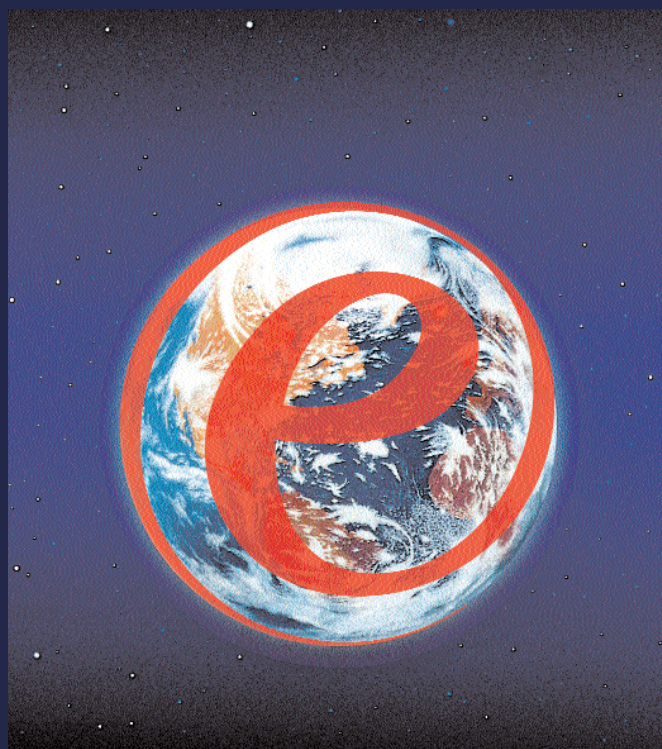


Luxembourg Business in the New Digital Economy



Report
December 2003

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CEPROS (the Centre d'Études PROSpectives) is a non-political, independent organisation, set up in 1996 as an association sans but lucratif (asbl) in Luxembourg. CEPROS relies on volunteer professionals with diversified backgrounds. Its purpose is to undertake socio-economic, socio-political and scientific studies to optimise Luxembourg's position at the regional, European and transcontinental level. Its Board is chaired by Mr Edmond Israël and includes Messrs Romain Bausch, Christoph Haas, Marc Hoffmann, Raymond Kirsch, Yves Mersch, François Tesch and Michel Wurth.

This report presents the basic findings and policy recommendations of the study groups that have been working within CEPROS's Information Society Committee (ISC), which was created in 1997 to address the opportunities and challenges presented to Luxembourg by the Information Society. Its objectives were (a) to develop a certain vision of the Information Society as applicable to Luxembourg, and (b) to make the general public, and business and government leaders aware of the need to create the conditions appropriate for promoting future development and prosperity in Luxembourg and the Greater Region.

While a great number of individuals worked on the development, analysis and preparation of this report, the Working Group (page 41) maintains sole responsibility for its content and conclusions.

Foreword

Cepros wishes to express its sincere thanks to all parties who have devoted their time and efforts to help compile this report and share their thinking and reflections on how to promote "Luxembourg Business in The New Digital Economy". A very special thanks to business leaders and officials who made themselves available to share their insights during interviews with the Working Group.

Table of Contents

Foreword	
Table of Contents	
Executive Summary	9
1. Introduction: The World Changed	11
2. Where does ICT stand globally in 2003	12
2.1. ICT play an increasingly strong role in the world economy	13
2.2. Phase 2 for e-commerce	14
2.3. The market for content management services grows	15
2.4. More customers use online content and are willing to pay for it	17
2.5. eEurope	17
2.6. eGovernment	18
2.7. Software quality	19
2.8. UMTS, 3G and Mobile Europe	19
3. The Economic Situation of Luxembourg	20
4. Luxembourg's ICT Sector	24
4.1. Introduction	24
4.2. The effect of ICT on productivity	24
4.3. Internet penetration: equipment use and infrastructure	26
- domestic use	26
- eCommerce	26
4.4. Infrastructure	28
4.5. Investments in human capital	29
4.6. eGovernment and the Public Sector	29
4.7. Information Security and the LuxTrust project	30
5. Review of previous recommendations	32
5.1. Government Initiatives	32
5.2. e-Commerce Legislation	33
5.3. Education and Research	33
5.4. Ideas for Business Actions	34
5.5. Joint Government and Business Initiatives	34
6. Conclusion and Recommendations	35
 Appendices	 41
Appendix A. Participants	41
Appendix B. SWOT Analysis of Luxembourg, based on Interviews	42
Appendix C. Tables	45
Appendix D. Bibliography and related web sites	48

List of Tables

Table 1: ICT Spending	13
Table 2: Number of people connected to the Internet	13
Table 3: Labour productivity in EU Member States, US and Japan in 1975-2001	25
Table 4: SME use of eBusiness	27
Table 5: Global classification - Progression since the 2nd measurement	29
Table 6: How EU Member States rank in the 2001 enterprise scoreboard	45
Table 7: Explanation of 2001 enterprise scoreboard indicator	47

List of Graphs

Graph 1: Transformation to a Digital Economy: Investments in Telecommunication	16
Graph 2: Economic Dynamism and Competition	22
Graph 3: Penetration of the Internet among households	28
Graph 4: Percentage change in spending on eGovernment Oct - April 2002	29
Graph 5: E-Luxembourg Model	35
Graph 6: 2001 enterprise scoreboard indexed indicators - Luxembourg	46

Executive Summary

In November 2000, Cepros produced a report that analysed the revolution in information and communications technologies (ICT) and the way they could contribute to the competitiveness of the Luxembourg business environment.

Essentially, the report concluded that local awareness of ICT as a key means of improving economic competitiveness was not widespread and that Luxembourg needed to adapt its core competencies and create new ones in the digital arena to retain its competitive advantages and develop new activities.

Two years later, following global economic shifts and market realignments, Cepros' ICT working group decided to have a fresh look at the subject. Based on both hard research and interviews with local business leaders, the report analyses recent developments in ICT and the impact of changes in the economic situation on this sector. It assesses progress in the development of ICT in Luxembourg and makes a number of recommendations regarding ways to further develop these activities.

Despite the bursting of the "dot.com" bubble, the global economy's use of digital means to develop and operate continues to increase. ICT remain enabling technologies that foster productivity and improve systems when they are properly implemented.

In Luxembourg, the critically important financial sector is feeling the general pressure of the financial markets, with unemployment growing as Luxembourg's GDP slows down in line with the rest of Europe. At the same time, while some parts of the economy have integrated the enabling benefits of ICT, others continue to lag behind. Thus better and more extensive use of ICT could yet contribute to improving Luxembourg's economic performance as well as to increasing Luxembourg's ability to attract new business.

Consequently, the ICT working group developed the following recommendations:

1. Develop eLuxembourg as a strategic project for the Luxembourg economy
2. Optimise the marketing of Luxembourg
3. Recognise EU institutions as an underdeveloped opportunity
4. Develop creativity and innovation by leveraging Luxembourg's intellectual capital.

1. Introduction: The World Changed

In November 2000, Cepros issued a report that analyzed the evolution in information and communication technologies (ICT) and the way they could contribute to the competitiveness of Luxembourg's businesses. The report was based on a study of the state of ICT and of Luxembourg's economy, as well as on a survey of Luxembourg businesses of their perception of their competitiveness and their use of ICT.

The major conclusions of the report were:

- ICT are substantially transforming the way in which business is done;
- The main building block of the new digital economy is the Internet, which allows realtime, worldwide communication of text, data and media and gives the smallest business a global reach in buying and selling goods and services;
- Luxembourg's growth has relied on a number of competitive advantages that the Grand Duchy identified and developed in highly efficient ways;
- Certain of these advantages may be challenged by:
 - Lack of business awareness of the new opportunities presented by ICT
 - Business readiness to embrace these opportunities
 - Concerns about job skill sets and labour costs;
- A new business segment could be developed were Luxembourg to create an additional competitive advantage by positioning itself as a centre of excellence in new technologies.

The report received wide press coverage and was highly appreciated.

However, since the report's publication, some significant changes have occurred.

- Technology stocks fell from the heights reached in 2000; the full economic impact of this bursting "bubble" is still being absorbed;
- Telecom companies are suffering the consequences of the high prices they paid for licenses and other acquisitions;
- The euro was launched successfully;
- Recession in OECD countries slowed the adoption of ICT;
- The 9/11 attacks and subsequent "war on terror" created tension between government use of ICT for information gathering and surveillance and the individual's right to privacy;
- While many "dot.coms" disappeared, Amazon and e-Bay began to report profits;
- Luxembourg embarked on a significant e-Government programme.

For all the reasons above, the Cepros ICT work group that produced the November 2000 report felt the time was right to review its previous findings and develop new ideas and recommendations.

2. Where does ICT stand globally in 2003

This chapter gives an overview of the present state of ICT by highlighting developments particularly relevant to this study. Its intent is to provide a context in which Luxembourg's situation can be analyzed. Sources are referenced in the Bibliography.

Globally, ICT continues to progress, albeit more slowly than predicted in 2000. The Internet has, in fact, become core infrastructure on which new, integrated IT applications are based. Greater efficiency and better customer service have been achieved by its use.

Development of broadband wireless services, mainly based on UMTS, has been slowed due to:

- the complexity of building networks and devices;
- lack of compelling applications;
- huge debts amassed by telecommunications companies.

New technologies continue to emerge at an accelerated pace. Grid computing (linking computers in diverse locations through the Internet) promises profitable applications. Content management is making progress and XML (Extended Markup Language) has enabled a move from syntax to semantics and linkages of all types of information into a single consistent presentation.

The shortfall of needed ICT skills in the OECD countries remains significant, even though the current economic slump has somewhat eased this pressure. At the same time, capabilities being developed in India, as well as in China and Russia, may not only alleviate this deficit but also offer serious competition to the OECD's dominant position.

A key issue confronting ICT remains the quality of software, which still needs to be improved. Software must become as reliable as a car and vendors must assume some liability for the malfunctioning of their products.

In view of ICT's current state, recommendations made in the 2000 report remain valid, although some of the windows of opportunity previously cited are closing.

2.1. ICT play an increasingly strong role in the world economy

Firms, industries and countries are reaping increasing benefits from their ongoing investments in ICT and widespread use of the Internet.

ICT represented 8.3% of GDP of OECD countries in 2001. ICT spending was USD 2.1 trillion, of which by segment:

Table 1: ICT Spending

ICT Segment	% contributed
Software	9%
Telecommunications	39%
Hardware	17%
Other ICT services	35%

Source: NUA (September 2002)

While software represents less than 10% of the total ICT market, it is the segment that is growing the fastest, at almost 16% a year since 1992. The overall CAGR (Compound Annual Growth Rate) of the sector is about 9% for the same period.

Meanwhile, Ireland has become Europe's chief software manufacturing and distribution centre for many of the world's top vendors, accounting for over 40% of all packaged software and 60% of all business software sold in Europe.

More than ten percent of the world's population now has access to the Internet, according to figures released from Nua (www.nua.com), with Europe now having the highest number of Internet users in the world. The ten top countries have an average connection ratio of more than 60%. Nua forecasts that the number of worldwide Internet users will reach one billion by 2005.

Table 2: Number of people connected to the Internet

World Total	638 million
Africa	9 million
Asia/Pacific	205 million
Europe	196 million
Middle East	5 million
Canada & USA	180 million
Latin America	43 million

Source: eMarketer (May 2003)

2.2. Phase 2 for e-commerce

Any doubts about the viability of e-business resulting from concerns about e-security as well as the demise of so many "dot.coms" are fading fast. According to the Yankee Group's 2002 survey, *Doing Business on the Internet*, 71% of respondents reported that the Web is important to their company's overall business goals, a rise of 16% from the 2001 data. This shift in perception reflects the fact that businesses are beginning to learn how to use the Internet as a strategic resource (Bib3).

The Center for Research on Information Technology and Organizations (CRITO) of the University of California at Irvine published a survey in 2002 on global e-Commerce that created benchmarks for the use of the Internet for e-commerce among 2,100 companies in three major sectors (manufacturing, distribution and finance) in 10 countries: Brazil; China; Denmark; France; Germany; Japan; Mexico; Singapore; Taiwan; the United States (Bib 6).

The key findings were:

- The most common use of the Internet is for advertising and marketing purposes (57%);
- Only 33% of respondents use the Internet to formally integrate business processes with suppliers or partners;
- Nearly 47% use the Internet to make purchases online, but only 30% sell their products and/or services via the Internet;
- Online customer service is provided by 44% of companies surveyed;
- The banking and insurance sector leads in use of the Internet for advertising and marketing, making sales online and making purchases online;
- Manufacturers are the leaders in exchanging information with suppliers and customers;
- Wholesale/retail distribution companies lead in the integration of business processes with suppliers and partners;
- The most important drivers of Internet use are the desire to expand markets for existing products and services (48%), to improve co-ordination with customers and suppliers (44%) and to enter new businesses or markets (42%);
- The biggest barrier perceived to doing business on the Internet is concern over issues of privacy and security (44%);
- The most significant results of doing business online are improved customer service, more efficient internal processes and widened sales areas, each mentioned by 30-35% of respondents.

The study also reported that 70% of the companies surveyed have tried with purchasing online, but that less than 10% of their total spending is currently being done via the Internet.

In the B2B e-commerce segment alone, research firm eMarketer reported in April 2003 that worldwide B2B ecommerce revenues should surpass USD 1.4 trillion by year end and that by 2004, worldwide ecommerce revenues are expected to total USD 2.7 trillion.

On the B2C side, Europe is beginning to catch up to the US. According to an April 2003 study by RoperASW and AOL Time Warner, Europeans spent on average EUR 430 online between August and October 2002, compared to EUR 543 in the US. In addition, nearly three out of four Europeans surveyed said they regularly or occasionally use the Internet to research purchases before buying products offline.

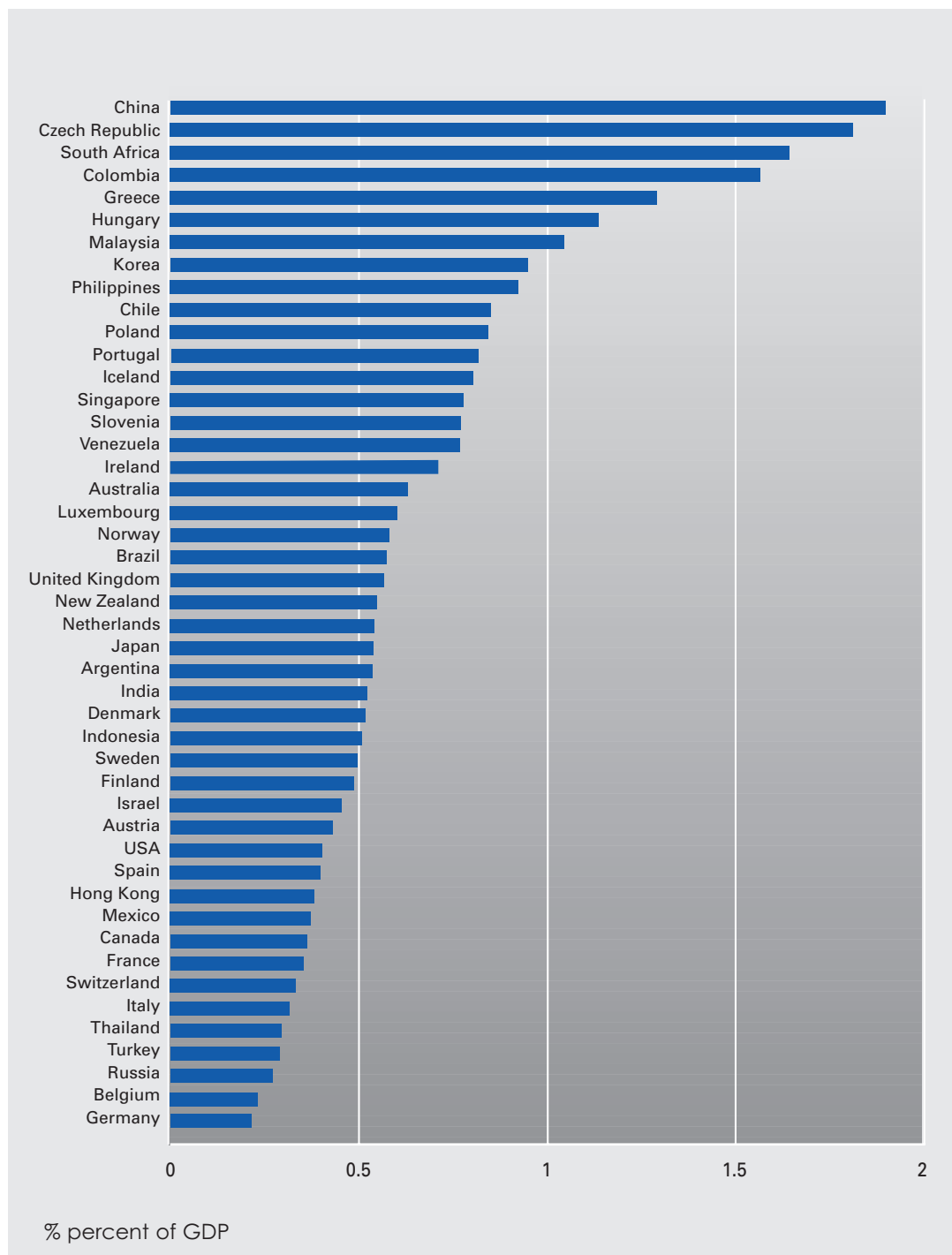
The study also revealed that Europeans are more likely to bank online than their American counterparts. Currently, 47% of Europeans bank online compared to just 36% of Americans. In another sector, online travel sales in Western Europe increased 53% during 2002, according to the Centre for Regional and Tourism Research. Travel sales in 2002 were worth EUR 7.3 billion, representing an increase of 1.2% over 2001.

2.3. The market for content management services grows

The content and document management services market will grow at a compound annual growth rate (CAGR) of 44% to reach approximately \$24.4 billion in 2006 according to a March 2002 study by IDC. This is supported by a forecast from META Group in August 2002 that predicts that by 2004, 95 percent of Global 2000 organisations will have implemented a content management system (CMS).

An April 2003 report by Gartner Research confirms these predictions, as significant gains in revenue for CMS licenses bucked technology's generally downward trend in Q1 2003. Gartner identified two factors in particular that should continue to drive the market for content management. First, content management has become a core infrastructure that all enterprises must have for success in a Web- and document-centric business world. Second, growing political and social forces demanding greater corporate accountability will drive enterprises to increased adoption of content and records management technologies.

Graph 1: Transformation to a Digital Economy: Investments in Telecommunication



Source: Extracts of the Global Technology Index

2.4. More customers use online content and are willing to pay for it

InternetNews reported in March 2003 that consumer spending on paid Internet content will reach USD 2 billion by year end. This represents a 30% increase in the paid content market compared to 2002.

Jupiter Research forecasts that the paid content market will grow at an annual rate of more than 20% until 2007, when it will be worth USD 5.4 billion, and with syndication revenues for consumer content reaching USD 1.4 billion.

A similar growth trend is seen with newspapers, where Web traffic to their sites has soared. In July 2002 the audiences for major newspaper websites in seven of the ten largest US markets has grown faster than the market's total Internet user base over the past six months.

Europe shows similar trends. In the UK, the Internet is now established as the third source of news for British citizens in the 16-35-age bracket, behind television and radio. Newspapers and magazines have moved down to fourth and fifth place respectively.

The influence of the Internet as a dominant source of content was demonstrated as traffic to major news websites soared during the week ending 23 March 2003 as populations went online to find out about the war against Iraq. According to new data from Nielsen-Netratings, CNN.com broke the 10 million mark, with traffic rising by 58% compared to the previous week.

In addition, 8.3 million unique users visited MSNBC.com during the same week, an increase of 38% on the preceding week. Yahoo News recorded a 21% increase to nearly 6.5 million, while NYTimes.com attracted 2.8 million visitors. More than one million visitors logged on to Time magazine's website, up 169% compared to the prior week, and the UK's Guardian drew 835,000 visitors, an increase of 137%.

2.5. eEurope

The European Union is strongly promoting ICT, with emphasis being given to cheap and fast networks, e-commerce, security and trust, the knowledge-based economy, online health, education and e-government.

One of fruits of the EU's emphasis is Sweden's overtaking the US to become the world's leading nation for e-readiness, according to the Economist Intelligence Unit (EIU).

Defined as the extent to which a country's business environment is ready for Internet-based commercial opportunities, e-readiness ranking is based on a number of factors including connectivity and technology infrastructure, business environment, consumer and business adoption, social and cultural infrastructure, and legal and policy environment and support services.

The US had lead the EIU's e-readiness rankings for the past three years, but the downturn in the US economy has meant that other nations have gained ground. Scandinavian countries in particular dominate the top ten positions. Denmark took second place in the latest e-readiness rankings, while the Netherlands, US and the UK tied for third position. Finland and Norway took sixth and seventh place respectively, while Switzerland came eighth and Australia ninth. Canada and Hong Kong tied for the ten spot, giving eEurope 7 of the top positions.

According to the EIU, what sets Scandinavia apart is the extent to which the Internet has pervaded the marketplace and reshaped business transactions, and the eagerness with which citizens have incorporated Internet technology into their daily routines.

In contrast to their northern European neighbours, Southern Europeans regard the Internet sceptically and are reluctant to move business online. Among the region's stragglers are Italy (21st), Portugal (22nd), Spain (23rd) and Greece (26th).

2.6. eGovernment

eGovernment means using the Internet to deliver efficient, interactive public services for citizens. Achieving productivity gains in the public administration significantly improves the competitiveness of a national economy. The main targets for eGovernment as spelled out by the European Commission include:

- Essential public data available online;
- Electronic access to main basic public services;
- Simplified online procedures for business;
- Electronic signatures within the public sector;
- All basic transactions with the Commission online.

2.7. Software quality

Engineers believe that software quality is declining because it suffers from a profound lack of design. The increasing size and complexity of programs have significantly reduced the effectiveness of the "code and fix" method, in which programmers write code and use compilers to detect and correct errors. Software vendors have turned defective software into a profit centre by accompanying it with poorly-developed help files that give users no choice but to seek expensive customer support.

Some software companies believe they can reverse the decline in quality by dramatically reforming their engineering processes and implementing higher standards of reliability measurement, but others think that product liability lawsuits will be even more effective in compelling developers to improve their software (Bib8).

2.8. UMTS, 3G and Mobile Europe

European adoption of third generation (3G) mobile telecommunication networks based on UMTS (Universal Mobile Telecommunications Services) standards and technologies has been slow. The demonstration staged in October 2002 by Nokia and Sonera in Helsinki to launch Europe's first commercial 3G service was not very successful.

Thus the US, which in the past has lagged in cellular technology, may outdo Europe in the adoption of 3G. The reason lies in the different mobile technology standards of the two regions. European operators are moving from their existing 2G GSM (Global System for Mobility) technology to the interim 2.5G of GPRS (General Packet Radio Service) and only then following with 3G and W-CDMA (Wideband-Code Division Multiple Access). The US, on the other hand, is moving directly to 3G.

Datamonitor, in a report released 19 August 2002, suggested that European telecom operators should abandon 3G. Even the European Commission has identified difficulties and reported that: "there are no 'easy fixes' in response to current challenges".

3. The Economic Situation of Luxembourg

During the last fifteen years of the twentieth century, Luxembourg's economy experienced an admirably high average growth rate of 5.5%. This growth was predominantly due to the vigorous expansion of the financial services sector that also spurred the development of Luxembourg's ICT industry that, predictably, focussed extensively on supporting this same sector.

Unfortunately, after this idyllic period, Luxembourg has not managed to escape the current economic slowdown that began in the US in March 2000. The financial sector, so important a component of Luxembourg's economy, has begun to slow down and correspondingly cut its ICT budgets, with predictable effect. Thus the country's ICT sector cannot be evaluated independently from the context of Luxembourg's economy overall.

While Luxembourg's economic downturn has been both more recent and less severe compared to the major European countries, the most current figures from Statec and the European Union confirm the decline of the local economy with GDP predictions of 0.5% in 2002, 2% in 2003, and 3% in 2005.

In addition, although Luxembourg's 3.2% unemployment rate is still the lowest in the EU, this figure represents an increase of 25% during the course of 2002.

This figure is likely to further deteriorate, as local banks have already announced staff reductions for the current year. Still, according to Statec, there should be some growth in employment, albeit be it at a reduced rate of 1.5% for 2003. According to Statec, unemployment will stabilise around 3.5% (5.5% of the active population if one takes the expanded measure of people in 'special reinsertion programs'), assuming that the measures of continued education and job creation will allow to absorb a good part of the resident population. It is also assumed that there will be a decrease in the numbers of the cross-border workforce. Luxembourg having piled up some reserves through the past booming years, the country is reasonably prepared to overcome a momentary draft. The risk to the above mentioned scenario lies mainly with a continued sluggishness of the world economy. Luxembourg remains one of the world's highest per capita income countries in the OECD.

Given that Luxembourg has "marched to its own drummer" in relation to the economies of many countries in the EU, it may be helpful to compare the Grand Duchy's economy specifically to Ireland, a nation that likewise experienced a prolonged period of economic growth coupled with low inflation and high employment.

Ireland's ICT sector, which includes computers, peripherals, telecommunications and Internet, represented approximately 39% of Ireland's exports in 2001 and placed Ireland third in terms of ICT value-added to the economy in the OECD's Science, Technology and Industry Scoreboard. Moreover, Ireland has become the world's second leading software exporter, attracting 40% of all US investment in European electronics, with over 300 companies present. According to Irish Development Agency (IDA), one out of every three PCs, 40% of all packaged software and 60% of all business application software sold in Europe comes from Ireland.

The development of a competitive ICT production sector during the 1990s made Ireland one of the fastest growing countries in Europe, with 4.5% related growth in employment. However, due to the downturn in the global ICT market and Ireland's heavy reliance on the sector, output growth is forecast at 3.4% in 2002 and 4.7% in 2003, with GDP of around 6.7% as of 2Q 2002 (IDA).

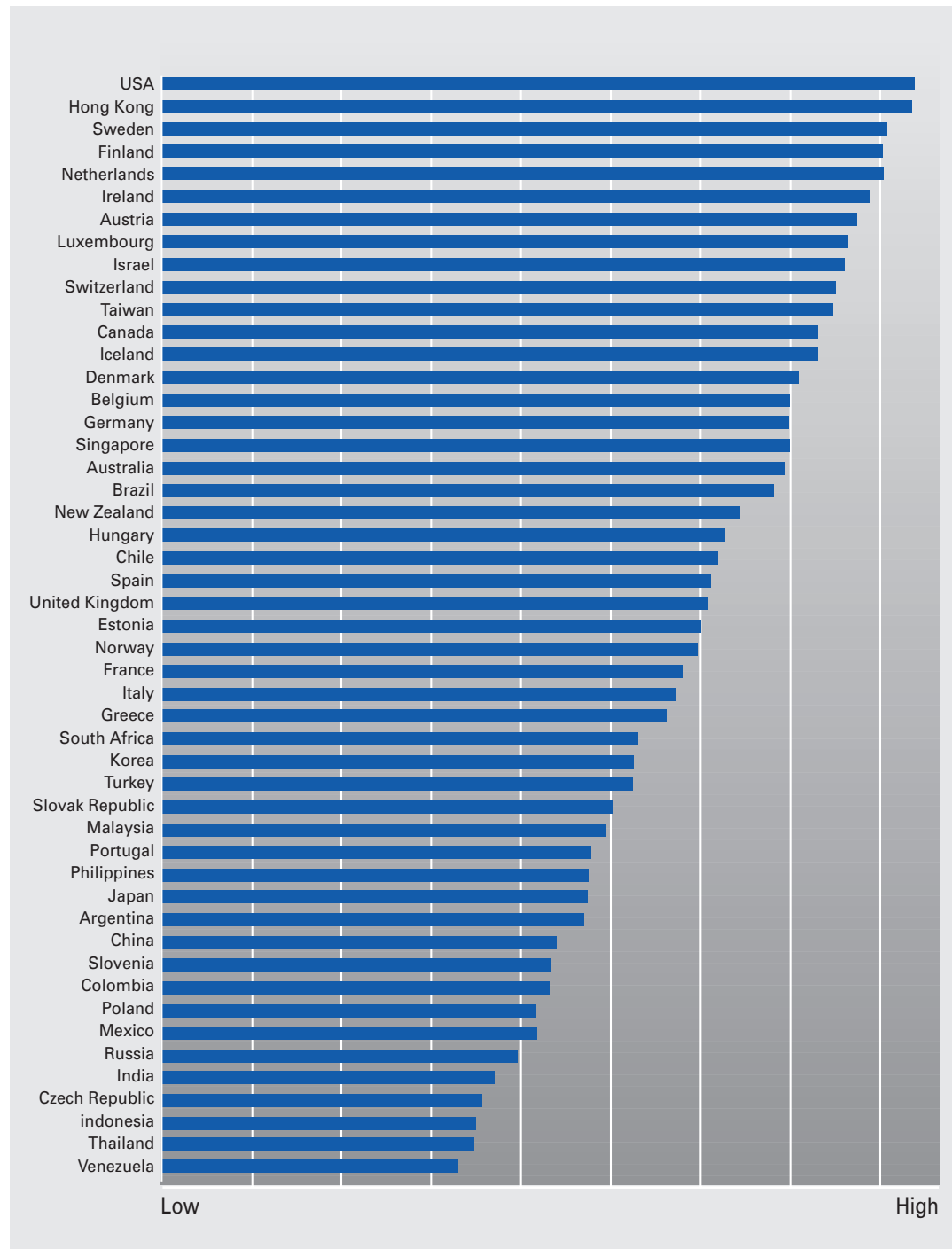
To support the ICT sector, Ireland doubled its number of software graduates between 1998 and 2003 by funding places at universities.

For Luxembourg, the picture is quite different. Luxembourg is a service-based economy, with services representing 82% of its economy, compared to 64% for Ireland (OECD). In addition, the share of the ICT sector is far less (around 7.5% of GDP).

Activities that are dependent on domestic demand, and in particular on private consumption, are doing well. So far, the confidence of Luxembourg consumers has not been affected by the economic gloom in neighboring countries, attributable to comparatively low unemployment, relatively high salaries and a trend towards lower taxation.

The financial sector has also lost momentum. For the full year 2002, the CSSF reported banking revenues at the same level than 2001. Net income decreased by 7% compared to the previous year. In the first half of 2003, banking revenue of Luxembourg's banks declined by 6% compared to the prior year's period. In addition, the investment fund sector saw its total net assets fluctuating at almost same levels since one year. Uncertainty, lack of growth and pressure on costs are serious challenges given the considerable weight of the financial sector in Luxembourg: with a workforce representing 11% of the total population, the sector accounted for 22% of GDP and contributed to approx. 32% of the tax revenues in 2000.

Graph 2: Economic Dynamism and Competition



Source: Extracts of the Global Technology Index

The Law for Financial Sector Professionals

Historically, because of banking secrecy requirements, Luxembourg's financial sector has been unable to outsource many non-core functions, such as issuing account statements. This situation has resulted in inefficiencies and unnecessary overheads for certain banks and lost opportunities for companies that could effectively support such tasks.

The law for PSF ("Financial Sector Professionals") seeks to address this issue by creating new categories of PSF for support functions that are not financial in nature, including:

- IT and telecommunication network operators;
- administrative agents for certain back-office tasks;
- client reporting and communication agents.

The objective of this bill is to ensure a favorable legal and statutory framework for the regulation of such support functions, and thus open up the possibilities of outsourcing, by bringing all PSF under the supervision of the CSSF ("Commission de Surveillance du Secteur Financier"). The result will be a whole range of functions that can be effectively outsourced, with cost-savings for the financial sector and new profit opportunities for the service providers.

An additional opportunity from the law could be to make Luxembourg one of the first European countries granting back-office service insourcing companies a PSF status. Luxembourg could subsequently develop this business niche and become a European hub for support functions for the financial sector, a development that would provide additional opportunities for the ICT sector.

4. Luxembourg's ICT Sector

4.1. Introduction

This chapter focuses on Luxembourg's position in ICT compared to other EU countries. Its objective is to see what the figures say about the penetration of ICT into Luxembourg's businesses and homes, as well as the impact the Internet has had both on how business is done and on private life.

The comparison between Luxembourg and the rest of Europe is made possible by the work of the OECD and the EU's benchmarking of eEurope, which evaluated the progress made by each member state in meeting EU objectives.

As discussed in Chapter 2, new technologies play an increasingly important role in the world economy, with their use driving growth and increased productivity. As traditional indicators do not accurately capture ICT's role, new indicators have been adopted that include:

- the degree of Internet penetration in business and at home;
- measurement of human capital;
- capacity for innovation;
- investment in telecommunication infrastructure;
- development of broadband access;
- the extent of online governmental services.

4.2. The effect of ICT on productivity

It is widely acknowledged that the growth in productivity observed in the second half of the 90's in the US and in some parts of Europe is related to the use of ICT. Its use has been extended to a large set of economical activities, as well as to good management of human capital and innovation. In such an environment innovative possibilities appear that new firms can use and of which existing firms can take advantage in order to improve their working habits and modernize their functioning.

A report of the European Commission titled, "Information on the 2001 Competitiveness Report and the Enterprise Scoreboard" shows that ICT permit better organisation of production and distribution. ICT strengthens a company's adaptability and creates downward pressure on prices, which favours the emergence of new industries. For countries as for businesses, increasing productivity is crucial because, historically, productivity growth is linked to

economic growth. Productivity growth also has been shown to reduce working hours, at least on a mid term basis.

The slowdown of Europe's productivity growth is worrying. Some people explain it as a result of insufficient investment in IT, which represented only 5.6% of European GDP between 1992 and 1999, as compared to more than 8.1% in the United States and 8.3% for all OECD countries.

What, then, about Luxembourg? If Luxembourg's productivity is still at a very high level, it could be attributed to the exceptional growth of employment, which was 5.5% in 2001, against a European average of 1.1%.

Table 3: Labour productivity in EU Member States, US and Japan in 1975-2001

(average annual growth of GDP/employed person in per cent, ranked according to performance in 1995-2001)

	1975-1985	1985-1990	1990-1995	1995-2001	2001	Labour productivity in 2001 (US=100)
Ireland	3,5	3,5	2,7	4,0	4,1	90
Greece	1,0	0,5	0,7	3,0	3,0	64
Portugal	3,3	4,6	2,3	2,9	0,2	49
Finland	2,4	3,0	3,2	2,1	- 0,8	77
Austria	2,4	2,6	2,1	1,7	1,1	89
Sweden	1,1	1,4	2,8	1,7	- 0,4	69
United Kingdom	2,1	1,5	2,7	1,5	1,6	73
Luxembourg	2,2	3,1	1,2	1,5	- 1,4	108
Belgium	2,5	2,2	1,6	1,4	0,1	92
Denmark	1,6	1,2	2,2	1,4	0,9	78
France	2,4	2,4	1,5	1,2	- 0,2	87
Germany	2,0	1,9	1,5	1,0	0,4	74
Italy	2,1	2,1	2,1	0,9	0,3	83
Spain	3,2	1,2	2,0	0,7	0,4	73
Netherlands	2,0	1,1	1,2	0,7	- 0,4	94
EU-15	2,2	1,9	1,9	1,2	0,5	78
United States	1,2	1,0	1,2	1,9	1,2	100
Japan	2,9	3,8	0,6	1,2	- 0,3	67

Note: Growth rates were calculated on the basis of GDP at constant 1995 prices and national currencies, while the 2001 productivity levels are based on GDP at current market prices and PPS.

Source: Commission services

The "Global Technology Index 2002", edited by the Meta Group and Metricnet (www.metricnet.com), in association with the Progressive Policy Institute (www.ppi.org), adds to this productivity indicator some indicators such as employee motivation, entrepreneurship, adaptation to change, venture capital and ability to self-fund (finance from cash flow) in order to calculate a global indicator of "competitiveness and economical dynamism". Luxembourg places eighth out of the 49 countries analysed (see the full table in Appendix D).

4.3. Internet penetration: equipment use and infrastructure

Studies show that Luxembourg rates highly in equipment use and infrastructure, both for homes and businesses.

Domestic use

At the end of 2003, 74% of Luxembourg's homes had a computer and 62% had an Internet connection (ILReS November 2003). These figures place Luxembourg well above the European average, in which 42.6% of homes had Internet connections in 2002.

55% of Luxembourg's population use the Internet regularly, i.e. at least once a week, either at home, at work or at school. The Internet is primarily used to search for general information and email. 26% of the population (or 46% of those connected) have made online purchases at least once. However, these purchases are almost all from foreign vendors.

eCommerce

According to the statistics, eCommerce hardly exists in Luxembourg. According to Eurostat's "Benchmarking National and Regional eBusiness Policies" in July 2002, only 9% of businesses with more than 10 employees offered eCommerce.

This study also reports that 54% of these same businesses are connected to the Internet, that 39% have a web site and that 18% buy online. However, only 9% sell online. As shown in the table below, these are among the lowest rates of any EU country.

Table 4: SME use of eBusiness

% of SMEs:	AT	DK	ES	FI	GR	SE	UK	DE	LU	NL*	IT	NO
Using ICT	92	95	91	98	84	96	92	96	90	87	86	93
Having Internet access	83	86	66	91	54	90	62	82	54	62	71	73
Having own web site	53	62	6	58	28	67	49	65	39	31	9	47
Using a third-party web site	26	NA	28	NA	8	NA	11	21	13	NA	26	NA
Making online purchases	14	36	9	34	5	31	32	35	18	23	10	43
Making online sales	11	27	6	13	6	11	16	29	9	22	3	10

*Netherlands data based on enterprises with 10 to 49 employees

Source: Eurostat 2002

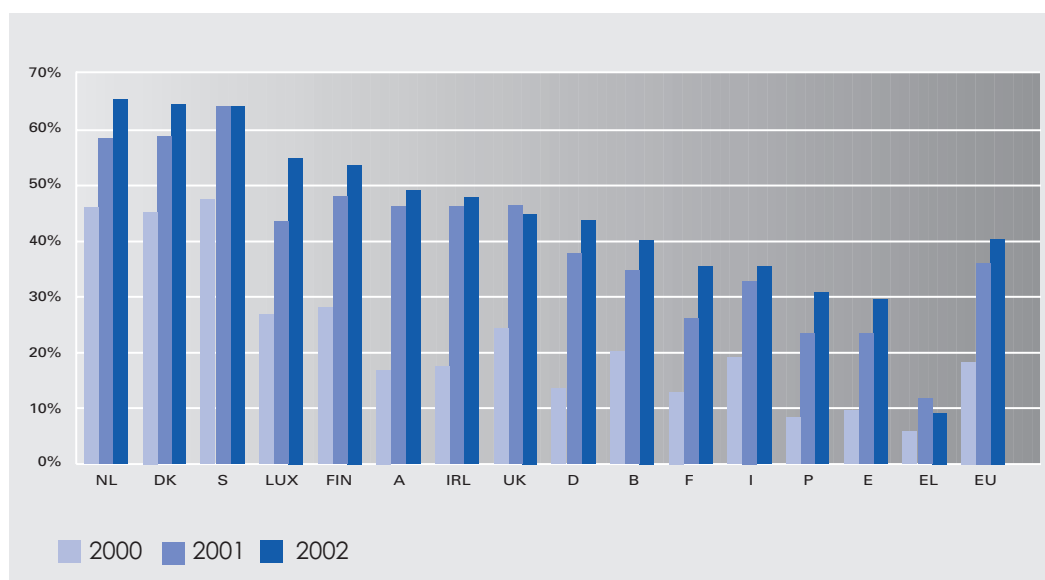
The situation does not improve when the characteristics of Luxembourg's business web sites are assessed. 78% of these provide informational content, but no service to customers. Only 16% offer services and 5% sales.

A 2001 survey of businesses by the Chamber of Commerce and the Gabriel Lippman Research Centre found that more than half of businesses interviewed did not plan to, or did not know if they would develop, eCommerce activity.

These figures are all the more surprising given the conclusions of the European Commission survey, "Benchmarking National and Regional E Business Policies":

"Very few barriers do exist for Luxembourg SME's to the use e-commerce for purchases or sales. 8% of the SMEs surveyed did not identify any barrier as to the use of e-commerce for either purchases or sales. For all possible inhibitors, the response from Luxembourg SMEs was among the lowest of the countries surveyed. It is therefore surprising that, as shown in Table 1, the actual percentage of Luxembourg SMEs who have adopted e-commerce for purchase or sales transactions is relatively low (18% for purchases and 9% for sales)."

Graph 3: Penetration of the Internet among households



Définition: Pourcentage de la population (âgée de 15 ans et plus) disposant d'un accès à Internet à la maison.

Années: 2000 (mars), 2001 (juin) et 2002 (juin)

Note: Enquêtes Eurobaromètre réalisées dans le cadre de l'évaluation comparative réalisée sur eEurope

Source: European Commission (Eurobarometer) 2002

4.4. Infrastructure

ICT's ground level infrastructure is the communication network. State policy, regulation, technological improvements and market changes all play a role in the way that a country uses this infrastructure.

Compared to other EU countries, Luxembourg leads in terms of ISDN penetration, with more households connected via ISDN lines (47%) than via analogical ones (40%). ADSL is used by up to 11% of households and an additional 3% of the households use CATV (ILReS, November 2003). National investment in telecommunications is 0.6% of GDP, which ranks Luxembourg 19 out of the 49 countries in the "Global Technology Index".

4.5. Investments in human capital

According to an OECD report (OECD Science, Technology and Industry Scoreboard, published 2001), Luxembourg ranks just after Ireland in employment growth in the "Science and Technology" sector. It is noteworthy that in Luxembourg, in 1999, more than a third of new jobs were in that sector, and that the growth in that number of jobs was 9%, well above the average of 3%.

At the same time, IT professionals alone represented 2% of jobs (ranking fifth in Europe), and engineers or scientists represented 6% of jobs (ranking seventh in Europe). Highly qualified workers in the ICT sector represented 2% of jobs (ranking second after Finland), with annual growth of 20%.

4.6. eGovernment and the Public Sector

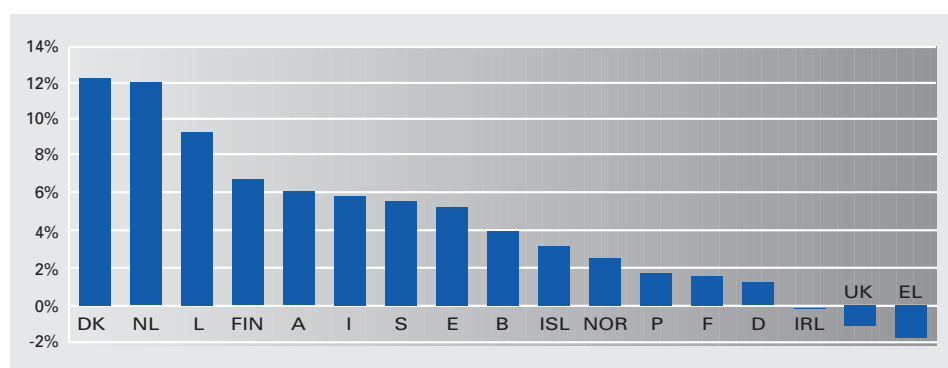
The 2002 report of the European Information Technology Observatory indicates that Luxembourg spent 0.27% of GDP (about EUR 60 million) on e-government in 2000 compared to the European average of 0.3%. At present, although many projects are in process under the lead of the eLuxembourg action plan, the government has yet to launch any e-service targeted at Luxembourg's "citizens" (G2C).

A December 2002 Cap Gemini Ernst & Young report on online public services in Europe shows significant progress, even if the country is in last position.

Table 5: Global classification
Progression since the 2nd measurement (April 2002)

Country	S	IRL	DK	FIN	NOR	E	F	UK	P	I	A	NL	ISL	EL	CH	D	B	L
Oct 2002	87%	85%	82%	76%	66%	64%	63%	62%	58%	57%	56%	54%	53%	52%	49%	48%	47%	32%
Apr 2002	81%	85%	69%	70%	63%	58%	61%	63%	56%	51%	49%	42%	50%	54%	35%	46%	43%	22%
Oct 2001	61%	68%	59%	66%	63%	50%	49%	50%	51%	39%	40%	37%	38%	39%	-	40%	23%	15%

Graph 4: Percentage change in spending on eGovernment Oct -April 2002



Source: Cap Gemini Ernst Young 2002

4.7. Information Security and the LuxTrust project

Luxembourg requirements for technology risk governance are currently defined by both the banking industry and the emerging e-government projects. Indeed a vision of positioning the Grand-Duchy as a European competence centre for information security is one of the factors driving the eLëtzebuerg program (Commission Nationale pour la Société de l'Information) in order to implement Government online services and public key infrastructures (PKI).

In 1997, the ABL began to study opportunities for the development of e-commerce in Luxembourg and ways in which its members might benefit. These efforts led to the adoption of the Law of 14 August 2000 on electronic commerce and the Grand-Ducal regulation of 1 June 2001 on electronic signatures.

Between 1999 and 2001, the ABL brought together a dozen financial institutions based in Luxembourg in the framework of the LuxTrust project, the purpose of which was to analyse the possibilities for deriving practical benefits from this legislation. However, as the government had put similar studies in hand, a decision was taken to await the finalisation of the government's own studies before envisaging further work on the project in cooperation with the public sector.

In October 2002, the LuxTrust project was re-launched. This cooperation between the private and public sectors was given practical effect by the creation of the Economic Interest Grouping (EIG) between the financial institutions and the ABL "LT Banques" in February 2003 and the creation of the EIG LuxTrust formed by the "LT Banques" EIG and the State in March 2003.

The purpose of the LuxTrust EIG is to look into ways and means of setting up a Luxembourg Trust Centre which would enable the specific needs of the private and public sectors in Luxembourg to be met. Such a Trust Centre is the central link in a public key infrastructure (PKI) which forms the basis for the electronic signature.

A PKI operates on the basis of a private key which is held solely by the user and a public key. For example, the user makes use of his private key to sign a message and the addressee asks the Trust Centre for the corresponding public key which enables the signatory's private key to be authenticated.

The Trust Centre provides a guarantee for the recipient that the signature is indeed that of the purported person and that this person is the only one to possess the relevant key. This proves the importance of such a centre within the infrastructure: the beneficiary does not need to know the signatory and place direct confidence in him. It is sufficient for him to place that confidence in the Trust Centre.

The LuxTrust project will have to analyse the requirements for such a public key infrastructure to assure this relationship of trust at both the technical and operational levels. Moreover, the project will look into the possibilities for application of the PKI and develop an operational plan which will have to show whether such an infrastructure is economically viable and can bring any real advantage to Luxembourg and its financial centre.

5. Review of previous recommendations

The Cepros Report 2000 made recommendations in five specific areas:

- Gouvernement initiatives;
- e-Commerce legislation;
- e-Education and research;
- Ideas for business action;
- Joint government and business Initiatives.

5.1. Government Initiatives

As noted in the previous chapter, a major eLuxembourg programme was launched in early 2001. An eLuxembourg task force has been organised involving all Administrations concerned. Many projects for the digitisation of administrative tasks have been initiated, have an assigned project leader and have an approved time schedule. In addition, the government has increasingly relied on private companies for the development work, thereby providing a boost to a beleaguered IT sector.

The Technoport Schlassgoard is now hosting a mix of technology start-ups. However, despite the efforts of Mediaport, only limited business has developed.

In the framework of eLuxembourg, a substantial eGovernment programme has been initiated.

The creation of a regulatory environment that simplifies the establishment of small businesses and the development of entrepreneurship is a two-sided sword. Luxembourg, like many other countries, has been hit by an increase in the number of bankruptcies resulting from the economic downturn; some 750 insolvencies in 2001.

To protect against business failures, the Government is investigating measures like introducing compulsory management courses and raising the minimum capital requirement to start a new company. However the business licence which the Government intends to introduce may become a barrier to new ventures in the ICT industry.

5.2. e-Commerce Legislation

In line with the recommendations of the previous report and the tasks allocated to ANAS, the Government has established in April 2003 the Office Luxembourgeois d'Accréditations et de Surveillance (OLAS). Its mission is to implement a quality policy through the accreditation of calibration and testing laboratories, certification and inspection bodies and certification-service providers (CSP), delivering qualified certificates linked to electronic signatures. The conformity evaluation reinforces the security of online transactions.

In order to facilitate the development of eCommerce relationships between its members, the Luxembourg Chamber of Commerce has established a partnership with GlobalSign to offer a secure and efficient environment for electronic transactions. Amongst other services proposed are:

- advisory services for establishing a secure eCommerce infrastructure;
- verification of the submission data for obtaining an e-certification;
- issuance of e-certificates.

5.3. Education and Research

The Luxembourg government was the first to implement the EU directive to equip each primary and secondary school with Internet-enabled computers. In addition, training in new technologies is being offered to educational staff. However, since the courses are not compulsory, the response to date has been limited.

Some secondary schools have introduced specialised ICT sections. Others have reduced the size of their classes, making them more appropriate for computer-based education.

The creation of the myschool.education portal provides comprehensive information about the Luxembourg educational system, promotes educational events and facilitates an exchange of ideas with schools from the greater Luxembourg region.

The LIASIT (Luxembourg International Advanced Studies in Information Technology) project, which entered its pilot phase in 2003, offers post-graduate studies and doctoral research programmes in information technology.

LIASIT is built around a partnership between the "Centre Universitaire de Luxembourg", the "Institut Supérieur de Technologie" and the Centers of Public Research Henri Tudor and Gabriel Lippmann. LIASIT is an ambitious project build around the following key principles:

- identification of thematic niches beneficial to the economical and educational development of Luxembourg;
- establishment of partnerships with international universities for research and educational exchanges;
- establishment of partnerships with Luxembourg companies for the promotion of doctoral research programmes.

The P.A.R.E.N.T. project offers people on parental or disability leave training in new technologies in order to ease their reintegration into the workplace.

5.4. Ideas for Business Actions

Many of the ideas for business actions described in the previous report remain valid and should be pursued.

5.5. Joint Government and Business Initiatives

New business initiatives can receive guidance and information from LuxInnovation and the Chambre de Commerce. The Société Nationale de Crédit et d'Investissement (S.N.C.I.) also has programs for business investment.

6. Conclusion and Recommendations

Despite the bursting of the "dot.com" bubble and the global economic slowdown, both the business and personal use of ICT continues to increase. ICT remain enabling technologies that foster productivity and improve systems when they are properly implemented.

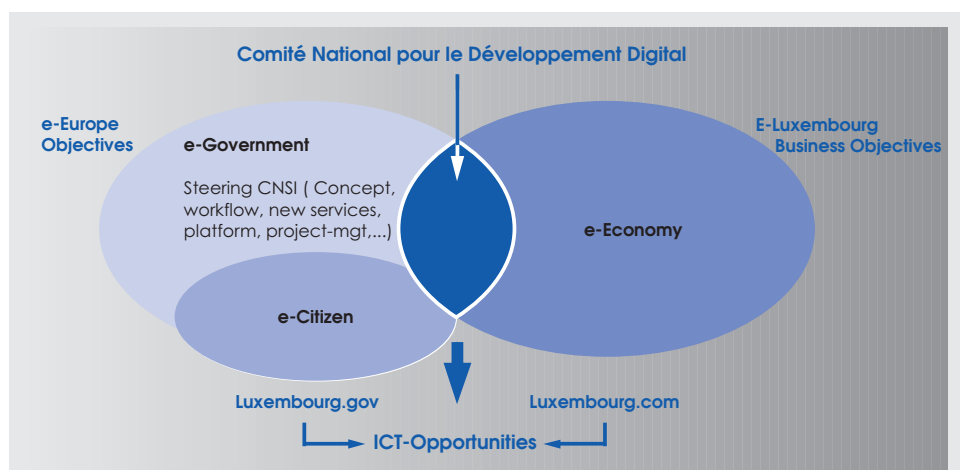
In Luxembourg, while some parts of the economy have integrated these new enabling tools, other still lag behind. While regrettable, this also means that better economic performance is possible by improving and expanding the use of ICT at a time when Luxembourg's economy would welcome additional growth as well as increased diversification. The recommendations in this report are based on these considerations.

Recommendation 1: Develop eLuxembourg as a vital strategic project for the Luxembourg economy

As mentioned earlier in this report, the contribution of ICT to Luxembourg's economy is a fraction of that of other EU nations. Consequently, it is recommended that a strategic project that, for the purpose of this report we call "luxembourg.lu", should be launched. The project would ensure ICT 's contribution in Luxembourg can meet or, even better, exceed those in other member states. The project would have two foci:

- **luxembourg.gov**
Make dealing with public administrations easier and more efficient while meeting Maastricht targets and EU directives. This focus is largely addressed by the government's eLuxembourg initiative.
- **luxembourg.com**
Establish the development of Luxembourg's ICT based services as a political objective that would include positioning Luxembourg as a centre of excellence, developing exports, etc.

Graph 5: E-Luxembourg Model



Source: Cefpros 2003

luxembourg.gov

In 2001, the Luxembourg government launched a major e-Government programme that includes both national administrations and the citizenry.

To realize its objectives, the Government has chosen to proceed by an internal route, rather than to go for a "turnkey" solution. While slower, the internal solution ensures "buy in" of the participants at all levels of the administration.

The working group welcomes the launch of the e-Government programme and emphasizes its importance to the entire ITC sector of the country. It is recommended that this initiative be given very high priority by government as the direct and indirect impact on the ICT sector and society is anticipated to be significant. Ongoing support of this initiative as well as continuous momentum and progress will be highly beneficial to Luxembourg. Given the importance, government may consider how to further increase the pace of progress.

luxembourg.com

While the private sector participation in [luxembourg.gov](#) programmes will help the country's ICT sector, more can be done to develop "[luxembourg.com](#)". An excellent national legal infrastructure supporting the development of e-commerce was put in place by the government several years ago. However, while the use of e-banking by customers has been a real success, the development of Luxembourg as a centre for e-commerce has yet seen limited success.

Therefore, to provide further assistance in the development of this sector, it is recommended that a joint public and private Committee, CNDD (Comité National pour le Développement Digital) be created that would:

- address the reasons why Luxembourg's ICT sector contributes less to the economy than in other EU countries;
- elaborate a policy to stimulate the establishment and development of ICT companies in Luxembourg;
- reflect how the benefits of ICT can be extended to para-public entities and elaborate recommendations for its use;
- identify projects with highest value for enterprise and the public.

The CNDD could further advise on:

- incentives for firms and individuals to use e-systems in their dealings with the government;
- building local ICT competencies, with a focus on SMEs;
- stimulating the creation of e-commerce in Luxembourg.

Recommendation 2: Optimise the marketing of Luxembourg for the ICT sector

Luxembourg undertakes marketing efforts to both attract business from abroad and promote exports. Carried out by the government as well as various business organisations, some are undeniably effective. However, based on input from numerous interviews, the consensus among business leaders is that these efforts could use far more coordination and that follow-up and ongoing support could be improved with the objective to install a proactive marketing approach towards targeted ICT businesses. Luxembourg's promotional activities show limitations when compared to the successful ICT campaigns undertaken by Ireland, for example.

In addition, the marketing efforts referred to above have tended to focus on attracting large businesses. Undeniably, these businesses generally do have an important direct and indirect benefit for the country and the supportive role of government in this process is highly beneficial for the local business community.

However, feed-back during the study indicates that, while support for larger businesses is assured, requests for information and support from medium and smaller ICT firms do not always find a satisfactory response.

As many ICT firms fall into the SME category (companies with less than 250 employees), this also limits opportunities for growth in this sector. Finally, the same dynamic holds true for efforts to promote Luxembourg's exports—resources go to the big companies rather than ICT SMEs.

We recommend that an existing body should be re-oriented, or a new body created, that would provide guidance regarding the promotion of Luxembourg abroad and be a single point of contact for enquiries, with specific resources focused on ICT. This body does need not to be public; it could be semi-public or even private.

The tasks of such a body would be to:

- Provide recommendations as to where promotional efforts should be directed and what incentives should be provided;
- Develop an overall marketing approach that would allow multiple initiatives while ensuring they have a common and coherent basis;
- Provide a single point of contact for enquiries, with staff who can: respond to questions and provide arguments in favour of Luxembourg; organize visits and meetings with ministries, business organisations and municipalities; assist in providing support in areas like incorporation, staff, premises, etc.;

- Network with embassies, consulates, trade representatives, ministries, business organisations, etc.;
- Organize and implement promotional campaigns;
- Create and implement a plan to actively promote exports of services as well as products;
- Develop special strategies and services to attract and support SMEs;
- Produce both printed and digital marketing materials.

Recommendation 3: Recognise EU institutions as an additional opportunity for ICT

A concrete example where Luxembourg could benefit from a ICT body referred to in the previous recommendation are the European Institutions. How to serve those institutions from a ICT point of view is in the best interest of these EU institutions, local ICT businesses and Luxembourg at large.

European institutions located in Luxembourg that are of world-class standing include:

- Court of Justice;
- Court of Auditors;
- European Commission;
- European Parliament;
- Eurostat;
- OPOCE (Office for official publications);
- CdT (Translation Centre for the Bodies of the European Union);
- EIB (European Investment Bank);
- EIF (European Investment Fund).

The presence of these institutions should be perceived as a business opportunity for Luxembourg to develop specific business clusters that could include:

- A legal industry centring around the Court of Justice;
- A content industry including the creation, packaging and distribution of EU public sector information;
- A translation services industry centring around the CdT and OPOCE;
- A venture capital industry leveraging the presence of the EIF;
- A consultancy services industry assisting companies in doing business with these institutions.

These business clusters, like the European institutions themselves, have intensive needs for ICT-related services. Hence, fully exploiting this opportunity would mean further development in Luxembourg's ICT sector.

Recommendation 4: Develop creativity and innovation by leveraging Luxembourg's intellectual capital

The following are proposed as points in an action plan to foster the development of creativity and innovation, both of which are central to a vital ICT sector.

Raise awareness of innovation and intellectual capital on a national level

There are close linkages between ICT, innovation and intellectual capital. Luxembourg should develop itself as a centre of excellence in innovation and the exploitation of intellectual capital. To begin to raise the awareness of decision makers about these issues, a first step could be to organise a conference on these issues.

Such an event would attract the top experts in the field, draw prominent attendees and generate media coverage to promote further public discussion. Ultimately, the country as a whole as well as the ICT sector would benefit.

Undertake an audit of Luxembourg's intellectual capital as a prerequisite for developing creativity and innovation

Undertake an audit of Luxembourg's Intellectual Capital, similar to those conducted by Israel and Denmark, which were sponsored by governmental agencies and professional bodies.

An "audit" would identify Luxembourg's strengths and weaknesses in areas such as relational, structural and human capital and suggest concrete ways to enhance innovation. Additional recommendations and action plans would be developed based on the audit results. ICT should be a particular focus.

Support the development of institutions of higher learning

Institutions of higher learning are natural sources of creativity and innovation. Luxembourg's initiatives to establish these institutions, are highly beneficial in this process.

LIASIT (Luxembourg Institute for Advanced Studies in Information Technology) is the first step in this direction. Its development should be supported and assistance provided to ensure its success. A second step is the recent decision to create a university. It is recommended that these essential efforts are continued and supported by the public and the private sector.

There are other projects that have the objective of attracting international research institutes to Luxembourg, which can be positioned as an ideal location for developing such programs in Europe. It is recommended that these initiatives be actively supported by both the government and the business community.

Appendix A. Participants

The Working Group

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Appendix B. SWOT Analysis of Luxembourg, based on Interviews

In the course of the interviews conducted by the working group, the following strengths, weaknesses, opportunities and threats (SWOT) for Luxembourg were identified repeatedly. Those that do not directly relate to ICT, indirectly effect the development of the sector.

1. Strengths

Accessible government officials

There is general agreement that Luxembourg's government officials are unusually accessible. They are business-minded and willing to listen to the business community. Luxembourg has a history of passing legislation that provides business with a competitive advantage, particularly in the financial sector.

Multilingual, multicultural environment

Luxembourg is especially attractive to foreign businesses and expatriates because of its multilingual, multicultural environment. This is partly due to the high percentage of foreigners already living here (the highest proportion in the world) and the number of people who commute to work across the Belgian, French and German frontiers. Multilingualism also reflects the country's educational system that teaches in both German and French.

Good infrastructure

Luxembourg works. In all areas vital to business-transport, telecommunications, IT, logistics-Luxembourg provides services that are equal if not superior to those of the rest of Europe.

Quality of life

Ranked as having the highest per capita GDP in the world for several years, Luxembourg is virtually unrivalled in the high quality of life it offers its inhabitants.

Favourable tax structure, both corporate and individual

Luxembourg has a favourable fiscal environment, particularly in comparison to neighbouring France, Germany and Belgium. This makes it attractive to establish businesses and to recruit employees.

2. Weaknesses

Monolithic economy

Luxembourg's economy is heavily dependent on the financial sector, to the extent that "when the banks sneeze, the economy catches a cold". This is especially apparent at present.

Educational system

As a result of its multi-cultural and international population, Luxembourg faces complex educational challenges. Recent results of studies indicate that there are opportunities for improving the educational environment.

Limitations in promoting Luxembourg abroad

There is no "one stop shop" for the marketing of Luxembourg to foreign companies or marketing of its "exports" (both products and services). Luxembourg receives lower marks than Ireland, Switzerland and the Netherlands. Promotional efforts often focus on the financial sector, which compound the problem of Luxembourg's monolithic economy.

Limited availability of risk capital and financing

Luxembourg has only limited risk capital available to entrepreneurs compared to other financial centres. In addition, it can be difficult to obtain credit lines from local banks, especially for service companies that have few hard assets. Thus self-financing of start-ups is common and many fail due to cash flow problems.

3. Opportunities

Presence of EU institutions

The opportunities presented by the EU institutions in Luxembourg are under-exploited. While certain business clusters servicing such niches as translation and IT support have been developed, commercialisation of the content produced by institutions such as the Court of Justice or Eurostat has yet to be realised.

Presence of the financial centre

Even while under pressure, the role of Luxembourg as a world class financial centre can be exploited in terms of ICT development. ICT can be used to increase the efficiencies of existing operations and any new business opportunity targeted by the financial sector will have related ICT applications needing development.

Presence of SES Global

SES Global is world's leading provider of satellite capacity for direct-to-home broadcast and broadband applications. Given its pre-eminence, the growth of a significant cluster of related businesses would seem to be a natural development.

4. Threats

Assumptions about the ongoing presence of EU institutions

Luxembourg's economy benefits significantly from the presence of EU institutions. The general consensus identified by the working group's interviewees is that Luxembourg does not take enough advantage of their proximity.

Competition from the East with EU expansion

Now that EU expansion is on track for 2004, Luxembourg's service companies will face competition from the new member states, which offer highly skilled professional services at a significantly lower cost basis.

Impact of changing ownership structure

Major Luxembourg companies are now majority - owned by foreign shareholders. This development leads to decisions being taken outside the country and imposes the need to constantly improve the environment and competitiveness of the Luxembourg operations of the respective corporate groups.
Statec's Statistics on Dépenses ITC (Courtesy of Serge Allegrezza)

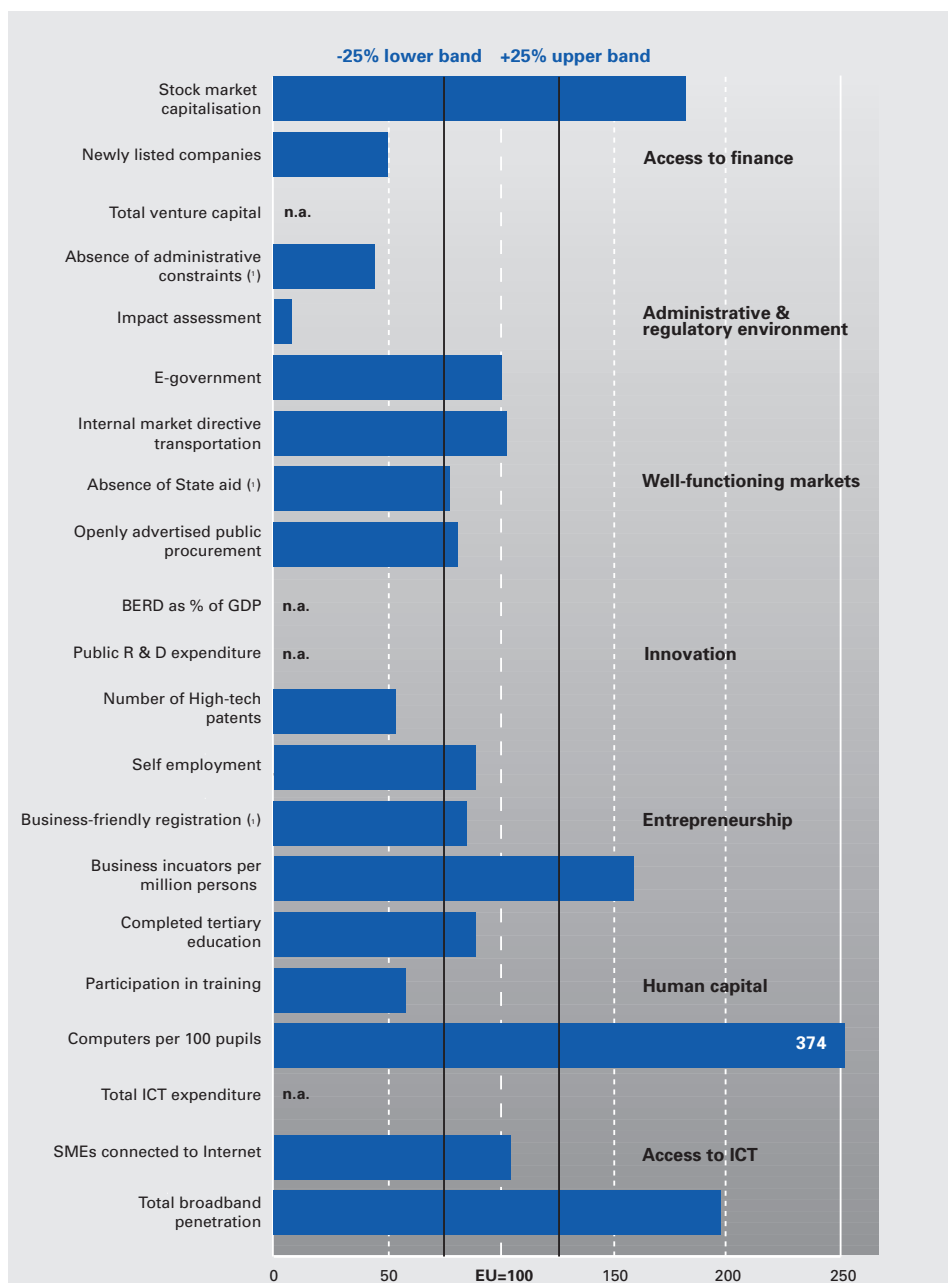
Appendix C. Tables

Table 6: How Member States rank in the 2001 enterprise scoreboard

ACCESS TO FINANCE INDICATORS																
	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	EU
Importance of stock market, market capitalisation as % of GDP	83%	72%	69%	98%	95%	114%	98%	74%	200%	182%	16%	60%	260%	154%	206%	113%
Newly listed companies as % of already listed companies	4.4%	3.0%	21.6%	19.8%	29.9%	9.5%	3.8%	18.2%	9.8%	3.9%	7.2%	3.2%	12.9%	15.9%	20.0%	19.0%
Total (= early + later stage) venture capital as % of GDP	0.22	0.11	0.19	0.16	0.13	0.21	0.21	0.14	n.a.	0.39	0.07	0.12	0.19	0.23	0.41	0.23
ADMINISTRATIVE & REGULATORY ENVIRONMENT INDICATORS																
	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	EU
Administrative burden on business performance (% of total SMEs)	12%	16%	19%	6%	2%	16%	1%	5%	15%	15%	12%	1%	10%	7%	11%	10%
Use of business impact assessment (5 sub-ind. total 27 points max.)	7	18	16	4	6	8	11	19	1	20	19	5	17	23	22	13.1
'E-government' contact for SMEs as % of total (infos, e-mails and forms accumulated)	77	105	66	52	60	77	59	71	69	81	67	40	75	131	63	71
WELL-FUNCTIONING MARKETS INDICATORS																
	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	EU
Internal market directive: transposition deficit %	23	0.8	2.6	3.0	1.3	3.0	2.4	1.7	2.1	1.3	2.9	2.5	0.7	0.9	2.8	2.0
Total State aid in the EU as % of GDP	1.41	1.08	1.39	1.21	1.17	1.38	1.36	1.28	1.31	0.90	1.16	1.56	1.74	0.84	0.60	1.18
Openly advertised public procurement as % of total pub. procurement	16	21	6	38	25	15	21	18	12	11	13	15	13	20	22	15
INNOVATION INDICATORS																
	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	EU
BERD as % of GDP	1.47	1.25	1.72	0.13	0.48	1.37	1.1	0.56	n.a.	1.05	0.71	0.17	2.18	2.86	1.26	1.24
Public expenditure on R & D as % of GDP	0.50	0.71	0.75	0.38	0.43	0.80	0.35	0.48	n.a.	0.87	0.65	0.40	0.95	0.86	0.59	0.66
Number of patents in high-tech classes per million inhabitants	17.6	21.5	29.3	0.5	2.5	20.2	13.3	4.8	9.2	35.8	9.8	0.4	80.4	22.9	18.9	17.9
ENTREPRENEURSHIP INDICATORS																
	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	EU
Propensity towards self-employment (% of total population - all ages)	36	38	48	70	62	55	63	56	44	41	38	67	27	31	48	51
Minimum cost requirements for plc-type registration	980	0	634	1.700	1.518	213	445	1.270	850	535	1.120	450	252	186	40	679.5
Number of business incubators per million persons employed	3.4	2.6	8.4	1.8	2.8	4.9	4.0	2.2	8.5	0.8	1.4	4.9	11.7	8.5	8.1	5.5
HUMAN CAPITAL INDICATORS																
	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	EU
% of population (25-64 years) with a completed tertiary education	27.1	25.8	23.8	16.9	21.8	21.6	22.2	9.6	18.3	25	14.2	9.8	32.4	29.7	28.1	21.3
Population participating in training as % of age group (25-64 years)	6.8	20.8	5.2	1.1	4.9	2.8	5.2	5.2	4.8	15.6	7.8	3.3	19.6	21.6	21	8.4
Computers per 100 pupils (all levels)	8.6	30.6	4.9	4.9	7.2	9.5	10.9	5.5	32.2	12.5	11.0	4.0	38.4	15.3	11.1	8.6
ACCESS TO ICT INDICATORS																
	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	EU
Total ICT expenditure as % of GDP	5.6	6.1	5.7	5.8	6.3	6.1	4.8	5.3	n.a.	6.6	5.8	6.6	6	7.7	7.1	6.1
SMEs connected to Internet as % of all SMEs	75%	66%	80%	78%	63%	56%	72%	72%	73%	65%	86%	47%	80%	81%	75%	71%
Total broadband penetration in general public, as % of households	15%	21%	22%	1%	2%	4%	4%	7%	22%	24%	21%	3%	10%	12%	9%	11%

Source: Extract of "A pocketbook of enterprise policy indicators" - 2001 edition

Graph 6: 2001 enterprise scoreboard indexed indicators - Luxembourg



(1) See comments in the introduction

Source: EU Competitiveness Report 2001

An arbitrary band of 25% above and below the benchmark is established to make the comparison of each Member State easier to display (2). Indicators higher (lower) than 125% (75%) of the benchmark are considered to reflect a strong (weak) performance.

Legend: see next page

Table 7: Explanation of 2001 enterprise scoreboard indicator

Abbreviated indicator definition used in the graphs	Full description of the basic series
Stock market capitalisation	Importance of stock market, market capitalisation as % of GDP
Newly listed companies	Newly listed companies as % of already listed companies
Total venture capital	Total (= early + later stage) venture capital as % of GDP
Absence of administrative constraints ⁽¹⁾	Administrative burdens as a major constraint for business performance (% of total SMEs)
Business impact assessment	Measuring business impact assessment practices: 5 sub-indicators total 27 points max. ⁽²⁾
E-government	Overall "e-government" contact for SMEs as % of total ⁽³⁾
Internal market directive transportation	Internal market directive: transposition of directives, %
Absence of State aid ⁽¹⁾	Total State aid in the EU as % of GDP
Openly advertised public procurement	Openly advertised public procurement as % of total public procurement
BERD as % of GDP	Business expenditure on research and development as % of GDP
Public R & D expenditure	Public expenditure on R & D as % of GDP
Number of high-tech patents	Number of patents in high-tech classes per million inhabitants
Self-employment	Propensity towards self-employment (% of total population - all ages)
Business-friendly registration ⁽¹⁾	Minimum cost requirements for the registration of a new plc-type company
Business incubators per million persons	Number of business incubators per million persons employed
Completed tertiary education	Population (25-64 years old) with a completed tertiary education
Participation in training	Population participating in training as % of age group (25-64 years)
Computer per 100 pupils	Computers per 100 pupils (all levels)
Total ICT expenditure	Total ICT expenditure as % of GDP
SMEs connected to Internet	SMEs connected to Internet as % of all SMEs
Total broadband penetration	Total broadband penetration in general public, as % of households ⁽⁴⁾

⁽¹⁾ Inverted indicator (see introduction for details).

⁽²⁾ Long-term commitment 7/Corerage of impact assessment 10/Criteria 2/Economic analysis 4/External consultation 4.

⁽³⁾ Sum of three criteria: find administrative information/send them an e-mail/form filling, procedures.

⁽⁴⁾ Sum of cable modem/ADSL/ISDN

Source: EU Competitiveness Report 2001

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