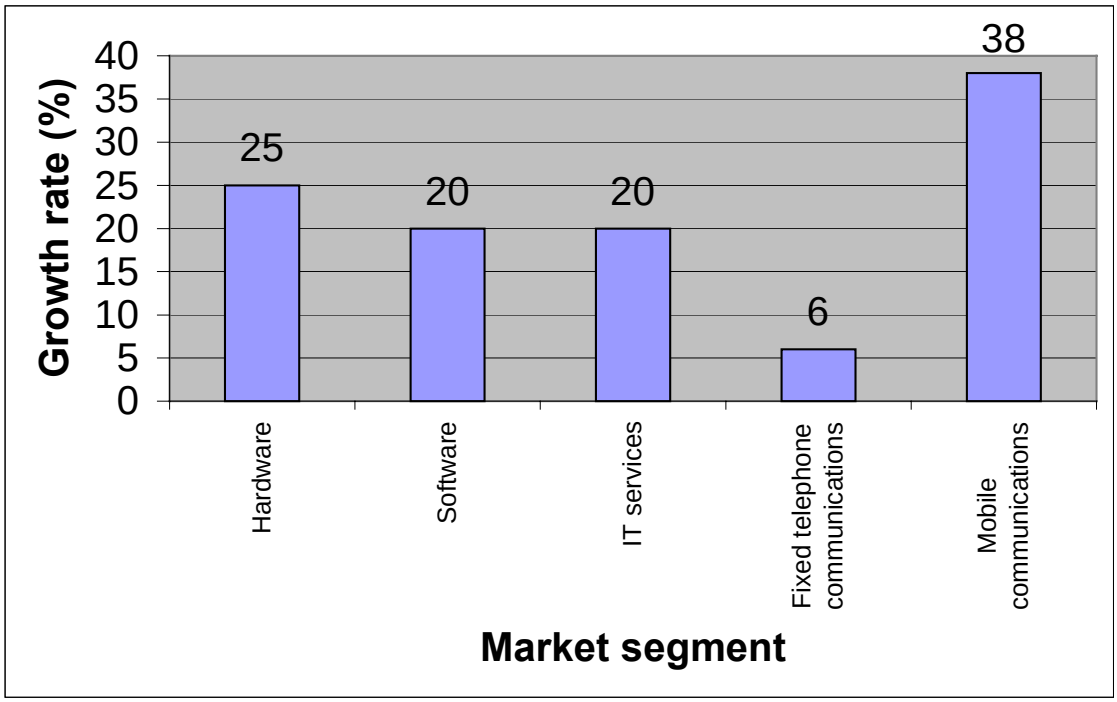


Table. Employed Population by Economic Activity, 1999 (annual average number in thousand).

Total	1,647.5
Computer and related activities	2.9

Indicators from the ICT sector performance presented by Lithuania's Statistics Department are not adequate for assessing the importance of this sector in the national economy. There is no accurate information reflecting its contribution to GDP, investment into it or the number of its employees. Nor are there consolidated indicators measuring its share of foreign trade.

2.1.2 Foreign Investment in ICT

The telecommunications sector has attracted the largest amounts of foreign capital within the ICT sector. The Swedish-Finnish consortium's investment into Lietuvos Telekomas is the single largest foreign investment in Lithuania. Most Lithuanian IT companies were started with local capital. The first private offering to international financial investors took place as late as 1997. Today the companies that acquired

international funding are the strongest performers in the IT market. Despite these few success stories, foreign investments in IT companies have remained low. In the past years, investors have become increasingly interested in internet and programming service providers. The Nordic and the Baltic countries have invested most actively in the Lithuanian ICT companies.

Text Box. Lithuanian ICT Companies with Significant Foreign Investments.

Company	Investor
Lietuvos Telekomas	Amber Teleholdings Consortium
Omnitel	Motorola
Bite	Tele Denmark
Tele2	NetCom
In Your Pocket	Baltic Republic Fund
Alna	Baltic Republic Fund
Taide and Skaitmenines komunikacijos	Microlink
Pirk	Osta
Sonex	Baltic Post Privatisation Fund (EBRD)
Informacines technologijos	Baltic Republic Fund
Baltneta and Infomacijos tiltas	Finnet International
Ashburn International	BalAEF

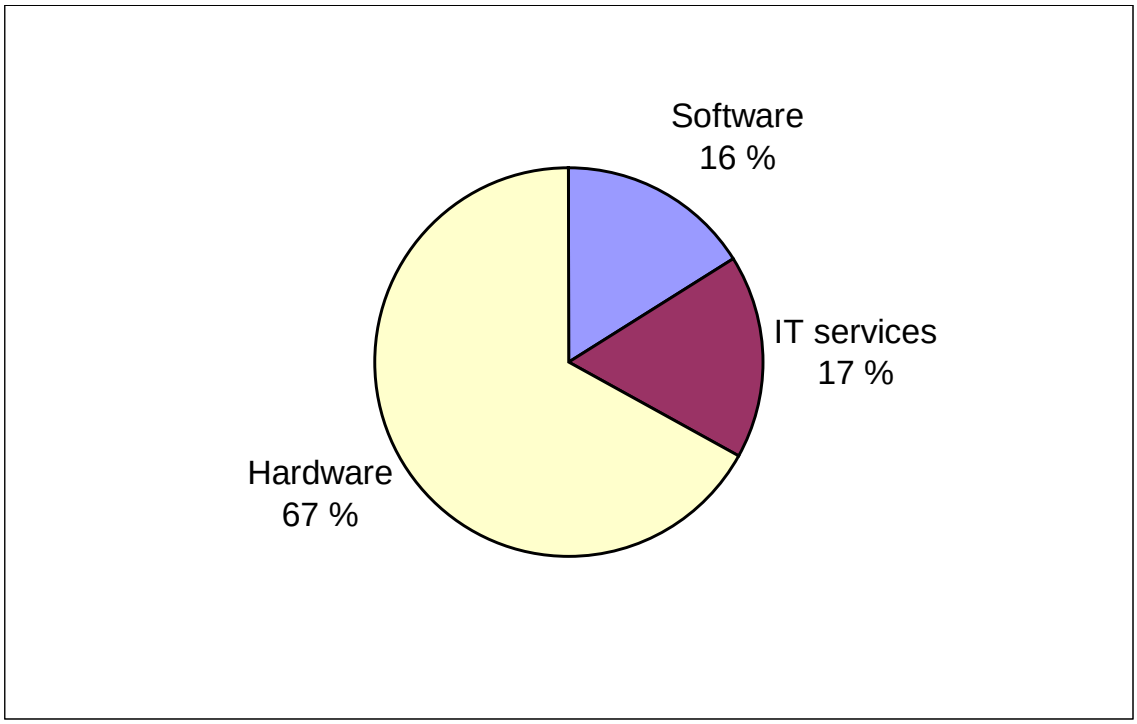
Table. Value of Foreign Direct Investment in the ICT Sector, 1 July 2001.

	FDI (*in million euros)*	Share of total FDI (%)
Total economy	2 938.7	100
Post and communication	477.5	16
Computers and related activities	7.6	0.3

2.1.3 Information Technology

2.1.3.1 Structure of the IT Market

Figure. Structure of the IT Market, 2000 (in per cent).



Up to now the Lithuanian market has been heavily oriented towards hardware, which is a feature of an underdeveloped IT market. Hardware, in turn, has been dominated by personal computers. According to Prime Investment's estimates, about half of all computers sold in Lithuania are imported, while another half are assembled locally. The existence of low-cost assemblers distorts a fair comparison of the IT market structure between Eastern and Western Europe because the actual hardware sector in Eastern Europe is in fact larger than the absolute figures indicate. Although laptop sales accounted only for five per cent of the total sales in 2001, the market shows a growing demand for mobile equipment.

Lately the focus has started to shift from hardware to software development and services. An increasing demand for more sophisticated software over the last few years has speeded up the growth rates of software sales, although large scale piracy curtails the revenues. As for services, hardware maintenance, software support and training have so far captured the largest share of the embryonic IT service market, but system integration and IT consulting are forecast to become the most rapidly growing segments in the next few years. The shifts in market structure affect company structure: small

hardware resellers are in trouble due to reduced margins and the growth of the industry mainly comes from the largest companies. Strengthening software also contributes to industry exports.

The developmental logic of the IT market goes as follows: At the first stage, both government and private sector actors buy (primitive) computers, in which they often run illegal programme copies. At the second stage they realise that computers alone do not make sense and begin to demand business management software. Next they start purchasing solutions, a step which many Lithuanian enterprises have already taken or are about to take. The biggest Lithuanian companies buy complete systems. Demand for support and system integration services is driven by an increasing complexity of the tasks to be performed in the enterprises.

2.1.3.2 IT Companies

According to Infobalt, the Lithuanian IT sector employed more than 10,000 specialists in 2000–2001. The number of IT companies is assessed to be about 200. A great majority of them are very small, employing up to 10–20 people. However, the market is dominated by a handful of large firms that compete for major supply contracts. The top companies are mostly ISO 9000 certified.

The leading IT companies have a diversified business profile as they are composed of a group of daughter companies or separate departments which altogether cover every market segment from office equipment and hardware sales to software development and services. Even when a company has a special emphasis on a certain segment, it nevertheless operates on a broad scale. In Lithuania everybody does everything. Services are usually integrated with hardware sales, and pure IT service companies are rare.

Table. The Biggest IT Companies, 2001.

		Turnover (*in million euros*)
1	Sonex Group	29.5
2	Elsis Group	28.0
3	Alna Group	25.2
4	Penki kontinentai	14.2
5	Blue Bridge	14.1
6	Varos Group	11.5
7	Fima	10.4
8	Minolta Baltia	7.9
9	Baltic Amadeus	7.8
10	Compservis Group	7.3

Table. The Biggest IT Service Companies, 2001.

		IT service revenue (*in litas*)	IT service revenue (*in euros*)	Growth of IT service revenue (%), 2001/2000	Proportion of IT services of total revenue (%)
1	Alna	21,457,000	6,214,000	124	25
2	Informacines technologijos	11,872,000	3,425,000	33	57
3	Blue Bridge	7,354,000	2,130,000	151	15
4	Sintagma	4,500,000	1,303,000	-14	27
5	Baltic Amadeus	2,913,000	844,000	151	11
6	Compservis	2,598,000	752,000	-8	10
7	HNIT-Baltic GeoInforServisas	2,364,000	685,000	0	38
8	Sidabrinis tinklas	2,135,000	618,000	126	91
9	Sonex	Na	Na	-	-

The biggest IT distributors, 2000

1. Alna
2. Elsis
3. Blue Bridge
4. Baltic Amadeus
5. Minolta Baltia
6. Compservis
7. Biznio masinu kompanija
8. Sintagma
9. Informacines technologijos

The biggest wholesalers, 2001

1. GNT Lietuva
2. TechData Lietuva
3. Elko Kaunas
4. Acme Computer Components
5. Asbis Lietuva
6. Sonex distribucija

IT wholesales is the first business sector to be dominated by e-trade B2B services. GNT Lietuva generates about 60 per cent of its turnover from its e-warehouse sales. TechData and Acme provide similar services for retailers. The numerous retailers face a fierce survival struggle. Competition is based on the price with the result that mark-ups are between five and fifteen per cent.

The biggest computer assemblers, 2000

1. Sonex kompiuteriai
2. Lintec Baltica
3. Baltic Microcomputer System
4. Skaitos kompiuteriu servisas

In 2001, Sonex kompiuteriai, one of the companies of Sonex Group, became the leading PC manufacturer in the Baltic States with a total production of 18,204 units, outperforming Estonian Microlink with 17,914 computers produced in 2001.

2.1.3.3 Supply in the IT Market

The main group of Lithuanian IT companies is oriented to two markets: sales of hardware on the one hand and provision of solutions on the other. Lithuanian IT companies do not usually create "green" software but they adapt it and provide solutions. Yet some Lithuanian software products are quite competitive, and especially a few years ago, there was demand for locally developed accounting and management systems. Compared to Vilnius, enterprises in Kaunas represent a more technological orientation which focuses on inside programming rather than, say, Microsoft or Oracle applications. Their know-how rests on a deep understanding of computer structure and basic programming. Those Lithuanian companies that have entered the foreign market do not export software products but programming services.

In addition to selling software development services, the Lithuanian experts wish to find some competitive niches to be conquered in the foreign market. Infobalt has identified potential areas of specialisation in which the Lithuanian industry could gain a foothold within the next few years:

- Traditional software product implementation services, i.e. programming
- Multimedia product development
- E-business applications for ERP, SCM and CRM
- E-signature applications for e- and m-business
- Open source developments for commercial applications
- Systems based on chip development, such as smart house, social security, hospitals and transport
- Electronic nose
- Computer science applications in biotechnology and laser technology
- Call centres and telemarketing

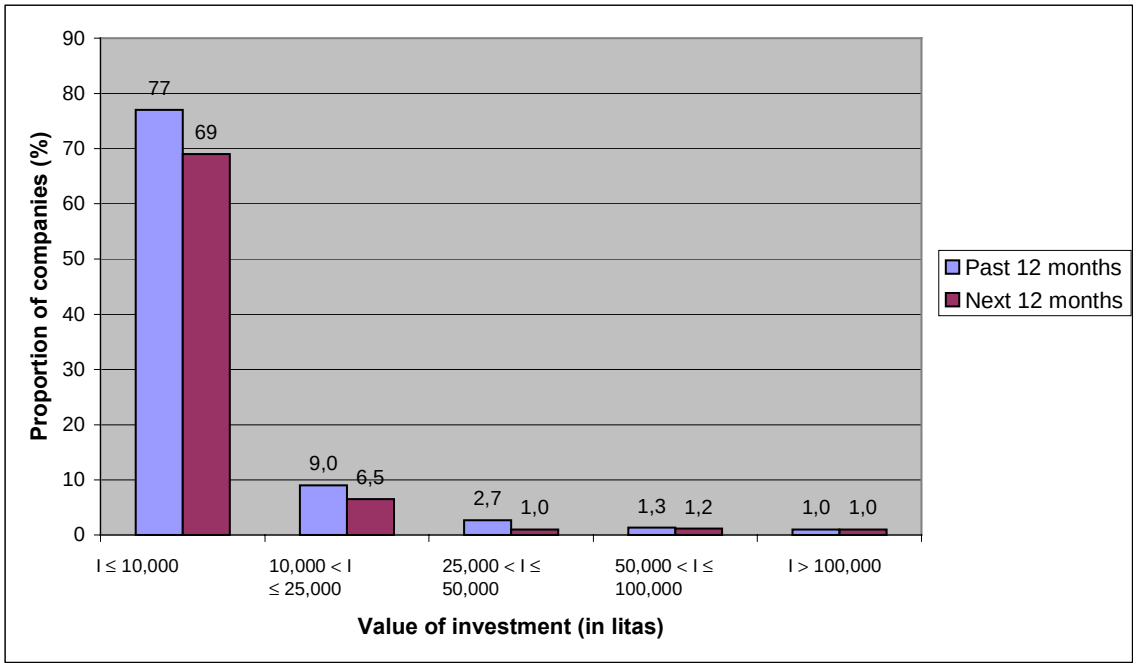
Text Box. Specialisation Strategies of the Four Largest IT Exporters.

Company	Specialisation
Sonex	Business management system installation, hardware assembly and mobile business solutions
Elsis	Telecommunication solutions
Alna	IT solutions
Penki kontinentai	Banking solutions and machines

2.1.3.4 Domestic Customers and Exports of the IT Industry

The main domestic customers of the IT industry come from the banking, telecommunication and government sectors. In the past decade the government's spending on large systems acted as a growth motor, whereas in the new millenium the technology investments of the industry have begun to play a more important role than before. Infobalt has surveyed the investment activity of the Lithuanian industry in information technologies. The results are presented in the chart below.

Figure. Investment in Information Technologies in the Past and Next Twelve Months (in per cent).



In the early 1990's, large unconquered markets in the former Soviet Union countries created opportunities for Lithuanian companies to re-export Western ICT equipment to the east. Informacines technologijos, Penki kontinentai, Elsis and Technogama found profitable markets in the former Soviet Union countries, to cite few examples of

exporting companies. The Russian crisis in 1998, which slowed down eastern exports, forced the Lithuanian companies to look for new markets from Western Europe.

The first attempts to export software development services to the west were made by the forerunners Alna and Penki kontinentai in the mid-1990s. The mainstream started to follow some three years ago. That is to say, software exports are only beginning to develop. Today Alna pursues a software export strategy most consistently, but nevertheless the share of exports of its total sales was just 12 per cent in 2001. Moreover, several start-ups have entered the western markets with internet solutions and web design services, although these activities are on a quite small scale in Lithuania. The most important export countries in Western Europe are the Nordic countries and Germany.

Today local computer assemblers sell PCs to Latvia, Estonia, the Ukraine and Russia primarily but some of them export to Western Europe as well. Thanks to the recovery of the eastern market, telecommunication equipment manufacturers are also likely to increase their sales there.

Table. The Biggest IT Exporters, 2001.

Company	Value of exports (*in million euros*)	Share of exports of total sales (%)
Alna	3.3	12
Elsis	2.8	18
Strauja	0.52	15
Kordab Vilnius	0.43	65
HNIT-Baltic GeoInforServisas	0.41	25

2.1.4 Telecommunications

The telecommunication sector has been booming, becoming one of the fastest growing sectors in the Lithuanian economy. According to Infobalt, telecommunications made up 4.5 per cent of Lithuanian GDP in 2001.

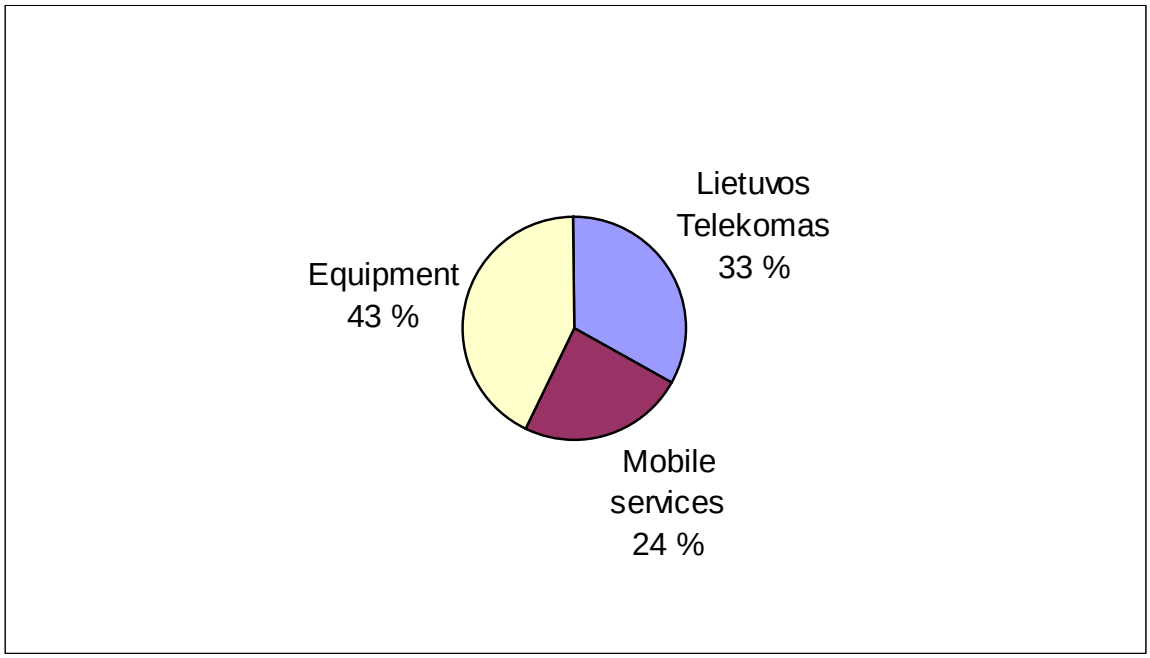
After the collapse of the Soviet Union, Lithuania inherited an outdated fixed line network with one of the lowest penetration rates and longest waiting lists among the Central and Eastern European countries. The state enterprise Lietuvos Telekomas was established in 1991 to operate this network. Sixty percent of Lietuvos Telekomas was sold to Nordic operators Sonera and Telia in 1998 in order to speed up the renewal of the network and the services. Lietuvos Telekomas was simultaneously granted monopoly rights on fixed telephone services till 31 December 2002. In return it has heavily invested in the expansion of the digital network, which will reach 85 per cent of all subscribers by the end of 2002.

In 2001, the total revenue of Lietuvos Telekomas was 1,058,500,000 litas (305,062,000 euros), indicating merely a modest increase over the results in 2000. The main course

behind the slowdown was a falling income from fixed telephone services due to a fierce competition with cellular operators. Thirty-one per cent of the Lithuanian population are fixed line subscribers. Mobile operators are becoming equal competitors even in the international calls market. Lithuanians regard the monopolist's tariffs as high. Revenue from internet and data transmission services experienced a robust growth of 69 per cent and 15 per cent respectively.

Lietuvos Telekomas is diversifying its services in preparation for the end of the monopoly in the fixed line network in 2003. A memorandum of understanding was signed with TietoEnator to set up a joint venture which would provide IT services in the Baltics. The new company will be built around the information systems department of Lietuvos Telekomas, which currently employs about 200 people. In mobile telecommunications regional alliances are expected to be established across borders. Lithuanian Omnitel, Latvian LMT and Estonian EMT already founded the Baltic Sea Alliance in 2001.

Figure. Structure of the Telecommunication Market, 2000 (in per cent).



The biggest telecommunication companies, 2000

1. Lietuvos Telekomas
2. Omnitel
3. Ericsson Lietuva
4. Bite GSM
5. Siemens
6. Tele2
7. Elsis

8. Fima
9. Mikrovisata
10. Belam Kaunas

Table. The Number of Subscribers to the Biggest Cellular Operators, 2001.

	Cellular operator	Number of Subscribers	Market share (%)	Turnover (*in million euros*)	Growth from the previous year (%)
1	Omnitel	557,000	57	143	43
2	Bite GSM	273,700	28	66	36
3	Tele2	150,000	15	17	-
Σ	Total	980,700	100	226	

Mobile telecommunications form the fastest growing segment in the Lithuanian telecommunication market, followed by internet services. The penetration rate of the Lithuanian cellular market doubled from 2000, reaching 27 per cent in 2001; it is forecast to surge to 40 per cent by the end of 2002. Despite the tightening competition, which has led to constant reductions in call rates, the gross margins of the cellular operators have grown fast. A growth of the subscriber base has been the main factor explaining this success. It has been enabled by a growing economy, large capital investments by the operators, tariff reductions of mobile calls and tariff increases of Lietuvos Telekomas. Lithuania's telecommunication companies plan substantial investments in cellular network development, new wireless technologies and enhanced customer service in the future, too. Better WAP services, e-business solutions and GPRS technologies will be available for customers.

Table. The Telecommunication Equipment Traders, 2001.

		Turnover (*in million euros*)
1	Ericsson Lietuva	33.3
2	Siemens	33.0
3	Elsis	27.8

2.1.5 Internet and e-Banking

At the beginning of 2002, 14 per cent of the Lithuanian population had been connected to the internet at least once in six months, 13 per cent had used the internet once a month and 11 per cent once a week. Even though internet use grew by four to five per cent in the previous year, Lithuania's internet penetration was still the lowest in the Baltics. In 2002 large telecommunication companies and banks launched a project to open public internet accession points where citizens can freely use the internet all over the country. Thanks to this Window to the Future Project, the internet penetration is forecast to increase to 15 per cent by the end of 2002.

More than three fourths of the computerised enterprises in Lithuania had internet access at the end of 2001. A little earlier in January 2001, 57 per cent of Lithuanian companies possessed at least one computer, and 38 per cent of all companies were using the internet.

The modest growth in the number of internet users has not allowed e-banking and e-commerce to gain the expected momentum in the Lithuanian market. On the other hand, new e-services are enthusiastically accepted by the market. Slightly under 40 per cent of the computerised companies and more than one fourth of all companies used e-banking services in the first year of their introduction. By the end of 2001, e-banking had 60,000 customers. Seven out of thirteen commercial banks provided internet banking services, and the rest planned to launch them during 2002. GPRS services had 1,100 users at the end of 2001. DSL internet services were launched in mid-2001.

The meagre penetration is explained by low average income and a telecommunications monopoly which restricts competition. The monopoly of Lietuvos Telekomas exerts a noticeable indirect influence on the internet market, since the internet service providers are forced to buy communications channels from it at a wholesale price and at the same time compete with it. Lietuvos Telekomas has about a half of the internet market. Local cable TV companies entered the ISP market in 2001, challenging its position.

2.2 Latvian Information and Communication Technology[9]

2.2.1 Size of the ICT Market

Economic activities related to the production of goods and services in information technologies equalled 4.5 per cent of GDP in 2000 and 4.6 per cent in 2001 in Latvia. In the sub-sector 'office equipment and computer production' the added value was 0.1 per cent of GDP, in 'computers and related activities' 0.5 per cent in 2000. In the latter sub-sector the highest share – three fourths – belonged to software development. In 2001, the software production made 0.5 per cent of GDP. The annual output of 'computers and related activities' increased by 15 per cent. Software consultancy services were also buoyant, adding to the growth of the sector. Software and computing services grew by about 40 per cent in 2001.

Telecom services was valued at US$ 469.0 million in 2001 compared to US$ 405.3 million in 2000, a growth of 16 per cent. It is approximated that telecommunications grew by one hundred per cent from 1997 to 2000. Such a vigorous growth was encouraged by two conditions: 1) the growing number of permanent internet users, which reached 16 per cent of the total population at the end of 2001; 2) growing data

[9] Baltic IT Review 4(15) 1999, Birzinš 2002, Contreras & Kasemaa 2001, Ernst & Young 1999, International Trade Centre 2002, LDA & Nordea 2002, LITTA 2002, Lūsis et al. 2000, Lyons 2002, Ministry of Economy of the Republic of Latvia 2001, Stučka 2001; www.amercican.edu/carmel

flows, including among others the expansion of electronic payments. According to the estimate of the Ministry of Economy, the value added of this subsector reached four per cent of GDP in 2000.

Latvia's software industry had an annual turnover of 28 million in 2001. There are approximately one hundred software development companies in Latvia. Most of them are small enterprises which produce specialised software and offer various services. Some twenty or thirty companies handle large scale software development projects. The top 25 companies employ over 3,000 professionals. The Latvian telecommunication sector employs approximately 7,000–10,000 people.

The total number of IT companies rises to some 500, when one also includes the computer technology companies that manufacture computers, provide computer servicing or software maintenance, or sale peripherals. Typically these are again small companies, employing fewer than ten people. Only four of them have more than one hundred employees. In 2000 the capacity of the Latvian market for computers (both locally assembled and imported) and peripherals was around 80–100 million lats (133–166 million euros) per year. Import of computer equipment has risen since 2000.

Table. Size of the ICT Market in Latvia According to the European Information Technology Observatory, 2001 (in million US$).

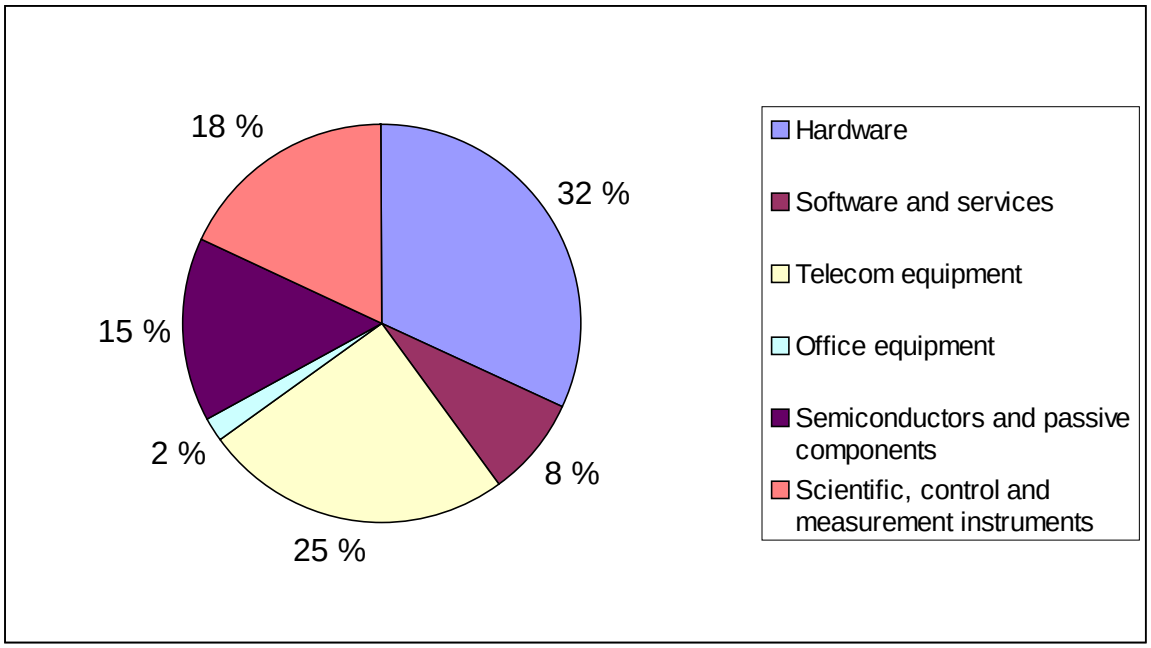
		Value (*in million US$*)	Growth from the previous year (*%*)
1	**Electronic data processing**	**152**	**20**
1.1	Servers	28	
1.2	PCs, workstations and other add-ons	124	
2	**Data communication hardware**	**37**	
2.1	LAN hardware	25	
2.2	Other data communication	12	
3	**Software and services**	**51**	
3.1	Software products	21	
3.2	Software services	30	
4	**Telecom equipment**	**147**	**20**
4.1	Public network equipment	97	
4.2	Private network equipment	50	
5	**Office equipment**	**13**	**16**
5.1	Copiers	4	
5.2	Other office equipment	9	
6	Semiconductors	17	
7	Passive components	72	
8	Scientific instruments, control and measurement equipment	109	36
Σ	**Total**	**598**	**20**

Table. Latvian IT Companies According to Enterprise Register, 2001.

	Value of production (*in million US$*)	Number of companies
Software and computing services	79.90	173
Software consultancy	295.46	251
Total	375.36	424

2.2.2 Structure of the ICT Market

Figure. Structure of the ICT Market in Latvia According to the European Information Technology Observatory, 2001 (percentages).



In a study organised under the auspices of the *Vocational Education and Training 2000* project from the Phare programme, 157 Latvian ICT companies were surveyed in 1999. Companies were among others asked to forecast growth in the number of employees. The results show that the most rapid growth is expected in internet and e-commerce services, consulting and software development.

Segment		Employees in 2005, compared to existing numbers (%)
	Manufacturing	
Computers and equipment	+	172
Telecommunication network operators	-	88
Software development	+ +	194
	Services	
Telecommunication services		154
Internet and e-commerce services	+ + + +	363
Information systems maintenance		153
Consulting	+ +	201
Hardware services		148
	Sales	
Equipment	+	177
Software	+	173

2.2.3 Foreign Investment in ICT

Foreign investments in Latvian telecommunications have been substantial. Communications make up one tenth of total accumulated foreign direct investment (FDI) in Latvia. Latvian IT companies, by contrast, have attracted foreign capital modestly when compared to other areas of economy. At the end of September 2001, total accrued FDI in 'computers and related activities' accounted for 8.9 million lats (14.8 million euros) and in 'office equipment and computer production' 723 thousand lats (1.2 million euros), while the value of accumulated FDI in all sectors was 1,430.3 million lats (2,372 million euros). The owners of IT companies thus form the main source of investment, which restricts developmental investments.

There are cases where foreign firms have acquired Latvian IT companies, merging Latvian buy-outs into a multinational group. The most significant acquisitions from recent years are listed in the table below. Moreover, many multinational IT companies have established their regional headquarters in Riga. Alcatel (France), Exigen (USA), IBM (USA), Marconi (UK), Microsoft (USA), Nomad Software (UK), Sybase (USA) and TietoEnator (Finland/Sweden) can be cited as examples of these.

Text Box. Foreign Owned IT Companies in Latvia.

Latvian company	Purchaser	Country of origin
Konts > Tieto Konts > TietoEnator	Tieto > TietoEnator	Finland + Sweden
SWH Technology	Exigen	USA
Fortech	Microlink	Estonia
VAR	Microlink	Estonia

2.2.4 Information Technology

2.2.4.1 Supply in the IT Market

Software development services constitute the most important segment of the Latvian IT sector, and outsourcing plays a central role. Maintenance of information systems as well as repair and maintenance of equipment are also wide spread areas of operation. Usually Latvian IT companies use existing development tools to create customised solutions for client needs or they outsource their services. As in Lithuania, Latvian IT companies mainly provide software services instead of new products. One of the few successful software products is GRADE (see p. 159) along with accounting systems and localisation programmes designed for the local market. The most commonly used technologies are based on relational database systems that involve a client-server architecture or on the internet environment. Latvian companies are able to provide clients with turn-key solutions, which are also exported to more than ten countries. Some of the companies have begun to move from the provision of cheap solutions as subcontractors to becoming main contractors in complex areas.

Offshore outsourcing, once the engine that drove the Baltic IT industry, is running out of steam as the Baltics become expensive compared with some other transition economies, such as Belarus, the Ukraine, Bulgaria and Romania. Latvia's relative prosperity and increase in wages is pricing it out of the off shore outsourcing market. International outsourcing has been critical in building companies like Dati but in recent years Dati has begun to focus more on home grown outsourcing. Foreign contracts have dried up as Dati's services have become cleverer and consequently more expensive. At the next stage, the IT market should focus more on research and development but first the companies need to build up capital, which will be a difficult step to be taken. Mr Harry Piela, Director of Sybase Baltic and Board Member of the Finnish Lithuanian Trade Association, summarises his view as follows:

> "I do not believe in outsourcing. Only innovation can put the Baltics anywhere near the top of the IT world. Doing subcontracting for Nokia or IBM is not going to get you there."

Latvia advertises the following segments as its competitive areas:

- Software development outsourcing, especially enterprise resource planning (ERP) implementation services and system integration
- Financial solutions as well as advanced solutions for e-commerce and e-government
- Independent testing, adaptation and localisation services
- Information systems auditing
- Application service providing: data centres and back office business services
- Call centres and telemarketing

Ernst & Young's (1999) analysis of Latvia's IT services sector lists both strengths and weaknesses:

\+ Availability of well-educated IT specialists

+ Interest of secondary school graduates in IT, resulting in a high number of applicants in IT studies
+ Low costs of the unskilled labour needed for call centres
+ Acceptable availability of data communication services
+ Relatively low infrastructure costs and overheads
+ ISO 9000 certified companies
+ Government's commitment to improving the IT environment and creating an information society: national programmes and public projects, such as the informatisation of schools
+ European business culture and geographical proximity to Western Europe

− Companies are too small to offer complete outsourcing services directly to the largest international clients. Often such contracts also involve technology or employee transfer that Latvian companies cannot provide.
− Lack of marketing skills as well as lack of extensive experience with foreign clients
− Small number of highly qualified and experienced programmers, system analysts, project managers, technical writers and IT consultants
− Limited access to venture capital restricts the financing of new enterprises.
− Underdeveloped other industries cannot create enough demand for services and e-commerce.
− Underdeveloped legal setting in IT
− Limited government support for the industry and insufficient investment in education compared to some competitors. Companies lack means to invest in education.
− Poor development of the labour market in IT

2.2.4.2 Domestic Customers and Exports of the IT Industry

The state has also made significant investments in developing its communication networks and redesigning its national registers. The Latvian government has invested 650 million euros in the telecommunication and IT sectors since 1998. The Public Investment Programme implemented 26 projects in the sector of information and communication in 2002 with a value of 18.2 million lats (30.2 million euros). Initially the private demand for IT services came from financial institutions which needed to set up back office systems. Gradually companies in other business areas, too, began to invest in the development of computer networks, communications and accounting systems.

At the end of 2000, computerised companies accounted for 39 per cent of all Latvian companies. Companies in and around Riga had the highest level of computerisation, 43 per cent. Among the computerised companies, 41 per cent possessed only one computer, 13 per cent more than ten. Fifty-three per cent of computerised companies had an internet connection, but only five per cent of all companies. 13 per cent of computerised companies had their own home page. Huge discrepancies in computer usage exist between the capital and the countryside.

The exports of Latvia's information technology and electronic equipment industry amounted to US$ 75 million in 2001 with hardware accounting for US$ 49 million and software US$ 26 million. Latvia is a net exporter of IT services which has established its position as a software development and development related services provider in Eastern Europe. In 2001 its software exports increased by about 15 per cent, but the country intends to further strengthen its position. By 2010 the Latvian IT service sector aspires to export services worth 0.5–1 million euros in annual revenues. Major foreign orders come from Germany, the United States, Ireland and Sweden. Large assignments have been completed among others for IBM, Siemens Nixdorf, Hewlett-Packard, Unisys, Nokia, LTU, Citibank and Daimler-Chrysler. Latvia's Information Systems Cluster Projects aims at improving the prerequisites for large-scale software projects and thus ensuring the export growth.

IBM has involved Latvia in an innovative systems development project which may revolutionise the applications industry. Along with teams in Seattle, Belarus, and China, a Latvian team of system programmers is part of the IBM's 24-hour-a-day application development project.

UNCTAD/WTO's team identified areas for export promotion based the available capacities and technologies:

- New system development for public utility projects, re-engineering, system maintenance, testing, CASE tools, B2B internet technologies, web and networking solutions, SAP/R3 interfaces, SAP and Oracle consultations, Java software design, software product development, payment card systems, localisation and documenting of software, application service providing, data storage
- PC systems, system integration

2.2.4.3 IT Companies

- Most IT companies are concentrated in Riga.
- Latvian IT companies do not have as mixed profiles as Lithuanian ones.
- ISO 9001 quality certificates for software development have been awarded to nine companies: Dati, Exigen, TietoEnator, IT Alise, Fortech, Baltic Data, DataPro, Elva-1 and Elko.
- Testing and/or R&D services: RITI, Verdi
- Application service providers: DEAC, IBM Latvia, Telia, Verdi

Text Box. A Sample of Major IT Companies.

Company	Turnover *in lats*, 2001	Number of Em-ployees	Area of operation	Target market	Share of exports in turnover (%)
Fortech	9 200 000	240	60 % - infrastructure solutions 40 % - system integration, software development, installation of management solutions (company and financial)	Large enterprises, public sector	Baltics
Dati Group	6 606 000	515	Large scale software projects, development of new information systems, re-engineering, software testing, CASE tools	Telecommunications, banking and finance, transportation, public sector	*50 % in 1999*, subsidiaries in D and GB
Tilde	5 083 001	75	Localisation software, multilingual solutions, internet solutions, software applications	Software developers, end users	13 %
Exigen (formerly SWH Technology)	4 951 137	270	Medium and large scale software projects, software engineering, consulting	Large international enterprises, such as IBM, public sector	95 %
Verdi	ND	240	IT strategies consulting, development of software, web and networking solutions, system integration, PC workstation and data centre services	Telecommunications, business and public sector	Baltics, sees major potential in the CIS countries
Tieto Konts	3 842 000	128	Payment card systems (software), ATMs (equipment), card personalisation systems and coding equipment, software maintenance services	Banking and finance	Exports to the CIS countries in particular, *70 % in 1999*
IT Alise	2 035 241	120	Large scale software projects: client/server and internet/intranet software development, office solutions, system development, installation and adaptation, sale of Oracle and Lotus licenses	Telecommunications, banking and finance, public sector	Baltics
DataPro	1 133 100	90	Data base and data warehouse applications, financial and office applications, business intelligence solutions	Banking and finance, sales and distribution, public sector	10 % Germany, Austria, Switzerland
DeSL	320 000		Software development for the finance and telecommunication sector in the Java environment	Banking and finance in Western Europe, especially in Germany	98 %
BTG	ND	80	Financial applications on a Unisys platform	Banking and finance	Exports - yes
DEAC	$ 164 000	16	Co-allocation services (hardware deploy-ment), hosting services, mobile solutions (SMS services), ASP, ISP and VPN		Baltics, FSU

Table. Computer Manufacturers and Retailers.

Company	Computer units sold, 1999
EET-Riga	947
Elko-Vecriga	1 100
Elva-1	1 636
FIX	500
Fortech	4 054
Komerccentrs (Dati Group)	2 400
Latinsoft	345
LIS	800
Norel	231
VAR	3 000
Capital	ND
EET	ND

Table. Wholesalers.

Company	Computer units sold, 1999
Computer 2000	2 540
CHS-Riga	3 940
Microlink datori	4 972

2.2.5 Telecommunications

A high level of FDI in the telecommunications field has enabled a relatively fast infrastructure development. The government is working to harmonise the telecommunications sector and align it with European requirements. Lattelekom manages the only public fixed line network.

The Latvian Law on Telecommunications granted a monopoly in the provision of fixed telecommunications services for twenty years in 1993. The goal of this decision was to invite investments that ensure the replacement of the technologically backward and technically worn out telecommunications network from the USSR. Fourty-nine per cent of Lattelekom's shares were sold to a foreign consortium called Tilts Communications, which was registered in Denmark but in which Sonera nowadays owns 90 per cent and Finance Corporation of the World Bank the rest. The monopoly company Lattelekom invested close to $ 550 million by 2001 to substantially upgrade the national telecommunications network.

Almost 70 per cent of the telephone lines were connected to a digital network in 2001, while the tele-density was around 30 per cent. Optical cables were installed in Riga and other major towns for large on-line customers and for inter-city connections, but most lines still stemmed from Soviet installations. Lattelekom's monopoly status hindered reductions in the service prices and undermines the spread of internet technologies.

In 1998 the new policy line for the telecommunications sector envisioned a withdrawal of the state ownership from Lattelekom and opening the telecommunications market to competition. Consequently, Lattelekom's fixed line monopoly was set to be moved from 2013 to January 2003. Because Tilts Communications did not reach an understanding on the compensation to be paid for shortening the period of exclusive rights, the foreign consortium brought the dispute to a court of arbitration. The Telecom Association, mobile operators, internet service providers and the public opinion resisted the monopoly.

Lattelekom's monopoly extends to international calls and usage of fixed lines for mobile operators and internet suppliers. Its high tariffs motivate bypassing efforts on the service providers' side, such as call back and IP telephony. Lattelekom is losing potential clients to mobile operators especially in the countryside owing to the cost of providing fixed line services, as those costs will be transmitted to the subscribers in the end. It offers a broadband service of the ADSL type as well as other internet services.

The mobile communication market is partially liberalised and the data transmission market is fully liberalised. Three cellular operators Latvijas Mobilais Telefons (LMT), Tele2 and Radiokoms serve one fourth of the population with a mobile phone. The mobile communication market has been growing at a rate of 65 per cent. Demand for new services, like call centres, virtual private network services, ultra-DSL and home-DSL, will ensure a market growth in the future as well.

Latvia's first cellular operator Latvijas Mobilais Telefons (LMT) is the market leader. Its GSM network, which covers more than three quarters of the territory, is available to 90 per cent of the population. Lattelekom, Sonera, Telia, the state radio and TV company and Latvia's government own LMT. LMT organises its operations directly with the international suppliers' home companies, among others with Nokia and Ericsson. As regards software development, LMT relies on its own skilled personnel who developed for instance its own software for a billing system and WAP solutions.

Tele2, formerly Baltkom GSM, operates the GSM 900 network which covers Latvia's biggest cities and main roads. Tele2's network is integrated with access networks of LMT and Baltkom TV. Marketing-oriented Tele2 was the first company to introduce pre-paid cards and mobile bank services in Latvia. Its technological systems are imported from abroad but tested by its own software designers.

Over forty internet service providers try to profit from the extension of the internet market. Apollo, Delfi, Latnet, Neonet and Telia Latvia are among the largest internet service providers. In 2001, there were 210,000 internet users, of whom 14 per cent used the internet at home. In spite of high prices, the internet market grew by 45 per cent.

Text Box. Telecommunications Infrastructure Elements per 100 Residents at the End of 2001.

Telephone main (fixed) lines	31
Digital lines as % of main lines	69
Mobile telephones in the whole country Mobile phones in Riga	25 40
Personal computers	11
Internet hosts	3
Internet users	21

2.2.6 Factors Affecting the ICT Sector

During the Soviet time, Latvia already had one of the most advanced ICT sectors of the USSR. The government's ambitious national programme "Informatics" for the period 1999–2005 is further propelling the development of the ICT sector. The Latvian Information Technologies and Telecommunications Association (LITTA) conducted a survey about the preconditions for developing the ICT sector in Latvia:

What is the main obstacle for the development of the ICT sector?	Agree-%
Communications infrastructure	43
Education policies	40
Legislation	36
Taxes	34
Insufficient co-operation with foreign partners and investors	16
Service infrastructure	11
What supports the development of the ICT sector most?	**Agree-%**
Co-operation with foreign partners and investors	47
Service infrastructure	30
Education policies	24
Communications infrastructure	19
Legislation	4
Taxes	3
What should the state do to promote the development of the ICT sector?	**Agree-%**
Promote education	63
Liberalise telecommunications	51
Invest more in ICT projects	43
Promote the establishment of e-government	37
Promote co-operation with foreign partners, clients and investors	29
Reduce taxes	17
Subsidise technology parks	14
Implement stricter controls over the sector	7

2.3 Estonian Information and Communication Technology[10]

2.3.1 Size of the ICT Market

The Estonian ICT sector is consolidated in the sense that the eight largest companies, measured by turnover, account for approximately four fifths of the ICT market, which consists of 250–300 enterprises. According to some estimations, approximately one half of these enterprises are engaged in developing software; according to other assessments, the number of software companies is around one hundred. Telecommunication enterprises dominate the sector.

Estonia's IT expenditure was 3.5 milliard crowns (223.7 million euros) in 2001, which accounted for about four per cent of GDP. The annual growth of the IT market was around 20 percent from 2000 to 2001. The growth was concentrated on the largest and smallest companies: Big companies received significant orders for building up infrastructure systems and databases. Small companies received commissions from the large ones or they exported software. The net sales of top 12 companies were 150 million crowns (9.6 million euros) on average. In 2000, an average IT company had 23 employees. Close to two thirds of Estonian ICT companies considers that the shortage of qualified workforce is a major impediment to their future development.

2.3.2 Structure of the ICT Market

Segment	Market *(in million euros)*	Exports *(in million euros)*	Employ-ment	Foreign capital*	Subcon-tracting	Concen-tration
Software	13	3	1 200	¤¤	¤¤¤	¤
Computers and office equipment	105	5	1 100	¤¤	¤	¤¤
Telecom services	220	4	4 500	¤¤¤	¤¤¤	¤¤¤¤
Multimedia and content	0.65	0.04	100	¤	¤	¤¤
Σ**	338.85	12.04	6 900	¤¤	¤¤	¤¤+

* ¤ … ¤¤¤¤¤
Insignificant Very significant
**Average instead of a sum in the last three colums.

[10] Contreras & Kasemaa 2001, Einama 2001a, Einama 2001b, Kalja & Oruaas 1999, Kalvet et al. 2002, Martinson 2002; www.amercican.edu/carmel, www.et.ee, www.export.ee, www.hurMaster.ee, www.mac.doc.gov, www.opt-init.org; Haamer 20.11.2001, Kaljundi 17.5.2002

2.3.3 Exports

Elcoteq Tallinn accounted for 83 per cent of Estonian ICT exports and 96 per cent of telecommunications equipment in 2000. The share of services in Estonian ICT exports was marginal, only four per cent, but their relevance is increasing. In the Estonian IT market, exports represent only 10–15 per cent, meaning that most local companies focus on the domestic market. Consequently, they experience growth only when the volume of the domestic market expands, as happened over the last few years. Mr Allan Martinson, Director of Microlink, does not believe that high tech exports will represent Estonia's future, because there is not enough money to ensure that high tech products could be produced at a competitive level.

Finland and Sweden are the leading trade partners for the Estonian ICT industry, as 84 per cent of ICT exports are directed to these two countries. Assembled computers are exported to Latvia, Lithuania and the Ukraine as well. The close relationship with the Nordic ICT industry has facilitated the uptake of modern technologies and secured sustainable income for Estonian firms. On the negative side, Estonian companies are involved in low-value added, technology serving activities in the form of subcontracting and outsourcing. About three fourths of subcontracting orders originate from abroad.

2.3.4 Information Technology

2.3.4.1 Supply in the IT Market

Mobile technologies and their innovations are advanced in Estonia, giving the country a valuable competitive edge. Estonia has been using digital citizen ID cards for communicating with government agencies, for online banking and for digital signatures since the beginning of the year. Two-thirds of all Estonians own mobile telephones, and Estonia is ranked first in Europe when it comes to wireless internet access. Estonians can park using mobile phones and SMSs, and soon they will be able to pay for local transportation in the same way. The text box below lists Estonian companies providing mobile technology solutions.

Company	Activities
Abobase Systems	Software development for mobile solutions, data warehousing systems
Cell Network	Software development, maintenance of business applications, setting up IT infrastructures
Cybernetica	IT-security solutions: firewalls, PKI technology, navigation systems
Helmes Ltd	Software development outsourcing
Microlink	Customer-specific IT solutions, portal and new-media solutions, wireless broadband equipment, internet software
Oskando	Mobile-telephony-based security solutions and control systems
Real Systems	Web & client/server applications, Oracle-based applications
Trigger Software	Payment and billing systems for mobile services, SMS parking system, content solutions for mobile services (UMTS)

2.3.4.2 Investment in IT

Investments in the Estonian IT industry are equal to 3–4 per cent of GDP, while the average in other countries ranges between three and five per cent. Those software companies and system developers that have received foreign investments have become the most profitable companies in their sector. Assert, Estonia's most successful IT firm in 2000, is fully owned by Swedish Cell Network.

2.3.4.3 Domestic Customers

Banking, government and telecommunications are the driving forces of the IT industry. Predicted trends in the Estonian IT industry in 2002 look as follows:

Sector	Trend
Government	Plenty of work for system developers and digital signature system providers through e-government project, unified state databases, ID cards
Healthcare	IT expenses grow two or three times.
Infrastructure	Introduction of the digital signature
Medium sized companies	Application service providers lease financial automation software and client management software.
Small companies	Outsourcing grows by 50 %.
PC market*	Growth of 10–15 % because the life cycle of a PC shortens.
Communications	The 3G mobile network in place by the end of 2002 ⇒ Software companies start building up new services around it.
ISP market	Broadband services (ADSL, cable connections) grow 50–100 %.

*There are 36 residents per sold PC in Estonia. In the Baltics the correspondive figure is 58 and in Scandinavia seven.

2.3.4.4 IT Companies

The Estonian daily business newspaper *Äripäev* has ranked the country's computer companies every year since 1994 in terms of six categories: sales, sales growth, profits, annual profit growth, profit margin and return on assets. In 2000, the most successful firms were system developers that produce major infrastructure systems, since there was not too much competition in this segment. In 1994, all the three top companies dealt with sale and/or assembly of computers; in 1999, they were engaged either in software or information systems development. The total number of assembled computers decreased from 1999 to 2000. The leading computer manufacturers were Microlink Computers and Ordi.

Text Box. Estonia's Top Ten IT Companies According to Äripäev, 2000.

Rank	Company	Profile	Location
1	Assert	Software and systems development	Tallinn
2	Microlink Systems	Systems development	Tallinn
3	Abobase Systems	Systems development	Tallinn
4	Aetec	Systems development	Tallinn
5	Infotark S	Sale of computers and peripherals	Tallinn
6	Cygate Estonia	Computer networks	Tallinn
7	KTK Overall	Digital systems development	Tallinn
8	Ordi	Sale of computers and peripherals	Tartu
9	ID Systems	Systems development	Tallinn
10	Kulbert	Sale of peripherals	Tallinn

Text Box. Gross Margins by IT Segment, 2001 (in per cent).

Segment	Gross Margin (%)	Leading companies
Distributers	5–10	Tech Data, GNT, Elko Reval
Assemblers	5–15	Microlink Computers, Ordi
Resellers	10–20	Microlink Astrodata, Ordi, PC Kaubamaja
System integrators	30–50	Microlink Systems, Abobase Systems, Helmes, BCS Itera
Software development	70–100	Assert
Outsourcing	70–100	

Microlink is the largest IT company in the Baltics today. Mr Allan Martinson, Director of Microlink, forecasts a major merger among the largest Baltic IT companies, which will result in another powerhouse. Contemporary Estonian software firms can be classified into five groups:

1. Two largest software firms in Estonia are the information technology divisions of Estonia's two largest banks, Hansabank and Estonian Union Bank. These divisions taken together employ more than 200 programmers. Since the IT divisions of banks have no serious problems in financing, they can buy state-of-the-art computers. It also means that software development processes at these divisions support programming novelties. Banks employ many of Estonia's best IT specialists. Tallinn Technical University has lost dozens of highly educated employees to them.
2. Firms which represent major Western companies, such as Microsoft, IBM, Oracle, etc. work at a good level, too, thanks to the technological support from abroad.
3. The fortune of firms that develop software for Western clients depends on the quality of their work. To survive in competition, they must maintain the same quality level as western software houses. Sometimes these companies push down expenses in questionable ways by producing software without a proper project documentation.

4. Those companies that work exclusively for the Estonian market produce financial software, Estonian language specific text editors or Estonian registers and databases. The maturity level of their processes varies greatly.
5. Finally, there are many companies at which software development activities take place on an ad hoc basis. The main reason for their survival is the shortage of qualified IT people in Estonia.

2.3.5 Telecommunications

The Estonian telecommunications sector has gone through a considerable development in the last eleven years, driven by high levels of foreign direct investment. The share of GDP spent on telecommunication services is the highest in the Central and Eastern European countries – almost five per cent. Today Estonia ranks among the top 20 countries worldwide for teledensity.

In 1991 the Estonian telecommunications were characterised by long waiting lists and the poor quality of the network. The foundations for establishing a telecommunication market were laid in 1992. In 1999 the direct involvement of the state in telecommunications diminished, as the state sold its direct participation in Eesti Telekom via a public offering to a Swedish-Finnish consortium. Sonera and Telia purchased 49 per cent of Telekom's shares, the Republic of Estonia 27.3 per cent and public investors 23.7 per cent. In this connection the shares of Eesti Telekom were listed at stock exchanges in Tallinn and London. In January 2001 the market was liberalised by opening it to a free competition. The Estonian National Communication Board regulates the market and controls the telecommunication companies, including the prices and the customer protection.

Eesti Telekom, the market leader, comprises both the fixed line and mobile business. In 2000 almost 40 per cent of its revenues were derived from mobile communications and about ten per cent from internet and data communication services. Cellular operator EMT and internet service provider Atlas belong to Estonian Telekom Group. Tele2 and Uninet have also entered the market for fixed telephone services to offer domestic and international calls. In addition, the Estonian National Communication Board has issued eleven other permits.

Wireless network is well developed and covers the whole country. About 40 per cent of the Estonian population uses GSM services. Three operators dominate the Estonian mobile communications market: 1) EMT, which belongs to Eesti Telekom Group, 2) Radiolinja Eesti, which belongs to Finnet Group, and 3) Q GSM, which belongs to Tele2. The cellular market grew vigorously especially in 1999 after EMT and Radiolinja had introduced the pre-paid call cards during the second half of 1998. The mobile operators have developed some innovative services, such as a parking service and a mobile positioning system. The Estonian operators were among the first ones to introduce WAP services to their customers.

Table. The Number of Subscribers at the Biggest Cellular Operators, 2000.

	Cellular operator	Number of subscribers	Market share (%)
1	EMT	316,000	61
2	Radiolinja	118,000	23
3	Q GSM	80,000	16
Σ	Total	514,000	100

Text Box. Telecommunications Infrastructure Elements per 100 Residents, 2000.

Telephone main (fixed) lines	36
Digital lines as % of main lines	71
Mobile phone subscribers	41 (January 2001)

2.3.6 Internet and e-Banking

The Estonian market for internet service providers is highly competitive. The major players include Atlas (Eesti Telekom), Uninet (Finnet), Esdata (Sonera & Eesti Telekom), Eunet (KPNQwest), Tele2 and Microlink Online/Delfi Online. The first commercial internet service providers were created as spin offs from the governmental research network EENET. Many ISPs as well as some computer retailers provide web hosting and design services, too. Fibre optic cables cover the whole country, direct undersea connections to Sweden and Finland together with links to Russia and Latvia improve data transmission capabilities. E-banking has taken root so well in Estonia that 80 per cent of commercial banking transactions are conducted via the internet. Internet banks had about 435,500 customers at the end of October 2001, which made up about 30 per cent of the total population.

The proportion of internet servers and mobile phones is surprisingly high in Estonia, which outperforms by these indicators many countries with much higher GDP. There are about 300 free public internet access points, which simultaneously serve as e-government access points. Through another initiative known as Tiger Leap, all Estonian schools are connected to the internet. The internet is more often used in workplaces than at home. Ninety-five per cent of Estonian employees have a computerised workplace. Less than a fifth of the population owns a home computer and more than a half of these home computers are connected to the internet.

Text Box. Internet Access, 2000.

Share of population connected to internet (%)	41
Number of internet hosts	40 909
Hosts per 10,000 inhabitants	284
Number of personal computers	195 000
PCs per 10,000 inhabitants	14

2.4 Lithuanian Electronics[11]

The life cycle of the Lithuanian electronics industry is reminiscent of that of the Latvian. The Soviet Union turned Lithuania into an important centre of electronics by building gigantic factories with thousands of workers. Until 1990, the Lithuanian electronics industry was a leader in the USSR in the manufacture of television receivers, radio and television signal transmission systems, precision measurement devices, laser technologies, microelectronics and computers. Such giants of the electronics industry as Radio Measurement Devices Factory and the television factories Nuklonas, Venta, Tauras and Banga were located in Lithuania. Banga employed 14,000 workers in Kaunas. Sigma, which produced mini computers to Soviet standards, was a leading manufacturer in the USSR, comprising six production plants in Lithuania.

The industry co-operated with scientific research institutes, such as the Kaunas Radio Measurement Devices Institute for example. As in Latvia, Lithuanian companies and research institutes were among the major suppliers of electronics products also to the Soviet military industry and space programme. What distinguishes Lithuania from Latvia is the geographical distribution of the electronics industry. Four Lithuanian towns – Vilnius, Kaunas, Panevezys and Siaulai – have significant factories in electronics, while in Latvia the whole industry is heavily concentrated in Riga.

In 1990, the Lithuanian electronics sector employed about 25,000 people, and its annual average production valued US$ 200 million. During the transitional period, which was accompanied by a privatisation programme, the industry experienced a decline and went through a restructuring. Although some of the flagships of the Soviet-Lithuanian electronics sector went bankrupt after independence, a few factories succeeded in reorienting their production so that they found new markets from the West. Adaptation was usually easier for component producers than end-product manufacturers.

Lithuania managed to retain few truly large electronics manufacturers with more than a thousand employees without strategic investors from abroad. Lithuanians point out proudly that their electronics industry does not rest on foreign owned assembly plants. A tentative explanation for the lesser role of foreign direct investment in the Lithuanian electronics industry derives from the privatisation strategy adopted in the 1990s, which had the side-effect that the control remained in Lithuanian hands.

Yet this does not mean that the Lithuanian industry would live in isolation or that foreign ownership would be totally absent. The main electronics companies co-operate with technology partners from the West or Far East, and they have financing from western banks. That is to say, they have imported modern production technologies from abroad, for instance, by buying a licence.

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[11] LDA 2000, *Statistical Yearbook of Lithuania* 2001, *Economic and Social Development in Lithuania* 12/2001; www.lda.lt; Celutka 25.10.2001, Gruodis 6.11.2001, Kirsis 9.11.2001, Maceika 6.11.2001, Seputis 7.11.2001, Sleiniota 26.10.2001 Sutkus 25.10.2001, Tamulevicius 7.11.2001.

Major foreign investors in the electronics sector include Siemens from Germany, Samsung from Korea, Farimex from Switzerland and Henley Trading from Ireland. Danish and Swedish companies also have invested in Lithuania. Ekranas in Panevezys and Baltijos automobilu technika in Klaipeda are among the companies that have received significant foreign investments.

Table. Cumulative Foreign Direct Investment by Economic Activity in the Lithuanian Electronics Industry, July 2001.

Economic activity	Value of FDI in thousand US$	Proportion of total FDI (%)	Number of enterprises
Manufacture of office machinery, computers and other electrical machinery	12.5	0.5	7
Manufacture of radio, television and communication equipment and apparatus	41.6	1.6	8
Manufacture of medical, precision and optical instruments	8.8	0.3	8
Electronics and ICT altogether	480.7	19.0	82
Total	2 530.7	100.0	1 847

The Lithuanian electronics industry started to grow in the second half of the 1990s. In terms of product groups, colour television sets, electronic blocks, automobile wires and cables, colour picture tubes and deflection yokes experienced the fastest growth. At the turn of the millennium, the sector comprised 15,000–16,000 employees and over 90 companies[12]. Over ten major companies formed the core of the industry. The demand for qualified engineering, electrical energy and telecommunications specialists was forecast to increase in 2002.

[12] **A report of the Lithuanian Development Agency gives this figure but the Statistical Yearbook shows a higher number, more than 140 companies**.

Table. Structure of Industrial Production by Economic Activity in the Lithuanian Electronics Industry in 1999 and Changes in Sales of Industrial Production in 2000 (in per cent of manufacturing, mining and quarrying).

Economic activity	Proportion in 1999 (%)	Annual growth in 2000 (%)*
Manufacture of office machinery, computers and other electrical machinery	0.2	-52
Manufacture of electrical equipment and apparatus	2.2	10
Manufacture of radio, television and communication equipment and apparatus	3.0	13
Manufacture of medical, precision and optical instruments	1.1	61

* Growth of total industry in 2000: 17 %

The Lithuanian electronics industry consists of the following segments:

Large-scale electronics products, i.e. traditional electronics

1. Televisions, radios and their parts: Siauliu Tauro Televizoriai, Ekranas, Vilniaus Vingis, Teleorbita, Selteka, Elsis
2. Appliances for communication transfer and reception, devices for remote control by means of radio waves: Vigintos elektronika, Televizine technika, Televizijos ir rysio sistemos, Terra, Geozondas
3. Telephones, telephone stations and power supplies for telecommunications: Vilniaus Sigma, Katra, Fonas
4. Measurement equipment

Microelectronics and components

1. Integrated circuits and micro chips: Vilniaus puslaidininkai, Hibridas, Elecon
2. Pressed boards: Telga, Madematic
3. Autoelectronics: Baltijos automobilu technika

Laser technologies, i.e. quantum electronics

1. Laser and other precision instruments: Ekspla, Standa, Sviesos konversija, Geola (laser holography), Lazerines technologijos centras, Elmas, Eksma, Agnis, Rimkevicius Company, Skaidula, Altechna

A multistage value chain of television manufacture forms the spearhead of Lithuanian electronics. Vilniaus Vingis produces deflection yokes for TV tubes, which it delivers to Ekranas in Panevezys. Ekranas, in turn, provides TV tubes to Siauliu Tauro Televizoriai, which produces TV sets. Ekranas employs about 5 700 people, Vilniaus Vingis 2,000 and Siauliu Tauro Televizoriai 1,000. As indicated above, there are also other Lithuanian companies that produce components for foreign television manufacturers. Many companies of the TV cluster carry out R&D.

Vilniaus Vingis is the largest manufacturer of deflection yokes for b/w and colour picture tubes in the Baltic and CIS region with more than 40 years' experience. Its product assortment also includes flyback transformers and power transformers for TV sets, monitors, video control equipment, winding machines and household goods. Like Ekranas, Vilniaus Vingis has established itself in western markets with its own production under its own trademark. In 1999, the company was estimated to have a market share of 11 per cent in the European market. In the market for deflection yokes, the market share was even larger, more than a quarter. The share of exports amounted to 64 per cent of the production in the same year. The major partners and buyers of the company's products are Samsung (Germany), Philips Components (UK), Thomson (France), König (Germany), Profilo Telra (Turkey) and LG Electronics (Korea). The most important export countries are Germany, UK, CIS and Turkey. Vilniaus Vingis received an ISO 9001 certificate in 1997. All its new products are certified by the German VDE, the British BSI and the US UL safety requirement system. It applies quality control and management systems used at RCA in the United States and Sanyo in Japan.

Ekranas belongs to the top ten of European colour picture tube manufacturers. It produces glass components as well. In 1999 about 85 per cent of its production was exported primarily to Turkey, Italy, France, UK, Poland and Germany. Ekranas collaborates with Thomson and some Japanese companies. It adopted the ISO 9001 quality control system in 1999. Its production is certified according to the Russian GOST, the British BSI and the German VDE standard.

Šiauliu Tauro Televizoriai manufacturers television sets, equipment for television studios, mobile operating units as well as testing equipment. Almost the whole production is exported - mainly to Western Europe, to some extent to Belarus and the Ukraine. Siauliu Tauro Televizoriai also deals with newly exported televisions that fit the French L-L" standard.

Lithuanian laser technology producers have established themselves in the world market as short-impulse (picoseconds) and multi-colour laser producers, which are mainly exported to Western Europe and Japan. Lithuanian companies have a strong focus on lasers for scientific laboratories but they also offer applications for industry and medicine. More than ten companies work in laser technology, employing around one hundred specialists of whom nearly a third hold a doctoral degree. In 1999, the added value per person was almost 17 times higher in Lithuania's laser technology industry than in the processing industry as a whole.

The Laser Research Centre and the Quantum Electronics Department in the University of Vilnius as well as the State Institute of Physics and the Ultrasound Research Centre in Kaunas Technical University carry out scientific research in the field of laser technology. The first mentioned Laser Research Centre has installed laser measurement and diagnostic devices at Ekranas to measure the curvature of the surface of a tube screen with an accuracy of microns. Lithuanian laser companies co-operate with foreign research institutes.

Most enterprises in Lithuanian electronics are small specialised subsuppliers that serve larger companies both in Lithuania and abroad. For instance, former specialists from research institutes have founded a great number of small companies in Kaunas. The supporting industry is broad due to the Soviet background. There are also former electronics companies that have been forced to focus elsewhere because of the lack of demand but that were willing to return to their previous competence area. Currently active companies include among others the following ones:

1. Eksma: lasers for marking and engraving
2. Ekspla: spectroscopy systems, lasers
3. Elgama: computerised measuring equipment, such as industrial electric metres
4. Elinta: process and production automation, control systems
5. Elsis: telecommunications equipment, EMS
6. Katra: measurement equipment, energy prepayment and billing systems
7. Kemek Elektronika: barcode equipment, automation components, laboratory and weighing equipment
8. Lazeriniu technologiju centras: automated lasers for metal cutting and product labelling
9. Lietkabelis: cables
10. Modematik: printed circuit boards
11. Skaiteks: monophase domestic electricity metres
12. Technogama: power electronics, embedded software
13. Telga: printed circuit boards
14. Vilniaus Sigma: digital automatic telephone exchange for telecommunication network
15. Vilniaus Venta: integrated circuits, semiconductor devices, solar cells and masks

Figure. Breakdown of Enterprise Size by Number of Employees in Lithuanian Electronics, 1999.

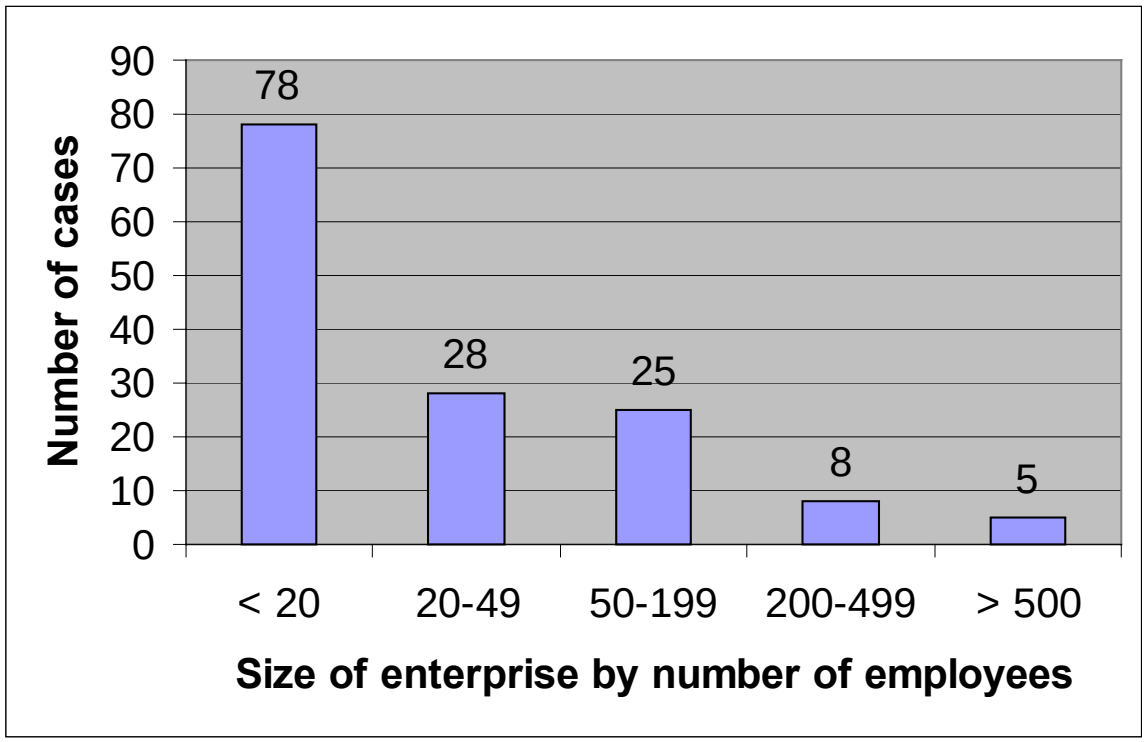
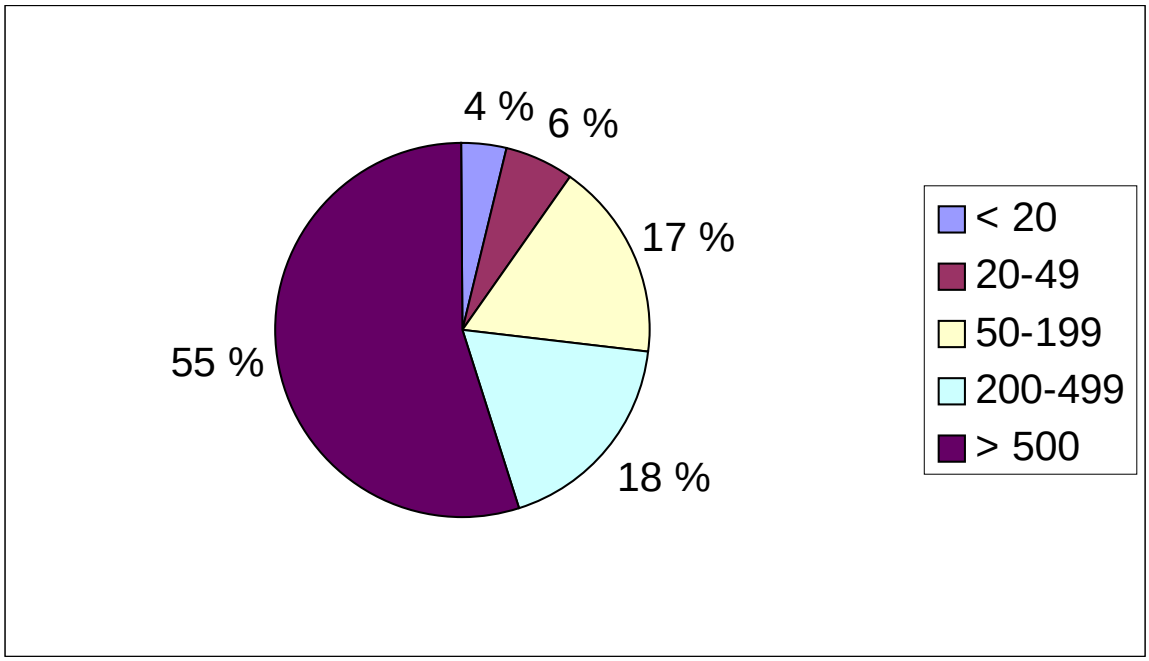
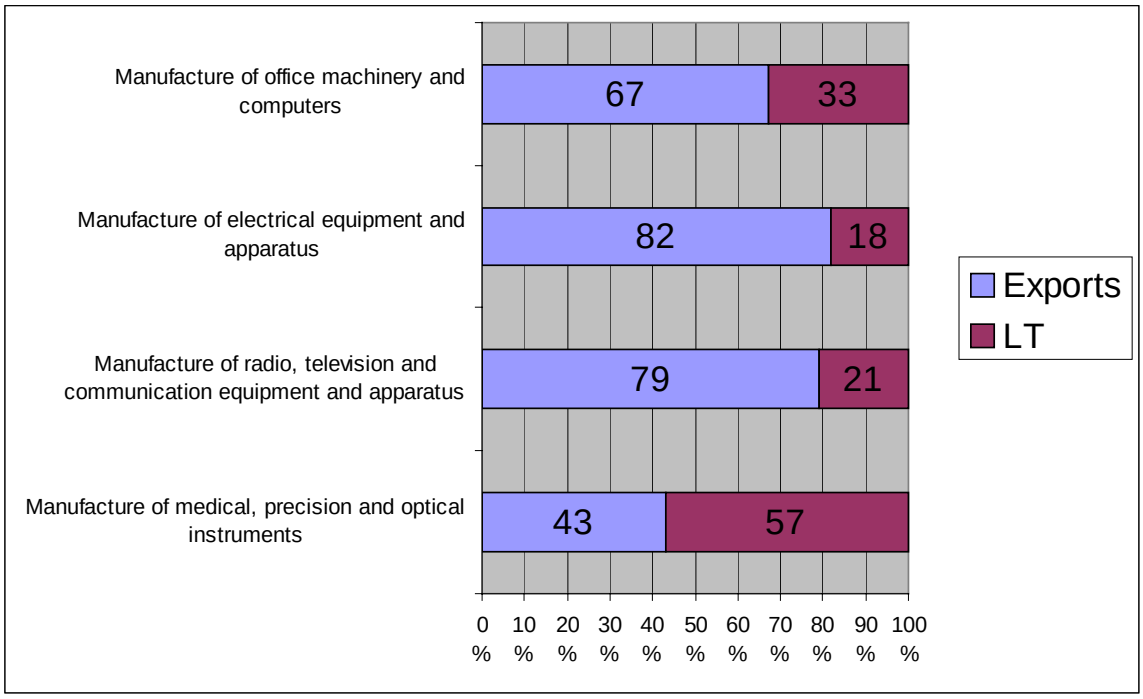


Figure. Breakdown of Workforce by Enterprise Size in Lithuanian Electronics (in per cent).



A major part of the output in the electronics industry is exported, since the home market cannot keep producers alive. As for television exports, Lithuanians compete with Korean and Chinese production.

Figure. Sales of Industrial Production by Market in the Field of Electronics, 1999 (in per cent).



2.5 Latvian Electronics[13]

During the Soviet era, Latvia's electronics industry played a central role not only in civil production but also in the Soviet military industrial complex. Five huge plants with specialised production formed the backbone of Latvia's electronics industry: VEF, Alfa, Rigas Radiotehniskais Rupnica (RRR), Komutators and Elar. The electronics sector employed about 30,000 specialists. The industry in general was supported by a system of scientific institutes, involved in 'industrial science', which employed a research staff of 10,000 people. These also included large institutes where Soviet specialists copied western technologies.

Latvia had one of the most advanced ICT sectors in the USSR, because Riga was an important hub of the Soviet telecommunications industry with its research institute

[13] Contreras & Kasemaa 2001, Högselius 2002, Roženbergs 2001, LDA 2002, Letera 2001, Lūsis et al. 2000, Nissinen 1999; www.amercican.edu/carmel, www.lda.gov.lv; Bergs 15.5.2001, Kalnins & Lūsis 16.5.2001, Rantins 9.4.2001, Smilga 11.4.2001 and 8.5.2002.

RUNIS and company VEF. VEF was responsible for the production of long-distance digital kvant exchanges, which were officially based on Soviet technology but were produced under a licence from Nokia in 1983–1991. VEF already had a long pre-war tradition as a company.

Despite its importance in Soviet times, the Latvian electronics industry could not compete with western companies when the markets were opened at the beginning of the 1990s. Low prices could not compensate for the poor quality of the products. The production of electronics companies fell more than 90 per cent between 1993 and 1997. VEF, for instance, reduced its personnel by 95 per cent from 20,000, and the company was split into small pieces. All the Soviet giants, which did not go bankrupt, went through a similar kind of drastic restructuring: the best people and the best technologies were gathered into smaller units, which sought to specialise themselves.

An imposing example of a successful survival struggle is Dambis, which nowadays concentrates on robotised test equipment for western telecommunication manufacturers. At its worst nadir, Dambis delivered metal litter bins for the City of Riga as well as other metal works, until it made a comeback to its core competence area in the late 1990s.

Even though some individual companies have been successful in finding competitive niches and the trend in the last few years appears positive, the industry remains weak. It is still in need of restructuring, strategic investment and a market. The problem of the old factories is their old-fashioned technology and outdated production facilities. The Latvian electronics industry has attracted few foreign investments, which has hindered rehabilitation. SAF Tehnika was merged with Microlink in 2000.

Today the Latvian electronics and electrical (E&E) engineering sector is made up of 50–60 companies that altogether employ 5,500–6,000 people. In 2001 the industry's output was 1.2 per cent of GDP and its turnover was 97.1 million euros. The annual growth of turnover in electronics and electrical engineering was over 15 per cent in the same year. Compared to ICT, the electronics sector was assessed to be weaker and smaller in terms of turnover. About 60 per cent of the industry's turnover was generated by small and medium-sized enterprises. Letera's membership structure by size looks as follows: 9 large companies (more than 250 employees), 12 medium sized companies (50–249 employees) and 29 small companies (fewer than 49 employees).

Table. A Sample of Electronics Companies.

Company	Turnover *in lats*, 2001	Number of Em-ployees	Area of operation	Share of exports in turnover (%)	Main export Market
Alfa	1 000 000	200	Production of microcircuits	80	Eastern market
Amerilat	1 200 000	13	Design and manufacture of medical equipment	70	Eastern market
Anda Optec	680 000	50	Optical fiber bundles and instruments for medical laser equipment	99	F, D, I, JAP, USA
Arcus Elektronika	400 000	18	Management control and security equipment, software for the energy industry	30	LT, CH
Autoelektroaparatu rupnica	3 000 000	363	Production of automobile control equipment	93	RUS
Baltic Scientific Instruments	650 000	41	Design and production of semiconductor detectors, measuring equipment for nuclear radiation, spectrometers	90	FIN, D, RUS, Singapore, Ukraine
Biosan			Bio electronics for health care		
Dambis	7 000 000	324	Telecommunication equipment, automated programmable test equipment, robotised modules for automated assembly lines	94	EE, FIN
Elkom	12 000	10	Design of telecommunication equipment	10	Eastern market
Hansa Electronics			EMS and design services: ASIC, PCB layout and micro controller code develop-ment, assembly and manufacture of PCB, test and repair of circuits		
Mikro-elektronika	800 000	29	Design of microcircuits		
Radiotehnika RRR	1 700 000	337	Manufacturing of speakers up to 60 models, production of printed circuit boards	85	EE, FIN, D, F, LT, RUS, S, UK
SAF Tehnika			Solutions for fixed wireless radio and infrared laser communications equipment		Europe, USA
Sidrabe			Evaporative coating technology		
VEF-KTR	1 400 000	120	Digital telecommunication exchanges	80	RUS

Exports made up 70 per cent of the electronics industry's output in 2001. More than half of these exports were destined for western markets. The main export countries were Sweden (19 %), Estonia (18 %), Russia (18 %), Germany (15 %), Lithuania (13 %) and

Finland (7 %). The main export goods were electronic devices (28 %), testers (19 %), radio and telephony devices (14 %), automotive components (10 %), integrated circuits (8 %) and loudspeakers (5 %). Successful E&E companies have reputable customers, such as ABB, Siemens, Nokia, AEG, ELGA, Bayer, Agfa, Bio Tek, LT Industries, Telia, Sonera, Tele Denmark and NetCom.

The industrial sub-branches represented in Latvia include electrical engineering, traditional electronics, microelectronics, telecommunications and fibre optics. Intelligent control technologies, automated testing solutions, telecommunications equipment, measurement and test equipment, optoelectronics and embedded software are advertised as strongholds of Latvian electronics. According to UNCTAD/WTO's team, Latvia has a competitive edge in the following areas: quality control systems, telemetry, sensory instruments with artificial intelligence, plastic and electromechanical components, and laboratory instruments for biomedicine. Products include, among others, the following ones:

- Electronics for control equipment and management systems, equipment for industrial automation
- Electronic semiconductor components, design and production of integrated circuits
- Telecommunications equipment
- Medical electronic equipment
- Food product quality equipment
- Electronic security equipment

Latvia offers projects in the areas listed below:

1. Subcontracting in most production technologies
2. SKD and CKD assembling
3. Upgrading of production technology of speakers
4. Upgrading of EMS technology using SMT lines
5. Development of active semiconductor devices and upgrading of their production technology
6. Software development for microcontrollers and microprocessors
7. Development of electrical engineering products, including mini electric motors
8. Intelligent sensor instruments and application technologies

The E&E industry is supported by subsupply capabilities in related production technologies, such as

- tool manufacturing,
- sheet metal processing,
- casting of ferrous and non-ferrous alloys,
- welding,
- metal machining: CNC tuning, milling, grinding,
- surface treatment: electrolytic plating, powderpainting, enamelling,
- plastic injection moulding,
- EMS.

In contrast to Estonia, large-scale assembly plants have almost disappeared in Latvia. The contact between the local electronics industry and the telecommunications service sector is also surprisingly weak when looked at against the historical background. Dambis and SAF Tehnika are among the few that have managed to get contracts from the telecommunications sector.

The Latvian industry was never involved in the modernisation of the country's telecommunications infrastructure, even though the government had intended to give indirect incentives to operators to use domestic suppliers. The operators' justification was that local quality standards were insufficient to meet the demands of new technology. The condition that Latvian companies were shunned germinated a heated political debate in the context of Lattelekom's controversial privatisation. The defenders of the local industry were outraged because VEF did not receive any orders, although it had been the largest manufacture of telephone switch boards in the Soviet Union. Another Latvian company won a US licence to produce cable slicing parts, which represent a relatively low-tech area, but Lattelekom did not use them either.

Latvia can still offer scientific backing for developing high tech products in the field of electronics. Siemens has opened two regional centres of excellence for microwave data transmission and indoor networking solutions. The EU awarded a prize to the Institute of Electronics and Computer Science for research in the field of digital signal processing in 1997. The Institute of Solid State Physics was declared a Centre of Excellence by the EU for its research in advanced materials. Latvian research has competencies in the following areas:

- Sensor technologies
- Nanosize coatings for touch screen technologies
- New composite materials for microelectronics
- New power-source technologies
- New generation for robotised testing equipment
- Advanced measurement equipment
- Medical optoelectronics solutions
- Intelligent start-stop control systems

As far as higher education is concerned, Riga Technical University collaborates with Siemens, Motorola, Microlink and Lattelekom. Riga Technical University, the Transport and Telecommunication Institute and Riga Technical College offer programmes for electronics and telecommunications engineers. Five specialised second level institutions train technicians and associate professionals.

Even though the size of the skilled workforce in electronics was tremendous at the beginning of the 1990s, the main part of this workforce was forced to look for new jobs between 1992 and 1997, when most Soviet plants were ruined. Those who created a new career in another sector may not be willing to return any more. In other professions or unemployment, skills have also gone out date, and many former specialists have grown old. In this sense, some of the human resource potential has been lost, although it is still possible to exploit the old knowledge base and find qualified people. These days, the E&E industry as well as mechanical engineering are starting to face a shortage of

young engineers, because these fields did not attract students in the 1990s. Demand is not massive but these branches have passed their lowest point, showing signs of recovery. Mr Normunds Bergs, Director of SAF Tehnika, summarised the prospects of the Latvian electronics industry in May 2001 as follows:

> "If we had had this interview, say, two years ago, I would have said that the industry will die out fast. But today the situation is changing and more and more new companies are emerging. Still, it is not yet the best time."

2.6 Estonian Electronics[14]

The roots of the Estonian electronics industry go back to the beginning of the 20th century. A telephone factory Edisson-Kopagnie was founded in Tartu in 1907. In the 1920s it started to produce radio receivers, and in the 1930s a close co-operation with Ericsson started. During the Soviet time, radioelectronics and semi-conductors belonged to the strongholds of Estonia. At the high point, the Estonian electronics sector employed 26,000 workers, which made up 13 per cent of Estonia's total industrial workforce. Still the plants were not quite as large as in Latvia and Lithuania.

The electronics industry collapsed in the early 1990s, as it did in Latvia and Lithuania, which resulted in a drop in the workforce to 3,000. In contrast to its Baltic neighbours, the turnaround came already in 1994, when the electronics industry started to grow vigorously. Its production increased nearly five-fold between 1994 and 2000, achieving a value of 2,628 million crowns (168 thousand euros) in 2000. In 2001, it accounted for 11 per cent of total industrial output. Despite the double-digit growth rates over the past years, the number of employees has changed relatively little concurrently. The Estonian electronics sector employs about 9,000 people nowadays.

The electronics industry in Estonia consists of about 300 companies. Most of them are small and medium-sized enterprises with fewer than 50 employees. SMEs account for more than half of the industry's turnover. Large enterprises with more than 300 employees make up close to one third of its turnover. The biggest company of the sector, Elcoteq, employs 2,000 people.

Abundant foreign investments have facilitated the expansion of the Estonian electronics industry, which makes a difference to Latvia and Lithuania. Greenfield investments have been typical. Companies assembling printed circuit boards have been favoured with the largest foreign investments. Foreign-owned companies are to a great extent subcontracting catering to Nordic multinationals. An overwhelming majority of subcontracting agreements within the Estonian electronics industry are signed for Finland and Sweden. The strong presence of important suppliers to Nokia and Ericsson,

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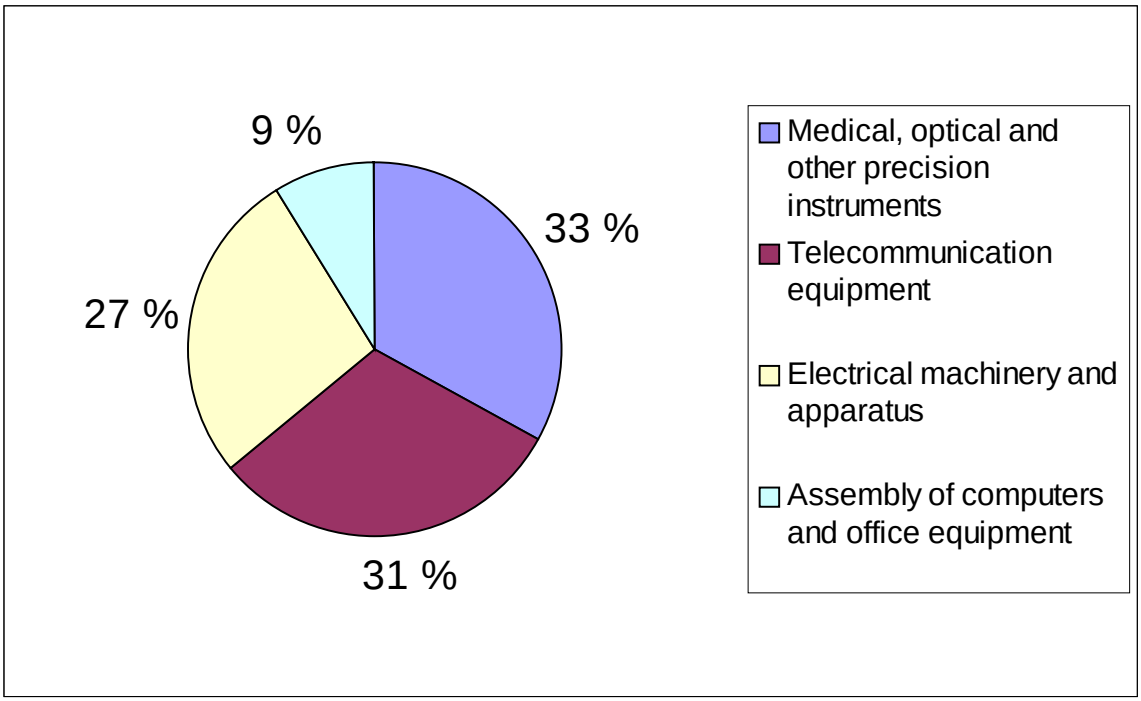
[14] Contreras & Kasemaa 2001, Estonian Investment Agency 1999, Högselius 2002, Lili 2001; www.eia.ee, www.export.ee; Märtens 17.5.2002, Penjam 27.2.2002, Rang 21.11.2001.

such as Elcoteq, has made Estonia attractive to other firms in the same supply chain. Thus an array of subcontracting firms, which all work for Nokia and/or Ericsson, have established production in Estonia: Nolato, Merab, Traction, Nefab and PMJ Automec can be cited as examples. Estonia's Top Investor Award was granted to JOT Eesti in 2000 and to Elcoteq in 1996.

Elcoteq runs an engineering centre in Tallinn but it is more the exception than the rule. A great part of the subcontracting activity consists of plain assembly. Simultaneously a number of start-up companies have emerged to focus on high tech products in laser and signalling technologies as well as in measurement equipment. Estonia advertises good business opportunities for foreign investors in the following areas:

- Assembly of PCB products and cables
- Office machinery assembly services
- Customisation of electronics equipment and value-added logistics
- R&D

Figure. The Main Subsectors of Estonian Electronics, 2000.



As compared to the situation in 1994, telecommunications equipment has grown in importance at the cost of electrical machinery and apparatus. Main products comprise printed circuit boards and their assembly, cables and cable assembly, assembled computers and power electronics devices.

The major part of the industrial output is exported. In the sub-sector of telecommunications equipment, exports exceed 90 per cent of production. While the

output of large foreign owned companies is exported worldwide, the local companies, such Estonian computer assemblers, have entered the Baltic and Scandinavian market. The single most important export countries are Finland and Sweden. Elcoteq is Estonia's largest exporter. Most imports for electronics come from Finland, Germany, Taiwan and Sweden.

Text Box. A Sample of Electronics Companies.

Company	Number of employees	Area of operation	Foreign investor's Country of origin
AMP		Components, cables and machine tools	USA
Amphenol, formerly Microlink Elektroonika		Subcontracting	USA
Clifton		Power electronics, development and production of semiconductor devices	
Elcoteq	2 000	Electronics manufacturing services in three business areas: terminal products, communications network equipment and industrial electronics	Finland
Fabec Elektroonika	65	Thermo regulators, power supply units, remote control devices, bus information panels, detectors, battery assemblies	Sweden
Harju Elekter	500	Switchboards, cable harnesses	Finland
Incap Eesti	50	Assembly of PCBs	Finland
JOT Estonia	165	Production automation equipment for telecommunications, car and electronics manufacturing subcontractor industries	Finland
RD Electronic	80	PCBs, transformers, charger devices	Norway
Regio	About 65	Geoinfo systems and databases, MPS	Finland
Scanditron		Cable assemblies, fibre optics, electronic components, communication products	S
Stoneridge Electronics	150	Electronic control units, sensors, man-machine interface products	USA
Tradex	35	Customer designed electronic products	
Tarkon	600	Assembly services, cable systems for mobile base stations	Sweden
Tondi Electronics	300	Hearing aids	?
Wecan Cables	250	Cable assembly	Finland

2.7 Latvia's Cluster Project[15]

The Latvian government has assumed a cluster approach for restructuring the Latvian economy in a way that will ensure its long-term competitiveness. Since clusters are by definition cross-sectored, they provide a mechanism by which traditional and new fields can be integrated so that their unconventional combination will give rise to new kinds of activities. Education and innovation are placed at the centre of the cluster system. Four clusters have been identified the government for promotion:

1. Information Systems and Application Services
2. Engineering
3. Composite Materials
4. Forestry

The **engineering** cluster is envisaged to evolve around optical technology, especially biomedical optics and optical recording. Its core scientific institutes are the Institute of Solid State Physics and the Institute of Atomic Physics and Spectroscopy, both in the University of Latvia. Anda Optec, a producer of fibre optics and fibre optic cables, and Amerilat, a manufacturer of software and fibre optic cables for the medical sector, are the key enterprises in the cluster.

The **information systems** (IS) cluster aims at improving the competitiveness of Latvia's IT industry and ensuring export growth on the basis of a shared vision. By 2010, Latvia's IS services exports (development and hosting) should be worth US$ 500 million and the sector should employ at least 5,000 qualified specialists. Joint sales and marketing efforts as well as sharing of knowledge and experience are expected to contribute to this goal.

The IS cluster fosters linkages between cluster participants and vertical industries to overcome the "small country" programme. Resource sharing is supposed to enable the attraction of large-scale projects. A code of ethics is adopted by the cluster participants in order to formalise the collaboration principles. The IS cluster offers the following advantages: 1) project management and quality assurance, 2) efficiency in sharing infrastructure and support services, such as communications, data centres and training, 3) independent testing services for large projects, 4) joint human capital development, 5) marketing and PR, 6) research and development, and 7) government support.

LITTA is the co-ordinator of the IS cluster, which consists of five working groups:

1. Human resources group: harmonisation of HR policies in the cluster companies and exchange of information, training
2. Education group: co-operation with universities (The cluster companies have signed an agreement with RTU and LU on reciprocal aid. For instance, universities may modify their courses if some large project requires special competence.)

[15] LDA 2002, 9–13; LITTA 2002, 8–9; Avotins 8.5.2002, Jakobsone 6.5.2002, Laucins 14.5.2001.

3. Marketing and PR group: international marketing
4. Business environment group: pointing out existing frailties to government institutions for remedy, such as immigration laws and social taxes
5. Products group: regular marketing intelligence and selection of product lines for international branding

The IS cluster involves 18 participants.

- Software developers: Data Pro, Dati, Elva, Fortech, IT Alise, Exigen, TietoEnator, Tilde
- Application hosting providers: DEAC, IBM Latvija (also software developer), Lattelekom, Telia
- Testing: RITI
- Web content and marketing companies: Bates ADM, DT Media
- Professional training centres: BDA
- Educational institutions: Riga Technical University, University of Latvia

The cluster companies possess a pool of one thousand programmes with programming language (e.g. Java, C++), project management and documentation skills. The two application service providers have 700 m^2 of data centre space in several locations with communication solutions, secure access and data security features.

3 SURVEY RESULTS

3.1 Characterisation of the Sample

The target group of the survey covers Baltic ICT and electronics[16] enterprises that are involved in production in the broad sense. Targeted enterprises are expected to develop software, provide internet or telecommunications services, assemble equipment, manufacture components, parts or end-products, or carry out corresponding activities. In other words, mere distributors, resellers, retailers, repair shops and the like are excluded from the sample. The way that the sectors are defined for the study can be seen from the text boxes below.

Text Box. ICT by Its Subsectors.

SUBSECTOR
Software
Hardware
Teleoperator
ISP (internet service provider)
ASP (application service provider)
Telecommunications equipment manufacturer
Multimedia, publishing and printing

[16] Electrical engineering is excluded from the focus.

Text Box. Electronics by Its Subsectors.

SUBSECTOR
Telecommunication equipment and apparatus
Computers and office equipment
Industrial automation and measuring instruments
Medical and precision instruments
Consumer electronics
Lighting electronics
Components of electronics
Software products and services

Local marketing research companies were used as contractors to implement the field work in the three Baltic countries, although the questionnaire and the instructions were provided by the author. The goal was to attain the widest possible coverage over the sectors by maximising the size of the sample. This objective was fulfilled quite satisfactorily as far as the sample size is concerned. Both Baltic sector experts and the marketing research companies themselves regarded the number of companies that participated in the survey as good.

The sizes of subsamples in the ICT sector are systematically larger than those in the electronics in all three countries, because the total number of companies is larger in the first mentioned sector. Taking into consideration the relative strength of the Latvian ICT industry, one might have expected a better response rate in Latvia. Partly the deficit is probably due to the failure of the Latvian marketing research company, but it is also noteworthy that Latvian ICT companies within the sample show less interest in co-operation with Finnish firms than companies on average. The Lithuanian ICT sector forms just the opposite case in both respects.

Table. Sample Size by Country and Sector (number of companies).

	ICT	Electronics	Total
Lithuania	129	42	171
Latvia	70	43	113
Estonia	90	60	150
Total	289	145	434

Because the available registers and listings of enterprises tend to be deficient, the pool of active enterprises is in a constant state of ferment to a greater extent than in western countries and it is hard to persuade enterprises to respond (partly due to cultural factors), data collection was no easy task, which was however anticipated in advance. Because the population of all enterprises in the sector could not be defined exactly for the reasons mentioned above, it was not possible to determine an accurate response rate either. The proficiency of local marketing research companies was not bad as such, but their service still left something to be desired, when compared to Finnish marketing

research companies. Under these circumstances, it was considered unrealistic to keep the requirement of a statistically representative sample. It was only ensured that the sample contains different kinds of companies in terms of size and other features.

As the representativeness of the sample is not controlled, one should not generalise the results of this survey too boldly to the whole industry. Nor should one stick at individual percentages too keenly by paying excessive attention to whether the figure is, say, 33 % or 32 % or 34 %. Unknown biases within the sample can distort observations. Therefore it is of utmost importance to scrutinise survey results critically against the information gathered from other sources. Such comparisons as well as the size and a relatively balanced composition of the sample convince one that the data is likely to reveal at least some relevant major tendencies, even though their reliability and validity is hard to verify. What is nevertheless sure is that the data outlines a profile of group of Baltic enterprises that are interested in co-operating with foreign firms. Hence, the sample has its own intrinsic value per se.

3.2 Analytical Framework

The survey **data is analysed by a uniform standard approach**. All the questions are thus examined in an identical fashion, using the frame presented below. This standardised frame consists of three parts: A) a definition of the phenomenon under consideration, B) its description, and C) notes on it. In many cases it is useful to try to highlight the connections of the phenomenon with some other phenomena or background factors. A **comparison** between the subgroups is an essential element of the analysis. The method rests exclusively on the **descriptive** statistics (i.e. frequency distributions) due to the limitations of the sample. The individual items are grouped under four broader themes of which they are indicative: 1. business profile, 2. origin and size, 3. research and development, and 4. internationalisation.

Standard Frame

A) Defining the topic to be examined

Title

The issue we want to explore; the phenomenon we try to describe

How the question was put

What was asked from the respondents? What was the original formulation of the question or the statement on the questionnaire?

Code name

The abbreviation of the original question or statement is a shortcut key, which is used in the graphs. See an example below:

Original question:	Is your company a successor of a former Soviet enterprise?
Code name:	Soviet successor

B) Describing the phenomenon

Prevalence of the phenomenon

How common is the phenomenon? How frequently does it occur? What does its distribution look like within the whole sample? A classification assessing its significance is based on the frequency of yes answers:

More than 50 per cent:	$f > 50\ \%$	≡ strong prevalence
Between 25 and 50 per cent:	$25\ \% \leq f \leq 50\ \%$	≡ fair prevalence
Less than 25 percent:	$f < 25\ \%$	≡ weak prevalence

Comparison of subgroups by country and industry

How does the distribution of the phenomenon vary from country to country and from industry to industry? Do the subgroups differ from each other? In which subgroups is the phenomenon particularly frequent, in which unusual? The leaders and the tailenders - i.e. the top two and the bottom two - are depicted by ranking the subgroups according to the frequency of the yes answer. The abbreviations used for the country-industry subgroups are listed below:

Country codes:	LT = Lithuania, LV = Latvia, EE = Estonia	
Industry codes:	ict = information and communication technologies, ele = electronics	
Combinations:	LTict = Lithuanian ICT	LTele = Lithuanian electronics
	LVict = Latvian ICT	LVele = Latvian electronics
	EEict = Estonian ICT	EEele = Estonian electronics

3.3 Business Profile

Core Business

How the question was put	How would you define your core business in terms of the alternatives given above? Please select the appropriate subsector from the list.		
Code name	Core business		
RESULTS			
The most typical subsector			
ICT	**Software**		
Electronics	**Industrial automation & measuring instruments**		
Comparison by subgroup			
ICT	**EE: Software**	**LV: Software**	**LT: Software**
Electronics	**EE: Industrial automation & measuring instruments**	**LV: Industrial automation & measuring instruments**	**LT: Industrial automation & measuring instruments**

Both the ICT and electronics industries have slightly different foci in the Lithuanian, Latvian and Estonian samples. The share of firms that define software as their core business is overwhelmingly largest in the Latvian ICT subsample. Hardware is conspicuously more weakly represented in the Estonian ICT subsample than in the two other ones, whereas in Lithuania the share of hardware is slightly above average. As for electronics, industrial automation and measuring instruments as well as components of electronics are pronounced in Lithuania, while this is true of telecommunication equipment as well as computers and office equipment in Estonia. The Latvian subsample is mixed.

3.3.1 Information and Communication Technologies

Figure. Breakdown of "Core Business" in ICT by Country-Industry Subgroup.

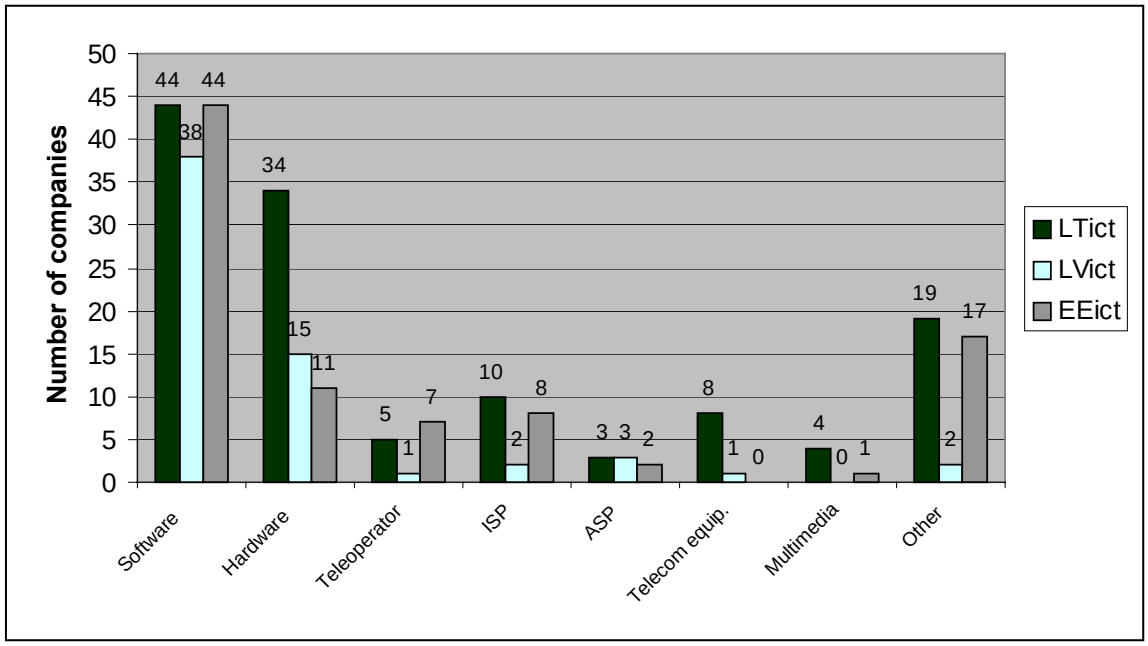
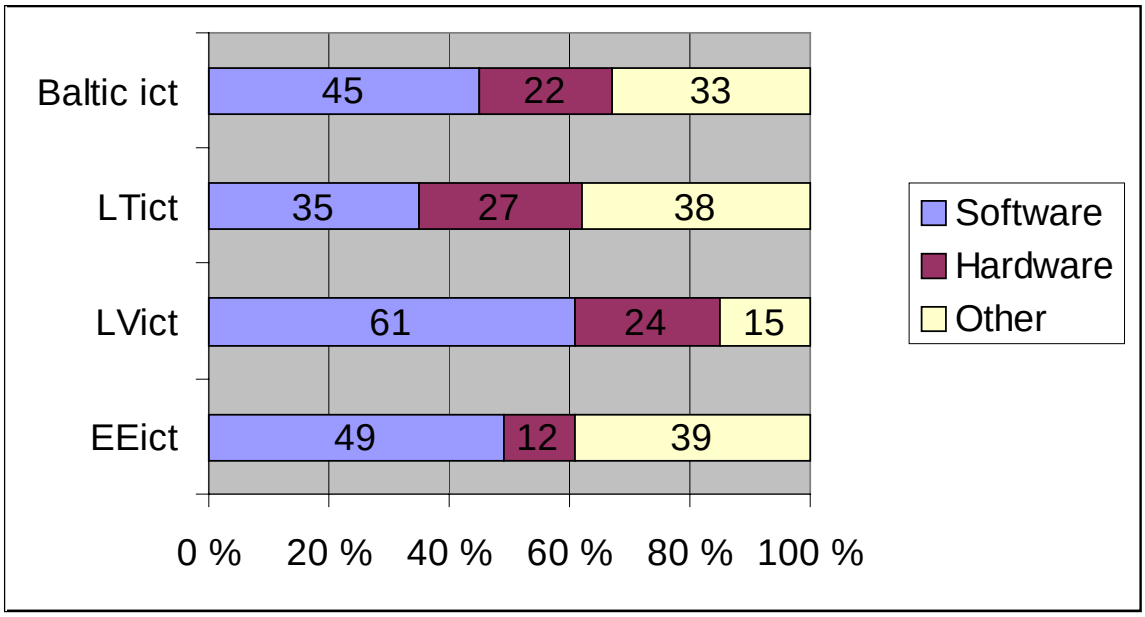


Figure. Regrouped Breakdown of "Core Business" in ICT by Country-Industry Subgroup (in per cent).



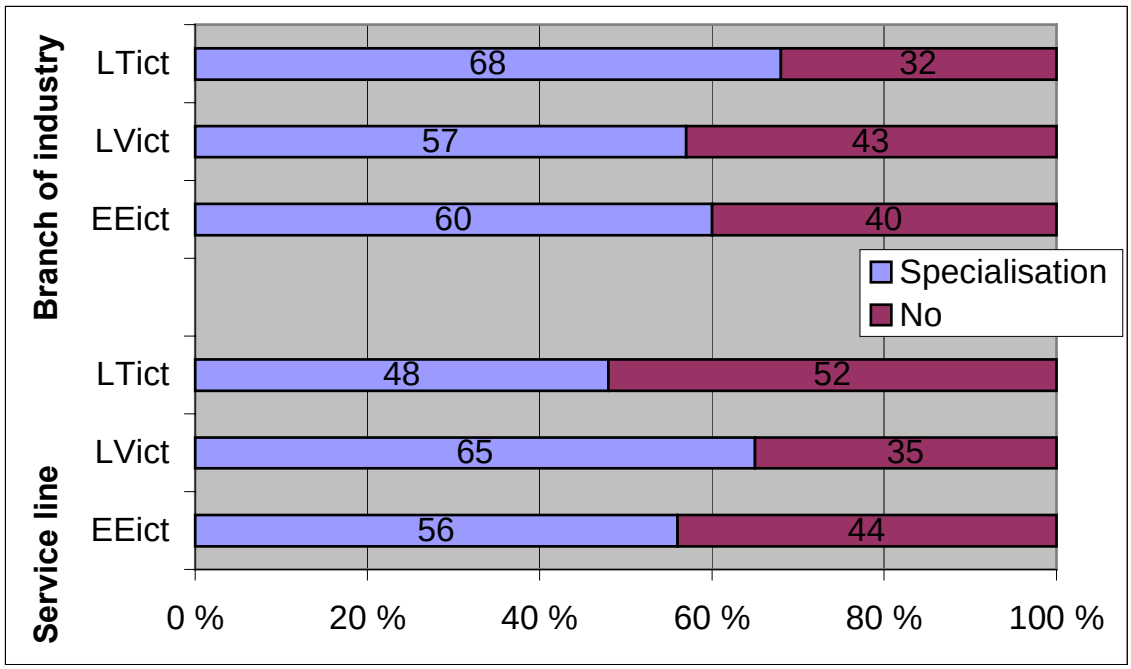
Text Box. The Most Frequently Mentioned Business Activities by Country.

LITHUANIA		LATVIA		ESTONIA	
Rank	Field of activity	Rank	Field of activity	Rank	Field of activity
1.	**Customer specific, tailor-made software**	1.	**Customer specific, tailor-made software**	1.	**Customer specific, tailor-made software**
2.	***Local area networks (LAN)***	2.	***Local area networks (LAN)***	2.	*Databases and information systems*
3.	*Databases and information systems*	3.	*Databases and information systems*	3.	***Local area networks (LAN)***
4.	Internet (networks)	4.	E-commerce	4.	Design of web pages
5.	Wireless networks	5.	Application software, tools to be copied for wide use	5.	Application software, tools to be copied for wide use

Text Box. The Most Frequently Mentioned Service Lines Defined as Special Focus by Country.

LITNUANIA		LATVIA		ESTONIA	
Rank	Service line	Rank	Service line	Rank	Service line
1.	*Data warehousing*	1.	**Accounting and financial management**	1.	Business process management
2.	**Accounting and financial management**	2.	*Data warehousing*	2.	**Accounting and financial management**
3.	Content management	3.	Business process management	3.–4.	*Data warehousing*
4.	Business process management	4.	Enterprise resource planning	3.–4.	Customer relations management
5.	Supply chain: procurement and logistics	5.	Customer relations management	5.	Enterprise resource planning

Figure. Specialisation in Solutions for Some Particular Branch of Industry and/or Service Line by Country (in per cent).



Text Box. The Most Frequently Mentioned Industries Defined as Special Focus by Country.

LITHUANIA		LATVIA		ESTONIA	
Rank	Industry	Rank	Industry	Rank	Industry
1.	**Software**	1.	**Software**	1.–2.	**Software**
2.	*Telecom-munications*	2.	Financing and insurance	1.–2.	*Telecom-munications*
3.	Trade and distribution	3.–4.	*Telecom-munications*	3.–4.	Public administration
4.	Electronics and electrical industry	3.–4.	Public administration	3.–4.	Trade and distribution
5.	Financing and insurance	5.	Electronics and electrical industry	5.	Financing and insurance

Text Box. The Most Frequently Mentioned Technologies and Tools in Lithuania.

Operating systems and platforms	Windows 98
Programming support environments	Visual C
Distributed software technologies	CORBA (infrequent)
Databases	MS SQL Server
Other products	AutoCAD (fairly infrequent)
Programming languages	1. SQL, 2. Visual Basic, 3. C++, 4. Java, 5. Perl
Communications	GSM
Data transmission	TCP/IP
WWW-protocols and languages	HTML

Text Box. The Most Frequently Mentioned Technologies and Tools in Latvia.

Operating systems and platforms	Windows NT and 2000
Programming support environments	Delphi
Distributed software technologies	DCOM (infrequent)
Databases	MS SQL Server
Other products	JSP, CASE tools (infrequent)
Programming languages	1. C++, 2. SQL, 3. Visual Basic, 4. C, 5. Java
Communications	GSM (infrequent)
Data transmission	TCP/IP
WWW-protocols and languages	HTML

Text Box. The Most Frequently Mentioned Technologies and Tools in Estonia.

Operating systems and platforms	Windows 2000
Programming support environments	Visual C
Distributed software technologies	CORBA (infrequent)
Databases	MS SQL Server
Other products	UML (infrequent)
Programming languages	1. SQL, 2. PHP, 3. Java, 4. C++, 5. Visual Basic
Communications	GSM (fairly infrequent)
Data transmission	TCP/IP
WWW-protocols and languages	HTML

3.3.2 Electronics

Figure. Breakdown of "Core Business" in Electronics by Country-Industry Subgroup (in per cent).

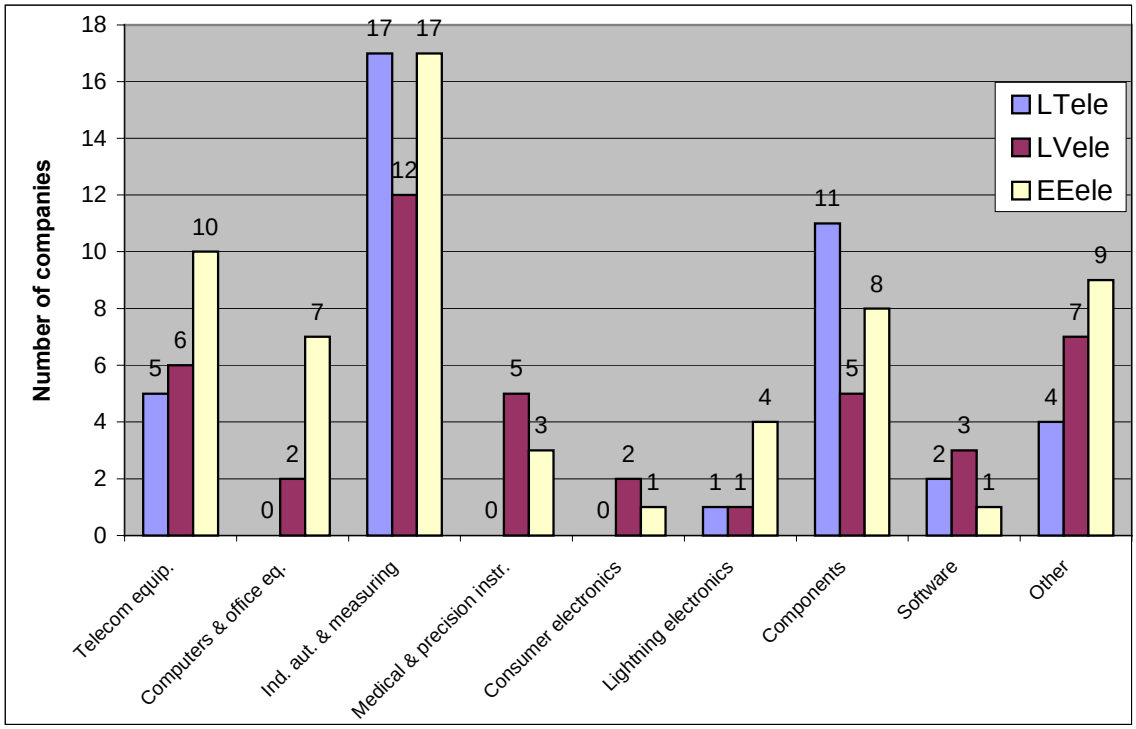
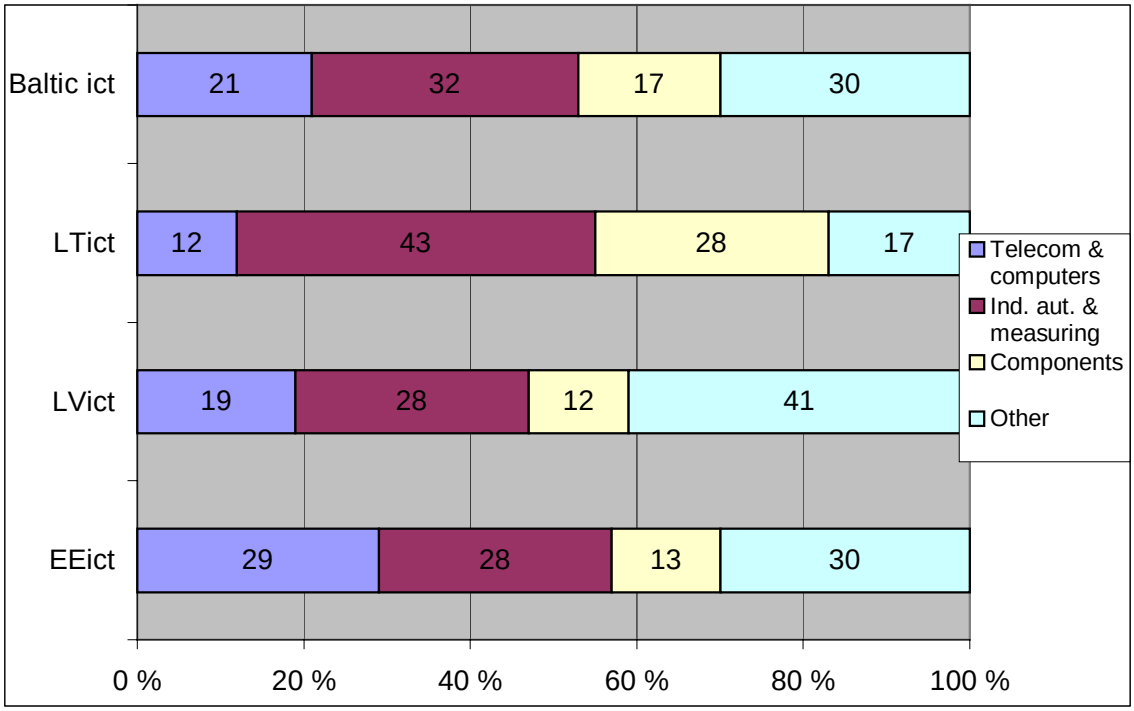


Figure. Regrouped Breakdown of "Core Business" in Electronics by Country-Industry Subgroup (in per cent).



Text Box. The Most Frequently Mentioned Manufacturing Services Defined as Core Business by Country (in per cent of total).

LITHUANIA		LATVIA		ESTONIA	
Manufacturing service	%	Manufacturing service	%	Manufacturing service	%
Manufacture of final devices	40	**Manufacture of final devices**	22	**Manufacture of final devices**	43
Manufacture of electrical components or PCB	23	***Manufacture of units or parts***	17	***Manufacture of units or parts***	13
Manufacture of units or parts	10	Software products and services	12	Assembly	13
Tools and industrial automation	10	Manufacture of electrical components or PCB	10	Tools and industrial automation	13
Manufacture of mechanics	8	Design services for electronics industry	10	Design services for electronics industry	12

Text Box. The Most Frequently Mentioned Technologies Defined as Core Competence by Country.

LITHUANIA		LATVIA		ESTONIA	
Rank	Technologies	Rank	Technologies	Rank	Technologies
1.	**Electronics design and manufacturing**	1.	**Electronics design and manufacturing**	1.	**Electronics design and manufacturing**
2.	***Measurement***	2.	***Measurement***	2.–3.	Power electronics
3.	Power electronics	3.	Digital signal processing	2.–3.	***Measurement***
4.	Optics and optoelectronics	4.	Integration of information systems and communications	4.–5.	Digital signal processing
5.	Precision mechanics	5.	Optics and optoelectronics	4.–5.	Communication protocols
6.	Integration of information systems and communications	6.	Embedded software	6.	Real-time programming

Table. Availability and Capacity of Automated Assembly Lines by Country (number of mentions).

		Lithuania	Latvia	Estonia
Surface mounting assembly lines		3	4	5
Assembly on multiplayer PC's		0	0	3
Electrical testing capacity*		8	16	15
	Manual	7	10	13
	Automated	1	2	5

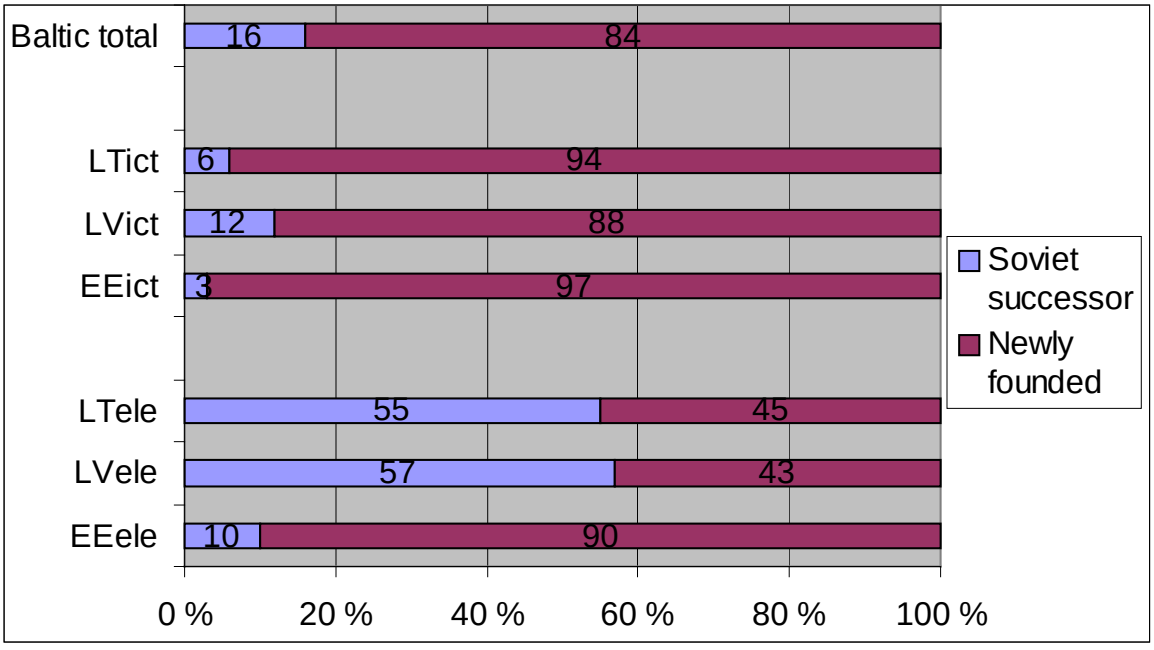
*All respondents did not specify whether their testing is manual or automated.

3.4 Origin

Successor of a former Soviet enterprise

How the question was put	Is your company a successor of a former Soviet enterprise?	
Code name	Soviet successor	
RESULTS		
Prevalence	**Weak**	
Comparison by subgroup		
Leaders (top two)	1. **LVele**	2. **LTele**
Tailenders (bottom two)	6. **EEict**	5. **LTict**

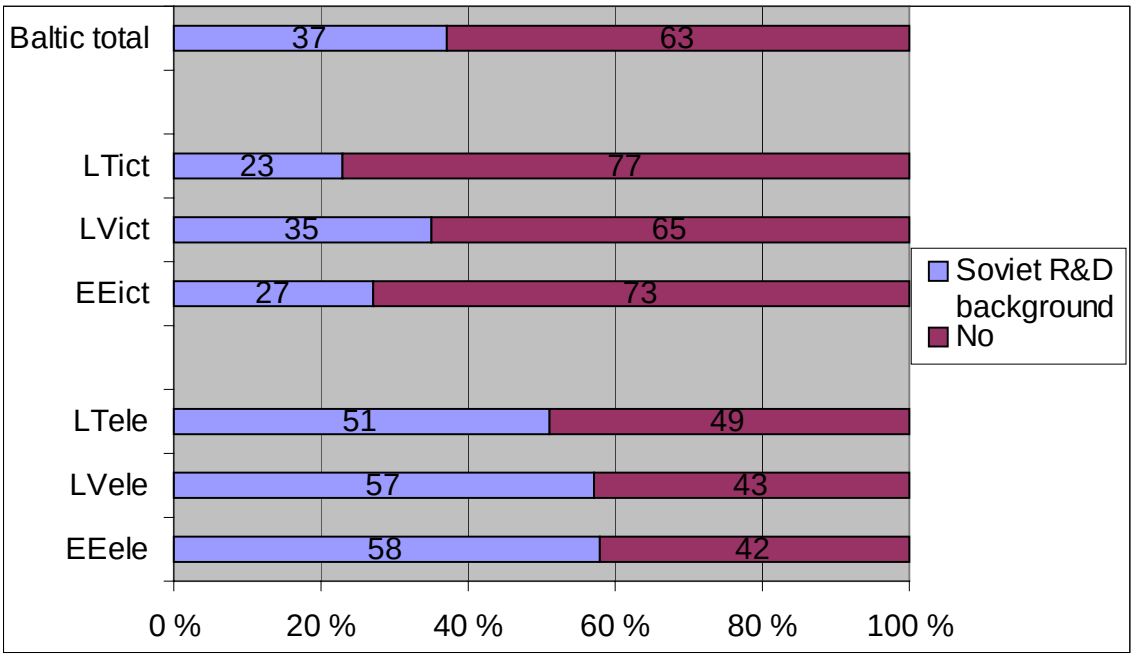
Figure. Breakdown of "Soviet successor" by Country-Industry Subgroup (in per cent).



Roots in Soviet R&D

How the question was put	Did the founder of the company or its other key persons belong to a former Soviet firm or research institute's R&D staff?	
Code name	Soviet R&D staff	
RESULTS		
Prevalence	**Fair**	
Comparison by subgroup		
Leaders (top two)	1. **EEele**	2. **LVele**
Tailenders (bottom two)	6. **LTict**	5. **EEict**

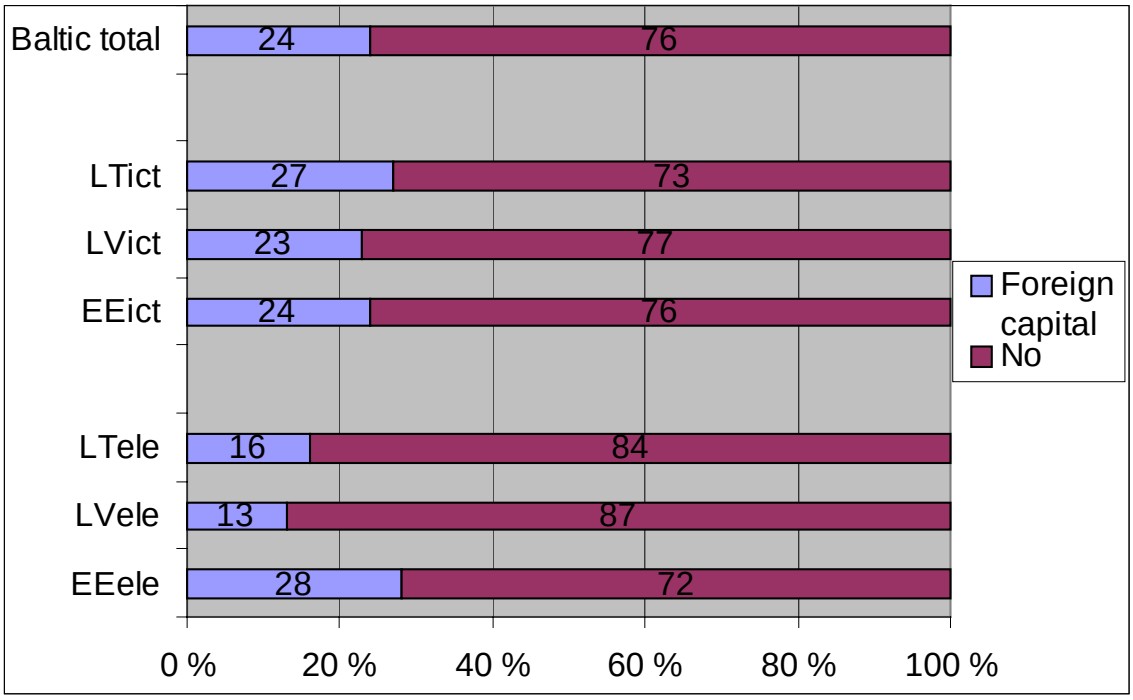
Figure. Breakdown of "Soviet R&D staff" by Country-Industry Subgroup (in per cent).



Foreign capital

How the question was put	Does the capital stock of your company contain foreign capital?	
Code name	Foreign capital	
RESULTS		
Prevalence	**Weak**	
Comparison by subgroup		
Leaders (top two)	1. **EEele**	2. **LTict**
Tailenders (bottom two)	6. **LVele**	5. **LTele**

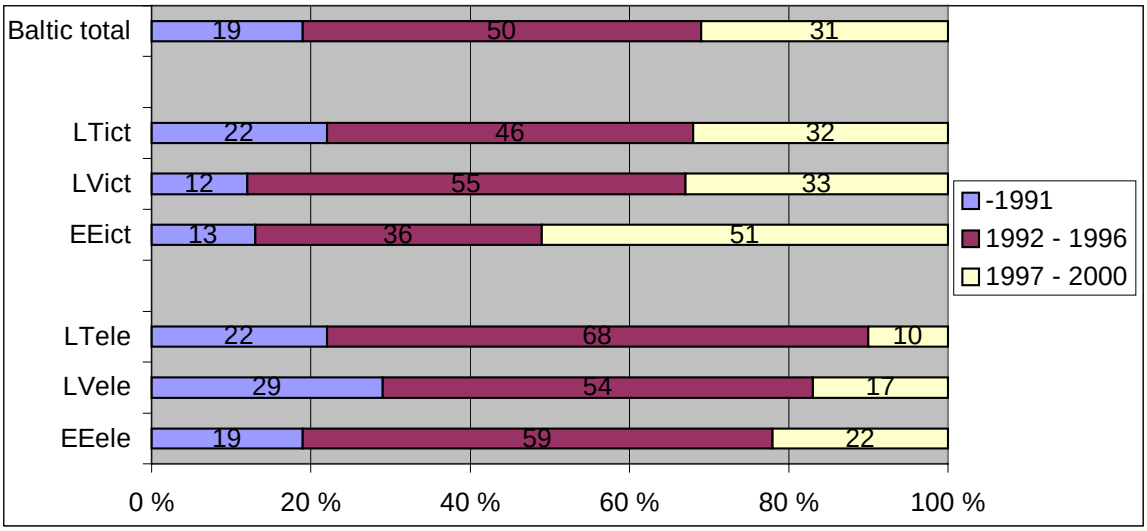
Figure. Breakdown of "Foreign Capital" by Country-Industry Subgroup (in per cent).



Year of foundation

How the question was put	Year of foundation			
Code name	Year of foundation			
RESULTS				
Mean				**1993**
Median				**1994**
Comparison by subgroup: means in an ascending order	1.**LVele**	**1989**	4.**LTict**	**1994**
	2.**LTele**	**1990**	5.**LVict**	**1994**
	3.**EEele**	**1992**	6.**EEict**	**1995**

Figure. Breakdown of "Year of Foundation" by Country-Industry Subgroup (in per cent).



Companies in the electronics industry more often have a link to the Soviet era than ICT firms, whereas ICT firms more often have foreign owners. The inherent nature of these industries makes this result self-evident: the Baltic republics were centres of Soviet electronics production, while the emergence of the modern ICT industry dates back to more recent days. However, the Estonian electronics sectors is an exception, as its share of Soviet successors is considerably lower and its proportion of foreign owned companies is higher. Thus the path of industrial development in Estonia differs from that in Latvia and Lithuania, where it is characterised by greater continuity, although the Soviet R&D background plays a crucial role in Estonia too. Latvian ICT firms seem to have Soviet roots slightly more often than Estonian and Lithuanian ones. This observation may of course be a random outcome that arises from a bias in the sample, but in principle it is logically consistent with Latvia's industrial-scientific heritage.

The year of foundation does not only create a picture of the age structure of companies but it also illuminates industrial dynamics. Yet these results should be compared with the growth rates of given industries to conclude reliably how accurately the formation of

new firms in the past years reflects a sector's development. The information from the earlier years is more difficult to interpret in this respect, because privatised and restructured Soviet successors are sometimes recorded as having been founded when they changed their company form. The formation of new companies after the restructuring period has been brisker in the ICT sector than in electronics. Estonia has overtaken its Baltic neighbours both in ICT and electronics since 1997.

Small, even micro-sized, enterprises dominate the Baltic industries. The average company size is small compared to the Finnish one, not to talk about the international. Especially the turnover per employee is often so low that in Finland it would be impossible to survive with it, but of course one has to take local conditions into consideration. Nevertheless, the following illustration is revealing: a Latvian high tech company with a staff of over forty employees, including Ph.D. degree holders, has approximately the same turnover as a Latvian subsidiary of a small Finnish construction company, which employs two persons in Latvia, located in a single-room bureau.

*Figure. Breakdown of Turnover in Euros, 2000 (*percentages*).*

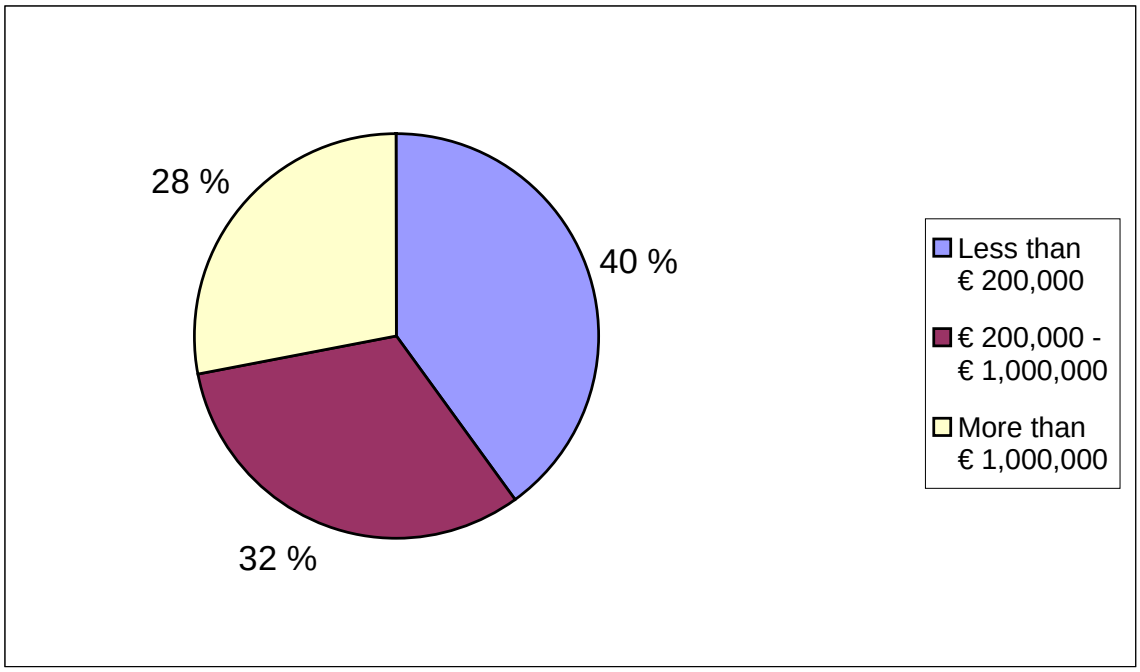
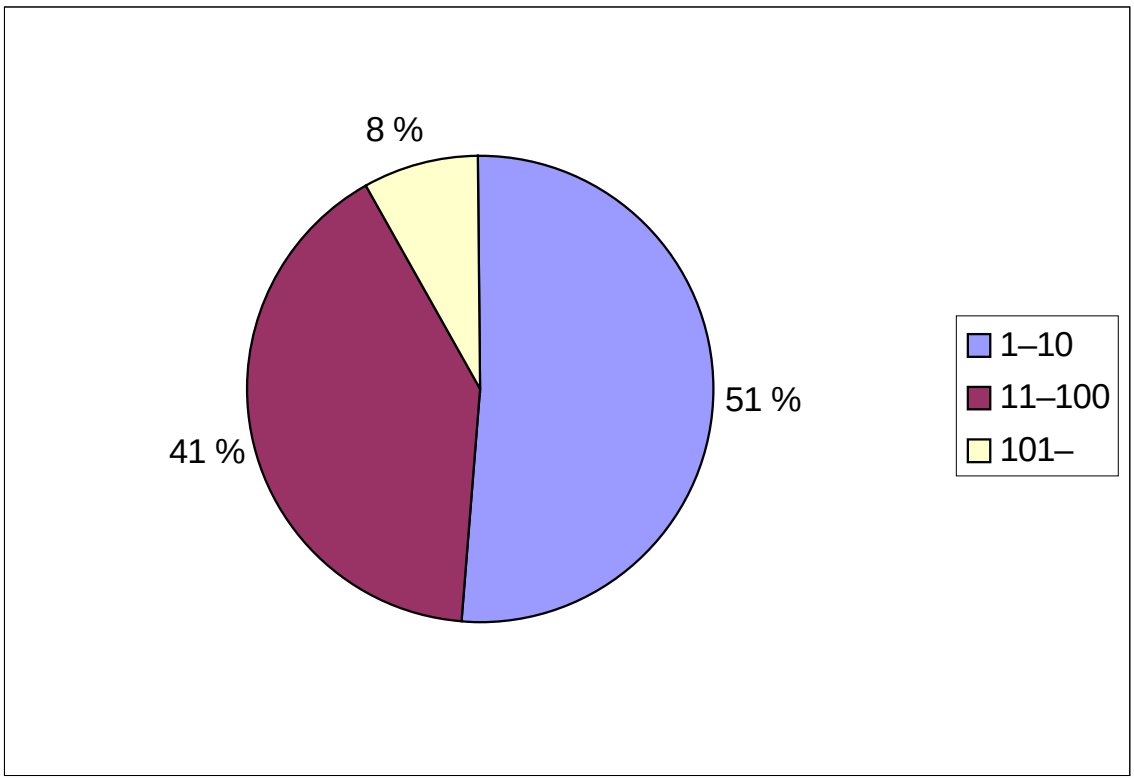


*Figure. Breakdown of Number of Employees, 2000 (*percentages*).*



3.5 Research and Development

The level of R&D intensity within the sample appears implausibly high in the light of the other information collected from these countries. Forty-three per cent of all respondents assert that their company carries out R&D, and nearly a quarter of them say that they buy external R&D services. Almost half of the companies are thus involved in R&D either in both above mentioned ways or in one of them. But only one tenth of the companies possess patents. The last mentioned figure corresponds to experts' assessments of the proportion of innovative companies in the Baltics.

Another striking feature in the data is that companies more often have R&D activities of their own rather than making use of external R&D services by collaborating with universities, research institutes or development companies. This observation contradicts the well-known fact that most Baltic enterprises possess scarce financial means and cannot often afford strategic long-term investments, not to mention product development. (Also these data show low turnover.)

When the companies were further asked how large is their R&D expenditure as a share of their turnover and how many of their employees are engaged in R&D, answers were unconvincing in some cases. To pick up an extreme example, it does not sound realistic if a company claims to use forty or sixty per cent of its turnover on R&D.

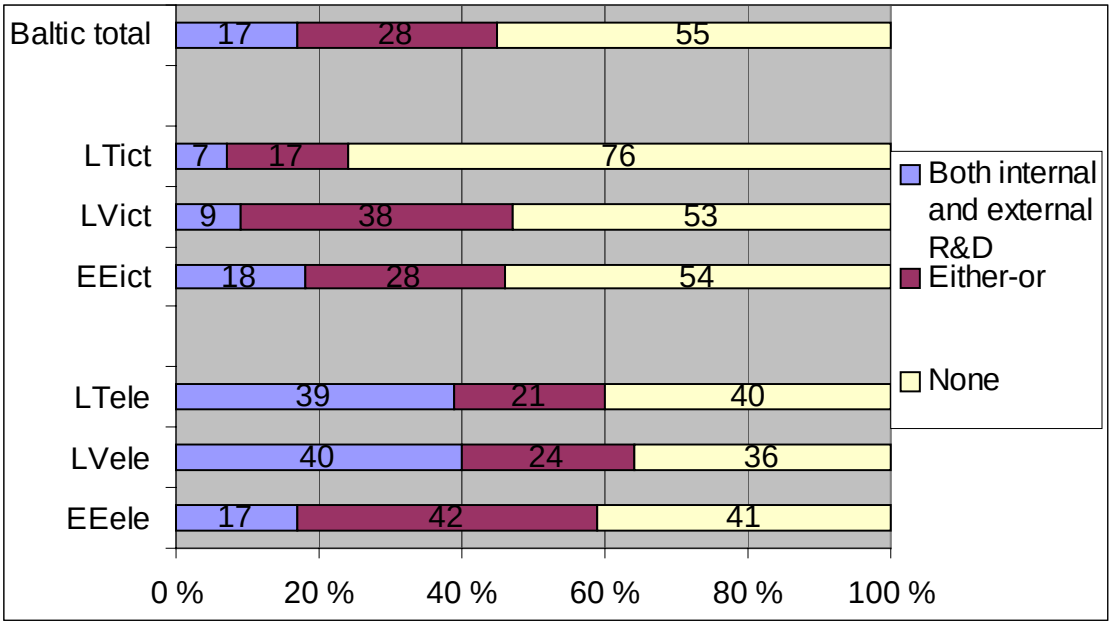
Hence it seems likely that part of the respondents either misunderstood the meaning of R&D, although the concept was defined in the questionnaire, or they deliberately exaggerated their R&D activities in order to lift the status of their enterprise. Many regard it as a prestige to have a high tech company with its own product development. It is possible, for instance, that some IT firms have treated software development erroneously as R&D.

Although the spread of R&D activities appears too broad within the sample, the sector differences appear more tenable. The various indicators behave consistently, rendering congruent results. One can also trace plausible explanations for the observed patterns from the background information from other sources. Therefore the data is considered to be reliable enough to enable sector comparisons.

R&D activities

How the question was put	Composite variable based on the following two questions: Does your company currently have R&D activities? Does your company collaborate with R&D institutes or buy external R&D services?	
Code name	R&D	
RESULTS		
Prevalence of cases in which both conditions are fulfilled	**Weak**	
Comparison by subgroup		
Leaders (top two)	1. **LVele**	2. **LTele**
Tailenders (bottom two)	6. **LTict**	5. **LVict**

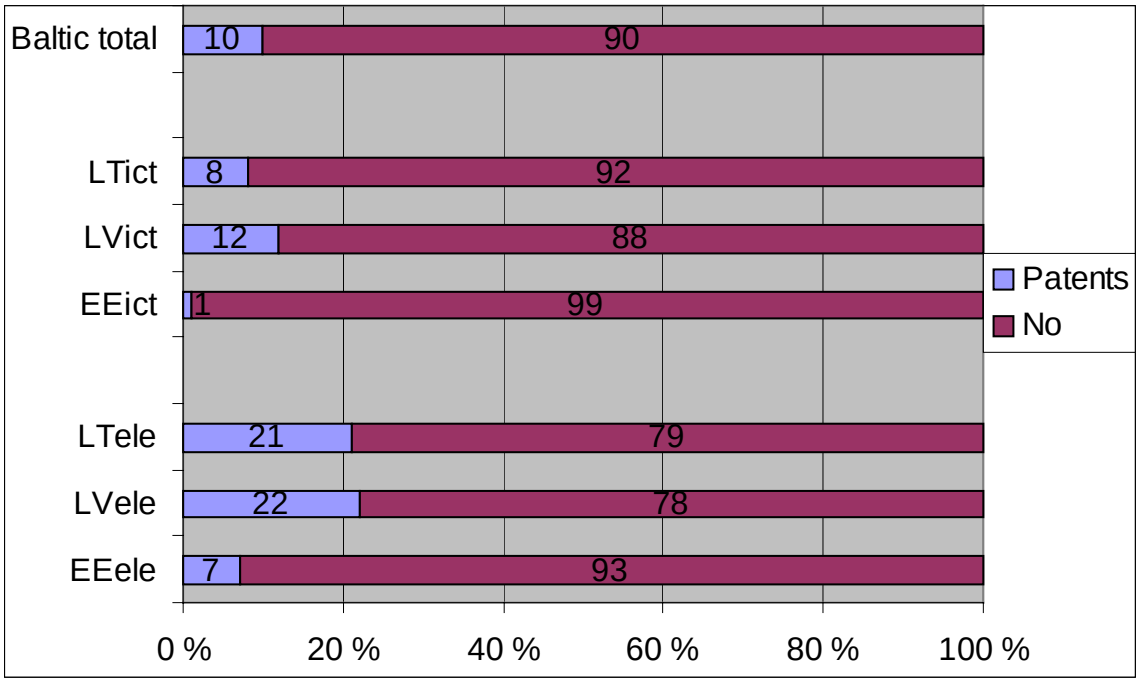
Figure. Breakdown of "R&D" by Country-Industry Subgroup (in per cent).



Patents

How the question was put	Does your company possess patents?	
Code name	Patents	
RESULTS		
Prevalence	**Weak**	
Comparison by subgroup		
Leaders (top two)	1.–2. **LVele**	1.–2. **LTele**
Tailenders (bottom two)	6. **EEict**	5. **EEele**

Figure. Breakdown of "Patents" by Country-Industry Subgroup (in per cent).



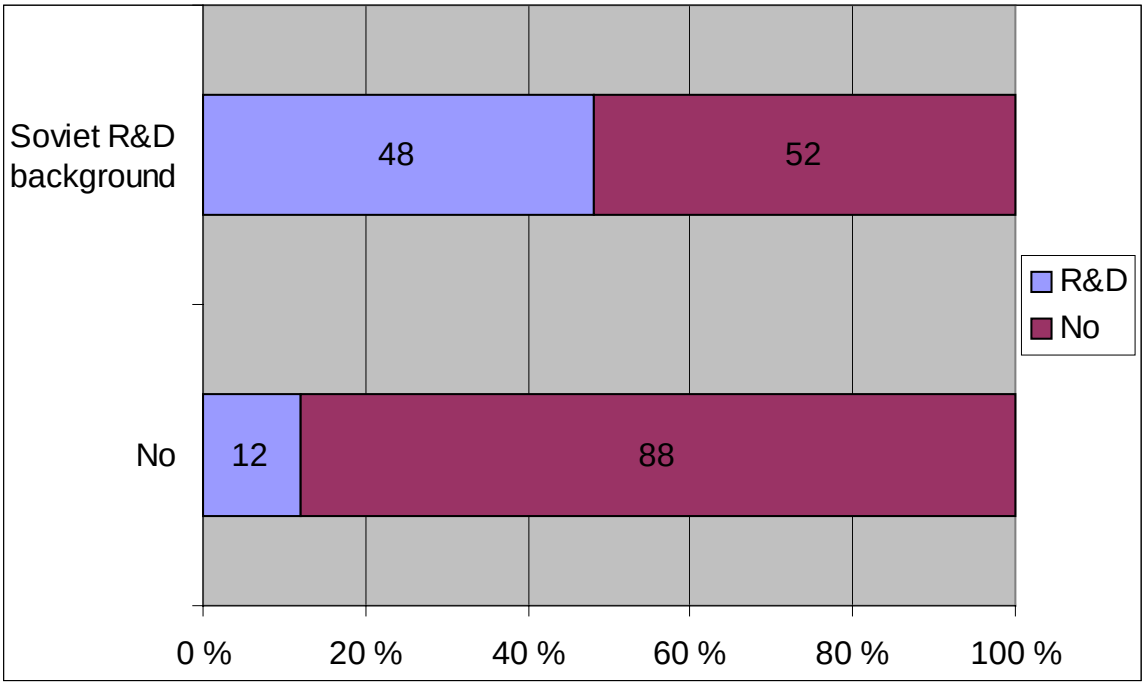
R&D intensity, as measured by a company's own R&D activities, its collaboration with R&D institutions and possession of patents, distinguishes the Latvian and Lithuanian electronics industries from the rest of the sample. Their R&D intensity is considerably higher. From this arises a subsequent question of what makes the difference. Do the Latvian and Lithuanian electronics sectors differ from the Estonian electronics sector as well as the ICT branch in additional respects, too?

ICT vs. ELE

The proportion of companies with Soviet roots is understandably higher in the electronics industry than in ICT. This background factor seems to contribute to the likelihood of R&D in a company. Especially in firms where the founder of a company

or its other key persons belonged to a former Soviet firm or research institute's R&D staff, R&D activities are much more common than in other firms.

Figure. R&D Activities within Companies with a Soviet R&D Background in Comparison with Other Companies (in per cent).



EE vs. LV + LT

The number of foreign companies in the Estonian electronics sector is bigger than those in Latvia and Lithuania. Foreign owned companies in Estonia typically offer assembly and other subcontracting services to Nordic principals. Thus, foreign capital does not necessarily facilitate a country's own product development, if the strategies of mother companies rest on the exploitation of cheap labour. Foreign investments only help modernise production technology and generate – in many cases low value added - exports. Expert opinions quoted in previous chapters (cf. Kalvet et al. 2002a and Piela 2002, p. 39) concluded similarly that serving a subcontracting industry does not foster innovation.

Conclusion

To sum up, a long standing scientific tradition seems to be a more important prerequisite for R&D activities than technology transfer from abroad, although this is not meant to deny the transition economies' dependence on the infusion of western technologies. Ericsson's research centre in Estonia is a positive example of beneficial spill-over effects that boosted activities of the local industry. As for the future of high tech production in the Baltics, the dilemma is that most foreign companies are not

interested in introducing extensive R&D activities there, while at the same time the countries' own research system suffers from a severe lack of resources. The existing knowledge base alone will not carry them forever.

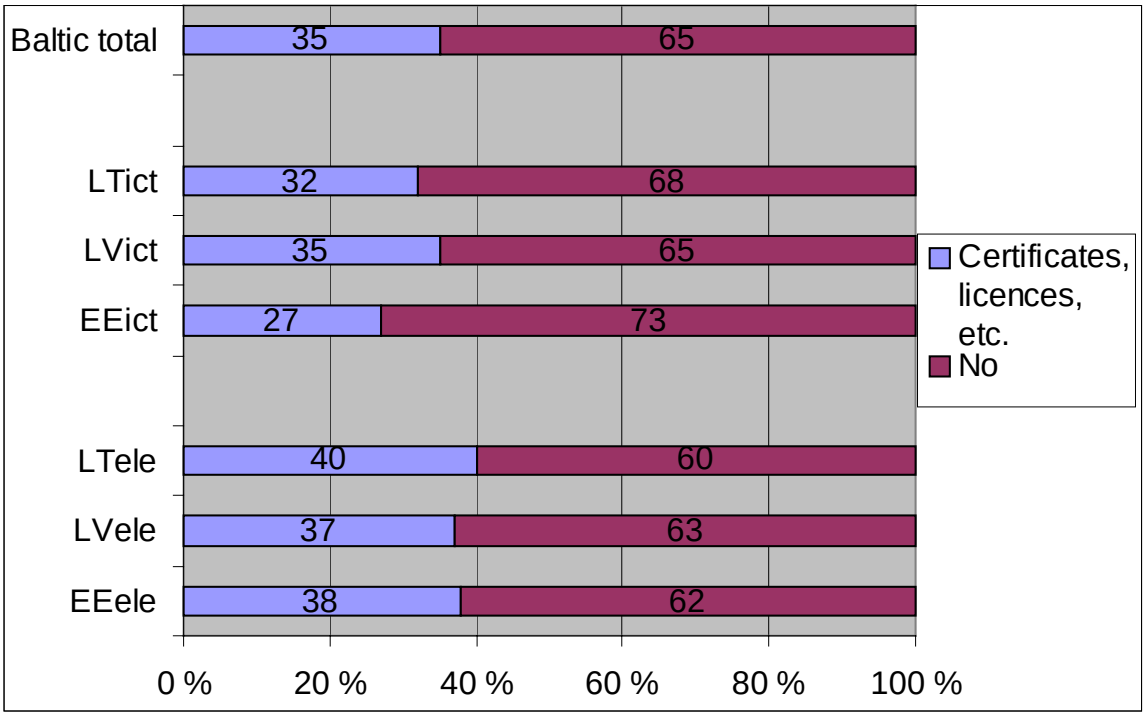
* * *

As mentioned before, less than one fourth of Baltic companies within the sample collaborates with R&D institutes or buys external R&D services - Lithuanian and Latvian electronics companies more and Latvian ICT firms less than the others. The most common R&D collaborator is a domestic university or research institute. Collaboration with foreign universities or research institutes is infrequent.

Certificates, licenses or authorisations

How the question was put	Has your company been granted any certificates, licenses or authorisations, such as ISO quality certificates?	
Code name	Certificates , licences, etc.	
RESULTS		
Prevalence	**Fair**	
Comparison by subgroup		
Leaders (top two)	1. **LTele**	2. **EEele**
Tailenders (bottom two)	6. **EEict**	5. **LTict**

Figure. Breakdown of "Certificates, Licenses, etc." by Country-Industry Subgroup (in per cent).



The category of certificates, licenses or authorisations has a miscellaneous content, which may be one of the reasons why it does not seem to bear a direct relation to R&D activities.

The majority of Baltic companies provides professional training to their employees. As compared by sector, ICT firms train their employees more often than those in electronics; as compared by country, Estonian firms are the most active ones in training, whereas Lithuanian firms invest in it slightly less than the others. The Latvian ICT sector can be singled out as a active provider of training, whereas the Latvian electronics sector, along with the Lithuanian electronics, offers employee training relatively little. The provision of professional training seems to be in a reverse relation to the R&D intensity.

The most commonly offered training forms are ranked in a descending order in the table below. Irrespective of the country and the sector, almost all companies emphasise training in the latest technologies or production methods. The Lithuanian electronics makes the only exception in that it pays less attention to it than the others. Quality control is more important to the electronics industry than to the ICT, while the ICT industry stresses project management, marketing and sales as well as foreign languages more than the electronics industry. Training in interpersonal skills does not significantly differentiate between the industries.

Text Box. Training Provided by Companies to Their Employees.

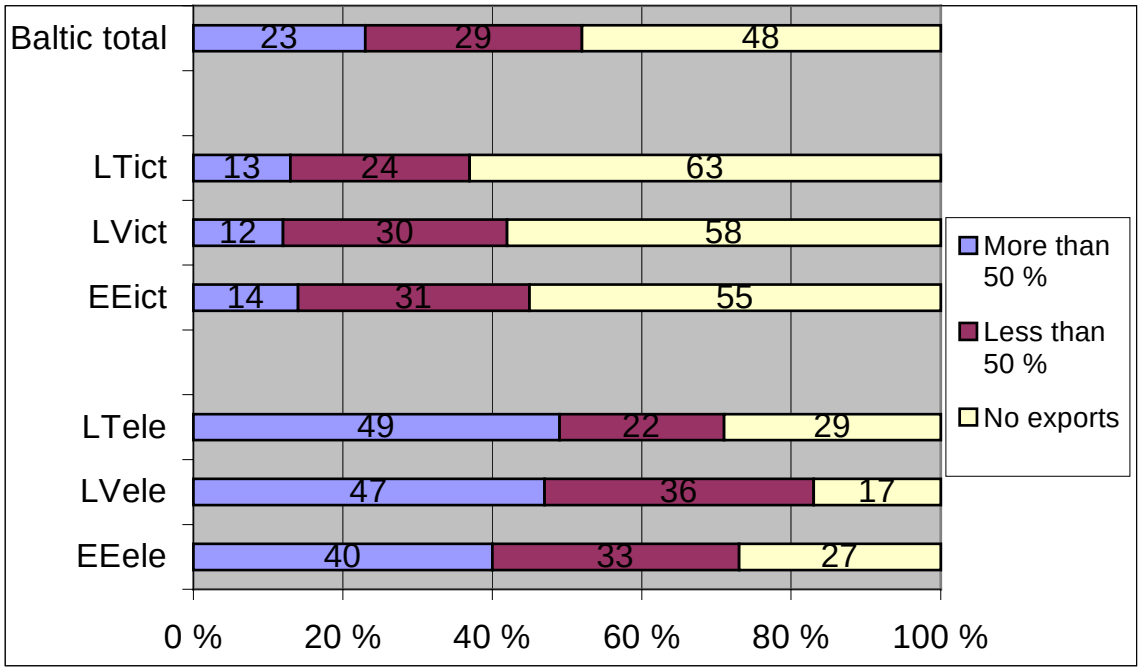
Rank	Type of training	Prevalance	Leaders (top two)	Tailenders (bottom two)
1.	Latest technologies or production methods	Strong	1. LVict 2. EEele	6. LTele 5. LTict
2.	Quality control	Fair	1. EEele 2. LTele	6. EEict 5. LTict
3.	Project management	Fair	1. LVict 2. EEict	6. LVele 5. LTele
4.	Marketing and sales	Fair	1. LVict 2. EEict	6. LTele 5. LVele
5.	Foreign languages	Weak	1. LVict 2. LTict	6. LVele 5. LTele
6.	Interpersonal communication skills	Weak	1. EEict 2. LVict	6. EEele 5. LTele
7.	Other	Weak	1. LVict 2. EEict	6. LVele 5. LTict
No training at all		Weak	1. LTele 2. LVele	6. EEele 5. EEict

3.6 Internationalisation

Share of exports

How the question was put	What is the share of exports of your net sales (in per cent)?			
Code name	Export share %			
RESULTS				
Mean				**23**
Comparison by subgroup: means in an descending order (%)	1. **LVele**	**47**	4.**EEict**	**15**
	2. **LTele**	**42**	5.**LVict**	**14**
	3. **EEele**	**40**	6.**LTict**	**13**

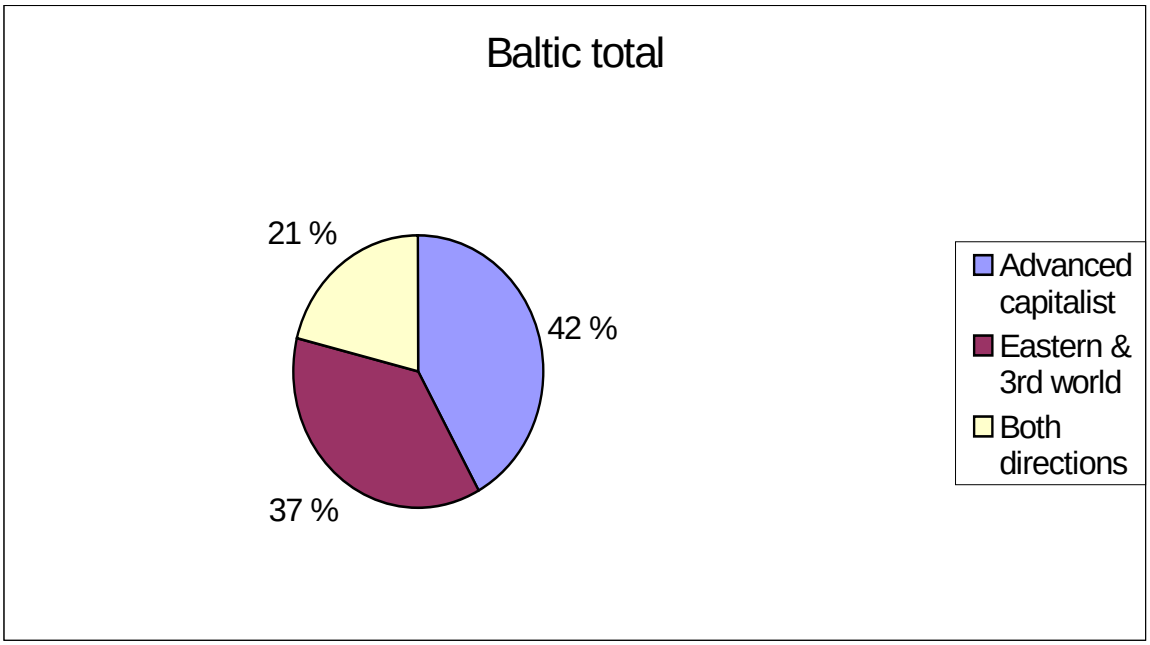
Figure. Breakdown of "Export Share %" by Country-Industry Subgroup (in per cent).



Main export market: advanced capitalist or Eastern and third world countries.

How the question was put	Composite variable based on the question: If you are exporting, to which countries?
Code name	Export market
RESULTS	
Prevalence of advanced capitalist countries	**From fair to strong,** depending on the classification criterium of the composite variable
Comparison by subgroup	
Leader	1. **LVict**
Tailender	6. **EEict**

Figure. Breakdown of "Export Market" (in per cent).



The Baltic electronics industry is much more export oriented than the ICT branch, within which well over half of the companies work for the domestic market solely. A strong exporter is typically a large foreign owned company with subcontracting experience. Less than a half – around 45 per cent – of Baltic companies has experience in performing as a subcontractor, for instance, in software outsourcing or contract manufacturing. Well more than a half of them purchase components, raw materials and the like from sub-suppliers. In the electronics industry the use of such subsuppliers is almost the rule.

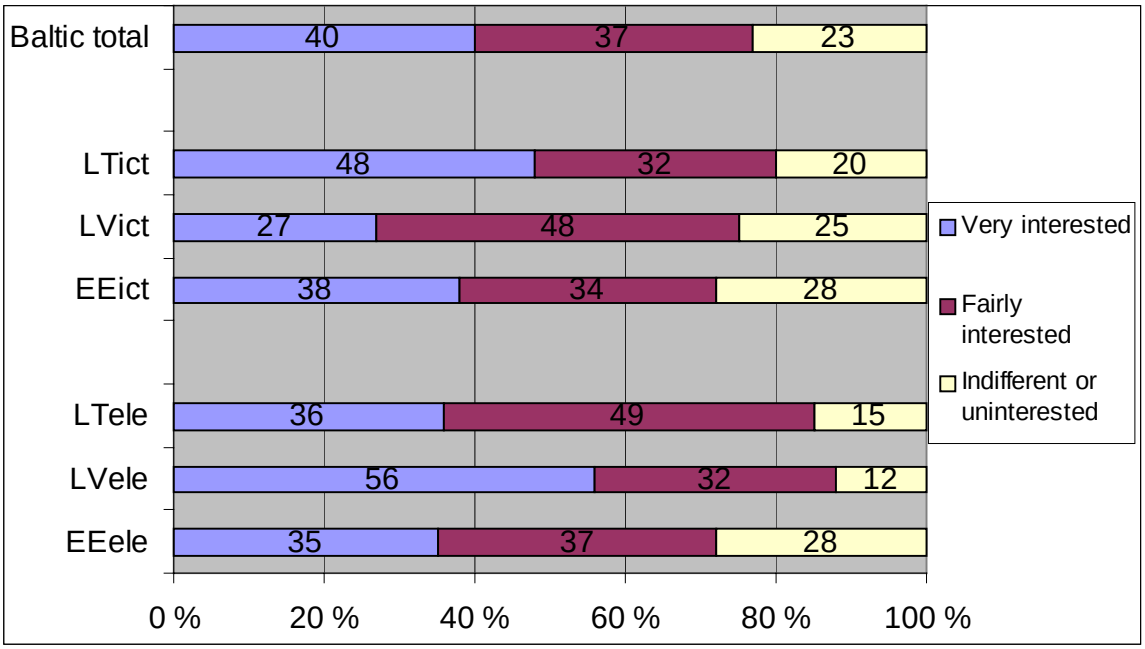
The main export market for Baltic companies is in western industrialised countries. The most frequently mentioned export countries among the respondents are **the Nordic countries – Finland** and **Sweden in particular – the Baltic neighbours, Russia, Germany** and **the United States**. This holds for Estonia, Latvia and Lithuania

irrespective of the sector. The same target countries, with the exception of Russia, constitute the core group of foreign investors, principals of subcontracting contracts and subsuppliers of Baltic companies. Taiwan and China belong to major subsupplier countries in addition to the above mentioned ones. These results are hardly surprising, when they are compared with corresponding statistics concerning the whole national economy, provided by the statistical offices of the Baltic States.

Interest in Finland

How the question was put	How interested are you in co-operation with Finnish firms? Very interested / fairly interested / Indifferent / Not so interested / Totally uninterested	
Code name	Finnish interest	
RESULTS		
Prevalence of cases that are very interested in Finland	**Fair**	
Comparison by subgroup		
Leaders (top two)	1. **LVele**	2. **LTict**
Tailenders (bottom two)	6. **LVict**	5. **EEele**

Figure. Breakdown of "Finnish Interest" by Country-Industry Subgroup (in per cent).



In Estonia the Finnish presence is stronger than in Latvia and Lithuania, but at the same time Estonian companies show slightly less interest in co-operation with Finnish firms than most others. The Latvian ICT industry is also reserved, whereas the Latvian electronics industry appears to be the most interested partner in Finnish firms according to the sample. Lithuanian companies also hold a responsive attitude toward Finland. It is telling that the response rate among Lithuanian ICT firms was exceptionally high.

Apart from these observations, the available data does not reveal any uniform pattern which would allow an accurate characterisation of companies with a strong interest in Finland in terms, for example, of size, ownership, R&D intensity, or international orientation and readiness. All kinds of companies look for partners from Finland. The only unifying feature within these settings is subcontracting. Companies with a strong interest in Finland seem to have a little bit more experience in performing as a subcontractor than the rest.

Basically, the interest shown towards Finland and international co-operation in general is conspicuously high. More than three quarters of the companies surveyed are very or fairly interested in productional co-operation with Finnish firms and over four fifths with foreign firms generally. The sample may be biased in this respect, because it is likely that companies which were not interested in expanding their international contacts refused to participate in the survey right from the beginning. Correspondingly, anxious companies were motivated to respond, which distorts the selection.

When the respondents were asked explicitly to name the three most preferred countries with which they would like to co-operate, the Scandinavian countries[17], Sweden in particular, and Germany took the first two places in Latvia and Lithuania. In Latvia, Finland belonged to the top three. The United States and the United Kingdom were also frequently mentioned; electronics enterprises preferred Russia, too. In Estonia, the first favourite was Finland, followed by Sweden. Latvia, Germany and Russia were also frequently mentioned. It was somewhat unexpected that Estonians ranked Finland so clearly in first position, when one remembers how they answered the question 'FINinterest'.

Those respondents who had indicated interest in productional co-operation with foreign firms were asked what sort of co-operation they aspire to. Most commonly these companies offer services as a subcontractor in software outsourcing. In Lithuania, however, the supply of software outsourcing appears considerably lower than in Latvia, where it is the most abundant. This result, derived from the existing sample, should not be interpreted in such a way, that subcontracting possibilities would be poor in Lithuania, on the contrary. Almost a third of Lithuanian companies would welcome a foreign partner for investment or a joint venture, in Estonia only a quarter.

[17] Many respondents used the term 'Scandinavian countries'.

Figure. Type of Co-operation Suggested by Baltic Companies (in per cent).

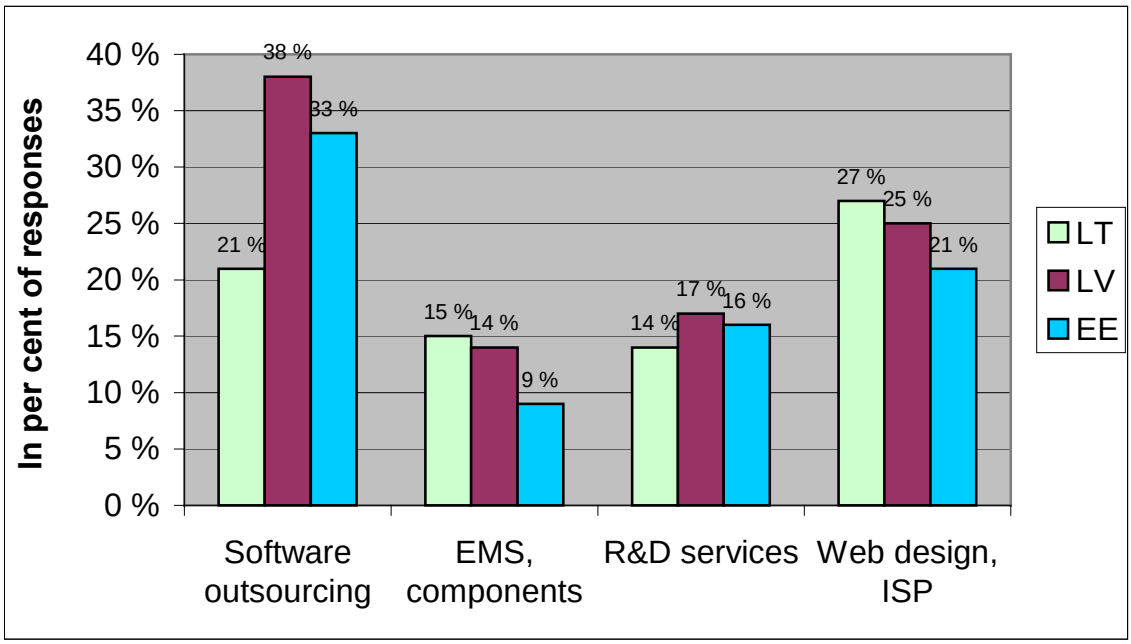
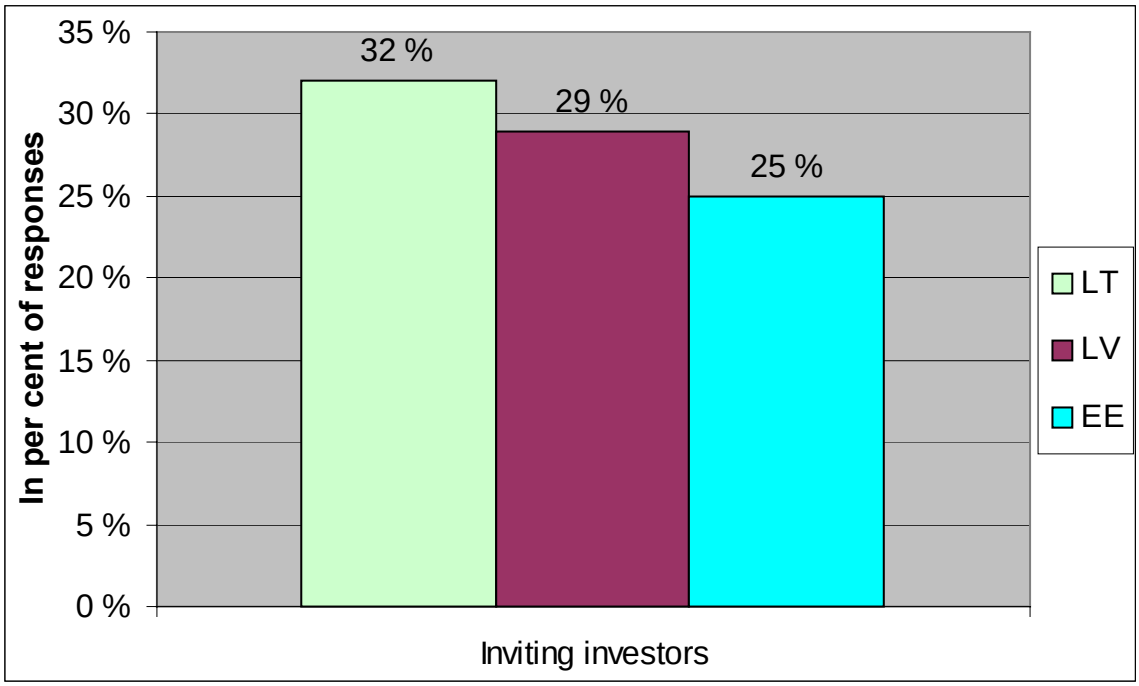


Figure. Companies Looking for a Foreign Investor (in per cent).



A drive to go international exists clearly in the Baltics but what are the facilities for internationalisation? The international readiness was measured by a set of five questions, which was converted into a single indicator, presented below. Again the

Latvian electronics industry distinguishes itself, whereas the Estonian ICT industry lags far behind all others. Differences between sectors are quite large. The typical profile of a company with good international facilities includes a large size, a large share of exports and a high R&D intensity.

Prerequisites for international contact making

How the question was put	Composite variable based on the following five questions: 1. Are your company's marketing brochures available in English? 2. Has your company participated in fairs and exhibitions abroad? 3. Has your company directly contacted foreign firms, on its own initiative? 4. Has your company participated in competitive biddings abroad in order to win a (sub)contract? 5. Has your company been involved in EU funded projects?	
Code name	International readiness	
RESULTS		
Prevalence of cases in which five or four of the prerequisites is fulfilled	**Fair**	
Comparison by subgroup		
Leaders (top two)	1. **LVele**	2. **EEele**
Tailenders (bottom two)	6. **EEct**	5. **LVict**

Figure. Breakdown of "International Readiness" by Country-Industry Subgroup (in per cent).

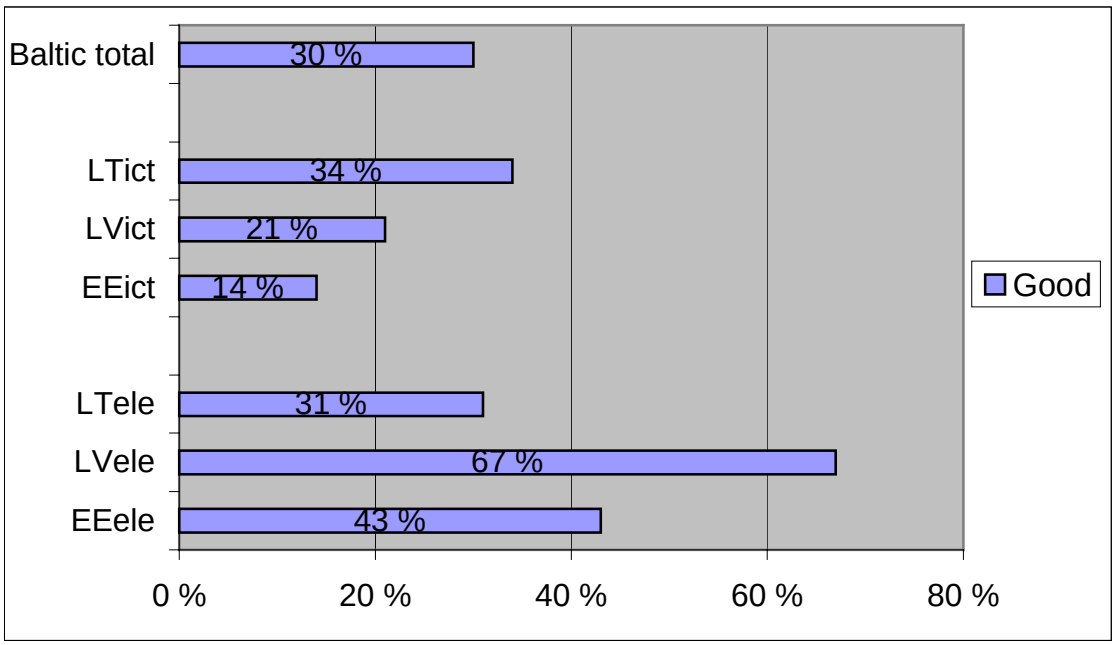
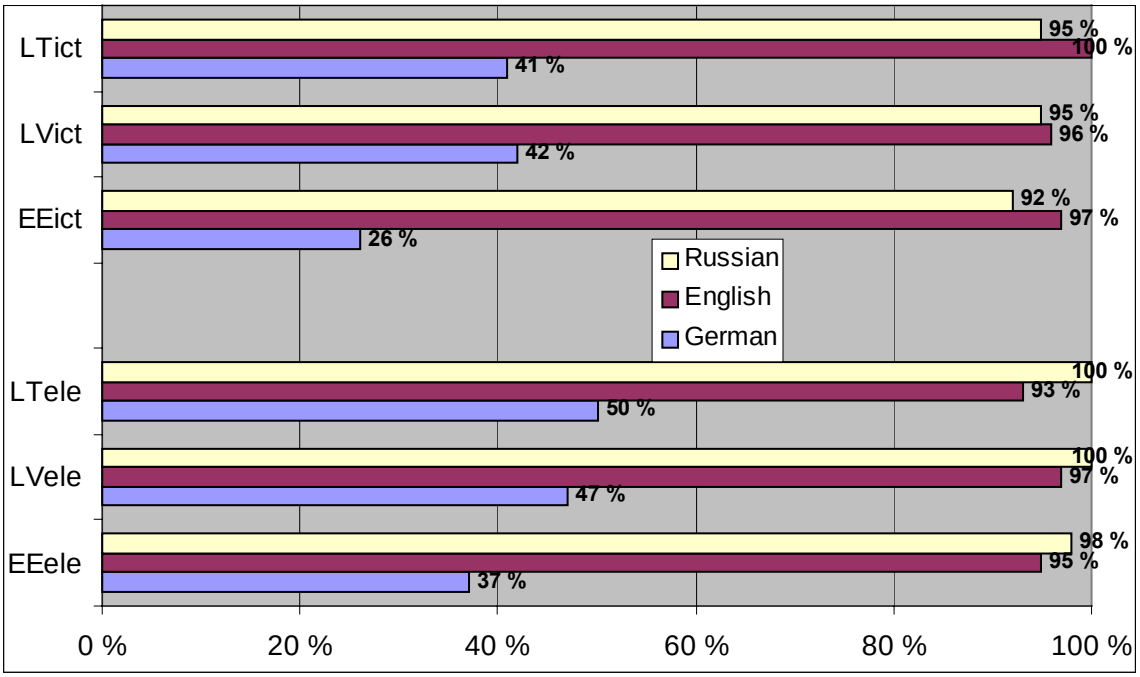


Table. The extent to Which Conditions for International Access Are Fulfilled in Baltic ICT and Electronics Companies (share of affirmative answers in per cent).

	Yes-%					
	LTict	LVict	EEict	LTele	LVele	EEele
1. Directly contacted foreign firms on own initiative	69	65	***64***	73	**87 !**	77
2. Marketing brochures in English	53	44	***32***	46	54	**60 !**
3. Participated in fairs abroad	28	24	***22***	51	**58 !**	43
4. Involved in EU funded projects	33	24	***19***	27	**45 !**	20
5. Participated in competitive biddings abroad	26	***14***	22	18	20	**33 !**

Almost all Baltic companies can communicate in English and Russian with their business partners according to their own information. It probably holds true that nearly every company employs persons who do speak English, but it does not yet mean that everybody in the company speaks it. It can be the case for example that salesmen and an assistant to the director are fluent in English but key technical persons responsible for the production process do not necessarily have command of foreign languages. Finnish is spoken only in Estonia with the exception of sporadic individuals in Latvia and Lithuania. In Estonia 73 per cent of ICT companies and 67 per cent of electronics companies can do business in Finnish.

Figure. Command of Languages in Baltic Enterprises (in per cent).



Only a small minority of the sample's companies owns units abroad, such as production plants, sales offices, foreign representations or agencies. Their share is about ten per cent, and foreign subsidiaries are even more seldom. Typically a foreign unit is located either in another Baltic country (though less frequently in Estonia than in Latvia or Lithuania) or in Russia. Few companies have units in Germany, Finland, the Ukraine, the United States or some other countries. In general, Estonian companies are known to have spread out to Latvia and Lithuania more vigorously than vice versa, although this expansion is not clearly manifested in the sample under consideration. The data shows however that Latvian ICT companies, followed by Lithuanian ones, are also looking beyond the national borders. Even though the electronics industry is a stronger exporter than the ICT industry, it has relatively less foreign units.

The Estonian Microlink is probably the best know example in the ICT field of a regional company with Latvian and Lithuanian subsidiaries. Dati and Tilde belong to the forerunners of Latvian ICT companies with subsidiaries abroad. All in all, the number of truly regional companies in the Baltics still remains low.

4 HIGHER EDUCATION AND ACADEMIC RESEARCH IN ENGINEERING AND IT-RELATED FIELDS

4.1 Description of the Educational System

4.1.1 Higher Education

4.1.1.1 Structure

The higher education systems in the Baltic countries are binary, consisting of academic and non-academic, i.e. professional, degrees. University type institutions often offer both academic and professional programmes; non-university type institutions run applied professional programmes solely.

4.1.1.1.1 Academic

The Lithuanian universities award Bachelors', Masters' and Doctors' academic degrees. A higher scientific status of Habilitated Doctor can also be obtained.

Undergraduate studies 4 years ➪ ***Bachelor***

Bachelor of Science (B.Sc.) is the first academic degree which is awarded after the completion of undergraduate studies. These basic academic studies take four years and their overall scope is 160 credits, including a final thesis. During the first two years, the Bachelor's study programmes are orientated towards the fundamentals of the discipline under consideration, providing background courses in natural sciences and/or engineering which are common to all students of the field. During the next two years, emphasis is placed on in-depth studies of a specialised sub-field to be opted for. A Bachelor's degree grants the right to enter either a Master's or a professional programme, or start a professional activity in working life.

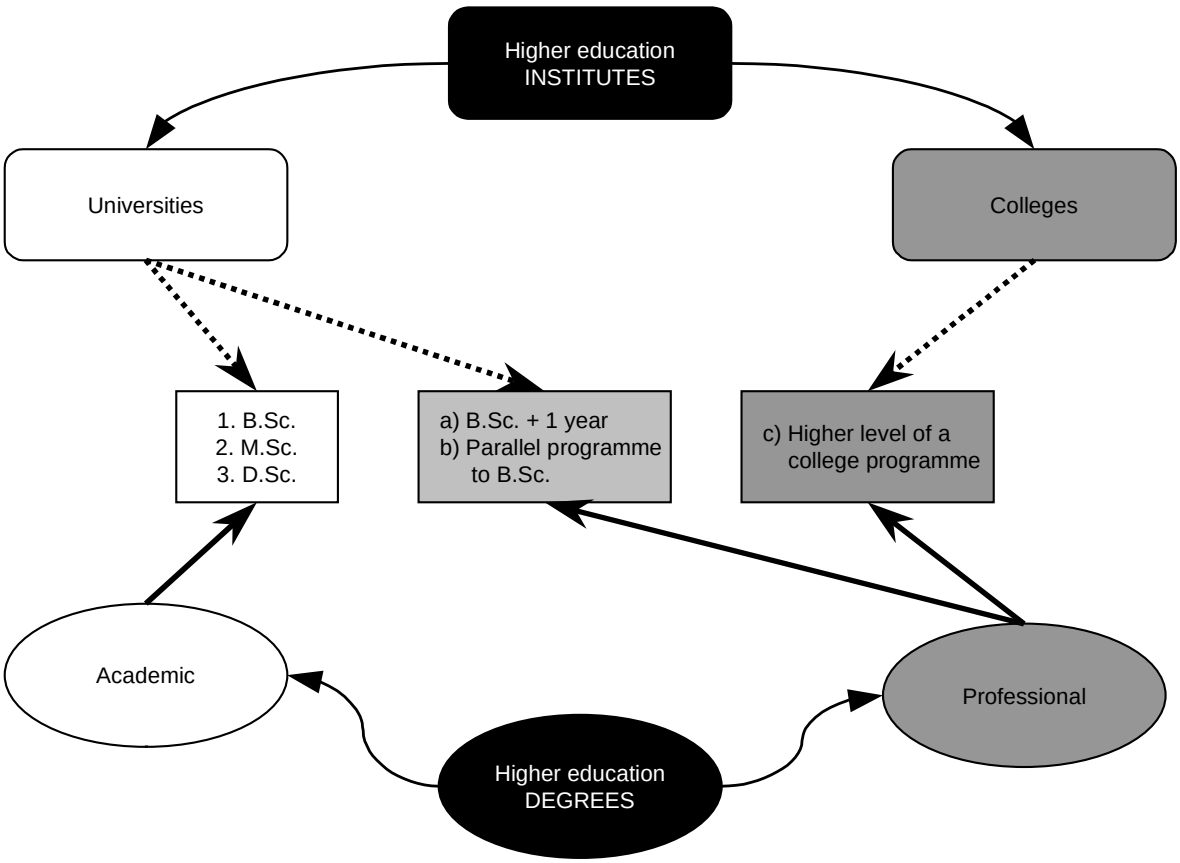
Graduate studies 4 + 2 = 6 years ➪ ***Master***

Master of Science (M.Sc.) is the second academic degree which is awarded after the graduate has defended a Master's thesis. Two years' studies comprise 80 credits and deepen one's specialisation in the sub-field selected. Upon obtaining a Master's degree, the graduate may pursue doctoral studies.

Postgraduate studies 4 + 2 + 4 = 10 years ➪ ***Doctor***

Doctor of Science (D.Sc.) is a research degree which denotes a person's competence to independently formulate scientific tasks and conduct research in a particular field of science. The doctoral thesis must bring an original and significant contribution to that field. Doctoral studies take a further four years: the first year and a half is devoted to studying based on an individual plan, after which a doctoral thesis is written and defended.

Chart. The Binary Structure of the Higher Education System in the Baltics.



Habilitated Doctor

Habilitated Doctor (Dr.Habil.) is the highest research degree which is conferred on holders of a doctorate who have published significant scientific results. A habilitation thesis is also required.[18]

The Latvian and Estonian degree systems are basically similar to the Lithuanian one. A Bachelor's degree is awarded after the first stage of academic studies and a Master's degree after the second one. Doctoral studies constitute the third stage of academic studies, the admission requirement for them being a Master's degree. In Estonia, the Doctor's degree is divided into research and professional degrees. Until the year 2000, Latvia had a two-tier doctoral degree system which distinguished between the first level doctoral degree, which is internationally recognised as a Ph.D., and the second level doctoral degree, Habilitated Doctor. Earlier the Habilitated Doctor's degree used to be a formal prerequisite for a full professorship.[19]

4.1.1.1.2 Professional

Professional education is in a state of ferment in the Baltic countries with the result that the field is diverse. Three variants can be distinguished (see below). The first two of them are attributed to university type education, while the third one represents the non-university type.

1. Traditionally Baltic universities have granted professional qualifications as an alternative to a Master's degree. Such professional programmes have followed the Bachelor studies. This form prevails in Lithuania in particular, whereas it has been abolished in Estonia.

2. Universities also run professional undergraduate programmes parallelling academic Bachelor studies. In this case, a professional qualification is an alternative to a Bachelor's degree. In Latvia these kinds of professional degrees are widespread and available for almost every study programme in engineering sciences. Provincial universities often award them rather than academic degrees. In Estonia such professional studies are called diploma studies.

3. Finally, the reforms of post-secondary education aim at lifting the status of some existing polytechnics or junior colleges in order to create separate non-university higher education institutions with applied professional programmes. They are usually called colleges in English. Moreover, new non-university higher education institutions have been established, and some of them are private.

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[18] *Ministry of Education 2001a*; *Higher Education in Lithuania* 2001, 42–43, 53; web pages of all the universities mentioned in the text, especially www.ktu.lt and www.vtu.lt.
[19] Rauhvargers & Brensone 1999, 19–20; Vaht et al. 2000, 24–25.

Professional studies 4 + 1 = 5 years ⇨ ***professional qualification****, such as engineer, teacher or economist*

Professional programmes of **universities** are more practically oriented than Master studies, which emphasise a proficiency to carry out independent academic research. The former, by contrast, have more in common with vocational studies, while they primarily prepare students for professional activities in working life. A professional qualification is conferred after a further year following the Bachelor's degree. Usually a professional programme does not entitle the graduate to continue in a doctoral programme. There is no uniform regulation imposed on the titles of professional qualifications, nor do all study programmes award them.[20]

Kaunas University of Technology offers professional programmes, among others, at the Faculty of Informatics and the Faculty of Telecommunications and Electronics. The Faculty of Informatics at the University of Vilnius has a professional programme for teachers of mathematics and informatics, whereas the Faculty of Electronics at the Vilnius Gediminas Technical University has no professional programme.[21]

The system of higher education in Lithuania is undergoing a similar kind of change to that which took place in Finland during the first half of the 1990s when the polytechnic sector was reformed. Until 1999, the Lithuanian educational system acknowledged university-type higher education alone. Yet the **reform** of post-secondary education, which started in that year, aims at transforming some of the existing polytechnics into colleges by 2004, while some of them will remain as institutions of lower post-secondary education. While the process is still underway, the interviewed experts maintained in the last quarter of the year 2001 that all the institutions of higher education still represent university-type education and non-university higher education is missing.[22]

However, the booklet "Higher Education in Lithuania 2001", published by the Ministry of Education, already acknowledges non-university higher education and mentions a few colleges representing it. According to the booklet, **non-university** one-level undergraduate studies can also award professional qualifications. These studies usually last three years, sometimes four or three and a half years. The qualifications to be awarded cannot be easily summarised, since they depend on the study field, as do the length of the studies. In technological sciences six three-year study programmes have been registered, among others in electrical, electronics and informatics engineering. Upon completion of the studies, the qualification of engineer or technologist is awarded.[23]

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[20] *Higher Education in Lithuania* 1999, 43.
[21] Dekeris 24.10.2001; Maceika 6.11.2001; Mitasiunas 26.10.2001; Targamadze & Macikenas 24.10.2001,
[22] Zalys 8.11.2001 among others.
[23] *Higher Education in Lithuania* 2001, 44–45, 55.

Latvia

Latvia introduced by law in December 2000 professional Bachelor's and Master's degrees which are replacing the earlier higher professional education programmes, quoted in law as second-level professional programmes. A professional Bachelor will have 25 per cent of studies in the form of a practice and emphasis will be placed on applied science. During the present transition period, two groups of professional programmes can be distinguished: (A) those based on a standard of the first academic degree, which make graduates eligible for further academic studies, and (B) the applied ones which do not entitle one to further academic studies.

(A) The university type professional programmes are usually independent parallel programmes based on the Bachelor standard, but they can be sometimes short programmes on top of Bachelor's degree, like in Lithuania. (B) The non-university programmes are organised around college programmes. They last four years, which distinguishes them from the first-level college programmes that are of two years duration.[24] Riga Technical College was a pilot school to be transformed from a polytechnic into a professional higher education institution.

Professional programmes for information technology were introduced at Riga Technical University in September 2000 and at the University of Latvia one year later. Their qualifications were determined on the basis of a survey, which asked the Latvian IT companies which professions are most demanded in the industry. On the basis of this survey the professional programme prepares computer programmers and system administrators. The pertinent industrial associations were involved in designing the content of the curricula. Although the titles of the courses may sound similar to those on the academic programme, the professional programme places main emphasis on practical skills that are needed in working life. Exercises replace lectures, and the students get to know the life cycle of a real software project. A six month practice in an IT company is a mandatory part of the studies. All-round courses in natural sciences, which are included in the academic studies, are reduced.

A shortage of teachers restricts the expansion of the professional studies. Presently their volume is much smaller than that of the academic studies. The objective is to attract teachers from the ranks of the professionals working in the industry in order to accentuate the difference between the professional and academic programmes.[25]

Estonia

Non-academic higher education qualifications are divided into vocational and diploma studies. The first one is offered either by secondary education institutions or applied higher education institutions (*rakenduskörgkool*), the latter by applied higher education institutions or universities. The length of both diplomas is from three to four years and 120–160 credits. The diploma study programmes may have common parts with Bachelor programmes. Consequently, the graduates of diploma studies may transfer

[24] CD-ROM of the Academic Information Centre of Latvia 2001.
[25] Borzovs 10.4.2001; Sukovskis 17.5.2001.

their credits to continue their study at the academic level according to the transfer requirements set up by the university. Not all study domains at universities run professional diploma programmes parallel to academic ones.[26]

Tallinn Technical University offers diploma programmes for instance in computer systems, telecommunication, informatics and network software. Kuressaare College at TTU launched in September 2002 a diploma programme for managers of electronics. University of Tartu has a diploma programme in applied computer science.[27]

4.1.1.1.3 Summary[28]

Country	LT			
Degree	Bachelor	Master	Doctor	Professional
Duration in years	4	2	4	4+1=5
Extent in indigenous Credits	160	80	160	160+40=200
Extent in ECTS Credits				

Country	LV			
Degree	Bachelor	Master[2]	Doctor	Professional
Duration in years	3–4	1–2	3–4	at least 4
Extent in indigenous credits	120–160	40–80		at least 160
Extent in ECTS credits	180–240	60–120		at least 240

2 Total duration no less than 5 years, 200 Latvian credits, 300 ECTS credits

Country	LV	
Degree	Professional Bachelor	Professional Master[3]
Duration in years	at least 4	at least 5
Extent in Indigenous Credits	at least 160	at least 200
Extent in ECTS Credits	at least 240	at least 300

3 Total duration including Bachelor

Country	EE			
Degree	Bachelor	Master[1]	Doctor	Professional
Duration in years	3–4	1–2	4	3–4
Extent in Indigenous Credits	120–160	40–80	160	120–160
Extent in ECTS Credits	180–240	60–120	240	180–240

1 Total duration no less than 5 years, 200 Estonian credits, 300 ECTS credits

[26] Vaht et al. 2000, 23–24.
[27] Web sites of the higher educational institutions mentioned in the text.
[28] CD-ROM of the Academic Information Centre of Latvia 2001; *Higher Education in Lithuania* 2001, 45–46; Vaht et al. 2000, 23–25.

4.1.1.2 Institutions

4.1.1.2.1 University Type

Definition: University type higher education institutions provide study programmes leading to **academic** degrees, making graduates eligible for further academic studies up to the highest level. In minimum they offer at least one Bachelor level programme. In many cases it is also possible to pass a professional examination.

Note: The binary structure of the higher education system is not strictly institutionalised in the Baltic countries. Therefore one can see universities running professional programmes and institutions not bearing the name of university running academic programmes. Besides, higher education institutions may sometimes call themselves universities even though they do not entail a range of various faculties corresponding to a full university in the Finnish terminology.

Lithuania

	Granting				Total
	doctoral degrees		degrees below doctoral level		
Public	I	11	II	4	15
Private	III	0	IV	4	4
Total		11		8	**19**

Main universities with study programmes in ICT and/or electronics:

1 Kaunas University of Technology	I	ICT + ELE
2 Vilnius Gediminas Technical University	I	C + ELE
3 Vilnius University	I	IT

University type higher education institutions with some teaching in ICT and/or electronics:

4 Vytautas Magnus University in Kaunas	I	IT
5 Klaipeda University	I	IT
6 Šiauliai University	I	ELE + IT
7 Vilnius Pedagogical University	I	IT

Latvia

	Granting				Total
	doctoral degrees		degrees below doctoral level		
Public	I	11	II	4	15
Private	III	0	IV	2	2
Total		11		6	**17**

Main universities with study programmes in ICT and/or electronics:

1 Riga Technical University	I	ICT + ELE
RTU's branch in Liepaja		ELE
2 University of Latvia	I	IT + radioelectronics
Postgraduate Professional Training Centre in the Institute of Mathematics and Computer Science		

University type higher education institutions with some teaching in ICT and/or electronics:

3 Daugavpils University	I	IT
4 Liepaja Pedagogical Academy	I	IT
5 Rezekne Higher Educational Institution	I	ICT (+ELE)
6 Transport and Telecommunication Institute[29]	IV	ICT + ELE
7 University of Agriculture in Jelgava	I	IT (+ELE)
8 Ventspils College	I	IT
9 Vidzeme College	I	IT

Plans/Initiatives: School of Multi Media

Estonia

	Granting			Total
	doctoral degrees		degrees below doctoral level	
Public	I	6	II 0	6
Private	III	1	IV 6	6
Total		7	6	**13**

Main universities with study programmes in ICT and/or electronics:

1 Tallinn Technical University	I	ICT + ELE
2 University of Tartu	I	IT

University type higher education institutions with some teaching in ICT and/or electronics:

3 Concordia International University Estonia	IV	IT
4 Tallinn Pedagogical University	I	IT

[29] **Formerly Aviation University**

4.1.1.2.2 Non-University Type

Definition: Non-university type higher education institutions provide **applied** non-academic study programmes with an emphasis on **professional** skills.

Lithuania

Total	**16**		
Public	7	Alytus College	IT
		Kaunas College	ICT + ELE
		Vilnius College	ICT + ELE
Private	9	-	

Latvia

Total	**18**		
Public	6	Riga Technical College	ICT + ELE
Private	12	Engineering and Information Technology Academy[30]	
		Riga International College of Economics and Business Administration	e-commerce
Plans/Initiatives:		Danish IT College	

Estonia

Total	**18**		
Public	10	Kuressaare College at TTU[31]	ELE
		Virumaa College at TTU	IT
Private	8	IT College	IT

4.1.1.2.3 Main Centres of Higher Education

Lithuania:	Vilnius, Kaunas
Latvia:	Riga
Estonia:	Tallinn, Tartu

[30] **No information about its study programmes: Academy is mentioned neither in the materials of the Academic Information Centre nor does it have a web site.**
[31] **Formerly Institute for Islands Development.**

4.1.1.3 Admission

Formally the Baltic States pursue a policy of government paid higher education but in practice a significant number of students pay for their studies. In Latvia nearly two thirds of the students cover the study costs themselves; in Estonia and Lithuania the share of self-financing students is lower. Non-state financed students are a source of income for the state universities. Private higher education institutions charge tuition fees to all their students.

Since the number of study places financed from the state budget is pre-determined, the universities can offer a free education only for the corresponding number of applicants. Tuition fees are charged to students who meet entrance requirements but fail to be admitted to the state financed places in the competition. Those with the best ratings are selected for the state financed group, whereas those with lower grades have to pay a tuition fee if they want to study. The tuition fees vary from subject to subject: such disciplines which necessitate an extensive use of laboratory equipment are more expensive than those which are conducted in mass lectures. In Lithuania, students who fare badly in exams can drop to the paying group during their studies, while some paying students may accordingly enter the free group.

Latvia is planning to gradually introduce tuition fees for all students, while concurrently creating a system of study loans. Some new professional higher education programmes in the fields of economics, business and law are available solely for self-financing students. Tuition fees are problematic for such professions which are not in high demand, like humanities, or which belong to the public sector, like teachers and medical doctors.

Examples of Tuition Fees to be Charged from Foreign Students in 2002/2003 (in US$).

	Kaunas University of Technology	Riga Technical University	Tallinn Technical University
Tuition fee (*in US$)*	2,000	2,900	32 per one credit point
Registration fee (*US$*)	250 + 30 = 280	100	63

Lithuania

The admission procedure is developing in a centralised direction. Most universities have joined the Association of Higher Educational Institutions which co-ordinates a centralised admission procedure to nine higher educational institutions. Candidates can apply for up to twenty study programmes in them but can accept only one study place.

The usual admission criterion is a competition rating determined by the grades of the school leaving examinations. Grades of relevant subjects may be emphasised and extra points may be given following success in national or international subject competitions. Most faculties do not have any additional entrance exam. The state examination can be

taken either at an examination centre, where a commission evaluates the tests, or at the pupil's own school, where teachers evaluate them. Universities prefer examinations taken at the centres because they are believed to guarantee better objectivity and comparability.

Latvia

The admission procedure is decentralised: each higher education institution may choose an appropriate procedure depending on the number of applicants per study place. The admission boards may organise one or more competitive entrance examinations or a competition based on secondary school transcripts with an emphasis on subjects pertinent to the chosen programme. In 2003, a new system will take over the decentralised entrance examinations. Since a system of centralised state examinations is being developed for secondary school leaving examinations, certificates of these centralised school leaving examinations will be used for selection in the future.

Estonia

The candidates apply directly to the higher education institutions, which administer admission procedures on their own. The most important selection criteria are the results of state examinations. Since 1997 it has been compulsory for secondary school graduates to pass centralised state examinations. The faculties of higher education institutions given notice which state examinations must be passed by the candidates. The specific requirements, which vary from institution to institution, may include entrance exams and interviews or grades on the secondary school leaving certificate.[32]

4.1.2 Vocational Secondary and Post-Secondary Education

4.1.2.1 Structure

Lithuania

Vocational secondary education consists of three levels. Depending on the level, training at vocational schools or training centres lasts from one or two to three years. For instance, Vilnius 1st Polytechnic School and Vilnius School of Radio Electronics and Precision Mechanics train skilled labour for electronics and electrical industries.

In addition to the highest level of vocational schools, the so called advanced schools provide vocational post-secondary education as well. These advanced schools are being evaluated at present during the ongoing institutional reform which aims at creating non-university type higher education. The most qualified advanced schools will be

[32] CD-ROM of the Academic Information Centre of Latvia 2001; *Higher Education in Lithuania* 2001, 45–46; Maceika 6.11.2001; Vaht et al. 2000, 20–22.

reorganised into colleges or made their departments. The rest will join the group of vocational schools.[33]

Latvia

Vocational secondary education is divided into levels. The lower level lasts two to three years, the higher four years.[34]

Post-secondary vocational education was not regarded as a part of higher education before 1999 but now it is being restructured into college programmes. The first level college programmes, which last at least two years and correspond to 80 credits, are currently considered as the first cycle of higher professional education. They are being established both at higher education institutions and former institutions of post-secondary vocational education. The fields in which first level college programmes are first being introduced are engineering, computer science, business administration, nursing and law.[35]

Estonia

Since 1998 there have been two levels of vocational education in Estonia, secondary and higher, i.e. post-secondary. 1) Secondary vocational education with the prerequisite of basic education lasts at least three years and with that of secondary education lasts at least one year. 2) Higher vocational education is a part of the higher education system and its duration is three to four years. The applied higher education institutions mainly offer the higher vocational programmes but some post-secondary vocational schools also have the right to provide them. Information technology, electronics and telecommunication are reckoned upon as the priority fields in developing vocational institutions. Other priorities are services and logistics.[36]

4.1.2.2 Examples of Institutions

Lithuania

Kaunas Technical College	ELE + ICT
Panevėžys Polytechnics	ELE
Vilnius College of Electronics	ELE + ICT

[33] *Education in Lithuania 2000–2001*; *Higher Education in Lithuania 2001*, 35–37; Kriaučionytė et al. 1997; www.vilniusregion.com/training.
[34] www.aic.lv
[35] CD-ROM of the Academic Information Centre of Latvia 2001.
[36] Vaht et al. 2000, 11–13.

Latvia

Olaine Mechanical and Technological College	ELE
Riga State Technical School	ELE + IT

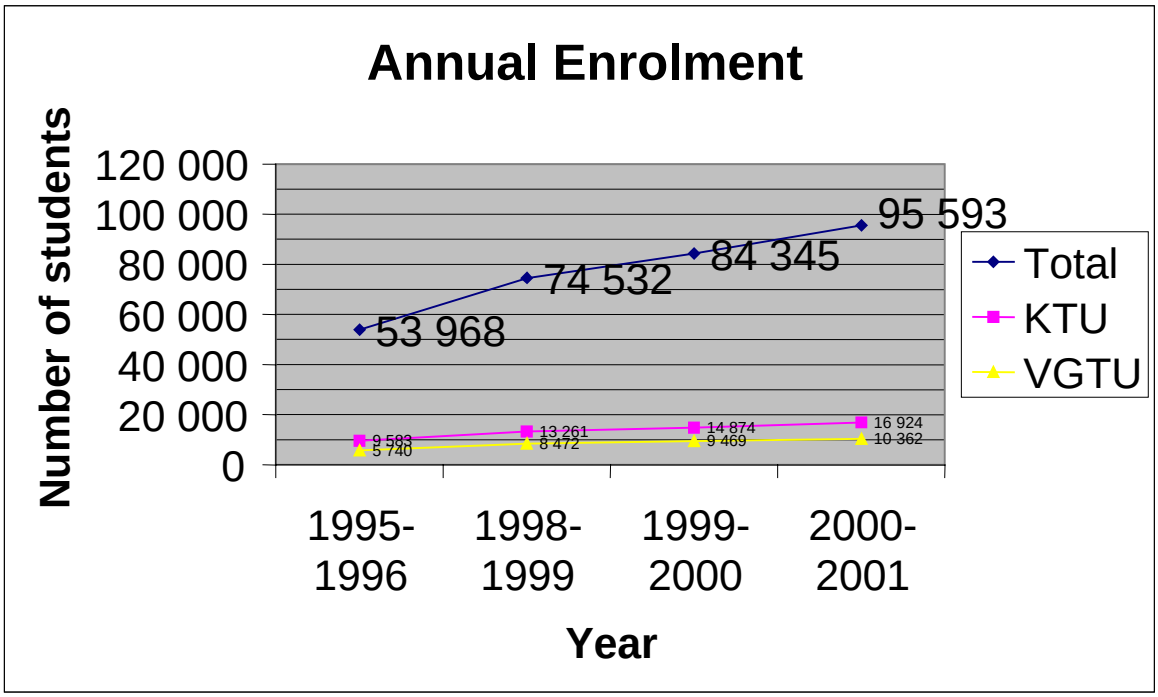
Estonia

Kohtla-Järve Polytechnics	ICT + ELE
Tallinn Polytechnics	ICT + ELE
Vöru County Vocational Education Tarining Centre	IT + mechatronics

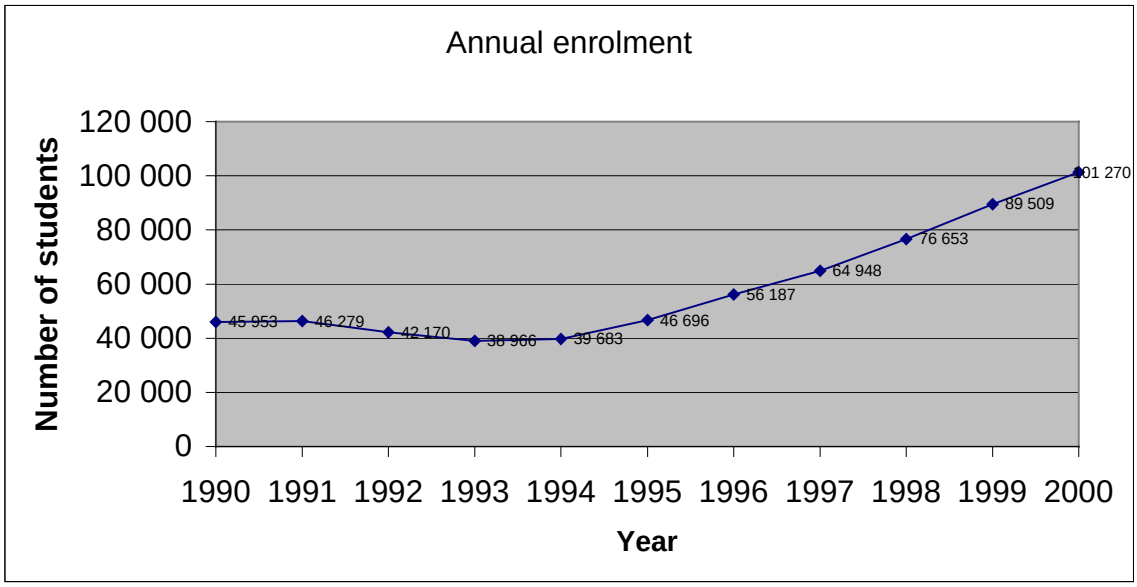
4.2 Higher Education Statistics

4.2.1 Number of Students

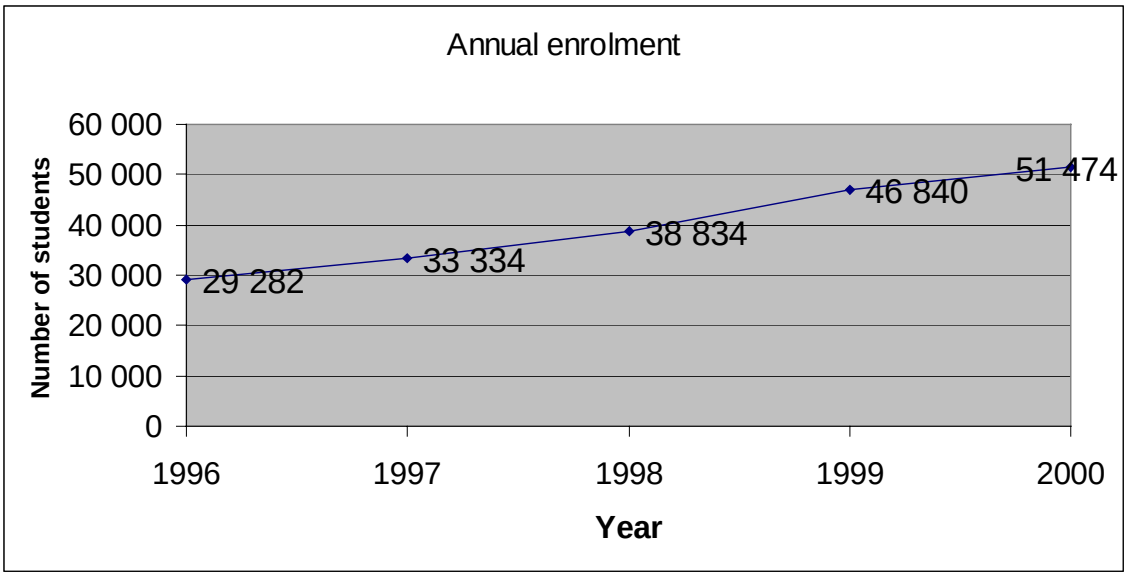
LT: Trend in Annual Enrolment in Higher Education Institutions, 1995–2000.



LV: Trend in Annual Enrolment in Higher Education Institutions, 1990–2000.



EE: Trend in Annual Enrolment in Higher Education Institutions, 1996–2000.



LT+LV+EE: Number of Students in Tertiary Education per 100,000 Inhabitants in Estonia, Latvia and Lithuania, 2000.

	Number of students per 100 000 inhabitants
1. Latvia	4 280
2. Estonia	4 024
3. Lithuania	3 681

LT+LV+EE: Enrolment in the Baltic Technical Universities at the Beginning of the Academic Year 2000/2001.

	Kaunas University of Technology	Vilnius Gediminas Technical University	Riga Technical University	Tallinn Technical University
Professional/ Diploma	13 138	8 097	11 970	1 716
Bachelor				5 903
Master	3 351	2 069	1 526	1 164
Doctoral	435	196	379	263
Total	16 924	10 362	13 878	9 046

LT: Enrolment in Higher Education Institutions at the Beginning of the Academic Year 2000/2001.

	COLLEGES		**UNIVERSITIES**	
	Number		**Number**	
Total	7		19	
Private institutions	3		4	
	Enrolment	**%**	**Enrolment**	**%**
Total	3 547	100	95 593	100
State/private institutions	2 972 / 575	84 / 16	94 963 / 630	99 / 1

LT: Shares of Self-Financed Study Places in Bachelor and Professional Programmes, 1995–2001.

	New enrolees paying a tuition fee		Total	All students paying a tuition fee		Total
	Number	**%**	Number	Number	%	Number
1995–1996	2 562	**18**	13 988	3 469	7	45 753
1997–1998	4 626	**27**	17 441	7 072	13	52 584
1998–1999	5 775	**31**	18 681	12 131	21	57 862
1999–2000	7 194	**35**	20 681	16 199	25	64 252
2000–2001	11 294	**46**	24 800	24 884	33	76 312

LT: Shares of Self-Financed Study Places in Master Programmes, 1998–2001.

	New enrolees paying a tuition fee		Total	All students paying a tuition fee		Total
	Number	**%**	Number	Number	%	Number
1998–1999	1 466	**20**	7 412	2 363	16	14 795
1999–2000	2 082	**23**	8 991	3 403	19	18 070
2000–2001	2 756	**30**	9 181	4 417	26	224

LT: Grants Allocated to University Students, Academic Year 2000/2001 (in per cent).

	%
Those entitled to a grant (of all students)	59
Those whose grant is below the minimum living standard (of grant holders)	59

LV: Enrolment in Higher Education Institutions at the Beginning of the Academic Year 2000/2001.

		Number of institutions	
Total		33	
Private institutions		14	
		Enrolment	**%**
Total		101 270	100
State/private institutions		87 203 /14 063	86 / 14
State financed/tuition fees		34 129 / 67 141	34 / 66
University of Latvia		33 942	34
	State financed	7 048	[21]*
	Tuition fee	26 894	[79]*
Riga Technical University		13 878	14
	State financed	10 555	[76]*
	Tuition fee	3 323	[24]*
Transport and Telecommu-nication Institute		1 296	1
	State financed	0	[0]*
	Tuition fee	1 296	[100]*

*These percentages are counted of the enrolment of the given higher educational institution, not from the total enrolment in Latvia like the other percentages.

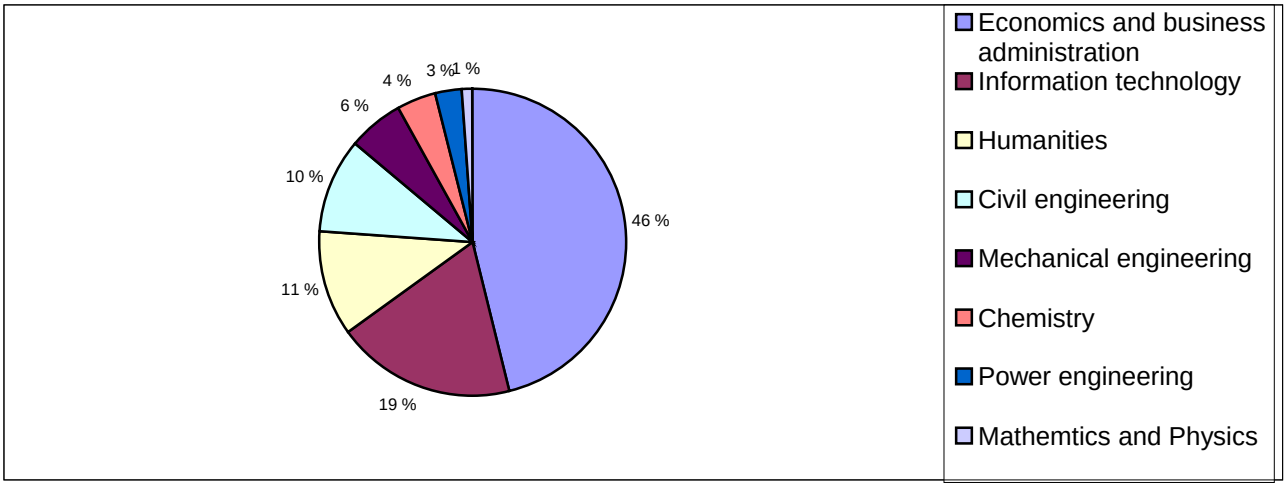
EE: Enrolment in Higher Education Institutions at the Beginning of the Academic Year 2000/2001.

		Number of institutions	
Total		35	
Private institutions		21	
		Enrolment	**%**
Total		51 474	100
State/private institutions		38 511 / 12 963	75 / 25

EE: Shares of State Financed and Self-Financed Study Places at Tallinn Technical University, 1999–2000.

	Financed from state budget		Tuition fee		Total
	Number of new enrolees	%	Number of new enrolees	%	Number of new enrolees
1996	1 428	94	98	6	1 526
1997	1 451	90	159	10	1 610
1998	1 484	86	232	14	1 716
1999	1 421	66	723	34	2 144
2000	1 313	63	774	37	2 087

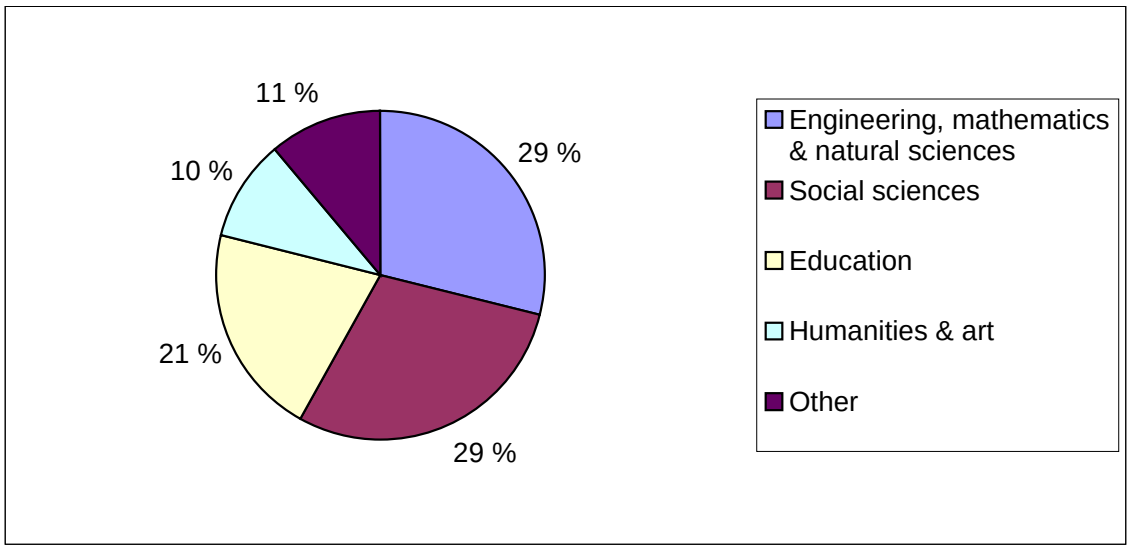
EE: Share of Self-Financing Students at Tallinn Technical University by Faculty at the Beginning of the Academic Year 2000/2001 (in per cent).



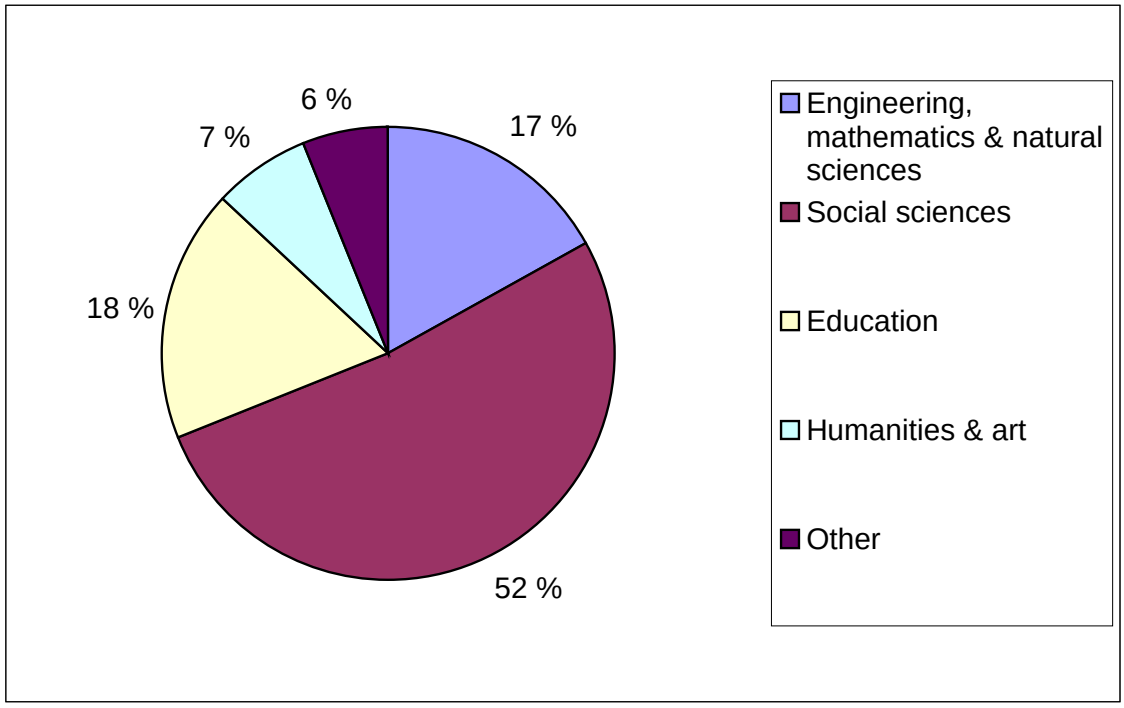
Source: Presentation by Tallinn Technical University 2002

4.2.2 Enrolment by Field of Study

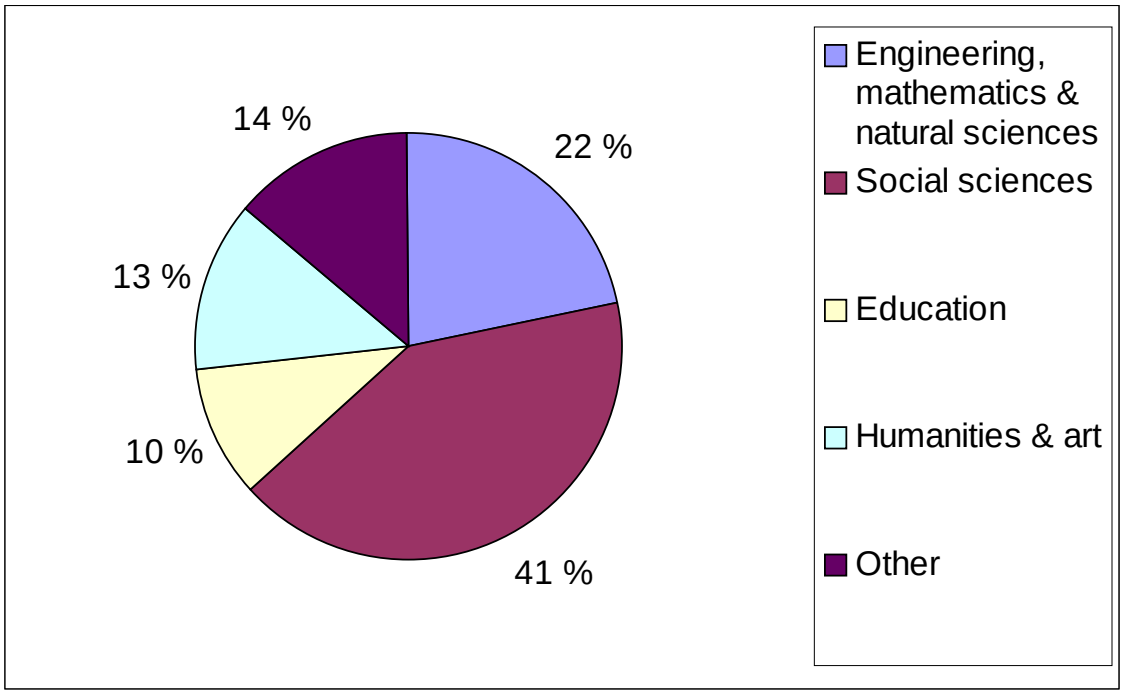
LT: Enrolment in Higher Education Institutions by Field of Study at the Beginning of the Academic Year 2000/2001 (in per cent).



LV: Enrolment in Higher Education Institutions by Field of Study at the Beginning of the Academic Year 2000/2001 (in per cent).



EE: Enrolment in Higher Education Institutions by Field of Study at the Beginning of the Academic Year 2000/2001 (in per cent).



4.2.3 Enrolment in Engineering and IT-Related Fields

LT: Number of Students in Computing in Higher Education Institutions by Study Programme at the Beginning of the Academic Year 2000/2001.

		B.Sc. + M.Sc.	Bachelor and professional	%	Master	Doctoral
Admission						
Total			842	100		
	Kaunas Technical University		322	38		
	Vilnius Gediminas Technical University		139	17		
	Vilnius University		153	18		
Enrolment						
Total		2 939	2 432	100	507	
	Kaunas Technical University		879	36		
	Vilnius Gediminas Technical University		386	16		
	Vilnius University		569	23		
Graduates						
Total		584	442	100	142	
	Kaunas Technical University		208	47		
	Vilnius Gediminas Technical University		81	18		
	Vilnius University		88	20		

LT: Number of Students in Engineering in Higher Education Institutions by Study Programme at the Beginning of the Academic Year 2000/2001.

		Total	Bachelor and professional	%	Master	Doctoral
Admission						
Total			3 428	100		
	Kaunas Technical University		1 922	56		
	Vilnius Gediminas Technical University		901	26		
	Siauliai University		202	6		
Enrolment						
Total		11 883	9 738	100	1 697	448
	Kaunas Technical University		5 341	55		
	Vilnius Gediminas Technical University		2 545	26		
	Siauliai University		608	6		
Graduates						
Total		2 000	1 284	100	619	97
	Kaunas Technical University		689	54		
	Vilnius Gediminas Technical University		384	30		
	Siauliai University		85	7		

LT: Proportion of Computing and Engineering Students in Higher Education Institutions by Study Programme at the Beginning of the Academic Year 2000/2001 (in per cent).

		Bachelor	Master	Doctoral
Enrolment %				
	Computing	3	3	
	Engineering	13	10	[22]
Graduates %				
	Computing	4	2	
	Engineering	12	10	[22]

LV: Admission to Bachelor, Master and Doctoral Programmes at the Beginning of Academic Year 2000/2001.

		Number of new enrolees	In per cent of new enrolees at a given level	In per cent of total, i.e. of all new enrolees	Percentages: next / previous level * 100
Bachelor	Total	9 512	100 %	66	-
Master	Total	4 630	100 %	32	49
	University of Latvia	2 497	54		-
	Riga Technical University	609	13		-
	Transport and Telecommunication Institute	105	2		-
Doctor	Total	371	100 %	2	8
	University of Latvia	150	40		6
	Riga Technical University	91	25		15
	Transport and Telecommunication Institute	3	0.8		3
Total		14 513	-	100 %	-

LV: Admission to Computer Sciences and Electrical Engineering in Selected Higher Education Institutions at the Beginning of the Academic Year 2000/2001.

		Number of New enrolees	Admission rate %	Number of state financed places	Share of state financed places %
Latvian University					
	Computer sciences	237	37	124	52
Riga Technical University					
	Computer sciences	907	73	860	95
	Electrical engineering	902	65	670	74
Transport and Telecommu-nication Institute					
	Computer sciences	293	85	0	0
	Electrical engineering	131	90	0	0

*LV: Share of IT Students of All Students, Academic Year 2000/2001 (*in per cent*): 4 %.*

LV: Number of IT Students, Academic Year 2000/2001.

	Enrolment	Graduates
Universities	3 898	1 059
Colleges and technical schools	926	140
Total	4 824	1 199

Source: LDA 2001

LV: Enrolment in IT Studies by Higher Education Institution, Academic Year 1999/2000.

	Number of students	%
Riga Technical University	1 738	59
University of Latvia	678	23
Transport and Telecommunication Institute	264	9
Liepaja Pedagogical Academy	149	5
Rezekne Higher Educational Institution	111	4
Total	2 940	100

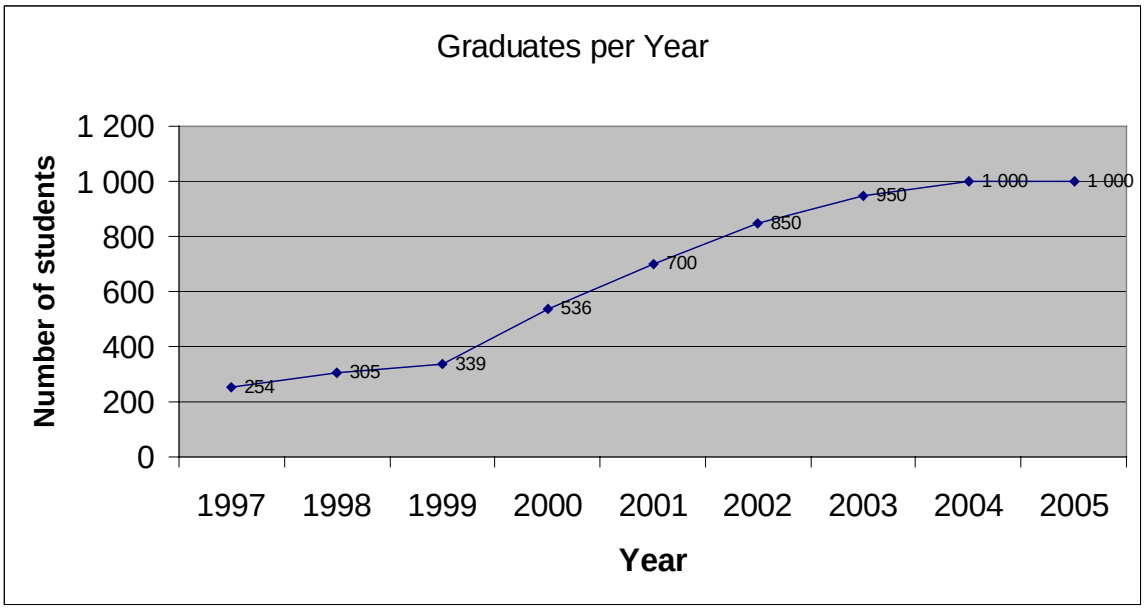
Source: Faculty of Computer Science and Computer Engineering, Riga Technical University

LV: Enrolment in IT Studies by Programme, Academic Year 1999/2000.

	Number of students	%
Bachelor/undergraduate	1 954	66
Master/graduate	425	14
Doctoral/postgraduate	46	2
First-level college	179	6
Professional/engineer	336	11
Total	2 940	99

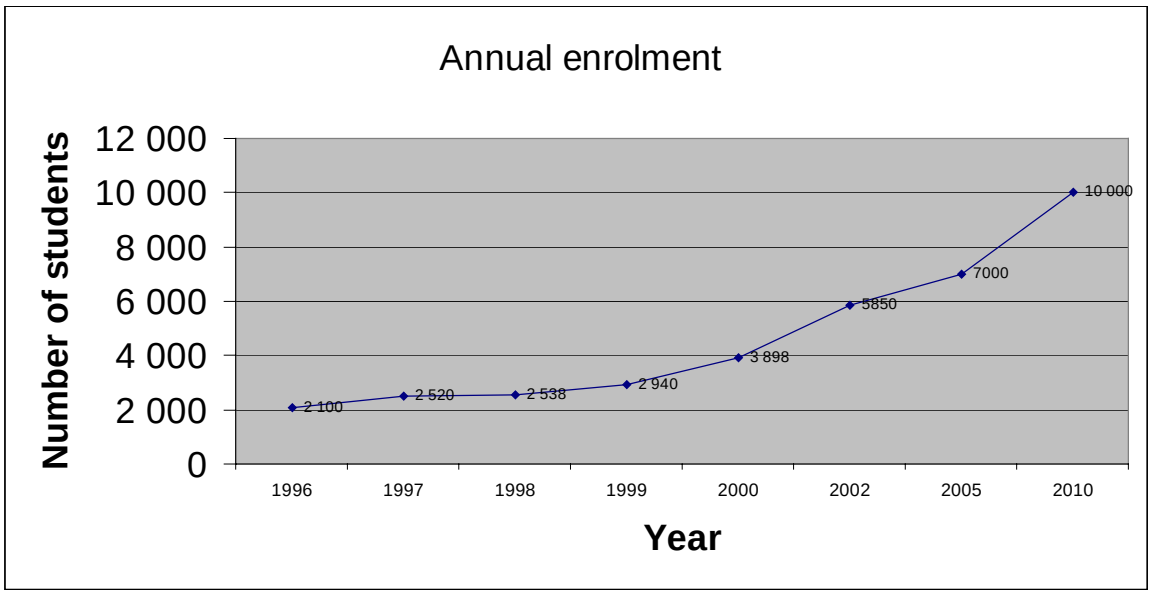
Source: Faculty of Computer Science and Computer Engineering, Riga Technical University

LV: IT Graduates from Higher Education Institutions, 1997–2005: Observed Number and Prognosis.

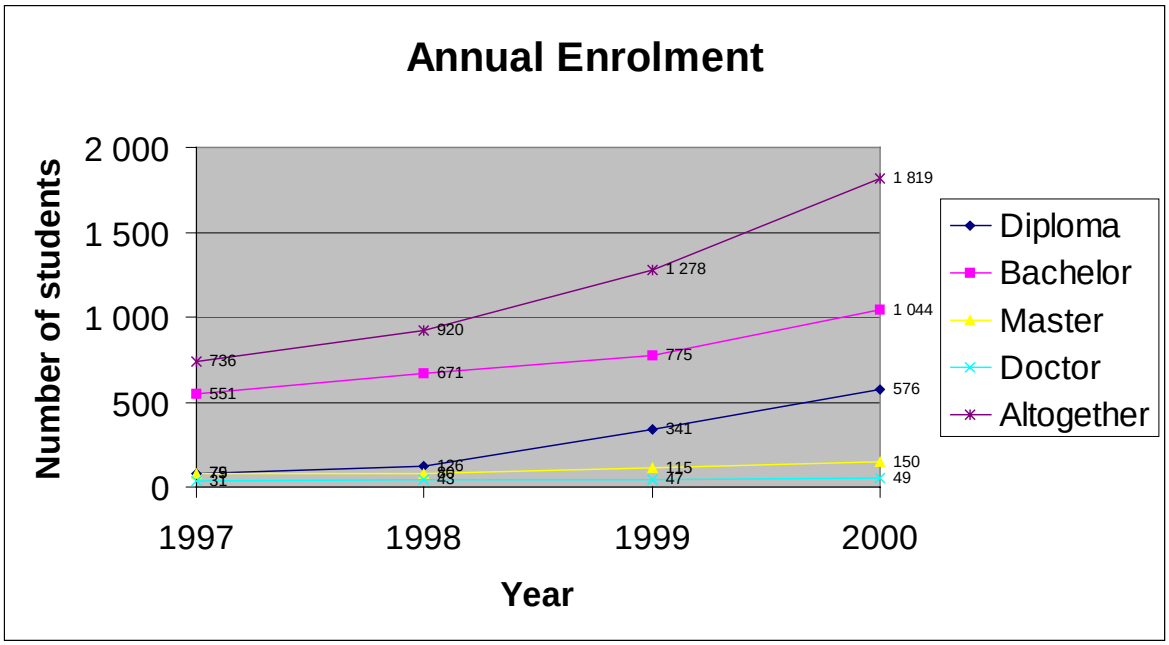


Source: Department of Higher Education, Ministry of Education

LV: Trend in Annual Enrolment in IT Study Programmes in Higher Education Institutions, 1997–2000.



EE: Trend in Annual Enrolment in Mathematics and Computer Sciences by Study Programme, 1997–2000.



EE: Admission to Bachelor, Master and Doctoral Programmes at the Beginning of the Academic Year 2000/2001.

			Number of new enrolees	In per cent of new enrolees at a given level	In per cent of total, i.e. of all new enrolees	Percentages: next / previous level * 100
Bachelor	Total		6 920	100 %	74	-
	University of Tartu		2 337	42		-
		Mathematics & computer sciences	142	3		-
	Tallinn Technical University		1 229	22		-
		Mathematics & computer sciences	123	2		-
		Engineering	874	16		-
Master	Total		2 074	100 %	22	30
	University of Tartu		970	51		42
		Mathematics & computer sciences	41	2		29
	Tallinn Technical University		468	25		38
		Mathematics & computer sciences	28	1		23
		Engineering	207	11		24
Doctor	Total		370	100 %	4	18
	University of Tartu		240	65		25
		Mathematics & computer sciences	10	3		24
	Tallinn Technical University		55	15		12
		Mathematics & computer sciences	1	0.3		4
		Engineering	40	11		19
Total			9 404	-	100 %	-

EE: Number of Students in Mathematics and Computer Sciences in Higher Education Institutions by Study Programme in 2000.

		Total	Diploma	Bachelor	Master	Doctoral
Admission						
Total		728	335	309	73	11
	University of Tartu	281	88	142	41	10
	Tallinn Technical University	238	86	123	28	1
Enrolment						
Total		1 819	576	1 044	150	49
	University of Tartu	702	136	446	80	40
	Tallinn Technical University	743	235	439	60	9
Graduates						
Total		103	3	76	20	4
	University of Tartu	76	3	57	13	3
	Tallinn Technical University	26	0	19	6	1

EE: Number of Students in Engineering in Higher Education Institutions by Study Programme in 2000.

	Total	Diploma	Bachelor	Master	Doctoral
Admission	1 968	658	1 032	229	49
Enrolment	7 126	1 499	5 028	429	170
Graduates	619	76	474	61	8

4.2.4 Languages of Instruction

In Lithuania 99.4 per cent of the students followed the teaching in Lithuanian in the academic year 2000/2001.

LV: Languages of Instruction in Higher Education Institutions at the Beginning of the Academic Year 2000/2001 (in per cent).

	Share of enrolment %		
	Latvian	Russian	English
Total	84	8	8
Latvian University	80	0	20
Riga Technical University	97	0	3
Transport and Telecommunication Institute	12	85	3

EE: Languages of Instruction in Higher Education Institutions by Field of Study and Programme at the Beginning of the Academic Year 2000/2001 (in per cent).

	Share of enrolment in mathematics and computer science %			Share of enrolment in engineering %		
	Estonian	Russian	English	Estonian	Russian	English
Diploma	100	0	0	100	0	0
Bachelor	83	17	0	80	20	0
Master	100	0	0	100	0	0
Doctoral	100	0	0	100	0	0

EE: Languages of Instruction by Type of Higher Education Institution at the Beginning of the Academic Year 2000/2001 (in per cent).

	Share of graduates %		
	Estonian	Russian	English
Total	89	9	3
Public universities	97	3	0.1
Private universities	79	0.6	20
Public higher school diploma courses	98	3	0
Private higher school diploma courses	29	71	0

4.2.5 Student-Staff Ratio in Universities

LV: Students per Member of Academic Staff in Higher Education Institutions at the Beginning of the Academic Year 2000/2001.

		Student-staff ratio
Total		23
State institutions		23
	Latvian University	35
	Riga Technical University	25
Private institutions		22
	Transport and Telecommunication Institute	20

EE: Students per Member of Academic Staff in Universities at the Beginning of the Academic Year 2000/2001.

		Student-staff ratio
Total		14
Public universities		13
Private universities		25

4.3 Current State of the Universities

4.3.1 Student Quality

4.3.1.1 Competition among the Applicants

In the first wild years following independence, economic transformation offered lucrative opportunities to make instant money in business. At the same time, the financial resources of people were very scarce. Therefore the motivation of young people to study sank and student numbers dropped. When the economy started to mature and stabilise, university degrees gained more esteem due to tightening competition in the labour market. Nowadays it is much less likely to start a career as a 19-year old managing director.

ICT related study fields (informatics, computer science, telecommunications) are popular among Baltic secondary school graduates, because the salaries paid by the ICT companies are substantially above the average and finding a job is guaranteed owing to the high demand for ICT specialists. In addition, some people remember the strong tradition in mathematics as well as natural and engineering sciences in the Soviet Union, a heritage which facilitates a cultural flair for orientating to technical studies, making the psychological threshold lower. Hence the study places are subject to a keen competition with the result that the faculties are able to screen the best applicants. Professors are content with their freshmen, characterising them as talented, skilful and motivated.

The traditional fields of engineering, such as electronics, electrical and mechanical engineering, reached the nadir in the 1990s as a consequence of the demise of the Soviet plants. The numbers of students dropped drastically and the institutes shrank in size. Electronics and automation survived best in Lithuania where the faculties remained quite robust. Orientation to telecommunication further increased their attractiveness. Following the recent developments in the market, some revival of interest in engineering studies is to be observed all over the Baltics.

After independence, it was not only lack of demand which explained the exodus of students from engineering studies but also the *Zeitgeist*. Engineering appeared unfashionable in the eyes of the youngsters. Law, economics and business administration emerged as new, attractive fields which promised lucrative career opportunities. Now when the biggest gap in the supply of these business professionals has been filled, young people start to realise that business studies do not automatically lead to a director's post. Thus the appeal of economic and social sciences is slightly weakening, while technical sciences – computer science in particular – is gaining in popularity.

The Baltic States are committed to increasing the number of study places in ICT. One way to realise this goal is to establish private higher educational institutions next to the state universities, like Tallinn's IT college or Latvian plans to open a Danish-funded IT college in Riga. The Tallinn college appeals to students because it possesses better equipped computer laboratories than the university. However, the Dean of Tallinn's IT college warns about counting too much on the possibilities for infinitely expanding private education due to the financial constraints caused by tuition fees. When Tallinn's IT college started, the number of students had been assessed to be twice as high as it actually was. The competition for scholarships is high, whereas the self-financing places are not so competitive with the consequence that the latter are filled with students with a mixed background and skill level. Because of the prevailing living standard in Estonia, students prefer state financed studies, even if they are forced to compromise over their dream field. Thus the supply of potential IT students who are willing to pay for their education has its limits. Moreover, one should remember the effect of the diminishing age cohorts in the near future.

4.3.1.2 Mathematical Skills of the Freshmen

The Baltic pupils have had the reputation of leaving school with strong mathematical skills, since the Soviet schools used to have a large number of weekly hours in mathematics with a demanding curricula. Up to now Baltic pupils have been successful in international competitions in mathematics, winning prizes in them. The Third International Mathematics and Science Survey 2000 ranks Latvia on the 18th place in the knowledge of mathematics, overtaking for instance the United States and the United Kingdom.

The assessments of the professors interviewed are nevertheless not solely positive. The professors are fairly satisfied with the mathematical skills of the freshmen, believing that the level is better than in many Western countries. (In this connection it should be remembered that popular faculties are able to pick the best applicants from the bulk of all applicants.) Simultaneously the professors refer to increasing disparities between schools, which results in a heterogeneity of pupils' mathematical skills. Small rural schools often fall short of the national average, whereas specialised secondary schools produce excellent students. That is to say, mathematical skills are diversified, depending on the school the pupil has attended.

Insufficient mathematical skills are one of the main explanatory factors for the first year drop outs. There was a time when Riga Technical University offered a catch-up course in mathematics for those first year students whose skills were insufficient. Yet it gave up these extra courses after the examination in mathematics became obligatory for every school.

In Latvia it is commonly maintained that the average level in mathematics has been deteriorating. After independence the Latvian schools were granted considerable freedom in defining their curricula, while a uniform country-wide teaching programme was abolished. Before the introduction of the centralised state examination, pupils were not obliged to take an exam in mathematics when leaving secondary school. At the same time there was a need to renew teaching in subjects neglected during the Soviet time, such as history. As a consequence, the instruction in mathematics and natural sciences was drastically cut down in some schools with the result that the quality suffered. Some professors further complain that contemporary young people are so indolent and comfort-loving that they do not want work hard on difficult items. Therefore they prefer social sciences to mathematics and physics.

The Faculty of Informatics and Mathematics in Vilnius University runs the Lithuanian School of Young Mathematicians for secondary school pupils, because the Faculty pays a lot of attention to mathematical skills. The Lithuanian School of Young Mathematicians operates through the internet with a distance learning method. The School, lasting two years, targets mathematically gifted pupils who are attending the last classes of the secondary school and provides them with demanding extra-curricular exercises in mathematics. Pupils interested in extending their knowledge in mathematics must first pass an entrance examination before they are admitted to the School. More than one thousand pupils take part in it, which shows how popular it is. The entrance fee is only 40 litas (11.6 euros). Exercises on eight different topics are sent to the pupils via internet approximately once a month. Teachers and students of the faculty correct and evaluate them. University students also prepare learning materials for the School as exercises for their courses; for instance, they prepare web pages where they explain various mathematical concepts, such as the linear function or the theorem of Pythagoras. A similar school was in existence already during the Soviet time but it was closed down in the early years of independence until the faculty restarted it in 1998.[37]

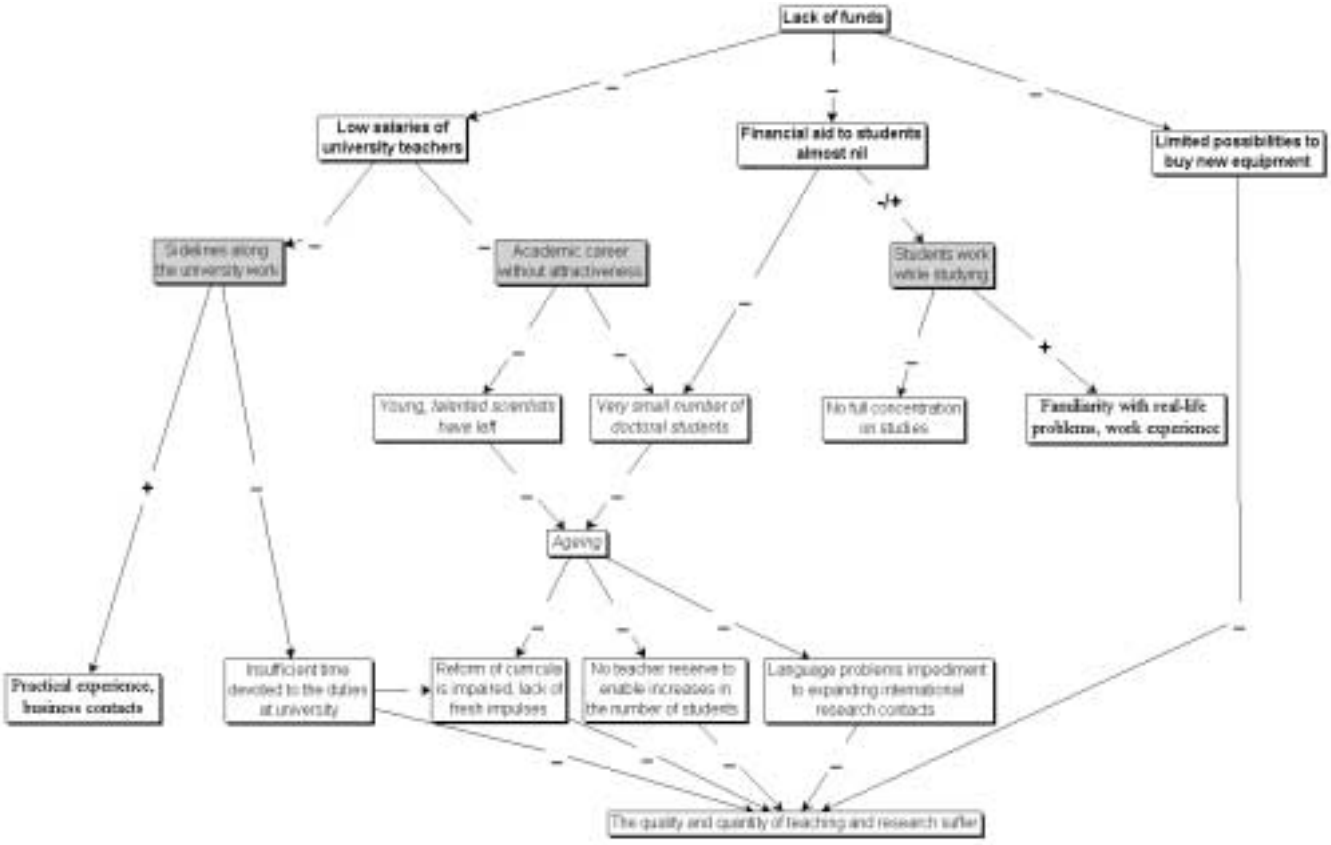
4.3.2 Impact of Financial Problems

The poor financing of higher education in the Baltic countries does not leave the university system unaffected. Its detrimental consequences are felt in three spheres at least: 1) The salaries of university teachers and researchers, including professors, are uncompetitively low. 2) The financial aid to students is ineffective. 3) The universities

[37] CD-ROM of the Academic Information Centre of Latvia 2001; *Higher Education in Lithuania* 2001, 45–46; Maceika 6.11.2001; Vaht et al. 2000, 20–22.

cannot afford to renew their equipment adequately. These drawbacks lead to further negative implications, which are likely to have an unfavourable impact on the prerequisites for instruction and research at universities.

Chart. The Effects of Resource Shortage on the Baltic Universities.



Low Salaries

The salaries of all public sector employees lag far behind those paid for professionals working in private enterprise. In the ICT branch the income gap is conspicuously wide because the ICT industry is placed at the top of the salary level. Private ICT companies offer earnings that are from three to five times higher than at universities. A professor earns roughly the average of this particular sector, but it has taken years to reach the necessary academic qualifications to become a professor. The same earnings can be achieved much faster without an academic background - for example, a young Bachelor of science who has just graduated can earn four times more than a docent with a Dr. Habil. degree.

➨ Aside from their regular work at universities, university teachers work for companies or run a business of their own in fields such as ICT and electronics where their know-how is demanded. If there are other state universities, private universities or evening courses for part-time students, a university teacher finds a number of options to give

courses in several places in parallel. One teacher can simultaneously teach at up to six educational institutes. Professors are invited to participate in state committees or lead public projects. The sidelines are particularly pronounced in Latvia where one can hardly talk about full-time professors and docents in ICT, though the phenomenon exists in all three countries. Many lecturers and research fellows have a full-time job in some company while they also give courses at the university, but that is slightly different.

+ Teachers' working at companies brings certain advantages to the university. Teachers are in touch with practical life, they learn about real-life projects and broaden their network among businesspeople. These business contacts can bring contracts to the university, contributing to the collaboration between universities and enterprises.

- The disadvantage is that university teachers hardly have enough time for carrying out research and preparing their courses properly. If they are constantly running from one place to another, their days are filled with routines. At the same time professors may complain about too heavy teaching loads and the burden of administrative duties at their institute or faculty. One professor formulates the problem as follows:

  ”If I am teaching six to seven courses, I do not have enough time to prepare very good handouts for all these courses. I am trying to do one or two each year but IT is changing so rapidly that I cannot follow. -- We have only 24 hours and we have not planned any special time for research. We do what we can... -- All our research projects are small. We cannot speak about large, serious projects. The reason is that we have not even enough time to prepare serious proposals. It is time-consuming.”

➨ Academic professions suffer from low prestige in the youngsters’ eyes since a badly paid academic career does not appeal to them. Talented researchers of the younger generation switched to private enterprise or moved abroad in the 1990s, and no new generation of scientists is replacing them as the graduates do not want stay at universities. Normally they already work in a company when they get their Bachelor’s degree, which makes it hard to persuade them to continue with postgraduate studies. The study grants of the doctoral students are below the subsistence minimum - for instance in Latvia the monthly allowance was 60 lats (100 euros) in 2001. Thus it is no wonder that the number of doctoral students is extremely small when the demand in the labour market is simultaneously high and the salaries are good. As a consequence, the ageing of the university teachers constitutes a serious problem as the average age of professors approaches 60 years. After a few years many professors will retire, raising the question of succession. A pessimistic commentator fears that university education in ICT may be lost within some five years, if the universities do not get more money.

➨➨ The critical staffing situation sets limits to the possibilities for drastically increasing the number of students or for establishing new higher educational institutes. The existing plans rest on inviting visiting professors and lecturers from abroad for a fixed term and further recycling the existing staff, but one could ask how realistic that is. It should be also taken into account that by character ICT and electronics are disciplines which require laboratory exercises in small groups with an interplay between

the instructor and a student. It is impossible to rely on mass lectures to 500 students. With minimal staff, it is difficult to develop modern interactive teaching methods.

➨➨ New faces bring new ideas but in the Baltics this natural renewal is missing. Old professors are less likely to seek out new paths for reorientating the research. They are often biased to basic research and are not aware of the requirements of the market with the result that their projects are based on the research interests of scientists alone.

The foundations of the instruction undoubtedly rest on high competence but one hears voices from the ranks of students and local companies that criticise the shortage of state-of-the-art knowledge concerning the latest technologies and business administration. The critics blame the teaching as old-fashioned and unpractical. Many firms organise an internal training period for their new recruits from university. The interaction between students and professors is distant, formal and hierarchical as the authority of a professor is strong. Students are not encouraged to ask questions or defy entrenched truths. It is not easy for a student to approach a professor to look for help.

➨➨As regards research collaboration with foreign universities and research institutes, the language barrier sometimes constitutes a hindrance to intensifying international contacts. Not all elder professors speak satisfactorily any other foreign language but Russian, whereas most young people with higher education have a relatively good command of English.

Financial Aid to Students Minimal

A student's monthly allowance in Latvia was about eight lats (13 euros) in 2001/2002, a sum on which nobody can live. The study loan system is only now being prepared. The level of financial support is likewise very low in Estonia and Lithuania, whereas the living costs in the capitals, where most of the students have to live, are above those in the countryside and provincial towns.

➨ Students need money and IT firms have until recently suffered from a shortage of specialists, a condition which has compelled them to hire students. In Latvia most students work regularly from the second or third year; in Lithuania they usually take full-time jobs during the third or fourth year at the latest. In Estonia the circumstances are roughly the same. It is a rule that Master and Ph.D. students work. The example of university teachers can also affect attitudes as students see that their teachers have work on the side.

Many students also value work over studies, maintaining that real work is the best education. An extreme case is a conceited group of overly self-confident young persons who believe that they will acquire the necessary skills better without any schooling or they will handle their studies with their left hand because the university courses offer them nothing new or useful. The standard answer to any enquiries of how they manage all this is simple: "We are clever people." Freshmen who stress a familiarity with programming languages exclusively get disappointed when they attend the introductory courses at universities because the curriculum contains basics of engineering and natural sciences. Students who have this kind of attitude wonder why the study times in many Western European countries are so long. Between the lines one can perhaps read that

they regard Western students as less intelligent than themselves. The same people cannot understand why it would make sense to obtain a doctor's degree if one gets a well-paid job with a Bachelor's degree. Postgraduate studies would only mean a loss of income, even though the main thing in life is to make money.

➨ As shown above, graduates have little incentive to take doctoral studies. Even if the person is interested in studying further, the financial constraint makes the choice difficult.

➨ Opinions diverge as to the desirability of combining studies with a full-time job. The defenders treat work in the industry as an integral part of overall education as much as theoretical courses. They emphasise the valuable practical experience which contributes to studies as well. It is helpful in preparing a Bachelor's thesis for instance. Students also learn to know modern technologies and become involved in real-life projects. Those who are sceptical about the quality of university education feel that students learn more useful things in companies than in outdated university classes. When a student graduates, he/she already knows the practices of working life and does not need to look for work.

➨➨ Nobody disputes the value of work experience, but those who take a more critical stand on the issue are concerned about the quality of studies when students devote only a small part of their time to university. Working students attend lectures sporadically, if at all. Moreover, working prolongs graduation times so that working students often cannot finish their studies in four years as scheduled. It also affects drop-out rates.

Recently many young people have begun to see the significance of formal education in the new light, which can be noticed in the increasing interest in Master's studies. While the number of state financed study places for Master programmes is small, the competition is getting keener for them. Respectively de facto drop outs who have been busy working are returning to lecture rooms. The reason for this change in mood can be derived from the reduced demand in the IT market. The international slump in IT is reflected in the Baltics too, and the outsourcing industry is slowly withdrawing from these countries.

In Latvia a policy change accompanies the new tendency. The focus of the policy used to be placed on increasing the enrolment numbers but now the emphasis is being shifted from quantity to quality. The objective is to encourage students to continue their studies in order to raise the general competence level, instead of producing just basic programmers. The industry has awakened to the threatened shortage of specialists at the highest level with a doctoral degree which are needed if Latvia is to sustain any R&D in the future.

No Money to Buy New Equipment

When the manpower costs eat up nearly the whole budget for universities, there is little money left for modernising the equipment and buying new books for the library. The buildings remain unrenovated and their corridors are unlit in some places in order to save electricity. Once famed and celebrated research institutes in traditionally strong fields, such as electronics, look like museums of technology nowadays. Because the old

equipment is Soviet built, the dependence on eastern technology makes its maintenance and repair difficult. It is hard to find spare parts when something gets broken - the only hope is Russia. A Latvian professor of radioelectronics cites an example of the scarcity of public funding: the annual sum allocated to the renewal of infrastructure in Latvia equals the price of one modern control apparatus in his field. The universities set their hopes on European programmes and donations from foreign companies. What is positive is that the universities have been able to furnish many computer laboratories to the extent that some professors are quite satisfied with their condition.

4.3.3 Assessments on the Quality of University Education

A constant shortage of resources is not likely to do any good for the quality of teaching, though it is not possible to evaluate its implications in this context. Besides, the signals are somewhat contradictory. Nokia's internal survey on the technical education in the Baltics pinpoints similar shortcomings in the learning environment as listed above. It pays attention to the outdated technical equipment as a major deficiency and underlines the low salaries of teachers. The report does not give a flattering picture of the IT education in the Baltics. A representative of Nokia believes personally that students' working along the studies compensates the poor technical furnishing at universities, because only in a such way students get to know the state-of-the-art technologies.[38]

The results of a survey commissioned by Tieto Konts in Latvia in 2000 show that computer science students are not in all respects satisfied with the university education. More than 70 per cent of the students surveyed felt that practical skills are not taught sufficiently at Latvian universities. Skills that students missed mostly included programming, project development and computer network administration. The Estonian e-Vikings study respectively refers to a discrepancy between the needs of the market and the education provided by the universities.[39] Many local companies share these critics, complaining about the poor match between the university education and their needs and referring to a necessity to train new recruitees internally.

The universities defend themselves by saying that their curricula are compatible with the Western ones, which have been used as models in designing them. Managers of foreign companies who work in the Baltics claim to be satisfied with the technical and mathematical skills of their Baltic employees. They often refer to the Soviet past when the Baltic republics used to be prominent scientific centres.

The Latvian Information Technologies and Telecommunications Association (LITTA) asked in its survey from 220 representatives of ICT industry, government and education what should be done to improve education so that it would better serve the development of the ICT sector. Respondents agreed with the suggested measures to the following extent:

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[38] Tamminen 17.5.2001.
[39] Kalvet et al. 2002, 57; Lūsis et al. 2000, 26.

Develop new training programmes	51 %
Award better financing	51 %
Increase salaries of the educational staff	46 %
Admit more students to ICT programmes	31 %
Get companies to co-finance education	29 %
Establish new universities	6 %

The following observations of the student life in Latvia and Lithuania primarily cover the faculties of arts, social sciences and economics. Students who have got scholarships to foreign universities see some differences between the studies abroad and at home. First, they are surprised at how diligently Western students work throughout the term. In Latvia and Lithuania it seems to be typical that students devote themselves to their studies just before the exam period at the end of the term, while most of the time they take it easy. One student describes the style as follows: they pick up their books two weeks before the exam and then read day and night - even on a bus and during meals. In practice it often suffices to read the notes taken at lectures and maybe some articles or chapters from books, instead of going through whole books. The other difference concerns the way students process what they learn. Learning by rote prevails at Latvian and Lithuanian universities, whereas the development of analytical skills is fostered less than in the West. Those who have studied in the United States regret the smaller amount of exercises in a lecture-based teaching system.

Estonia and Latvia have established Academic Education Quality Evaluation Centres under the Ministry of Education to monitor higher education institutions. In Lithuania the same functions are fulfilled in the Ministry of Education. The Academic Education Quality Evaluation Centres co-ordinate national and international evaluations on education and research. The Estonian universities went through an extensive international evaluation in 1999–2000. The Latvians have conducted a number of programme-specific evaluations in the past few years. Recently they have started to translate these evaluations into English and place them on the web site of the Academic Education Quality Evaluation Centre. According to the information received from the Lithuanian Ministry of Education, the last major international evaluation was carried out in 1996.

Programmes to be evaluated:	Four computer-related study fields at all three levels: Informatics, Computer and Systems Engineering, Telecommunication, Electronics and Biomedical Engineering
Faculty:	Faculty of Systems Engineering and Faculty of Information Processing
University:	Tallinn Technical University
Country:	Estonia
Evaluators:	Members of the expert team

1 Professor John Impagliazzo (Chairperson), Hofstra University, USA
2 Professor Peter Johansen, University of Copenhagen, Denmark
3 Professor Theo Ungerer, University of Karlsruhe, Germany

Programme to be evaluated:	Computer Science and Teaching of Informatics
Faculty:	Faculty of Mathematics and Computer Science
University:	University of Tartu
Country:	Estonia
Evaluators:	See above

TTU: The curricula of the study fields are comparable with programmes of similar institutions in Europe. The contents of study correspond well to academic goals.

UT: The Institute of Computer Science offers a quality programme that reflects the tenets of programmes within a classical university. The faculty members demonstrate a high quality of professionalism.

TTU: Teaching methods are rather standard but teaching is generally of high quality. Computers and software are extensively used in teaching and learning.

UT: The methods used are standard. There appears to be a proper proportion of lecture and individual learning within the Bachelor's programme. The programme involves problem-solving tasks and creativity at all levels.

TTU & UT: It is questionable whether the programme offers the newest knowledge and skills because of insufficient facilities.

TTU: The students were generally very content with their study programmes, quality of teaching and examination procedure. Computer access does not cause problems. The quality of laboratory equipment is partly excellent, partly bad and partly terrible. There is definitively need for more modern equipment in some laboratories. A specific problem arises for the students because the teachers often use the newest books available as course books. These books are often available to students only in the limited amount of a single library copy or no copy at all.

UT: Students expressed concern about the quality of teaching when Master-level students sometimes teach lower-level courses rather than the regular academic staff. Computer access for free exercises is limited due to the lack of equipment. Sometimes students must make reservations one week in advance. Students would like better software to meet the quality standards of industry. They use the internet regularly and have access to email, which they use extensively. Some students raised the issue that they cannot work on problems that are more practical. In addition, they voiced concern that the University lacks the monetary resources to purchase specialised software. Specialised hardware is practically non-existent.

TTU: The expert team is concerned about industrial involvement of faculty members who pursue external enterprises. This can easily lead to diminished involvement in their basic research and in their involvement in developing better academic programmes for their students.

UT: The most pressing problem is to recruit a new generation of academic teachers. The graduating students are attracted to positions in industry, which is good for the country. However, without excellence in research and teaching, the quality of the graduating student will diminish.

From Latvia two English evaluations concerning the IT education are summarised below, since they mirror the prevailing circumstances more widely. One is the accreditation committee's assessment on the academic study programme "Computer Control and Computer Science" and the professional study programme "Programming" at the Faculty of Information Technology of the Latvian University of Agriculture; the other is the evaluation of the computer science doctoral studies programme at the University of Latvia. Both evaluations assess the quality of the programmes to be high.

Programme to be evaluated:	Academic study programme "Computer Control and Computer Science" and professional study programme "Programming"
Faculty:	Faculty of Information Technology
University:	University of Agriculture
Country:	Latvia
Evaluators:	Members of Accreditation Committee:

1. Professor em. Janis Bubenko Jr., Royal Institute of Technology, Stockholm
2. Professor Jüri Kiho, University of Tartu
3. Professor Janis Grundspenkis, Riga Technical University

Positive Remarks

- The Faculty offers quality programmes that reflect the tenets of programmes within a classical university. The Faculty members demonstrate a high quality of professionalism and the programmes they teach are fundamentally comparable to other classical universities in Europe.

- The programmes and courses are nicely and systematically designed. There appears to be a proper portion of lecture and individual learning within the programmes. Proper attention is also paid to develop and/or adapt modern teaching/learning methods. The educational programmes very much involve problem-solving tasks and creativity at all level. Computers are used extensively.
- The commission found the structure of the study programmes satisfactory. The inclusion of 20 credit points practical training in the professional programme is adequate, but more attention should be paid to the quality of practical work training.
- Facilities in terms of rooms as well as computing and networking equipment meet the requirements of the study programmes.
- Potential future employers are enthusiastic about the programmes. The students are extremely enthusiastic about the programmes.

Suggestions for Improvement

- Students as well as employers have pointed out the need to increase possibilities for foreign language studies.
- A certain lack of applied courses with high tech topics can also be noted, e.g. distributed systems, parallel and mobile computing, ERP systems, CSCW.
- More attention must be paid to the students' individual work, especially within the academic programme. The current number of term papers is extremely small.
- It is a concern that very little amount of research is performed by the faculty staff in core topics of computer science. There does not seem to exist an explicit supervisory system to monitor the staff.

General Conclusions

- Studies – well organised
- Educational process - high quality
- Teaching methods used - standard
- Modern teaching methods – satisfactory
- Student assessment – fair
- Resources – satisfactory
- Research focus – concern
- Quality assurance system – deficiency

Programme to be evaluated:	Doctoral Programme of Computer Science
Faculty:	Faculty of Physics and Mathematics
University:	University of Latvia
Country:	Latvia
Evaluators:	Members of Accreditation Committee:

1 Professor em. Janis Bubenko Jr., Royal Institute of Technology, Stockholm
2 Professor Jüri Kiho, University of Tartu,
3 Professor Janis Grundspenkis, Riga Technical University

The Faculty offers a quality program that reflect the tenets of Ph.D. programmes within a classical university. The Faculty members demonstrate a high quality of professionalism and the research work at the advisory level is fundamentally comparable to other classical universities within Europe. The graduating procedures seem clear, and they guarantee objective evaluation of candidates.

- The set of Ph.D. study supervisors includes a number of internationally well reputed scientists in computer science. Most of the supervisors have extensive lists of publications and conference presentations, as well as invited lectures at other international centres. However, not all highly qualified supervisors are involved in the supervision of Ph.D. candidates. The involvement of all staff in the programme should be more carefully planned.
- The facilities in terms of rooms and computing and networking equipment meet the requirements of the study programme.

The Commission found a number of issues that urgently need attention and improvement.

- The current number of Ph.D. students is too small compared to the potential of LU and the needs of Latvia. Explicit plans for future recruitment of students are missing. Currently only nine doctoral students are in the programme. The nominal study time will apparently be exceeded in some cases, evidently because of extensive involvement of students in outside labor activities.
- The scope of the topics of the programme could be broadened in order to make it attractive to students with interests bordering traditional core topics of computer science.
- One of the pressing problems is to recruit a new generation of qualified professors and associated professors. The average age of professors is 62 and associated professors 51. Graduated Ph.D.s are attracted to well-paid positions in industry and companies. There is no explicit plan to involve graduates of the programme into research and teaching at the Faculty.
- It should be mentioned as a concern that the lists of theoretical courses contain only current courses at Master or even Bachelor level.

4.3.4 Assessments on the Quality of the University Research

The research is presumably affected more severely by the frailties of the system than the teaching. In many university departments the teaching function clearly prevails over the research function, nearly smothering it. Paradoxically this constellation repeats the Soviet model since it unintentionally separates higher education from science. In fields of science where the research tradition is robust with top scientists, the research has survived better, achieving continuously remarkable results. However, where the background is weak, the risk of a department to degenerate into a "school" is larger. Sometimes the university teachers are not motivated to start practising research if they lack former experience inherent in the research tradition. In ICT, professors are actively involved in managing practical programming projects but they are not necessarily frontrunners of technology development. Also when the university teachers face plenty of parallel work opportunities elsewhere, they will inevitably run out of time.

Even though the universities are precluded from doing their best in research as a result of external circumstances, various evaluation teams have identified a number of good, even excellent research groups by international standards. The key notes of the Estonian evaluation on IT-related research are summarised below. The analysis of the Lithuanian research system, which is presented in Chapter 4.4.1, rests to a great extent on an international evaluation from 1996. The Lithuanian report is already pretty old but its main findings seem to be congruent with other more recent sources that have also been used.

Field to be evaluated:	Information technology and systems engineering
Academic units:	Institute of Computer Science (UT) Department of Information Technology (UT) Faculty of Information Processing (TTU) Faculty of Systems Engineering (TTU)
University:	Tallinn Technical University and University of Tartu
Country:	Estonia
Evaluators:	Members of the evaluation team:
1 Professor Karl-Erik Årzén (Chairperson), Lund University, Sweden 2 Professor Janis Grundspenkis, Riga Technical University, Latvia 3 Professor Kai Koskimies, Tampere University of Technology, Finland 4 Professor Peeter Normak, Tallinn Pedagogical University, Estonia	

GENERAL OBSERVATIONS CONCERNING IT-RELATED RESEARCH IN ESTONIA

The situation for IT-related academic research in Estonia today is to a great extent decided by factors that are outside the control of the involved research institutes and research leaders. The main such factor is the current economic situation in Estonia, caused by its rapid transition from Soviet-controlled to a western-style, democratic country. The major result of this is a large difference in salaries between universities and industries, at all levels from M.Sc. students to professors. Due to this it is very difficult for the universities to keep their current staff and students and to recruit enough students for post-graduate studies. The situation is particularly alarming at the student and young faculty staff level. The result is t situation remains the situation at the universities will rapidly become unmanageable.

The economical situation also has other effects. It forces the majority of the Masters and Ph.D. level students to work in parallel with their studies, in many cases to a very large degree. This extends the study period and decreases throughput. The need for extra income sources is also seen at senior staff level. Many university departments have created spin-off companies that remain affiliated with the department. This is, of course mainly positive, since it makes it possible to rapidly transfer research results to industry. However, in many cases the boundary between the companies and the department is vague, e.g., with respect to economy. It is also common that senior staff work part time for the companies. In the long run this has serious consequences for their basic research competence.

The strong involvement with companies at the student level also affects the nature and topics of the research. Since the companies to large degree finance the studies they, quite naturally, want to have influence on the research topics. This favours research that is directly commercially applicable, i.e., applied research rather than basic research. A sound research environment should contain a balance between applied and basic research. It also favors research in areas that are “hot” or with a large amount of “hype”. It thus becomes even more important to use the correct buzzwords to describe the research. The only possibility to continue to do basic research is either to find students that are very theoretically inclined, to work in areas without direct current interest for Estonian industry, or to have a strong enough research network and position that allow finding external, e.g., international, funding sources and to use this to improve the financial situation of the students. The latter is a very difficult task. The situation is particularly serious if the governmental funding system gives priority to basic research over applied research. In the worst case it may lead to a situation where Estonian funding agencies give money to research that is relevant from a scientific perspective, but totally irrelevant to the Estonian society and industry.

The lack of research funding also has other consequences. It makes it difficult to travel, thus limiting contributions to international conferences and making it difficult to maintain an international contact network. This decreases the number of international publications, often the number one criterion in research and proposal evaluations, thus making it even more difficult to obtain research funding, especially from EU. Very often the level of research infrastructure does not so much depend on the scientific quality of researchers as on their abilities to attract investors from outside the university.

EVALUATION GRADES

The team assessed 18 research groups. Both the average grade and the median grade were *good to satisfactory*. The Department of Computer Engineering at Tallinn Technical University was the only unit to be rated as *excellent*.

The evaluation team used the following criteria as the basis when assigning grades. The grade e*xcellent* was used for research units that have a very strong international publication record, have good participation in the international research community, have generated several completed Ph.D. theses and have several in progress, have a strong group, and where the future prospects for the area are good. The grade g*ood* was used for research units that have showed continuing high-level international publications, have some participation in the research community, have generated at least one completed Ph.D. thesis and have several in progress, have a strong group, and where the future prospects for the area are good. The grade s*atisfactory* required that the group have some international publications, although on a weak level. Interval grades are given. The grade g*ood to satisfactory* is better than s*atisfactory to good.*

4.3.5 University-Industry Relations

The majority of university researchers and students work in the private sectors both in the field of ICT and electronics. In this sense the contacts between the academic and business world are manifold. Simultaneously the research collaboration between universities and enterprises is weak. Contract research plays a minor role with the exception of some active individuals or institutes. The assignments to be carried out for companies do not often deal with research in the strict sense of the word but are geared to solutions. The Baltic industry does not invest in pure research. Reasons for the weakness of the research collaboration are analysed in the discussion below.

Small local companies lack money.

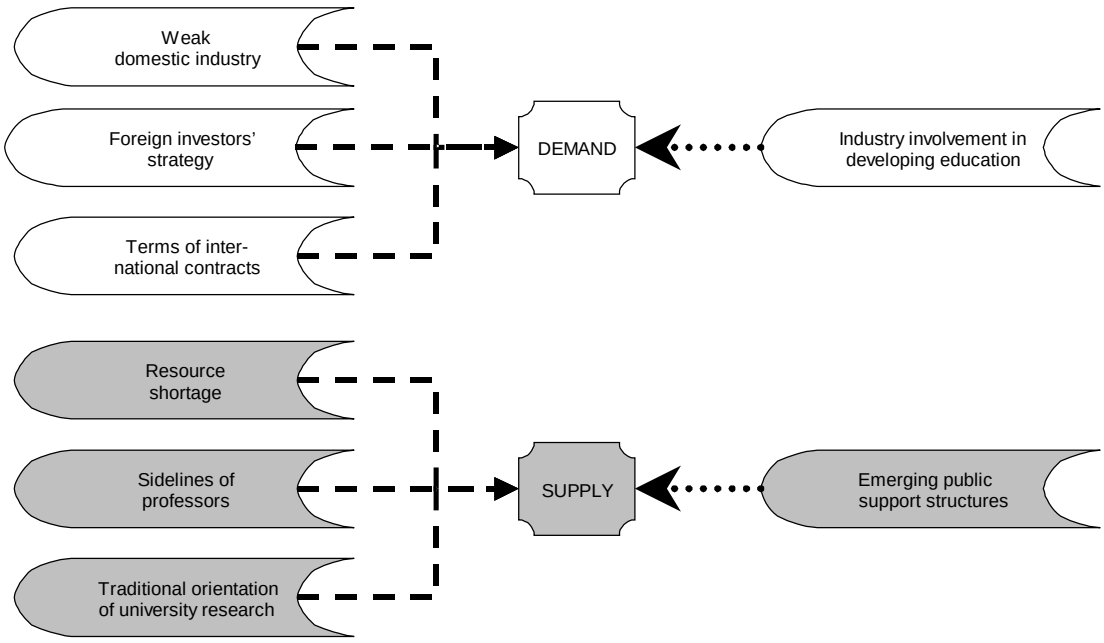
The indigenous industry does not possess sufficient financial means except for a few top companies. The huge Soviet plants in electronics, the former customers of the research institutes, either went bankrupt, shrank in size or were splintered into small companies. Today a typical Baltic enterprise is small and capital-poor, which is reflected in its business strategy. The ICT industry primarily focuses on customised applications instead of developing products of its own. The poor risk taking ability combined with a short-term approach to doing business does not favour R&D either. Both the local and foreign companies have been mainly interested in researchers as good specialists to be hired, which has led to a shortage of scientists at universities. Thanks to the gradual recovery of the local industry, it has recently started to show signs of increasing interested in the co-operation with universities.

Foreign firms do not need research services in the Baltics.

So far the foreign firms have constituted the main customer group of the universities along with the public sector. Telecommunications companies especially have been significant clients but also banks have invested in developing their systems. Still the presence of foreign investors has not stimulated research activities as much as the universities would have wished. The foreign business consists of a subcontracting industry which leans on cheap labour to a great extent. The foreign companies bring ready concepts and technologies from their home countries, instead of developing them in the Baltics.

To sum up, the case of the electronics industry in Estonia illustrates the situation: "If the industry is not at a good level, we cannot do interesting collaboration. Things are getting better but at least one or two years ago Elcoteq was the only one who could say what it needed. Still, it subcontracts simple work and its needs are simple. Other smaller companies could not even define what they need."

Chart. Factors Affecting the Collaboration between Universities and Business Enterprises.



Terms of contracts and tenders are sometimes unfavourable.

The fact that universities lack partners from the enterprise sector constraints their possibilities to compete for certain international projects. The small size of Baltic high tech companies can prohibit them from participating in international tenders, since sometimes organisers define the minimum turnover of the entitled participants. Even when there were no such formal size limit, the biggest projects are usually offered to the biggest companies.

Inexperience in agreeing on the financial terms of a contract can lead to unfair deals. First, apparently lucrative international contracts can turn out to be unfavourable when the pricing is based on the costs-plus-X-per-cent principle. The compensation may not be in relation to the profits rendered, because the research costs in the Baltics are very low. The research costs may be close to zero from the perspective of the foreign company if the revenue from the end product is substantial. There have been cases in which the Baltic scientists have not known who is the true principal and what is the actual use of the results. Second, the pricing of research services can be very mixed so that compensation for similar work can vary excessively. Tallinn Technical University offers for Estonian enterprises a service packet which advises how to conclude an agreement in a proper way and at a proper price.

The readiness of the universities for industrial co-operation has its deficiencies, too.

The preconditions for conducting research at universities are not the best possible for several reasons highlighted in the previous chapter: departments are short of researchers, teaching together with work on the side tends to absorb most of the time, and equipment is deteriorating. The universities have also been accused of an inability to respond to the current needs of the industry.

The critics argue that the universities are too heavily orientated to basic research while they are neglecting applied research. Universities are said to cleave to the scientific tradition, continue working with theoretical questions and concentrate on scientific publications solely when the industry would need a more practical product oriented approach. There are reputable research groups with a 20–30 year tradition without any demand for their know-how in the changed conditions. People with a long successful work history within a certain area easily stick to the past, having difficulties in reorientating themselves.

Owing to the vested interests, it is hard to redirect the allocation of public funds to the new priority sectors when each professor defends his lot jealously. As a consequence, everybody receives something but too little. Furthermore, the universities are blamed for being too passive and inflexible in making contacts with enterprises since they are accustomed to rely on state money and academic freedom. Enterprises sometimes complain that the universities treat them as funding sources without considering the reciprocity in the interaction: professors do not understand that the sponsoring should bring some return to companies too.

Those researchers who co-operate with enterprises get a major part of their funding from the private sector. In many cases one could talk about hidden underground spin-offs even though people are lazy to register their companies officially. The Faculty of Informatics at Kaunas University of Technology receives about 40 per cent of its finances from externally paid research.

Fields like ICT and electronics feel disadvantaged in scientific comparisons because they have fewer doctoral students and scientific publications than purely academic disciplines. The reason for their lagging behind is that their know-how is demanded in industrial development and students have plentiful job opportunities. Strikingly many people in the Baltics see the choice between (basic/theoretical) research and product

development as a juxtaposition, stressing that these countries cannot afford to finance basic research. The following quotation is revealing:

> "In information technology we are oriented towards industrial software development and have no publications in prestigious journals. We should conduct research but it is impossible to focus at the same time on industrial development and research. When we are talking about an industrial customer, it has nothing to do with research."

Support structures aim at facilitating a closer collaboration with the industry.

Structures for supporting the commercialisation of research results and promoting co-operation with the industry are mainly in place but their operation is still at a take-off phase or occurs on a small scale. Usually the universities can present development departments, innovation centres, spin-off programmes and/or technology parks. The number of official spin-offs is nevertheless low.

Estonia has founded about ten competence centres which entail a contribution from the industry as well. A proposal for opening such a competence centre for electronics and communication technologies has been submitted by Tallinn Technical University. Its scope of technologies covers semiconductor, ASIC, embedded software and hardware design. There is also a centre for developing mobile services in Estonia. In Lithuania a provisional project aims at establishing an internet house in Vilnius to promote the utilisation of internet technologies in IT. The Department of Informatics at Vilnius Gediminas Technical University runs a virtual software development company which is activated whenever an order arrives.

In Latvia some university and research institutes emphasise business-related research activities. The most significant of them are the Institute of Mathematics and Computer Science in the University of Latvia, Riga Information Technology Institute (RITI), which is Dati's daughter company, Centre for Applied Computer Science Research and Development, and the Institute of Electronics and Computer Science in the Latvian Academy of Sciences.

The industry contributes to the development of curricula.

The major steps in introducing systematically organised collaboration between universities and enterprises have been taken in the sphere of education rather than research in Latvia and Lithuania. In Latvia the pertinent industrial associations, headed by LITTA, participated in creating the professional programme for IT and developing professional standards. One of the working groups in Latvia's cluster project, co-ordinated by LITTA, focuses on education and is linked with educational establishments. The University of Latvia co-operares with Cisco in the creation and implementation of course programmes.

In Lithuania the Confederation of Industrialists has concluded an agreement with the Kaunas University of Technology on reinforcing the mutual understanding of each other's needs. The agreement covers the improvement of study programmes, the promotion of practical training in the industry and contract research. The largest

Lithuanian IT companies, like Alna, offer scholarships and traineeship programmes to students. In 2002, the mobile telephone operator Bite GSM signed partnership agreements with Kaunas University of Technology and the University of Vilnius on training specialists. Bite GSM will support the development of programmes, teaching and research. In addition, it will assist the universities financially in the acquisition of literature and laboratory equipment and allocate grants to postgraduate students. The Knowledge Economy Forum aims at enhancing the co-operation between universities and business in view to the adaptation of curricula, the practical skills of students and the numbers of technical students.

4.4 Case Studies

4.4.1 Lithuanian Research System

4.4.1.1 Impact of the Soviet Heritage

The fact that Lithuania was part of the Soviet empire, also meant that much of its research was structured and run according to the needs of this empire with a strongly centralised power of direction, which did not give priority to the needs of Lithuania. To protect research from the ideological constraints imposed on teaching at the universities, large, specialised government funded research institutes were established to undertake basic and applied research for industry. Several of the most significant Lithuanian research institutes were set up to serve the Soviet military and space industries, because Lithuania was given an important role as a research pool for the Ministries of Defence and the Military Industry.[40] These research institutes were well funded by Moscow and were allocated challenging scientific problems. In contrast to many former Eastern bloc research institutes serving industries with little interest in innovation, the Lithuanian institutes were expected to deliver applicable outputs. They built up a good track record of delivery, which, in turn, attracted further funding from Moscow. In general, these institutes were of fairly high quality, doing good research.

Lithuania's research role within the Soviet system was also reflected in the technology orientation of its local industry. A rather advanced type of industry, especially mechanical, electrical and electronics engineering, was set up in Lithuania. A large electronics sector, for example, incorporated a focus on the design and production of semiconductors for the space and military industries.

While the Soviet era left Lithuania with a significant asset, independence brought major challenges. A small country was left with an overly large and specialised research system cut off its former users and sources of funding. With the loss of customers both

[40] **Latvia was respectively an integral part of the Soviet military-industrial complex with large research institutes.**

in Russia and locally with the demise of technology oriented industries, downsizing of the research system was inevitable. In contrast to many Eastern bloc countries, the Lithuanian research institutes had been mainly staffed by titular nationals. Consequently, with independence these scientists remained in Lithuania while elsewhere talent was lost as Russian scientists returned home. During the next stage, however, Lithuania lost high quality researchers to European and US universities (and to a lesser extent overseas companies), which proves that there were researchers with something unique to offer.

Despite the restructuring of the research system and collapse of corporate R&D, Lithuania possesses a science base of significant size, which forms a good potential for catching up with international standards. Foreign evaluators have identified a number of excellent research groups that stand up to any international comparison. In specialised niche areas, Lithuania produces research of high quality which has simultaneously both industrial and commercial relevance. At least some of its research has already proved to be of interest to Western companies but the potential for applications is much wider. Biotechnology, laser technology, ultrasound technology, semiconductor physics, precision engineering, cardiology and mathematics are areas where Lithuania has gained an international reputation.

Yet Lithuania's strengths should not be exaggerated, keeping in mind that Soviet technology was not western technology and part of the Soviet era research has no more relevance. Lack of communication with western countries and lack of means to buy western equipment prevented Lithuanian research from reaching international standards. Nowadays opportunities are being missed again because the research environment is less than helpful and support for individual researchers is inadequate. Some features of the Soviet heritage have influenced the present situation, although Lithuanian authorities have made a marked effort to restructure the research:[41]

1. A negative consequence of the isolation from the West is a poor knowledge of English in the older generation of scientists. Since English is the main tool of communication in science, a lack of knowledge in English is a serious obstacle to receiving new ideas from the West. Progress has been made in this aspect, which can be seen in Lithuania's participation in EU programmes and collaborative research programmes with western universities as well as their publishing in leading western journals. The level of activity varies individually from one researcher/research group to another.

2. The separation of research and higher education by encapsulating them into two distinct spheres is reflected in an uneven distribution of teaching responsibilities between research institutes and universities. The university staffs are often overloaded with teaching, having too little time for research, whilst the capacity of the present research institutes is under-utilised in teaching. The research institutes are engaged in teaching to some extent and have some responsibility for the

[41] Bakanauskas 1999, 54; Botham 1999, 10–11, 26–27, 44; Lindqvist 1.6.2001; Research Council of Norway 1996, 4, 6–7, 11, 66

education of Masters and doctors, but they are generally not very active, except for habilitating their own doctors.

3. The Soviet practice tended to make Lithuanian scientists too tied up with their own research world and academic publications. The Soviet research projects were organised in such a way that the research groups themselves had no responsibility for the whole chain from basic research to user application. It was enough to deliver a research report or work out a prototype. As a consequence, part of the research community is not genuinely keen on the use and implementation of research results; it is only committed to science.

4. Research is directed more towards products than productivity, and theoretical research very often has little impact on introducing new important technologies. The strength of the Lithuanian system is that most research institutes and universities integrate basic and applied research.

5. Some research groups are looking back to the "good old days" with generous contracts from the ministries. They are not active enough in searching for substitutes from external sources of financing. Reverse examples of those who have succeeded in generating external research income can be found in plenty, too.[42]

4.4.1.2 Present Challenges

There is a pressing need for better financing of Lithuanian research as the situation at the universities is worrying. The fate of the research institutes has not been guided by a constant policy either. Low national funding and few or no customers make it impossible to keep up with the standard and the staff, thus precluding the universities and the research institutes from doing their best in research. An international evaluation group ends up suggesting a selective approach: it should be insured that the best research in important fields is adequately funded, if necessary at the cost of discontinuing less important research activities. Given the need to create a more rounded science base to meet society's needs, it may be difficult to maintain such overly specialised fields which are not needed to the same extent as before. Unfortunately drastic reductions in research personnel have often been made under immediate economic pressure rather than according to long-term goal-setting so that the reductions are not necessarily compatible with future needs.[43]

The Lithuanian White Book on Science and Technology lists the following functional shortcomings in the country's research system:

- loose ties with the economy and society, weak reaction to demands;

- lack of regulation, no promotion programme to attain strategic goals;

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[42] Botham 1999, 10–11, 27; Research Council of Norway 1996, 7–8, 11, 67–70.
[43] Botham 1999, 28; Research Council of Norway 1996, 4, 9, 11.

- unsatisfactory concentration of the resources for priorities;
- insufficient competitiveness and disposition to internal and international competition;
- poor inter-institutional and interdisciplinary co-operation as well as poor orientation of activities towards the problems and results;
- insufficient speed of regeneration of the ageing R&D personnel and training of the young;
- deteriorating quality of the research because of the obsolete and almost unrenovated technical and experimental equipment.[44]

As a consequence of inadequate funding, salaries of researchers and university teachers are too low. A scientist's career proceeds slowly and rigidly in a step-by-step fashion, whereas companies can offer a well paid position immediately after graduation. As a result, a great many have left the Lithuanian academic world. This condition has lead to the ageing of the researcher pool, because a young researcher generation is not replacing the old one, which will cause a serious shortage situation within a few years time. More than 60 per cent of the researchers are over 50 years old and 25 per cent of them are over 60. In order to satisfy the minimal regeneration needs, it is necessary that 300–400 young scientists become researchers for R&D, but only 150 doctor's degrees are granted per year. The exception was the year 2000, by the end of which there were about 250 young doctors, though in 2001 the number will be smaller (in 2000, the degrees were granted to those admitted for a four- and five-year programme). Simultaneously younger and younger, but already mature scientists go try their luck in the West. In addition to attempting to correct the age distribution, universities should pay attention to the gender distribution.

The excessive load of teaching curtails research activities of the university staff. The teaching takes too much of each teacher's time, even though the low student/teacher ratio is propitious. The teaching depends too much on lectures, instead of relying on textbooks and other means of self-study. A paid sabbatical leave is usually unavailable. Co-operation between universities and research institutes should also be strengthened and the flexibility of the university structures increased. Research personnel should be encouraged to broaden their fields of interest, when it is desirable to meet the changed economic and societal needs. According to the critics, the management is more occupied in finding the means to continue their work within established circumstances, i.e. to maintain the status quo, rather than to addressing the question of reorganisation. The management of the research institutes and laboratories is sometimes accused of inefficiency, low productivity and stagnation. University structures are claimed to be rigid.[45]

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[44] *White Paper on Lithuanian Science and Technology* 2000, 64.
[45] Botham 1999, 28; Research Council of Norway 1996, 4–5, 8–11, 72; *White Paper on Lithuanian Science and Technology* 2000, 34.

4.4.1.3 Science Base

The research system consists of 15 state and 4 non-public university type institutions of higher education, 29 state research institutes and more than 20 smaller state research institutions. The system is hence quite fragmented. Nearly all research and higher education institutions are concentrated in five largest cities: Vilnius, Kaunas, Klaipėda, Šiauliai, and Panevėžys, especially in the first two mentioned. The following ones can be cited as examples of relevant research institutes for the purposes of this study: Mathematics and Informatics, Physics, Semiconductor Physics, and Theoretical Physics and Astronomy. There are smaller research institutions for instance in the fields of electrography and information technology.

The majority of the educational and research institutions fall within the jurisdiction of the Ministry of Education and Science. The Science Council of Lithuania is an autonomous advisory body which assists the government and the parliament in questions concerning the development of research, reorganisation of the research system and allocation of funds. Two thirds of the Council's members are chosen by the scientific community and one third are assigned by the parliament. The Academy of Sciences brings together esteemed scientists for solving major scientific problems, stimulating research and academic studies, establishing international scientific co-operation, acting as independent experts and consultants on science, technology and culture. The Conference of Rectors represents institutions of higher education; the Council of Directors represents state research institutes. The Higher Education Quality Evaluation Centre organises expert assessments on research and pedagogical activity.[46]

Lithuanian science has a strong emphasis on the so called hard or exact sciences (Figures 1 and 2). Within these, physics is relatively pronounced. Technological, physical and natural sciences account for 56 per cent of all R&D expenditure and 43 per cent of all researchers. Research related to the technological infrastructure was deliberately encouraged after liberation. Indeed, research groups working on infrastructure problems found a meaningful place in the new environment. These include telecommunications, energy, water supply and environmental management as well as roads and transportation.

Research which is based on thinking and intellect, such as mathematics, has been able to adjust to the shrinking resources better than experimental research. Experimental research makes up a relatively small part of the science base, although it had increased its share in 2000 compared to the late 1990s (Figure 3). Expenditure on basic research is in turn much higher than in the EU countries. State research institutes seem to emphasise basic research more than universities nowadays (Figure 4). In physical and natural sciences the orientation towards basic research is strong, while technological sciences are more involved in applied research. The latter also show above average activity in experimental development (Figure 5).[47]

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[46] Bakanauskas 1999, 54; Botham 1999, 12–17; Kriaučionyte et al. 1997, 24–35; *White Paper on Lithuanian Science and Technology* 2000, 33–34.
[47] Research Council of Norway 1996, 67–68.

In 2000, about 270 million litas was allocated to the R&D sphere. The amount appears low by western standards, but the low salaries and the higher purchasing power of the dollar in Lithuania should be taken into account when making comparisons. Notwithstanding these reservations, the fact remains that Lithuania's R&D share of GDP lags far behind that of advanced countries. In 1999, expenditures on R&D comprised 0.52 per cent of GDP in Lithuania, whereas in Sweden the corresponding figure was 3.6 per cent, Finland 3.2, in Japan 3.0, in the USA 2.5, in Germany and France around 2.3. The GDP share of state allocations - 0.41 per cent - was however higher than in many western countries. The corresponding figure was 0.23 per cent in the USA, 0.25 in Japan, 0.36 in the EU and about one third in Finland.[48]

The public sector dominates research activities. Universities and state research institutes account for almost four fifths of the whole R&D expenditure (Figure 6). The R&D expenditures of the enterprises shrank during the 1990s. The state budget funds are the main source of R&D funding, even though other sources have recently increased in significance (Figure 7). Presumably the latter refer to EU funding. Furthermore, nearly 97 per cent of all researchers and 99 percent of qualified scientists with a scientific degree or an academic title work either at universities or state research institutes (Figure 8). Their R&D manpower is much higher than the EU average: in Germany, for example, only under 38 per cent of all R&D personnel are employed by the state sector.[49] The total R&D manpower per thousand inhabitants was 4.0 in 2000, which is below the EU average.[50]

4.4.1.4 Science Indicators

An abundance of publications, the intensity of licencing, and patenting activities are used to describe a country's competitiveness and role in the world market. Such indicators refer to economically effective fields in the first place, like IT and telecommunication, biotechnology, microelectronics and new materials.

Every year more international patents come into force in Lithuania than are developed within the country. The Lithuanian State Patent Office received 66 applications from Lithuania and 60 from foreign applicants in 2000 (Figure 9). It granted 148 patents in that year.[51] The number of Lithuanian patent applications has almost halved since 1997. In addition, 3,666 applications to extend the validity of European patents in Lithuania were handed to the State Patent Office. Lithuania imports more high-tech and R&D products than it exports.

Patenting a new product makes sense only if the product has a market and will be protected in this market. Hence it is beneficial to patent only for economically strong

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[48] *White Paper on Lithuanian Science and Technology* 2000, 35–36.
[49] *White Paper on Lithuanian Science and Technology* 2000, 33–34.
[50] Source of the statistical data in this chapter: Statistics Lithuania 2001.
[51] **The difference between the number of applied and granted patents in a given year arises from the handling time of applications**.

companies and institutions which constantly perform market analyses and have economically grounded provisions to produce and distribute new products. The majority of Lithuanian research and higher education institutions and companies involved in applied sciences do not have such opportunities yet. Lithuania could profit from licensing, but up till now very few licences are put in practice.

One index of publication value is the citation indicator. The number of such publications per researcher in developed countries usually comes to 0.5 publications per year. According data from 2000, this indicator is 0.05 in Lithuania. Usually the research institutes publish most. Universities and other higher education institutions follow them. Researchers from the industrial R&D sector put forward fewest publications, but they mostly get patents. Too few Lithuanian scientific publications are known to the international science society, especially those on technological problems.

Even when the publishing activity is viewed from the other angle, the result is the same as above. The number of independent research papers in scientific magazines is also low: the number of publications per researcher is ten times smaller than the average of other countries. In recent years efforts have been taken to promote such publications by using their number as one of the main indicators when evaluating research and higher education institutions. The Ministry of Education and Science use it when distributing state subsidies. The publications have increased in Lithuania by 1.5 times since 1997.

Researchers very often feel bewildered: the support and attention of the Government is shrinking, its demands for the level of research is increasing, but the influence of science on the economy is decreasing. Also the prestige of science and technology in industry is diminishing and the researchers of the first rank are leaving their jobs and emigrating. Such a situation usually develops when there is no socially and industrially based demand, no need for research and no conversion plan for the accumulated knowledge that exists. No less important is the fact that Lithuanian scientists have not been ready to compete under a market economy. First of all applied research does not have a conversion plan, but basic research, as the grounding for applied research, does not have a proper place in economic development.[52]

4.4.1.5 Corporate R&D

While the science base is fairly large, very little research is undertaken in the business sector. The amount of contract research for private companies is also small. It is very unfortunate for the development of applied research that after independence the electrical and electronics industry, among others, suffered a substantial decline, with the consequence that R&D contracts from national industry disappeared. Only a few companies in Lithuania are able or willing to purchase research output nowadays. The scant contract research is mainly undertaken for a limited number of foreign companies.

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[52] *White Paper on Lithuanian Science and Technology* 2000, 38–40, 49.

While the contracts from foreign companies represent export income, the long-term benefits accrue ultimately to foreign firms rather than to the Lithuanian economy. The compensations for subcontracting projects bear no relation to the long-term profit of a successful product, taking into account the low salaries of researchers in Lithuania. Top scientists are thus exploited as cheap subcontractors, even when a contract may appear lucrative at first sight in the prevailing situation. Although no systematic data is available, it is clear that the amount of money from a wider economic perspective rather than that of the individual department or institute is small.

Some contract research arises from participation in the EU's Framework Programmes. Several examples have been recognised where foreign partners had more or less by accident found and recruited Lithuanian researchers. The Lithuanian researchers were operating almost as subcontractors with little link with or understanding of the foreign industrial partner. While this is a further testimony of the strength of Lithuania's science, it also illustrates the need for mechanisms which enable researchers market their knowledge more proactively to foreign companies.

As far as new company formation is concerned, a number of companies have been created from the break-up and downsizing of the research institutes. Individual researchers have been forced to set up businesses of their own when they were laid off. Alternatively, parts of the old research institutes have been privatised and turned into commercial operations. An example of the latter is the former Textiles Institute which now operates as a commercial concern seeking to sell research, consultancy and technology to the textiles industry. Many laser, electronics and biotechnology companies have emerged as successors of research institutes.

A number of current researchers are running their own small companies alongside their regular work. They can also work in other companies on a part-time basis in order to supplement their low salaries, which has the positive effect that they transfer technological know-how to local companies. The creation of spin-offs has been meager and they have not grown into any significant business. The technology based companies hosted by science and technology parks and business incubators are supposed to commercialise the science base. Generally little research has been successfully commercialised, although there are examples of research underpinning economic development. The small number of companies undertaking R&D reduces the commercialisation opportunities.[53]

[53] Botham 1999, 18, 29–30, 44; Research Council of Norway 1996, 67; interviews carried out by the author in Lithuania in October–November 2001.

Figure 1. R&D Expenditure by Field of Science, 2000 (percentages).

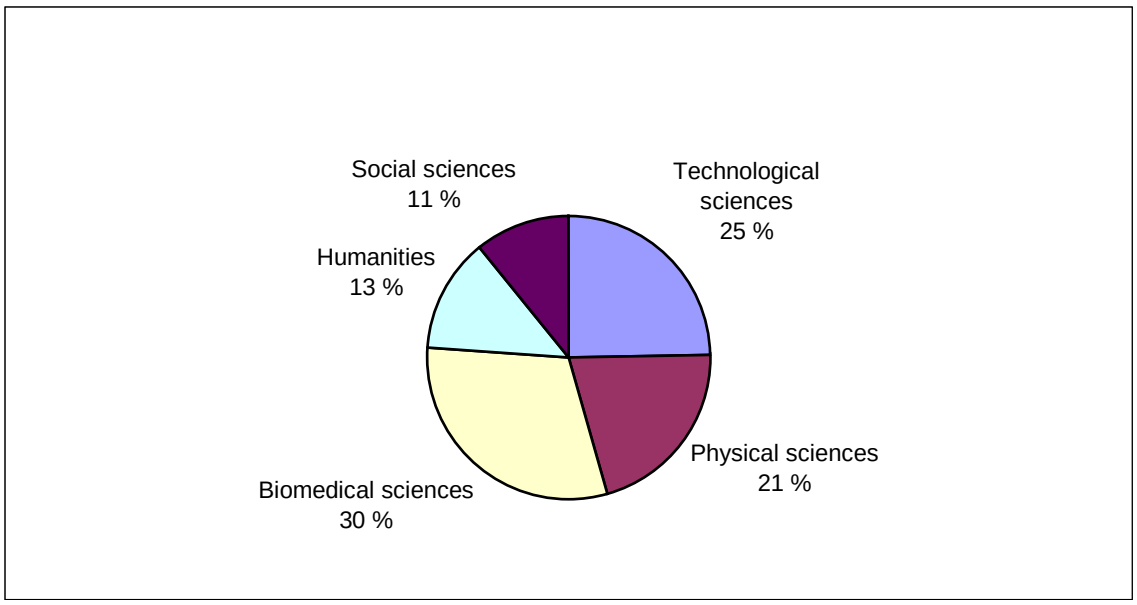


Figure 2. Breakdown of Researches by Field of Science, 2000 (percentages).

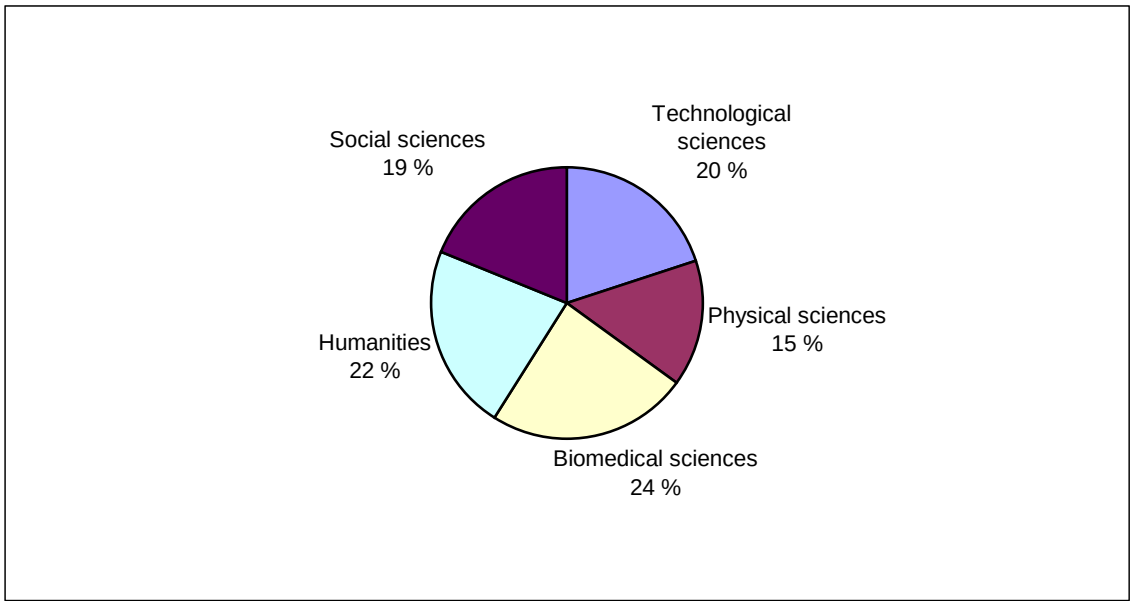


Figure 3. R&D Expenditure by Type of Research, 1997–2000 (percentages).

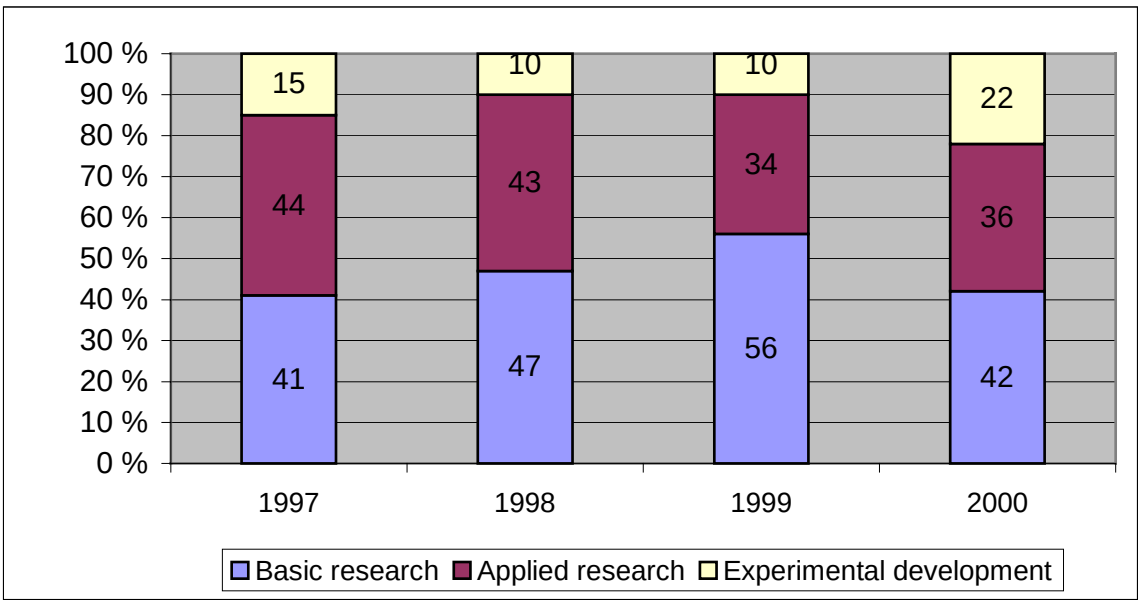


Figure 4. R&D Expenditure by Type of Research within Sectors, 2000 (percentages).

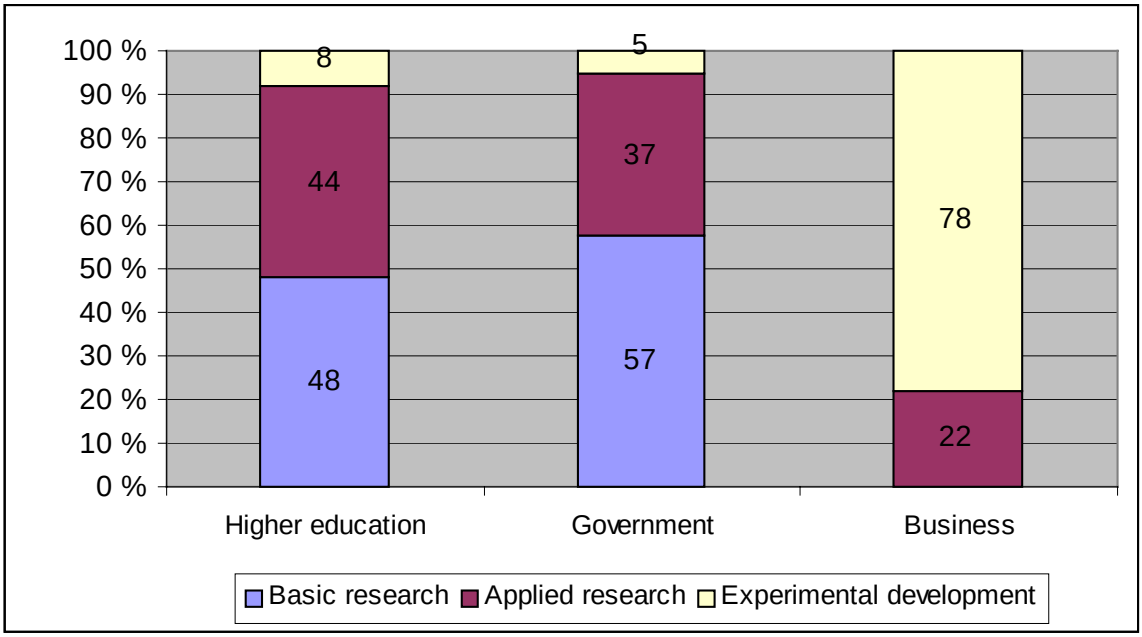


Figure 5. R&D Expenditure by Type of Research within Exact Sciences, 2000 (%).

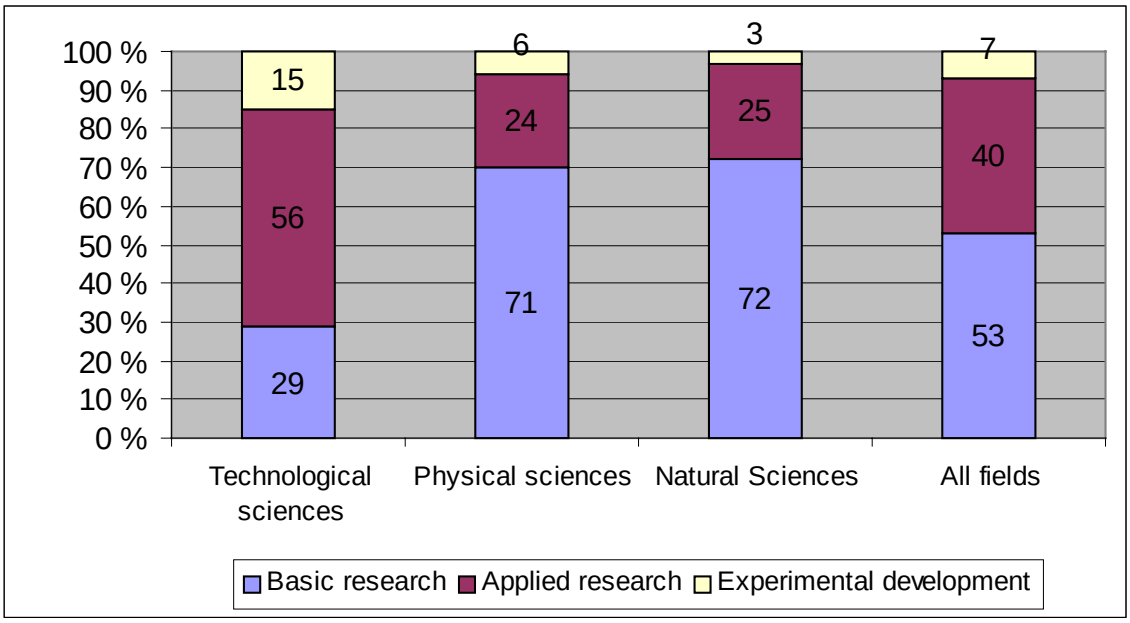


Figure 6. R&D Expenditure by Sector, 2000 (percentages).

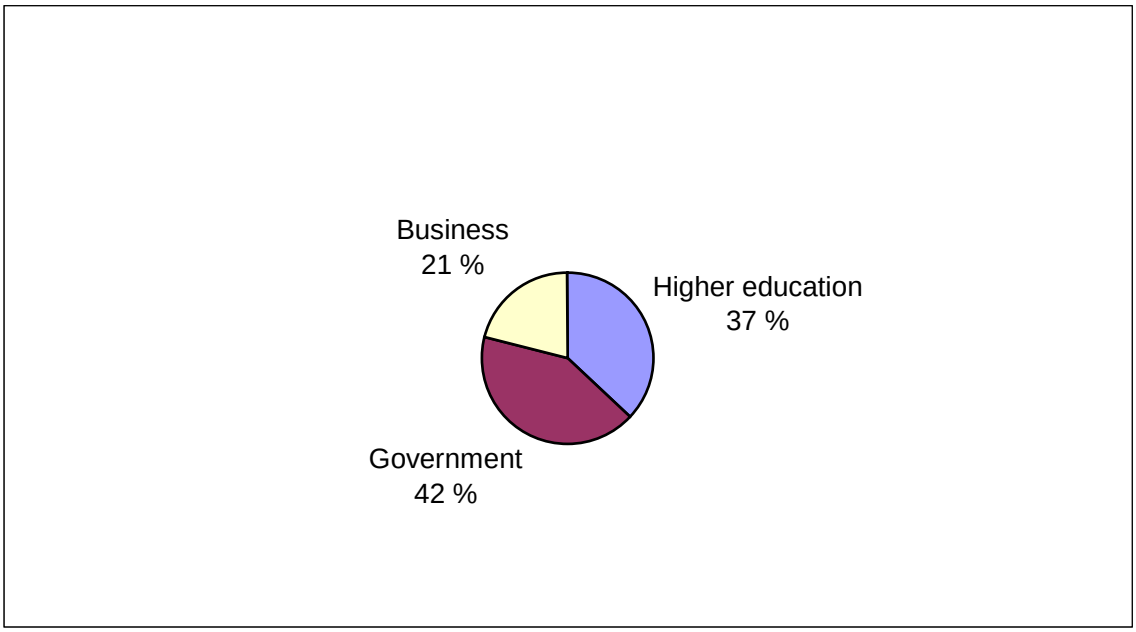


Figure 7. Sources of R&D Financing, 1997–2000 (percentages).

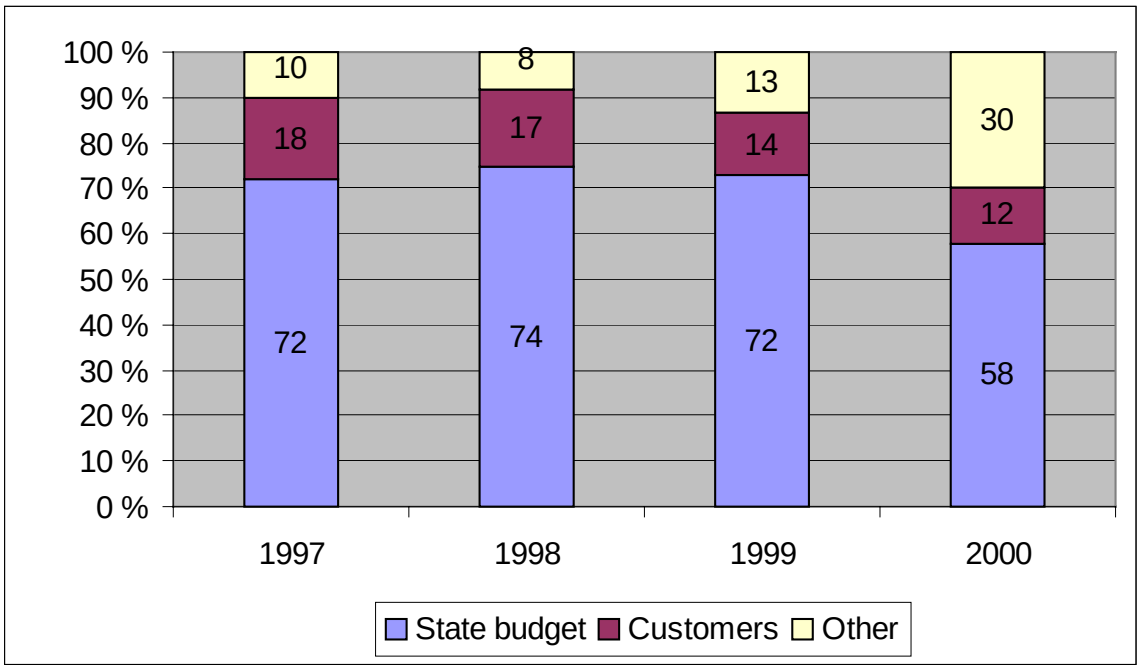


Figure 8. Distribution of R&D Personnel by Sector, 2000 (percentages).

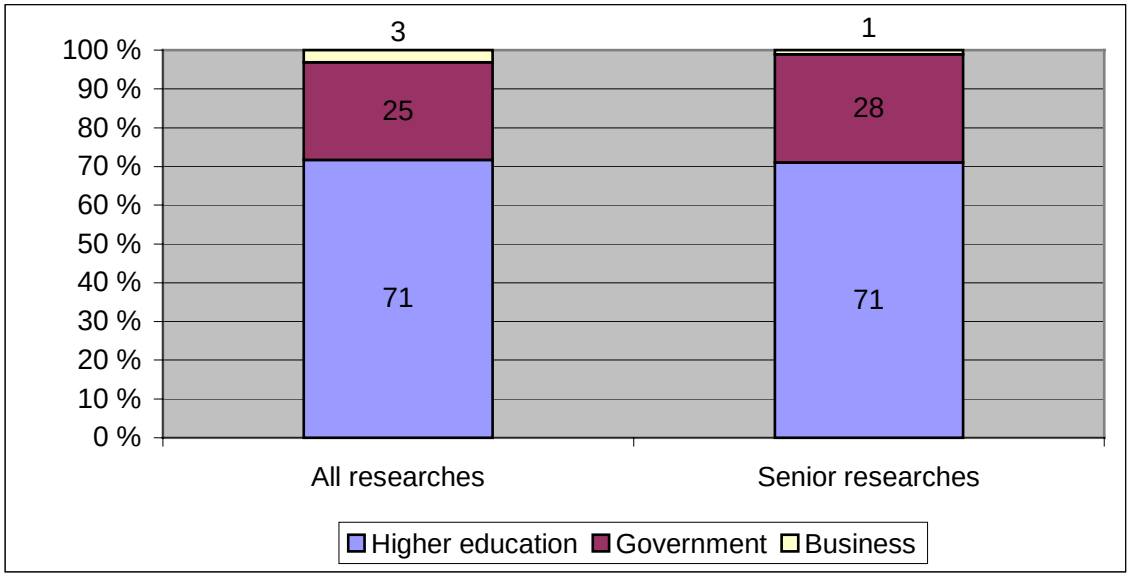
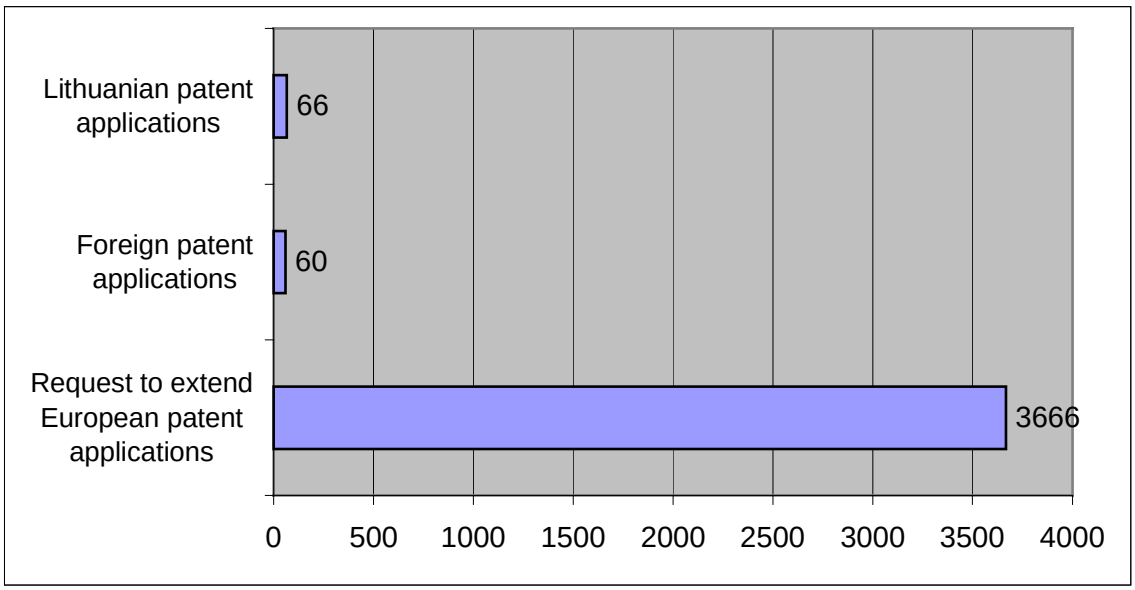


Figure 9. Number of Patent Applications, 2000.



4.4.2 Latvian Research System[54]

Text Box. R&D Statistics from Latvia.

Public investment in R&D of GDP	1,3 %
Researchers per million population, 2000	1,190
Number of countries represented by co-authors in scientific publications, 1997–2001	55
Success Rate at the Fifth Framework Programme, 1999–2001	28 %
Success Rate at the Innovation & SMEs Programme (5th FP), 1999–2001	52 %
The Fifth Framework Programme financing from EC funds as percentage of Latvia's contribution fee, 1999–2001	187 %
Number of patent applications per million population, 2001	157
Licenses sold per million population, 2001	11

Latvia does not have sufficient infrastructure for innovation and cannot keep pace with technological changes. Private companies and public institutions hardly invest in R&D and informatics, which jeopardises future growth and competitiveness of the industry. The level of public investment in R&D is considerably behind EU average of 1.3 per cent of GDP. Little emphasis is placed on universities and research institutes for piloting new fundamental R&D initiatives. Private sector is engaged in chasing short-

[54] International Trade Centre 2002, 72–74; LITTA 2002, 21.

term revenue opportunities rather than reinvesting portion of revenues in applied research and development and creation of breakthrough products and new ventures. There is accent on developing large number of skilled manpower, however, IT industry lacks training of specialists with higher qualifications (Master and doctor's degree) who could lead project implementation.

Various Latvian universities and institutes conduct business-related research activities. University of Latvia's Institute of Mathematics and Computer Science designed and managed Latnet, the server hosting Web sites from all sectors of Latvian society. Currently it focuses on three major research areas:

1. Internet technologies, software engineering, language processing/artificial intelligence
2. Development of new software modelling programs and technologies, including GRADE, Latvia's best-known commercial IT product. GRADE is a graphical modelling tool for complex business and technology systems which is currently used by Boeing, IBM, Siemens and Telecom Italy.
3. Language processing, involving development of Universal Networking Language, a UN funded programme

The Riga Information Technology Institute (RITI) is involved in computer aided systems and software engineering tools. The R&D areas covered are business process re-engineering and modeling, systems and software engineering and modeling, software system application code generation, reverse engineering and CASE data conversion. RITI also undertakes research in development of programming tools, independent testing of software products and development of IT standards and terminology

A center for Applied Computer Science Research and Development is planned in Riga to promote applied research and development in IT service sector. The center is expected to attract additional R&D outsourcing contracts, promote IS cluster as reliable location for R&D activities, mitigate project seasonality, and co-ordinate activities on R&D spending on ideas generated by cluster participants.

The Institute of Solid State Physics in the University of Latvia is involved in basic research in solid state physics and chemistry. It is declared a Centre of Exellence of the EU for its investigations into advanced materials. The Institute of Electronics and Computer Science in the Latvian Academy of Sciences undertakes research in digital signal and data processing. It has founded a joint laboratory in collaboration with Westminster University from the United Kingdom. The Ventspils International Radio Astronomy Centre monitors the environment with a European Group Station Alliance radio telescope system, which is located in various towns in Latvia, Norway and Sweden.

4.4.3 Estonian Research System

R&D Expenditure

The expenditure on R&D is small in Estonia. Between 1995–1999, gross domestic expenditure on R&D was 0.6 per cent of gross domestic product (GDP). In international terms this indicator is very low, constituting only a third of the corresponding average indicator of the EU member states where it was 1.8 per cent in 1998. In developed industrial countries, expenditure on R&D generally constitutes 2–3 per cent of GDP. As the Estonian GDP is about four to five times lower than the average GDP in the EU, the actual amount of money is even smaller than the percentage indicator. Compared with other EU-associated countries, Estonia is outranked by Slovenia, Hungary, the Czech Republic, Poland and Malta, while it overtakes the other Baltic States.

Financing of R&D from the Estonian state budget did not surpass two per cent from 1992–1999. In 1998, the share of public sector spending on R&D was nearly 63 per cent of the total. In the EU member states the corresponding figure for 1998 was 36 per cent. Yet the contribution to R&D by Estonia's public sector is smaller than that of the EU Member States on average: 0.45 per cent of GDP in Estonia as against 0.66 per cent in the EU in 1998.

R&D expenditure by business enterprises was only 0.15 per cent of GDP in 1998, constituting 23 per cent of the aggregate R&D expenditure. Only every 39th business enterprise employing more than 20 persons spent on R&D. R&D expenditures by business enterprises formed merely 0.13 per cent of their net turnover. Business enterprises ordered research from abroad in amounts exceeding the domestic development work by 1.4 times.

In 1998 the total R&D funding was divided as follows: basic research 48 per cent, applied research 39 per cent and technological development 13 per cent. The corresponding ratio was 1 : 0.8 : 0.3. In the developed countries the ratio is reversed with emphasis on development, which forms up to 60 per cent of total R&D. However, types of R&D by fields of science are very different. For example, in 1999 the volume of applied research and development constituted 74 per cent in engineering, development forming 23 per cent.

The state financing of R&D has ensured a high level of basic research in some disciplines but the connection between the emergence of new knowledge and the development of new technologies on the basis of this knowledge has remained weak. Estonia has good preconditions for gaining success in biotechnology, gene technology, information and communication technology, technology of materials, industrial technology and environmental technology.

Human Resources

Human resources as an R&D input is expressed by the number of researchers hired. The largest drop in the number of researchers occurred between 1992–1995. Between 1996–1999 the total number of researchers declined by 15 per cent first and foremost from those without a higher academic degree. In 1998, the total number of researchers was 3,045, including 291 employees in the business enterprise sector (data are given in full-time equivalent, excluding technicians and other supporting staff). So there were 4.3 researchers per 1,000 employees. This is less than the average EU indicator of 5.0 and also that of the OECD countries, which is 5.5. In the same year this number was 7.4 in the USA, 9.2 in Japan, 8.6 in Sweden and 8.3 in Finland.

For the future of Estonian science it is of the utmost importance to involve postgraduate students in research because at present around 40 per cent of the researchers are over 50 years old. In 1999 only two per cent of all the research grant holders were under 30 and 4 per cent were younger than 35. A quarter of them were over 60.

In 1992 the universities started to run doctoral courses, but the slow increase in the number of Ph.D. holders cannot ensure restoring the potential of Estonian science and higher education, to say nothing of providing industry with academically trained employees. To ensure the continuity of academic education and research, Estonia would need 80 new Ph.D. holders per year. It would need another 80 Ph.D. holders annually to provide employees for research institutes outside the public sector. To match Finnish and Swedish rates, it would need 200 new Ph.D. holders annually. Between 1991–1998 thirty-eight students on average obtained a Ph.D. degree in Estonia and 5–10 students abroad. The other critical aspect is that the doctoral students are relatively old. Their average age is 30. The average age of the Ph.D. graduates is 34 at the University of Tartu and 42 at other universities. External Ph.D. students graduate at the age of 43 at the University of Tartu and at the age of 55 elsewhere. Only 20 per cent of the Ph.D. graduates in engineering are under 36.

Patents and Publications

Patenting activity, showing the results of applied research, is very low in Estonia. For the period under discussion, the number of domestic patent applications per year has fluctuated between 12 and 20, whereas the number of foreign applications has multiplied. In Estonia the number of patent applications per 10,000 inhabitants is 0.1, while in the EU member states the average indicator is 2.5. The low patenting activity may be put down to a paucity of inventions having a potential for application, because the national innovation system is oriented towards basic research. There are other reasons as well, such as insufficient knowledge of intellectual property rights, lack of a market and patenting costs.

As regards publications, data are more pleasing. Even though the number of scientists has decreased, the number of publications in international journals has grown. In 1996 there were altogether 439 Citation Index publications from Estonia; in 1999 the number of cited publications had reached 623. More than a half of international publications are written in collaboration with foreign authors. According to the Citation Index, the closest collaboration takes place with Swedish, Finnish, German, US, Russian, French

and British researchers. The per capita number of international publications is smaller in Estonia than in most developed countries but at the same level with Central European countries.

Problems

Although Estonia has achieved many milestones in consolidating its R&D system, there are still problems to be solved:

- Total R&D expenditure is small and the share of corporate R&D is even smaller.
- The proportions of financial allocations among the fields of science have remained almost the same for years. Introduction of new relevant topics is hard because of a vicious circle: without stable teams the level of applications is so low that they fail to get a positive appraisal.
- The financing of technological development has essentially lagged behind that of research.
- It is not possible to purchase modern research equipment. There is no funding for maintaining the existing large size equipment, such as cryostations or electronic microscopes.
- Due to the limited budgets, the departments cannot ensure vacancies for fresh Ph.D. holders.[55]

4.5 International Co-operation

The leading Baltic universities have established an extensive network of international relations with foreign research and higher education institutes. They have bilateral co-operation agreements with individual partner organisations from different countries; they have joined EU programmes for international mobility and research co-operation, such as Tempus, Socrates, Leonardo and the Framework Programmes; they participate in other multilateral arrangements, such as Nordplus, BALTECH, COST and Eureka. In this sense they are formally integrated into the international collaboration.

[55] Kaarli & Laasberg 2001.

4.5.1 Student and Researcher Exchange

The number of foreign partners per university can climb to over 150 universities but the international mobility of students still remains at a much lower level than in Finnish universities for example. Unfortunately there are no unitary statistics available from the Baltic technical universities, which prohibits an accurate comparative calculation of outgoing student mobility. The student flow is approximated here by computing a ratio in which the number of outgoing students is divided by the admission rate within a sample of Baltic technical universities (see table below). The Finnish ratios are extracted from a CIMO report[56]. In Helsinki University of Technology, where the number of students totals some 14,000, the number of outgoing exchange students was 407 and that of incoming students 295 in 2001.

The weak point of the Baltic universities is that the exchange is unbalanced in that the number of outgoing students clearly exceeds that of those incoming. Germany and the Nordic countries are among the main destination countries for Baltic students, as is true in almost all forms of the foreign relations of these states.

FIN+LT+EE: Shares of Outgoing Exchange Students of New Enrolees at Selected Technical Universities in Finland and the Baltics, 2001/2002 (in per cent).

Finnish average	All	19 %
Helsinki University of Technology	HUT	20 %
Lappeenranta University of Technology	LUT	14 %
Tampere University of Technology	TUT	14 %
Vilnius Gediminas Technical University	VGTU	5 %
Kaunas University of Technology	KTU	4 %
Faculty of Informatics in Vilnius University	VU	≈ 3 %
Tallinn Technical University	TTU	3 %

[56] Aalto, Pirjo (2002). *Kansainvälinen liikkuvuus yliopistoissa ja ammattikorkeakouluissa 2001.* CIMO publications 3/2002. Helsinki: Centre for International Mobility.

LT+LV+EE: Basic Statistics on the International Mobility at Selected Technical Universities in 2001/2002.

	Number of Partner Universities		Number of Exchange Students		Number of Exchange Teachers	
	Bilateral	Multilateral	Outgoing	Incoming	Outgoing	Incoming
KTU	84	72	201	106	61	43
VGTU	42	55	139			
TTU	49	46	74	19	12	0
	Enrolment		Foreign students			
			Number		Proportion (%)	
KTU	17 384		44*		0.2*	
VGTU	10 046		98*		0.9*	
TTU	9 046		19		0.2	
RTU	13 878		71		0.5	

* It is not specified whether these data contain exchange students too. If it does, their eventual share is likely to be low judging from the breakdown of the countries of origin. This assumption holds for KTU especially.

LT: Outgoing Students from All Lithuanian Universities, Kaunas University of Technology and Vilnius Gediminas Technical University by Country of Destination, Academic Year 2000.

	Number of students per country		
	All	KTU	VGTU
Germany	315	19	51
Sweden	120	16	13
Denmark	114	15	17
Finland	98	2	11
France	78	15	7
Poland	38	0	18
Other	339	25	30
Total	1,102	92	147

EE: Outgoing Students from Tallinn Technical University by Country of Destination, Academic Year 2001/2002.

	Number of students per country
Finland	25
Germany	20
Sweden	17
Denmark	9
Greece, Netherlands, Switzerland	1
Total	74

The resource shortage restricts the student mobility in the Baltics but at the same time the group of students eager to spend a year at a foreign university is not necessarily as large as one might expect. Many students are not ready to leave because they work regularly and do not want to lose their jobs. In addition to the importance of earning money, the unwillingness to depart from family members or a boy-/girlfriend, an insufficient command of foreign languages and professors' fear of loosing good students explain this reluctance.

The researcher exchange rests on a more irregular ad hoc basis than the student exchange and its scale is modest. According to the interviewees, the visits are usually short-term. The interviewed professors emphasised that it often requires a lot of personal effort from those willing to go abroad. Just to be able to visit a conference, a researcher may be forced to bargain with the organisers about an exemption for hotel and travel costs or to look for sponsors from domestic companies. Still there are examples of professors who regularly teach in foreign higher education institutes or are invited to act there as opponents at public defences of doctoral dissertations.

4.5.2 Foreign Students

The number of foreign students admitted to degree studies in the Baltic technical universities is low: their share is well less than one per cent in most cases. At Helsinki University of Technology the corresponding figure is 3.5 per cent. In other Baltic universities the numbers of foreign students are considerably higher, for instance, all the three countries attract medical students. At the University of Latvia the share of foreign students is as high as 21 percent and in the whole of Latvia it is 8 per cent. The old reputation, relatively low tuition fees and living costs attract students from third world countries especially. Foreign students of the Baltic technical universities come mainly from the Asian countries, Lebanon and Pakistan being the major countries of origin.

LT: Major Groups of Foreign Students in all Lithuanian Universities, Kaunas University of Technology and Vilnius Gediminas Technical University by Country of Origin, Academic Year 2000.

	Number of students per country		
	All	KTU	VGTU
Lebanon	198	27	22
Israel	66	0	1
Pakistan	56	0	20
Poland	39	3	6
Germany	33	1	7
Finland	27	0	12
Other	183	13	30
Total	602	44	98

LV: Proportion of Foreign Students of Enrolment in Selected Higher Education Institutions at the Beginning of the Academic Year 2000/2001 (in per cent).

	Share of foreign students of enrolment %
Total	8
University of Latvia	21
Riga Technical University	0.5
Transport and Telecommunication Institute	5

LV: Major Groups of Foreign Students in Higher Education Institutions by Country of Origin at the Beginning of the Academic Year 2000/2001.

	Number of students in Latvia
Israel	6 819
Lithuania	330
Russia	189
Sri Lanka	120
Estonia	113
Lebanon	56
Pakistan	51
Germany	36
Other: 49 different nationalities	203
Total	7 917

LV: Major Groups of Foreign Students in Riga Technical University by Country of Origin at the Beginning of the Academic Year 2000/2001.

	Number of students in RTU
Lebanon	25
Pakistan	15
India	7
Sri Lanka	7
Other: 14 different nationalities	17
Total	71

Source: Central Statistical Bureau of Latvia 2001, 15, 81–107.

EE: Major Groups of Foreign Students in Tallinn Technical University by Country of Origin, Academic Year 2001/2002.

	Number of students per country
Finland	5
Russia (3 students from the Republic of Mari)	4
Bangladesh, France	2
Armenia, China, Israel, Korea, Peru, Ukraine	1
Total	19

Source: International Relations Office of Tallinn Technical University 2001.

4.5.3 Participation in International Research Programmes

The lack of money restricts the participation of the Baltic universities in European research programmes, because each participant must cover a certain proportion of the project costs. As for the Framework Programmes, the preparation of a project proposal alone can cause a hindrance. This work is not only laborious and time-consuming but also requires specific knowledge of how to present the project. The proposals from the accession countries compete against all others, and just a small fraction of the submitted proposals finally become accepted. Awareness of the tight competition sometimes discourages Baltic scientists from investing long hours in their writing, especially when they often tend to have limited time for research. On the other hand, growing experience and the positive example of successful applications contribute to future efforts.

Estonia had submitted seventy-five proposals to the European Commission IST programme by June 2001. The Estonian success rate was 17 per cent, while the programme average was 25 per cent. The majority of failures were caused by poor scientific or technological quality, low innovativeness and insufficient utilisation plans. The underlining reasons can be derived from weak strategic planning and innovation

management.[57] The Latvian project success rate in the Fifth Framework Programme between 1999–2001 was 28 per cent[58].

In product oriented programmes strong partners from the enterprise sector are needed, which is a further impediment to Baltic universities in certain fields, like electronics. The Balts see themselves as competent partners rather than as co-ordinators. Visibility is a prerequisite for being recognised as an interesting partner. Personal contacts, research history and the activity of individual professors play a crucial role in this respect. Participation tends to accumulate everywhere so that some persons or research groups are active, others not. If a professor does not speak English, the language barrier constitutes an obstacle to international co-operation.

In addition to human exchange, Tempus programme, among others, has supported the purchase of modern equipment and software for university laboratories. The national budget financing is so small that it hardly allows for modernisation of the infrastructure, which is a serious problem. Therefore the international programmes are often looked to for rescue euphorically, although another question is to what extent they can really solve the financial problem. However, besides buying apparatus, there are other possibilities for utilising international co-operation, as the next example shows. One institute which cannot afford to buy a measurement instrument fit for its purposes has an agreement with a foreign partner institute that its scientists can do the needed measurements in the latter's premises. The equipment problem is solved by joint research activities.

4.5.4 The Brain Drain

The brain drain represents a negative manifestation of highly educated people's international mobility. It is pointed out in the Baltics that at the same time the EU countries are worried about losing their best brains to the United States, they themselves are trying to attract IT specialists from Eastern and Central Europe to Western Europe. It is not in the interest of these countries to train specialists for the EU countries, instead they prefer joint ventures to be realised on the spot.

Assessments on the severity of the brain drain vary from country to country astonishingly. The Lithuanians recognise the problem whereas the Latvians and the Estonians play down its significance. Nobody can present statistics about the scope of the phenomenon but different persons' estimations were congruent within a given country. In the absence of waterproof evidence this leaves room for speculation whether political correctness tempers statements in Estonia and Latvia or whether the Lithuanians' fear is exaggerated.

Lithuanian television has presented unofficial statistics according to which 300,000 Lithuanians have left the country. Irrespective of the reliability of the figure, the fact remains that the issue is debated in the public to a different extent from Estonia and

[57] Kalvet et al. 2002, 27.
[58] LITTA 2002, 21.

Latvia. The Lithuanians are openly concerned about the outflow of its citizens. A high-ranking representative of the Lithuanian Ministry of Economy has confirmed the existence of the brain drain, referring to the information from the industrial associations, IT companies and universities. Lithuanian IT specialists find employment abroad easily, which is regarded as recognition of Lithuania's educational system. Students who go to Germany or the United States, for example, to complete their Master or doctoral studies often take a job there and finally decide to stay in the West. Sometimes western companies offer students scholarships on the condition that they will work for them for a certain period of time after graduation. A Lithuanian professor of informatics cites an example from his faculty: fourteen graduates continued their doctoral studies in the United States and various European countries – only two of them returned to Lithuania. The reason for the emigration is said to be poor conditions and uncompetitive salaries at local companies and universities.

The Estonians and the Latvians point out examples of the repeated failures of Western firms to recruit ICT specialists in large numbers: a Danish company wanted to employ 200 programmers from Estonia but received 6–10 applications; the German green card campaign managed to attract only 3–4 Estonian specialists. A representative of Nokia admits that when Nokia was looking for Estonian engineers for its Oulu plants, it received no single serious application. The results were likewise modest in Poland when the Germans tried to recruit Polish ICT specialists with a massive campaign.

In Estonia and Latvia most observers do not believe in a massive outflow of specialists. It is admitted that a small number of specialists have emigrated to the West but their decision to leave is mainly derived from their personal reasons rather than from common push factors. A widespread belief is that most Estonians and Latvians prefer to work in their own country, while well educated persons have no problems in finding a good job at home. It is rather the people with a low education who are eager to search for their luck abroad. The very top class scientists make an exception to this rule if they deal with global issues for which the Baltic countries are too small. It is indeed recognised that a considerable number of famous scientists have left for foreign universities.

One explanation why "ordinary" ICT specialists with a Bachelor or Master's degree may not be willing to emigrate lies in their social status. In their home country they earn substantially above the average level, have good career opportunities and can achieve a leading position quite fast. In a foreign country, by contrast, they would most likely work as standard programmers without great chances of having a rocket career. To put it briefly, in the home country they feel they belong to the cream of society whereas abroad they would be nothing special. Some may fear they will be treated as second class citizens from Eastern Europe. When assessing the difference in the incomes, one has to take into account the lower living costs and the increasing salaries in the Baltics.

In Estonia and Latvia the national feeling among the titular population is strong, so that guesses can be made whether the patriotism affects the attitudes. Accordingly it is postulated that the Russian-speakers would be more willing to emigrate. However, neither the nationality factor nor any of the other arguments given above explain why Lithuania would differ from Estonia and Latvia, especially when the economic differences between the countries are shrinking. Some people offer the national character for explanation, but the notion is too vague for any rigorous use.

5 BUSINESS CULTURE

5.1 Methodological Notes

National character is an ambiguous metaphysical concept which cannot be founded on tangible evidence. Business culture, the subject of this chapter, is far less a metaphysical item but nevertheless it rests to a great extent on less than rigorous notions and subjective perceptions that are hard to verify. Different people draw on different experiences from the same environment, thus holding different views on it. One's role, background and resources, among other things, affect one's perceptions. Moreover, the same person may present mutually contradictory opinions in various contexts, depending on the audience. Foreign businessmen working in the Baltics are likely to talk differently when they are relaxing over a beer in a pub with their trusted fellow countrymen from when they are giving a speech as representatives of their company in a seminar organised by the authorities of the country in which they are running their business.

The arguments presented later in this chapter hold no claim to the whole truth, because an exhaustive, purely objective treatment of the subject is impossible. Some people may raise objections against these views, but hopefully they still reveal certain aspects of the multi-faced reality experienced by others. The discussion is based on knowledge accumulated from a number of sources over a few years:

1. *Prepared interviews with foreign investors* in the three Baltic countries. Nearly all the interviewed directors of foreign companies have been working with the Baltics for several years. Local people were also interviewed about these questions.

2. *Informal, spontaneous conversations with business people* who know the Baltics well. Such conversations took place for instance at seminars, cocktail parties and private meetings.

The people who were interviewed either formally or informally represent *eleven* different *nationalities*. They come from Denmark, Estonia, Finland, France, Germany, Italy, Latvia, Lithuania, Sweden, Switzerland and the United States.

3. *Participatory observation.* The author has been involved with the Baltics both professionally and privately since 1992. In the late 1990s, she lived and worked in Latvia, dealing with foreign direct investment. During the current project, she did outsourcing in the Baltics and bought services from there, relying on a network of local contractors. That is to say, she knows the business in the Baltics through her own activities, not only as a researcher.

One aim of this chapter is to critically scrutinise stereotypes that are often clung to the Baltic nations. Nowadays it is popular to overemphasise the cultural distinctiveness of Estonia, Latvia and Lithuania vis-à-vis one another, which is underscored by the nations themselves. The emphasis on the differences between the Baltic neighbours sometimes goes so far that it appears as if one moves to another world totally when crossing the border.

The cultural distinctiveness of the three separate Baltic countries was indoctrinated into Finnish minds during the second half of the 1990s. Immediately after independence in the early 1990s, most Finns treated the Baltic republics as a homogeneous collective monolith, but after half a decade or so every civilised man knew to start a conversation concerning the Baltics with a sentence in which he/she assured that he/she knows well that there are three different Baltic countries. It was a way of proving to others proudly that one is familiar with the area, unlike the simple man in the street who solely visits Tallinn.

The Baltic peoples do not feel close affinity for one another at the level of the nation, which is for instance reflected in the infrequent people-to-people contacts at a grass-root-level. As is common among neighbouring countries everywhere, the Balts also make jokes about their neighbours and hold stereotypic characterisations of them. In many fields the states see each other as competitors rather than as collaborators, with the result that co-operation building has often been sluggish and slow. During Soviet era, everything was co-ordinated through Moscow while inter-republic relations were neglected, which further contributed to their isolation. Many Baltic people regard the collective label "Baltics" as an expression of an anti-national Soviet policy, which lumped together the nations without recognising their particularity. The nationalist counter reaction sometimes rejects the whole term.

It is an indisputable fact that no solid monolith called the Baltics exists; there are indeed three separate nations with their own vivid cultures, languages, history and development paths. From the point of view of comparative research the question arises whether the Baltic countries are so very different that they cannot be grouped together at all. Should one write in this connection three subsequent chapters about the business culture in Estonia, Latvia and Lithuania? When the Baltic countries are viewed from close range or even from inside, their distinctiveness is accentuated; as soon as the perspective is removed to a distance, the similarities become more stressed. Latvia is likely to share many more similarities with Estonia and Lithuania than with Brazil, Japan or South Africa. The Baltic Rim countries still belong to the same cultural area in the broad

sense. The point is that one should maintain a sense of proportion when comparing countries so as not to inflate their differences by losing relativity. A nation's self-perception may also differ from the perception of an outsider.

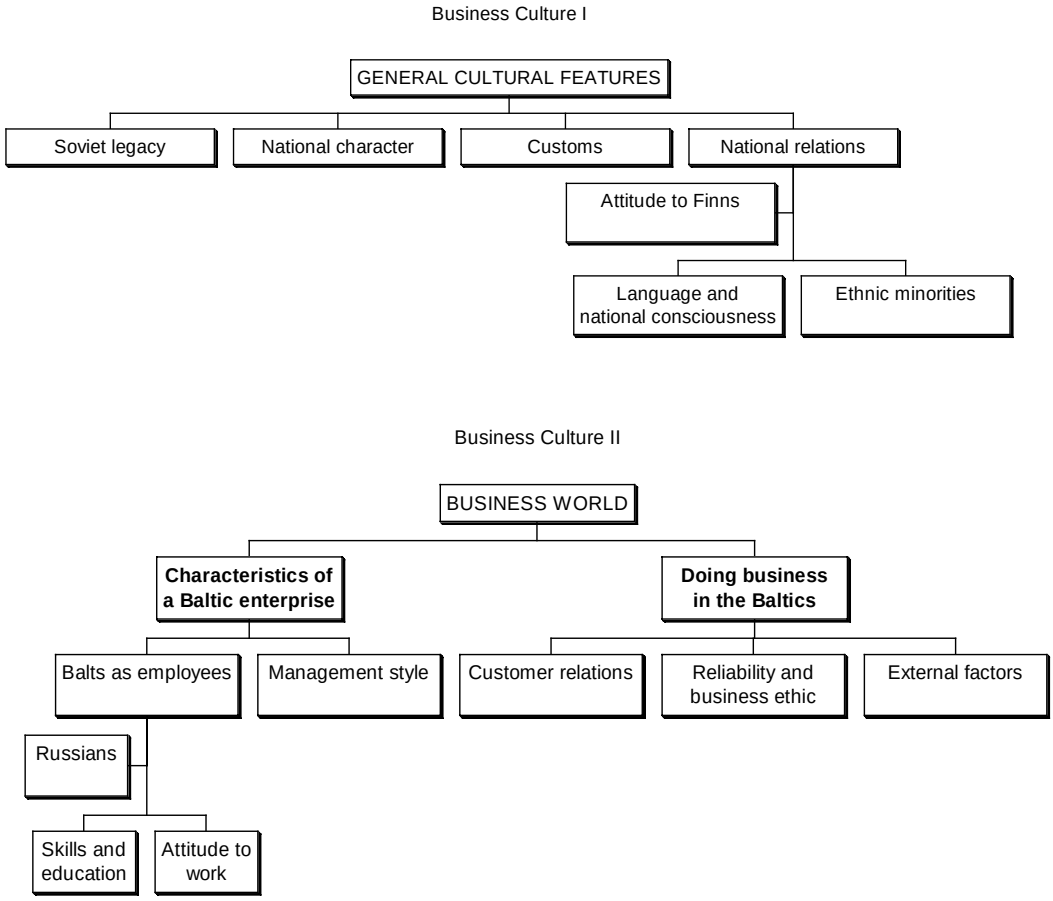
In the Baltic case, the newly independent states have an ideological and psychological incentive to stress their national distinctiveness. Furthermore, all nations, including the Baltic ones, are prone to define themselves through their past. Sometimes early history is emphasised at the cost of recent history, if the former appears more benign. When searching for their national identity from history, the Baltic peoples are naturally more eager to look back to the heroic deeds of ancient mythology or the glorious days of a medieval great power rather than to the stultifying Soviet occupation with its alien elements.

However, as far as business culture and practical life is concerned, the influence of the Soviet era cannot be denied, because it is still present. The Soviet legacy not only manifests itself in the cultural and psychological heritage but also in the societal structures and the economic situation in which the transition countries found themselves after independence. This legacy is uniform and is indeed a major unifying factor between the Baltic countries.

The position taken here maintains that within the framework of this study the main explanatory factor for many deviant practices, which a foreign businessman will encounter in the Baltic countries, can be traced back to their common Soviet heritage. The impact of the Soviet era is still so predominant that many peculiarities of doing business in the Baltics can be explained by it. This uniform heritage often overshadows other cultural traits so that the similarities exceed the differences. Therefore it is possible to talk about the business culture in the Baltics, as long as one keeps in mind that national differences do play a certain role too. Yet these differences should not be exaggerated too much either due to the broader cultural affinity in relative terms.

The discussion below will focus on those traits that *differ* conspicuously from the Nordic practice in order to help avoid unpleasant surprises and understand why things do not always turn out as expected. At the same time it should be kept in mind that **often one hardly notices a difference between a Baltic or any other country. The top companies meet the international standards, and the ICT sector is one of the best developed sectors in this sense. Both the leading ICT and electronics companies have plenty of experience of international customers and provide first-class service.** The content of this and the next chapter is not confined to the ICT and electronics sector exclusively but it embraces whole society.

Chart. Business Culture.



5.2 General Cultural Features

5.2.1 Soviet Legacy

The reader should not misinterpret the emphasis placed on the Soviet legacy as if the Baltic States would have stagnated in the remnants of the Soviet system. On the contrary, their virile development has enabled an amazingly fast catch-up. Despite the excellent results in the economic and political transition and the people's firm commitment to building modern societies, it always takes less time to replace the institutions than to internalise a new way of thinking, because the latter inevitably necessitates personal experience of a market economy and democracy. A dozen years is not enough for that. The transformation of minds will take place gradually with the result that two parallel mental worlds will co-exist for some time. In one instance things may function as smoothly as in any Western country, whereas in another place a foreigner may get a back-to-the-Soviets-feeling. Sometimes the first impression may appear very promising, but as soon as the surface is scratched, the coating can turn out to be thin and superficial.

It is common to state categorically that the older generation has not managed to get rid of the Soviet thinking, whereas the young people represent a new life style. Of course it holds true that the renewal process first reaches the young generation but such a straightforward statement is still too black-and-white. First, it does injustice to all those active, flexible and reform-minded individuals of the older generation who have adjusted to the new system perfectly and even acted as primus motors of the transition. It would be unfair to cast them in a Homo Sovieticus mould only because of their date of birth. Second, there are a lot of young people who have inherited Soviet habits, even though they themselves are probably unaware of their "old-fashioned" state of mind. Their proportion is surely lower than in the old cohorts but nevertheless the Soviet mentality keeps on exerting its influence in all age groups and is not likely to disappear overnight. It is one thing to repeat fashionable slogans like a parrot and another thing to live according to them.

What made the Soviet regime paralysing for its citizens? There were two particularly fatal defects. Firstly, the system was built on lie and pretence, which resulted in a thoroughgoing demoralisation. People lived between two truths, the official one and the private one. In order to cope with the system, one had to play according to the rules by participating in the fake rituals or at least keep one's mouth shut. All this created an atmosphere of distrust. Homo Sovieticus is a wary, suspicious and two-faced character who never shows his cards because he suspects intrigues everywhere. A witty proverb from the Soviet era sums up the resulting work ethic: "They pretend to pay us; we pretend to work."

Secondly, the goal was to make the citizens passive. If you did nothing, you were good; if you showed activity, you were suspect. People were taught to obey leaders' orders instead of taking the initiative. People did not learn to take responsibility for themselves but regressed to a child-like behaviour, expecting the state to take care of them.

The consequences of these characteristics are felt in the contemporary Baltic societies. A tangible manifestation of the tradition of falsehood is wide spread corruption. Baltic employees are typically less enterprising and more cautious than their Western colleagues: they do not easily take the initiative on their own but rather follow orders from above. They do not openly question these orders, even when they are stupid. They do not dare to express their thoughts openly, which makes it difficult to receive feedback from them.

The reverse consequences of the Soviet system are counter reactions against the Communist doctrine, manifesting themselves in the form of nationalism, consumer orientation and uncritical admiration of a laissez-faire capitalism. In the trendy bars of the Baltic capitals, one meets fashionably dressed young professionals who believe themselves to be the winners in the Darwinist struggle over the survival of the fittest. In those places every twenty-year-old male student blusters that he is a big businessman.

National independence is such an important issue for the Baltic people that it often overwhelms the cross-border co-operation, because sovereignty is protected jealously. Nobody wants to give up any piece of his/her decision-making power. Co-operation with the neighbouring countries does not belong to the cultural heritage either. This lack of collaborational tradition is reflected even in business life from time to time. National

companies of the same international chain can be incapable of co-ordinating their activities in order to provide the customer a pan-Baltic solution, even when the customer requests it. Despite the promises in the marketing brochures, the threshold for contacting a foreign sister company can be high.

The next traits have been observed in Latvia and Lithuania but due to the lack of evidence the author can not take a stand whether they hold for Estonia likewise.

Latvians and Lithuanians do not easily protest but are ready to accept without complaints such faults that would raise grievances elsewhere. On one hand, Soviet citizens learned that complaining is not wise; on the other hand, people's mentality is such that they do not get upset: people are calm and patient. They have got used to coping with hardship. Strikes happen seldom in the Baltic countries, which of course reflects labour relations too. Manufacturers and service providers do not experience pressure from the local consumers to improve their products or services, because consumers are not accustomed to demanding a better response. If an individual customer tries to complain, the company does not necessarily bother to react at all. It may behave indifferently, since it really does not care about losing one customer. In the communist shortage economy where the shops were empty, people queued to get consumer goods irrespective of their quality. When the Soviet tradition is combined with weak consumer awareness, firms lack the initiative to treat the customer as a king.

The acceptance of things as they are has another implication as well: a status quo orientation. People are satisfied with the prevailing state of affairs which is defined as "normal". The normality is taken for granted without questioning whether it is good or bad. People shun changes, adhere to convention and appeal to the old practice when somebody tries to introduce novelties.

5.2.2 National Character

None of the titular nations in the Baltics resembles the Italians in their mentality. In Estonia and Latvia at least, people identify themselves with the Nordic peoples, pointing out similarities in the national character. With foreigners or in strange situations, the Balts are shy, reserved, taciturn and close-mouthed rather than lively and extrovert. A newcomer is observed silently to find out what kind person he/she is: his/her deeds and sayings are registered carefully. In public discussions the Balts behave like the Finns: sit and listen quietly instead of commenting and asking questions actively. A Finnish businessman compared a seminar with a Baltic audience to an American perception of a Finnish audience. The speaker may start wondering whether the seminar guests are listening to him/her at all due to the lack of feedback. Such doubts are groundless despite the silence.

Even though the Balts are not always so talkative, it does not mean that it is difficult to communicate with them. Their style of communication is correct, businesslike and friendly. Owing to parallels in Baltic and Finnish mentalities, it is relatively easy to

reach a mutual understanding and the same wavelength According to the author's experience, the Balts are very pleasant to interview, because they are both willing to and capable of explaining things properly. They are more verbose than the Finns. Generally they appear nice, polite, well-mannered and cultivated.

So far we have lumped together the three Baltic nations, although the national characters also diverge from one another. The Estonians are said to be most akin to the Finns, and they are characterised as determined. The Latvians are characterised as polite and even-tempered people who are able to move on after hardships without great bitterness. The Lithuanians are regarded as the most open people among the Baltic nationalities, being considered joyful and pleasant. The Estonians are also described as arrogant, the Latvians as indecisive and the Lithuanians as slow. The author's personal impression is the Latvians and the Lithuanians resemble one another more than the Estonians. The Russians are regarded as more social, communicative, carefree and emotional than the titular nations but they are also said to be noisy and brash. The Balts take a clear distance from the Russian mentality, although familiarity with Russian thinking is seen as an asset to be exploited in business by adopting an intermediary role.

One of the reasons why the Balts have a need to distance themselves from the Russians is probably related to their determination to "return" to Europe. They want to underscore their belonging to the Western cultural sphere historically. The Baltic States are working effectively to harmonise their economic, political and legal systems with the EU. The states' efforts to create an information society welcome new technologies. Youngsters talk to their mobile phones on the streets of the Baltic capitals just like in Finland. The mobile phone culture is also a snobbish symptom of showing off, while young people value a trendy, comfortable life style based on spending money. Material values have a high esteem. On one hand the atmosphere is progressive and enthusiastic, on the other shallow.

An inferiority and a superiority complex alternate in the collective self-esteem of the Baltic nations. On one hand, their diffidence leads to a defensive attitude towards Western Europeans whose acceptance they are fishing for. In Latvia foreigners are frequently asked what they think of Latvia. Elcoteq's Estonian engineers are said to stand in awe of Elcoteq's Finnish engineers but even more they are afraid of Nokia's Finnish engineers. On the other hand, the Baltic people are - on good grounds - very proud of their achievements during the past decade as well as their national culture. A Latvian man had travelled to Italy on his holiday and visited among others Rome, Florence and Venice. In his opinion these cities were just dirty and did not compare to Riga. Sometimes the Balts overestimate their industrial know-how or educational system. Young Estonians can boast how the Estonians accomplish the same tasks in less than half the time that others need for them.

Historically the Baltic peoples are civilised nations with rich cultural traditions. Theatre, ballet, opera, music and arts represent a high standard and people visit events of high culture actively. Especially in Lithuania it is conspicuous how much children and teenagers go to classic concerts, ballet and opera. Lithuanian teenagers attend them not only with their parents but also with their peers.

The next two paragraphs contain observations from Latvia alone but as many of the characteristics described are typical of small nations as well as postcommunist countries, it is possible that these reflections might be somewhat valid for Estonia and Lithuania as well. Yet there are no objective foundations on which to make such generalisations.

The Latvian community is closed and inward-looking, which means that it is very hard for outsiders to become part of it. The internal ties are firm because the networks can often be traced back to kindergarten, which has the side-effect that personal relations are of the utmost importance for instance in the labour market. Even politics is highly personalised. Since a perfect command of the Latvian language and ethnic identity are cornerstones of group membership, foreigners and Russian-speakers tend to be excluded from the Latvian community. (Another question is of course whether they would be even interested in joining it.) A foreigner can make friends with Latvians but it does not mean that he/she would be acknowledged as one of them, while Latvians keep a distance in spite of their friendly behaviour. People's thinking is more complicated than their calm exterior might lead one to expect: it is smouldering beneath the surface.

A contact network is of the utmost importance, because it lays the foundations for exchanging favours. Latvians take care of their family members, relatives and friends better than Finns, which can be partly ascribed to the lack of social security. However, this care is not extended to the worse-off at large in the form of a social consciousness. Indifference, hard attitudes and a pecking order can be perceived in the treatment of fellowmen. The idea of the public good is not deeply rooted, and collective solidarity towards the worse off is missing. Paradoxically the outcome of "egalitarian" communism was an atomised, unsolidary society with a low mobilisation of citizens. Thinking is often self- and Latvia-centred, while interest in international incidents is limited.

Two Latvian anecdotes describe the Latvian character in a witty fashion. 1) When a Latvian comes to a crossroads, he hesitates for a long time deciding which direction to turn. After lengthy pondering he finally decides to go in both directions. 2) Unlike the quick-tempered southerners, a Latvian always considers properly before taking action. Even after a careful contemplation, he may fail to act. The reverse side of moderation and tranquility is sometimes certain phlegmatism.

An easy, widely used notion in explaining differences between nations is religion. In the Baltics it is common to remind people that the Lithuanians are Catholics, whereas the Estonians and the Latvians are primarily Lutherans, which is the reason why some things are assumed to differ in Lithuania either in a positive or a negative sense. Such explanatory attempts are not only confined to general features related to national character or social life but they may even cover the style of handling matters in business or at work.[59] However, when you then start asking the people who cling to the slogan

[59] **Two amusing opposite examples: A Lithuanian view: "The response rate for VTT's survey was better in Lithuania than in Estonia and Latvia - i.e. the Lithuanian companies were more active to answer - because the Lithuanians are Catholics." An Estonian view: "The economic development is Lithuania is lagging behind Estonia and Latvia, because the Lithuanians are Catholics."**

about the mechanisms of how religion affects in practice, you usually get no specifics. Those people who do not believe in its influence argue that business is business and it follows the rules of the market. Respectively it is impossible to recognise from the actions of an employee whether he/she is Catholic or Protestant.

In today's Baltic context, references to the Catholicism-Protestantism cleavage often appear shallow, populist clichés that remain unfounded. Religion as a universal explanation sounds too simplistic in these countries, even though it may be a relevant factor in some other geographic areas. Even in Catholic Lithuania, secularisation has gained ground so that the Lithuanians are not as assiduous churchgoers as the Poles. Nor is the Lithuanian Catholic church such a political force as the Polish one.

5.2.3 Customs

Customs do not differ so drastically from Finnish or European manners that a foreigner would not get along with locals by following a universal code. The Balts possess better manners than the Finns on average, which is manifested in politeness, consideration and gentleman-like gestures. People have style and cultivation. A peculiar detail from Lithuania is that according to a pagan custom one should never shake hands at a doorway, because it will bring bad luck. In practice this superstition has lost its relevance.

Clothing and stylish appearance are paid more attention to than in Finland. When a Finnish fashion editor was watching ladies in public places in Riga, she praised their flair and good taste. The same holds for Estonians and Lithuanians who also know how to dress. It is not only women that like to dress fashionably, but also young businessmen, consultants, brokers and such like look spruce. The other side of the coin is that many women invest a substantial part of their low salaries in expensive clothes and cosmetics, even when they live in a primitive flat without hot water. The unofficial dress code in offices requires a change of dress every day. As it is impossible to buy new clothes indefinitely, the clothes are rotated so as not to wear the same dress two days in a row. Birthday parties are often celebrated with friends in long evening gowns and black ties. Status symbols are purchased as soon as the earnings allow them; that is, showing off is important.

A sense of aesthetic can also be perceived in Baltic cities. People work hard to make their living environment look nice and tidy. The centres of the Baltic capitals were renovated fast so that today these beautiful cities offer marvellous tourist attractions.

Strangers are addressed formally as in German-speaking countries where *Siezen* (teititteIy) is the prevailing norm. During the first contact the form of address is Mr/Mrs X. After business contact has continued for a while at least in a correspondence, the forename usually replaces the surname in the address. However, this does not yet mean giving up all formality: if the language of communication were German, the personal pronoun to be used would continue to be *Sie* (te) instead of *du* (sinä) (cf. *hansische Sie*). A combination of Mr/Mrs and the forename - for example Mrs Marja - is slightly more

formal than the forename alone. Only when the intercourse reaches a truly personal level, will people get on informal first name terms and say or write *du* (sinä). People in high positions expect to receive appropriate obeisance, since organisations are more hierarchic than in the Nordic countries.

Punctuality in appointments is also akin to the German cultural sphere. People attend meetings on time, not 15 minutes late. As in Russia, flowers play a central role in social life. Whenever one is invited to visit a person at home, one should always bring flowers to the host. When a traveller is picked up from the railway station or the airport or brought there, he/she is usually given flowers either as a welcoming or a farewell gift. Name days and birthdays are celebrated extravagantly at working places so that the person of the day serves the personnel pastries, cakes and cookies as well as alcoholic beverages with afternoon coffee. His/her superior presents him/her a bouquet of flowers. Sometimes the personnel officer collects a flower fund from the employees to finance the regular purchases of flowers for such celebrations.

Flowers and gifts, such as a bottle of cognac, are part of the business culture, too, not just private relationships. When local businesspeople deal with the state administration, they typically give the pertinent civil servant small presents in accordance with the socially accepted custom. A foreign observer describes this convention as follows: "The bureaucratic apparatus is greased by champagne and chocolate."

The worst blunder a foreigner can mistake in the Baltics is to mistake Estonian, Latvian or Lithuanian for a Slavic language or to equate these countries with the CIS countries. The Baltic people do not like to be treated as Eastern Europeans. In fact, it is better to avoid the whole term 'Eastern Europe' when referring to the accession countries and instead talk about Central Europe. Correspondingly, one should be cautious in speaking Russian (cf. Chapter 5.2.4.1). Since Finns come from a small country which is not very far away, they should know some basics about the history and culture of the Baltic nations. Some people expect it and even when that it is not the case, it is a convenient way of winning sympathies.

The most crucial thing is to respect the other party irrespective of his/her nationality and show genuine interest in him/her as well as his/her country. Nothing is more irritating than a derogatory, patronising *Besserwisser* attitude towards "poor cousins", accompanied by a plenty of good advice. Arrogance and boasting with money or a Western background does not impress anyone; it merely reveals the boorish nature of the speaker himself.

5.2.4 National Relations

5.2.4.1 Attitude to Finns

No national attitudinal problem prevails such that it would impede business relations in the Baltics. The newspapers have written about the Estonians being fed up with the Finns, but professionals and business people are most likely willing to co-operate if a joint interest is identified. Customer service in Tallinn's hotels, restaurants and shops may be cold and contemptuous but when one talks to colleagues or would-be partners, Estonians appear friendly, co-operative and actively interested. Many Estonians consider ties with Finland natural. It is telling that Finland is the most popular country in which Estonians would like to work.

In Latvia and Lithuania a greater distance ensures that a little brother complex does not burden the relations with Finland. The disputes over tariffs and the monopoly of Lattelekom and Lietuvas Telekomas have brought a lot of bad publicity to the Finnish share holder Sonera, but these contentions hardly ruined Finland's otherwise good image in Latvia and Lithuania. The general attitude varies from neutral to positive. In Latvia Finland is a little more present and better known than in Lithuania. In Latvia one hears comments that Finns understand Latvians better than Swedes or Norwegians owing to our history and specific relation with the Soviet Union. Therefore Latvians are supposed to prefer to work together with Finns. Elderly people admire Finland because of the Winter War. Finland's small size and geographical proximity serve as an advantage because the conditions are comparable to the Baltic countries. However, in some cases a collaboration with a large Western country, like the USA, Germany or Great Britain, may be more persuasive than with a small, peripheral country in the far north.

The Nordic countries are seen as the main reference group in all three Baltic countries because of the economic ties. This same answer is given even in Lithuania in spite of the fact that Central European elements grow stronger when moving towards the south. In Estonia the Nordic influence is most prevalent, whereas Lithuania is more adapted to the continental model, which is noticed in the administrative culture among others. Latvia usually takes an in-between position between the two poles.

Popular images of the close standing countries assign Estonia to the Finnish and Swedish sphere of influence most clearly. Latvia is said to be geared to Germany and Russia, Lithuania to Poland and Belarus. There used also to be speculations about the unofficial division of the Baltic countries between the Nordic countries so that the Finns would be particularly active in Estonia, the Swedes in Latvia and the Danes in Lithuania. None of these classifications should be taken too seriously because all countries are developing their economic relations on a multilateral basis.

5.2.4.2 Language and National Consciousness

Ethnicity and national consciousness penetrate into everyday life to a quite different extent than in Western countries. In Latvia, for instance, contemplation on the essence of the Latvian mentality is not a rare discussion topic. Folk dances are a popular hobby among teenagers and students. People are proud of their cultural particularity.

Language is an integral part of ethnic identity in the Baltics. The states protect the position of the titular languages because under the Soviet rule Russian displaced the local languages for official use. As a consequence, their development was inhibited, which could be seen for instance in the lack of a modern vocabulary. It is understandable and justified that the Baltic States want to promote their national languages after the colonialism which threatened their survival, but sometimes the most radical suggestions of national conservatives go too far. To cite an example from Latvia, one draft of a proposed language law assigned Latvian as the language of all foreign companies as well. If an internal company meeting took place in English, a Latvian interpreter should attend it. The entire internal correspondence, including e-mails, should be written in Latvian. The foreign management should have a command of Latvian. This law never came into force because the President of the Republic refused to ratify it, but there are other examples. A foreign company was prohibited from hanging up an English sign at the company door, although its target group consists of foreign firms in Latvia.

In Latvia and Lithuania, the foreign proper names of persons and cities are modified according to the alphabet and pronunciation rules of the Latvian and Lithuanian languages. This irritates Russian-speakers and Poles, who have protested against the Latvialisation and Lithuanisation of their names, but English, German or any other names are adopted similarly using these language rules. It may take time to recognise which names are Endijs Vorhols (Andy Warhol), Margareta Tecere (Margaret Thatcher), Dzordzs Raits (George Wright), Deivids Brauns (David Brown) or Volfgangs Sisels (Wolfgang Schüssel). The author of this book is known in Latvia as Marja Nisinena.

The Latvian and Lithuanian languages distinguish between male and female names by using different endings so that the name reveals the gender of the person under consideration. Male names end with the letter -s, female names with -a or -e. In Latvia there are also few male names which end with o, such as Hugo and Uno. The Lithuanian language goes further by differentiating between married and unmarried women. The surname of unmarried women ends with -aite, -ute or -yte, when the name is inherited from the father; that of the married women ends with -iene, when the name is from the husband.

If a foreigner wishes to make a good impression, it is advisable to learn a few basic phrases in the indigenous language because it will delight the native speakers. English is the most commonly spoken foreign language, followed by German which is already much rarer. With the exception of the youngest generation that went to school during independence, nearly everyone speaks Russian too.

Yet people tend to prefer English to Russian and it would be unwise to open a conversation with strangers in Russian. A grave mistake is to take it for granted that Russian is automatically the conversational language, because it will be considered insulting. It is important to show that the foreigner understands that Russian is not a state language in the Baltic countries. Estonians are more reluctant to speak Russian than Latvians and Lithuanians who take the language issue more pragmatically. If one approaches a Latvian in a correct way and then asks politely whether he/she would be willing to speak Russian, the Latvian partner will not usually mind. In any case, the safest thing to do is to avoid Russian in the beginning in order to be able to assess whether the Baltic partner is nationally minded.

5.2.4.3 Ethnic Minorities

One of the most complicated legacies of the Soviet occupation is the minority problem in the Baltic States. The share of the indigenous population is 58 per cent in Latvia, 68 per cent in Estonia and 82 per cent in Lithuania. Because the minorities consist of various nationalities - Russians, Poles, Belarusians, Ukrainians, Jews, etc. - the correct term in referring to the minorities is Russian-speaker: the Russian language unites these minority groups but they are not all ethnic Russians. However, the Russians are overwhelmingly the single largest minority group except for Lithuania where the 7-per-cent-share of the Poles is almost as large. The Russians' share of the population is 30 per cent in Latvia, 26 per cent in Estonia and 8 per cent in Lithuania.

Under the Soviet regime, the Russians formed the leading elite - only in Lithuania was the Communist party mainly manned by Lithuanians - while the Balts were in many respects second class citizens in their own countries. Now the roles have changed. Only in Lithuania were all residents given a citizenship after independence in contrast to Estonia and Latvia. In Estonia and Latvia, the problem with non-citizens should be resolved before their accession to the EU. The slow pace of naturalisation exposes these countries to Russia's political pressure, because Russia can then use the position of the non-citizens as a weapon in a propaganda war.

Owing to the smaller size of the minority, the ethnic question is less relevant in Lithuania than in the other Baltic States. The author's subjective impression is that the negative attitude towards the Russian-speakers is harder and sharper in Estonia than in Latvia, where the relation is moderate, tolerable and pragmatic, even though not cordial. A taxi driver from Tallinn explained angrily that he wants to have nothing to do with Estonia's Russians because they are all criminals and whores.

In Latvia, where the Russian-speaking minority is the largest, the society is segregated into Latvian- and Russian-speaking communities which live separately from each other. This does not mean open animosity or acute conflicts at a grass root level, while everyday life is based on a peaceful co-existence. The Russian-speakers are active in business, while the ethnic Latvians dominate public life. When the adoption of the citizenship law was topical, the average Latvian was ready to accept a Russian-speaker as a neighbour but not as a co-citizen. Thus, the political behaviour of Latvians was

more nationalistic than their social behaviour Most Russians wish to stay in the Baltic countries, accepting their independence, and do not yearn for Russia or the old Soviet Union, but they require protection of their minority rights.

A major source of tension between the minority and the majority concerns the status of the Russian language and the alleged reluctance of the Russian-speakers to learn indigenous languages; Estonian, Latvian and Lithuanian. Those Russian-speakers who are not eager to learn Latvian/Estonian/Lithuanian complain that these languages are too small and insignificant in comparison to large European languages. They wait for relief from the EU accession of the Baltic States.

Latvia's Russians are primarily worried about the curtailments in the Russian-language school education as a consequence of the gradual abolition of minority schools. There are also voices to be heard from the Russian-speaking camp that would like to see Russian as a second official language. The Latvian majority rejects a bilingual state. The Latvians are afraid that the Russian-speakers would lose the last motivation to learn the indigenous language, which would lead to a situation in which Russian would again become a dominating language because of the large size of the Russian-speaking population. Because most Latvians speak Russian fluently while a considerable part of the Russian-speakers do not speak Latvian, Russian usually becomes the conversational language in a mixed group. The knowledge of Latvian is steadily increasing among young, well-educated Russian speakers as well as among Russian-speaking children. Younger people have started to understand that it is necessary to speak Latvian, if one wishes to make a career in Latvia.

The nationality question is so essential for understanding the Baltic societies that it is advisable to for anyone involved with the Baltics to study the topic a little bit. Unfortunately it is not possible to examine the issue more deeply at this point, since the theme is broad and goes beyond the focus of this report.[60]

[60] The author has analysed the nationality question in Latvia extensively in a former publication *Latvia's Transition to a Market Economy: Political Determinants of Economic Reform Policy* from the year 1999.

5.3 Business World

5.3.1 Characteristics of a Baltic Enterprise

5.3.1.1 Balts as Employees

Foreign employers are generally very satisfied with the quality of the workforce in all three Baltic countries. Foreign firms manage to recruit competent, motivated, multilingual and well-educated people with ease. Employees who have experience of various nationalities in these countries say that they cannot deduce from the work performance the nationality of the responsible person. Skilled workforce is one of the prime assets of the Baltic countries.

5.3.1.1.1 Skills and Education

+ The level of both school and technical education is assessed to be fairly good. The education system is also broad, reaching the whole population, not just a tiny elite. Professionals possess a strong competence in their field and it is possible to find top level specialists, but also university graduates have acquired a decent basic knowledge.

+ The young enter working life earlier than in the West. Students start working in their second or third study year. If they finish their Bachelor studies according to the schedule, they are 22–23 years old. When they get a Master's degree, they are 24–25. It is easier for the employer to train young employees to match the requirements of the company than 30-year-old ones. Most foreign employers train their new recruits internally because university education does not provide sufficient practical skills.

(+) A widespread knowledge of Western languages is normally reckoned among the strengths of the Baltic countries. The countries themselves advertise this advantage proudly, showing impressive statistics with unbelievably high percentages of residents who speak two, three, or four languages. It is true that young educated people usually speak English, but in the older generation the picture looks different. In the latter group there can be highly educated people who speak only Russian. Another aspect is that the Balts tend to overestimate rather than underestimate their knowledge of languages. Besides, a person who speaks English most fluently is not necessarily the best programmer or engineer.

- The bottleneck is not the technical knowledge but the understanding of business processes, which is weak. The lack of project management skills is a major shortcoming in the Baltics. The deficiencies range from the inability to define projects to insufficient quality control. People lack experience of large-scale projects in a Western project environment. Furthermore, it is very hard to find people who are capable of doing business consulting and who can set priorities. In general, all-round management skills are weak in the Baltics.

- Concentration on details instead of the whole picture causes difficulties, which in turn can lead to mistakes despite technical know-how. When the woods are not seen for trees, employees can tinkle with redundant details without attaining the main goal. A Finnish director illuminates this bias with an example: "If a Finn demonstrates some design with a simple flow chart which is made up of only a few lines and circles, a Balt will draw every single link into it." Secondly, people cannot apply their knowledge. They follow orders rigidly without using common sense or their own creative thinking. They are less equipped for independent decision-making than the Finns.

- Marketing and sales skills are poor. Substantial efforts are needed to introduce customer orientation to technical specialists who have difficulties in understanding that the maintenance of customer relations is important and requires hard work. It is not only technical competence that matters.

5.3.1.1.2 Attitude to Work

+ Foreign companies are among the top-rated employers, because the locals regard them as more secure and stable, more modern and egalitarian than domestic companies. An opportunity for an international career, better salaries, state-of-the art technologies and a comfortable work environment make them attractive. Especially Russian-speakers prefer foreign companies where they feel safer. A reputable foreign investor is in a position to cream off the best applicants.

- The scarce supply of experienced professionals leads to a situation in which companies buy resources from their competitors. If Baltic employees are offered even slightly higher earnings, they are prone to change jobs. Money is valued more highly than other job aspects. Moreover, people like to change jobs much more frequently than in the West; it is part of the culture. If a person has worked for the same employer for a few years, he/she becomes worried that he/she is losing touch. It is considered to be a black mark to stay for too long at one place, while a diversified work history is appreciated. Because the market economy is still young and new kinds of career opportunities offered by it have only emerged recently, people have a need to try different options.

+ Foreign investors praise their Baltic employees for assiduity and diligence. "They work like crazy!" says one company manager. One hears comments that their work capacity would exceed that of Western employees, if they had the same experience and tools. Under good management, the quality of work is already better than in many Western countries where the work is sometimes accomplished too hastily with an insufficient number of workers. In the Baltic countries firms can afford to hire enough people who also take their work seriously. Baltic employees are said to be content: they never complain and they are anxious to try their best and work hard. One foreign entrepreneur characterises them as follows: "A man, who has served 24 months in the Red Army without a single day off, must be exceptional." Baltic employees are flexible, for example they are willing to work late hours on request. They are also highly motivated as well as easy to motivate further. Because they are determined to improve their life, they are greedier than their well-paid Western colleagues, which makes them

responsive to financial incentives. Nor have they lost the charm of novelty in their work. In addition, they try to please the employer - presumably partly out of fear of losing an above-average job, partly out of servile deference to Westerners.

Although foreign employers commend the industriousness of the Balts, many have also faced less rosy encounters with a work moral. One explanation why foreign investors are so laudatory might be that they have been able to select the most active people and have better resources to encourage them. Not all employees in every work place are ambitious, result oriented and willing to take responsibility for the outcome. Passivity, negligence, reluctance and inertia are tolerated in some places.

> A customer had left a letter with the receptionist/secretary to be forwarded to the director of the company. In the next meeting between the director and the customer, it turned out that the director had never received the letter. The customer went to ask the receptionist/secretary about the letter. She was absolutely certain that she had forwarded the letter, being offended at the polite enquiry, and refused sharply to start tracking down the missing letter. After much persuasion, she reluctantly agreed to check her mailbox. Then the customer saw that three weeks' mail was lying behind her desk.

- A Soviet attitude is represented in a typical answer to any inconvenient question: "I don't know. It is not my responsibility." A narrow self-definition of one's duties is related to general tunnel vision, i.e. a one-eyed way of thinking, a narrow interest in the organisation and a limited knowledge base, which means that the person is likely to know nothing beyond the minimum required to accomplish his/her tasks, not even the self-evident basics of his/her field. The work process is not designed to serve the achievement of the end result; the employee is satisfied whenever he/she is doing something. The main thing is to spend the required hours at the work place and socialise with colleagues, not forgetting important birthday parties. There are still people who continue treating a job as a social safety net.

- An effective supervision of the work process is of central importance in order to ensure a flawless performance. The control must be tighter than in one's own company at least in the beginning when the employees have not yet internalised the norms. First, the quality conception may differ from the Finnish standard. Second, if people are not accustomed to take overall responsibility for the end result and to use their brains independently, some detail will fall short, even when they try their best. Third, people who have got used to an authoritarian management style easily misapply freedom by shirking. It can also happen unintentionally that inexperienced managers fail to plan a viable schedule, assess their use of time and foresee eventual complications.

+ A director of a foreign-owned IT company in Lithuania admires the Lithuanians' ambition to deepen their knowledge in the field of their specialisation. According to him, the Lithuanians strive to become good specialists instead of aspiring to the manager's post. He regards this as a perfect match: the management in the home country and the IT specialists in the Baltics. A director of a foreign-owned IT company in Latvia hails his Latvian developers for excellent solutions but since they are shy and solemn they are better suited for development than management or customer relations.

- Because the Balts are silent and withdrawn, they do not dare to express their thoughts and give feedback even when it is requested explicitly. One foreign director is annoyed about the behaviour of his Baltic employees when he asks for ideas in a meeting. Nobody says a word, but then after the meeting when the employees go for a smoke they grouse about the decision taken. Outside the meeting room they have plenty of opinions of what should be done. The reasons for the diffidence lie not only in the national character but also in institutional traditions. People were oppressed by an authoritarian regime which restricted the freedom of expression. The educational system is old-fashioned and does not encourage the students to ask questions or to challenge established authorities. The university professors are not open to a dialogue with the students, while they keep rigidly to their high standing.

- One consequence of the uncommunicativeness is that Baltic employees are afraid to admit that they do not understand the instructions or do not know something. Therefore they do not ask for advice or further instructions but instead try to conceal the problem. They go amiss or gloss over the task rather than look for help from their superiors. They also do not like to show an unfinished piece of work to anyone. Nor do they extend their knowledge base by asking questions about new things. Asking questions is regarded culturally as a sign of stupidity, similar to Finnish village culture in the old days. Hence people try to pretend they are omniscient. The hierarchical organisation in Baltic companies distances managers from employees, impeding intercourse, so that the managers see their function as leadership, not as support and tutelage. In order to prevent errors, the supervisor should regularly go to individual employees and ask them in a friendly way if they have any questions. Although the employees do not usually approach their supervisors spontaneously, it easier for them to raise problems when they are asked specifically.

- Another implication of the Soviet culture is a lack of initiative. Bold innovative thinking, or searching for new kinds of solutions, is likewise rare. Most people prefer to adhere to "normality". Their reasoning rests on the argument that these things have always been done this way. They are not ready to adopt a different viewpoint, they only comply with orders.

5.3.1.1.3 Russians

The nationality question pervades recruitment, especially in Latvia. As far as white-collar employees are concerned, foreign companies used to recruit mainly Estonians/Latvians/Lithuanians rather than Russian-speakers. The recent tendency indicates in Latvia especially that foreign companies are hiring increasingly also Russian-speakers. Still the recruitment policy often rests on the principle that the number of the Russian-speakers should not exceed the number of the Latvians, because then Russian could replace Latvian as conversational language in the company. Russian-speaking employees are usually expected to speak Latvian, if they are hired.

Latvia's Russian population encompasses a layer of active, well-educated people who speak foreign languages even better than the Latvians. Foreign employers are most satisfied with their Russian employees, characterising them as talented, hard-working

and loyal. The Russians are more open, communicative and social than the Latvians which makes it easier to exchange views with them. The more business-minded Russians are better salesmen than the Latvians. They are also more cosmopolitan than the Latvians who give a high priority to national values and a familiar environment. The way the Russians are marketing themselves differs from the Latvians' low profile in that they talk more, rendering an enterprising image. In the end they do not necessarily accomplish more than the shy Latvians.

The Russians have a strong need to prove that they can manage their duties successfully, preferably better than their Latvian colleagues, because they are insecure about their position in independent Latvia. Deep down they may feel themselves to be unwanted second class citizens. This insecurity leads to an unnecessary caution, restricting their courage to take their own decisions, while they try to avoid mistakes too much. Ultimately they fear dismissal. They are not as capable as Finnish employees of working independently.

In mixed work places the Russians and the Latvians get along but keep some distance from each other. The nationalities do not mix automatically but the employer can promote their integration. One entrepreneur has observed that women have fewer problems in the integrating than men, who consider the other group as competitors.

5.3.1.2 Management Style

The organisation of the local companies is hierarchical and the management style authoritarian. The chief is the chief in an old-fashioned manner which does not question his/her authority. The older the leadership, the more authoritarian their style is. Delegation of decision-making power is very limited with the result that the employees do not have much freedom of action. They mainly fulfil orders, and their relationship with their superiors is formal and respectful. This kind of leadership culture has direct implications for business-to-business relations.

When approaching a Baltic company, the best way forward is to contact the director (if the company is not very large) since often he/she alone holds the decision-making power that can set the wheels in motion. The middle management or the employees may listen to you but after a while you may notice that nothing has happened because they have not dared to make any move. You cannot count them to bring something to the attention of the director. It is surprising how trivial the matters are that are cycled to the director. This can slow down dealings, if your contact person has to wait for the director's approval when the latter is on a business trip or otherwise occupied. In case of a controversy, it may be difficult to identify a person who can negotiate about the corrective measures, because the employees are likely to deny their overall responsibility for a given project. Everybody explains that he or she did only this or that part.

Significant contracts are always agreed at the highest level among the directors. It is not proper to send a sales representative to such a negotiation or contract signing ceremony,

even though that would be the normal practice in Finland. When the directors of the local companies are dealing with these and other operational matters, they expect to see the same level of representation on the other side. The local directors rank their peers according to company size. If a director of a small company meets a director of a larger company, the latter is expected to show his/her subservience to the former, since they are not conceived of as being equals.

Weak management skills are one of the main problems in Baltic enterprises for the simple reason that people lack in-depth experience of the market economy. Baltic managers can lead according to rules and paragraphs but their own judgement falls short, with the consequence that they cannot deal with unexpected situations by reacting flexibly to changing circumstances. They can be fastidious about details but fail to master the large picture. They can also behave inconsistently: One item is handled strictly in accordance with the law, whereas another item is dealt with randomly. In the morning the way of handling things can be very exact, whereas in the afternoon detailed rules do not matter any more.

This deficient business know-how is manifested in the shortage of long-term strategic thinking. Managers consider one project at a time, ensuring that each project will pay out. In this way they get high revenue but lose the ability to make strategic investments. A return of investment is calculated for a period of three to nine months. The goal is to make a big profit fast and safely, while the risk-taking ability is missing. As the management pursues an immediate gain, it does not dare to invest in such endeavours that do not yield profit at once, such as innovation activities and product development. Many exporting IT firms rest on nothing but the hiring of resources; that is, there is technical competence but no business expertise.

People look for easy but unimaginative solutions, which leads to wavelike trends when everybody opens an electronics shop, a fashion boutique, a CD shop or a restaurant simultaneously. If a more expensive initial investment guarantees long-lasting durability with better quality, it does not necessarily convince the Balts, who want to see results immediately. They have difficulties in perceiving causal relations and alternative costs.

5.3.2 Doing Business in the Baltics

5.3.2.1 Customer Relations

The main difference between Baltic and Western ICT people lies in the business thinking and marketing know-how rather than in the technical knowledge. It is hard to find people who can sell in the global market, because the Baltic countries lack the experience. Locally, too, the service culture is largely at an embryonic level, and the customer is not always king in the Baltic countries. The attitude is too often indifferent and passive: "Ok, I can sell something if somebody calls me or comes and picks up the article from here." A sales transaction does not seem to be the first priority and losing one or two customers is obviously no big deal, as the following two examples indicate:

A foreign customer went to a TV shop in order to buy a satellite antenna. The shop assistant refused to do business in English, explaining that he sells only in his native tongue because he does not speak English well enough. The customer thought in his mind that if the shop assistant was able to tell him all that information in English he could have sold the antenna as well. Then he went to the next shop where the Russian shop assistants did not speak better English than the first guy but had no trouble in selling the antenna.

A foreign customer visited a fair stand and decided to buy a broad selection of the articles on view. The total price of the purchase climbed to a pretty significant sum. The customer needed a receipt for his purchase, which caused a headache for four salesmen. The salesmen argued that they have no cash register available, which is why they cannot give a receipt. As the customer said that a hand-written duplicate receipt will do as well, they answered him that they have no such receipts either. Then the customer proposed that they could write a free form receipt on a piece of headed paper or on any piece of paper but the salesmen just spread their hands since they had no paper. Finally the customer came to the conclusion that he will get the same article somewhere else. This backlash did not bother the salesmen who just started to arrange the articles back on the shelves.

Two fundamental failures undermine the marketing and sales concept of many Baltic enterprises. First, their starting point is the offer, the product or the service they are supplying, not the satisfaction of a customer's need. Many technology firms believe that a good product will sell itself but do not understand the necessity to actively contact potential customers. Production managers may not pay attention to the user-friendliness of the interface and the instructions. Typically companies do not carry out any market survey in advance to map their competitors, while they trust themselves strongly and do not recognise the significance of benchmarking. They can be proud of their outstanding product without realising that there are ten other producers in the neighbouring country with the same product. Firms often claim to do innovative product development but in reality they may deal with basic solutions.

Second, short-sightedness, which was referred to above, can be perceived in the focus on an instant spot trade: the sellers are merely interested in selling the commodity at the best possible profit margin without considering the next step. While they are exclusively confined to maximising their momentary profit, they do not seek a reciprocal value added that would benefit both sides. They do not acknowledge the reciprocity of the transaction as if they were underestimating the other party. Nor do they understand idea that if their customer is doing well, it is also their advantage in the long run. A deeper understanding of the concept of customer relations is missing in many enterprises, and not every businessman can properly explain what the function of a key account manager is. Many Baltic companies cannot convert sales into co-operation, because they do not invest in establishing long-standing customer relations. After the commodity has been sold, the customer will be forgotten and the seller will concentrate on a new project. In a small market such an approach is untenable.

Buying a product or a service from a Baltic company can sometimes be laborious, if the customer must be the most active party, as strange as it may sound. If a potential customer requests an offer, there is no guarantee that the company will ever respond or the response may come very slowly. The offer may look primitive, it may be printed on a bad paper and its content may be inadequate or unspecific. In a bargaining situation, the sellers may keep silent, being unable to put forward their product, with the consequence that the buyer is compelled to interrogate them. The customer's wishes about the commodity are taken into consideration only to the extent it is convenient to the supplier. If the seller regards the order as small, the customer is labelled as uninteresting and can be ignored. This disinterest can be signalled to the customer in an undisguised way. The Balts tend to suffer from megalomania, even though their enterprises and markets are minuscule. When they are dreaming exclusively of a jackpot, i.e. a huge contract or a big internationally well-known investor, they can neglect smaller opportunities.

The example below captures a few typical mistakes that Baltic companies can make. The firm under consideration participated in a competitive bidding tender.

1. The bidder sent a bid a week after the deadline, although he had known about the tender early enough.
2. The pricing was inaccurate as it did not contain transportation costs. The buyer could not tell what the final price was.
3. The price was high, because it was set according to the Finnish market price, although the production cost in the Baltics is substantially below the Finnish level due to low wages. Yet this cost advantage disappeared in the pricing. Its competitiveness should have been based on a good price in the first place since the Finnish buyer did not know the Baltic bidder in advance. The Baltic factory had suffered from a shortage of contracts for some time - only 30 per cent of its capacity was in use - but still it was looking for a highly profitable deal, instead of trying to mobilise all its resources.

5.3.2.2 Reliability and Business Ethic

The business ethic in the Baltics is not always as consistent as one may be accustomed to at home. Companies are different in this sense: reliability and quality of delivery as well as the general level of activity vary from case to case. The best companies play according to international standards. It is crucial to draw up detailed, elaborate contracts that take into consideration all thinkable hazards. Nothing should be done merely on an oral gentleman's agreement. Some businessmen in the Baltics are gamblers who are ready to see how far they can go. One has to be prepared for a hard game in a situation of conflict.

The understanding of a customer-supplier relationship can differ from the Western one, which means that the Baltic partners may not even apprehend the intention behind the customer's reaction. The reason is that they view a partnership, a fair deal and the conclusion of an agreement differently. For instance, if the delivery does not exactly

match the order and the customer complains about it, the company may not perceive the problem because the customer received something.

A bigger problem than quality is perhaps keeping to the agreed schedule. The risk of delay is considerable, and the deliverer does not necessarily give any early warning or start negotiations about a new deadline on his own initiative. The customer is often forced to claim for the delivery actively or even act up about the matter, whereas the seller hardly thinks of offering compensation from its side. If a customer agrees to a flexible deadline, saying that he/she is not in such a hurry, he/she can be sure that his/her project will be postponed endlessly. It is better to be strict from the beginning and set the deadline early. The Baltic mentality is such that the start will be slow and the work will be seized only at the last moment. If one organises a seminar, one is unlikely to receive the presentations of the Baltic speakers in advance.

It is not just inability to schedule things but there can be some underlying frailties that have a negative influence on the operations of the company. A great number of Baltic enterprises are constantly struggling with financial problems. Some of them pay their wages overdue perpetually, which will unavoidably affect the work quality in the long run. Off-shore companies are also rife in the Baltics. If the brains of a company concentrate on circulating money to avoid taxes, it will not be a developing business.

Strict control, regular inspections and frequent reporting are essential when starting a collaboration with a new partner abroad. The lesson of the next example is that it is important to follow the changes in the partner company.

> A Finnish principal had worked hard for a long time to train workers of the Baltic subcontractor so that the quality would meet its standards. The Finns had succeeded in this goal and everything was functioning well. All of a sudden they received a delivery in which there was a complete dud with every conceivable thing having gone wrong. All the trained workers had gone on a holiday at the same time and untrained workers had replaced the skilful core group.

What should be taken into account in contacting an unfamiliar company in the Baltic countries? The first tip concerns the mode of contact. It is better to approach the company in writing before a phone call or a visit: that is, to send a letter, a fax or an e-mail which explains your intentions. The Balts like to familiarise themselves with new propositions in private so that they can win time for opinion building among themselves. Especially if their knowledge of English is not the best possible, they will appreciate a letter. In addition, the employees probably want to introduce the matter to the director before doing anything.

No matter what your initiative is about, demonstrate concretely what kind of advantage it provides to the Baltic partner, preferably in the short run. Utility is perceived in the form of tangible benefits, such as profits or contracts. Your proposition should be prepared carefully because your professionalism will be assessed. The Balts are fed up with amateurish daydreamers and adventurers who have come to the Wild East to try their luck, underrating the professionalism of the Balts. The Balts do not waste their

time on obscure projects that bring nothing, because they have seen too many such endeavours.

Sometimes the Balts reply very promptly; sometimes you will have to wait indefinitely. If your initiative does not arouse interest, it is probable that you will receive no answer. In addition to the human factor, poor technical facilities can slow down the communication. Small firms may possess merely one computer which is usually located on the director's desk. Therefore the other employees can send e-mails only when the director is out of his office. In order to advance your cause, be active and do not hesitate to remind him of your existence. The Balts themselves call back frequently, if they are waiting for a response in an important matter, because they know that some persons never reply.

5.3.2.3 Foreign Investors in the Baltics

All the Baltic States welcome foreign investors warmly and foster foreign trade relations actively. The larger and better known the foreign firm is, the more welcome it is, since large international companies spread a sense of security. Foreign businessmen do not complain about the official attitude of the Baltic States, even though some criticise an incomplete investment promotion strategy that neglects post-marketing measures. Promotion programmes attract new foreign investments but as soon as capital enters the country, nobody is interested in cultivating the investment any further. Instead of developing existing activities, attention is turned to the promotion of new projects. Local businesses may try to cash in on the investment, and in an extreme case, which is though exceptional, the investor can get a feeling that the mentality is "let's take the money and bypass the foreigner".

Most ordinary people view foreign firms positively - with the exception of foreign monopolies - because they offer jobs in a capital poor country and are safer employers than domestic companies. If one country achieves a dominant position among the foreign investors, it can be seen as undesirable among the public but it is another question whether the attitude has any practical significance. Labour unions have nothing against foreign companies as such but criticise them for applying different rules in the Baltic countries than in their home countries, for instance in safety regulation. Local competitors are the only ones who are less than delighted about foreign companies but it is rare that they can take any action. Sometimes they do not even notice smaller, less visible newcomers. One entrepreneur mentioned that his IT company was not recognised for three years: "The local competitors are so proud that they do not look around very often."

Business communities consist of people of one nationality, instead of forming a melting pot. Local businessmen have their own circles and foreigners meet their countrymen and women in their own clubs. Foreigners are organised around trade guilds, chambers of commerce or other corresponding associations which inform their members about developments in the business environment and arrange leisure time activities. These meetings are excellent places to make contacts with other Finnish businessmen and can

help newcomers establish themselves in a given country. For instance the chairman of the Finnish-Latvian Trade Guild in Riga welcomes those looking for tips, emphasising the value of peer group information. He can gather a core group of experienced colleagues to tell a newcomer about the basic business practices in Latvia at a lunch meeting. In Finland one can contact the board members of the Baltic Trade Associations. Moreover, different nationalities favour certain bars or restaurants where they see each other informally. The English- and German-speaking churches also serve as a meeting point.

Even though the various business communities do not mix together very much in the sense that individuals would be closely involved in the other circles, business requires co-operation with the locals. In most branches it is necessary to build a confidential relationship with local companies if one wants to succeed. Co-operation will not be problematic, if the foreigner comes to the country with the right attitude. Let us quote a Finnish company director at the end of this chapter:

> "At least half of the problems faced depend on one's own attitude as well as one's expectations and intentions. One must be prepared to work harder than in Finland in order to achieve results and to establish contacts with local companies. If one posits that everything will go according to one's plans, it is better to stay away."

6 BUSINESS ENVIRONMENT

The Central Chamber of Commerce of Finland has conducted opinion polls among Finnish enterprises operating in a variety of sectors about the business environment in Lithuania, Latvia and Estonia. Estonia was surveyed during 2001[61], Latvia and Lithuania during 2002[62]. The Estonian survey gathered information from 75 Finnish enterprises engaged in trade with the target country, while the Latvian and the Lithuanian polls involved 70 enterprises each. The main results of these surveys are summarised here and combined with the executive interviews carried out by the author of this report.

The business environment in all three Baltic States is developing in a positive direction as it becomes increasingly predictable. Differences between the countries are fairly marginal, although Estonia is slightly ahead of Latvia and Lithuania. Finnish companies gave Latvia and Lithuania the same school grade of 6½ for the efficiency of the business environment in 2002, while Estonia's score was 7+ the year before. Finland's business environment was awarded a 9 so it is clear that the Baltic countries still have some catching up to do.

The author's personal, unverified feeling is that those companies that have established a subsidiary company in the Baltics and are operating on the spot might be more positive about the business environment than others. The average grades of the Chamber's survey are hardly satisfactory, but the investors interviewed gave fairly good assessments. Investors who possess experience of other foreign countries tend to regard the Baltics as easy in comparison to many other countries.

[61] Keskuskauppakamari 2001.
[62] Keskuskauppakamari 2002.

Finnish companies believe that the Baltic States will become increasingly significant for their businesses. When respondents were asked about the Baltic market potential over the next five years, the majority maintained that these markets will become more important: 74 per cent expected this in the case of Lithuania, 70 per cent with regard to Latvia and 54 per cent with regard to Estonia. Thus the potential seems to be greater in those countries that have been slower in their development and are less known to Finnish companies.

According to a forecast by the European Commission, the average income per capita in 2004 will be 48 per cent of the EU average in Estonia, 37 per cent in Latvia and 35 per cent in Lithuania. The corresponding figures for 2000 were 38 per cent in Estonia, and 29 in Latvia and Lithuania. EU accession is expected to gradually boost the low purchasing power in the Baltics as well as in other accession countries.

Although the Baltic business environment is relatively stable and its tendencies appear positive, there are still weaknesses that cause problems for enterprises operating in the Baltic States. Some of these items are elaborated under the text box to clarify what the table's statements mean in practice. The charts at the end of this chapter allow comparisons between countries.

Text Box. The Main Nuisances of the Business Environment in the Baltics.

Lithuania	Latvia	Estonia
Customer liquidity/ creditworthiness	Customs clearance	Infrastructure
Fierce price competition	Customer liquidity / creditworthiness	Corruption, bribery
Red tape	Business culture	Customs clearance
Customs clearance	Red tape	Economic policy environment
Infrastructure	Fierce price competition	Small market
Purchasing power	Infrastructure Legislative matters	Purchasing power
Business culture	Market entry Purchasing power Economic situation	Fierce price competition
Price level Legislative matters	Corruption, bribery	Differing interpretations of laws
Payment traffic	Price level	Legislative development and harmonisation
Language problems Economic situation	Language problems	Need to adopt international practices in accountancy and taxation

Infrastructure

The telecommunications infrastructure is quite good in the Baltic States, as has been indicated in other parts of this study. The energy sector is also developing well. The main problems concern roads, railways and logistics – especially in Latvia.

Legislation

The commercial code is more or less in place and harmonisation of the legislation with the EU is proceeding, but the implementation of legal acts is sluggish and controversial. Civil servants may interpret the same law in different ways. Laws are often prepared poorly without involving pertinent interest groups, and there is little analysis of the effects the legislation will have once implemented. Changes in legislation are too frequent, unpredictable and illogical.

Market entry

Founding a company with the help of a local law office is not too difficult, but actual market entry is less easy. It takes time and costs money. The results are better if the newcomer finds a partner who is familiar with local conditions. First-to-market opportunities have long since passed, so one has to be prepared to face competition. Sometimes foreign investors feel that local companies are favoured in ways that distort competition. Building up working, trusting subcontracting relationships is a longer-term process, which may fail as a once-and-for-all exercise. It is essential that clients clearly define the work they wish contractors to undertake.

Shady practices

The preconditions for local SMEs to do business are harsh, and government support is almost non-existent. This creates a temptation to bypass the law, evade taxes and pay part of the wages in cash. Software piracy is widespread in the Baltics, although governments have recently introduced measures to combat the problem.

Heavy bureaucracy

Red tape, combined with a low administrative capacity, causes a lot of extra paper work for enterprises, which complicates their everyday life. Minor issues that are handled in Finland within a few days can take a month in Baltic countries. As one businessman puts it, it requires artistry to turn a small, simple thing into such a cumbersome, time-consuming process which will ultimately kill the interest of the enquirer. Foreign investors may feel that everything is made as complicated as it possibly can be. What further irritates business people is the arbitrary dispersion of authority among various agencies, requiring repeated visits regarding the same matter.

Corruption

The low salaries of civil servants give rise to corruption. Latvia fared worst in the comparison among the Baltic States in 2001. On the corruption index of Transparency International, an organisation which investigates the international extent of bribery, Latvia ranked 59th in a comparison of 91 countries. The placement was the second worst

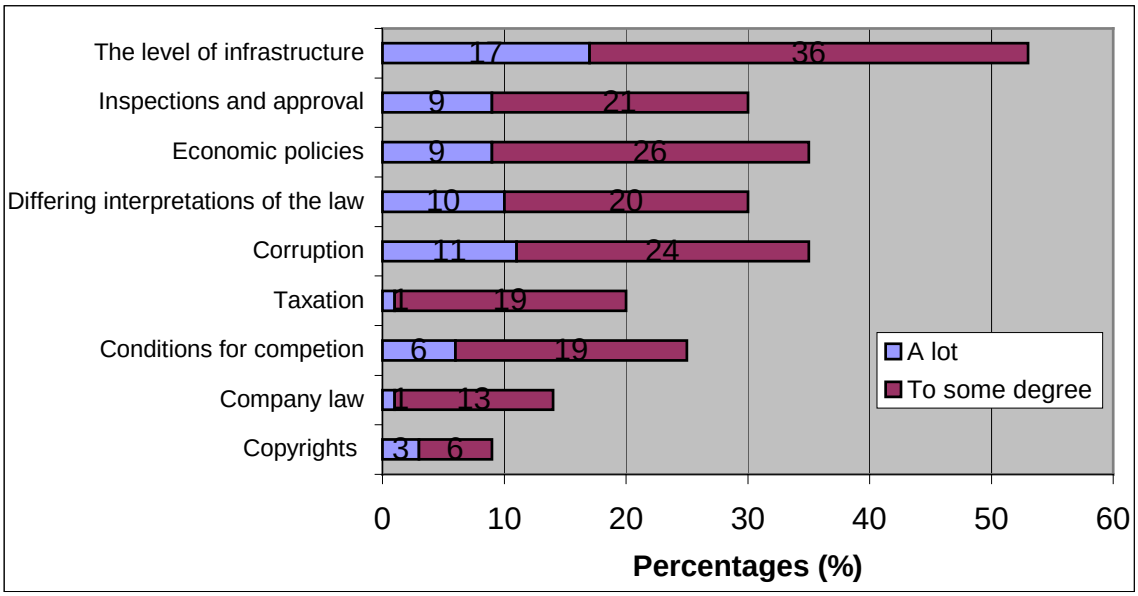
of the EU applicants after Romania. Lithuania ranked 38th and Estonia 28th, while Finland took first position as the least corrupt country.

It can be hinted to a businessman that this or that matter could be dealt with a faster way too... To win a contract, a bidder can be requested to reward the decision-maker for a favourable choice. Official tenders and construction projects are considered to be difficult for foreigners because of the strong entanglement of insider interest. In IT branch, corruption is not so big issue. At least in public, foreign investors stress that it is quite possible to do without bribery in the Baltic countries. Those foreign companies that ban bribery strictly in their internal rules do not see this principle as an impediment.

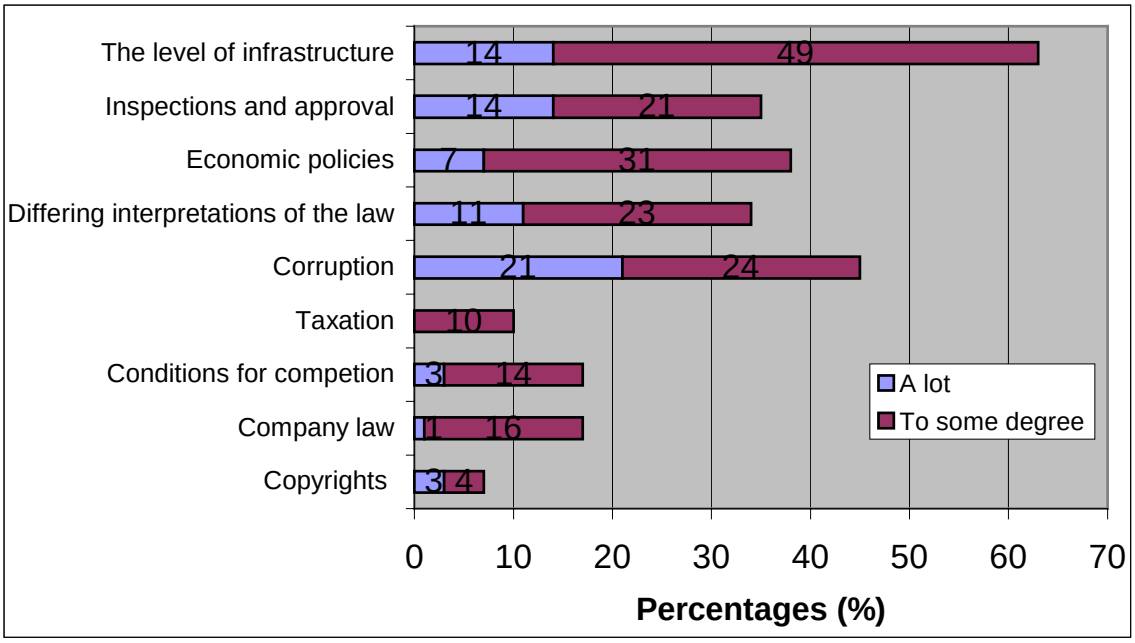
Organised crime

Organised crime is losing its significance and is withdrawing from "protection" to drugs and prostitution. Local bar and shop owners are more threatened than foreign firms, which do not report contacts with organised crime. A foreign company director advises that it is best to stay on the right side of the law in one's business, then one will never have any problems with the mafia. However, if the firm itself starts to do dirty business, such as evade taxes, the mafia will soon hear about it. Then they will pay a visit and one is on a hook.

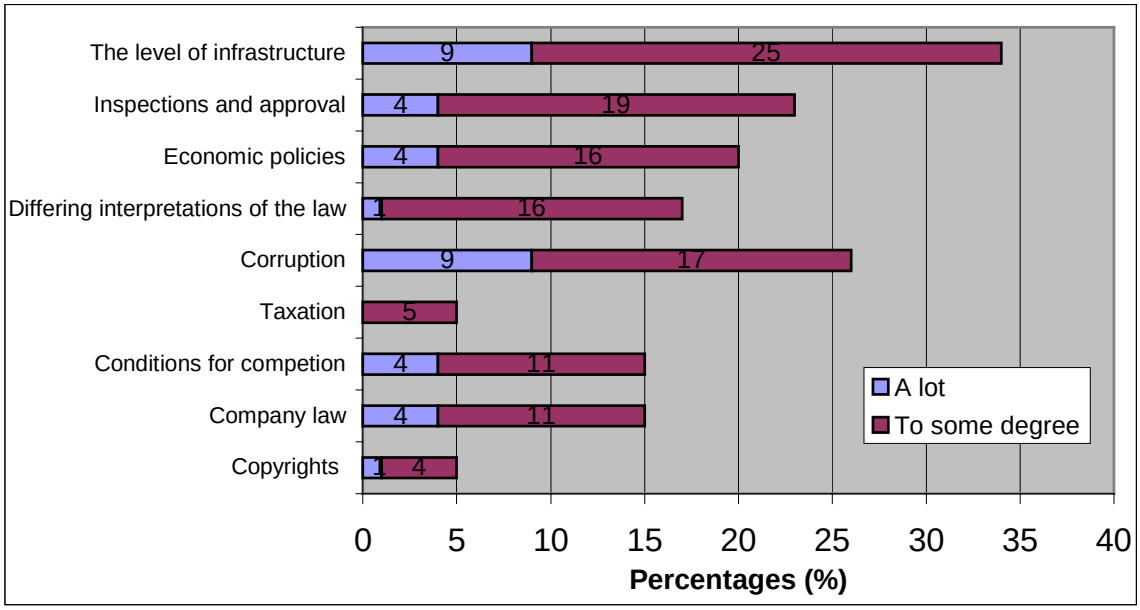
LT: Functionality of the Business Environment: Have the Following Factors Hampered the Operations of Your Company?



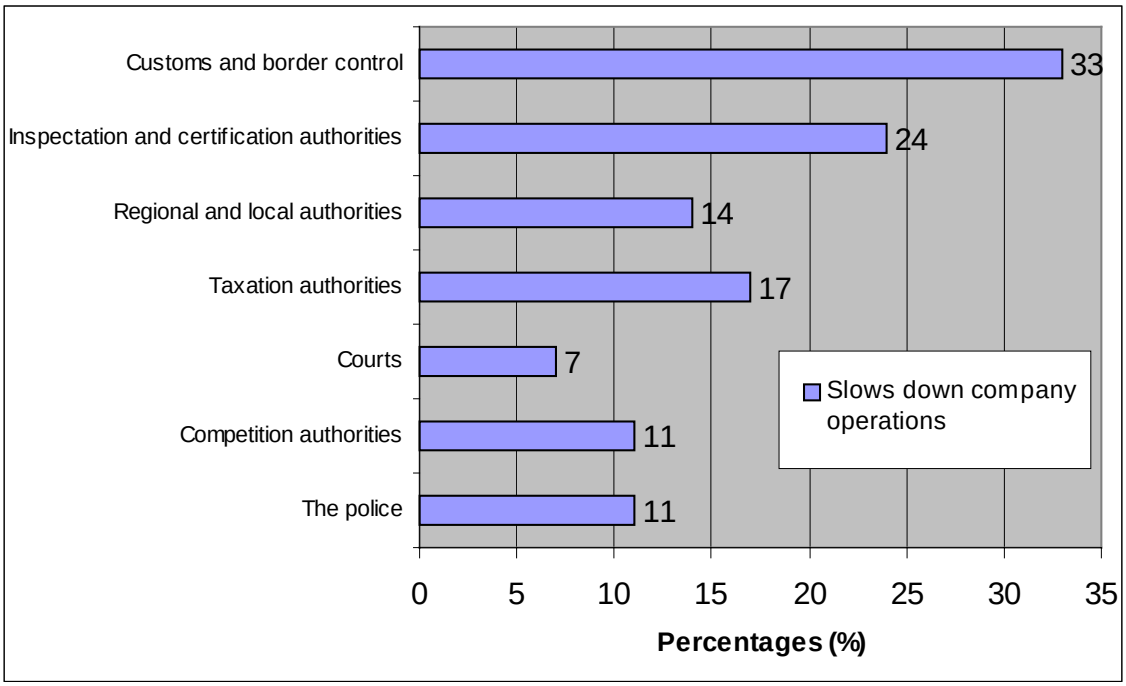
LV: Functionality of the Business Environment: Have the Following Factors Hampered the Operations of Your Company?



EE: Functionality of the Business Environment: Have the Following Factors Hampered the Operations of Your Company?



LT: What Kind of Experiences of the Authorities Does Your Company Have?



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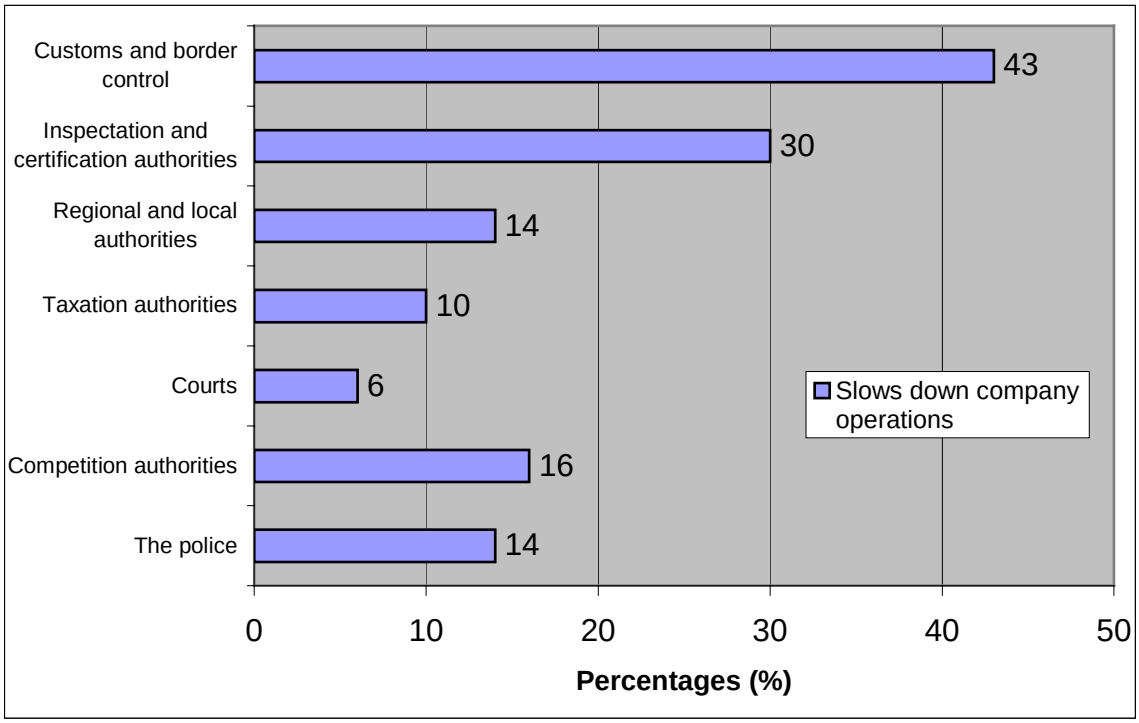

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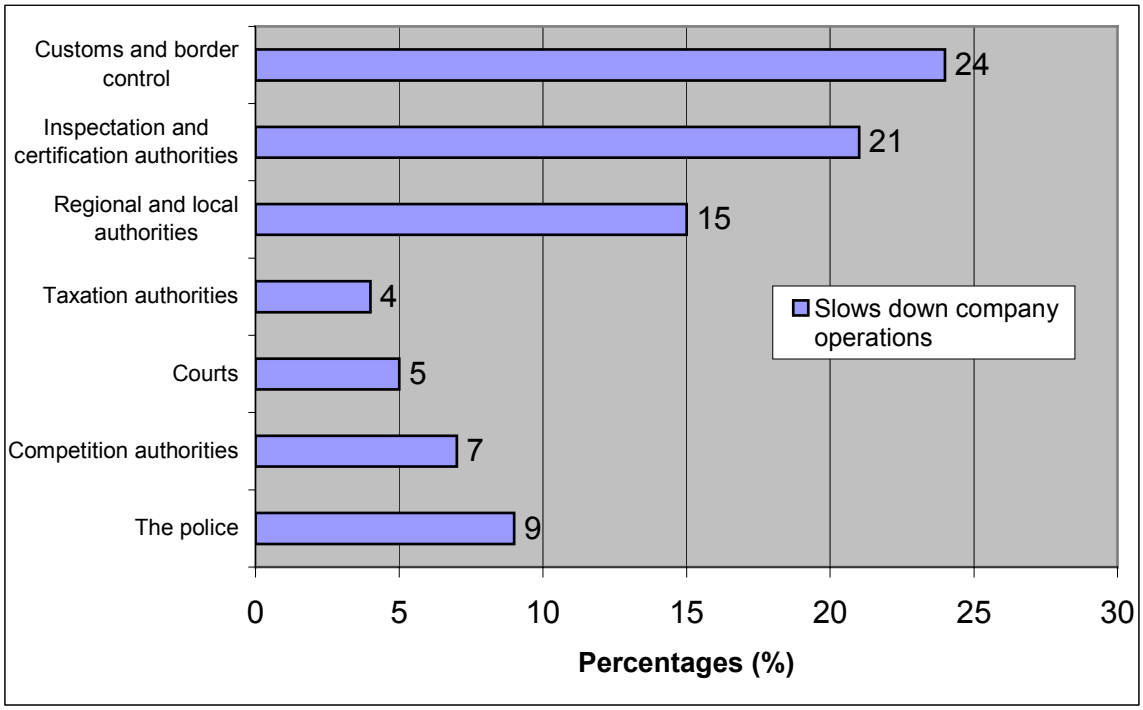


6.1 Salaries

Salaries paid to IT and business specialists, who are in great demand, deviate considerably from those stated in official wage statistics. The costs of unskilled labour are low, but the salaries of experienced specialists, such as good software designers, system administrators and IT project managers, as well as high-level executives with management skills are already relatively high, approaching even Finnish salary levels in some cases. The salary level is lowest in Lithuania, where the supply of IT specialists is also best. In general, the electronics industry pays lower salaries than the ICT branch.

Foreign companies pay higher salaries than domestic ones. A peculiarity of the Baltic practice is that salaries are often defined in net terms; that is, what the employee receives in hand. The employer must calculate the various taxes and social costs on top of this. These costs are regulated by the legislation in each country. Hence, it should be remembered that the cost of an employee is clearly higher than the net salary also in the Baltics.

The salaries given in the table below are based on rough estimations made by company directors who operate in the Baltics. They should not be treated as precise facts or systematic statistics, as they are not mutually comparable. It should be also taken into account that the situation is constantly changing, and these data were collected in 2001–2002. Various consulting companies, such as Fontes R&I Consultants, collect regular wage information in the Baltics.

Table. Salaries in the IT Branch by Country (in national currencies and euros).

Position	Lithuania	Latvia	Estonia
Junior programmer with little experience	LTL 1 000–1 200 **€ 290–350**	LVL 300 **€ 500**	EEK 8 000–10 000 **€ 510–640**
Middle-level programmer	LTL 1 900–2 200 **€ 550–630**	LVL 500–650 **€ 830–1 080**	EEK 10 000–15 000 **€ 640–960**
Experienced top programmer	LTL 3 000–4 000 **€ 870–1,160**	LVL 650–800 **€ 1 080–1 330**	EEK 15 000–30 000 **€ 960–1 920**
Project manager	LTL 4 000–6 000 **€ 1,160–1,740**	LVL 800–900 **€ 1 330–1 500**	EEK 30 000–35 000 **€ 1 920–2 240**
Account manager or similar with broad areas of responsibility	LTL 8 000 **€ 2 300**	LVL 1 000–1 200 **€ 1 660–2 000** no upper limit	
Typical salary	*€ 550–630*	*€ 830–870*	*€ 640–1,280*

Table. Average Wages by Country, 2001.

	Lithuania	Latvia	Estonia
Average wage	LTL 1,054 **€ 305**	LVL 159 **€ 264**	EEK 5,300 **€ 339**

LT: Average Monthly Gross Salaries in Lithuania, 2000 (in euros).

Position	Salary in euros	Position	Salary in euros
Minimum wage	115	Engineer	363
Average industrial worker	268	Software programmer	552
Secretary	268		

Source: LDA 2001.

LV: Average Monthly Gross Salaries in Latvia, 2000 (in US$).

Position	Salary in US$	Position	Salary in US$
Assembler	337	Logistics deskman	671
Warehouse worker	414	System administrator (IT)	941
Truck driver	643	Senior engineer	1 021
Programmer (IT)	521	Project manager	1 172
Advanced machinery operator	524	Team leader (IT)	1 263
Engineer-technologist	560	Technology director	2 738

Source: LDA 2002.

EE: Average Monthly Gross Wages in the Estonian Electronics Industry, 2001 (in euros).

Subsector	Salary in euros
Telecommunication equipment	290
Medical, precision and optical instruments	375
Electrical machinery and apparatus	453

Source: www.eia.ee

7 SUMMARY

Structural similarities, which ensue from parallels in recent history as well as subsequent economic and geopolitical situations, can be perceived in many of the phenomena described in this report, such as the problems of the research and education system, the company profile of the industry and some features of the business culture. These shared structural traits justify the use of the umbrella term 'Baltics' and the analysing of the Baltic countries together as a group in certain occasions. This practice is not meant to deny the cultural distinctiveness of three different nations.

7.1 Information Technology and Telecommunications Industry

The Baltic ICT sectors are in a vibrant state with high annual growth rates of up to 10–20 per cent or more, but the size of the ICT market is relatively small. It also has to be remembered that these sectors still make up a relatively small share of GDP to be measured by a single-digit number. Furthermore, while spending on information technology has grown remarkably over the last decade in all Central and Eastern Europan countries, the IT expenditure remains at a level that is lower than in the EU Member States. This can be seen by comparing the relationship of IT expenditures to GDP and per capita IT spending. Only Estonia exhibits spending levels relative to GDP which match those of many EU Member States.[63]

[63] International Trade Centre 2002, 36.

Table. Country Market Comparison of IT Spending in the Baltic States and the EU Member States, 2000–2001 (in million euros).

	IT expenditure (MEUR)		Growth of IT expenditure (%, 2001 against 2000)	IT expenditure in 2000	
	2000	2001		% of GDP	Euros per capita
Lithuania	166	182	9.6	**1.4**	**45**
Latvia	153	166	8.5	**2.0**	**64**
Estonia	168	182	8.3	**3.1**	**117**
Total EU-15	294 042	305 781	4.0	3.4	777

Telecommunications account for the overwhelmingly largest share of the ICT market in all three Baltic countries. Finnish-Swedish capital dominates the Baltic telecommunications companies, which have heavily invested in upgrading networks and services. The modernisation of the telecommunications infrastructure is the most complete in Estonia, but the level of technical infrastructure is quite good from the business point of view in Latvia and Lithuania as well. The fast expansion of mobile phone operators has turned out to be an important growth engine in the telecommunications market. The abolition of the fixed line monopolies in Latvia and Lithuania on 1 January 2003 is expected to accelerate the growth rates of the whole segment and contribute positively to the development of internet-based services. The monopolies have kept tariffs high both in absolute and relative terms. Estonia liberalised its telecommunications market successfully already in January 2001.

Estonia's internet penetration is high even by international standards. Lithuania's internet penetration is the lowest in the Baltics, while Latvia holds an in-between position. A network of free public internet access points is an important instrument in expanding the circle of uses. E-banking is strongly positioned in Estonia.

When the structure of the Baltic **information technology** market is compared with that in the United States and Western Europe, two principal deviations can be observed: the proportion of hardware is higher and the proportion of IT services lower. The computerisation of public administration and schools first generated a great demand for hardware. At the next stage, the government's information society programmes generated – and will continuously generate – demand for software applications. The private sector followed basically a similar path. The manufacturing industry has started to buy solutions increasingly, and the demand for system integration and IT services is in growth. Along with the public sector, the banks and the telecommunications companies form the most important customers of Baltic IT firms. Estonia's two biggest software firms are information technology divisions of the largest banks.

Figure. Structure of the IT Market in the Baltic States, 2001.[64]

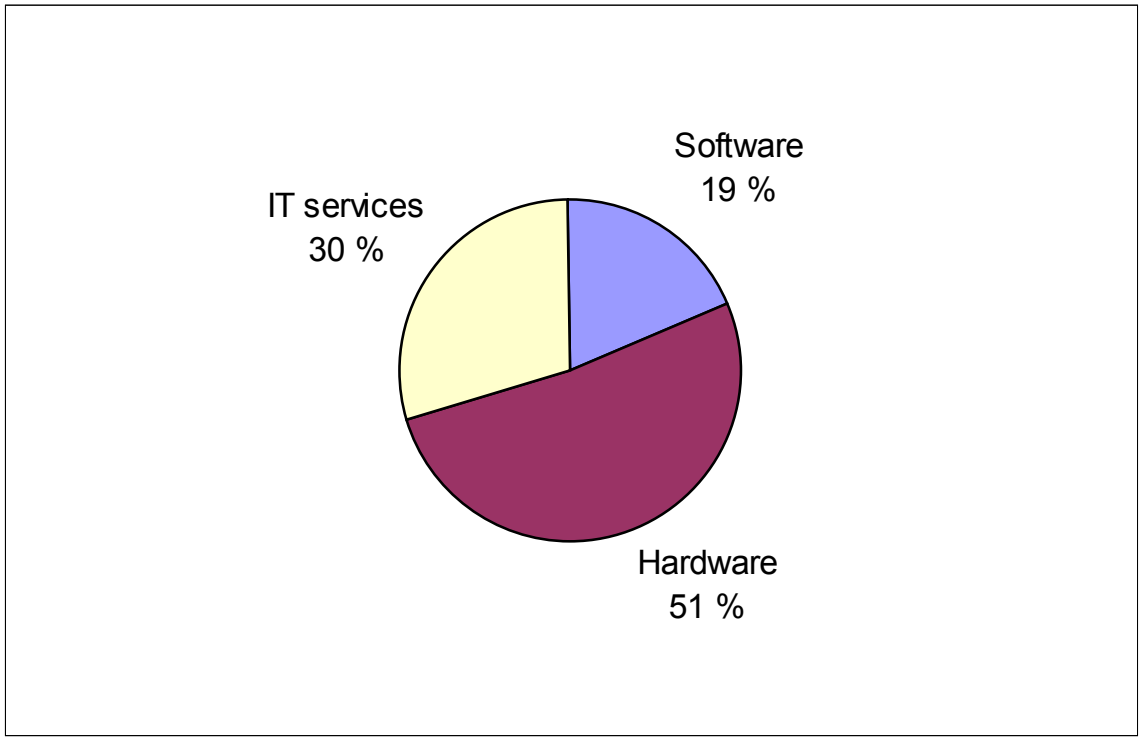


Table. The Value of the Baltic IT Market by Segment, 2001–2002 (in million US$).

	2001	2002*
Software	87.2	101.4
Hardware	238.7	261.5
Services	143.0	165.2
Total	468.9	528.1

*Estimation

The orientations of the Baltic IT sectors differ from one another when their competitive edges are compared. Estonia is the most advanced Baltic country in innovative mobile technologies; Latvia possesses the largest outsourcing offer; Lithuania has some interesting software products.

- Lithuania's largest IT exporters are specialised in programming services, banking and telecommunications solutions, and business management system installation. Large IT companies continue to be simultaneously oriented to hardware sales and solutions development in order to cover all product segments.

[64] Information Society Development Committee under the Government of the Republic of Lithuania 2002, 25.

- System development and integration, software re-engineering, localisation software, payment card systems, CASE tools and B2B internet solutions belong to the core competencies of Latvia's major IT companies. Latvia's niche speciality is a reserve of programmers who command old, nowadays rare programming languages.
- In addition to wireless solutions, system developers that produce major infra-structure systems have been successful in Estonia. The Estonian Microlink is the largest Baltic IT company with activities spread over the whole Baltics and over five divisions (systems, data, computers and services, new media and microwave).

The outsourcing industry has become quite a significant branch in Latvia, and the Information Systems Cluster Project aims at further increasing its export capacity and competitiveness. The software development service segment is strongest in Latvia, which is a net exporter of these services. In Estonia software service exports are more marginal. Except for a few pioneers, Lithuanian software houses have started to pursue a consistent export strategy only in recent years but they hope to expand these activities. According to the survey data, more than half of the Baltic IT companies work for the domestic market solely, whereas less than 15 per cent of them export more than half of their net sales. The main export markets are in the Baltic Sea region countries.

Baltic IT firms have seldom software products of their own, while they mostly provide customised solutions. In addition to applied customer-specific software, local area networks (LAN) as well as databases and information systems are typical activities to them. Locally developed accounting and financial management products are mainly sold in the domestic market, where their heyday was in the 1990s.

Small companies, employing up to 10–20 people, predominate the Baltic IT industry, which weakens the capacity to receive large-scale projects. The Estonian Microlink employs 640 persons in the whole Baltics and the Latvian Dati Group 515 persons. A narrow spearhead of large firms competes for major supply contracts. The number of leading companies varies between ten and twenty in each country. In Lithuania, the total number of IT companies is assessed to be about 200; in Latvia, the number of software companies is around 100 and the total number of ICT companies around 500; in Estonia, the ICT sector consists of 250–300 companies. The top companies are usually ISO 9000 certified.

The Baltic industrial associations assess that national ICT sectors employ around 10,000 people in each country. The number of software specialists, who can be acknowledged as programming professionals, is smaller. According to a bold estimation, there might be 12,000 competent software developers in the Baltics altogether, but some consider this estimation too high. The top 25 IT companies in Latvia employ over 3,000 professionals.

The IT industry has attracted less foreign investments than the telecommunications sector so that the industry is mainly home-grown. Yet the most prospective companies have often – though not always – benefited from foreign capital. This is the case in Lithuania especially. Foreign investors have sometimes bought and merged successful Baltic companies: the purchase of Konts by the Finnish Tieto (later TietoEnator) and the purchase of SWH Technology by the US-American Exigen can be cited as examples

from Latvia. The Nordic countries, Germany and the USA belong to the most active foreign investors in the Baltic IT industry. Local companies that have expanded over more than one Baltic country by establishing a daughter company are rare. Within the survey sample, only one tenth of the responding companies had any foreign units, such as sales offices, representations or production plants. Most often those were located in other Baltic countries or Russia.

7.2 Electronics Industry

Electronics was a very significant branch in the Baltics, especially in Latvia and Lithuania, during Soviet time, but huge Soviet plants could not compete with western technologies when the market was opened up in the early 1990s. Today the Lithuanian electronics sector employs about 15,000–16,000 people in some 90 companies and the Latvian one about 5,500–6,000 people in 50–60 companies. A substantial part of the former labour reserve was forced to start a new career in the 1990s so that the human resource potential was partly lost. Today the significance of traditional electronics is lesser than that of ICT in Latvia and Lithuania.

Thanks to abundant foreign investments, the Estonian electronics industry became one of the country's fastest growing sectors in the second half of the 1990s. In 2001, it accounted for 11 per cent of the total production of the manufacturing sector. Today subcontracting industry is flourishing in Estonia. Clients come principally from Finland and Sweden. Telecommunications equipment, precision instruments and assembly of printed circuit boards are well presented in the Estonian electronics industry.

Foreign investors have not favoured Latvia and Lithuania to the same extent as Estonia in the field of electronics, which has constrained the modernisation of production technologies. The leading Lithuanian electronics companies have solved the problem by a collaboration with foreign technology partners. Lithuania has managed to retain a value chain of large-scale television manufacturers with 1,000–5,700 employees. Lithuanian laser technology producers have established themselves in the world-market of short-impulse (picoseconds) and multi-colour producers. One also finds producers of microelectronics and components.

The Latvian electronics sector has know-how in intelligent control technologies, automated testing solutions, telecommunications equipment, measurement and test equipment, and optoelectronics. A small number of new promising electronics companies have emerged in Latvia after the nadir of the past decade. To conclude, it can be seen that the Baltic electronic industries have differentiated profiles with divergent foci of production, just like just like the ICT sectors.

The most frequently mentioned technologies in all countries that the survey sample's companies defined as their core competence include 1) electronics design and manufacturing technologies, 2) measurement technologies, 3) power electronics, 4)

digital signal processing, 5) optics and optoelectronics and 6) integration of information systems and communications. The most typical definition of one's core business was manufacture of final devices in the field of industrial automation and measuring instruments.

7.3 Research and Development

The Baltic electronics industry is backed by a convincing scientific knowledge still in these days. According to the survey results, the Latvian and Lithuanian electronics companies were the most R&D intensive ones within the sample. Furthermore, Soviet roots appeared to contribute to the likelihood of R&D in a company. Especially in such firms, where the founder of a company or its other key persons belonged to a former Soviet firm or research institute's R&D staff, R&D activities were much more common than in other firms.

Foreign capital, by contrast, did not seem to have the same effect. It was thus concluded that a long standing scientific tradition is currently a more important prerequisite for R&D activities than a technology transfer from abroad, although this was not meant to deny the transition economies' dependence on the infusion of western technologies. Foreign companies often import ready concepts and technologies from their home country, instead of designing them in the Baltics. Thus, foreign capital does not necessarily facilitate a country's own product development, if the strategies of mother companies rest on the exploitation of cheap labour. In that case foreign investments only help modernise production technology and generate – in many cases low value added – exports. Ericsson's research centre in Estonia is the opposite example of beneficial spill-over effects that boost activities of the local industry.

The need for strengthening R&D is urgent in the IT branch. Despite the buoyant development, the Baltics face a serious challenge, as they are pressed to shift their industrial development into a more innovation-driven direction. Offshore outsourcing, once the engine that drove the Baltic IT industry, is running out of steam as the Baltics become expensive compared with some other transition economies, such as Belarus, the Ukraine, Bulgaria and Romania. Consequently, the IT market should focus more on research and development but first the companies need to build up capital, which will be a difficult step to be taken.

The expenditure on R&D as a share of GDP is considerably lower in all three Baltic States than in developed industrial countries. As the Baltic GDPs are about four to five times lower than the average GDP in the EU, the actual amount of money is even smaller than the percentage indicator shows but on the other hand the low salaries of researchers counterbalance the situation. R&D activities take place primarily in the public sector, while very little research is undertaken in the business sector. This is reflected in a high basic research ratio vis-à-vis applied research and technological development. The financing mechanism has suffered from an inertia in redirecting the allocation of research funds to new relevant fields.

Not only is corporate R&D marginal in the Baltics but collaborational relations between universities/research institutes and business enterprises are also weak. The industry, which consists of small, capital-poor enterprises to a great extent, does not usually possess sufficient financial means to purchase research output. In addition, the shortage of long-term strategic thinking and a poor risk-taking ability in Baltic companies obstruct investment in innovation activities and product development on the attitudinal side. The scant contract research is mainly taken for a limited number of foreign companies, for instance for telecommunications companies. However, the presence of foreign owned companies does not necessarily stimulate R&D relations as much as one might expect. In the IT field, contracts typically deal with development of practical applications or management of public projects rather than real research.

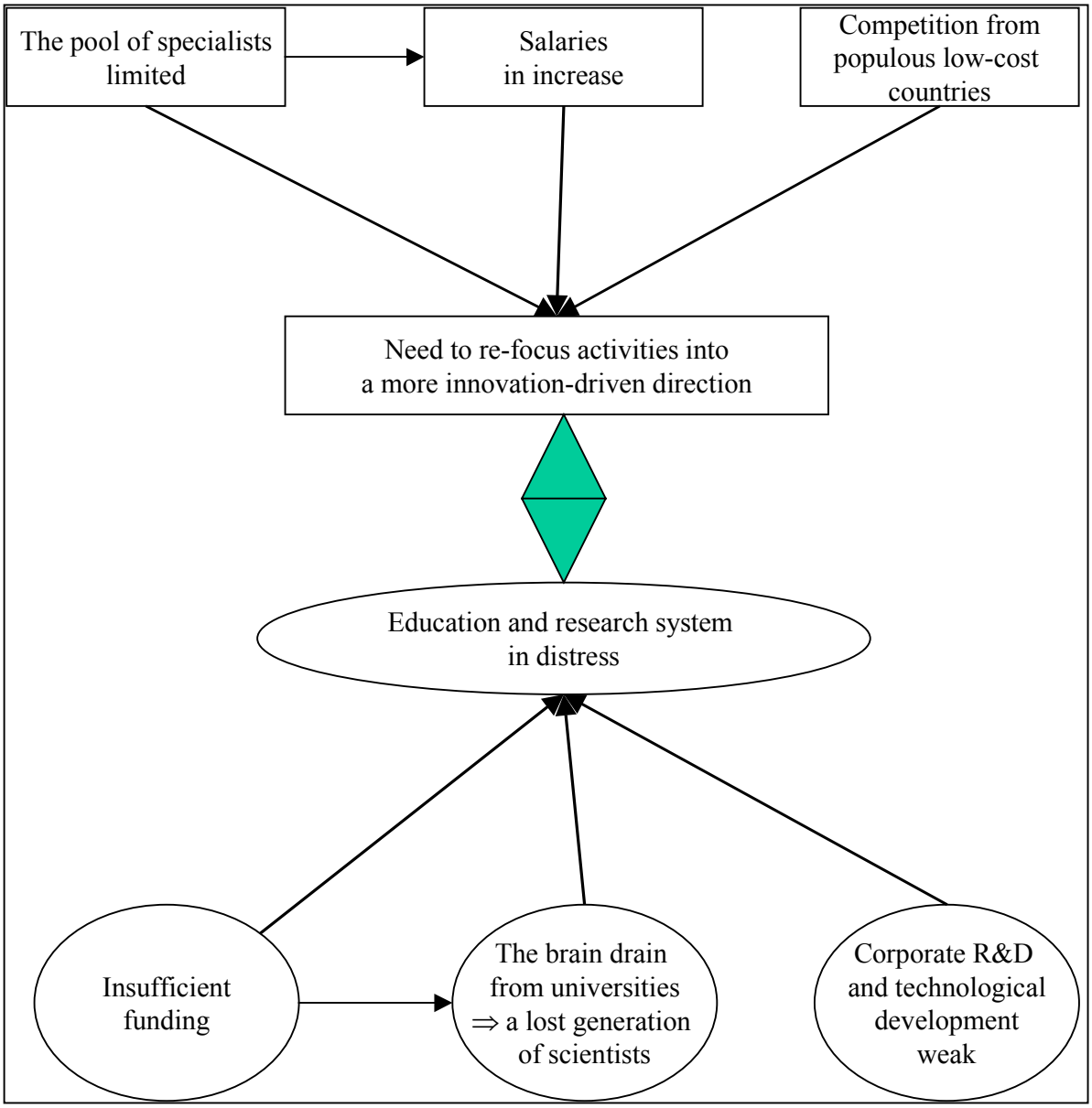
Both local and foreign companies are interested in researchers primarily as good specialists to be hired, which has led to a dramatic shortage of young, talented scientists at universities and research institutes. The top scientists are said to have shifted to private companies or foreign universities in the 1990s. The bad salaries of the public sector, together with the slow career path of a university researcher, cannot compete with the opportunities that the private sector offers. In the ICT branch the income gap is particularly wide because ICT specialists are at the top of the salary structure. As academic professions suffer from a low prestige in the graduates' eyes, it is difficult to recruit postgraduate students. Even in those cases a person would be interested in postgraduate studies, the monthly allowances are so little that one cannot live with them. Besides, the departments cannot often ensure vacancies for fresh doctors due to limited budgets. The poor financing of the research systems also has the consequences that universities cannot afford to renew their equipment, buy enough new books for the library and renovate their buildings.

To compensate their low salaries, the university staffs work in private companies or run a business of their own in such fields where their know-how is demanded, as is the case in ICT and electronics. On the positive side, these sidelines provide knowledge about practical industrial needs to the university and transfer technological know-how to local companies, but they also hinder a full devotion to research and teaching, making large research projects often impossible. In many university departments the teaching function clearly prevails over the research function. Where the scientific tradition happens to be weaker, the risk of a department to degenerate into a mere educational institution is real. At the same time, foreign evaluators have identified excellent research groups which stand up any international comparison and produce high quality research in specialised areas. The following ones can be cited as examples of reputable research fields in the Baltics – naturally there are plenty of others, but they all cannot be listed here:

- *Lithuania*: laser technology, ultrasound technology, semiconductor physics, precision engineering, mathematics and cardiology
- *Latvia*: solid states physics, material sciences, digital signal processing, organic synthesis, biotechnology and pharmaceuticals
- *Estonia*: biotechnology, cybernetics, computer engineering, semiconductor electronics, micro-optics technology and energy

In the innovation system, a lot needs to be done to make the system produce results. Generally little research is successfully commercialised, although there are examples of research under-pinning economic development. The formation of spin-offs is meagre, and spin-offs have hardly grown to any significant business, even though researchers often have their own small firms. Sometimes companies hosted by science and technology parks are no science-based firms at all. The proportion of innovative firms is assessed to be one tenth of all firms. Patenting activity, showing the results of applied research, is very low in the Baltics. More international patents come into force in the Baltic countries than are developed there. According to the survey of this project, one tenth of the sample's companies possessed patents, which corresponds to the estimated number of innovative companies.

Chart. The Dilemma of the IT Industry in the Baltics.



7.4 International Readiness

More than half of the survey sample's companies have exports and nearly a quarter of them exports more than half of their net sales. A strong exporter is typically a large foreign owned company with subcontracting experience. Less than a half – around 45 per cent – of Baltic companies have experience in performing as a subcontractor, for instance, in software outsourcing or contract manufacturing. The main export market for Baltic companies is in western industrialised countries. The most frequently mentioned export countries are the Nordic countries – Finland and Sweden in particular – the Baltic neighbours, Russia, Germany and the United States.

The Latvian electronics industry appears to be the most interested partner to Finnish firms within the sample. Lithuanian companies also hold a responsive attitude to Finland. Almost a third of Lithuanian companies would welcome a foreign partner for investment or a joint venture, in Estonia only a fourth. Companies interested in co-operation with foreign firms most often offer software outsourcing or web design and ISP services but also electronic manufacturing and even R&D services.

Almost all Baltic companies can communicate in English and Russian with their business partners according to their own announcement. It probably holds true that nearly every company employs persons who do speak English, but it does not yet mean that everybody in the company speaks it. It can be the case for example that salesmen and an assistant to the director are fluent in English but key technical persons responsible for the production process do not necessarily command foreign languages. Young, well-educated people generally speak English fluently. Finnish is spoken only in Estonia with the exception of sporadic individuals in Latvia and Lithuania. About half of the companies have their marketing brochures available in English, while less than a quarter of them have participated in competitive biddings abroad in order to win a contract.

7.5 Higher Education

The educational system is broad, reaching the whole population, not just a tiny elite. The young enter the working life earlier than in the West. Foreign investors usually regard both school and technical education as being of high quality, although the signals are contradictory. Two common complaints are that practical skills are not taught sufficiently and the technical equipment at universities is outdated. The resulting mismatch between the university education and the industry's needs is alleged to create a necessity to train new recruits internally. The universities defend themselves by saying that their curricula are compatible with the Western ones, which have been used as models in designing them.

Evaluations of curricula confirm that programmes reflect the tenets of similar programmes in western universities and teaching methods are standard. Typical concerns of evaluators include the industrial involvement of faculty members, which can lead to diminished involvement in developing academic programmes. Evaluators also doubt whether the programmes offer the newest knowledge and skills because of insufficient facilities.

The higher education systems in the Baltic countries are binary, consisting of academic and non-academic, i.e. professional, degrees. University type institutions often offer both academic and professional programmes; non-university type institutions run applied professional programmes solely.

ICT related study fields (informatics, computer science, telecommunication) are popular among the Baltic secondary school graduates, because the salaries paid by the ICT companies are substantially above the average. Hence the study places are subject to a keen competition with the result that the faculties are able to screen the best applicants. Professors can be content with their freshmen.

The traditional fields of engineering, such as electronics, electrical and mechanical engineering, lost their popularity in the 1990s as a consequence of the demise of the Soviet industry. The numbers of students dropped drastically and the institutes shrank in size. Electronics and automation survived best in Lithuania where the faculties remained quite robust. Orientation to telecommunication further increased their attractiveness. Following the recent developments in the market, some revival of interest in engineering studies is to be observed all over the Baltics.

The Baltic pupils have had the reputation of being entrusted with strong mathematical skills, since the Soviet schools used to have a large amount of weekly hours in mathematics with demanding curricula. Until these days Baltic pupils have been successful in international competitions in mathematics, winning prizes in them. However, professors refer to increasing disparities between schools, which results in a heterogeneity of pupils' mathematical skills. Small rural schools often fall short of the national average, whereas specialised secondary schools produce excellent students. The Faculty of Informatics and Mathematics in Vilnius University runs the Lithuanian School of Young Mathematicians for secondary school pupils.

The poor financial aid to students forces them to take a job already in the second or third study year. As long as IT firms suffer from a shortage of specialists, they are compelled to hire students. A student can get better earnings than his/her teacher at university, which makes working lucrative. It is a rule that Master and Ph.D. students work. Opinions diverge as to the desirability of combining studies with a full-time job. The defenders emphasise that it enables students to get know modern technologies and gather experience of real-life projects. The sceptics point out that students devote only a small part of their time to studies, which easily leads prolonged graduation times and increased drop-out rates. Many students value work over studies, especially if they are unsatisfied with the quality of university education.

The industry has been more active in building up collaboration with universities in education than in research. Both individual large enterprises and industrial associations

have concluded partnership agreements with universities in order to elaborate curricula, set up practical training programmes, grant scholarships and assist in the modernisation of technical equipment. The Latvian LITTA, for instance, contributed to the development of professional education standards for programmers, data base administrators and system analysts.

7.6 Student Numbers

The number of students in higher education is highest in Latvia both in absolute and relative terms. The absolute number of students is lowest in Estonia, while the student-inhabitant ratio is smallest in Lithuania. The share of engineering and natural science students is highest in Lithuania, whereas the share of social science students (which includes economics and business administration) is lowest there. In Latvia the share of engineering and natural science students is smallest, but in terms of absolute numbers Latvia overtakes Estonia due to a larger population. Lithuania has two major technical universities, both Latvia and Estonia only one.

The number of IT students is biggest in Latvia and smallest in Estonia. So far Latvia has increased study places for freshmen in IT-related fields, but at the next stage the government will shift the focus onto encouraging postgraduate studies.

Figure. Annual Enrolment in Higher Education Institutions by Country, 2000 (number of students).

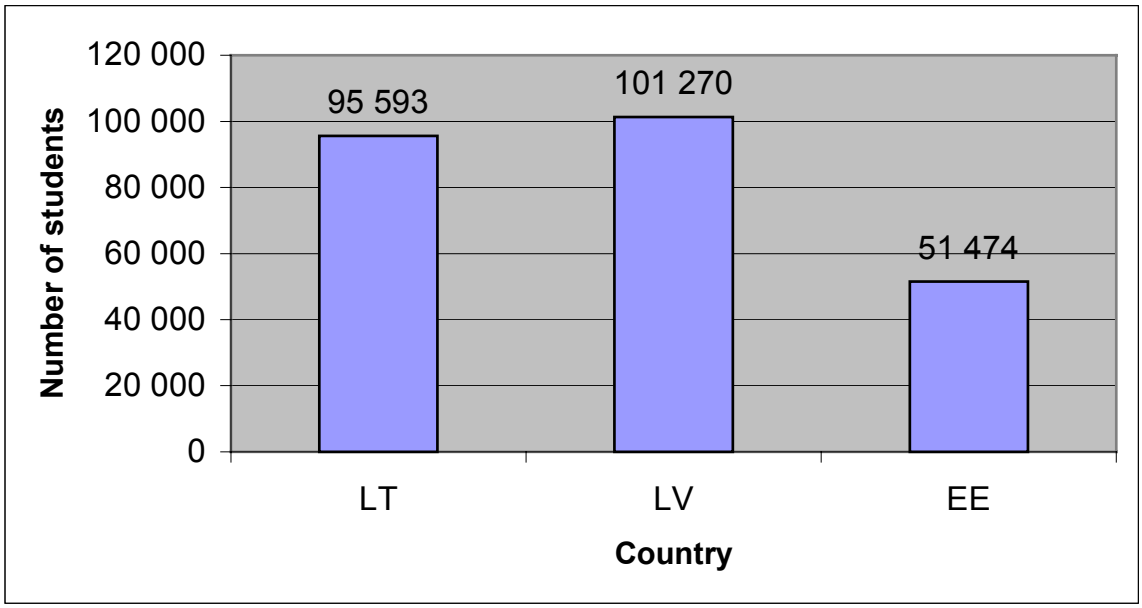


Figure. Number of Students in Tertiary Education per 100,000 Inhabitants by Country, 2000.

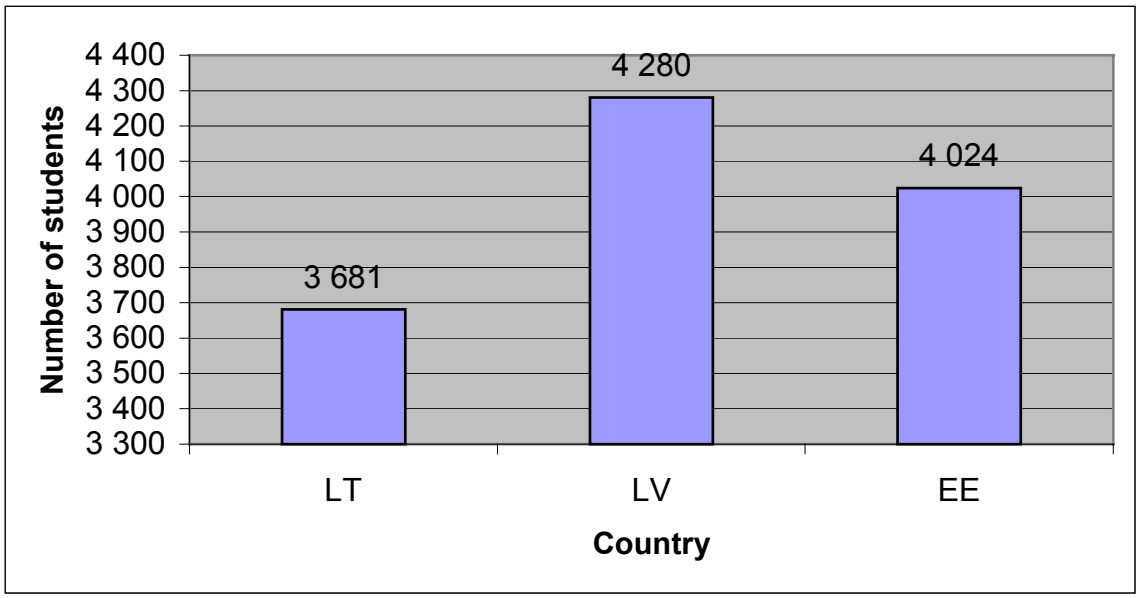


Figure. Enrolment in Higher Education Institutions in Selected Study Fields by Country at the Beginning of the Academic Year 2000/2001 (in per cent).

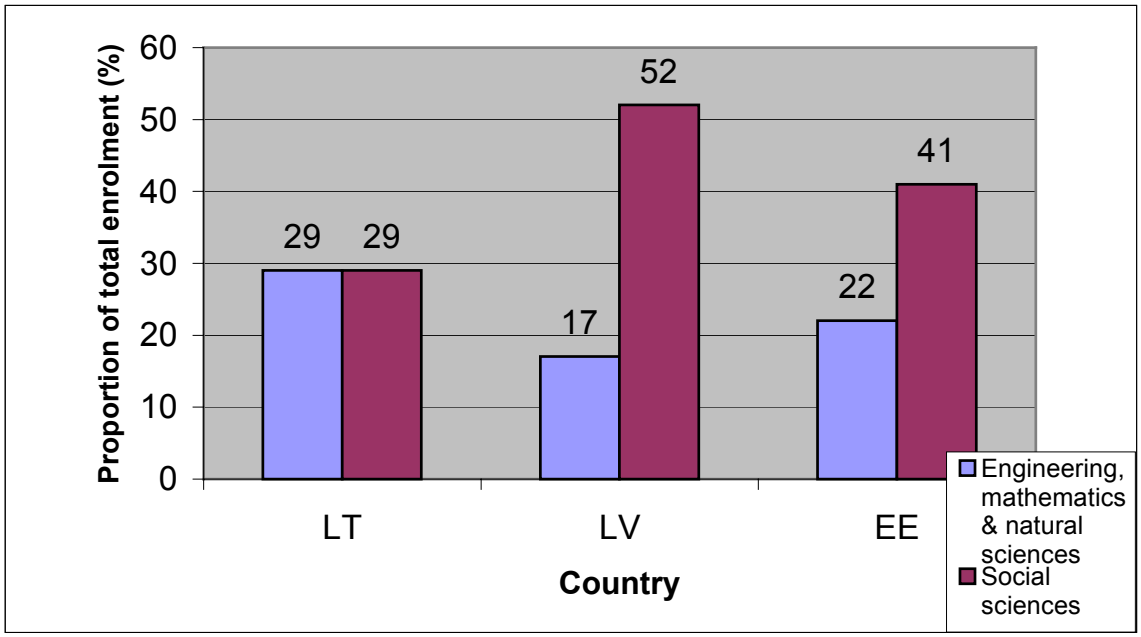


Figure. Enrolment in the Baltic Technical Universities at the Beginning of the Academic Year 2000/2001 (number of students).

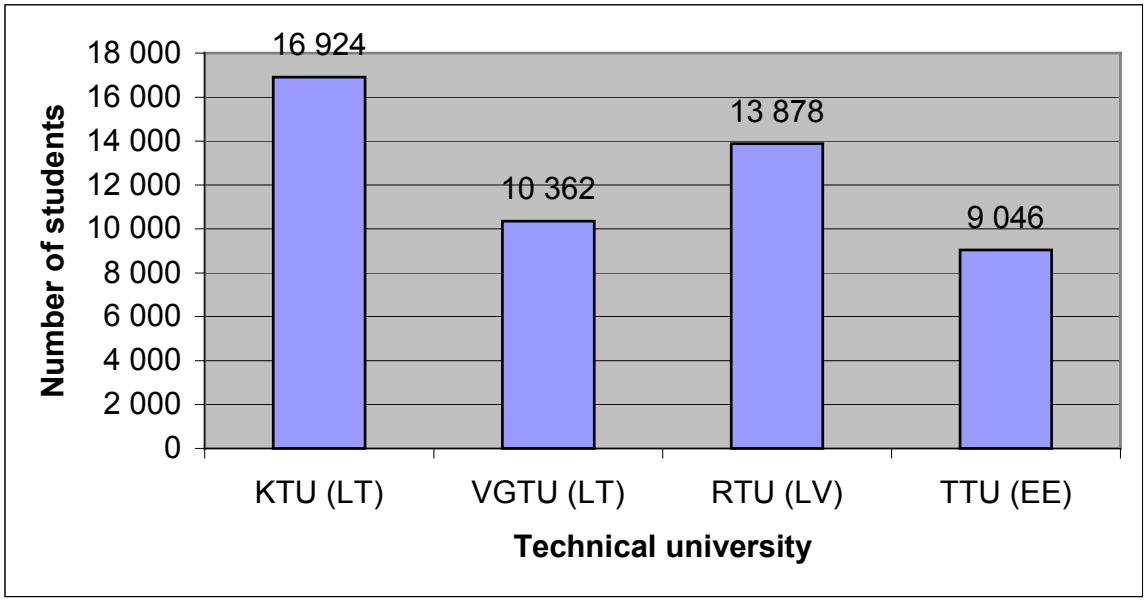
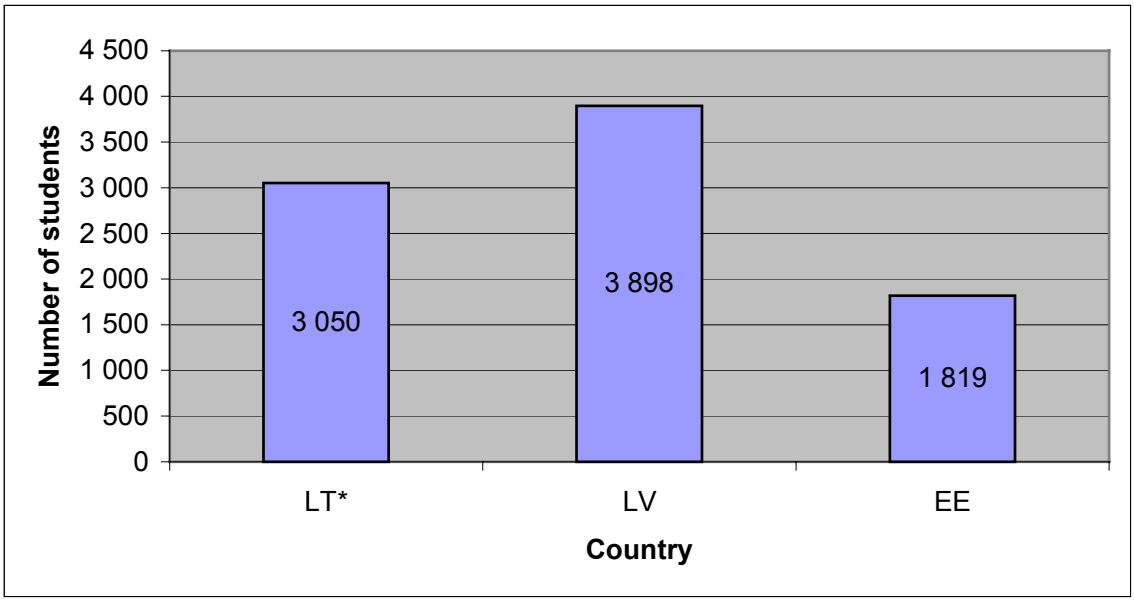


Figure. Enrolment in Computer Sciences in Higher Education Institutions by Country at the Beginning of the Academic Year 2000/2001 (number of students).



* The Lithuanian data does not include doctoral students as the Latvian and Estonian data do, which makes the Lithuanian figure 2,939 too small. If it is assumed that the proportion of doctoral students in computer sciences is the same as in engineering, it can be estimated that the number of students might be 3,050.

Formally the Baltic States pursue a policy of government paid higher education, but in practice the number of self-financed students, whose studies are not financed from the state budget, is growing fast in all Baltic countries. The latter's share is highest in Latvia where nearly two thirds of students pay tuition fees. Those with the best ratings are selected to the state financed group; tuition fees are charged from students who meet the entrance requirements but fail to be admitted to the state financed places in the competition.

Furthermore, the need to increase study place for instance in ICT and business administration prompts to establish private higher educational institutions on the side of the state universities. Tallinn's IT college or Latvian plans to open a Danish-funded IT college can be cited as examples of the trend. Due to the prevailing living standard in the Baltics, students prefer state financed studies. Thus the supply of potential IT students who are willing to pay for their education has its limits.

The number of foreign students is highest in Latvia and accordingly the offer of English instruction is broadest. Estonia provides Russian teaching during Bachelor studies; in Latvia some of the private universities and colleges are primarily Russian-speaking. In Lithuania the language of instruction is mostly Lithuanian.

7.7 Countries in Comparison

As the most populous Baltic State, Lithuania offers two large technical universities, industrial and technological concentrations in province towns too and, finally, still undiscovered market opportunities. On the other hand, Latvia's Riga is the largest city in the region, whose cosmopolitan flair and hub position in the heart of the Baltics make it attractive for regional headquarters of multinational companies. Latvia has enjoyed the fastest economic growth among the EU applicant countries. Very liberal economic policies, a solid legislative environment and a slightly better infrastructure than in its Baltic neighbours are among Estonia's assets as a place to do business.

Few knowledgeable businessmen and entrepreneurs from Finland, who have been doing business in all of the Baltic countries for a long time, were asked to assess features of their industrial branch and the business environment. According to this informal opinion poll, the IT and the electronics sector are strongest in Estonia, but the potential for starting a new business is regarded as higher in Latvia and Lithuania. The respondents chose Latvia or Lithuania, when they were asked in which Baltic country they would set up a company over the next year.

Estonia got a rapid start in its transition to a market economy, attracted a lot of foreign direct investment and simultaneously its own industry grew stronger. As a consequence, its markets became competitive and resources scarcer which resulted in increasing wages and prices. Riga, too, is expensive in many ways. For IT, the competition is smallest in Lithuania, the wages are lowest there and the supply of

qualified specialists best. According to national statistics, the number of IT students is greatest in Latvia, but the demand for them is also substantial and the wage level higher than in Lithuania. The wages in the electronics industry are considerably lower than those in IT throughout the Baltics.

The Baltics offer an educated workforce but the supply is not terribly large, which sets certain limits. Even though the level of higher education is considered to be between 'average' and 'fairly good', a need for internal company training is widely stressed when recruiting employees in the Baltics. This factor decreases productivity and increases investment costs in the beginning, but recruits are eager to learn new things. As they learn fast, the harvest can be reaped even after a few weeks. The enthusiasm, curiosity and diligence are not short-term flushes but a lasting phenomenon. In others words, motivation is no problem, on the contrary.

The advantage of young workforce is their language skills and decent basic education, whereas the older workers benefit from long work experience and a proper education. The latter may have communication problems due to insufficient knowledge of English. Some people also doubt their attitudinal flexibility. IT firms mainly hire young graduates but it is interesting what one respondent points out: he gives credit to the valuable know-how of elderly electronics engineers. He found the real "gold nuggets" from the old man group, when these experienced engineers were equipped with modern CAD programmes.

The growth prospects for both the ICT and electronics sectors are average according to the expert assessments rendered for this study, with the exception of Lithuania's IT industry which is expected to have better prospects. (One sometimes sees reports that forecast exponential growth rates for the ICT sector.) The share of strong or promising companies with good developing capacity is counted low in both sectors. This is probably linked to their low innovativeness and R&D capabilities. The potential for exports is better in electronics than in IT. Estonia's export capacity in IT is better than Latvia's or Lithuania's, whereas the latter two countries offer better subcontracting possibilities in IT. Opportunities for subcontracting are considered fairly good in Latvia and Lithuania. The same holds for electronics in all three countries.

As a place to operate a company, Estonia appears to be slightly more business-friendly than Latvia or Lithuania, although these latter countries are rapidly catching up. The respondents' assessments are consistent with the results from the survey conducted by the Central Chamber of Commerce of Finland. During a 2001 survey, Finnish companies awarded Estonia's business environment a score 7+ for effectiveness. In Latvia and Lithuania the grade was 6½ for both countries, while Finland was awarded a score of 9. Companies working in the IT sector tend to be more positive than those in other branches, probably because the nature of their activity enables them to avoid some of the usual pitfalls.

7.8 SWOT Analysis

The strengths, weaknesses, opportunities and threats listed below constitute a miscellaneous composition in the sense that the individual items examine the situation both from angle of the Baltic States and from that of foreign companies.

Strengths

+ EU and NATO membership in 2004; extensive harmonisation work accomplished in preparing the access to the EU.
+ Dedication to creating an information society, which has induced various informatisation programmes.
  ⇒ Public projects for ICT companies
  ⇒ Efforts to spread e-skills, adaptation of workforce to the needs of the labour market
  ⇒ E-government: improved public utilities for citizens and enterprises
  ⇒ Adoption of EU's strategic goals
+ Fairly well developed and modern telecommunications infrastructure. The coverage of both fixed and wireless networks is the most complete in Estonia, but also in Latvia and Lithuania the major cities, their connections and much more are covered. Latvia lags behind Lithuania in the digitalisation of fixed lines. In Lithuania digital lines make up 85 per cent of main lines, in Latvia 69. The teledensity is highest in Estonia and lowest in Latvia.
+ Study places in IT-related fields have been increased to raise the number of specialists. The IT field appeals to secondary schools graduates, which results in a high number of applicants and competition on study places. The universities can select good students.
+ The quality of technical education is fairly good.
+ The system of general education is broad-based.
+ Young people enter the working life early.
+ Low costs of unskilled labour.
+ High quality research in specialised niche areas which have industrial and commercial relevance.
+ Industrial traditions in high tech branches, for instance in electronics and telecommunications
+ Leading companies are usually ISO 9000 certified.
+ A number of companies with exports to Western markets and subcontracting experience.
+ Most companies can communicate in English (if not every employee, at least those who are in contact with customers). It is not necessary to speak Russian or

indigenous languages to do business in the Baltics. In Estonia many people speak Finnish.

+ Geographical proximity. Belonging to European cultural sphere. Customs do not drastically differ from those in Finland. If one follows a universal code of good manners and mutual respect, one will not face problems.

+ Stable political regime and continuity in the fundamental policy lines despite government reshuffles.

Weaknesses

- Small population with a low purchasing power, small market size.
- Other industries not strong enough to create strong demand for services and e-commerce.
- Companies are too small to offer complete outsourcing services directly to the largest international clients. Often such contracts also involve technology or employee transfer that companies cannot provide.
- Small number of highly qualified and experienced senior programmers, system analysts, project managers.
- Weak management skills. Lack of long-term strategic thinking in companies. Lack of sales and marketing skills.
- Weak enterprise finance. Limited access to venture capital restricts the financing of new enterprises.
- Limited government support for the industry. Conditions for SMEs hard.
- Insufficient public finance for higher education and research. Companies lack means to invest in education.
- Weak innovation system, commercialisation of research output meagre, low patenting activity.
- Small number of innovative companies. Corporate R&D weak.
- Neither students nor university teachers devote their time to the university whole-heartedly.
- The content of education at universities and their equipment does not always provide the state-of-the-art knowledge of the latest technologies.
- Lack of finances and insufficient administrative capacity for implementing policies, more plans on paper than actual deeds.
- Too frequent government changes cause unpredictability and delays.
- Poor preparation of laws, changes in legislation with short notice.

Opportunities

+ Rapid growth of the economy and ICT market in recent years. Growth is forecast to continue.
+ Areas of opportunity in ICT: mobile communications and related services, ISP, e- and m-business applications, ASP, call centres and telemarketing, IT and system integration services, software development, consulting.
+ Areas of opportunity in electronics: manufacture and assembly of PCBs, plastic and electromechanical parts, components of electronics, precision and measurement instruments, control systems, optics, laser and sensor technologies, biomedical applications.
+ Subcontracting possibilities.
+ Regional cross-border alliances in mobile communications, mergers of large software houses to create regional companies.
+ The ICT sector will have a multiplier effect on other sectors.
+ The telecommunications market is already liberalised in Estonia, and the fixed line monopolies will end in Latvia and Lithuania too in January 2003. This is expected to give a further impetus to the growth of the internet market as well as the whole telecommunications market.
+ Law on Digital Signature.
+ Cluster Project in Latvia. Knowledge Economy Forum in Lithuania. ESTAG in Estonia.
+ Further accumulation of foreign direct investment and co-operation with foreign firms.
+ Participation in EU research programmes and other forms of international R&D collaboration as well as international mobility programmes for students and researchers.
+ Initially a relatively large science base in basic research to be conducted in the public sector.
+ Professional programmes in higher education.
+ Positive attitude to Finnish firms.
+ Firm determination to catch up with the EU Member States, succeed in the global competition and adopt new technologies.

Threats

- The brain drain from universities: a whole generation of young scientists has been lost, as an academic career does not attract youngsters because of low salaries.
- Poor financial support for postgraduate students.
- Insufficient resources for fostering product development in the private sector.
- Neglect of technology transfer to traditional industries and a subsequent failure to create jobs.

- Failure to shift to a production culture which is based on effective organisation and high productivity rather than cheap labour.
- Failure to differentiate the industrial orientation and pull away from the competitors: a number of countries all over the world market biotechnology, nanotechnology and laser technology as their focus.
- Low investment capacity in local enterprises.
- Sharply increasing wage levels without corresponding changes in productivity and management of processes. Withdrawal of outsourcing contracts.
- Unbalanced regional development. Emergence of a digital divide within a country. Differences between schools, for instance in mathematical skills.
- Ageing population and decreasing cohorts due to low birth rates. The brain drain from Lithuania.
- Russia tries to blackmail the Baltics or the EU by using blockades. Unsettled position of those Russian-speakers who are still without citizenship. The impact of impending economic crises in Russia such as the one in 1998.

7.9 Epilogue

Mapping out the opportunities that the Baltic States might offer your organisation is by no means an insurmountable task nowadays, as access to basic information on this area has become available to everyone. The Baltic countries are easily approachable, not only geographically, but in terms of their manageable size, their stable environment, and the cultural and linguistic prerequisites that facilitate interpersonal communication. Of course there are still many things to be improved in the Baltic countries before they reach the level of the most advanced industrial nations, but they offer a potential for development that more advanced countries may lack.

No general recommendations can be made regarding the superiority of one country over another, since standard economic indicators do not reveal everything. One country may be ahead of the others in one sector, while another may fare better in a different sector. When the pros and cons are taken together, differences seem quite irrelevant, and they are also diminishing all the time. The choice of country depends very much on one's own business activities and goals, perhaps even on personal preferences.

A similar lack of resolution is evident in the beauty contest between the Baltic capitals Vilnius, Riga and Tallinn. It is absolutely impossible to decide which one of these marvellous cities is the most elegant: Is it Vilnius with its numerous spectacular churches, decorated houses and authentic old town lanes, or Riga with its visible Hansaetic past, magnificent boulevards and large parks, or could it be Tallinn with its unique medieval city centre, surrounded by a wall, and a picturesque parliament house?

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List of Interviewees

The positions following the names of interviewees are those held at the time of interviews. The interviews were taken in separate sequences in different countries. In Latvia they were mainly conducted in April–May 2001, although a few additional interviews were taken also in May 2002. In Lithuania the interviews were carried out in October–November 2002, while the visits to Estonia took place in November 2001 and February 2002.

LITHUANIA

Babravičius, Gintautas	Member of Parliament, Chairman of Information Society Development Committee at Seimas
Brazdeikis, Vainas	Director, Centre of Information Technology of Education under the Ministry of Education and Science

Bražinskas, Sigitas	Director of Export Department, Lithuanian Development Agency
Čelutka, Kornelijus	Senior Finance Analyst, Prime Investment
Čiukšys, Osvaldas	Vice-Minister, Ministry of Economy
Dekeris, Brunonas	Dean of the Faculty of Telecommunications and Electronics, Kaunas University of Technology
Gruodis, Vytas	Executive Director, Lithuanian Development Agency
Juknys, Džiukas	Executive Director, Infobalt
Juozapavičius, Algimantas	Associate Professor, Prodean for Information Technologies, Faculty of Mathematics and Computer Science, University of Vilnius
Jurkynas, Mindaugas	Researcher, Department of International Relations and Political Science, University of Vilnius
Kekkonen, Petteri	Business Unit Manager, TietoEnator Corporation / Telecom Baltic (FIN)
Kiršis, Svajūnas	Area Manager, Sybase Solutions
Krivickas, Romanas	Professor, Faculty of Telecommunications and Electronics, Kaunas University of Technology
Maceika, Kazimieras	Vice-Dean of the Faculty of Electronics, Vilnius Gediminas Technical University
Mačikėnas, Eugenijus	Docent, Faculty of Informatics, Kaunas University of Technology
Milaknis, Tomas	Managing Director, Alna
Milius, Pranas	Director, Kaunas Innovation Centre, Kaunas University of Technology
Mitašiūnas, Antanas	Head of the Department of Computer Science, Faculty of Mathematics and Informatics, University of Vilnius
Potet, Laurent	Chief Executive Official, Lonus Technologies Lithuania; President, French Chamber of Commerce in Vilnius (F)
Sadauskiene, Raimonda	Director of Investment Department, Lithuanian Development Agency
Saudargas, Algirdas	Member of Parliament, Member of Information Society Development Committee at Seimas
Šeputis, Klemensas	President, Association of Machines and Appliances Industry Enterprises
Šimkevičius, Albertas	Executive Director, Vilnius Industry and Business Association
Šleiniota, Vaclovas	Director General, Vilniaus Vingis; Vice-President, Confederation of Lithuanian Industrialists

Sutkus, Valdas	Director of Information and Public Relations Department, Confederation of Lithuanian Industrialists
Tamulevičius, Robertas	President, Fund of the Association Infobalt
Targamadzė, Aleksandras	Dean of the Faculty of Informatics, Kaunas University of Technology
Ulevičius, Liutauras	Correspondent, Verslo Žinios; Editor-in-Chief of this newspaper's supplement "IT & Office Equipment"
Vilpišauskas, Ramūnas	Expert, Lithuanian Free Market Institute
Žalys, Albertas	Director of the Department of Science and Higher Education, Ministry of Education and Science
Židonis, Evalds	Director of Information Technologies Development, Information Society Development Committee under the Government of the Republic Lithuania

LATVIA

Avotiņš, Valdis	Director, Engineering Cluster Development, Latvian Development Agency
Bergs, Normunds	Managing Director, SAF Technika
Bičevskis, Janis	Chair of Programming Department, Faculty of Physics and Mathematics, University of Latvia
Boržovs, Juris	Director, RITI; Board Member of LITTA
Čakste, Janis	Director of the Department of Higher Education, Science and Research, Ministry of Education and Science
Erkmane, Inga	Head of Informatics Division, Enterprises Register
Freibergs, Imants	President of LITTA
Glienecke, Michael	Director, Deutsche Software Lettland (D)
Griškane, Laura	Debuty Director, Informacijas Tehnologijas
Grundspenkis, Janis	Dean of the Faculty of Computer Science and Information Technology, Riga Technical University
Jākobsone, Māra	Director, Data Media; Board Member of LITTA
Karnītis, Edvīns	Adviser to the Minister of Economy, Ministry of Economy; Professor, University of Latvia
Klavinš, Inārs	President, Letera
Kovalčuks, Jevgenijs	Project Manager, VereinsLeasing Riga; Doctoral Student
Kristinš, Alberts	Head of the Division of Radioelectronics, Institute of Solid State Physics, University of Latvia

Krols, Guntars	Consultant, Ernst & Young
Lapiņa, Gundega	Project Manager, Innovation Relay Centre, Latvian Technological Centre
Lauciņš, Andris	Consultant, Arthur Andersen
Lukstina, Gunta	Project Manager, Development Council of Riga Region
Lūsis, Andrejs	Head of Semiconductor Material Department, Institute of Solid State Physics, University of Latvia; Board Member of Letera
Melnis, Anatolijs	Deputy Director of the Department of Higher Education, Science and Research, Ministry of Education and Science
Miezeris, Janis	Co-ordinator, Development Council of Riga Region
Millers, Donats	Head of the Division of Disordered Materials, Institute of Solid State Physics, University of Latvia
Pasanen, Petteri	Country Manager, People Management; Chairman of Riga's Finnish Trade Guilde (FIN)
Rantiņš, Vilnis	President, Association of Mechanical Engineering and Metalworking Industries of Latvia
Ribickis, Leonids	Vice-Rector for Research, Director of the Institute of Industrial Electronics and Electrical Drives, Riga Technical University
Šlihta, Gunta	Consultant, Innovation Relay Centre, Latvian Technological Centre
Smilga, Janis	Director, Business Innovation Center of Latvian Electronic Industry; Vice-President of Letera
Stabulnieks, Janis	Managing Director, Latvian Technological Centre
Sukovskis, Uldis	Head of Laboratory, RITI
Suojanen, Juha	Director, Latnet (FIN)
Tamminen, Petteri	Managing Director, Nokia Latvija (FIN)

ESTONIA

Grønvaldt, Ib	Adviser, Estonian Information Technology Society (DK)
Haamer, Andres	President, Association of Estonian Information Technology and Telecommunications Companies; President, Overall
Kaljundi, Jüri	Public Relations and Marketing Manager, MicroLink
Kataja, Mauri	President, Dart Ta (FIN)

Katkosild, Kersti	Project Manager, Association of Estonian Information Technology and Telecommunications Companies
Kivilo, Marko	Development Manager, Department of Research and Development, Tallinn Technical University
Kuusik, Rein	Head of the Department of Informatics, Faculty of Information Technology, Tallinn Technical University
Märtens, Olev	Research and Development Manager, M & T Electronics
Oruaas, Jaan	Chairman, Estonian Information Technology Society
Ott, Arvo	Head of the Department of State Information Systems, Ministry of Transport and Communications
Penjam, Jaan	Director, Institute of Cybernetics, Tallinn Technical University
Raie, Siim	Marketing Director, Estonian Chamber of Commerce and Industry
Rang, Toomas	Director of the Department of Electronics, Faculty of Information Technology, Tallinn Technical University
Ruubel, Rein	Project Manager, Innovation Centre, Tallinn Technical University
Tamkivi, Raivo	Managing Director, Innovation Centre, Tallinn Technical University
Tammemäe, Kalle	Rector, Estonian Information Technology College
Vahter, Priit	Project Manager, Estonian Investment Agency
Valmra, Egert	National Eureka Co-ordinator, Estonian Technology Agency
Viik, Linnar	Specialist

Appendix 1. ICT Indices

Different kinds of indices have been designed to assess and compare the progress that various countries have made in the ICT sector and the information society. Two of them are presented here. The first index measures the country's capacity to exploit the opportunities offered by ICT, and it was developed at Harvard University[65]. The second one assesses comparative advantages of different countries on the global ICT market in terms of their export capacity[66]. The delphi method was applied to obtain the latter index by interviewing ten professionals per country.

Table 1. Country Capacity for Exploiting ICT Opportunities: Three Indices.

	Network readiness	Enabling	Usage
Lithuania	3.59	4.11	3.08
Latvia	3.78	4.31	3.26
Estonia	4.73	4.95	4.51

Top country: the United States

Table 2. ICT's National Export Potential Index.

	Advan-cement	Business environ-ment	IPR	Market openness	E-business readiness	National ICT competi-tiveness	Other national advantages	Country export potential
Lithuania	6.5	5	4.5	8	6	8	7	**6.4**
Latvia	7	5.5	5	8	6.5	8	7	**6.7**
Russia	7	5	5	5	5	5	5	**8**
Finland	7	8	9	6	8	9	8	**9**
EU	8	8	10	6	7	8	8	**9**
USA	10	9	9	7	10	10	10	**10**

Grading: 1 to 4 = low capacity, 5 to 6 = average capacity, 7 to 10 = high capacity

[65] Mäenpää 2002.
[66] International Trade Centre 2002, Appendix 8.1.

Appendix 2. The Innovation System in Lithuania, Latvia and Estonia

Lithuania		
INNOVATION		
Policy		
1	Executive bodies	Ministry of Economy - Department of Industry
2	Strategy documents	**Programme on Innovation in Business** (2000) White Book on Science and Technology (1999) Government's Programme for 2000–2004 Mid-Term Industry Strategy (1999) Industry National Development Plan 2001–2003 Small and Medium-Size Business Development Strategy till the year 2003 Information Society Development Strategy 2001–2010
3	Programmes	Phare ESC: Business Development - Innovation Actions (target regions 2000–2001, country-wide 2002+) Phare twinning project "Lithuanian Innovation Capacity" 2002–2003 Programme for the Support of SMEs Programme for Competitive and Innovative Products of the Lithuanian Industry
4	Legislative acts	Company Law Law on Enterprises Law on Development of Small and Medium-Sized Business Law on Investment Law on Profit Tax of Legal Persons Law on Value Added Tax Law on Donation and Support Law on Patents Law on Protection of Intellectual Property in the Import and Export of Goods Law in Science and Higher Education (*Cf. Estonia*)
Financing		
5	Government funded financial intermediaries	Business and Innovation Guarantee Fund Export-Import Insurance Agency *See 'Programmes'*
6	Venture capital fonds	There are no national private venture capital funds. Foreign venture capital funds offer their services in Lithuania as elsewhere in the world. Some major funds that provide capital in the whole Baltics include the Baltic-American Enterprise Fund, Baltic Fund 1, Stantion Capital Corporation, Baltic Small Equity Fund and the Nordic Investment Bank. The three first mentioned are of American origin.

Supporting services		Association of Lithuanian Innovation Networks Union of Lithuanian Business Centres
7	Knowledge providers and consultants	Four innovation centres: 1. Lithuanian Innovation Centre in Vilnius, established in 1996 2. KTU Innovation Centre in Kaunas, established in 1992 3. Innovation Centre of the University of Agriculture in Kaunas, established in 1992 4. Alytus Business Innovation Centre, established in 1998l
8	General business support agencies	1. Lithuanian Development Agency for Small and Medium-Sized Enterprises (SMEDA) 2. Lithuanian Development Agency (LDA) 3. National Regional Development Agency and its network of five Regional Development Agencies 4. Eleven Business Information and Advisory Centres
9	Patents	Patent Office
Infrastructure		
10	Science and technology parks	Three science and technology parks: 1. Vilnius Science and Technology Park, established in 1993 2. Science and Technology Park of the Lithuanian University of Agriculture 1994 3. Kaunas Science and Technology Park "Nova" 1991
11	Business incubators	Seven business incubators, established since 1999: 1. Kaunas University of Technology 2. Vilnius 3. Šiauliai 4. Alytus 5. Telšiai 6. Naujoji Vilnia 7. Kazlu Ruda
12	Industrial Parks	Utena, Kaišiadorys, Panevežys
13	Free economic zones	Klaipeda, Kaunas
R&D		
Policy		
14	Executive bodies: *planning and managing policy*	Ministry of Education - Department of Science and Higher Education, Education, Science and Cultural Committee of the Seimas
15	Executive bodies: *advising*	Science Council Academy of Sciences Council of Rectors, Council of Directors

16	International co-ordination	EUREKA National Information Centre 5FP National Contact Points
17	Strategy documents	White Book on Science and Technology (1999)
Financing		
18	Public fonds	Science and Higher Education Fund
Supporting services		
19	Knowledge providers and consultants	
20	Infrastructure	Lithuanian Academic and Research Network LitNet Lithuanian Distance Education System LieDM Lithuanian Research and Higher Education Information Systems LieMSIS Lithuanian Academic Libraries Network LABT
Implementation		
21	Universities	15 state and 4 non-state university type institutions of higher education
22	Research institutes	29 state research institutes and more than 20 smaller state research institutions

Latvia		
INNOVATION		
Policy		
1	Executive bodies	Ministry of Economy - Department of Industry (Ministry of Education and Science, Ministry of Agriculture, Ministry of Environment and Regional Development, Ministry of Communication, Ministry of Culture)
2	Strategy documents	**Concept for the National Innovation System (1998)** **National Programme on Innovation,** i.e. **White Paper on Innovation (2001)** Government's Declaration (2000) Latvia's Long Term Economic Strategy (2001) Industrial Development Guidelines of Latvia (2001)
3	Programmes	**Innovation Programme (2002)** **Industrial Clusters Project (2001)** National Programme for the Development of SMEs (1997) National Programme "Informatics" (1999)
4	Legislative acts	Law on the Innovation System (2000 or 2001) Law on Scientific Activity (1992, amendments in 1996 and 1998)

Financing		
5	Government funded financial intermediaries	Latvian Innovation Fund Environment Investment Fund and Energy Efficiency Fund Regional Development Fund EBRD-Phare SME Finance Facility at Unibanka SME development lending programme at Latvian Mortage and Land Bank
6	Private equity funds	Baltic-American Enterprise Fund Norway-Latvia Business Development Fund Baltic Small Equity Fund Baltic Investment Fund Baltic Post-Privatisation Fund
Supporting services		Latvian Association of Technology Parks, Centres and Business Incubators LTICA
7	Knowledge providers and consultants	Latvian Technological Centre (1993), hosting an innovation relay centre FEMIRC Latvian Technology Park at Riga Technical University (1996), hosting a business innovation centre Business Innovation Centre of Latvian Electronics Industry LEBIC (1997)
8	General business support agencies	Latvian Development Agency LDA
9	Patents	Patent Office
Infrastructure		
10	Science and technology parks	
11	Business incubators	Latvian Technological Centre (1993) Latvian Technology Park at Riga Technical University (1996) Business Innovation Centre of Latvian Electronics Industry LEBIC (1997)
12	Industrial Parks	Nordic Industrial Park in Olaine Rhodia Industrial Area in Daugavpils RVR Technology Park SIVA Industrial Park in Ogre Skanska Industrial Village NEW DEVELOPMENT PROJECTS: Baltic Business Park in Ventspils Cybercity in Valmiera Karaosta and Pulvera Industrial Parks in Liepaja Nordic Technology Park Riga Airport Industrial Park
13	Free economic zones	Liepaja, Rezekne

R&D		
Policy		
14	Executive bodies: *planning and managing policy*	Ministry of Education and Science - Department of Higher Education and Science
15	Executive bodies: *advising*	Council of Science Academy of Sciences Academy of Agricultural and Forestry Sciences Council of Rectors
16	International co-ordination	National Project Consulting Centre for EUREKA 5FP National Contact Point
17	Strategy documents	National Concept on Research and Development (1998)
Financing		
18	Public fonds	Ministry of Education and Science: grants for market-oriented research projects on a co-financing basis
Supporting services		
19	Knowledge providers and consultants	Academic Information Centre
20	Infrastructure	Latvian Academic Network LANET Latvian Academic Computer Network LATNET
Implementation		
21	Universities	15 state and 2 non-state university type institutions of higher education
22	Research institutes	12 state research institutes and 20 university research institutes with an independent status Planned: Ampere Institute devoted to magneto hydro dynamics (MHD)

Estonia		
INNOVATION		
Policy		
1	Executive bodies	*Planning and managing policy*: Ministry of Economy - Technology and Innovation Division *Advising*: Technology and Innovation Council, Foundation of Strategic Development Centre SAK

2	Strategy documents	**Estonian State Innovative Programme** (1998) Innovation Part of National Development Plan 2001–2004 Ministry of Economic Affairs Strategic Plan 1999–2003 Guidelines for Estonian Spatial Planning (2000) The Principles of and The Action Plan for Information Policy (1998)
3	Programmes	Development of regional co-operation network for the development of innovative business 1999–2001 Inno-awaress (2001) Spin-off programme (2001) Raising competence in innovation management (2002)
4	Legislative acts	There is no separate special law regulating the innovation and technology transfer support and SME policies. These fields are covered by the R&D Law and Business Law as well as by the Patent Law, Industrial Design Law, University Law and tax laws. Terms for granting state support to R&D activities (2000) Terms for state subsidies to SMEs (2000) Research and Development Act (1997)
Financing		
5	Government funded financial intermediaries	Technology Agency ESTAG* Start-Up Fund Export Crediting and Guarantee Foundation Kred Ex Regional Development Foundation
6	Venture capital fonds	Foreign: Baltics Small Equity Fund, Estinvest IM Estonian: Baltic Cresco, Trigon Capital, LHV A public venture capital fund is planned to be established.
Supporting services		Association of Estonian Science and/or Technology Parks
7	Knowledge providers and consultants	Innovation Centre of Tallinn Technical University (1998) Tartu University Technology Centre (1996) Ida-Virumaa Innovation Centre (1999) Archimedes Foundation with its Estonian Innovation Relay Centre FEMIRC (1997) Laser Job Shop of Tartu Science Park (piloting 1999–2001)
8	General business support agencies	Departments of Estonian Business Development Foundation "Enterprise Estonia" (*ESTAG is one of them): ¤ Regional Development Agency with three regional offices ¤ Investment Agency ¤ Export Agency SME Association EVEA Enterprise Centres in almost each county Business Advisory Centres in Tallinn, Tartu & Narva, planned in Pölva, Võru & Valga
9	Patents	Estonian Patent Board

Infrastructure		
10	Science and technology parks	Tartu Science Park (1992)
11	Business incubators	Cybernetica Ltd. (1997) Jõhvi Business Incubation Centre (2001) Mustamäe Technology Park (2002)
12	Industrial parks	Tapa, Paldiski
13	Free economic zones	Sillamäe - under preparation
R&D		
14	Executive bodies: *planning and managing policy*	Ministry of Education - Department of Science Policy: research Ministry of Economy - development, know-how transfer
15	Executive bodies: *advising*	Research and Development Council Research Competency Council Academy of Sciences
16	International co-ordination	Archimedes Foundation
17	Strategy documents	White Paper on Research and Development (1998) Knowledge-Based Estonia: Estonian Strategy for Research and Development 2002–2006
Financing		
18	Public fonds	Estonian Science Foundation
Supporting services		
19	Knowledge providers and consultants	Department of Research and Development at the Tallinn Technical University Research Office and Science Centre AHHAA at the University of Tartu
20	Infrastructure	Centres of Strategic Competence at TTU and University of Tartu, incl. IT (application for electronics at TTU) Estonian Educational and Research Network EENet
Implementation		
21	Universities	6 state and 7 non-state university type institutions of higher education
22	Research institutes	54 public and private research institutes

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Title

The Baltics *as a Business Location for* Information Technology and Electronics Industries

Abstract

This study examines the current state of the ICT and electronics industries in the three Baltic States. In doing this, it implicitly highlights the opportunities for co-operation between Baltic and Finnish firms. The study consists of three parts: 1 a sector analysis of the industry, 2 a review of the education and research system in the field under consideration, and 3 an analysis of the business culture and the business environment.

The first section is based on extensive surveys among ICT and electronics enterprises in Estonia, Latvia and Lithuania. It sheds light on the following areas: the size and the growth prospects of the ICT and electronics industries, their focus of production and core competence, the significance of exports and subcontracting as well as the prevailing interest in Finland. Higher education is examined from the perspective of the availability of workforce; research from that of innovation capacity. Finally, the report discusses the qualities of Baltic employees, specialities of the local business culture and appropriate ways to approach a Baltic company.

The ICT and electronics industries in the Baltic States have differentiated profiles with their own specific strongholds. To cite examples, mobile technologies and electronics subcontracting are advanced in Estonia, software outsourcing and optical technologie in Latvia, television electronics and laser technologies in Lithuania. As for IT, the wages are lowest and the availability of qualified specialists is best in Lithuania. Latvia is the strongest exporter of software service in the Baltics. Estonia's business environment is slightly better developed than that of its southern neighbours.

Despite their buoyant development, the Baltics face a serious challenge as they are pressed to steer their industrial development in a more innovation-driven direction. The lack of funding for universities and research institutes is currently so alarming that it is starting to threaten the future of science. Due to low salaries, an academic career does not appeal to young, talented graduates, which has led to the ageing of the researcher pool. Corporate R&D and contract research are marginal, patenting activity is meagre, and the number of innovative enterprises is small.

Keywords
Estonia, Latvia, Lithuania; information technology, telecommunications, electronics, sector analysis of industry, market survey; higher education, research and innovation system; business culture, business environment

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This study examines the current state of the ICT and electronics industries in the three Baltic States. In doing this, it implicitly highlights the opportunities for co-operation between Baltic and Finnish firms. The study consists of three parts: 1) a sector analysis of the industry, 2) a review of the education and research system in the field under consideration, and 3) an analysis of the business culture and the business environment. The first part is based on extensive surveys among ICT and electronics enterprises in Estonia, Latvia and Lithuania.

The ICT and electronics industries in the Baltic States have differentiated profiles with their own specific strongholds. The countries offer technical competence, while cultural proximity paves the way for contact-making. These and other advantages are assessed in the SWOT analysis which summarises the study. Despite their buoyant development, the Baltic States face a serious challenge as they are pressed to steer their industrial development into a more innovation-driven direction. Traditionally they possess a broad science base, but the current shortage of research funding is alarming.

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