European Science and Technology Observatory

Identifying factors of success and failure in European IST-related national/regional developments

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ABOUT ESTO

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The European Science and Technology Observatory (ESTO) is a network of organisations operating as a virtual institute under the leadership and funding of the European Commission's Joint Research Centre's (JRC's) Institute for Prospective Technological Studies (IPTS) since 1997.

Today, ESTO is composed of a core of twenty European institutions, all with experience in the field of scientific and technological foresight, forecasting or assessment at national level. These 20 organisations have a formal obligation towards the IPTS and are the nucleus of a far larger network of an additional 25 Affiliated and Associated Members. ESTO is an open network: membership is continuously reviewed and expanded with a view to matching the evolving needs of the JRC-IPTS and to incorporating new competent organisations from both inside and outside the EU 25+.

In line with the objective of supporting the work of the JRC-IPTS, ESTO **aims** at detecting, at an early stage, scientific or technological breakthroughs, trends and events of potential socio-economic importance, which may require action at a European decision-making level. The ESTO **core-competence** therefore lies in prospective transnational analysis and advice on S&T changes relevant to EU society, economy and policy.

The **main customer** for these activities is the JRC-IPTS, and through it, the European policy-makers, particularly those within the European Commission and Parliament. ESTO also recognises and addresses the role of a much wider community, such as policy-making circles in the Member States and decision-makers in both non-governmental organisations and industry.

ESTO members, therefore, **share the responsibility** of supplying IPTS with up-to-date and high quality scientific and technological information drawn from all over the world, facilitated by the network's broad presence and links, and including access to relevant knowledge within the JRC Institutes. The JRC-IPTS involvement in the elaboration and guidance of ESTO tasks secures input, impartiality, quality and independence, as regards both the process and its output.

Currently, ESTO is engaged in the following **main activities:**

- A series of **Specific Studies**. These studies usually consist of comparing the situation, practices and/or experiences in various member states, and can be of different kinds: a) *Anticipation/prospective analysis*, intended to act as a trigger for in-depth studies of a European foresight nature, aiming at the identification and description of trends rather than static situations; b) *Direct support of policies in preparation* (ex-ante analysis); and c) *Direct support of policies in action* (ex-post analysis, anticipating future developments).
- Implementation of **Fast-Track** actions to provide quick responses to specific S&T assessment queries. On the other hand, they can precede or complement the above mentioned Specific Studies.
- ESTO carries out "**Monitoring of Prospective S&T Activities in EU+"** and provides "**S&T Alert/Early Warning**". These actions enable ESTO and JRC-IPTS to anticipate needs of European decision-makers.
- Support the production of **"The IPTS Report"**, a monthly journal targeted at European policy-makers that contains articles on S&T developments likely to emerge on the policy-makers' agenda.

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PREFACE

By 2010, Europe will have been enlarged to include thirteen or more new member states.[1] The Enlargement process will impact very strongly on Europe, its market, its projects, and its image. The development of the Information Society in the new member states, already underway in Western Europe, will have to keep up with this transformation.

The Lisbon strategy, launched at the EU Spring Summit of March 2000, set out a decade-long process of economic, social and environmental renaissance for Europe, with the declared aim to make Europe the most competitive knowledge economy by the year 2010. Information and Communication Technologies (ICTs) were seen to be one of the principal elements of the strategy, and the main engine of economic growth, competitveness and jobs.[2] The importance of ICTs in the recent economic growth and productivity performance in some EU Member States has two aspects. Firstly, the ICT–producing sectors, where spectacular technological advances have taken place, have directly contributed to increases in productivity and economic growth. Secondly, recent research supports the view that the impact of ICT, as a general purpose technology, goes beyond the ICT-producing sector and has a positive effect on overall output and productivity growth.[3]

All thirteen Accession and Candidate Countries have signed up to this strategy while at the same time adapting their national legislative and institutional frameworks to the constraints of the Acquis Communautaire.[4] However, given their overall social, political and economic situations, it is unclear what Information Society strategy would best fit their very specific contexts. One option to explore could be an industry-focused strategy as this has obviously generated success in several Western European countries such as Ireland, Finland, etc. This study investigates the potential of such a strategy in Candidate Countries, by identifying which factors have favoured success at national or regional levels in the European Member States.

Bernard Clements
Head of the ICT Unit, JRC-IPTS

[1] In 2003, the thirteen "Accession and Candidate countries" were: Estonia, Lithuania Latvia, Turkey, Malta, Cyprus, Bulgaria, Czech Republic, Hungary, Poland, Romania, Slovakia, and Slovenia. Negotiations were concluded with Cyprus, Czech Republic, Estonia, Hungary, Latvia, Lithuania, Malta, Poland, Slovak Republic and Slovenia by the end of 2002. After ratification these countries will join the EU on 1 May 2004. Detailed roadmaps have been agreed for Bulgaria and Romania, offering them the perspective of membership from 2007. The prospect was also established of starting Turkey's accession negotiations without delay after December 2004 if it fulfils the Copenhagen political criteria.

[2] Liikanen E., March 2003. Challenges of the Information Society. Speech at the "Swiat Telekommunicacji Symposium". Warszaw, March 2003.

[3] European Commission, 2001. European Competitiveness Report.

[4] The *Acquis* integrates all the European laws and rules adopted on the basis of the EU's founding treaties, mainly the treaties of Rome, Maastricht and Amsterdam. Its transposition in national law has been negotiated with the first applicant countries over the last 5 years.

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1 INTRODUCTION

1.1 OBJECTIVES

The overall objective of this study is to provide a series of short national or regional monographs describing the histories of IST[5]-related successful or failed developments, acknowledging that successes and failures are often interrelated, partial, or open to later reinterpretation.

Each regional or national success/failure story aims to give a contextualised and comprehensive picture of the relevant factors which have favoured the success (or contributed to the failure) of ICT-related developments in a given national or regional community.

Chapters 1 and 2 of this report have been written by Marc Bogdanowicz and Jean-Claude Burgelman, IPTS. They contain an introduction to the study and its main lessons, followed by a summary of the results of each of the five National and Regional case studies. Chapter 3 presents the five country reports in full.

1.2 RESEARCH RATIONAL

The last decade of IST-related development provides evidence of national successes and failures set against the particular economic, industrial, historical, social and geographical profile of the country or region concerned.

This study forms part of the work carried out by the ICT Unit of the IPTS to develop a prospective outlook on the Information Society in an enlarged *e*Europe up until 2010.[6] It aims to gain a deeper understanding of national or regional Information Society (IS) trajectories, assess their strengths and weaknesses, set out the conditions favourable to the development of the IS in general, and sketch out the main policies that have helped to achieve IST-related regional and national development.

Factors of success and failure

A number of apparent successes and failures in the development of the Information Society have occurred in various countries and regions around Europe. While some of these appear to be "tigers",[7] others have failed to fulfil their initial promise. Vast amounts of conventional economic and IST-related data are available in diverse reports, but there are still major difficulties in interpreting these and in assessing the root factors of potential success or failure at national and regional levels.

The underlying assumption of this research is that in each context, there is a specific set of observable parameters (pre-conditions, a required minimum set of factors) which may help to understand national and regional developments in relation to ISTs. These parameters can take in a broad spectrum of social, political, economic and cultural aspects and are based on a fairly long-term historical perspective on the relevant country environments (2 or 3 decades, for example). Furthermore, the succession of context-related events identified in any particular case is expected to give an insight into the

[5] IST- Information Society Technologies is preferably used in this report to express the importance of the applications of the Information and Communication Technologies taken as general purpose and enabling technologies

[6] FISTE – Foresight for the Information Society Technologies in an Enlarged Europe is the federating project of the ICT unit of IPTS. It is a cross cutting and multidisciplinary IST foresight exercise, that supports the policy making activity of the Information Society Directorate General of the European Commission (DG INFSO). More under: http://fiste.jrc.es/

[7] The concept of "Tiger" countries was originally coined in earlier decades with the observable rapid development of a series of Asian countries such as Taiwan, South-Korea, etc. Interestingly enough, the model of development here was largely based on the strength of a manufacturing industry (automotive, consumer electronics, etc.). The word has been used again, in particular when referring to Ireland as the "Celtic Tiger" in: Ferreira Luisa, Vanhoudt Patrick, February 2002. Catching the Celtic Tiger by its Tail: Unveiling the causes behind the growth success story. EIB Sector Papers. European Investment Bank. Draft.

interrelation between possible causal effects, institutional and cultural factors, human decisions and serendipity which affect the course of those events and result in the present situation. Thus, being context-related, the parameters so identified are seen as "necessary but not sufficient" conditions for success.

This study therefore centres around reconstructing and interpreting the histories of successful and failed regional/national IST-related developments and describing the role of the essential parameters identified, backing them up with solid factual data. The aim is to explain "how and why" some countries and regions have gained "Tiger" status in the IST area, and have become beneficiaries of the Information Society. Beyond the conventional analysis of the role of the efficiency of innovation systems, among others, attention was paid to original hypotheses about other possible essential determining factors.

These factors can be drawn from as broad a range of themes as is deemed relevant to each study. They can be related to geographical size and/or position, institutional and political organization, culture, societal norms, investment flows, export/import figures, patent performance, international co-operation, infrastructure (e.g. telecom, transport, financial, postal, etc.) at national and regional levels and the respective international networking, strength or presence of an industry, corporate histories, demographics, knowledge-base building and its related policies, in/out migration flows, regulations and policies (RTD, industrial, employment, education, regional, etc.), visionary statements and documents, etc. Any of these aspects could be identified and analysed if they are considered relevant factors for explaining success or failure.

Assessment of success and failure

Success and failure are usually assessed through the rate of development of a national/regional IST industrial cluster, combined possibly with facets of growth and employment. However, insight into a broader socio-economic range of impacts would support a wider ranging assessment of the IST-related impacts. Here again, each project partner was invited to develop a set of criteria for success and failure which would reflect more relevant parameters and the viewpoints of various stakeholders. This set of targeted parameters – backed up by factual data – and a qualitative description of their interrelations were expected to give a balanced and informed view on the positive and negative facets of IST-related development at national and regional level in each specific case-study. These parameters could be derived from sources such as reports and other documents, and also from interviews of representatives of the research and business communities by including questions on the anticipated impacts and visions of the future in IS developments.

1.3 POLICY BACKGROUND

Supporting the development of the Knowledge Society by 2010

Europe has defined not only specific economic targets, but also broader goals, to be achieved by 2010. "(It) has (…) set itself a new strategic goal for the next decade: to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion. Achieving this goal requires an overall strategy for:

- preparing the transition to a knowledge-based economy and society by better policies for the information society and R&D, as well as by stepping up the process of structural reform for competitiveness and innovation and by completing the internal market;
- modernising the European social model, investing in people and combating social exclusion;

- sustaining the healthy economic outlook and favourable growth prospects by applying an appropriate macro-economic policy mix.

(…) The shift to a digital, knowledge-based economy, prompted by new goods and services, will be a powerful engine for growth, competitiveness and jobs. In addition, it will be capable of improving citizens' quality of life and the environment".[8]

ICTs are therefore believed to play a specific role in the realization of these goals, by contributing to the growth of the economy, enabling the transition to a knowledge society, supporting the modernisation of public services, combating exclusion, and helping to develop new goods and services in a more sustainable framework. Their strategic role, both as a basic general purpose technology and as an industry, is of prime importance at the turn of the millennium.

Integrating the acceding and candidate countries into the process

The acceding and candidate countries, in particular those in Central and Eastern Europe, have during the last decade undergone three radical transformations: the shift to a market economy, integration into the European Union via the Enlargement Process, and finally, a move towards the Information Society, today enshrined in the different initiatives of the eEurope Action Plans.

These three transformations should lead to the emergence of an enlarged European knowledge society at various levels, as described in the March 2000 declaration of the Lisbon Council. This process will be a challenge for the economy, the institutional and political structures, constitutional and legal frameworks, and working conditions in the countries in question.

What the Information Society means for countries entering the European Union from 2004 onwards is a fascinating and complex question. Fascinating, because it opens up a real window of opportunity for these countries to leapfrog technical, economic and social divides, thereby enabling them to meet the Lisbon objectives by 2010. Complex, because building the Information Society is only one of many priorities these countries have today and because there is no single recipe for success.

The research carried out at IPTS and reported herein has attempted to answer the following straightforward question: Are there essential lessons to be learned from the IS trajectories of the EU15 Member States over the last decade and can these be transfered to the CC13?

1.4 METHODOLOGY

The "case study" monographs on specific countries or regions synthesise and interpret the most relevant statements and hypotheses on success and failure factors - conventional ones as well as original ones - as identified and developed from the following sources:

- the review of the available scientific and non-scientific literature and statistical data relevant to the subject – typically recently developed national IS development assessments.
- the authors' assumptions about factors seen as very relevant but not given sufficient emphasis in conventional literature and/or data gathering.
- Approximately 10-20 interviews per monograph of national/regional representatives of the research community, governments, business and NGOs

[8] European Council, Lisbon, March 2000. Expanded at Gothenburg and refined at Stockholm and Barcelona.

which offer a range of local expert opinion on the statements and hypothesis developed in the study, insights into the anticipated impact of IS developments and the changing status of success and failure factors over time.

The studies were performed geographically by State or region. Each research team worked largely independently, though MERIT provided overall coordination of the research effort. MERIT also produced a study on the Belgian region of Flanders (region). Austria was covered by ARC, Greece by ATLANTIS, Ireland by CIRCA and the German region of Dresden by ITAS. The choice of these cases allowed the study to cover a reasonable sample of countries and regions, both central and peripheral, which are reputed to be examples of successful and less successful Information Society development. Also, internal expertise in IPTS allowed us to back-up some of the findings with knowledge from other cases such as that of Finland.

The quality assurance process for this research has included several expert workshops, including that of Copenhagen (November 2002), and Sevilla (December 2002)[9], and an ESTO peer review (February 2003). Comments collected during the course of these and other reviews have been incorporated in the final versions of the reports.

[9] Experts who participated in these workshops are listed in the Acknowledgements on p. iii

2 MAIN RESULTS OF THE CASE STUDIES

2.1 SUMMARIES OF THE FIVE CASE STUDIES

The last decade of ICT-related development in EU15 Member States provides evidence of national successes and failures in specific economic, industrial, historical, social and geographical contexts. It is thus worthwhile understanding how relevant initiatives in given EU15 national/regional contexts have fostered conditions that favour the achievement of ICT-related regional and national development, and what this development has meant in each case.

Five cases were selected and are briefly described below.[10]

2.1.1 Austria

Austria was the fastest growing European economy from 1950-1960, only surpassed by the German "Wirtschaftswunder". The catching-up process of the 1950s and 1960s and above-average growth rates in the 1970s and 1980s make Austria one of the richest countries in Europe today. However, Austria's current favourable economic position cannot hide structural problems that are starting to affect economic performance. If we assess Austria's entry into the Information Society, we see structural change in a matured, developed economy. Hence, this is more the story of an "old Tiger", which has had to keep up, rather than simply catch up. Austria's story is also one of old virtues, which have partly turned into burdens. Austria's institutional set-up with its strong corporatist elements and its consensus-orientated policy did well in the times of catching up, but did not achieve as much structural change as Finland or other countries. Therefore, Austria may be better described as a country in the post "Tiger" period.

2.1.2 Belgium – Flanders

Flanders' general profile is that of a "Tiger" region – it is very wealthy and is part of a complex wider institutional structure which gives it a large degree of autonomy. It has a high population density and degree of urbanisation and hosts an important manufacturing industry. It also has a remarkably open economy in terms of trade and FDI, with very high levels of productivity (but salary costs are also remarkably high), and a highly educated population.

Analysis shows that while Flanders overall reaches at least the average European level for many aspects of the "Digital Society", this is not uniformly achieved across the different facets of its society:

- Flanders is strong in ICT infrastructure development
- It also hosts a reasonably important ICT sector
- This strong position is not matched by similar rates of ICT-use
- There are signs of a digital divide, as a comparatively large share of the population is not (yet) using ICT applications.

Thus, Flander's potential for ICT-related development is stronger than its actual effective and diffused usage of ICTs. The society as a whole has not realized the full potential benefit that ICT development can bring. ICTs are therefore under-exploited.

[10] These brief descriptions are based – under sole responsibility of the editors of the present report - on executive summaries written by the authors of the cases-studies

2.1.3 Germany – Dresden

Saxony was the most industrialised area in Germany before World War II. During GDR times, Dresden was the largest research centre, e.g. it piloted semiconductor production for Europe's first Megabit memory chip in 1988. In the course of the re-unification of Germany, employment shrank considerably and growth rates only reached the relatively low West German levels. The decision by Siemens in 1993 to invest the equivalent of € 1.38 billion in a semiconductor plant was essential to local development in the 90s. It was followed by AMD in December 1995 and by other players. In May 2002, AMD, Infineon and DuPont Photomasks founded AMTC, the Advanced Mask Technology Centre, as a global research centre. These major investments made it cost effective for about 30 international equipment producers to open permanent offices themselves. New producers such as DAS or Wacker Siltronic (in Freiberg nearby) started businesses. About 10,000 semiconductor-related jobs were created in the region, more than initially expected. It is estimated that government subsidies of about € 1.2 billion will be much smaller than the expected social insurance and tax payments, which will be about € 5.9 billion by 2010. The economic sustainability of these initiatives will largely depend on whether the investors are able to make substantial profits in the future, taking into account the fact that during downturns they will have to continue production even when revenues fall below average costs. Therefore, the timing, size and duration of the next boom will be crucial.

2.1.4 Greece

IS development in Greece started later than in most of the other EU Member States. The first and second CSF (Community Support Frameworks) made a major contribution to building telecommunications infrastructure, computerising public services and developing mobile telephony in the country. However, the success could have been much greater if these efforts had not been hindered by internal organizational matters like limited experience of the public sector in administration and implementation, lack of co-ordination, delays, fragmentation in programme design and implementation, etc.

At the end of 2002, Information Society initiatives were taking place within an economic environment marked by high growth rates (since 1995 the GDP growth rate has been higher than the EU average) low inflation and interest rates, and the elimination of public sector deficits. By 2002 the Greek economy was considered to be the fastest growing in the European Union. High development rates led to an employment increase, and unemployment has decreased during the last couple of years (but as a percentage, it remains one of the highest in the EU zone). Although real salaries have increased, labour cost per unit has been steadily decreasing, with labour productivity growing fast, approaching the absolute levels of other developed economies. This fact is undoubtedly related to the major increase in investment over recent years. In the past few years, significant efforts have been made and expenditure in information and telecommunication technologies as a percentage of the GDP has almost converged with the EU average.

The current situation, comparable to Portugal and Spain, is characterised by some of the lowest figures in IS-related indicators, but supported by the highest growth rates.

2.1.5 Ireland

Important early foundations for the Information Society in Ireland can be traced back to a number of events such as the early consideration given to FDI, the decision to expand the national education system, initially at secondary level and then at tertiary level, and the accession to the EU. More recently, against a backdrop of emigration,

unemployment and national indebtedness, the first of a series of National Partnership Agreements were made in 1987. These laid the foundations for the economic turnaround of the early 1990's. This combination of factors meant that, from the mid 1990's, the country was in the fortunate position of having a young educated workforce, a strong presence of FDI companies – particularly in industries relevant for the establishment of the Information Society (e.g. IT, software, etc) - and the fiscal resources to make strategic investment. In effect, these factors, which caused the "Celtic Tiger" period from the mid 1990's, also provided a fertile ground in which to launch an Information Society initiative. This commenced with a report, published in 1996, which defined Ireland's vision for the Information Society. The Government quickly recognised the potential of the Information Society in its own right, and as a result, the Information Society agenda became an integral part of its policy.

Several recent international benchmark studies suggest that, notwithstanding the significant momentum behind the Irish Information Society, the activities have not been sufficient to propel the country to become a leader. Moreover, in two of the recent benchmark studies, Ireland's relative standing deteriorated between 2001 to 2002, suggesting that momentum behind the national Information Society is slowing.

2.2 SEVEN FACTORS THAT STRONGLY AFFECTED ICT-RELATED DEVELOPMENTS IN THE EU

The analysis of these cases identified the following seven factors, which, taken together, help us understand the essential aspects of dynamics leading to more or less successful ICT-related development in EU15 since the mid 90s. Their sequential presentation is, of course, artificial, and does not acknowledge sufficiently their effective interaction. This assessment was done without taking into account these factors' potential transferability to the context of the CCs.

Seven factors leading to successful ICT-related developments in EU15

- Committed and adaptive public policy
- Co-opetition frameworks
- Adaptive use of the industrial profile rather than pushing for an ICT manufacturing industry
- Diversity/uncertainty: the role of adapted financing tools
- Education, info-culture, awareness: the intangible facet
- Creative use of specific contexts: alliances by position, language, identity
- EU-policy framework

2.2.1 A Committed and Adaptive (Smart) Public Policy

ICT-related developments do not develop spontaneously, even less in a socially inclusive way. The examples of ICT-related development described above were initiated, in each case, by a strong pro-active public policy push. Rather than being centralised or top-down, these policies were adaptable and committed, allowed risk-taking and long-term objectives, and played a co-ordinating role. They were often holistic - or multi-layered - and were concerned with the country's (economic), development as a whole rather than ICTs alone, and thus benefited from a broader set of interdepartmental co-operative means. Specifically IS policies were absorbed into the broader category of development policies covering economic development, industrial policy, science and technology, employment, regional policy, innovation policy,

education, media, etc. These policies arose in countries suffering domestic crises or seeking to build strong identities. They were characterised by proactivity (despite the high risk involved due to levels of uncertainty) and the apparent need for visible individual 'champions'. A key role for the government was to co-ordinate an on-going learning process and create predictability for most partners. This was achieved by, for example, establishing innovative partnerships among actors and by creating clear policy goals and roadmaps.

2.2.2 Co-opetition Frameworks

'Co-opetition' refers to the search for the right, creative mix of co-operation and competition, through, for example, the co-ordinated meeting of diverse – possibly competing - actors in a goal-focused and time-determined taskforce. This mix aims at creating mutually beneficial situations by providing diversity, and at generating synergies that could result in common goals and trajectories for all. This concept calls for innovative institutional arrangements in public policy management[11], and includes the delegation of decision making and implementation capacity, as well as a citizen/entrepreneur-oriented mindset. Possible areas for co-opetition frameworks are infrastructure development for the public good, a safe digital environment, standards and interoperability, and also education, societal assessments, democratic initiatives, environment. Such arrangements appear also to be crucial in cluster development.[12] They feed the idea that reciprocal responsibilities pay better than "Winner takes all" games. They may nevertheless result in privileged arrangements, which escape democratic control (nepotism) particularly because they seek consensus among a set of contradictory interests. Business mentality and ethics[13], and their relevance in a newly open market economy are cornerstones for such co-operative schemes where trust is an essential ingredient.

Scale and scope matter in co-opetition. The geographical scale or the technological scope may be too large for a given set of actors to ensure commitment and pursue a common goal. International, national, and regional partnerships are necessary and successful when they imply the adoption process is concomitant with adaptation. Smaller frameworks for co-opetition seem to be easier to handle, as shown by the successful examples of smaller countries or regional initiatives.

Governments play a particularly important role within co-opetition strategies. They must co-ordinate a diversity of actors on various scales and safeguard public interest and democratic representation. This role should also encompass the difficult issue of 'policy learning' in an environment that becomes highly complex and constraining for policy makers and partner-actors.

2.2.3 From ICT Manufacturing Industry to the Adaptive Use of the Industrial Profile

During the second half of the 1990's, several national economies have benefited from the contribution of ICT industries to added value, GDP and employment. A broad range

[11] See also Chong and Calderon, 2000,"Economic growth and institutional quality", Economics and Politics, 12, 1.

[12] The literature on regional innovation clusters shows that too much or too little competition between companies in a cluster may prevent growth of the cluster as a whole, due to there being too much or too little diversity. The same holds for co-operation. See: Cowan, R. and R. Wintjes (1999) "Addressing the Creation, Operation and Exploitation of Localised Technological Change". Chapter 4.2 in: "Industrial Districts and Localized Technological Knowledge", Final Report to the European Union, DG XII. With respect to the role of cooperation and partnership in such networks or cluster developments we also refer to Granovetters' statement on "the strength of weak ties", see Granovetter, M. (1985) "Economic action and social structure: The problem of embeddedness" American Journal of Sociology, 91, 3, p. 481-510.

[13] Corporate governance is one of the concepts at the heart of those issues, when considering the "post-Enron" context in US and European private and state-owned businesses.

of socio-economic indicators clearly confirm the "Tiger" status of countries such as Ireland, Finland, and Sweden. In these cases, the presence of foreign and indigenous ICT manufacturing multinationals and/or that of a dynamic SME sector that has successfully developed international niche-markets has been an essential ingredient.

However, it is evident that national/regional industrial structure also matters. Countries and regions, which have a tradition in industrial manufacturing, may succeed in modernising this industry through ICT use. Relevant software production and use of ICTs are at the core of these IS strategies. Specific national or regional assets – including services – can help to generate ICT-intensive industries and are referred to as 'sweet spots', either 'given', historical, or strategically created on purpose.

Mature industrial products, that are no longer susceptible to large productivity improvements, are at risk of ending up in low cost surroundings. Traditional industries are product- or supply-oriented, and cannot escape simple cost-based competition; whereas modern industries can compete on quality and be much more marketing, or demand-oriented. In order to develop - as a country or a region - there is the need to seize the right opportunities, by developing innovative products/services or becoming more productive in close to mature ones. In both cases, pre-existing industrial and service structure and its interplay with ICTs plays a major role and triggers additional trickle-down effects to the rest of the economy.

2.2.4 A Variety of Financing Tools

Foreign Direct Investment is a major tool for funding and developing an ICT (manufacturing) sector. Additionally, venture capital, seed capital, public subsidies and the protection of revenues through adequate regulation (for example: IPR) are also essential tools for promoting domestic development. ICT-related development is an uncertain path that needs a wide margin for trial and error, and financial tools that can support initiative and risk on very diverse scales. These are necessary because innovative products and services will emerge from a wide diversity of actors and starting points.

An additional challenge is to transform funding into knowledge transfers (cooperation, R&D centres, industry/university relations, etc.), incentives into committed involvement in the domestic economy and society, and isolated bets into spillovers that generate more sustainable and embedded benefits. To achieve these goals, financial tools themselves should be integrated into a broader framework that encourages an entrepreneurial mindset. These tools need skilled and experienced managers. Without them, there is a risk that finances are entirely devolved to possibly fragile mono-industrial aims and/or highly volatile initiatives.

3 CASE STUDIES

AUSTRIA by Bernhard Dachs, Petra Wagner and Mar Ananos, ARC Seibersdorf Research GmbH

BELGIUM – FLANDERS by Rene Wintjes and Claire Nauwelaerts, MERIT, University of Maastricht, Netherlands

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Identifying factors of success and failure in European IST-related national/regional developments

Final Report
Case Study: Austria

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Executive Summary

The Austrian Tiger

If Ireland is nowadays called the 'Celtic Tiger' because of its rapid economic development, Austria of the 1950s and early 1960s may be regarded as the 'Austrian Tiger'. Austria was the fastest-growing European economy of this time, only surpassed by the German „Wirtschaftswunder". The catching-up of the 1950s and 1960s and above-average growth rates in the 1970s and 1980s made Austria one of the richest countries in Europe today. If we combine GDP and unemployment to a superindicator of economic welfare, Austria lies in front of most other EU countries.

A few key indicators describing Austria

Austria	dimension	2000
Population	In millions	8,110.244
Population density	Inhabitants/ square km	97
GDP/capita at current prices	In euros *1000	25,530
Unemployment rate	In % of labour force (employees+self-employed)	3,7
National Debt/GDP	Ratio	63,6
Date of birth of the nation	Year	(1919) 1945
EU accession	Year	1995
Share of employment in agriculture	As a % of total employment (employees+self-employed+family members)	5,68
Share of employment in industry	As a % of total employment (employees+self-employed+family members)	20,7
Share of employment in (market + non market) services	As a % of total employment (employees+self-employed+family members)	73,7
Ranking in UNHD index		15
Information Society Index (ISI) ranking		14
Share of employment in the ICT sector (services+manufacturing)	As a % of total employment	2,6 (1999)
Share of population (15-65 yrs) with access to Internet technologies	As a % of total population	31,9 (2001)
ICT value added as % in GVA	As a % of	8 (1999)

However, Austria's current favourable economic position cannot hide structural problems that affect today's and tomorrow's economic performance. If we assess Austria's way into the Information Society, we are faced with structural change in a matured, developed economy. Hence, this is more the story of an "old" Tiger which has to keep up or even shape the developments than simply catch up. Austria's story is also a story of old virtues which partly turn into burdens. Austria's institutional set-up with its strong corporatist elements and its orientation towards a consensus-orientated policy did well in the times of catching up, but didn't result in as much structural change as Finland or the other countries examined in

this project. Therefore, Austria may be less suitable as a direct example for the CECs, but rather as an illustration of a country in the post-"Tiger" period.

Some "Stylized Facts" on Austrian IS Development

Austria is still clearly ahead of many other European countries with respect to many Information Society indicators, especially ahead of the CECs and the South-European members of the EU. However, this favourable picture changes if we compare IS indicators for Austria to those of countries of similar or higher income. Therefore Austria is relatively lagging behind in ICT: many indicators position Austria *above* EU-average, but constantly *behind* behind in its 'peer group', particularly the Nordic countries. If IT expenditure indeed have a measurable impact on growth, competitiveness and therefore future wealth, Austria invests too little in ICT compared with countries of similar wealth.

Internet use

Austria again ranks slightly above EU level. As the use of Internet is clearly related to a country's level of income, it is not surprising that high-income countries like Norway and the US are in the lead in the rankings of Internet use. However, Austria's position at the back of its 'peer group' of countries with equal income and behind the Nordic countries also becomes apparent.

Diffusion of ICT in the enterprise sector: e-commerce

Almost every enterprises in the European Union makes use of PCs and the majority of enterprises already have access to the Internet. According to Eurostat (2001), Austrian businesses have fully embraced the Information Society: almost every Austrian business (92%) uses computers, 76% have Internet access, every second business (54%) has its own website (EU: 46%). The gap between e-readiness of Austrian enterprises and actual use, however, is striking, yet common to all European states.

The Austrian ICT sector

Although Austria has a long-lasting industrial tradition in electrical engineering and electronics, the Austrian ICT manufacturing could not avoid continuously losing market shares and jobs. Employment in this sector dropped from 42,500 in 1995 to 39,250 in 2000. Rather traditional sectors like the manufacturing of cable or parts of telecommunication equipment and radio and television manufacturers lost the most. The only sub-sector in ICT manufacturing with considerable increases in employment in this period are the producers of electronic components.

One of the reasons for this unfavourable development of the Austrian ICT manufacturers may be that Austria's telecommunication equipment market was restricted to four national suppliers until the mid-1990s with low competitive pressure. Another reason why Kapsch and Schrack, two of the national telecommunication manufacturers, never turned into "Nokia", was the small size of the home market.

ICT services have turned out to be one of the most dynamic sectors of the Austrian economy in recent years. The number of employees doubled between 1995 and 2000. The telecom sector's contribution to employment have been clearly positive, and it was more than just positive in software services. Here the number of jobs more than doubled between 1995 and 2000 meaning that two out of three new jobs in ICT has been set up in the software industry. However, we should regard these figures with caution as we do not know how much of this growth comes from outsourcing of already existing employment and how much has been really created within the last five years.

Factors of success and failure

The political framework of the Austrian Information Society

Austrian ICT policy in the 1990s

Austrian ICT policy lacks a pro-active, strategic approach. The fact that Austria nevertheless has a quite well developed Information Society is mainly due to the initiative and the interest of the private sector, drawing on the ‘’wealth” of its enterprises and households. However, this policy inactivity may not have necessarily hampered IS in Austria because Austria strongly benefitted from policy initiatives at the European level like telecom liberalisation. The Delors White Paper of 1993 and the Bangemann-Report initiated the Report of the Working Group of the Austrian Government on the Information Society (1996). However, in comparison with the vivid discussion in other European countries like the Netherlands, the report remained a singular event. In 1999, the eEurope initiative of the European Commission put the Information Society back onto the Austrian political agenda and led to the initiative "e-Austria in e-Europe" in the spring of 2000. As there is no co-ordinating institution for strategic IS policy, policy initiatives by the various ministries are manifold, yet seem rather uncoordinated. Despite this strong institutional fragmentation, there are recent attempts in the public sector to establish a joint ICT Board to co-ordinate all e-government activities of the federal level. Moreover, is the virtual absence of public promotion schemes specifically dedicated to IST or mission-orientated programmes in the ICT sector. Most financial support has come from general promotion schemes, and from the EU Framework Programmes.

Social Partnership

What distinguishes Austria’s political system from other European countries until today is the degree to which the Social Partners, besides political parties, the elected parliament and the government, are involved in the policy process. Austrian economic policy has always been strongly consensus-oriented, taking into account the interests and demands of many societal groups. By stabilising price and wage expectations, the Social Partners were a central part of the Austrian economic policy until the 1990s. The merits of Social Partnership can undoubtedly be found in their stabilising efforts. But we also see negative, hampering effects of the Social Partnership with respect to the Information Society: there were also fears by the trade unions of job losses and the labour-saving effects of ICTs.

Telecom deregulation

The fast liberalisation of the Austrian telecom market is the most remarkable development in Austrian Information Society of the 1990s and an example for a successful policy initiative. Austria’s telecommunications market was restricted until the 1990s to the monopolist ÖPTV and four equipment suppliers. ÖPTV was an administrative body within the Ministry of Public Enterprises and Transport and acted as telecom and postal services operator as well as regulatory authority. It was not until Austria’s accession to the European Union in 1995 that telecom liberalisation began. The most striking effect of liberalisation was the fast diffusion of mobile phones in Austria, resulting in Europe’s highest mobile phone penetration within a few years.

Industrial structure and the diffusion of ICT

Different sectors exhibit very different opportunities for the use of ICT. Thus, the diffusion of ICTs in the business sector is strongly related to the sectoral composition of the economy. Using software investment as a proxy for "high opportunity concentrates in very few branches it can be shown that much of Austria's lagging behind in R&D expenditure can be explained by the Austrian industrial structure and its low share of technology-driven industries (Peneder et al 2002). The same holds for expenditure for research and development (R&D) in manufacturing.

Social factors

Information culture and e-literacy

E-literacy means having the skills, knowledge and attitudes to use ICT to maximum advantage and to keep up-skilling. Optimal levels of access and e-literacy may contribute to a person's well-being and thus allow him or her to be a more effective worker, entrepreneur, consumer, or citizen. E-literacy is determined by ICT infrastructure, financial means, ICT skills and attitudes. One of the most important challenges of the information society is to extend simple computer literacy to the complex phenomenon of e-literacy with positive attitudes towards ICT-conveyed information.

This development seems to closely related to the predominant information culture. Information culture may be generally interpreted as the value a society attributes to information. Overall, Austrians have readily accepted the availability of ICT-conveyed information products and services. However, as regards daily newspaper circulation and books titles published or the number of books available in public libraries, the difference between Finland and Austria is quite large. Differences in the use of libraries between Finland and Austria are also quite striking.

Hierarchical thinking and trust in institutions

Dominant religious and ethical values, the political and legal structures strongly influence the information culture at the societal level. The more trust is conveyed into public authorities and institutions, the less distrust or fear there is on the part of the individual concerning privacy, data misuse, etc.: highly important issues for the diffusion of e-commerce or tele-work. Scandinavian countries with their longstanding, democratic-liberal political system are generally regarded by experts as information-friendly, transparent, with flat hierarchies. By comparison, Austria with its absolutist legacy is characterised by a strong belief and trust in public authorities and institutions; experts thus find a rather information-restrictive climate with strong information gate-keepers.

The education system

Education plays a key role in the development of IS because it qualifies a society and its members to use new information and communications technologies and its services offered, increasing as well the demand and necessities of information. Austria's education system is generally regarded as democratic and egalitarian, providing equal access for all. International managers attest the Austrian education to meet the needs of a competitive economy. Austria's expenditure for education also rank among the highest in OECD comparisons.

Yet Austria's education system is also associated with a conservative academic tradition which is more "answer"- than "question"-oriented. This implies that it does not broadly and proactively promote creativity and/or research skills. The issue of a "digital divide" is addressed by the large-scale introduction of ICT in the schools. Statistics show that Austria has a very high percentage of population with completed secondary degrees but drastically less with completed tertiary degrees. Although it ranks first with regard to expenditure on tertiary education within the OECD, only 14% of secondary school graduates per year continue to pursue an academic career in the university. Only half of those successfully complete their studies with a formal degree (1995).

Gender differences

The 'Internet gender gap' is one aspect of the ongoing discussion about a 'digital divide'. If the gap were smaller, Austria may have a higher overall Internet penetration rate. Therefore, the reasons for the gender gap may also explain why the overall number of Internet users in Austria is smaller than in the Nordic countries. This gap exists in other countries as well, however, there are a number of countries where these differences appear to be much smaller than in Austria. Although women are one of the fastest growing sub-groups of Internet users, the Internet gender gap closes only slowly in Austria.

What can be learned from the Austrian experience?

Austria is well advanced in Information Society development, yet lags behind other countries of comparable economic status, especially the Nordic countries. A number of factors have very likely shaped the diffusion of ICTs and the development of the information society in Austria:

- Austria's political institutions showed only little concerted effort in pushing Information Society policy. A major impetus came from the EU through policy-making.
- 'Old' institutional structures seemed to work fine and there was little pressure for radical reform.
- A higher share of industries making little use of ICTs and a smaller share making heavy use of ICTs may partly explain lower adoption rates in the Austrian enterprise sector.
- Austria's information culture is comparatively restrictive. Its education system requires students more to learn contents rather than to learn how to search for information. This may be a reason why many people see only little additional value in the Internet compared to other media.
- Gender differences with respect to Internet use are still larger in Austria than in other countries.

Some lessons learned:

- Institutional reform and liberalisation can quickly develop a well-functioning telecom market and force down prices. A necessary precondition is an independent regulatory authority.
- Long-established structures can turn out to hamper the development of an Information Society when they do not allow for social, institutional and structural change ("lock-in").
- The development of an Information Society is not necessarily the result of 'good policy'. Only little concerted effort has been achieved on ICT-specific promotion schemes in Austria. Yet good framework conditions such as high levels of education and income may also favour high diffusion.

- Austria also shows that there may be other sources of wealth than ICT. Countries can also be successful if they manage to gain competitive advantage in other sectors.
- Changes in the education and training systems towards more problem- and research-orientation in order to affect (long-term) changes in information culture which will eventually foster more creative use, i.e. increased utility, of ICT.

Introduction to the Study

Which factors have shaped information and communication technologies in Austria? What determined the way people use mobile phones, personal computers and the Internet? We try to find answers to these and similar questions in our paper. Furthermore, we want to point at factors that turned out to be crucial to the development of the Information Society in Austria – in our opinion and in the opinion of experts.

Technological trends in ICTs like the Internet or mobile communication are truly global, set by the R&D as well as the marketing departments of large companies as well as 'grass roots' movements like Open Source. However, users, culture and content, or governmental institutions still act locally to a large degree. The practical implementation of the Information Society is the frequency of computer adoption, information networks, mobile telephones usage and the differences in 'information culture' and information-related habits among the various groups. Information Society development is all about how and to what extent the business sector, government authorities and citizens adopt modern information and communication technology in their daily routines.

Following a Social Construction approach (Williams 1997), software and ICTs in general are shaped by interactions between global (technologies, markets) as well as local (user, context) factors. ICTs have more or the less the same features everywhere in the world. What people actually do with the technology is a result of habits, social structure and history-related to a certain degree, all factors which are highly localised. This is where TIGERS comes into play. We want to reveal at least some of the country-related historical, social, structural, political or cultural factors which influenced the take-up of ICTs in Austria in order to give insights what has shaped the country's way into the Information Society.

We go on in this chapter with a description of Austria and relevant parts of its economic history. Chapter 2 tries to assess Austria's position in ICT with regard to other EU countries. Chapter 3 presents some characteristics in Austria's institutional framework, its industrial structure and cultural as well as social conditions that may have been influential on IS. Finally, Chapter 4 sums up and tries to sketch out some lessons that the CECs may learn form the Austrian experience.

The Austrian Tiger

Currently, Austria has 8.11 Mio. inhabitants and ranges between Sweden (8.9 Mio. inhabitants) and Denmark and Finland (5.3 Mio. and 5.1 inhabitants) with respect to population size in Europe. With respect to population density (97 inhabitants per km²), we have to distinguish between eastern, more flat parts of the country, the capital Vienna (1.55 Mio. inhabitants) and the Alpine regions in the West and South, where densely populated valleys alternate with deserted mountain areas. The First Austrian Republic was found in 1918 after the collapse of Habsburg Empire. However, the first Austrian Republic differed fundamentally from post-War Austria. We can also speak of 1945, the year Austria was liberated from Nazi occupation, as the date of birth of the nation.

Table 1: A few key indicators describing Austria

Austria	dimension	2000
Population	In millions	8,110.244
Population density	Inhabitants/ square km	97
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Unemployment rate	In % of labour force (employees+self-employed)	3,7
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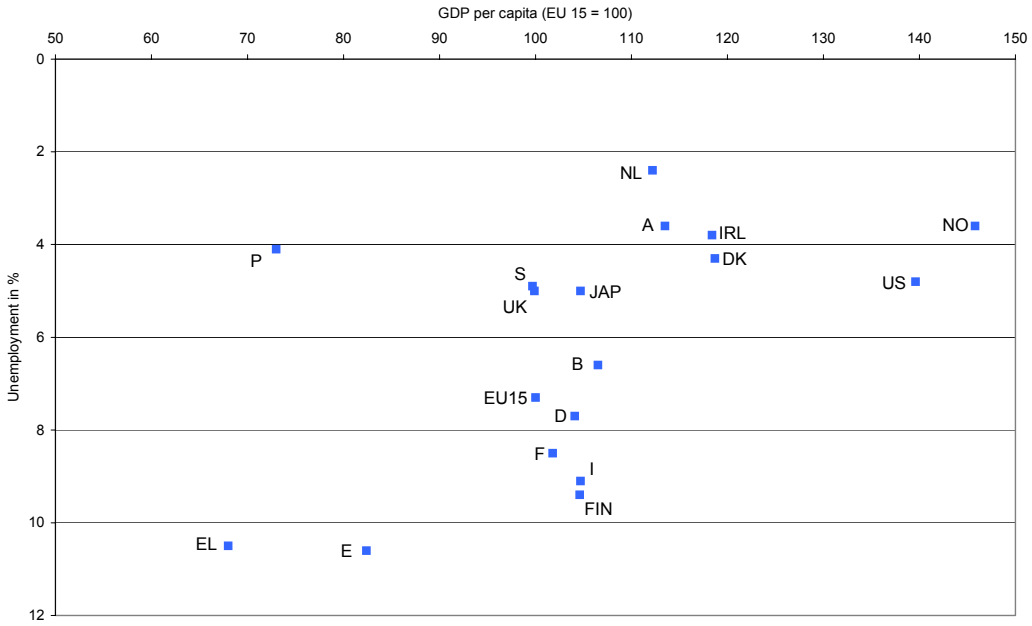
Ranking in UNHD index		15
Information Society Index (ISI) ranking		14
Share of employment in the ICT sector (services+manufacturing)	As a % of total employment	2,6 (1999)
Share of population (15-65 yrs) with access to Internet technologies	As a % of total population	31,9 (2001)
ICT value added as % in GVA	As a % of	8 (1999)

If Ireland is nowadays called the 'Celtic Tiger' because of its rapid economic development, we may label Austria of the 1950s and early 1960s as the 'Austrian Tiger'. Austria was the fastest-growing European economy of this time, only surpassed by the German „Wirtschaftswunder". The catching-up of the 1950s and 1960s and above-average growth rates in the 1970s and 1980s made Austria one of the richest countries in Europe today. Measured in GDP per capita (2000: 25,530 €, 1995: 21,411 €), Austria ranks 5th place in 2001, above countries like Finland or Germany. Austria also enjoys a favourable low level of unemployment of 3.7% (1995: 3.9%) and stable prices. If we combine GDP and unemployment to a superindicator of economic welfare, Austria ranks in front of most other EU countries.

Table 2: GDP per capita and unemployment in the European Union, 2000



Source: EUROSTAT, Structural Indicators.

However, Austria's seemingly favourable economic position cannot hide structural problems that affect today's and tomorrow's economic performance. The effective retirement age in Austria, for instance, is one of the lowest in the EU, an indication for a lot of 'hidden' unemployment. Economists are also worried about Austria's poor growth performance in the 1990s which may be due to structural problems. If we assess Austria's way into the Information Society, we are faced with structural change in a matured, developed economy. Hence, this is more the story of an "old" Tiger which has to keep up or even shape the developments than simply catch up. Austria's story is also a story of old virtues which partly turn into burdens. We suppose that Austria's institutional set-up with its strong corporatist elements and its orientation towards a consensus-orientated policy did well in the times of catching up, but - metaphorically speaking – didn't "produce" as much structural change as Finland or the other countries examined in this project. Therefore, Austria may be less suitable as a direct example for the CECs but rather as an illustration of a country in the post-"Tiger" period.

Catching up

The Austrian catching-up miracle of the 1950s and 1960s has diverse explanations. Austria has a long industrial tradition although many parts of the country remained rural until the 1960s. The war time losses of equipment, buildings, infrastructure and, of course, people were severe. But Austria had still a well-educated labour force. Furthermore, the Nazi economic planners invested so heavily in Austria that some economic historians speak of a "second industrial modernisation" (Sandgruber 1995) during these dark times. Despite the losses, a number of industrial facilities survived the War, many of them technologically very competitive. The reconstruction of post-War Europe boosted production and exports of steel, wood, paper and other raw materials but also investment goods, vehicle parts, and chemicals. But also a strong-growing domestic demand ensured continuous production growth until the 1960s.

The Austrian Tiger could also rely on a strong political and social commitment to growth and stability. The common vision of national re-construction ("Wiederaufbau") helped to cover many of the political and

social conflicts that accelerated the decline of the First Austrian Republic of the mid-war years. Economic growth and stability were also the primary goals of the institutional arrangement between employer's associations, the representation of agriculture and the labour unions ('Social Partnership') which helped to avoid strikes and ensure moderate but stable wage increases. The Social Partnership remained highly influential – partly even more influential than government and parliament - for income, economic, social, and labour market policy until the late 1980s. We believe that Social Partnership and similar institutional arrangements of catch up have decisively shaped the emergence of the Information Society over the years.

Slowing down

As growth slowed down during the 1960s, the need for structural reforms became more and more obvious. One of the most important areas was education. Until the end of the 1960s, only 10% of the children between the age of 10 and 14 attended secondary school, the number of students stagnated since the days of the Habsburg empire (see Bachinger, Hemetsberger-Koller et al. 1994). Education and far-reaching social reforms were main policy fields of the social-democratic governments of the 1970s and early 1980s. The economic policy of this time, "Austro-Keynesianism", succeeded to maintain full employment until the early 1980s.

We can also find the origins of the Austrian Information Society in this period. With respect to information and communication technologies, this was a time of great expectations and public as well as private enthusiasm for computers as means of technological progress and modernisation[1]. Austria had a long tradition in physics and engineering sciences as well as a sound industrial base in electrical engineering. However, early technological breakthroughs like the fully-transistorised, binary computer "Mailüfterl" developed at the Vienna University of Technology between 1954 and 1959 found only few industrial successors.

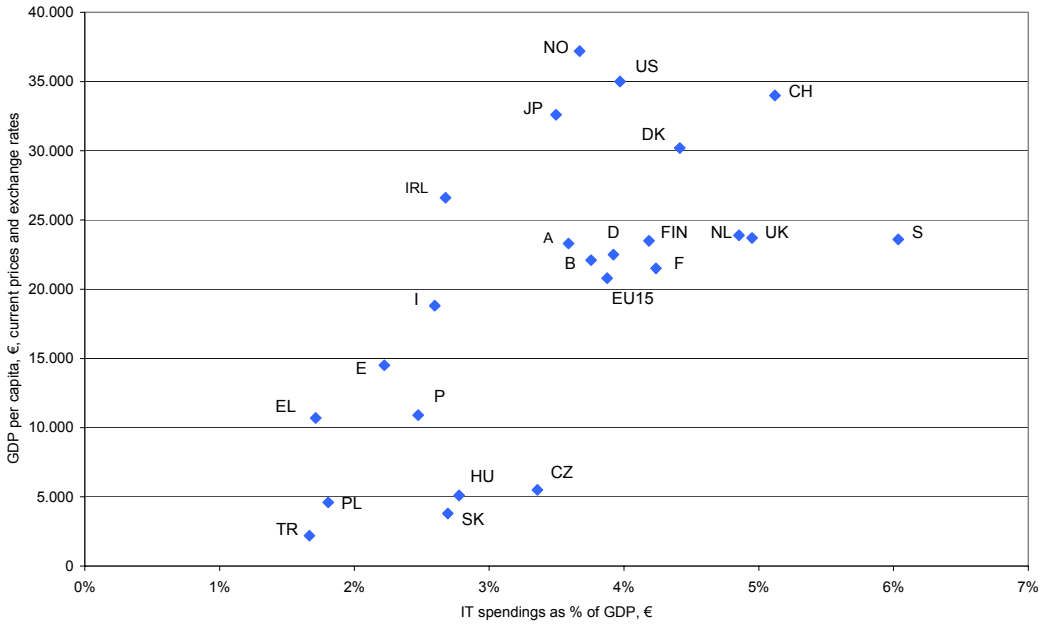
A third period of post-War economic history began in the early 1990s with the preparation of Austria's accession to the European Community. Austria joined the EU in 1995. Although historical developments can only be assessed in perspective, we can already state that this period brought far-reaching changes. There are also many signs that the Social Partnership has irrevocably lost its far-reaching influence. Moreover, a considerable part of Austria's economic and financial policy is now determined at the European level which gives less room for trends divergent to the European developments.

Tiger or Laggard? Some "Stylized Facts" on Austrian IS Development

If assessed by macroeconomic indicators, Austria is clearly an economic success story. The country is also still clearly ahead of many other European countries with respect to Information Society indicators, especially ahead of the CECs and the South-European members of the EU. However, this favourable picture changes if we compare IS indicators for Austria to those of countries of similar or higher income, with per capita income in the range of 20,000 and 25,000 €. Therefore, we may say that Austria is relatively lagging behind in ICT: many indicators position Austria *above* EU-average, but constantly *behind* behind in its 'peer group', especially behind the Nordic countries. A striking example is IT expenditure (see Table 3) where Austria is behind Belgium, Germany, Finland, France, the Netherlands, the UK and Sweden, all countries with a GDP per capita between 20,000 and 25,000 €.

[1] Sandgruber (1995) illustrates this enthusiasm by showing Austrian chancellor Josef Klaus taking computer lessons.

Table 3: GDP and IT expenditure as percentage of GDP, 2001



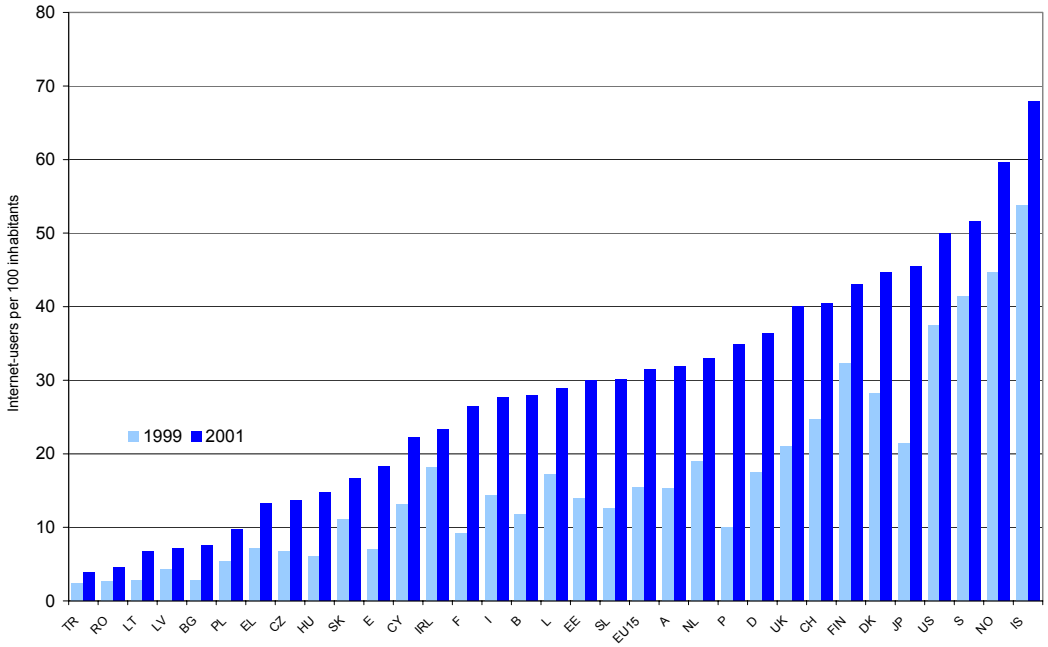
Source: OECD, EITO, own calculations.

If IT expenditure indeed have a measurable impact on growth, competitiveness and therefore future wealth, the figures show clearly that Austria invests too little in ICT compared with countries of similar wealth. Policy makers should also be worried if we look countries like the Czech Republic, the Slovak Republic or Hungary which already surpass Greece or Spain in IT spending as % of GDP to catch up even more rapidly than in the last years.

Internet use

Regarding Internet use, Austria again ranks slightly above EU level. There are seven countries ahead of Austria, seven behind. Again, Austria is in front of most South European countries and the CEEs. As the use of Internet is clearly related to a country's level of income, we can expect the number of people who can afford a PC to be relatively higher in Austria than, for example, in Poland. Therefore, it is not surprising that high-income countries like Norway and the US are in the lead in the rankings of Internet use. However, Austria's position at the back of its 'peer group' of countries with equal income and behind the Nordic countries also becomes apparent in this comparison.

Table 4: Internet users per 100 inhabitants, 1999 and 2001



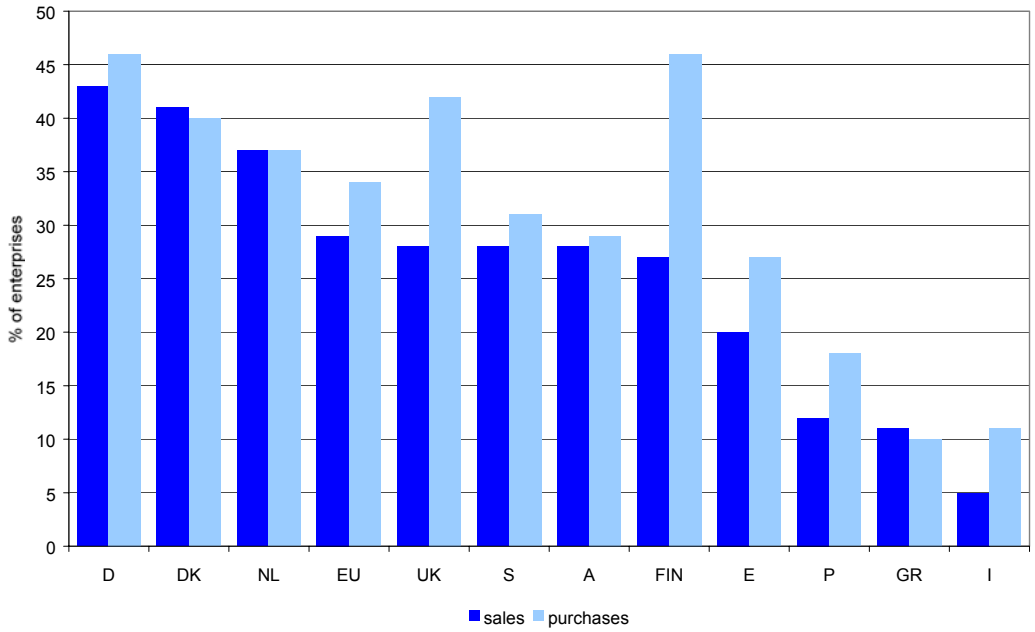
Source: ITU.

The relationship between income and the stage of diffusion of the Internet becomes apparent if we regard the position of the accession countries. But income alone cannot explain all differences between countries, because some of them, again the Nordic countries, are clearly ahead of others with a higher income. This may reflect the influence of other, "soft" factors which will be discussed later.

Diffusion of ICT in the enterprise sector: e-commerce

Unlike households, almost every enterprises in the European Union makes use of PCs and the majority of enterprises already have access to the Internet. According to Eurostat (2001), 92% of Austrian businesses use computers, 76% have Internet access. Every second business (54%) has its own website (EU: 46%). As the Internet has indeed become a "standard" tool for European businesses, it makes more sense to compare *actual use* and not *readiness*, measured by Web and PC penetration: Austrian enterprises are prepared for e-commerce, but up to now (2001) they use it only rarely. However, this sharp contrast between e-readiness and actual use is common to all European states.

Table 5: Diffusion of e-commerce in Europe, 1st half of 2001



Source: Eurostat, E-Commerce in Europe, Results of the pilot surveys carried out in 2001.

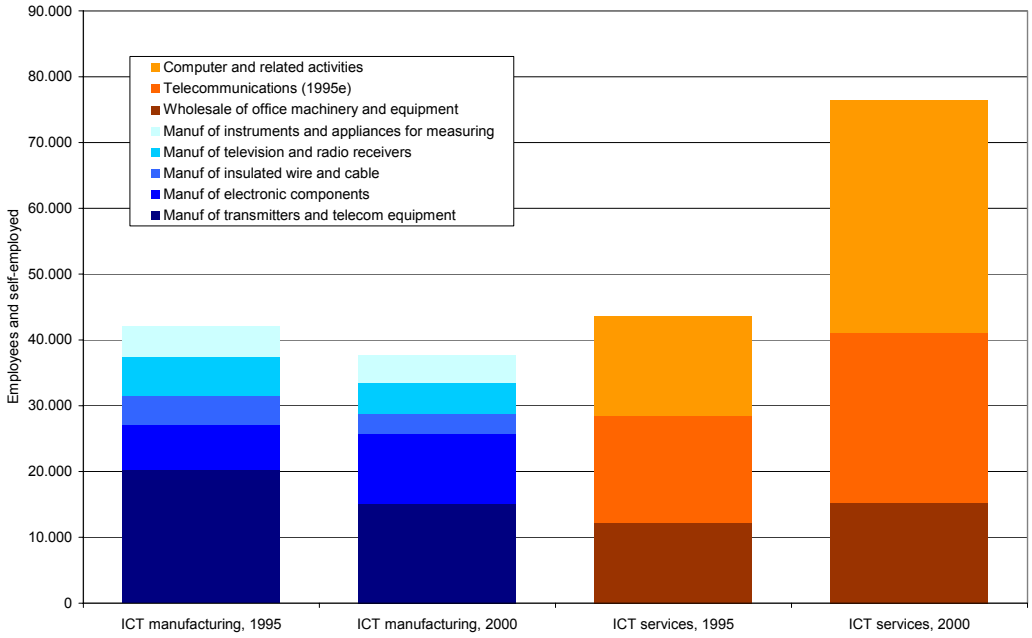
During the first half of 2001, 12% of all enterprises sold, and another 15% purchased goods and services over the Internet. Another 16% planned to introduce e-sales or e-purchases (14%) in the course of 2001. This matches with the picture of Austria drawn above – on average position, but lagging behind countries of equal economic strength. Data security proves to be a major concern and has resulted in slowing down e-commerce development (68%). Comparable with most other countries, Austrian enterprises fear the lack of potential customers (cited by 45%) and costs (48%). One sixth of all businesses also make use of specialised B-2-B marketplaces which again reflects the status of most European countries.

The Austrian ICT sector

Less obvious than growing diffusion rates are the supply-side effects of the Information Society in the production sector. It seems that this aspect of the IS is very unevenly distributed among the European industry. We again see the dualism between global technology development and local diffusion as mentioned by Williams (1997). New jobs have been largely created in all countries by localised, less tradable ICT services like software producers and telecom operators. Yet only three countries, Ireland, Sweden and Finland, managed to gain a surplus in their trade balances for ICT manufacture in 2000. Employment in IT manufacturing also stagnated or decreased in most EU states since the beginning of the 1990s. Again, the big exceptions are Sweden, Ireland, and Finland who were able to turn the benefits of the IS into new industrial jobs.

Although Austria has a long-lasting industrial tradition in electrical engineering and electronics, the Austrian ICT manufacturing could not avoid continuously losing market shares and jobs. Employment in this sector dropped from 42,500 in 1995 to 39,250 in 2000. Rather traditional sectors like the manufacturing of cable or parts of telecommunication equipment and radio and television manufacturers lost the most. The only sub-sector in ICT manufacturing with considerable increases in employment in this period are the producers of electronic components. Examples of successful firms are AMS, AT&S or Infineon Austria that established themselves as suppliers of custom-made components.

Table 6: Employment in the Austrian ICT sector, 1995 and 2000



Source: Statistics Austria, Enterprise Survey.

There are many reasons for the unfavourable development of the Austrian ICT manufacturers. Some of them, like the competitive pressure in consumer electronics and computers from the US and the Far East, are valid for the whole European ICT sector, others seem to be specific to the Austrian situation. In contrast to the Nordic countries, Austria's telecommunication equipment market was restricted to four national suppliers until the mid-1990s. With low competitive pressure and a centrally-planned, monopolistic demand side, incentives to innovate were relatively low.

Another reason why Kapsch and Schrack, two of the national telecommunication manufacturers, never turned into "Nokia", was size. Size is important if we take into account the nature of innovation in the telecommunications sector: it is a costly and risky business carried out by laboratories of large enterprises and does not come, like in the computer industry[2], from garage entrepreneurs. Austria, like Finland, is a small market. But unlike the Austrian companies, who restricted themselves to the domestic market[3], Nokia was at the beginning of the 1990s already a very large enterprise in relation to his home market, with more employees working outside of Finland (Nokia 1995). Nokia saw itself already as an internationalised, 'Nordic' enterprise which naturally focused on the world market. On the contrary, it would have been impossible for the Austrian telecommunication industry to earn enough in Austria to finance radical innovations like mobile communication.

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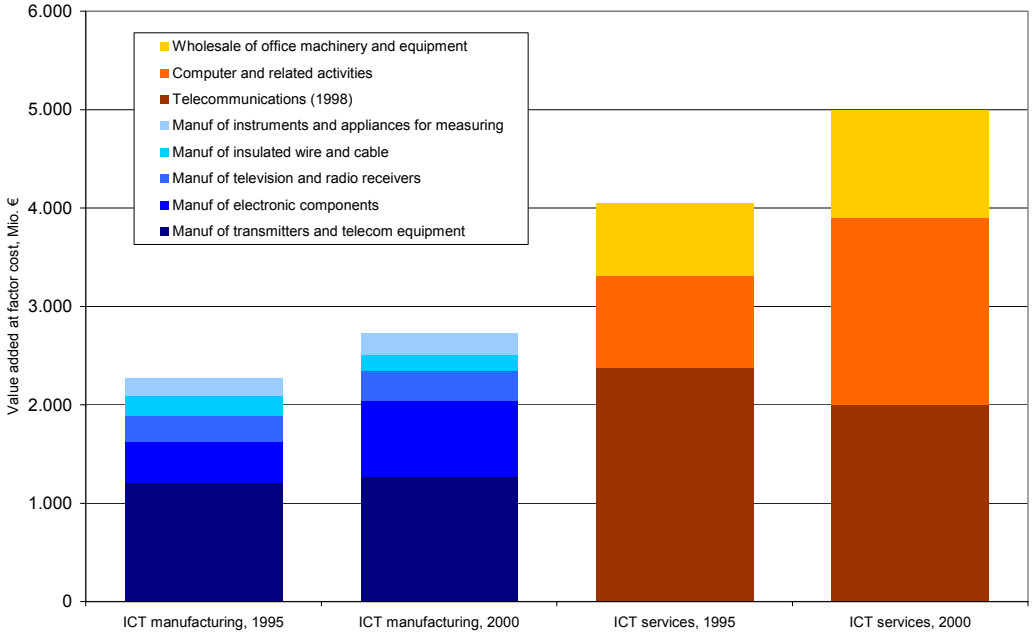
2 Unlike telecommunications equipment, manufacturing of computers, and other office machinery is negligible in Austria, despite some promising beginnings in the 1960s. The only public attempt to establish an Austrian computer industry dates from the beginning of the 1980s when the state-owned telecom operator developed MUPID, the Austrian version of MINITEL, together with other public enterprises and universities. Although technologically advanced, MUPID failed to gain a wider attention (see Latzer 1997)

3 One reason for this may be that two (Siemens, Alcatel) of the four national competitors have been subsidiaries of multinational enterprises.

Unlike ICT manufacturing, ICT services have turned out to be one of the most dynamic sectors of the Austrian economy in recent years. The number of employees doubled between 1995 and 2000. Here, Austria reveals a pattern of structural change very similar to that of Flanders: job losses at the national telecom incumbent PTV have been more than compensated by new jobs created by new entrants. Overall the telecom sector's contribution to employment have been clearly positive[4], and it was more than just positive in software services. Here the number of jobs more than doubled between 1995 and 2000 meaning that two out of three new jobs in ICT has been set up in the software industry. However, we should regard these figures with caution as we do not know how much of this growth comes from outsourcing of already existing employment and how much has been really created within the last five years.

Value added grew in manufacturing and services to a similar degree during the period 1995 to 2000. Again the producers of electronic components showed the best performance in manufacturing, while software services grew fastest in the ICT service sector. The development of value added in telecommunication services is difficult to assess as the 1995 numbers included both postal services and telecommunication. Compared to 1998, value added in 2000 has decreased which may be a sign of the fierce price competition in the Austrian telecom market.

Table 7: Value added of the Austrian ICT sector, 1995 and 2000



Source: Statistics Austria, enterprise survey

[4] The data on employment in the Austrian telecommunications sectors provided by the EUROSTAT Information Society Pocketbook is somewhat misleading as they state massive job losses between 1997 and 2000. Austria's national operator PTA (aka ÖPTV) delivered both postal and telecommunication services. Until 1997, the figures for telecommunication services contained both activities. According to PTA's 1995 annual report there should have been about 19,000 persons in telecommunications in 1995.

Factors of success and failure

The indicators presented in the previous chapter seem to form rather robust findings about the Austrian Information Society, being among the most advanced countries but somewhat lagging behind other countries of similar economic wealth.

We now turn to the question which factors have actually promoted or hampered Information Society development in Austria. Due to the limited resources available in this project and the complexity of the issue, we can neither give exhaustive answers nor offer clear 'cause-effect' explanations. Relations between influential factors and observable outcomes are often too complex and interactions sometimes work in both directions. Moreover, there exists surprisingly little literature on the long-term, historical factors that influenced the genesis of the Information Society in Austria and research is still in its infancy. We can only sketch out some strands of argumentation what factors typical to Austria may have been more or less favourable for the country's way into the Information Society, drawing on publicized IS indicators, the scarce available literature, and expert interviews, and simply leave others out. Two of these strands of arguments are:

- The lack of risk capital in Austria has been pointed out by numerous reports[5] as a hampering factor for the development of a dynamic ICT industry. The low share of venture capital can partly be explained by the traditional dominance of bank loans for investment financing and a highly critical attitude of all Austrian post-war governments towards the capital market which may be explained by the experiences made in the First republic. Moreover, shares constitute only a small part of private wealth compared to other countries. It is not clear if the low importance of risk capital also indicates that the 'entrepreneurial spirit' in Austria is comparatively low because internationally comparable statistics on the creation of new businesses do not exist.

- The role of neighbouring countries for IS development, namely Germany, is certainly higher than in other countries. Austria is closely connected to Germany through many cultural, economic and societal ties. Many things that work in Germany may work in Austria as well. Germany is often the first step for Austrian firms who want to sell their products abroad. Austrian subsidiaries of German firms are well represented in many sectors of the Austrian economy including ICT companies such as T-mobile or Siemens. Another effect of the proximity to Germany is that Austrians, compared with other small countries, have access to a much broader range of media contents in their language. This is certainly a positive influence on the diffusion of new media like the Internet. Yet, this may also turn out to limit the incentives to learn foreign languages.

The political framework of the Austrian Information Society

Austrian ICT policy in the 1990s

A common feature of the cases of Flanders, Ireland and Dresden is a strong public policy to drive Information Society development. ICT has been seen as a means to overcome an unfortunate economic

[5] See the Trend Chart on Innovation as a recent example http://trendchart.cordis.lu/Scoreboard2002/html/indicators/indicators_4.1.html

and demographic development (Ireland) or to achieve goals where the allocation of responsibilities between federal and regional level leave room for initiative (Flanders).

We do not find comparable strategic approaches in the Austrian ICT policy[6]. On the contrary, the finding that Austria has been 'forced' to telecom liberalisation may be generalised for ICT policy as a whole. The interest of the Austrian political players for ICT was remarkable lower than it was the case in Flanders of Ireland. The fact that Austria nevertheless has a quite well developed Information Society as shown in the previous chapters is therefore mainly due to the initiative and the interest of the private sector, enterprises and households. Briefly stated, Austria is well developed in ICT because it is a rich country, not because policy-makers pursued a pro-active ICT policy. However, we do not think that this inactivity necessarily hampered IS in Austria because Austria largely benefitted from policy initiatives at the European level like telecom liberalisation.

ICT policy developments in Austria in the 1990s have always been strongly influenced by policy-making at the European level. The Delors White Paper of 1993 and the Bangemann-Report can be regarded as starting points for a process which led to the Report of the Working Group of the Austrian Government on the Information Society (1996). However, in comparison with the vivid discussion in other European countries like the Netherlands, the report remained a single event. In 1999, the eEurope initiative of the European Commission put the Information Society back onto the Austrian political agenda and led to the initiative "e-Austria in e-Europe" in the spring of 2000.

The Working Group Report of 1996 is also remarkable because up until now it is the only paper developing a cross-cutting 'vision' for the Austrian Information Society. This shortcoming on the strategic level is another factor which distinguishes Austria from other countries involved in the study, and may be a consequence of the complex institutional setting of the Austrian ICT policy and technology policy as a whole. As in most other OECD-countries, information technology is a cross-cutting topic for which different ministries and agencies assume responsibility. The institutional set-up is, therefore, quite diverse and complex. The main policy makers and their competencies at the federal level are:

- the Federal Ministry of Economic Affairs and Labour (IT related research, technology diffusion, e-commerce, promotion of SMEs and start-ups, competition policy, labour related aspects of the information society)
- the Federal Ministry of Education, Science and Culture (promotion of IT-related research, IT-training at the secondary and tertiary level, IT equipment for federal schools and universities, research networks)
- the Federal Ministry of Transport, Innovation and Technology (promotion of IT-related research and technology diffusion, telecommunications policy, IT applications in transport)

In addition, other ministries have minor responsibilities in IS affairs: the Federal Ministry of Finance (electronic payment and revenue, security of the information technology, Corporate Network Austria), the Federal Ministry of Justice (consumer protection, electronic signature, e-commerce), the Federal Ministry of Public Services and Sports (information technology in the federal administration, e-government) and the Federal Chancellery (international co-ordination on activities related to IT and the Information Society, public procurement, privacy).

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[6] This section is partly taken from Dachs and Wagner 2001

The high level of administrative fragmentation is a well-known challenge for innovation and technology policy in Austria. Unlike other countries like the Netherlands, there is no co-ordinating institution for strategic IS policy. Consequently, policy initiatives by the various ministries seem rather uncoordinated, one example may be Kplus and Kind, two programmes to foster co-operation between academia and industry (Dachs, Wagner 2001). Yet things do change: for ICT in the public sector, an ICT Board has been established by the Federal Ministry of Public Services to co-ordinate all e-government activities of the Federal government. This reflects not only the importance that e-government has gained in recent years but also a growing sensitivity for the needs of inter-ministerial co-ordination in ICT policy.

Beside the institutional fragmentation and the lack of a common 'vision' or strategy, a third distinctive feature of Austrian ICT policy is the virtual absence of public promotion schemes specifically dedicated to IST or mission-orientated programmes in the ICT sector. Most financial support has come from general promotion schemes, and, of course, from the EU Framework Programmes. The Austrian Industrial Research Promotion Fund (FFF)[7], for example, devoted nearly a third of his funds to the ICT sector (NACE 31 and 72), and their share has increased very fast in recent years. Another example are the competence center initiatives k_{ind} and k_{plus}, where nearly half of all centers deal with information and communication technologies from image recognition to visualisation and telecommunications.

The Long Term: Social Partnership

What distinguishes Austria's political system from other European countries until today is the degree to which the Social Partners[8], beside political parties, the elected parliament and the government, are involved in the policy process. Austrian economic policy has always been strongly consensus-oriented, taking into account the interests and demands of many societal groups. If we talk about the long-term deteminants on the Information Society in Austria, we cannot leave this aspect beside.

Social partnership is not a uniquely Austrian phenomenon and similar arrangements may be found in many European countries: for example, the Irish TIGERS case study mentions a series of National Partnership Agreements closed in the course of the economic crisis of the late 1980s that exist until the present time. What distinguishes, however, the Austrian kind of Social Partnership from other countries is its duration, stability, and the influence it had on Austrian politics and policy. It was deeply anchored in the Austrian political system, and the two large parties. The relative loss of influence the institution has suffered in recent years is therefore closely related to changes in the political constellations, namely the rise of the Freedom Party, which disapproves of the institution. It also turned out that the Social partners had only limited problem-solving capabilities with respect to recent challenges, for example environmental issues. It can be seen as 'normalisation' and resembles an adjustment to the course of the political process in other EU member countries (Tálos 2001).

The existing literature tells only little about how Social Partnership shaped the Information Society in Austria. However, it is possible to draw some conclusions from the more general assessments of the institution. The Social Partnership's original intention and most important goal was to maintain stable and predictable development of wages that matches with other macroeconomic goals, like external stability

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[7] http://www.fff.co.at

[8] Tálos (1997) describes social partnership an informal system of interest groups and professional bodies that represent different socio-economic classes: the Federation of Austrian Trade Unions, the Federal Chamber of Labour, The Austrian Federal Economic Chamber, the Presidential Conference of the Chamber of Agriculture, and the Federation of Austrian Industry.

and competitiveness, without getting into industrial disputes. In contrast to other countries, this also included price determination to a certain degree (Novotny 1994). By stabilising price and wage expectations, the Social Partners were a central part of the Austrian economic policy until the 1990s.

The merits of Social Partnership can undoubtedly be found in their stabilising efforts. A stable macroeconomic growth and an orientation towards more equal income distribution creates mass purchasing power which is a necessary pre-requisite that as many people as possible can afford new technologies like mobile phones or Internet access. Most Austrian economists also agree that the stable wage and exchange rate expectations had a positive influence on investment behaviour of Austrian firms. This 'Hartwährungspolitik' let no room to compensate wage increases with devaluations of the Austrian Schilling and therefore forced Austrian enterprises to investment rates above the European average which also spurred ICT investment.

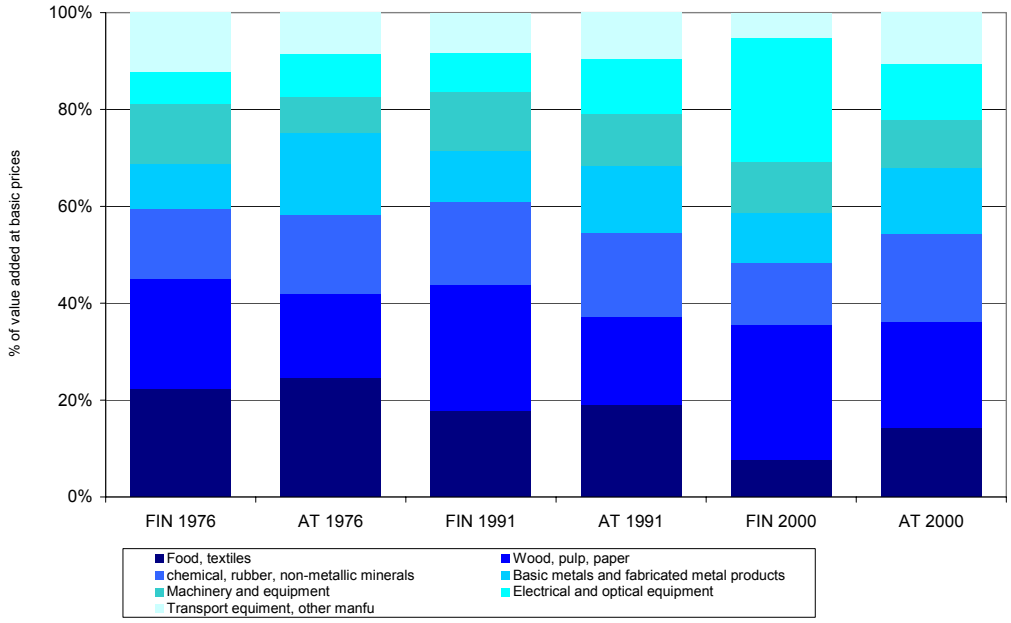
But we also see negative, hampering effects of the Social Partnership with respect to the Information Society: the Social Partner's understanding of growth policy was mainly tied to demand management and capital investment and less to the links between innovation, competition and growth. Kramer (1989) characterises Austria's growth policy as (over)emphasizing tangible capital. The pre-eminence of full-employment goal remained largely unquestioned. Austria's policy-makers were also much less aware about technology policy and the ICT sector as a whole, at least until the mid 1990s[9]. There were also fears by the trade unions of job losses and the labour-saving effects of ICTs.

The Social Partners together with the government also exerted price controls on local and long distance calls. The surplus from telecom operations had to finance deficits in postal and coach services, with the result that infrastructure investment like the digitalisation was seriously delayed. Moreover, the influence of trade unions in the nationalised enterprises was strong, and procurement and staff policy of the telecom provider ÖPTV was not mainly targeted to economic and technological efficiency, but had to serve a number of goals, including labour market policy (see Husz 1997).

If only judged by its original goals – stabilising wage and price expectations, maintaining constant income increases, guaranteeing social peace and therefore supporting Austria's catching up - the Austrian, consensus-orientated style of economic policy worked well and most economists agree to its account for Austria's post-War growth performance (Guger 1992). The development of an Information Society, hence, is more about fast change and overcoming old structures than about stability. Social partnership did well in the catching up-times, but - metaphorically speaking - 'produced' much less change than Finland or the other countries examined in this project. Moreover, Austria – luckily – did not experience the 'inspiration of crisis' found in other countries.

[9] Although the Social Partners were among the first to point at the importance of technology. The first Austrian R&D surveys, for example, were carried out by the Chamber of Commerce.

Table 8: Industrial structure in Finland and Austria, 1976, 1991, 2000



Source: OECD, STAN database

Success example: telecom deregulation

The fast liberalisation of the Austrian telecom market is the most remarkable development in Austrian Information Society of the 1990s and an example for a successful policy initiative. Austria's telecommunications market was restricted until the 1990s to the monopolist telecom operator ÖPTV and four equipment suppliers of switches and telephone sets, two of them affiliates of multinational companies. ÖPTV was an administrative body within the Ministry of Public Enterprises and Transport and acted as operative telecom and postal services operator as well as regulatory authority. This institutional set-up remained unchanged until the first steps of the liberalisation of the Austrian telecommunications market in 1994 (Latzer 1997). Early efforts for telecom liberalisation by the European Commission and Member States such as the Green Book of 1987, KOM (87)290) found no immediate response in Austria. It was not until Austria's accession to the European Economic Union and the European Community in 1995 that telecom liberalisation began.

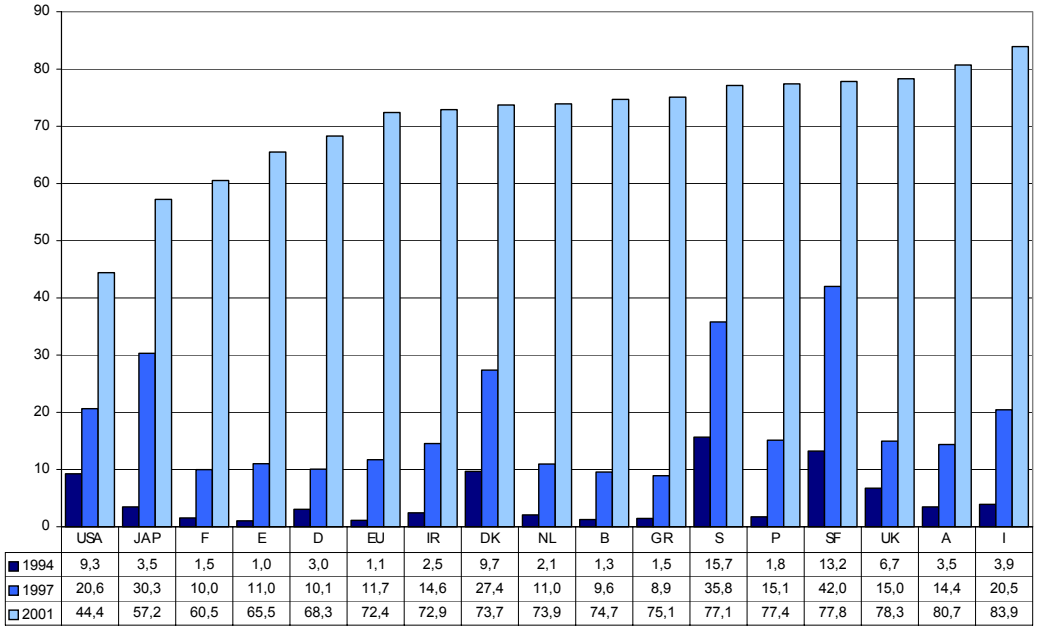
Important steps towards a fully liberalised telecom market were the separation of the ÖPTV's regulatory and operational branches and establishment of the National Telecommunications Authority in 1993. In the same year, the Telecommunications Act brought the liberalisation of all services except fixed-line voice communication. In 1996, the Post Structure Act 1996 resulted in the post and telecom operator founded as one independent public limited company (PTA). In the same year, the first GSM licence has been awarded to a private mobile phone operator. Austria remained a country of relatively high connection prices and low diffusion rates until the 1990s.

The Telecommunications Act of 1997 brought the liberalisation of fixed-line voice communication and the establishment of independent regulatory authority Telecom Control GmbH which started the following year. Market development continued with the start of unbundling of local loops, the decree of

interconnection fees, and the definition of dominant firms in 1999. A key step for the future of mobile communication was the award of UMTS frequencies in 2000.

In retrospect the idea of telecom liberalisation was certainly not a genuine Austrian one. Austria's telecom regulation authority TKG states: "*The restructuring of the Austrian telecommunications sector and the establishment of corresponding institutions and mechanisms, as shown below, was carried out not so much due to independent national initiative but rather the pressure for reform and reform patterns worked out by the European Union. In many cases re-organisational steps were performed late and only to the extent absolutely necessary*" (Telekom-Control 2000).

Table 9: Mobile phone users per 100 inhabitants in 1994, 1997, 2001



	USA	JAP	F	E	D	EU	IR	DK	NL	B	GR	S	P	SF	UK	A	I
1994	9,3	3,5	1,5	1,0	3,0	1,1	2,5	9,7	2,1	1,3	1,5	15,7	1,8	13,2	6,7	3,5	3,9
1997	20,6	30,3	10,0	11,0	10,1	11,7	14,6	27,4	11,0	9,6	8,9	35,8	15,1	42,0	15,0	14,4	20,5
2001	44,4	57,2	60,5	65,5	68,3	72,4	72,9	73,7	73,9	74,7	75,1	77,1	77,4	77,8	78,3	80,7	83,9

Source: ITU.

Although telecom liberalisation was in many ways not typical for Austrian IS policy, it was the most successful policy initiative in the 1990s. Austria's position in telephone charges comparisons improved considerably between 1994 and 1999 (OECD 1995, 1999). The most obvious effect of liberalisation was the fast diffusion of mobile phones in Austria. Starting from a low level in 1994, Austria managed to get to the top of mobile phone penetration in Europe within a few years. One important reason for this development was the fierce price competition between the telecom operators; another that mobile communication was affordable to large parts of the population because of an even distribution of income and relatively high GDP per capita.

But experts agree that this development would not have been possible without the independent regulatory body Telecom Control. This type of organisation, without the involvement of various interest groups, would have hardly been conceivable in the Austrian political environment of the late 1980s and early 1990s.

Industrial structure and the diffusion of ICT

It is a common observation that different sectors exhibit very different opportunities for the use of ICT. While labour-saving innovations based on ICT have been very successful in retail banking, there are only rare examples for similar applications in the restaurant business or other personal services. Following Malerba/Orsenigo (1996) and Marsili (2001), this may reflect different technological regimes in terms of different technological opportunities for the use of ICT and different characteristics of the underlying knowledge base which may be more or less suitable for automatisation and computerisation. This is also confirmed by industrial statistics which show considerable variations in the rate of investment of Information and Communication Technologies between sectors.

From this point of view, the diffusion of ICTs in the business sector would be strongly related to the sectoral composition of the economy. If sectors where ICTs offer 'high' technological opportunities are strongly represented, we may expect a high diffusion rate. If, however, the share of 'low opportunity' industries is high, we may also find a low penetration rate compared with countries with a different sectoral composition. This 'structural' dimension of technology explains to a large degree Austria's lagging behind in gross R&D expenditure (Dachs, Gassler et al. 2002). It turns out that Austrian enterprises do not invest considerably less in R&D than their foreign competitors in the same industry. However, some industries (mainly R&D-intensive high tech industries) are simply weaker represented in Austria than in other European countries.

Which are the 'high opportunity' sectors? We will use software investment as a proxy for total ICT intensity, as this is the only information available from official Austrian statistics on ICT-related investment at a low sectoral aggregation level. We have to assume that the use of software directly calls for adequate hardware investments, and therefore reflects the total ICT intensity of an industry.

Software investment concentrates in very few branches (see Table 2). In 1998, over 60% of all software investment in the Austrian business sector came from five service industries – 'high opportunity sectors' - which jointly encompass 20% of business sector employment. A common feature of all these sectors is that they handle large quantities of data – financial information, inventories, orders, etc. - or develop tools for data handling. 'Low opportunity' sectors[10], on the contrary, are hotels and restaurants (but not the travel and tourism sector in general!), construction, land transport or industrial services with a low skill profile (see Table 3). Furthermore, manufacturing as a whole is less ICT-intense than the service sector.

[10] The term 'low-opportunity' does not mean that there is no opportunity for productive applications in these industries. It just highlights the fact that – compared to other sectors – the input of ICT is quite low compared labour inputs, measured in persons employed.

Table 10: Top five industrial sectors in software investment, Austria, 1998

NACE	Industry	Software Investment (1,000 Euros)	Employment (persons)	SW investment per employee (Euros)
65, 66, 67	Financial intermediation	186,182	115,169	1.617
64	Post and telecommunications	75,896	63,587	1.194
51	Wholesale	55,216	199,258	277
72	Computer and related activities	51,941	24,781	2.096
741-744	business services	36,271	101,046	359
	‚High opportunity' sectors	405,505	503,841	805
	Share of Business Sector	64%	22%	

Source: Statistic Austria, Business Survey 1998

Table 11: Top five industrial sectors with lowest software investment, Austria, 1998

		Software Investment (1,000 Euros)	Employment (Persons)	SW investment per employee (Euros)
745-748	Personnel provision, industrial cleaning and security services	6,636	72,072	92
50	Sale, maintenance and repair of motor vehicles	6,500	78,435	83
45	Construction	16,577	248,135	67
60	Land transport	4,194	138,656	30
55	Hotels and restaurants	4,907	197,739	25
	‚Low opportunity' sectors	38,815	735,037	
	Share of Business Sector	6%	32%	

Source: Statistic Austria, Business Survey 1998

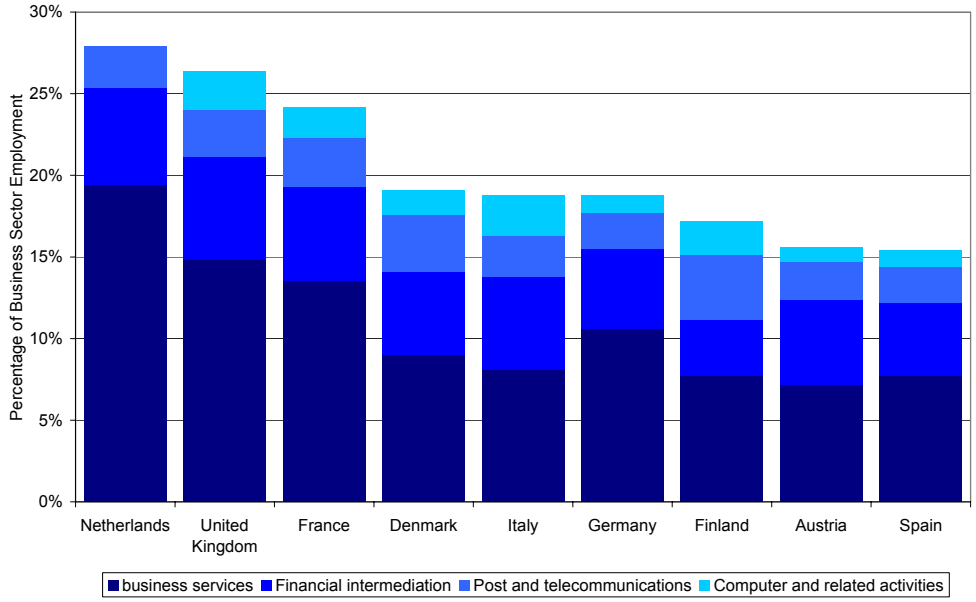
This structural dimension may help to understand the low diffusion rates for ICTs in the Austrian business sector. Although answering this question in full detail would require a proper econometric approach, descriptive statistics may already tell us a large part of the story. For this analysis, we use the STAN database by the OECD.

First, we look at ‘high opportunity’ sectors. While financial services and communication services are of roughly equal size compared to other EU countries, computer services and business services are considerably underrepresented. The largest differences show up in business services where Austria is behind all others, whereas Austria’s financial sector is relatively larger than that of Finland, Germany, or Spain. Altogether, the share of these industries in the Austrian economy is considerably lower than in most other EU countries where data are available. On the other hand, the share of industries which make only little use of ICT is in Austria higher than in any other country. This is due to Austria’s tourism industry, which in relative terms is the largest of all countries compared. But Austria has also a very large transport sector.

To sum up, the reason for a lower ICT penetration rate in the Austrian business sector may not be a lower propensity of firms to invest in computers and networks. The share of enterprises operating in sectors

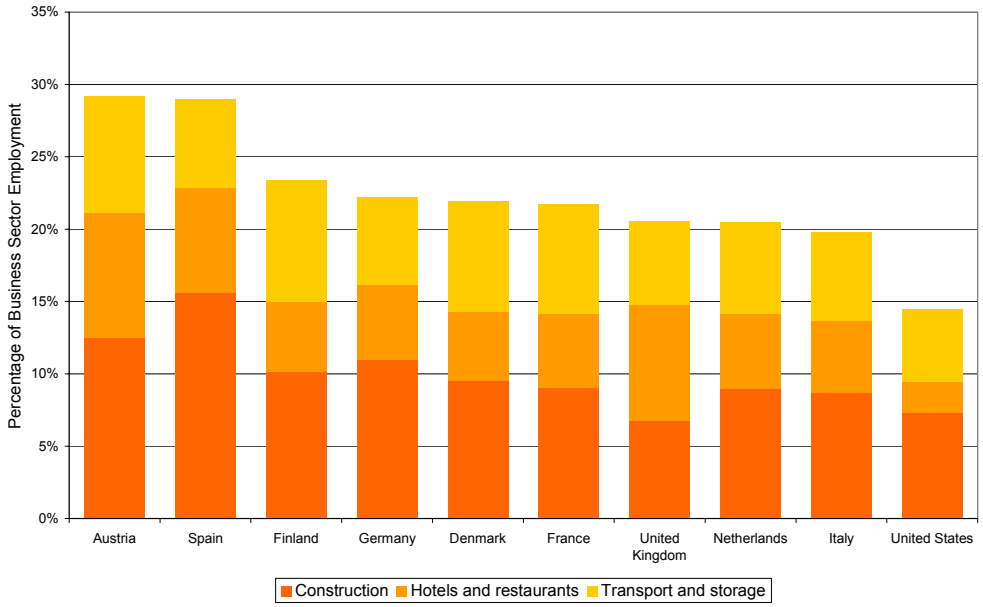
where ICT investment offers high technological opportunities is simply smaller. The same is true with expenditure for research and development (R&D) in manufacturing. Much of Austria's lagging behind in R&D expenditure can be explained by the Austrian industrial structure and its low share of technology-driven industries (Peneder et al 2002). But this may not necessarily be a sign of structural deficits. In tourism, we rather see a pattern of specialisation based on superior resources, like in the paper industry. In other sectors, Austrian enterprises have specialised in niche products and managed to serve the high quality segments within more traditional patterns of specialisation.

Table 12: Share of 'high opportunity' sectors in the European Union , 1998



Source: OECD STAN, own calculations

Table 13: Share of 'low opportunity' sectors in the European Union and the US, 1998



Source: OECD STAN, own calculations.

Social factors

What makes Austria's development and current position in IST very high but not "excellent"? We have already examined some factors related to politics and industrial structure. Another area of interest are private households and consumer habits with relation to the Internet and ICT. Conventional factors such as connection prices or the diffusion of the broadband access are often quoted as determining factors but do not always tell the whole story. Trying to understand why Austria with its favourable economic position in Europe has not so intensively developed for instance with respect to the penetration of several ICT leads us to look more closely at social and cultural factors.

We take as a starting point the following assumptions of how cultural and social factors may affect the diffusion of Internet and related utility derived from its use:

- If information is regarded as a highly valued good (i.e. the presence of an information culture), we expect a higher use of information and communication technologies.
- If a society has a high level of education and qualification, we also expect higher levels of higher ICT penetration rates because ICT use rises with technical and scientific skills.
- If differences between men and women in education, income and job qualification are small, we also expect higher penetration rates because Internet users tend to be better educated and earn higher incomes.

These assumptions may be difficult to prove through measurement, yet experts have strongly supported our interest in exploring these avenues further. We will follow the same rationale as before when we compared Austria's position to that of the Nordic countries, especially Finland.

E-literacy and Information culture

E-literacy means having the skills, knowledge and attitudes to use ICT to maximum advantage and to keep up-skilling. Optimal levels of access and e-literacy may contribute to a person's well-being and thus allow him or her to be a more effective worker, entrepreneur, consumer, or citizen. E-literacy is determined by the following factors:

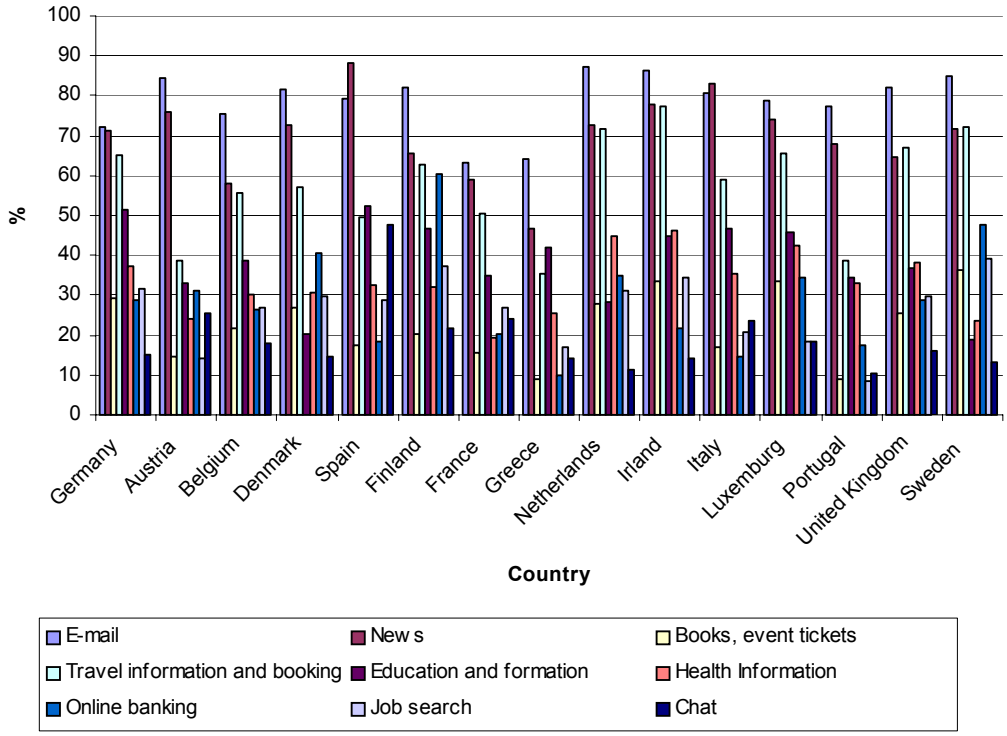
- Infrastructure, i.e. having access to ICT and sufficient levels of bandwidth available to carry out e-commerce, e-government or e-learning.
- Finances, i.e. connecting to the Internet in a way which enables a person to carry out required activities through affordable access.
- Skills, i.e. having sufficient skills, or access to tuition, to develop and increase skills, to use ICT to an optimal level for personal and economic gain.
- Attitudes, i.e. perceiving ICT skills and access to the Internet as value-adding and important for future well-being, perceiving the internet as having meaningful and relevant content.

One of the most important challenges of the information society is to extend simple computer literacy to the complex phenomenon of e-literacy with positive attitudes towards ICT-conveyed information.

This development seems to closely related to the predominant information culture. Information culture may be generally interpreted as the value a society attributes to information. The educational system may be another determining factor to explain the different attitudes to information. Several of the experts interviewed confirmed that the Anglo-Saxon system for instance is known to foster a learning, or information culture that it is more oriented towards learning-to-learn and to develop students' abilities to gather and use information independently. Libraries are additionally important institutions for providing information resources and services. Thus, reading newspapers and specialised magazines or using a library may be used as indicators for a population's interest in information as integral part of their daily life. Information culture thus describes the culture of using of information, the criteria for evaluating the quality of the information, as well as the capacity to identify which information is necessary for a specific purpose.

Overall, Austrians have readily accepted the availability of ICT-conveyed information products and services (see Figure 14).

Table 14: Types of Internet use by country, 2001



Source: Eurobarometer (2001)

However, when it comes to the number of daily newspaper circulation and books titles published, the difference between Finland and Austria is quite large (298 compared to 468 per 1,000 inhabitants). Even more striking are the large differences in the number of books available in public libraries and the extent to which people make use of them (see Table 15).

Differences in the use of libraries between Finland and Austria are also most obvious: Austrians do not frequent libraries as much as e.g. the Finns. Yet, we can also find other indicators that reveal a different attitude towards information related to leisure time activities such as the visit of museums, art galleries etc. (see Table 16).

Table 15: Cultural activities: newspapers, books and libraries

	Daily Newspapers (daily circulation per 1,000 inhabitants)	Book titles published (per 100,000 inhabitants)	Registered public library users (per 100 persons)	Number of books in public libraries (per 100 inhabitants)
	1994	1991-94	1989-94	1989-94
Austria	298	99	12	102
Belgium	316	138	17	294
Finland	468	246	47	712
Germany	313	86	11	158
Greece	153	39	…	71
Ireland	154	…	22	309

Source: UNESCO World Culture Report (1998)

Table 16: Types of establishments visited during the last 12 months (in % of EU 15)

	Public library	Zoo/Aquarium	Art gallery	Science / Technology Museum	None of those
Austria	15,8	30,2	15,6	11,7	51,1
Belgium	39,9	22,1	19,6	9,7	47,6
Finland	73,2	20,7	27,2	10,3	16,5
Germany	22,6	33,5	16,1	12,3	4,4
Greece	8,1	11,7	11,1	5,1	72,9
Ireland	31,3	19,6	11,1	4,1	51

Category "don't know" not included.

Source: Eurobarometer (2000)

However, Austrians may just as well have a different information culture, i.e. they use different sources or media to satisfy their information needs. Moreover, there may even be strong complementary or substituting effects among ICTs. The most frequently visited Web sites in Austria to date (see Table 17) confirm the attractiveness of the Internet to provide information (news) and communication (short message services).

Table 17: Most frequently visited Internet sites in Austria, 2002

No.	www site	Description	% of visits
1	ORF[1]	Austrian Broadcasting Corporation: news	44
2	Herold[2]	Telephone directory: white and yellow pages	38
3	sms.at	Short Message Service: communication	37
4	News networld[3]	Weekly magazine (yellow press): infotainment	26
5	Kronen Zeitung[5]	Daily newspaper (yellow press): infotainment	24

Source: Austrian Internet Monitor. Data April -June 2002. Rep. Austrians > 14 yrs. n=3.500 per quarter.

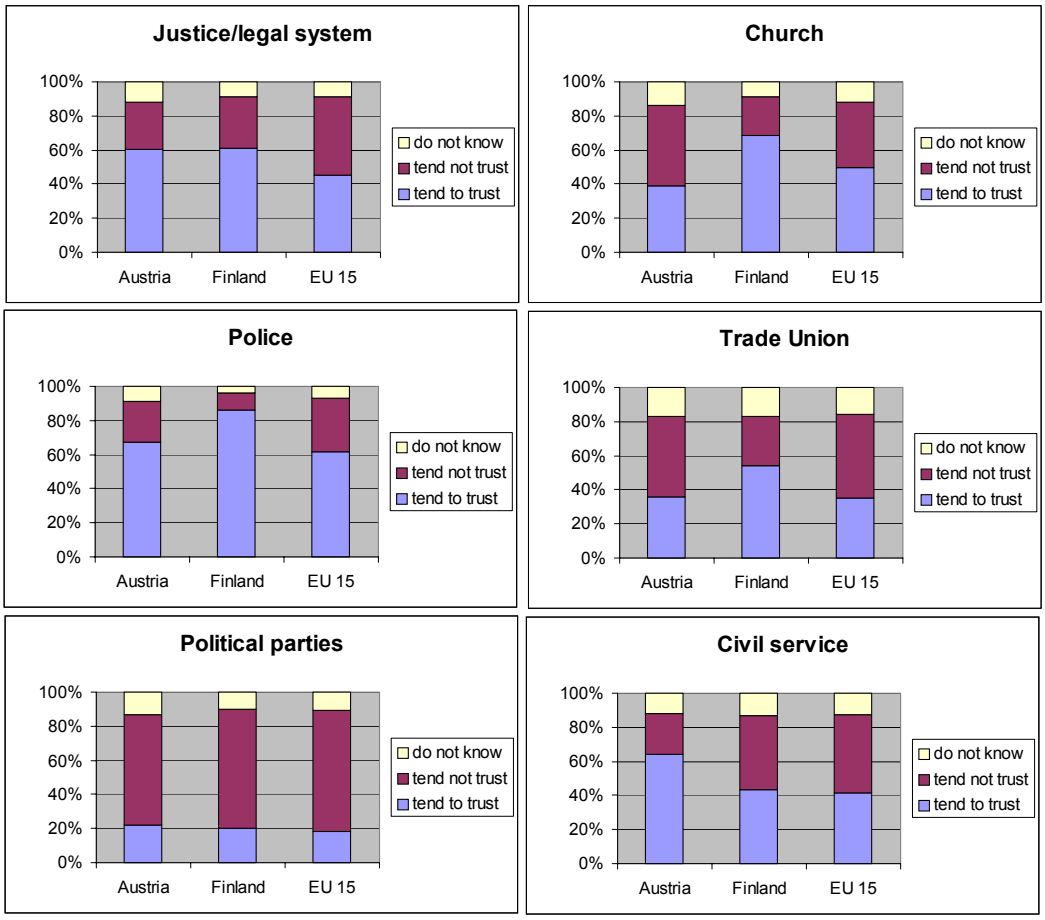
Hierarchical thinking and trust in institutions

Beyond the above described indicators of individual information attitudes and behavior, experts have indicated a specific "Austrian" information culture at the collective societal level (e.g. Maier-Rabler 1995). Major factors influencing a specific information culture are dominant religious and ethical values of a society as well as the political and legal structures. The underlying assumption is that the more trust is conveyed into public authorities and institutions, the less distrust or fear there is on the part of the individual concerning privacy, data misuse, etc. These are highly important barriers or carriers for the diffusion of e-commerce or tele-work.

Scandinavian countries with their longstanding, highly democratic-liberal political system are generally regarded by experts as information-friendly, transparent, and organised along flat hierarchies. By comparison, Austria with its hierarchical-absolutist legacy is characterised by a high degree of hierarchical thinking and stronger belief and trust in public authorities and institutions. The latter is not which is not explicitly conducive for actively sharing and disseminating information. Experts thus describe Austria as

having a rather information-restrictive climate with strong gate-keepers to public information, e.g. through a highly concentrated media market. A UNESCO survey (see) partially confirms this notion.

Table 18: Trust in institutions, 1998



Source: UNESCO (1998).

Information and communication technologies are organised as digital networks providing various kinds of information, communication and transaction services (Latzer 2000; Warta, Wagner 1998). Some experts argue that the closer a society's information culture resembles the decentral, network characteristics of ICT, the better a society will be able to make use of this potential (see Meier-Rabler 2002). If this is the case, Austria may have to adapt its information culture to take full advantage of the Network Society.

The education system

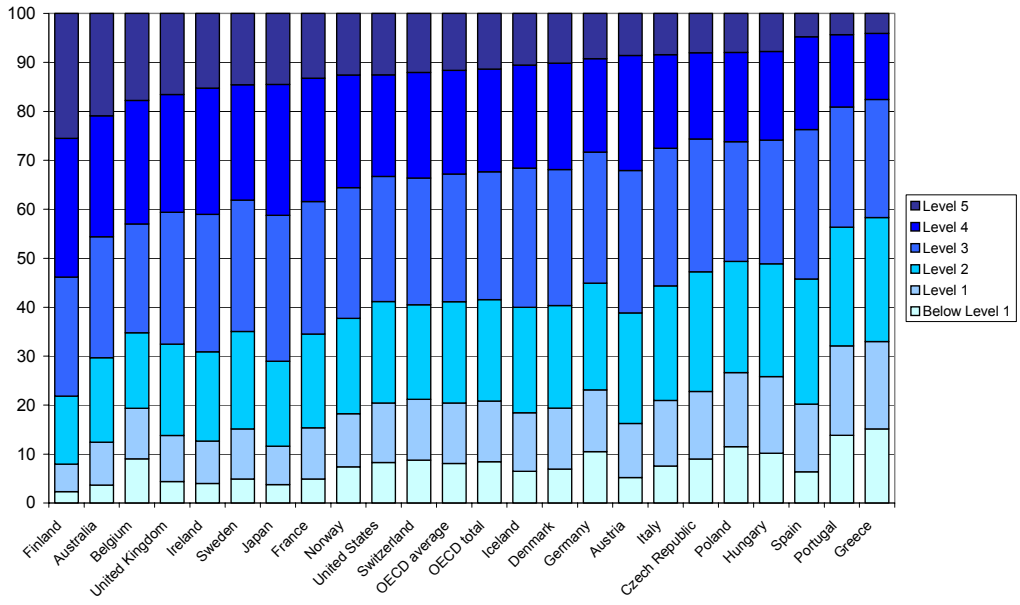
Education plays a key role in the development of IS because it qualifies a society to use new information and communications technologies and its services offered, increasing as well the demand and necessities of information. Thus, we are not only interested in the levels of education but also in the education system itself, i.e. to which extent it stimulates creativity, research skills, and information culture.

Austria's education system is generally regarded as democratic and egalitarian, providing equal access for all. International managers attest the Austrian education system meets the needs of a competitive economy (The World Competitiveness Yearbook 2000). Austria's expenditure for education also rank

among the highest in OECD comparisons. This is particularly the case for secondary education, resulting in one of the highest proportions of secondary school graduates in the population: Austria ranks third with over 80% of 22-year-olds with an upper secondary school degree only behind Finland and Sweden with around 90% (Eurydice, Eurostat). In Austria the proportion of students with vocational secondary education is comparatively high. In addition, the system of dual education combining vocational training and general education for youths results in a highly qualified and technically qualified work force for industry.

Yet Austria's education system is also associated with a conservative academic tradition which is more "answer"- than "question"-oriented (interview with Maier-Stadler). This implies that it does not broadly and proactively promote creativity and/or research skills. We also find some indications on this topic in the OECD-PISA assessment[11] on skills of students. Although no indicator has measured this 'creative search' capabilities directly, we see that the overall reading literacy of Austrian pupils is above OECD average, whereas the number of students who reached Level 5-reading literacy is below OECD average. Level 5 includes the most difficult tasks which may come closest to the creative search capabilities: managing information that is difficult to find in unfamiliar texts; evaluating critically and building hypotheses, drawing on specialised knowledge, and accommodating concepts that may be contrary to expectations.

Table 19: Percentage of students at each level of proficiency on the reading/retrieving information scale, 2000



Source: OECD, PISA Study

This implies that it does not broadly and proactively promote creativity and research skills. This may be illustrated by the fact that Austria is one of the few EU15 countries which does not explicitly include the development of creativity in elementary and pre-school curricula (see Eurydice).

[11] OECD 2002a) A lot of material can also be found on the OECD's Pisa homepage http://www.pisa.oecd.org/

The issue of a "digital divide" still is a major social challenge of the information society. The hypothesis is that segments of the population with higher social status tend to benefit more from the use of mass media that segments with lower social status. Therefore, the issue of closing and/or preventing of the digital divide is also an issue of influencing a country's information culture. One way to combat this effect is by the introducing ICT in the schools: By mid 2000, access to the Internet is provided in 52%, that is 3,307 of all 6,382 Austrian schools. The diffusion of Internet access to different types of schools is yet rather uneven. It is lowest in primary schools (34%) and special needs schools (44%), and highest among secondary schools (97%). According to a recent report on Austrian's progress within the eEurope initiative, nearly 100% of secondary schools will be connected to the Internet in the immediate future (eAustria 2000; Aichholzer, Schmutzer 2000).

Statistics show that Austria has a very high percentage of population with completed secondary degrees but drastically less with completed tertiary degrees (see Table 6). Although it ranks first with regard to expenditure on tertiary education within the OECD (and tuition fees only recently introduced), only 14% of secondary school graduates per year continue to pursue an academic career in the university. Only half of those (53% in 1995) successfully complete their studies with a formal degree within an average of 7,4 years. Official statistics however do not take full account of the fact that the Austrian tertiary education system has only recently introduced a bachelor's diploma as the first academic degree.

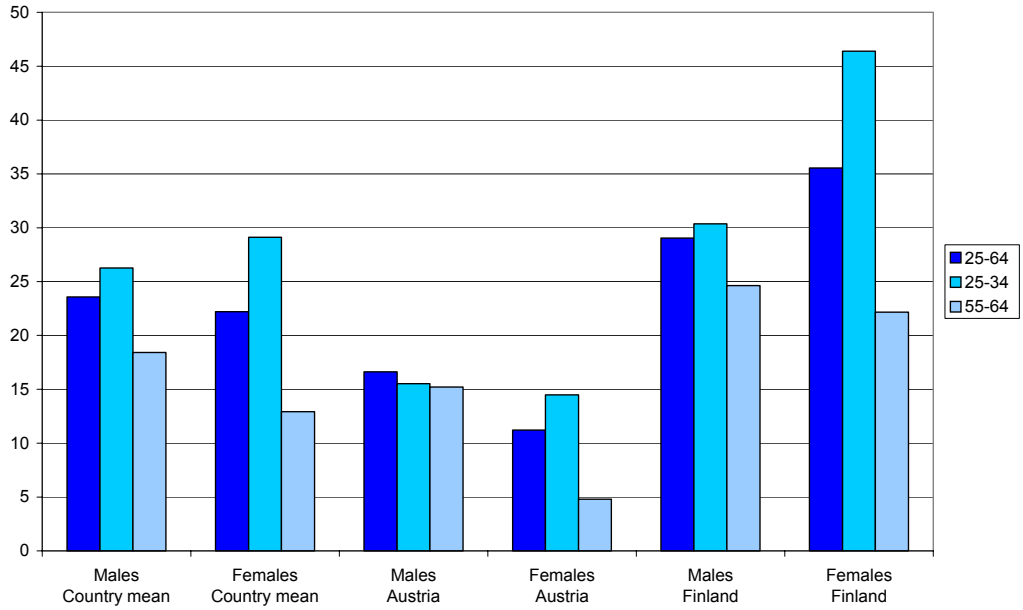
Table 20: Students enrolled in secondary and university level education (in % of population),1998

	Secondary school enrolment	University and post secondary enrolment
Austria	9,79	2,95
Finland	8,94	4,15

Source: Austrian Statistical Yearbook (1999/2000), UNESCO (1998).

The number of persons obtaining formal tertiary, science-related qualifications is an important indicator of the supply of high-level skills and knowledge. Moreover, people with a higher level of education tend to be more interested in reading books, newspapers and magazines. Compared again with Finland, OECD sources cite Austria with 13,3% engineering graduates from university and 14,2% in non-university institutions. Eurostat, using a different classification, finds the proportion of science and technology graduates in Austria at 7,1% (2000) comparable to Germany (8,2%), yet Finland with 17,8% (1999). Austria also shows a gender gap within the tertiary system: there are comparatively few women with science and engineering degrees and also in leading academic positions in Austria.

Table 21: Share of males and females with completed tertiary education (age breaks), 2001



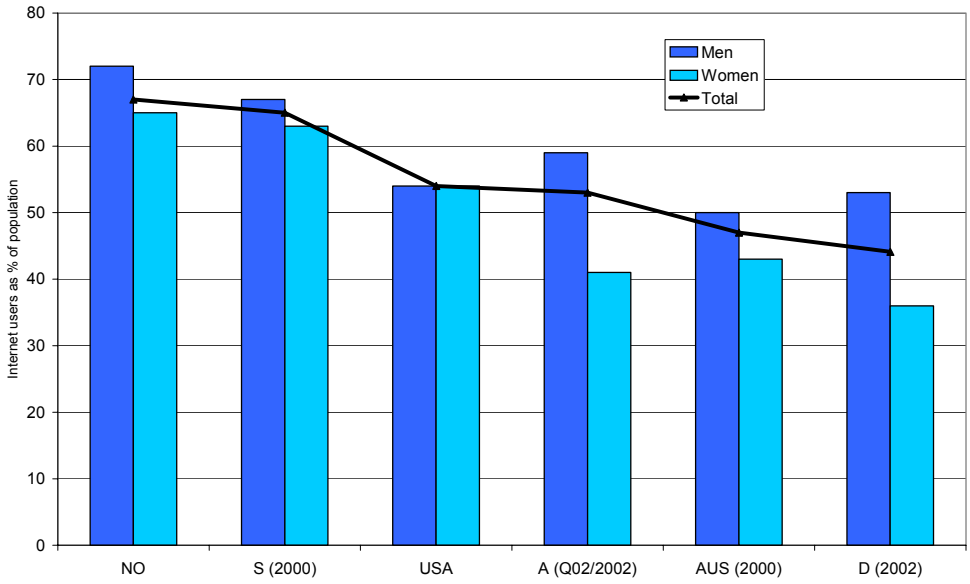
Source: OECD, Education at a Glance 2002

Gender differences

Finally, we briefly discuss gender differences with respect to the use of the Internet and how these differences may influence the overall diffusion of ICTs. This 'Internet gender gap' is one aspect of the ongoing discussion about a 'digital divide', describing differences based on economic status, gender, race, etc. with regard to their opportunities to access and use ICTs such as computers and the Internet (OECD 2002).

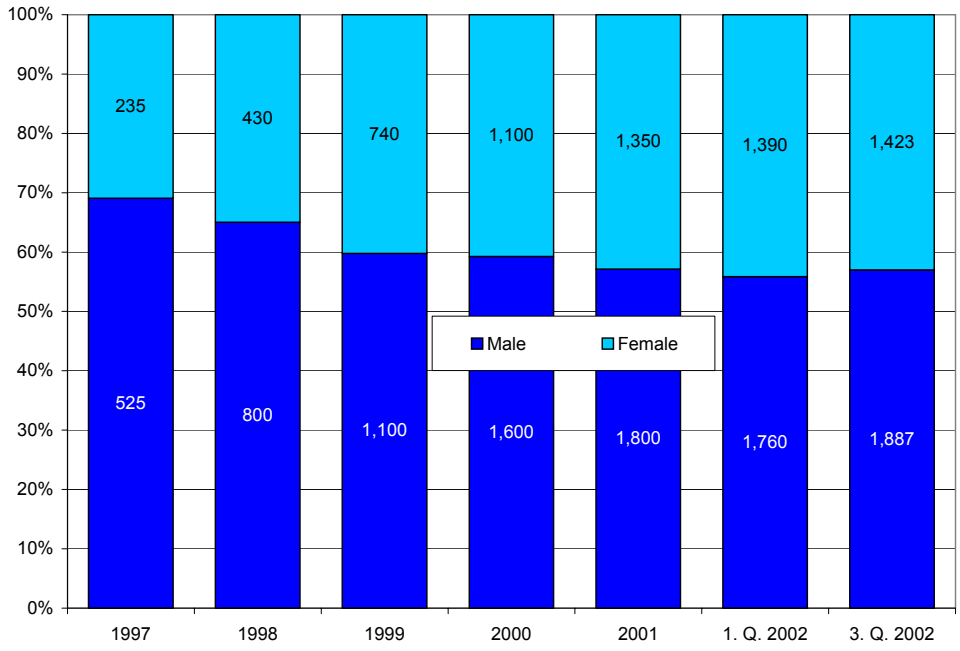
If the gap were smaller, Austria may have a higher overall Internet penetration rate. Therefore, the reasons for the gender gap may also explain why the overall number of Internet users in Austria is smaller than in the Nordic countries. This gap exists in other countries as well, however, there are a number of countries where these differences appear to be much smaller than in Austria.

Table 22: Internet gender gap in international comparison, 2001



Source: Austria Internet Monitor, OECD 2002, ARD/ZDF 2002

Table 23: Male and female Internet users in Austria, 1997 - 2002



Source: Austria Internet Monitor.

Although women are one of the fastest growing sub-groups of Internet users, the Internet gender gap closes only slowly in Austria. The number of female Internet users doubled between 1999 and 2001 in absolute terms, compared to an increase of 65% for male users. However, in 1997 almost 70% of all Internet users were male. Until 2001, the share decreased 57%. Differences are even more striking with

respect to intensive users where only 41% of users are female users. We also notice that a digital divide shows up in applications: women make less use of Internet banking or e-commerce (see AIM 2002)

According to expert interviews, the reasons for the gender gap mainly reflects the general differences between men and women in society:

- Labour participation rates of women are considerably lower in Austria than in the Nordic countries which reduces the opportunities for women to get computer and Internet access at work. Moreover, women frequently occupy jobs where they do not get in touch with the Internet.

- The gender gap is rather small between younger people and widens with age. Although increasing quickly, the number of elderly female Internet users is still considerably lower than the number of elderly male users. Reasons for hampering the diffusion of Internet access in this group are income disparities, a lack of computer skills, no opportunity to get access at work, but also simply a lack of utility. As experts point out, elderly women quickly become familiar with the Internet if they recognise that it is sometimes easier to keep in touch with friends and family members by email than by phone or paper mail (expert interviews).

- A larger gender gap than in the US or Scandinavia may also be a result of the relatively late take-off of the Internet in Austria. In 1997, only 4.5% of the Austrians had Internet access, a very low share compared to the US (14.9%), Sweden (23.7%), or Norway (29.4). The typical Internet pioneer user of these days was male, between 20 and 39, working and well-educated and this picture of the typical Internet users has been transported by mainstream media, putting off women and other people outside of this group to a large degree. As the Internet becomes a well-known, mature type of media, this 'nerd' image of the Internet that may have scared off women disappears.

- Finally, experts suggest that gender-specific differences in education with respect to technology are still widespread in the Austrian society, holding back girl's interest in computers and other technology. The low number of females students in engineering and natural sciences enrolled at universities as well as girls taking up technical crafts may be indicators for this.

What can be learned from the Austrian experience?

Austria is well advanced in Information Society development, yet lags behind other countries of comparable economic status, especially the Nordic countries. We have identified a number of factors that have very likely shaped the diffusion of ICTs and the development of the information society in Austria:

- Unlike other countries analysed in the TIGERS project, Austria's political institutions has shown only little concerted effort in actively pushing Information Society policy. Major stimuli have come from the EU through White Papers and regulation.

- The reason for these restraints may have been that the 'old' institutional structures seemed to work fine and – unlike in Finland or Ireland - there was no pressure for radical reform. Although we see no major hampering effects from the political environment, we may nevertheless assume that Austria would doing even better in some indicators if there had been a stronger public policy push towards the IS.

- Overall we find a higher share of industries making little use of ICTs and a smaller share making heavy use of ICTs in Austria compared with other European countries. This partly explains lower ICT adoption rates in the enterprise sector.

- Experts assess Austria's information culture to be different from Nordic countries. The Austrian education system for instance requires students more to learn contents than to learn how to search for information. This may be a reason why many people see only little additional value in the Internet compared to other media.

- Gender differences with respect to Internet use are still larger in Austria than in other countries. Without a gender gap, overall Internet penetration in Austria would also be higher than today.

Austria is not a country that has become affluent by specialising in ICT manufacturing and services and may thus provide only few lessons about catching up compared with Ireland or Finland. Some lessons though may still be derived from the Austrian case:

- Institutional reform and liberalisation can quickly develop a well-functioning telecom market and force down prices. A necessary precondition, however, is an independent regulatory authority.

- Long-established structures can turn out to hamper the development of an Information Society when they are unable to 'produce' social, institutional and structural change ("lock-in").

- The development of an Information Society is not necessarily a result of 'good policy'. Only little concerted effort has been achieved on ICT-specific promotion schemes in Austria. Yet good framework conditions such as high levels of education and income may also favour high ICT diffusion rates.

- Austria also shows that there may be other sources of wealth than ICT. Countries can also be economically successful if they manage to gain competitive advantage in other sectors.

- We also see the importance of the education and training system for providing the necessary skills (e-literacy) to make use of the full potential of ICT. Changes in education systems towards more problem- and research-orientation in order to affect (long-term) changes in information culture which will eventually foster more creative use, i.e. increased utility, of ICT.

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Annex: Expert Interviews

Field	Organisation	Expert	Function
Sciences and Academia			
	▪ WIFO Austrian Institute for Economic Research, Innovation and Telecom Group	Norbert Knoll	Researcher
	▪ Austrian Academy of Sciences, Institute of Technology Assessment	Georg Aichholzer	Researcher
	▪ University of Salzburg, Department of Multimedia Design and New Communication Technologies	Ursula Maier-Rabler	Professor
	▪ University of Vienna, Department of Communication Science	Johanna Dorer	Researcher
Administration, Social Partners, Interest Groups			
	▪ BMVIT - Austrian Federal Ministry for Transport, Innovation and Technology	Michael Wiesmüller	Civil Servant, National Expert IST-FWP
	▪ Verband für Informationswirtschaft / Information Industry in Austria	Gerhard Wagner	General Secretary, Industry lobby
Enterprises			
	▪ One	Florian Stieger	Head of Future One

Identifying factors of success and failure in European IST-related national/regional developments

Final Report
Case Study: Flanders (Belgium)

Claire Nauwelaers and René Wintjes

April 2003

MERIT – University of Maastricht

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Executive summary

1. This report examines the case of Flanders, one of the three Belgian regions, trying to explain "how and why" this region has gained some success in adopting the profile of a "Tiger" in the IST area, becoming beneficiary of the so-called Information Society. The aim is to contrast the view obtained for this region, with that of other EU countries and regions, in the framework of the EU-funded "Tigers" project.

2. The analysis is structured in two parts. The first part endeavours to sketch out the general profile of Flanders as well as its characteristics with regard to IST-related regional development: how far can Flanders be qualified as a "Tiger" in the Information Society ? The second section presents a number of factors that explain (or at least, shed some light on the underlying reasons for) the strengths and weaknesses of Flanders as an e-society. The concluding section presents some reflections on the sustainability of current developments for the future of Information Society in Flanders.

3. The general profile of Flanders bodes a region that has many assets to be a "Tiger":

- It is a very wealthy region;
- It is placed in a complex institutional structure in which it owes a large autonomy of powers;
- It shows a high population density and degree of urbanisation;
- It hosts an important manufacturing industry;
- It is remarkably open economy in terms of trade and FDI;
- Figures indicate a very high level of productivity (but salary costs are also remarkably high);
- The population is highly educated, even if there are signs that the education system might not yet have adapted to the new modes of knowledge development in the Information Society.

4. The next question is how far Flanders can be qualified as a "Tiger" in terms of the Information Society, or in what respect this region shows success and failures in the IST area. Available indicators on the various facets of the Information Society in Flanders are collected and assessed, with the difficulty that many useful indicators do not exist at the regional level. As far as possible, these have been put in a comparative settings with the rest of the European Union. Overall, the analysis shows that Flanders reaches at least the average European level for many aspects of the "Digital Society", but also that achievements are not similar according to different facets of this society:

- Flanders is strong in ICT infrastructure developments, with notably a leading position in broadband infrastructure (TV-Cable & ADSL) and, e.g. PC equipment in schools (although this is fairly recent).
- It also hosts a reasonably important ICT sector, with remarkable spin-offs dynamics in some places, and shows relatively high rates of private and public R&D expenses in ICT;
- This strong position is not matched with similar rates of ICT-use, notably the use of Internet by households and (especially small) companies, and also with regard to e-government practices. Flanders is even at the bottom of the European league concerning the rate of consumers buying on-line, showing a lag in the private use of Internet;

- There are signs of a digital divide, as a comparatively large share of the population is not yet accustomed with ICT applications.

5. Thus, potential for the IST developments in Flanders is stronger than effective and diffused usage. Society at large has not realized at full the potential for developments thanks to those IST, which are therefore under-exploited.

6. The report goes on identifying the reasons behind the more and less successful aspects of Information Society in Flanders. It argues that the three critical driving forces, shaping the Information Society in Flanders, are:

- The "Flemish identity push"
- The Telecom market and infrastructure
- ICT-relevant behaviour and attitude.

These three bundles of factors cover a mix of politico-institutional, economic and cultural aspects, as summarised in Table A below.

7. The "Flemish identity push" argument focuses on the politico-institutional dimension. This driving force is linked with the particular situation of Flanders, a region that is pursuing a long-term strategy of autonomy. The process of federalisation of Belgium was at initial time (in the eighties and beginning of the nineties) hampering the development of a strong national vision and policy plans of the IS. But then, supported by a strong political will to build on the Flemish identity, to differentiate from the rest of the country and obtain success based on its own forces, the region focused on high-tech development as a way to reach this ambition. Policy awareness and numerous pro-active programs have been developed, with as flagships IMEC, a world-level excellence centre in micro-electronics, and Telenet, the regional alternative telecom operator. However, the linear vision on which the policy actions were originally founded induced a strong focus on infrastructures and on the "hardware" of the Information Society, rather than a preoccupation for the "software" aspects – mainly the absorptive capacities for such technological developments in the wider public. Progressively, the minds are changing and recent initiatives show a growing attention to users' needs and the recognition of the importance of availability of appropriate applications that could widen the effective usage of ICTs and contribute to regional development in a larger sense. Notably, the Flemish political leaders have also supported the development of a number of agglomerations of firms, specialising in high-tech niches and co-operating both among them and with knowledge institutions. The positive aspects of these ICT-clusters, promoted and supported by the government through increasingly transparent and bottom-up schemes, constitute opportunities for endogenous growth, embedded in the Flanders's innovation system, and based on rather small networks of highly specialised SME's. The achievement of a really "holistic" innovation policy is still a challenge however, as it implies a fundamental change in traditional policy and administrative practices.

Table A The three driving forces behind the Flemish Information Society and their politico-institutional, economic and cultural aspects

3 driving forces	Politico-institutional aspects	Economic aspects	Cultural aspects
1 "Flemish identity push"	Pro-active policy moves in a complex institutional structure. Recent moves to less linear views on Information Society	Promoting knowledge creation in ICT (IMEC), promotion of cluster dynamics impulsing endogenous dynamics	Pro-active promotion of Flemish content in a market with under-critical size: a vicious circle for slow developments?
2 Telecom market and infrastructure	Publicly-led move to make room for Telenet to introduce competition in telecom-market and exploit advantages of the cable density	Dominant position of historical operator, curbing early developments but favouring new ones on the broadband	Responding to the diversity in modes of usage of NICT: the Interactive TV as a solution to the digital divide ?
3 ICT-behaviour and attitudes	e-government initiatives faced with: problems of trust in public institutions, perceived bureaucratic burdens, and complex institutional-structure	Are innovation moods, entrepreneurial environment, education models, and ICT flagships, barriers to develop an ICT-based economy ?	Preferences for the "real" over the "virtual", including real benefits: building a more adapted Information Society model for Flanders ?

8. The shape and dynamics of the telecom market and infrastructure is the second important force behind the development of the Flemish "wired society". A comparative advantage of the region for a long time was the availability of a dense cable TV network over the whole territory. Through the creation of Telenet, a regional telecom operator exploiting this cable network for telephony and data exchanges, Flanders made the plan to introduce competition in the quasi-monopolistic telecom market and exploit new technological opportunities. On the technical side, it is already a success, on the economic and societal aspects, much remains still to be proved. Though competition with the dominant operator did not allow Telenet to offer cheaper access for dial-up connections to the Flemish population, thus maintaining a financial barrier to "first time" Internet access. Today, the proportion of broadband users is remarkable in Flanders, and broadband prices relatively low, but the lack of cheap access to "Internet for beginners" might still be a problem, notably for the poorest and least-aware segments of the population. Even rich populations have their less wealthy citizens, and the digital divide is

present in Flanders. A saturation point seems to be reached in terms of attracting new Internet users, well below the rates reached in the Northern EU countries. A new regional strategy is currently implemented to address this issue, with the development of interactive TV. New challenges may appear soon, if satellite or mobile technologies introduce more competition in the market.

9. Behavioural and cultural aspects and Information Society constitute the latter driving force, showing some light on the relative lag in IS progress and for the digital exclusion of a (still too large) number of Flemish SMEs and citizens. One question here is how far the "model" of Information Society proposed is well adapted to the particular habits, preferences and characteristics of the population. The challenge could be to develop a more "Latin" model of Information Society, with room for the important "real" activities, attention to tangible benefits and profits, combination with social aspects, and the integration of various modes of access and use of information. Another issue is the need, as a pre-requisite for successful exploitation of IST-related opportunities, to foster entrepreneurial spirit and innovative behaviour in companies, and create more links between the advanced companies and the more traditional ones. Finally, the education factor is critical, as IST-developments challenge traditional modes of teaching and learning.

10. The main conclusion from the analysis of these three critical factors is that the bottleneck in Flanders on its way to an Information Society is on the 'demand-side IST-developments'. From a strength and policy focus on the supply side developments, Flanders has been catching up by addressing demand-side developments at the regional level with a set of initiatives. The balance between the supply-side developments and the demand-side developments improved and already gave rise to a catching up on several IST-related issues. However, much remains to be done if the whole Flemish society is to take benefit from IST-related developments and becomes able to create a customised version of the Information Society, adapted to its own needs and future challenges.

Introduction

The aim of the ESTO "Tigers" study is to explain "how and why" some countries and regions have gained some success in adopting the profile of a "Tiger" in the IST area, becoming beneficiaries of the so-called Information Society. This draft report presents the results of the analysis carried out by MERIT on the case of the Belgian region of Flanders. Reliable statistics on sub-national regions in Europe are still rather scarce and often not very well comparable internationally. More and more, Flanders has come to fulfil a state role, but only very recently statistics, e.g. about Internet, have become available systematically for Flanders. This analysis is based on existing studies and reports and interviews with key informants from the region.

The report is structured in two main sections. The first section endeavours to sketch out the general profile of Flanders as well as its characteristics with regard to IST-related regional development: how far can Flanders be qualified as a "Tiger" in the Information Society ? The second section presents a number of factors that explain (or at least, shed some light on the underlying reasons for) the strengths and weaknesses of Flanders as an e-society. The concluding section presents some reflections on the sustainability of current developments for the future of Information Society in Flanders.

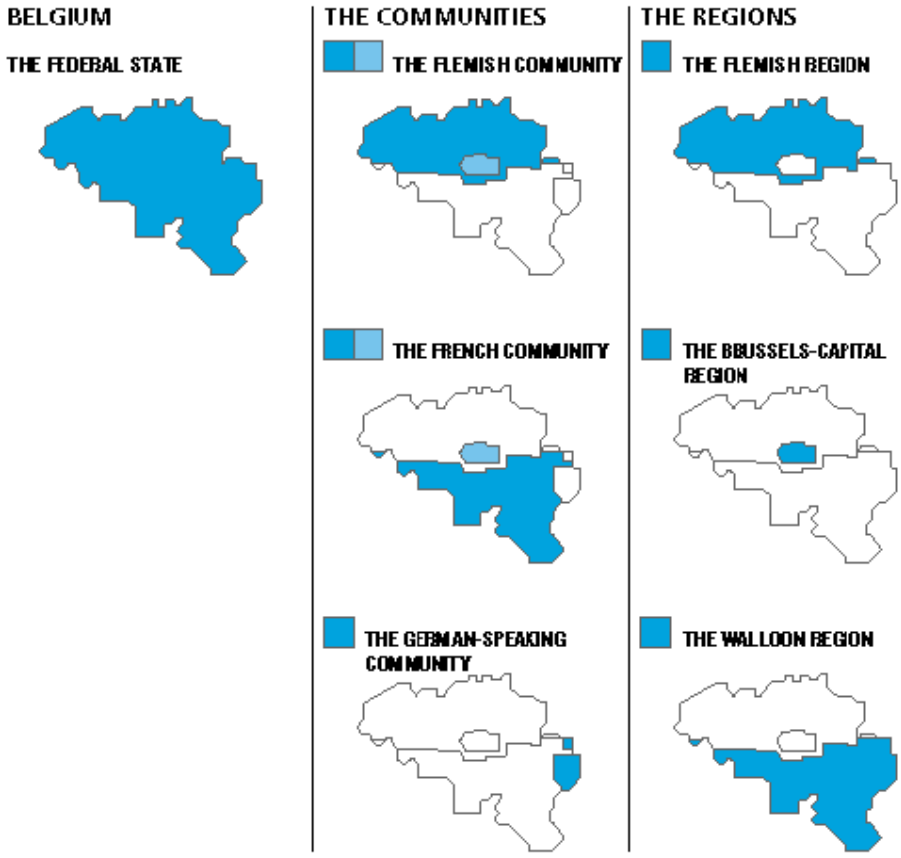
We like to thank all the people who have provided information for this study and those who have commented on earlier drafts of this report.

1 Profile of Flanders in the Information Society

1.1 Flanders, one of three Belgian regions

Since 1993, Belgium is a **federal state** composed of communities and regions. Four legal reforms were implemented in 1970, 1980, 1989, and 1993 to reach this federal structure. Belgium has three official languages (French, Dutch and German), these languages define three communities: French-speaking Community, the Dutch-speaking or Flemish Community and a small German-speaking Community. Belgium has three regions: the Flemish Region (in the north), the Walloon Region (the south) and the small Brussels-Capital Region in the centre (Figure 1.1). Each Community and Region and the federal state have their own government and Parliament.

Figure 1.1 Institutional organisation in Belgium



Source: Federal Office of Scientific Affairs (www.belspo.be)

The **allocation of competences** between those various entities of the Belgian federal state is such that Communities are responsible for "personal" matters (education, health, cultural affairs, etc.) while the Regions are responsible for matters related to the territory (economic development, territory planning, environment protection, etc.). In contrast with the other parts of the country, the Flemish Community and the Region of Flanders have merged into one single entity, with one government and one Parliament. The federal state retains

responsibilities for matters of national interest, such as defence, monetary and fiscal policy, social security system, etc. Most competencies of interest to the development of the Information Society are thus in the hands of the Flemish government, with the notable exception of the regulation of the telecom market, in the hands of the federal state.

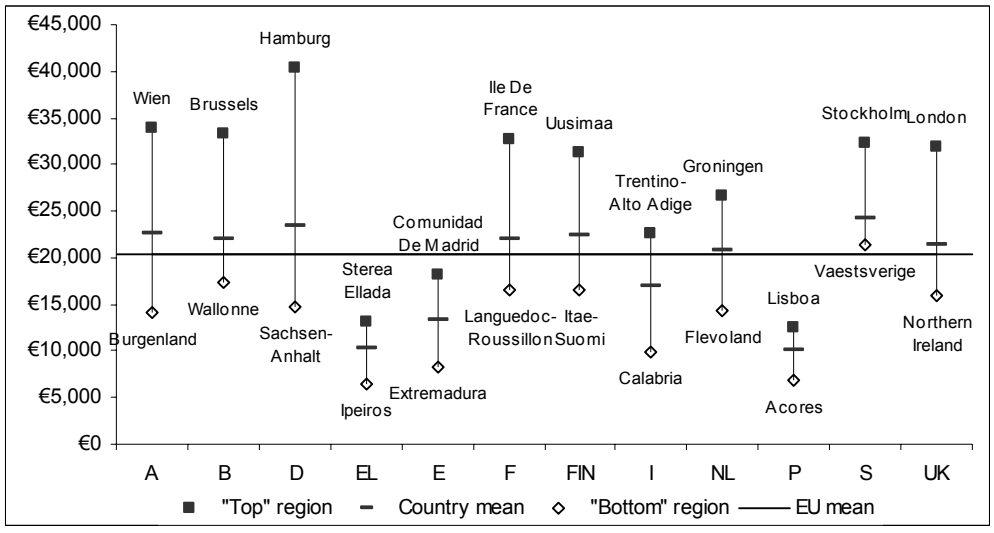
Flanders is the largest region of Belgium in terms of **population**, and **economic activity** (Table 1.1). It is a very densely populated region. Comparing the wealth of regions in Europe, Figure 1.2 shows that the wealthiest regions are mostly the 'state-capital' regions. The Brussels-Capital region has indeed the highest per capita GDP in Belgium.

Table 1.1 General economic data on Flanders as a region of Belgium

	Flanders	*Belgium*	*%*
Inhabitants,1-1-2001	5.952.552	10.263.414	58,0 %
Companies, 2000	414.852	689.453	60,2 %
Un-employed, '01	184.128	502.831	36,6 %
Turnover 2000, bil.EURO	440,7	689,6	63,9 %
GDP, market-prices''00	139,1	246,0	56,5 %
Population density, per sq.km	440	336	
Un-employment rate, 2001	4,3	6,6	
Degree of urbanisation	.	97,4	
GDP/capita, *1000 Euro '99	22,8	23,4	

Source: Ministry of the Flanders Community, 'Vlaanderen 2002 in cijfers'; APS, NIS, World Bank

Figure 1.2 Regional per capita GDP, 1998



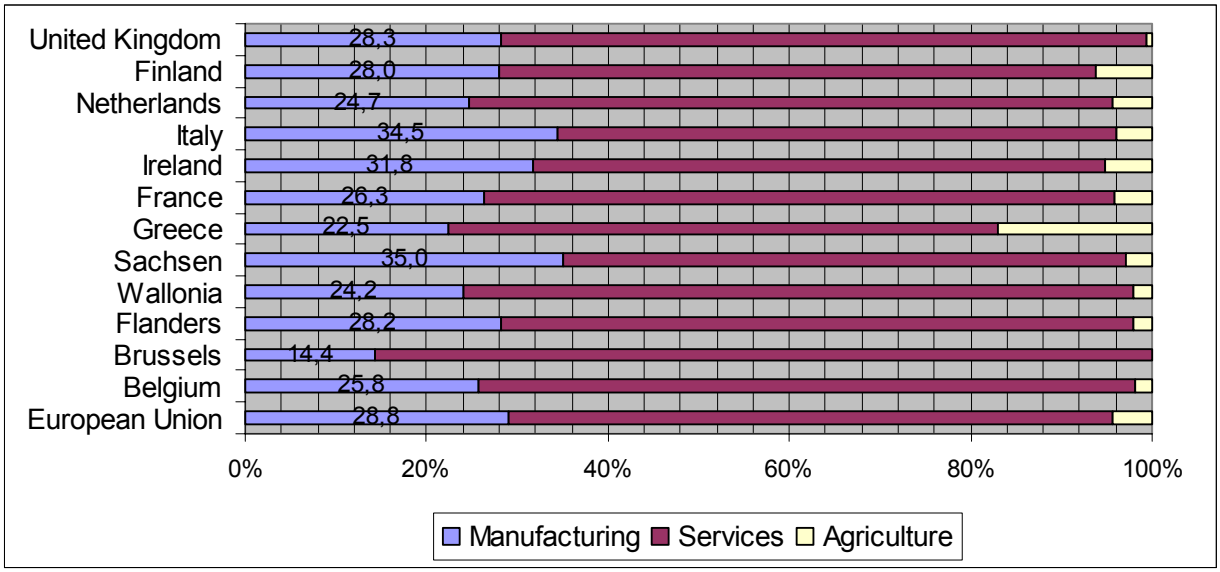
All data at NUTS 2 level, except for B, D and UK at NUTS 1. All data are for 1998, except 1996 for A, I and NL. No regional data for DK, IRL and L.

Source: Eurostat, own calculations.

Today, the **GDP per capita** is higher in Flanders than in Wallonia, notably because Flanders did not have to carry out the immense burden of the closure of heavy industries of the past at

the same level than Wallonia did and still does. Wallonia was the first region to industrialise in Belgium, and even one of the first in Europe. At present the **manufacturing industries** in Flanders form even a higher share in total employment (28,2 %) than it does in Wallonia (24,2 %), see also Figure 1.3. In Flanders the automobile industry, with several large foreign car-plants, is a major contributor to the manufacturing sector. Flanders even produces more cars per capita than Germany or Japan.

Figure 1.3 Economic structure of selection of countries and regions, 2000



Source: Eurostat, 2000.

Table 1.2 Flanders production structure, % of total turnover, 2001

Sector	Nace	% of total turnover
Agriculture	0	1,1
Energy	10	5,7
Mining & Chemical industry	20	8,3
Metal, fine chemical and optical	30	9,2
Other mnf. industries	40	9,7
Construction	50	4,4
Wholesale, trade, repair, hotels etc.	60	43,3
Transport & Communication	70	8,9
Financial services	80	7,8
Other services	90	1,6
Total	100	100,0

Source: NIS

In general however, the automobile sector has become a medium-tech sector. In terms of **innovation**, as measured by the European Community Innovation survey, Flanders does not appear at the top in Europe. Based on indicators like business and public R&D, and patents, Flanders ranks 21 in Europe (see Table 1.3).

Table 1.3 EU regions leading in innovation, 2000 (first ten regions, capital regions, Flanders)

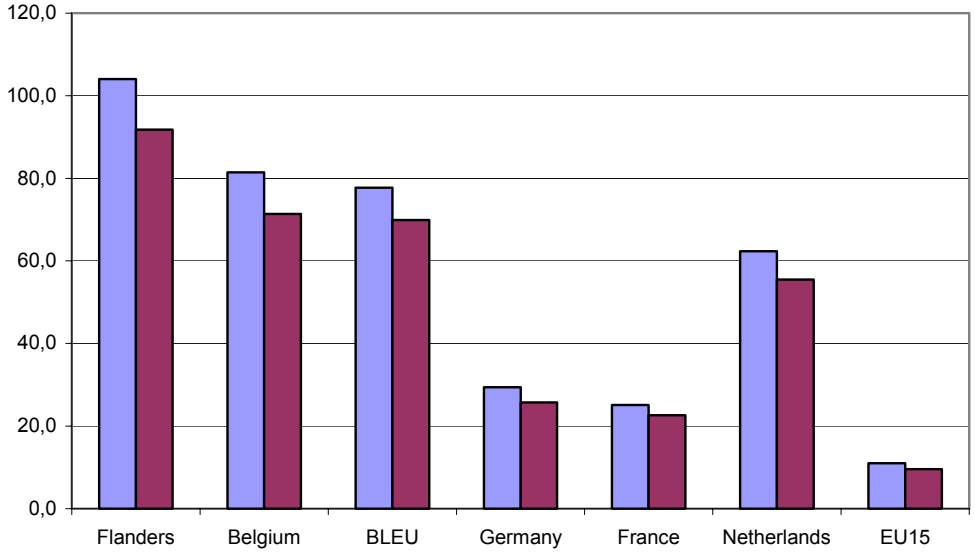
Rank	Region	Country
1	Stockholm	Sweden
2	Uusimaa (Suuralue)	Finland
3	Noord-Brabant	Netherlands
4	Eastern	United Kingdom
5	Pohjois-Suomi	Finland
6	Ile De France	France
7	Bayern	Germany
8	South East	United Kingdom
9	Comunidad De Madrid	Spain
10	Baden-Württemberg	Germany
17	Wien	Austria
21	**Vlaams Gewest**	**Belgium**
22	Lombardia	Italy
31	Southern And Eastern	Ireland
49	Lisboa E Vale Do Tejo	Portugal
50	Attiki Aigaio	Greece

Source: Eurostat 2002, own calculations.

Belgium as a whole, and Flanders in particular, are very open economies, showing extremely high **export** rates (Figure 1.4). Also in terms of **Foreign Direct Investment** (FDI), Flanders shows a remarkably large presence of multinational corporations, in this central part of Europe. The high level of incoming FDI for Belgium (after New-Zealand, the highest level in the world in relation to GDP) is not always seen as a very positive situation, because of the fear of becoming a branch-plant economy, visible e.g. at the time when Renault had closed down their car-plant in Flanders causing huge job losses.

An important economic aspect in relation to ICT is **productivity**. Detailed data for Flanders are not available, so here we have to rely on data for Belgium. Although data on productivity are difficult to compare internationally, Table 1.4 indicates that Belgian productivity performance during the period 1995-1999 was comparable to what was observed for the United States. According to the Federal Planning Bureau (2002) the result hides divergences between services, which overall performed better in Belgium than in the US, and manufacturing, which recorded a slower increase. Indeed, an important economic sector, the Durable Goods Manufacturing, recorded a clearly slower increase in its productivity than in the US. The Federal Planning Bureau (2002) concludes that this divergence partly reflects the better development of ICT producer sector in the US.

Figure 1.4 Degree of openness as a percentage of export in GDP, 1999,2000



Source: APS, 2001

Table 1.4 Comparison of productivity evolution: Belgium - United States - average annual growth rate 1995-1999 (%)

Sectors	Belgium	United States
Agriculture, forestry & fishing	3.7	- 0.7
Mining	2.1	2.5
Construction	2.4	- 0.8
Durable goods manufacturing	3.8	6.5
Non-durable goods manufacturing	4.2	3.3
Transportation & public utilities	3.7	2.4
Wholesale trade	6.3	4.2
Finance, insurance & real estate	2.5	2.9
Other services	0.2	1.2
Total Private Business sector	3.6	2.4

Source: Stiroh (2001) and Federal Planning Bureau (2002)

A next general characteristic is the high level of **education** in Flanders. Flanders scores indeed well on most indicators for the measurement of the level of education of the population. With regard to the quality of education, the PISA project (Program for International Student Assessment), launched by OECD, compared learning performance (reading, mathematics and scientific literacy) of 15-years olds, throughout a large number of countries. In Belgium, the study has been applied separately to the Flemish and French Communities. The results of the enquiry for Flanders are remarkably good: overall, they show that the Flemish youngsters belong to the best students in the world for reading and mathematics literacy, and just below the top level for scientific literacy.

Beyond the overall positive results, two less positive trends can however be noted with regard to the **adaptation of the education system** to the requirement of the Information Society. First, Flanders is one of the regions in which the distance in performance is relatively high

between students with high or low economic status; secondly, the scores in reading literacy decrease sharply when the capacities evaluated move from "localisation" capacities (finding an element in a text), to "interpretation" and, more markedly so, "reflection" (providing own vision on the text). Relatively speaking, many students score well in the first type of tasks, but many have more difficulty with the more complex tasks. The latter finding points out that there is still room for improvements in the education system, in the direction of the more analytical and critical capacities that are needed to survive in the "information overload society".

Finally, as a general characterisation of Flanders, we mention the position of Flanders regarding **overall human development**. The Flanders administration for planning and statistics has calculated the position of Flanders on the Human Development Index (HDI), which is based on the level of education, lifetime-expectations, and GDP. Next to Norway, the position of Flanders is number 1 (Table 1.5). This position ought to provide Flanders a 'head-start' in relation to future development towards an information and knowledge-based society.

Table 1.5 Human development index - 2002

	Index Life-expectation	Index education level	Index GDP	Human Development Index (HDI)
Flanders	*0,90*	*0,99*	*0,93*	*0,942*
Norway	0,89	0,98	0,95	0,942
Sweden	0,91	0,99	0,92	0,941
Canada	0,90	0,98	0,94	0,940
Belgium	0,89	0,99	0,94	0,939
Australia	0,90	0,99	0,93	0,939
US	0,87	0,98	0,97	0,939
Iceland	0,90	0,96	0,95	0,936
The Netherlands	0,89	0,99	0,93	0,935
Japan	0,93	0,93	0,93	0,933
Finland	0,88	0,99	0,92	0,930
Switserland	0,90	0,94	0,94	0,928
France	0,89	0,97	0,92	0,928
UK	0,88	0,99	0,91	0,928
Denmark	0,85	0,98	0,94	0,926
Austria	0,89	0,96	0,93	0,926
Luxembourg	0,87	0,90	1,00	0,925
Germany	0,88	0,97	0,92	0,925
Ireland	0,86	0,96	0,95	0,925
New-Zealand	0,88	0,99	0,88	0,917
Italy	0,89	0,94	0,91	0,913

Source: UNDP, APS, 2002

To sum up, the general profile of Flanders depicted above bodes a region that has many assets to be a "Tiger":

- It is a very wealthy region;
- It is placed in a complex institutional structure in which it owes a large autonomy of powers;
- It shows a high population density and degree of urbanisation;
- It hosts an important manufacturing industry;
- It is a remarkably open economy in terms of trade and FDI;
- Figures indicate a very high level of productivity (but salary costs are also remarkably high);

- The population is highly educated, even if there are signs that the education system might not yet have adapted to the new modes of knowledge development in the Information Society.

1.2 Flanders as an Information Society

The next question to be answered is how far Flanders can be qualified as a "Tiger" in terms of the Information Society, or in what respect this region shows success and failures in the IST area.

1.2.1 The ICT sector in Flanders

Flanders is clearly too small to be competitive along a 'complete' ICT-value chain, ranging traditionally from chips, PC-production to software, but it is big enough to develop industrial competitiveness in specific ICT-branches. The ICT sector in Flanders is specialised in telecom equipment (Siemens, Alcatel), consumer electronics (Philips, Barco), IT-system integration & installation (IBM, Telindus), IT-services & software (EDS, Dolmen, Origin, Ubizen), digital photography & printing systems (Agfa-Gevaert, Xeikon), and formerly, speech and translation technology (Lernout & Hauspie Speech Products). According to Larosse et al., 2001 the evolution of the Flemish ICT-sector during the nineties can be divided in two main periods. In the beginning of the nineties, the number of firms was rather stable (see Table 1.6) and employment even decreased (see Table 1.7). From 1994 onwards the number of firms and employment started to grow more quickly. The main players in Flanders are still the same large industrial constructors of the eighties. Most of the young companies are niche players which sometimes clearly benefit from location advantages, local knowledge specializations and network synergies, e.g. these young niche-players often have a link with local strengths in research (e.g. the large regional research centre IMEC) or with mature sectors such as the banking and graphics industry.

Table 1.6 Number of enterprises in Flanders in the ICT-sector in the nineties

Sector	1992	1993	1994	1995	1996	1997	1998	1999
Officemash. mnf.	22	24	15	12	10	10	10	11
Telecom & cons. electronics mnf.	36	32	47	54	59	61	60	55
Wholesale	523	526	543	605	657	726	744	784
Telecom.	5	7	14	23	40	63	81	88
Comp. services	789	796	833	870	942	1 020	1 141	1 279
TOTAL	1 375	1 385	1 452	1 564	1 708	1 880	2 036	2 217

Source: Social Security statistics, several years

For Belgium as a whole the share of ICT in business sector value added did not change much (from 6% to 7% between 1995 and 1999.

Table 1.7 Employment in Flanders ICT-sector over the period 1992-1999

Sector (ISIC)	1992	1994	1996	1998	1999
Office mach. mnf. (30)	511	441	335	341	352
Telecom & cons. electronics mnf. (32)	22 339	19 997	19 868	19 150	19 112
Wholesale (51.64)	6 212	6 191	7 128	9 475	9 879
Telecom. (64.2) (37% Belgacom)	9 809	9 385	9 713	8 267	7 445
Telecom (64.2) (other operators)	261	362	1 002	2 042	2 599
Comp. services (72)	8 136	8 960	11 270	16 250	19 590
TOTAL	47 268	45 336	49 316	55 525	58 977

Source: Social Security statistics (1992-1999)

The ICT production sector in Flanders has contributed considerably to economic growth, but diffusion in terms of ICT investment in other sectors is also an important economic factor. To measure this we again have to rely on national data. From Table 1.8, it appears that the sectors which have invested massively in ICT, are also the sectors which recorded the best performance in terms of productivity evolution.

Table 1.8 Investment in ICT and productivity performance in Belgium (%)

Sector	ICT share in investment 1995	Investment rate 1995	Average annual productivity growth rate 1995-2000
Financial Activities	46.5	10.2	5.1
Machines & Equipment Manufacturing	42.6	13.1	4.5
Electric & Electronic Equipment Manufacturing	37.5	17.7	11.2
Leather & Shoes Industries	33.4	11.5	6.7
Transport & Communications	31.5	30.4	4.5
Trade & Domestic Equipment Reparation	21.7	15.0	6.0
Other Manufacturing Industries	18.2	18.5	4.0
Metal Industry	17.2	13.4	4.5
Textile & Clothing Industries	15.2	16.3	7.6
Chemical Industry	12.0	18.0	6.7
Wood Industry	10.9	19.6	3.6
Food Industry	10.5	19.0	0.5
Transport Material Manufacturing	9.7	12.1	2.4
Public Utilities	8.8	35.2	4.7
Real Estate, Location & Business Services	6.4	33.5	2.4
Construction	6.1	12.0	2.6
Fishing & Aquaculture	5.6	29.0	1.6

Source: ICN (2001) and Federal Planning Bureau (2002)

As it has been identified in other countries, ICT-manufacturing seems to benefit the most in terms of productivity from investing in ICT. The ICT service sector contributed mainly in terms of employment (Table 1.9).

Table 1.9 Belgium productivity and employment, manufacturing and services average annual growth rate 1995-1999(%)

Sector	Productivity	Employment
Manufacturing	4.2	-1.0
ICT producers	6.6	-0.8
ICT users	4.3	-1.7
Non ICT users	3.7	-0.6
Services	1.2	1.0
ICT producers	1.1	4.1
ICT users	1.2	1.1
Non ICT users	1.3	0.2

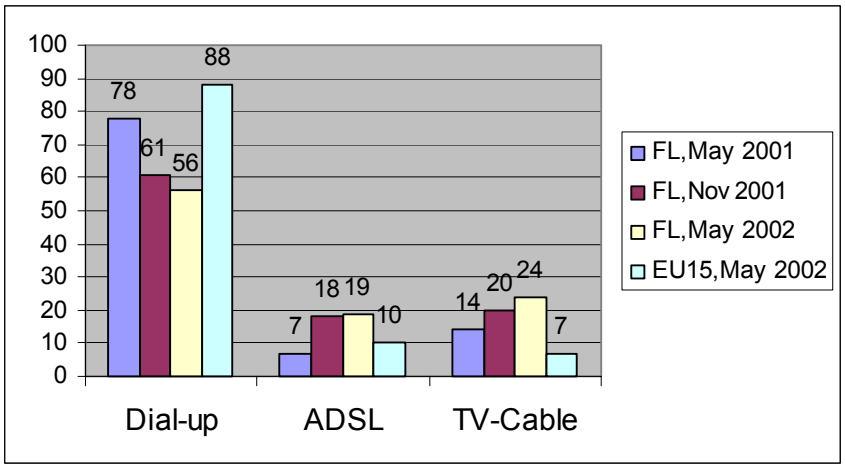
Source: Federal Planning Bureau (2002)

To sum up, it could be said that the Flemish ICT sector, though not remarkably important in the composition of the regions' industries, would certainly not constitute a limiting factor to the development of an Information Society in Flanders.

1.2.2 ICT-Infrastructure

The position of Flanders looks positive on the infrastructure side: broadband penetration is particularly high, especially through TV cable, but also increasingly through ADSL. As those types of connections show a lot of advantages over classical phone connections ("always on", higher speed, higher stability, flat rate prices, etc.), this is a very positive element. The advantage in infrastructure is largely based on the historical situation that almost every household has a TV-cable connection. For a long time this infrastructure has been a promising asset for IST development, although it is only recently paying off, in terms of an internationally high and rising popularity of a broadband internet connection trough cable (Figure 1.5). This makes it possible to study the development of digital television as a new channel for accessing the Web.

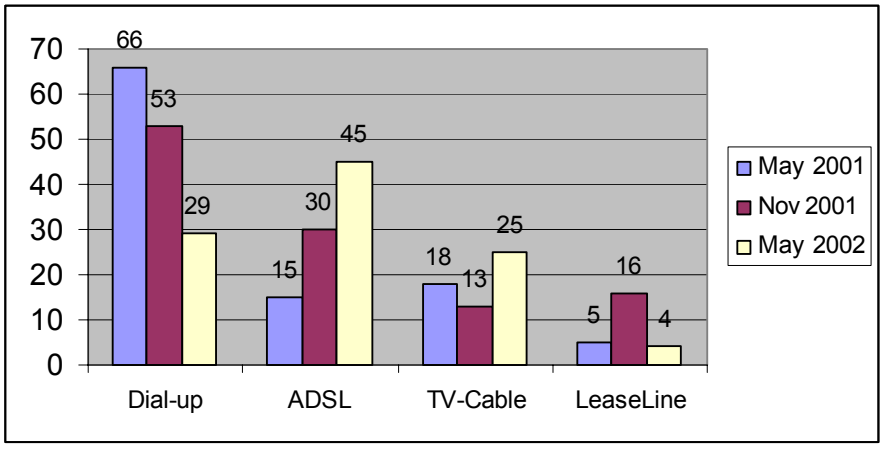
Figure 1.5 Main types of Internet connection in Flemish households, percentage of connections, 2001-2002



Source: Internet Statistieken Vlaanderen, May '01 - May '02 and Flash Eurobarometer 125, 2002. Note: For EU-15 multiple answers possible.

The rise in broadband connections is even more pronounced in companies than in households (Figure 1.6). Almost half the companies connected to Internet in May 2002, do this through an ADSL broadband connection. Most importantly, the dial-up connection mode is on a sharp decrease (see also section 2.2). For leased lines a sharp decrease was identified bringing it back to the level of the first measurement. Thus, the region experiences an overall shift from slow to fast internet.

Figure 1.6 Type of Internet connection in Flemish companies, percentage of those having connection, more than one type possible, 2001-2002

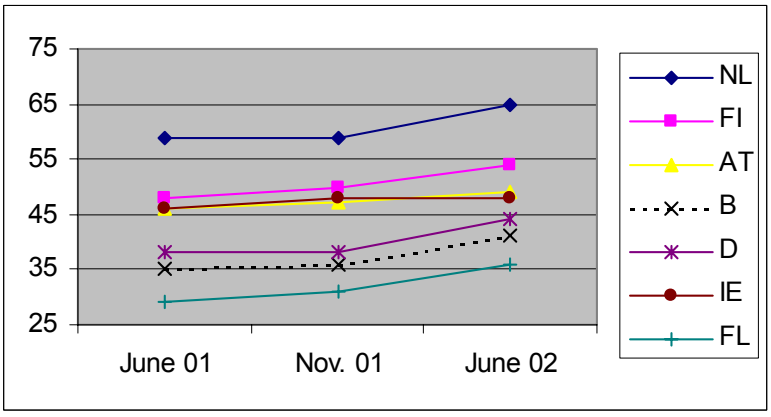


Source: Internet Statistieken Vlaanderen, May '01 - May '02

1.2.3 Citizens and the Information Society

Total penetration of Internet in households in Flanders is much lower compared to most European countries (Figure 1.7). Moreover, the trend over the last two years did not show a clear sign of catching-up, although the penetration rate has increased.

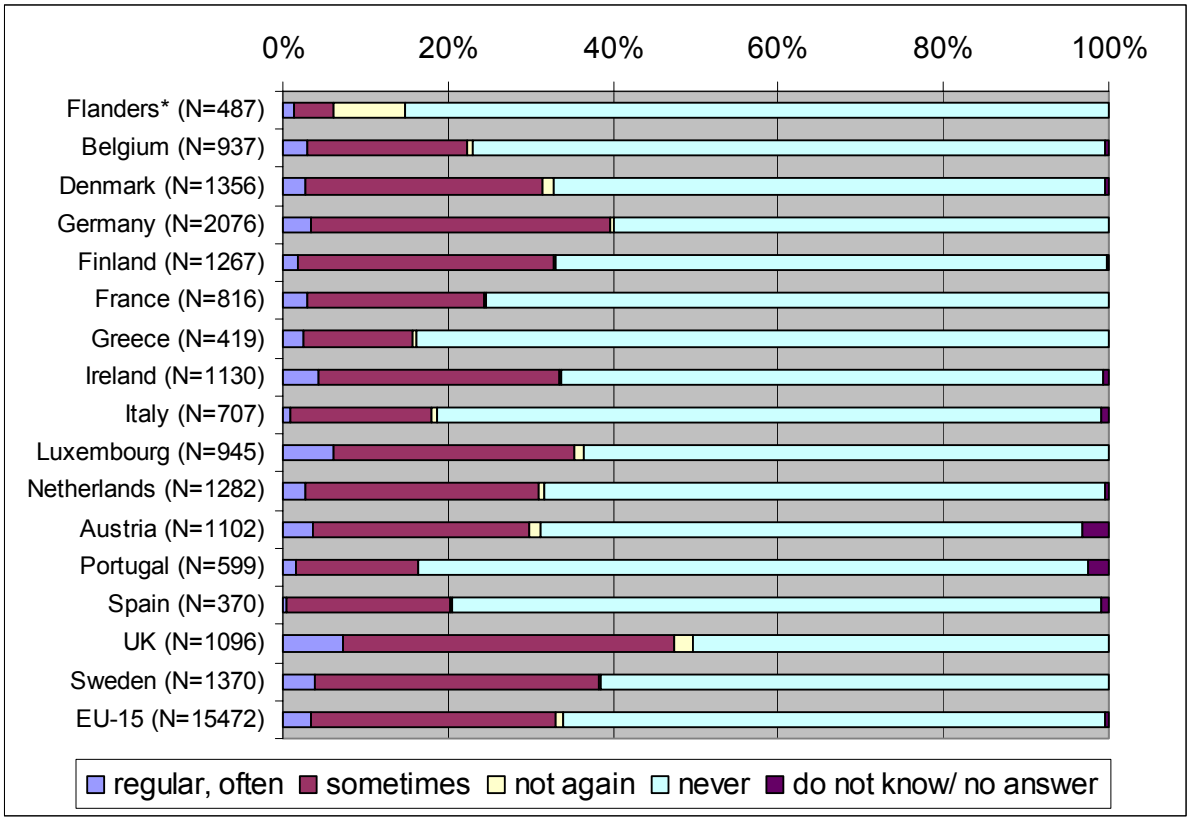
Figure 1.7 Internet penetration households, %, 2001-2002



Note: The survey for Flanders was in May 2001 and May 2002. Source: Flash Eurobarometer 125 and Internetstatistieken Vlaanderen, 3e meting

Besides access to Internet at home, the use of Internet for buying on-line by Flemish citizens is also strikingly low (Table 1.10). In 2001 more than 80% of the internet users never use it for buying on-line. Flemish citizens are not only weak users of Internet for buying-on-line, but count also the largest proportion of citizens in the EU, that have once tried to buy online but do not wish to do so in the future.

Table 1.10 Purchase frequency via Internet, percentage of Internet users in Flanders and EU Countries, 2001



Source: EOS Gallup Europe, MVG afdeling Media, 2001

According to data from a regional enquiry[1], the digital divide, by age, level and education (and less so by gender) is a reality in Flanders: the percentage of PC and Internet use in the categories of older and less-educated citizens, lies far below the overall figures for the total Flemish population (Tables 1.11 and 1.12). Other data on activities performed with PCs and Internet show that the rate of connection goes along with the intensity and diversity of use of ICT. To the question why they do not have a PC or Internet connection at home, most respondents state that they do not need them, or, as a second reason, that they are not able to cope with them. Differences in responses to this question are mostly linked to age and level of education, but not so much by gender, to the point that the analysts of the enquiry results state that "*this difference* (between mens' and womens' use of PC and Internet) *will probably completely disappear in a few years*" (VRIND[2], p.372).

[1] APS-survey, cited above.
[2] Vlaamse Regionale Indicatoren, 2001, Vlaamse Gemeenschap.

Table 1.11 Rate of PC and Internet use in Flanders, according to gender and age (2001)

	Total	Men	Women	18-24	25-34	35-44	45-54	55-64	65-74	75-85
Use of PC (% of population)	47.8	54.4	41.0	78.4	70.5	65.3	52.0	23.9	7.5	3.8
Use of Internet (% of population)	34.3	40.6	28.0	68.1	54.2	44	36.5	11.7	3.2	0

Source: VRIND (2001)

Table 1.12 Rate of PC and Internet use in Flanders, according to level of education (2001)

	Total	No or primary	Lower Secondary	Higher Secondary	Tertiary (non-univ.)	University
Use of PC (% of population)	47.8	8.7	36.9	61.7	83.9	86.7
Use of Internet (% of population)	34.3	4.5	26.8	42.7	62.8	72.3

Source: VRIND (2001)

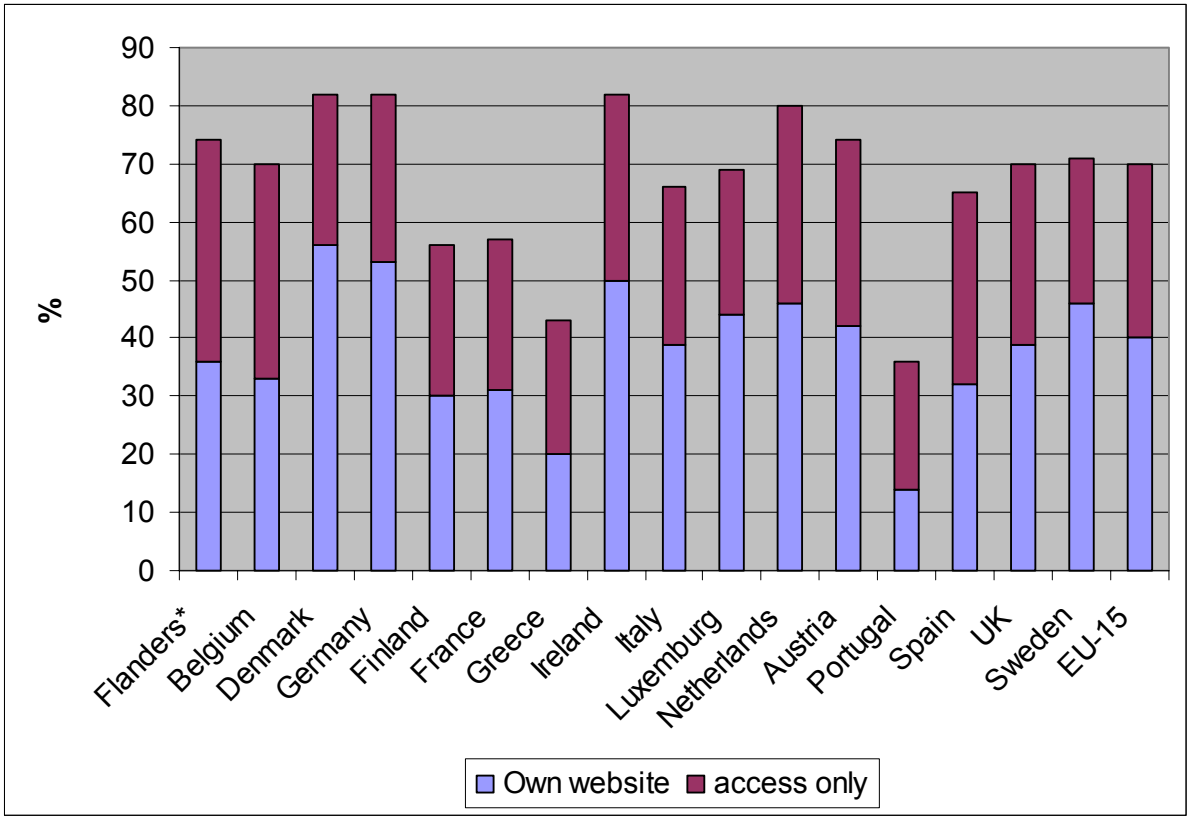
1.2.4 SMEs and the Information Society

A number of indicators show that SMEs in Flanders, as compared to SMEs elsewhere in Europe, achieve average results with regard to their integration into the Information Society:

- The proportion of companies with Internet access lies just above EU average (Figure 1.8);
- The proportion of SMEs with own Internet website is below European average: 36% as compared to 40% (Figure 1.8);
- The proportion of companies[3] with an Intranet connection is well below EU average: 20.4% as compared to 56.7% for the EU average (ICT-Monitor, 2001);
- Belgian firms are lagging behind in e-commerce practice: only 12% use Internet for procurement (as compared to 42% in the EU in average), and 19% for sales (as compared to 49% in the EU) (De Vil et alii, 2002). A relatively passive use of Internet by Flemish firms is evidenced in Figure 1.9, showing also the tiny share of firms active in e-commerce in the region. An enquiry conducted by Cisco Belgium in 1999 delivered the same message: 40% of companies had not interest whatsoever in e-business at the time of the enquiry (Aelbrecht, 2001).

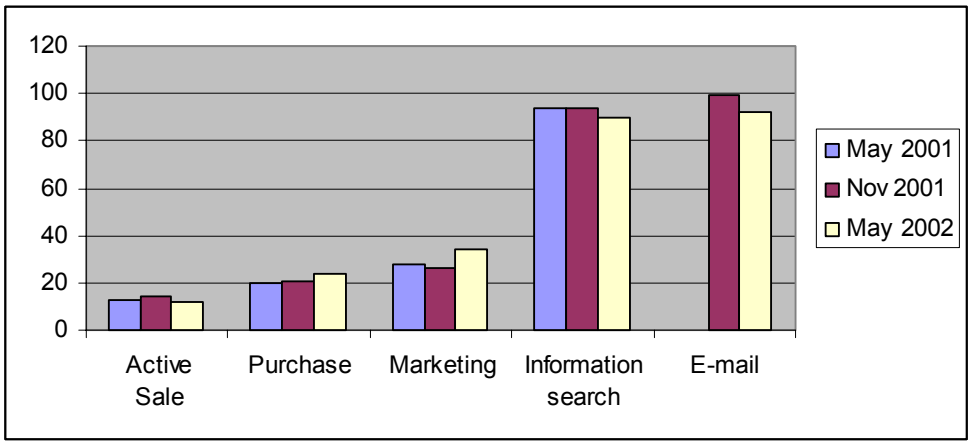
[3] Those figures refer to all companies, rather than SMEs.

Figure 1.8 Internet at SME's in Flanders and European countries, % own web-site and % access only, spring 2000[4]



Source: Eurobarometer, MVG afdeling Media

Figure 1.9 E-commerce activity for Flemish firms, 2001-2002



Source: Internetstatistieken Vlaanderen, 3e meting (2002)

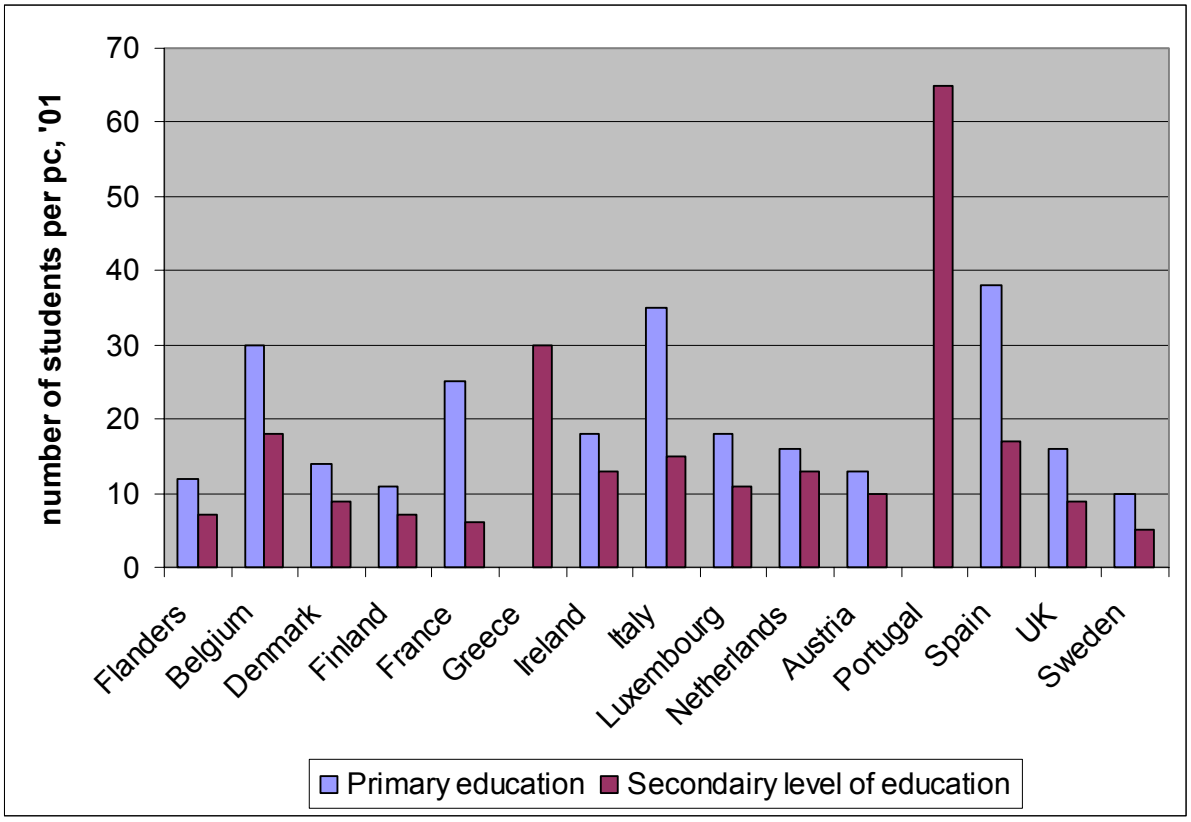
[4] Size limits for SMEs in the Flemish enquiry is 200 employees, while for the EU it is 250 employees.

Those figures show that Flemish SMEs have undertaken some catching-up with regard to the access to Internet, but not really in terms of developing an active use of its possibilities.

1.2.5 Schools and the Information Society

Flanders belongs today to the European leaders in terms of school connections to Internet and number of students per computer (see Figure 1.10; note that a low number shows a good performance) and performs much better than other Belgian regions on those two aspects. This current situation shows a strong and recent catching – up, to be linked to voluntary policies (especially the PC/KD project) put in place by the government in Flanders (see section 2.1).

Figure 1.10. Number of pupils per PC at schools in Flanders and EU countries, 2001



Source: Commission of the European Communities, Digikids, 2001

1.2.6 E-government

Regional data on e-government practices are scarce. Studies on this aspect usually focus on the national level (see Table 1.13). A recent European Commission study (European Commission and Cap Gemini Ernst&Young, 2002) analysed the degree of online sophistication for 20 public services. The enquiry reveals that the position of Belgium is systematically low on the availability of online public services, and particularly in the areas of:

- Income taxes (17th rank in a panel of 18 countries);
- Social security benefits (16th rank);
- Police declaration (17th rank);
- Enrolment in higher education (17th rank);
- Corporate tax (16th rank);

- VAT (13th rank);
- Customs declarations (14th rank);
- Public procurement (12th rank).

In only one area, environment-related permits, does the country belong to the best-rated countries.

Table 1.13 Ranking e-government achievements

Rank	Country	Score
1	USA	2,8
2	Singapore	2,4
3	Australia	2,2
4	Canada	2,0
5	France	1,6
6	UK	1,4
7	Hong Kong	1,3
8	New-Zealand	1,3
9	Norway	1,2
10	Spain	1,2
11	Germany	1,1
12	The Netherlands	1,0
13	South Africa	0,9
14	Italy	0,9
15	Japan	0,8
16	Ireland	0,6
17	Mexico	0,6
18	**Belgium**	**0,5**
19	Malasia	0,4
20	Brasil	0,2

Source: Accenture, 2001

At the municipal level, the situation is quite worrying too, according to a study carried out on 55 cities and municipalities throughout Belgium, by the research bureau AGConsult (Financieel Economishe Tijd, 8 November 2002). The main conclusions of the enquiry was that the websites of the municipalities were not sufficiently user-friendly: 85 % of them do not respond to the basic criteria to define this user-friendliness, and they were in general much lower scored that the average Belgian websites from other origins (out of which "only" 60% have failed the test). The main criticisms are that the information offered is very limited or difficult to find, even for basic information such as addresses and opening hours, and not organized to respond to citizens' needs and expectations.

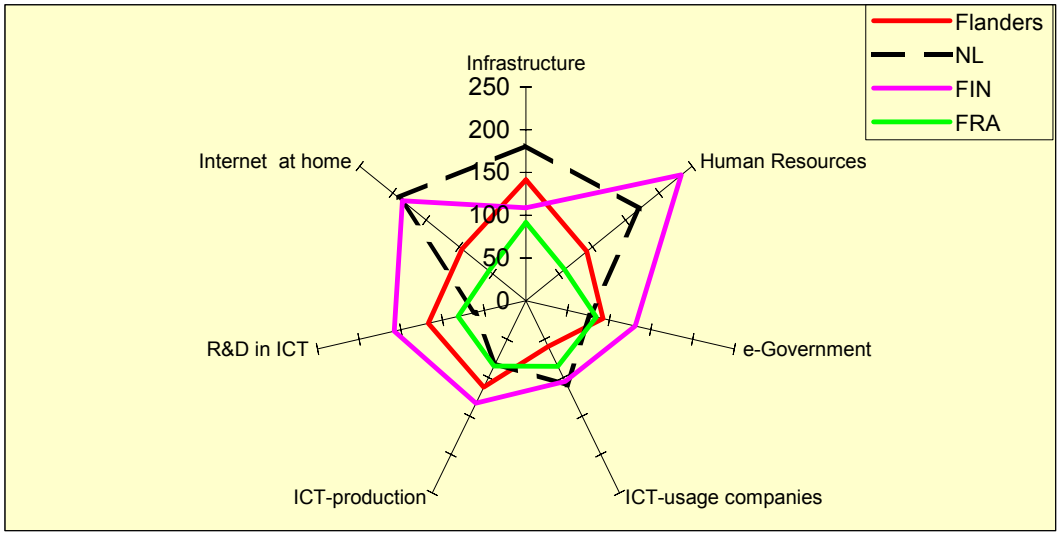
It is difficult to extrapolate the results obtained at national level to the regional level, as areas of competences, organization modes, resources, strategies, etc. differ a lot between federal- and regional-level administrations. Many initiatives have been taken by the Flemish government in recent years, in order to develop the scope and depth of e-government, but data to measure achievements are lacking. A positive indication is however given by e-Europe data which shows that the number of Flemish Internet users that have used the net for accessing government information in 2001 is higher, with 51%, than EU average (44.9%).

1.2.7 Summary of benchmarking exercises for Flanders as an Information Society

According to the Flemish "ICT Monitor" released mid – 2002, compared to the situation in Europe as a whole (EU15=100), Flanders is best placed on the infrastructure dimension, but

ICT use in companies and households is comparatively lagging behind. The other dimensions of the Information Society in Flanders do not differ significantly from the average in Europe, though they are generally slightly above average (Figure 1.11 and Table 1.14).

Figure 1.11 Benchmarking e-Flanders along 7 key dimensions



Source: ICT-Monitor Vlaanderen, 2002.

Table 1.14 Benchmarking e-Flanders along 7 key dimensions

IST indicators	Flanders	Bel.	EU+	NL	Fin.	Fra.
Infrastucture						
Internet-penetration companies, in %, 2001	**58**	49	63	65	95	69
Number of broadbandconnections per 1000 households, '00	**86**	103	45	117	30	33
Human resources						
No. of students sec. education per on-line computer '99/'00	**18**	14	15	15	8	22
Teleworking employees, %, 2001	**6**	6	6	14.5	16.8	2.9
e-Government						
% Internet-users use internet for Government-info, 2001.	**51**	50	45	47.5	42.6	49.3
% local communities with public website, '00	**40**	38	56	27	94	33
ICT-usage in companies						
% of firms with intra-net, 2001	**20.4**	…	56.7	61.0	59.0	50.0
SME's with internet (index: large firms = 100) 2001	**59.4**	72.0	71.7	80.0	76.0	59.0
ICT-production						
% share of value-added of ICT sector in GDP, '00	**7**	5.8	6.2	5.1	8.3	5.3
R&D in ICT						
R&D expenditure ICT sector, % of private R&D exp, '97	**37.8**	20.1	32.3	19.6	51.0	26.2
Internet at home						
Internet-penetration households, in %, May/June 2001	**29**	27.3	30.2	57.7	56.1	16.8

	Flanders	Bel.	EU+	NL	Fin.	Fra.
Infrastructure	**142**	153	100	182	109	91
Human Resources	**92**	104	100	171	234	58
*e*Government	**93**	89	100	77	131	84
ICT usage companies	**59**	100	100	110	105	85
ICT production	**112**	93	100	82	133	85
ICT Research and Development	**117**	62	100	61	158	81
Internet at home	**96**	90	100	191	186	56

Source: ICT-Monitor Vlaanderen, 2002.

Based on the above benchmarking exercise, we can estimate the position of Flanders on the ISI and IMD indexes[5], based on the identified 'distance' of Flanders to the scores of Finland on comparable indicators (see Table 1.15). The ranking of the countries are consistent across the three exercises. This brings us to an estimated ranking of Flanders between Canada and Japan on place 12 (see Table 1.16).

Table 1.15 Flanders in 3 Benchmarking exercises (estimates based on ICT-Monitor 2001)

BM exercices	Flanders	BEL	NL	FIN	FRA
ICT-monitor	87	81	89	100	60
IMD* (2001)	n.a.	70	89	100	63
ISI** (1999)	87 (est)	75	88	100	69

*Source: Wintjes, Dunnewijk & Hollanders, 2001; * World Competitiveness Report (IMD, 2001), http://www.weforum.org; ** Information Society Index.*

[5] Information Scociety Index; World Competitiveness Report (IMD, 2001), http://www.weforum.org.

Table 1.16 Benchmarking e-Flanders with 16 countries

Rank	Country	Score
1	Sweden	6,496
2	Norway	6,112
3	Finland	5,953
4	United States	5,850
5	Denmark	5,837
6	United Kingdom	5,662
7	Switzerland	5,528
8	Australia	5,382
9	Singapore	5,269
10	Netherlands	5,238
11	Japan	5,182
	Flanders	
12	Canada	5,126
14	Germany	4,937
15	Austria	4,868
16	Hong Kong	4,745

Source: Wintjes, Dunnewijk & Hollanders, 2001

The above findings were confirmed in an analysis of the ICT base in Flanders (PricewaterhouseCoopers, 2001), based on interviews. The infrastructure, ICT R&D and spin-offs dynamics are best rated. The "liberalisation of the telecom market" and "telecom costs" items came out as more problematic dimensions for Flanders, after the well-known argument of high overall salary costs, and together with the problem of shortage of ICT specialists in the market (Table 1.17).

Table 1.17 Rating of key indicators for the development of an ICT base in Flanders (2001)

Key indicators	Score, development
Firms environment	
Dynamics of ICT cluster	7 +
ICT office infrastructure	7 +
Availability of venture capital	8 =
Government	
Liberalisation of telecom market	5 +
Stimulation of R&D and innovation	8 =
Image of Flanders as an ICT location	6 =
Telecommunication infrastructure	8 +
Knowledge institutions	
ICT education	7 =
ICT R&D	7 +
Spin-offs/incubators	7 +
Population	
ICT specialists in labour force	5 +
ICT penetration and use	6 +
Regional costs structure	
Salary costs	4 =
Telecom costs	5 +
Real estate costs	8 -
Company tax	6 =

Source: PricewaterhouseCoopers, 2001

Note: Rate of 8 means that the development is sufficient to place the region favourably in Europe, rates lower than 8 indicate shortcomings that need to be overcome. The sign after the rate means: + positive evolution, = stable, -: negative evolution

1.2.8 Conclusion

Overall, the various elements analysed in this first part of the report deliver a contrasted view on Flanders' position as an Information Society. The region is very wealthy and possesses all the necessary pre-conditions for a development based on the exploitation of ICTs: it is a centrally-located and urbanised region, with high quality human capital, an open and well-performing economy. Turning to ICT-linked dimensions, analyses show that Flanders reaches at least the average European level for many aspects of the "Digital Society", but also that achievements are not similar according to different facets of this society:

- Flanders is strong in ICT infrastructure developments, with notably a leading position in broadband infrastructure (TV-Cable & ADSL) and, e.g. PC equipment in schools (although this is fairly recent).
- It also hosts a reasonably important ICT sector, with remarkable spin-offs dynamics in some places, and shows relatively high rates of private and public R&D expenses in ICT;
- This strong position is not matched with similar rates of ICT-use, notably the use of internet by households and (especially small) companies, and also with regard to e-government practices[6]. Flanders is even at the bottom of the European league concerning the rate of consumers buying on-line, showing a lag in the private use of Internet;
- There are signs of a digital divide, as a comparatively large share of the population is not yet accustomed with ICT applications.

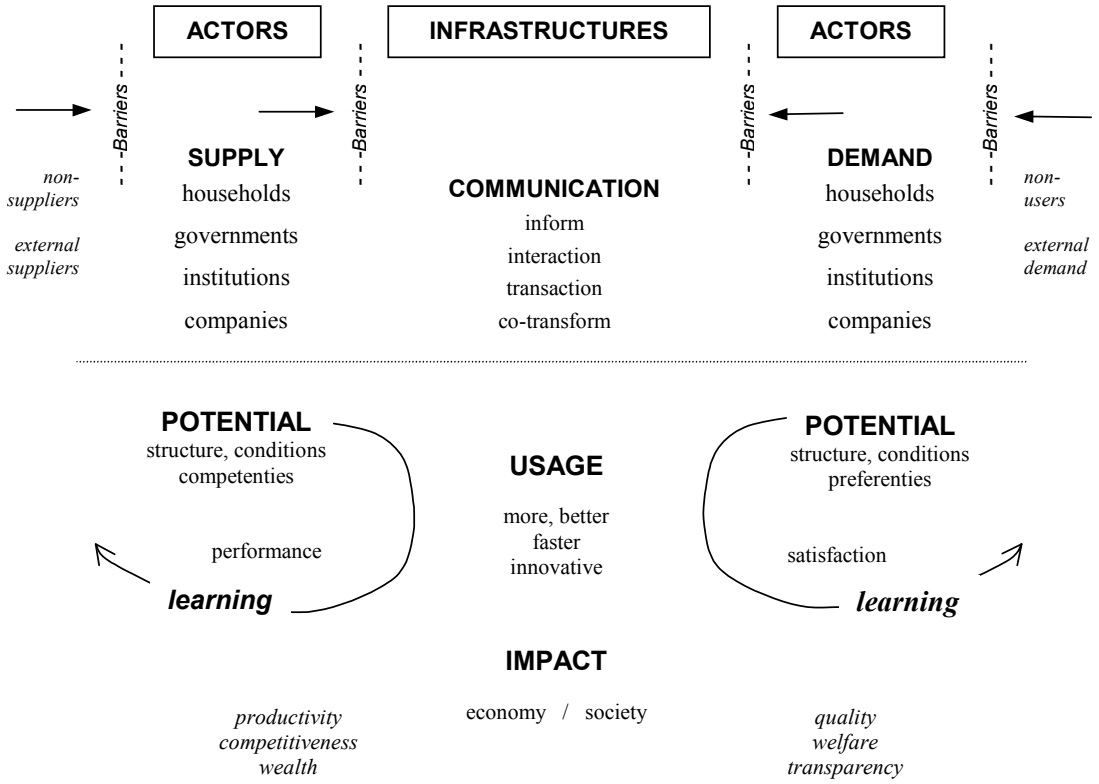
Thus, **potential** for the IST developments in Flanders is stronger than effective and diffused **usage** (Figure 1.12). Society at large has not realized at full the potential for developments thanks to those IST, which are therefore under-exploited.

On several factors which in the traditional linear conceptions could be labelled as 'input' factors, Flanders scores rather well. This raise the question why Flanders does not perform better on several non-economic aspects that have an impact on the digital Society at large. Or, as Aelbrecht (2001), the general director of Cisco Belgium, has put it: the fundamentals of e-Belgium are there, but there is a lack of "sense of urgency", so that the country has "missed the first Internet train"[7].

[6] A notable exception is the banking sector, that has been a pioneer in the use of ICT.

[7] As an allusion to the fact that Belgium was pioneer during the industrial revolution, and was the land where the first steam train was put on tracks.

Figure 1.12 Potential, Impact and Usage in the Information Society



Source: ICT-Monitor Vlaanderen, 2002

The traditional idea of what leads towards success in Information Society developments, is based on a linear view on innovation processes. In this traditional linear view, development starts with research in ICT, production of ICT-hardware, ICT-software, diffusion of ICT to other sectors, and finally to usage in society at large.

However, in a widely adopted more interactive and systemic view on innovation processes and technology diffusion, the emphasis has shifted from technology-push and production of ICT-hardware towards recognising the importance of demand and the societal aspects because of the pervasiveness of ICT. In this more interactive, demand driven, and systemic view, it is in the end hard to distinguish input from output factors, e.g. in the systems model, innovation may stem from any department of a firm, any sector of the economy or any part of society.

The question to be tackled in the next section of this report is thus: what are the assets and bottlenecks in the Flemish Information Society system ?

2 Success and failures factors for Flanders in Information Society

The second, core question of the study, is that of identification of reasons behind the more and less successful aspects of Information Society in Flanders. Inevitably, because of the multi-dimensional character of Information Society, one has to come with a host of explanatory factors, rather than with a single-factor approach. Economic, historical, social, cultural, institutional, geographical factors all exert a, potentially important, influence on the IST-related developments. In the paragraph below, we propose three main "explanations" or "key driving forces" that we believe exert the most determinant influence on the building of Flanders as an "e-society". Some other dimensions, like the labour market, the composition of the industrial fabric, the costs structure, or the geographical conditions, are not elaborated on here, not that they do not have any importance for the question at stake, but because we believe the three driving forces, taken together, are particularly specific to the Flemish situation, and sufficiently powerful to explain why a somehow unbalanced Information Society development, as described in the previous section, can be diagnosed for this region.

These three critical driving forces are:

1. The "Flemish identity push"
2. The Telecom market and infrastructure
3. ICT-relevant behaviour and attitude.

These three critical forces all involve institutional aspects, economic aspects and cultural aspects. This section is organised in three parts, one for each driving force, for which we subsequently examine the politico-institutional, economic and cultural aspects. The arguments are presented synthetically in Table 2.1 below. They will be examined in detail in the following sections.

Table 2.1. The three driving forces behind the Flemish Information Society and their politico-institutional, economic and cultural aspects

3 driving forces	Politico-institutional aspects	Economic aspects	Cultural aspects
1 "Flemish identity push" Section 2.1	2.1.1 Pro-active policy moves in a complex institutional structure. Recent moves to less linear views on Information Society	2.1.2 Promoting knowledge creation in ICT (IMEC), promotion of clusters impulsing endogenous dynamics	2.1.3 Pro-active promotion of Flemish content in a market with under-critical size: a vicious circle for slow developments?
2 Telecom market and infrastructure Section 2.2	2.2.1 Publicly-led move to make room for Telenet to introduce competition in telecom-market and exploit advantages of the cable density	2.2.2 Dominant position of historical operator, curbing early developments but favouring new ones on the broadband	2.2.3 Responding to the diversity in modes of usage of NICT: the Interactive TV as a solution to the digital divide ?
3 ICT-behaviour and attitudes Section 2.3	2.3.1 e-government initiatives faced with: problems of trust in public institutions, perceived bureaucratic burdens, and complex institutional-structure	2.3.2 Are innovation moods, entrepreneurial environment, education models, and ICT flagships, barriers to develop an ICT-based economy ?	2.3.3 Preferences for the "real" over the "virtual", including real benefits: building a more adapted Information Society model for Flanders ?

2.1 The "Flemish identity push"

The Flemish political leaders have been active promoters of the deep decentralisation of competences that now characterises the country under its federal structure. As mentioned at the start of this report, the Flemish Community has thus progressively gained its own autonomy of decision in most of the areas of importance for the development of Information Society (economic development, land planning, culture, education, etc.), with the notable exception of the regulation of the telecom market, maintained as a federal competence.

With these competences acquired during the eighties, the Flemish Community has decided to take the construction of a "high-tech" image for the region has an important strategic move.

This has consistently been, and still is, part of the project pursued by the successive regional governments: as a result, many programmes and instruments have been implemented in the last two decades to support the advent of the so-called "third industrial revolution" in Flanders. These policies have influenced and supported the development of the Information Society infrastructure, and, subsequently, applications. Multimedia applications promoting the Flemish culture and language have notably been given high priority on the regional policy agendas.

Thus, "High Tech Flanders" as a strong political project, with the aim to forge a distinct Flemish identity, is a strong driving force behind the development of the digital society in Flanders.

However, until recent times, this strong policy drive led to a focus of attention to infrastructure developments and image building (with, e.g. the "technology valleys" concept), but less to real aspirations from potential users. A new balance is appearing now on the policy agenda with the current e-Flanders and other programmes, but the direction of past policy efforts have undoubtedly influenced the present situation, as described in the first part of the report: strong infrastructure and potential, but relatively low rate of usage.

Furthermore, this institutional structure that made those pro-active regional policies possible, also can act as a barrier for the full development of the Information Society: the complicate public governance structure makes it notably more difficult to implement user-oriented e-government applications.

2.1.1 Pro-active policies in a complex institutional structure

The Flemish Community has progressively gained a lot of autonomy in major competence areas impinging on the development of Information Society. Pro-active regional policies have been implemented, that impacted favourably on Flanders' ICT infrastructure and production of ICT hardware, along the lines of the "Flanders Technology" and the "Third Industrial Revolution" in Flanders, the symbols for the new direction that the region needed to take to support its economic take off.

Before going on and looking at those policy efforts, it is worth noting the difficulty to conduct such pro-active policies for Flanders, linked to the institutional profile of the country. Indeed, there is a distance between the institutional and the economic definitions of the regions in Belgium. While Flanders and Wallonia are institutionally independent from the Brussels-Capital region, much activities of direct relevance to Flemish and Walloon actors are located in this region. Easy communication and small size of the territory reinforce the intensity of economic exchanges between the capital-region and the two others. In relation to ICT-developments this is an important aspect because ICT developments are often highly concentrated in core-urban areas. Therefore the two main Belgian regions are confronted with this uneasy situation, that the area of action of some of their policies stop at the borders of the place where critical development take place. The territorial logic, that lies behind the definition of the regions in Belgium, is indeed not very appropriate when it comes to ICT. And the capacities of the small bi-lingual Brussels-Capital region has for long been limited by lags in the definition of an appropriate governance system, thus making it difficult to develop co-operation agreements on a partnership basis. However, the "Community" competences of the Flemish Community (mainly education and culture) can be deployed on the Brussels region, in as far as they concern members of this Community (universities, for example).

Another consequence of the complicated institutional structure of the country is the difficulty in proposing e-government initiatives. As an example, the electronic identity card is a

necessary step to take to allow citizens to communicate with their authorities for a number of operations. As the federal level, the Regions, and the Communities need to agree on such a project, this makes in total 6 entities with their own government, parliament and agencies (federal state, three regions and three communities)[8] that need to develop a consensus on this project.

Despite these institutional complexities, Flemish policy-makers have been active in supporting a number of moves with important consequences on the development of Information Society. Most analysts of the Flemish Information Society pinpoint the high level of policy-awareness in this area. Since a number of years now, it can be claimed that policy-makers have appraised the importance of IST-related advances for the overall development of the region. From a national perspective, this region is certainly ahead of the other two Belgian regions in this area, both with regard to depth and continuity of policy moves.

Going back to the eighties, when early movers in Europe and elsewhere started to make their plans and develop their high-tech base, the situation seemed to be rather unfavorable for Flanders. At that time indeed, the country was busy organizing its new federal structure, rather than launching plans for building up the fundamentals for the Information Society to come. Therefore, national IST-plans in the 80's and early 90's have been quite modest compared to national policies elsewhere in Europe

However, when Flanders began to acquire more autonomy, the policy circles of the time had the idea to develop the image of a new region, based on new technologies, as a flagship for its new identity. The "Flanders Technology" program was launched in the eighties, around bi-annual gigantic fairs showing the high-tech assets of the region. But it rapidly appeared that more should be done to stimulate high-tech developments in the region.

Successive policy initiatives were thus implemented under the newly acquired autonomous competencies. A timeline of the main initiatives and programs is shown in the conclusion. Those programs are:

- The Third Industrial Revolution in Flanders (DIRV) – 1985-1992: a large multi-annual framework program encompassing the various initiatives to push technology developments in the region;
- Creation in 1984 of a large regional research center, IMEC, a leading research center specialized in fundamental and applied research in micro-electronics. Part of the missions of IMEC is to develop relations and services for the Flemish businesses, in the area of ICT, including the incubation of research spin-offs (IMEC is discussed in more details below);
- Flanders Technology, the big regional technology fairs and awareness-raising events for the "high tech", organized with a lot of media coverage and publicity at the end of the eighties and beginning of the nineties;
- Clusters, later transformed into "Technology Valleys", policies, with the aim to support the creation and growth of agglomeration of firms specialized in related activities and technologies. Most recently, VIS became the more generic policy tool to promote clustering.
- The Medialab program (launched in 1994), a research and demonstration center specialized in the analysis of the societal aspects of multimedia technologies;
- Impulse programs in areas related to ICT developments, e.g. the Action Program for Information Technology ITA (1995-1998, and 1999-2002), supporting R&D projects by

[8] The total is 6, since the Region of Flanders and the Flemish Communities have merged.

enterprises in the ICT field, with the aim to reinforce the competitive position of Flemish companies in those sectors;

- The Multimedia Demonstration program (1998), offering support to firms, associations, education establishments, etc. for demonstration programs;
- Creation of a second telecom operator covering the region, Telenet, with a broadband network based on the exploitation of the TV cable, in 1996 (first operation in 1998) (discussed in more details in section 2.2.1);
- The PC-KD program in 2000, with the aim to equip schools with PCs and train teachers as well;
- The KMO-ICT plan (2001), aiming at reinforcing familiarity and absorption capacities for ICT in SMEs;
- The global Flemish portal site for e-government;
- A recent important program for the development of e-government applications;
- The "Digital Home Platform" project, run by e-VRT (the R&D company of the regional TV operator) launched in 2000, with the aim to offer interactive TV services as a complement to traditional forms of access to Internet and electronic services, currently in a pilot test phase with 100 households in Flanders.

The observation of the evolution of these policy moves shows a growing awareness of the need to pay priority attention to users' needs, in conjunction with technological developments.

Currently, the policy statement of the latest elected government in 1999, and subsequent policy programmes of various Ministers all underline the wish of the Flemish government to sustain efforts in the view of placing the region firmly in the lead group of regions in the new digital society. Recently, the e-Fl@nders (Digital Action Plan Flanders) has been developed as an overall framework programme to reach this goal. The spirit of this policy (launched during the period in which Belgium chaired the EU) is very close to that of the e-Europe action plan 2002. Besides the ambition to move ahead towards a leading position among countries in Europe along the e-Europe indicators, the e-Fl@nders initiative puts a stronger accent on the struggle against digital exclusion, and on the economic importance of the ICT sector. The priorities of e-Flanders are:

1. High quality and accessible infrastructure
2. Top quality human resources
3. Development of key aspects of "Digital Flanders":
   - e-government
   - ICT use in companies
   - R&D in ICT
   - Development of an ICT industry through growth of starters and existing enterprises
4. Inclusiveness and democratization of information society

In addition to these four action lines, a fifth aspect of the programme consists of monitoring activities, e.g. in order to produce regional-level statistics on the Information Society in Flanders.

This framework programme for Information Society in Flanders, testifies the gradual move from infrastructure and hardware aspects, towards the diffusion and usage of ICT in the wide population. It has as an explicit goal to help the region catch up with the development of other regions in Europe. It also shows a willingness to come up with more "holistic" Information Society policies, creating synergies and complementarities between the actions of various governmental departments, rather than seeing it as a vertical area that "belongs" to one Ministry or administration. Whether this challenge will be met despite the traditional departmentalisation of ministries, is an interesting aspect to observe for the future. At the moment of writing this report, the ministries were organising the set-up of a cell in charge with this horizontal co-ordination, but was still at a preliminary stage of operation.

From this historical view on IST-related policies, one hypothesis for the good performance of Flanders in the development of an IST infrastructure, is thus the explicit political will to undertake a pro-active regional policy in this area. According to some view, "*without the political will 'to do something' in this field, the Flemish community would still be lagging behind*." (van Bastelaer et al., 1997). Most of the experts interviewed for this project shared this opinion.

While this sounds like an overall positive approach, the fact that Flemish policy approaches have, during a long time, put an imbalanced emphasis on the support to ICT production and infrastructure, at the expense of policy instruments for ICT diffusion and appropriation in the private sector, has still its impact on the present situation. The study of the multimedia sector in Flanders in 1997 concluded that "(*public promoters') initiatives are mainly concentrated on hardware and technology. Roughly only 10% is devoted on software and content*" (van Batselaer et al., 1997). Recent policy moves under the e-Flanders, the PC-KD or the KMO-ICT programmes, show a willingness to correct those weaknesses.

2.1.2 The economic aspect: promoting 'high-tech' clusters in Flanders

One remarkable element of the public strategy to promote a "High-Tech" Flanders, is the creation of IMEC, a leading research centre on ICT. Besides performing excellence research in this area, the idea is also to favour new firms creation and economic spill-overs around this high-tech node. The support to the creation of an ICT sector to renew the industrial fabric is also part of this strategy, notably through the promotion of the so-called "technology valleys". Nowadays the concept of "technology valleys" has been transformed into the more modest "Flemish Innovation Co-operation Platforms", with the same aim to create synergies between regional actors in innovative activities, with perhaps less accent on the policy side, on visibility, but more on tangible results. Positive cluster dynamics in ICT are indeed present in the region, and favour endogenous growth potential, in a region dominated by the operation of multinational companies.

2.1.2.1 IMEC: a key actor for knowledge creation in ICT

One crucial element of the Flemish Technological and ICT policy is the creation in 1984 of an international excellence centre in microelectronics, IMEC. IMEC's mission was to perform scientific research that runs 3 to 10 years ahead of industrial needs in the area of microelectronics, nano-technology, design methods and technologies for ICT. With a staff of over 1200 persons and turnover around 120 Million €, IMEC is now the largest independent research centre on micro-electronics in Europe and one of the largest in the world.

The title of a recent evaluation of IMEC pinpointed the challenge faced by this institutions "Tackling the paradox: can attaining global research excellence be compatible with local

technology valorisation?" (Van Helleputte and Reid, 2002). The evaluation found that the scientific quality of service given by IMEC to most advanced, largest companies involved in ICT (mainly through research contracts), was very high, while the transfer of knowledge to smaller companies was hampered by their limited absorption capacities. Thus the bottleneck here does not seem to lie in the supply of new knowledge, but rather in the demand from companies. Another bottleneck for the diffusion of new knowledge from IMEC to Flemish companies, is the small size of the regional market for this research institution. The creation of spin-offs is a successful aspect of IMEC's mission, notably since the creation of an IT-oriented group of venture capitalists was added to the strategy. This is the most visible result in terms of "return on investment" for the policy-makers, and it has been reinforced beginning of 2002 with the creation of a new department on "industrialisation and incubation" with the aim to reinforce the flow of know-how and technology to Flemish SMEs. A less visible sort of spill-over concerns the high rate of labour-mobility (17% change per year on average). About a third of the attracted new talent comes from abroad; while between 65-70% of the people leaving IMEC find new jobs in Flanders.

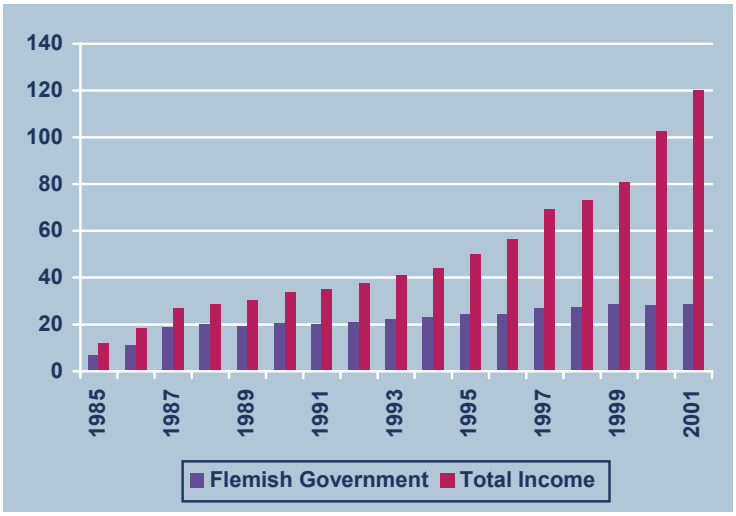
Moreover, a sophisticated model of IPR management was introduced[9] in order to increase the possibilities for regional contract-research, and recently IMEC proposed the creation of specialised 'ADS' (Application, Diffusion, Support) cells which will have an interface role between the scientific personnel of each division and SME's. In short, the evaluation found out that IMEC's mission of new knowledge creation is a success, while local technological valorisation less so, and that this is not so surprising because the two types of missions are not necessarily fully compatible under one roof. This analysis is coherent with the diagnosis above, of a region strong in ICT research and production, but less strong in ICT diffusion throughout the whole economy. But one can hardly blame IMEC for being successful in its main mission.

In 2001, IMEC's self-generated income (apart from the Government grant) rose by 22% to 91.1 million €. Today, IMEC generates 76% of its total budget, the remaining 24% being funded by the Flemish community (Figure 2.1). The financial sustainability of this institution looks thus high.

IMEC's income from international bilateral contracts amounted to 40 million € in 2001, which accounts for 44% of IMEC's self generated income. The income from bilateral collaboration with 72 Flemish companies grew in 2001 to 30.27 million € or 33% of IMEC's income generated from the market (Figure 2.2). The increasing importance of the Flemish industry matches the mission of IMEC to also support technology development in the Flanders region, and it is a remarkable performance given the strong trend of globalisation regarding the other part of the mission. One explanation for the increase in regional contract partners is that the share of the number of new contract partners outside the ICT and (micro)electronics industries has increased to some 30 percent for the period of 1995-2000, this development points at the multi-purpose of the technologies concerned.

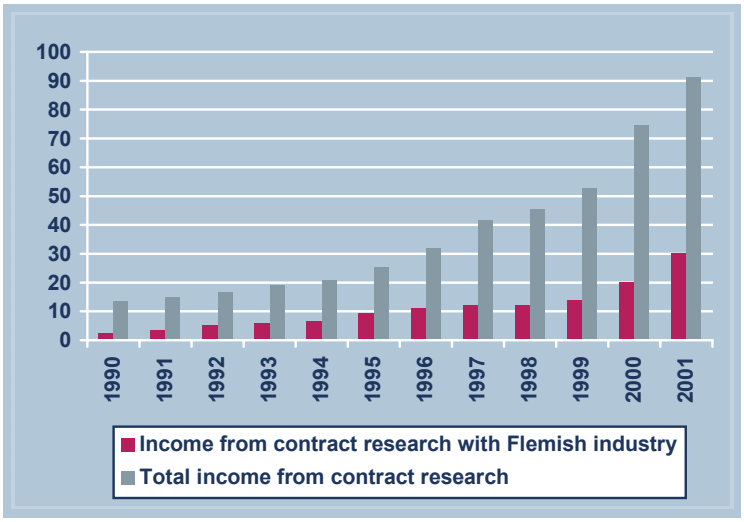
[9] See "Trends in the ICT world and impact on IPR – the IMEC case" (Van Helleputte & Robeyns; OECD, forthcoming)

Figure 2.1 Evolution of IMEC's total income 1985-2001, in million €



Source: Van Helleputte & Robeyns (forthcoming)

Figure 2.2 Evolution of total income from contract research between 1990 and 2001 vs evolution of income from contracts with the Flemish industry in the same period



Source: Van Helleputte & Robeyns (forthcoming)

A tricky question on the role of IMEC in the overall development of Information Society in Flanders is: what can be the effects of a concentration of resources on a single institution? Are the economies of scale (and scope) likely to offset possible lock-in effects? Is the focus on the "centre" compatible with attention to wide diffusion? This discussion resembles the dilemma other countries have with their 'National champions'.

2.1.2.2 Flanders Language Valley: Development of a localised node in a globalising network of ICT Clusters

Flanders Language Valley (FLV) is an ICT cluster which had developed between 1994-2000 in Ieper, a town situated in the rural periphery of Flanders. During 2000 this ICT cluster entered a crisis due to corruption and financial problems, mainly concerning its core firm Lernout & Hauspie Speech Products (L&H). After describing three phases of development, we discuss several lessons which can be learned from this case.

The first phase in the development of Flanders Language Valley concerns L&H, a pioneering ICT firm. Its founders Jo Lernout and Paul Hauspie made the initial choice of technology and location. After several years of work outside Europe, they returned to their home region, met in Ieper and decided to do business together in language- and speech technology in 1987. Jo Lernout had worked with Bull & Wang computers on a technology to codify natural speech, but it focused exclusively on English. Within the multilingual context of Belgium and Europe, L&H focused on a multi-lingual technology. They started their company in a building set up by the regional development agency (GOM) as a regional employment project. The first years of research and development were funded by 'regional' and mostly informal Venture Capital, which accords with the inherited entrepreneurial mentality this area in West-Flanders is famous for. GIMV, by then the Flemish regional Investment Company was the first main institutional investor.

During the growth in 1994 L&H sold licenses, opened offices in the US and started to acquire other pioneering companies. After years of internal orientation, the autarkic, closed mentality made room for a network mentality. In the beginning of 1995 L&H got many requests from clients wanting access to their R&D core, the language laboratory in Ieper. A lot of small firms had signed license agreements in order to integrate L&H technology with their own technology. Therefore, clients began visiting Ieper, usually for several months.

After L&H had adopted a network mentality a second phase started with the FLV initiative in 1995. A venture capital fund (the FLV Fund), focusing on speech and language related technology applications, was part of the concept. About 50 companies from Asia, the US and Belgium contacted FLV Fund. Out of these requests six to seven concrete opportunities were selected. This is an important point, since the screening procedure typically canvasses the opinion of L&H and the other firms in order to validate the technological and commercial capabilities of potential candidates to see if there could be some common interest or complementarity. After only three years of dynamic technological clustering through licensing, and financial clustering through participations, several language and speech related technology firms had clustered in a geographical sense. In 1999 the first group of firms were located at a Campus on a 65-acre business park in Ieper. The favourable communication conditions induced localised innovative linkages. Companies 'found' each other at FLV to their mutual advantage. They learned from each other and benefited from using and developing common pools of resources in proximity, e.g., companies found employees in the 'collective pool of labour' created by many education and training programmes. In 2000 more than 40 young, growing, innovative, FLV firms were listed in the FLV Fund portfolio of which a dozen are supported by the incubation services of the FLV Foundation. The two most important tasks of the foundation in those days were to create the infrastructure and to increase the availability of human resources for language and speech technology in the region. The Foundation was subdivided into 12 organizations. FLV Education took care of many training and education programmes in co-operation with several other existing training institutions; FLV Finance co-ordinated the start-up activities of a number of local Business Angels; FLV Telecom provided telecommunication infrastructure. Thousands of high-bandwidth internal access-points were installed at private households in the vicinity, in

exchange for active participation in testing of products of FLV companies. As a result even more interactive user-producer relationships were localised within the regional tissue of the Ieper area.

As of November 1999 the cluster announced to enter a third phase, one of exploitation. The foundation had planned to replicate and localise the FLV concept in 9 international centres of excellence, aiming for a worldwide network of centres. The financial and management crisis at L&H in 2000 has however brought the development to a halt.

Three key questions can be asked in face of this (aborted) success story:

1. Why did FLV develop in such a small, relatively isolated rural area and not in a region with a much stronger knowledge base, such as Leuven (where IMEC is located)?

It seems that the technological idea and assistance for L&H was destined to come from foreign sources so, from a technological point of view it did not really matter if the company was located in a bigger centre in Belgium or not (apart from the fact that an airport might have been convenient). However, the entrepreneurial spirit, the availability of venture capital in the region and the multi-lingual aspect can be conceived as regional specific advantages on which the success of L&H and its technology is partly based. Actually the strong family-oriented business ethic seemed crucial with regard to the faith of local private investors putting money into their vision, i.e.: would Lernout and Hauspie have succeeded in persuading local butchers and bakers in a community they were not familiar with, like Brussels or Leuven ? Social links drew and 'tied' them into Ieper. Another point is the fact that the human resources needed by the cluster were scarce in other regions as well, so the cluster firms had to invest in training and education anyhow and the presence of a large unused labour reserve in the Ieper area may have helped in this respect. This 'answer' has an important policy implication, with potential relevance for candidate countries: despite the crisis, the FLV case shows that even peripheral regions without a strong and preferably diversified knowledge base may have an inherent potential to generate innovative clustering in a modern industry. Moreover, from a public point of view it did not cost a lot of public funds to get the clustering process started.

2. Why is it that geographical proximity remained important in the case of FLV?

When explaining innovation clusters quite often reference is made to tacit knowledge and un-tradable technological interdependencies. In the case of FLV one would expect that the knowledge at hand could be codified and sold through licences? However, the FLV case shows that even the exchange of codified knowledge in the form of licence agreements can be a highly localised learning process. As "we can know more than we can tell" (Polanyi 1966, p. 4), L&H knew more than it could sell and their clients wanted more than they could buy through licenses. The need for face-to-face contacts in order to better interact and exchange the tacit knowledge which is used to combine the codified knowledge started to attract other firms with similar and complementary technologies to Ieper. Over time, later in the life, whether it concerns the life of a young firm, cluster or technology, more and more tacit aspects may become codified and standardised. The idea that firms and clusters evolve and mature, suggests that private and public policy has to evolve and mature accordingly: e.g. through providing a learning opportunity early in life by investing in infrastructure and education and support 'start-ups'. Later on, a reduction in market failures weakens the arguments for policy intervention.

3. What then is the role of public policy?

Although FLV received public support and FLV has even served as a flagship of Flanders cluster and high-tech policy, FLV is not a policy invention. Although the present crisis of

FLV does not seem to be based on problems related to technological or locational choices, it does question public support to this very risky kind of clustering. A policy lesson then is that the clustering may have been too much, too fast or too specific in technological, organisational or geographical sense. The FLV case shows that the new network economy offers opportunities for economic entities (firms, clusters or regions), which lack a strong and diversified knowledge base to overcome the problem of 'critical mass' by opting for a highly specific 'niche'-strategy. However, referring to Arthur's law of the New Network Economy: "of networks there will be few" (often translated in "the winner takes all"), there is a high risk of supporting a cluster that does not win. Another policy option would be not to frustrate private peripheral 'experiments', and provide a more generic temporary support to start-up phases, focusing on infrastructure and education, which may still be useful in case the clustering firms fail to survive or in case they leave.

2.1.2.3 Positive clusters dynamics help construct true endogenous dynamics in an economy with large degree of foreign control

An hypothesis for the good prospects for ICT sector development in Flanders could be that cluster dynamics are at work, that provide a favourable context for new companies creation and the development of synergies between existing and new firms, as well as other actors (research and training institutions). IMEC played an important role in initiating and nurturing some of those clusters dynamics, in attracting foreign investment in the sector, and in upgrading the qualification of labour force involved in R&D in this sector.

Flanders has also seen, in the recent period, the development of a number of agglomerations of firms, specialising in high-tech niches and co-operating both among them and with knowledge institutions. The positive aspects of these ICT-clusters, promoted and supported by the government, like the above-described Flanders Language Valley, or the Digital Signal Processing Valley and Flanders Media Valley constitute opportunities for endogeneous growth, embedded in the Flanders's innovation system, and based on rather small networks of highly specialised SME's.

On the policy side, it is obvious that innovation always involves risk, but temporary cluster support does not involve large sums of public investments, and relies mainly on firms dynamics. To the contrary, structural, long-term subsidies as is the case notably with IMEC but also the automobile industry, run the risk to lead into a sort of policy lock in, into supporting 'national champions' which might 'globalise out of the regional tissue' and become less well embedded in the innovation system as a whole. However, the latest figures on contract research by IMEC for firms in Flanders are reassuring in this respect.

The peculiar story of the Flanders Language Valley, that once upon a time was raised as the flagship of the home-grown, "genuinely Flemish" company able to drive the development of a region into a high-tech society, ended up as a failure. As the growth or the 'gains' of the cluster was rooted in the region, so were the 'pains' from the failure, e.g. many people lost their private investments when the value of their stocks collapsed. The loss of this flagship has had an impact on the attitude of venture capital investors towards promising ICT-start-ups. Nevertheless, even if the cluster experience proved not to be sustainable, it has shown that creating ICT-clustering dynamics in the "periphery" can be done. But the case at hand also shows that the role of policy-makers should be to facilitate such dynamics, rather than to "pick the winners". Support to clustering is a way to let variety grow and may be a good way to increase the necessary absorption capacity, in companies. The recent cluster-policy in Flanders has moved towards a more generic and more transparent policy instrument, leaving primacy to bottom-up dynamics.

2.1.3 The cultural aspect: a small market in Flemish content: a vicious circle?

There is a difference between situations faced by English-speaking Internet users, or those coming from big markets, and others. As the Flemish language is a "small language", and the region of limited size, it lacks the critical mass for the development of applications and contents, specific for this market. Therefore, for a number of users that value own-language and "local" information, the value of being connected is lower than for those who can freely access the information in English and the other languages present on the Net, or for those living in bigger markets with less diversity. In an Eurobarometer survey from 2000[10], Belgium was, together with Greece, Portugal and Spain, among the countries where Internet users most often reported being hindered by absence of sites in their own language. By the same token, such complaints indicate that there is a demand for local content.

As put forward in (De Vil et alii, 2002), a vicious circle phenomenon occurs when "*there are relatively few internet users because of the lack of domestic content but there are few incentives to create local content because there are few potential users*". For a quasi-autonomous and culturally distinct region as Flanders, the relevant borders for information search are more frequently the regional (rather than national) borders. The data in Table 2.2 below show light on the relatively weak development of Internet content in Belgium. However, when recent initiatives such as e-VRT will produce their effects, the situation could be changing rapidly.

Table 2.2 Indicators of Web content development in Belgium (2000)

	Belgium	European Union	United States
Number of Internet Sites per 1000 inhabitants (generic Top level Domain)	4.1	6.2	27.0
Number of multimedia sites per million inhabitants	117.3	130.8	578.0

Source: De Vil et alii, 2002

The exiguity of the market has also been used as an argument to explain the lack of adequate ICT-services for Flemish companies, since companies involved in ICT are forced to act in a wider market.

2.2 The Telecom market and infrastructure

The second driving force behind the shape of e-society developments in Flanders is linked to the particular situation in the telecom market and infrastructure of this region. Two main elements must be noticed here: the first is the presence of an alternative telecom operator, Telenet, installed by the authorities to cover the whole region with a complete infrastructure, based on the exploitation of the TV cable network; the second is the existence of a (still) dominant operator, Belgacom, the historical national telecom company.

In both respects, the situation of the region is remarkably different than elsewhere in Europe: no other country or region has established a similar alternative operator[11], and the rate of liberalisation of the telecom market is generally less advanced in Belgium than in other EU places.

[10] Flash Eurobarometer N°88 "Internet et le grand public" 10-30/10/2000.
[11] The federal Council for Telecommunications even states that the Telenet network is unique in the world (Annual Report 2001).

The impacts of this situation on the move towards the Information Society in Flanders, can be analysed as follows.

A first point relates to the history of the development of the Information Society, in the past decade or so. The persistent dominance of the historical telecom operator during this period, with associated monopoly prices on telephony, have contributed to high Internet access prices, impinging on connectivity rates of the general population and SMEs, at times when dial-up was the dominant mode of Internet access.

A second argument looks at the other side of the coin: thanks to its long-standing quasi-monopolistic position, Belgacom has been able to maintain a good financial situation, and to engage in an active policy for the development of broadband infrastructure with the ADSL technology. Telenet was at the same time developing an alternative broadband offer, based on TV cable, with as a result, the emergence of a fierce price competition between the two operators to capture the new market of Internet access through broadband, at the end of the nineties. Consequently, Flanders now holds a leading position in Europe with remarkably high number of users linked to Internet through broadband connections, as evidenced in the first part of the report. This certainly constitutes an overall advantage for Information Society developments, although a saturation point in terms of number of Internet users seems to have been reached recently.

The third element is a more prospective one: will the policy-driven efforts to develop interactive TV at regional level, be the corner stone to bring the rest of the population into the Digital Society ?

This discussion on infrastructure and prices should no hide the important question of content: unless attractive and useful applications are proposed through the various media to approach the Internet, any progresses in infrastructure provision or pricing are likely to fail in bringing the expected goal of creating an inclusive Information Society, enshrined in the e-Fl@nders plan.

2.2.1 A voluntary policy move to introduce a regional alternative telecom operator: opening and broadening the market, but at what costs?

As mentioned above, the Flemish government decided to establish its own telecom operator in the mid of the nineties. Telenet has been established in 1996 with the aim to provide telephony and Internet access, using the TV cable network, that was already available on the vast majority of the regional territory. This policy move is in contrast with the situation in Wallonia: in this region, the management of cable network is split between a multiplicity of operators, preventing them to reach the critical mass necessary to undertake the investments that would allow them to offer telecommunications and interactive services in addition to traditional TV programmes.

Much political will and some public money, followed by private investments, have made this endeavour a reality in Flanders. Telenet has developed pioneering work in the use of cable technology for telephone and Internet services[12]. As a result of these efforts, Flemish consumers have now the possibility to switch from the traditional telecom operator towards this new one.

Whether the project will be a full success, is still to be confirmed. For one, the huge investments that have been made to build the service, have not yet been matched by sufficient

[12] According to some sources, only Australia has developed similar technology, with as a result a limited competition and high prices for the specific equipments.

revenues. The heavy losses announced during Summer 2001, and the recent problems shown by Telenet during the Summer 2002, where the company underwent an important threat for lack of capacity to attract necessary funds to survive, show its fragility. This straight financial situation deprived Telenet from the possibility to enter into a war price with Belgacom on phone pricing. As a result, prices fixed by this alternative operator have generally stayed very close to the monopoly prices of the incumbent operator, yielding thus only marginal benefits for the consumer. With the growth of the mobile phone market, Telenet now finds difficulties to reach the market share needed to reimburse its huge initial sunk costs. The system is also characterised by important fixed costs for installation, making it costly to switch swiftly between Belgacom and Telenet. As a result, a situation of duopoly has been created, leaving those claiming for a more liberalised telecom market, with much unsatisfaction.

It is on the other hand true that, without the presence of Telenet on the newly created broadband market, Belgacom would not have been led into a price war with the aim to capture this new market. As a result, broadband prices have been maintained at a remarkably low level, to the benefit of the consumers.

2.2.2 The double-sided effects of the situation with the historical operator: curbing early developments but favouring recent ones

Belgium has been one of the last countries to open its telecom market to other operators than the historical operator, Belgacom. The degree of liberalisation of the Belgian telecom market has persistently lagged behind that of other European countries (Table 2.3). In a recent position paper (25th July 2002), the Belgian Association of Internet services providers (ISPA) claims that "*in today's Belgian market environment the appropriate regulations are not existing NOR foreseen to allow a liberated Internet market in line with EC's philosophy and frameworks*" and that "*there are great risks and even ascertained threats that those un-sustainable competitive conditions will very soon result in absence of competition due to absence of competitors, which in turn, will inevitably mean the absence of innovation, freedom of choice and hence penetration of Internet in the Belgian society*". The Belgian consumer association "Test-Achats/Test Aankoop" is of the same opinion, as it writes in October 2002 that "*liberalisation of fixed phone market is a failure for the household subscriber*"[13].

The main arguments of ISPA are that: Belgacom is abusing from its dominant position in the telephone market to place its own Internet offer; because the company is the owner of the local loop, it is able to retain an unjustified share of customer revenue (65%) while supporting low part of the costs; Belgacom is building a dominant position in the ADSL market too and erecting barriers to other Internet Service Providers by imposing such a high wholesale price that no alternative operator can cover the fixed costs to enter the ADSL market.

[13] Test-Achats, n° 458, October 2002.

Table 2.3: Evaluation of liberalisation of telecom market (2000)

	EU mean	BE	FR	DE	EI	NL	DK
Overall liberalisation score	66	65	68	67	68	75	90
Effective regulation	17	15	18	14	17	19	20
Fair interconnection	16	17	17	18	16	18	22
Infrastructure competition	19	19	21	21	21	23	24
Non-discrimination	14	13	12	14	14	15	24

Source: British Telecom, The Liberalisation Milestones, 2000, cited in PricewaterhouseCoopers, 2001

Belgacom responds to those arguments that the national regulator (IBPT) is not playing a positive role in this debate, since application rules for the regulations are not clearly set: some proposals for price reductions by Belgacom have not been agreed, on the ground that they were not reflecting real cost conditions. Belgacom also retorts that it is contradictory to deny the company at the same time, the right to fix low or high prices, both on the ground of abuse of dominant positions. Concerning ADSL, the argument is that the prices fixed have helped to create a new market, with great success. Belgacom is also demonstrating the reality of the cost-based approach for price fixing, on the basis of technical arguments. Moreover, contrary to many operators elsewhere, the financial situation of the company is sound, allowing it to invest in future developments. Finally, the company points to other factors than pricing arguments to explain lags in Internet penetration: according to empirical observations, it seems that the Belgian consumer has a very low price elasticity for phone consumption (important price diminutions in 2000 did lead to marginal changes in consumption patterns).

Beyond this technical debate, it cannot be denied that high Internet access prices for traditional dial-up connections can be taken as one explanatory factor for Flanders' lags in Internet penetration in the first times of Internet penetration. According to empirical analyses performed by OECD, there is a clear negative correlation between the cost of Internet access and Internet host density, and "*those countries that moved early to liberalise their telecommunications industry now have much lower communications costs and, consequently, a wider usage and diffusion of ICT technologies than those that followed later on*" (OECD, 2001, p.29).

The costs of Internet access through classical phone lines can be divided in three parts:

- Fixed costs
- Communication costs
- Charges of Internet Service provides

The latter part has tended to lose significance nowadays, as the number of ISP offering free access has grown rapidly. As concerns the two other parts, Belgian telecom prices have persistently stayed well above EU means, as shown in Table 2.4[14]. More recent, unpublished data, computed in 2002 by the Belgian consumers association Test-Achats, still place

[14] Table 2.3 presents figures for residential phone charges; the position of Belgium remains identical when business phone charges are taken into consideration.

Belgium amongst the most expensive countries, on a 5th position amongst the member states, after Portugal (the most expensive), Spain, Italy and Austria, with a basket price of 137, as compared to an index of 100 for the less expensive country, Denmark. Another element to be taken into account, is the very low density of phone connection in Belgium, ranked in 2001 at the 13th position in a ranking of EU countries published by the Federal Council for Telecommunications (Annual Report 2001, p.58).

Table 2.4: Telecommunications pricing (2000)

	Basket of residential phone charges: fixed charges in US $ based on PPP	**Basket of residential phone charges: usage charges in US $ based on PPP**	**Basket of residential phone charges: total charges in US $ based on PPP**
PT	241.79	286.9	528.69
IRL	230.13	216.23	446.36
BE	**215.89**	**229.53**	**445.43**
IT	180.6	259.45	440.04
GR	137.25	302.32	439.57
ES	186.27	253.15	439.43
AU	233.31	176.36	406.67
EU mean	***182.52***	***185.93***	***368.46***
DE	157.39	202.45	359.84
FR	146.76	208.57	355.33
NL	202.79	141.38	344.17
LU	175.65	151.3	326.95
FI	156.61	162.47	319.08
DK	173.9	119.31	293.21
UK	201.28	84.73	286.01
SE	142.54	115.17	257.72

Source:OECD (2001), Communications Outlook

The above data referred to traditional phone line use, for voice traffic. Tariffs for Internet use over the phone are in many cases different from the tariff used for voice traffic. For these tariffs too, Belgium show a very high price structure, as it is constantly located amongst the most expensive countries, especially for peak-hours use (Table 2.5).

Table 2.5 Internet dial-up access costs (residential user): 20 hours/month

	USD/PP and rank of Belgium (1=most expensive country) **Peak hour 1998**	**USD/PP and rank of Belgium** (1=most expensive country) **Off- Peak hour 1998**	**USD/PP and rank of Belgium** (1=most expensive country) **Peak hour 2000**	**USD/PP and rank of Belgium** (1=most expensive country) **Off- Peak hour 2000**	**USD/PP and rank of Belgium** (1=most expensive country) **Off- Peak hour 2001**
EU-15	64	46	42	32	29
BE	**98 (2)**	**47 (7)**	**52 (3)**	**36 (4)**	**37 (2)**

Source:Information Society Statistics – Pocketbook 2002.

The above discussion and data relate mainly to the "smallband" access to Internet, which has for long been the only way to access it, and subsequently remained the dominant form until recently, when broadband connections (through either phone line or cable) have been put on offer on the Flemish market. While classical dial-up connections coupled with subscription to free Internet providers still constitute the cheapest option for light users, ADSL and broadband become more interesting when usage increases. International comparisons of ADSL pricing are compounded by difficulties linked with the different composition of the service (speed, size limits, etc.). Nevertheless, recent data computed by Test-Achats/Test-Aankoop show that the Belgacom tariffs are, this time, amongst the cheapest from all European countries[15]. ISPA interprets this as an abuse of dominant position, with the aim of limiting competition on this market through internal cross-subsidies within the company. Nevertheless, for heavy Internet users in Belgium, there is now a much better –priced solution on offer, through ADSL. This solution is currently available to approximately 93% of the country population (le Soir, 17 October 2002).

Cable access prices in Belgium are also comparatively much better aligned with EU average, with Belgium occupying a fifth position among the 12 countries offering such possibilities in Europe, according to European Commission data of December 2001[16].

In absolute terms however, broad band access is always more expensive than dial-up connections, leaving out of the game that part of the population that cannot afford a share of telecom expenses in the household budget above a certain limit.

Thus, it can be suggested that the high dial-up costs may have favoured the early, faster shift towards broadband, both through ADSL and cable, in Flanders. The price structure for the two types of connections, "small" and "large" band, in Belgium is such that the difference is much thinner than elsewhere, thus favouring a migration of (part of) Internet users from the narrow to the broad band.

Indeed, the latest data on Internet penetration produced by ISPA (September 2002), presented in section 1 of this report, enlighten the rapid switch occurring in Belgium, from phone lines

[15] Monthly rents do not however, take into account the installation costs, for which Belgium ranks again as the second most expensive EU country after Luxembourg, with an index of 359, to be compared to an index of 120 in the Netherlands.
[16] European Commission (2002), E-Europe – Benchmarkingsverslag, COM (2002) 62.

to broadband (ADSL+cable): new broadband connections are growing while the number of phone connections are continuously declining. Mid-2001 already, the number of broadband connections for households bypassed the number of narrow band paying connections. In fall 2002, more than 70% of business connections were of the broadband-type, 44% of households have turned to broadband, and those percentages are increasing very rapidly. With such high percentage of broadband connections, Belgium is leading the European league. Thus the high price for dial-up connections in Belgium should not play such an important role in explaining present and future rates of Internet connection in Flanders, at least for that part of population that can afford to pay the fixed price for those connections, which eliminates the lower segment of consumers. That part of the population is at risk to be left out of the game and remain Internet-illiterate.

The relatively high share of Flemish Internet users connected through broadband access with permanent connection should impact positively on the behaviour of users. According to (Horrigan et Rainie, 2001), broadband residential Internet users "*spend more time online, do more things, and do them more often than dial-up users*" in the United States. In particular, they more often become creators and managers of online content. Thus, an increasing proportion of Internet surfers connected through broadband in Flanders is likely to upgrade the intensity and widen the scope of their use of Internet.

2.2.3 Pro-active content promotion using "new" infrastructure": a way forward to the inclusive digital society?

As mentioned above, more choices and price changes in the telecoms market, have not yet resulted in a "sufficient" rate of Internet penetration, at least when overall rates are compared to those reached in more advanced EU countries. ISPA calculated that the maximum Internet penetration rate in Belgium will be stagnating around 46 %, i.e. 20% lower than in Scandinavian countries. Those left out are at risk to stay at the margins of the Information Society. In section 1, data have been presented that showed that the digital divide, mainly by age and level of education is a reality in Flanders.

Specific elements of the Flemish context act to reinforce this digital divide:

- a low employment rate of older workers. Belgium has the lowest rate (around 25% in 2000) of all Europe (around 38%[17]) of employment of workers aged between 55 and 64. The country has been singled out recently in OECD reviews, because of the danger and costs of such situation. Older people not in the workforce are faced with less opportunities to get familiarised with IT applications.
- A high tax rate for low-wage earners (50% for Belgium, as compared to 39% for the EU[18]). For this indicator, Belgium occupies again an extreme position in the European league. This is a negative factor as regards the possibilities of the poorest segment of the population, to afford expenses needed to enter into the wired world.
- A scarcity of Public Internet Access Points (PIAPs): Belgium is among the countries with the lowest number of PIAPs per 1.000 inhabitants, with figures of 0.06 in January 2001, as compared to 0.54 for Finland, 0.46 for Finland, or 0.39 for Sweden[19].

To tackle this digital divide problem, a new voluntaristic strategy is being implemented by the Flemish government, as mentioned above: the development of new modes of connection and

[17] Data taken from EU structural Indicators, 2002, source Eurostat.
[18] Idem.
[19] European Commission, Information Society Statistics Pocketbook, 2002.

usage of new IT applications via the interactive TV. A pilot project is underway at the moment of writing this report, with the aim to test the feasibility and effectiveness of this new entry point into the Information Society. The reasoning behind this strategy is linked with the idea that the needs and capacities of various categories of people are different: for some, using a familiar terminal such as the TV, under user-friendly modes of access and with the attraction of appealing applications, is believed to be the best way to get connected. The television channel might be a way to overcome a possible historical bad perception linked to phone use and anxiety in face of PCs, that would characterise part of the population. The current trial with a limited set of households has combined the technical aspects of turning the TV into an interactive device, with applications proposals (such as emails, e-government, e-banking, etc.), in order to present the digital society as something that is more than just technical offers.
This is one current challenge that the Flemish authorities have set for themselves. It is also a main strategic development area for Telenet. Future will tell is this is a success or if other barriers still need to be overcome to reach this critical mass of wired citizens needed to develop e-government, e-commerce and other people-centred applications.

2.3 ICT-relevant behaviour and attitude

The third driving force which seems important in explaining the position of Flanders in the Information Society concerns ICT-relevant behaviour and attitude. This is an explorative section of the report, as such factors are hardly measurable. In the next paragraphs some social and cultural data are introduced to indicate behavioural factors that could explain some of the observed weaknesses in the uptake spread and diversified use of IST in Flanders . This is a tricky exercise there is a danger to simply turn to deterministic arguments like all Flemish think, feel or behave in a certain way. However, it remains that some essential explanatory ground has been untouched in this and other reports on the information society in Flanders so far. The strong 'potential' based on traditional input-factors like wealth, ICT-infrastructure, ICT-research and ICT-production, coupled with a lack in a widespread, diversified ICT-use, especially in households and small firms, calls for a multi-disciplinary approach to explore additional explanatory factors in order to gain more insight in the barriers to usage of IST in the Flemish society.

First, possible relationships between the trust in public institutions and the progress in e-governance are explored (paragraph 2.3.1). A next paragraph deals with behavioural factors which have more direct economic implications, e.g. concerning innovation and entrepreneurship (2.3.2). In paragraph 2.3.3 potential explanations for the low use of ICT at home, that is, after work, for leisure or consumption, are proposed.

This section cannot provide decisive conclusions on such intangible factors. However, there are some signs in the data collected that specific behaviours or attitudes have an impact on how Flemish citizens prefer to communicate or deal with information. This should be taken into account in the shaping an Information Society adapted to the aspirations of the inhabitants of the region.

2.3.1 A relation between trust in public institutions and e-behaviour?

Using figures on trust towards public institutions could be one way to search for possible explanations for the modest position of Flanders concerning e-government.

As already mentioned in the first section of this report, the position of Belgium with regard to e-government does not look very positive. According to Table 2.6, regular and occasional contact with the government is with 4 and 12 percent below the EU-averages of 10 and 20 percent, in 2000. Moreover, Eurostat data shows that the percentage of municipalities which have a website for civilians in 2000, was 38% in Belgium , against 56% in the EU-15.

Table 2.6 Contact between civilians and government via internet, 2000

	Has there been contact between civilians and the government via Internet (website or e-mail)?			
	Regularly	**Occasionally**	**Seldom or never**	**Do not know/ no answer**
European Union	***10,3%***	***20,4%***	***59,8%***	***9,6%***
Belgium	**4,3%**	**12,2%**	**53,9%**	**29,5%**
Denmark	12,7%	19,0%	66,9%	1,4%
Germany	7,7%	10,1%	73,8%	8,3%
Greece	4,8%	41,9%	52,4%	0,8%
Spain	15,7%	42,8%	39,8%	1,7%
France	9,1%	24,1%	66,7%	0,0%
Ireland	4,0%	16,7%	55,0%	24,3%
Italy	14,7%	38,7%	40,7%	5,9%
Luxemburg	11,6%	21,1%	56,0%	11,3%
Netherlands	13,7%	24,6%	56,6%	5,1%
Austria	8,7%	21,3%	38,7%	31,4%
Portugal	13,2%	31,3%	38,1%	17,3%
Finland	11,7%	15,4%	59,1%	13,8%
Sweden	8,1%	15,6%	53,7%	22,6%
UK	10,3%	15,3%	62,4%	12,1%

Source: Eurobarometer 2000

For Flanders similar comparative data are not available, but Table 2.7 shows very recent data on the same issue. The percentages of regular and occasional contacts with government institutions via Internet is closer to the EU-15 average in 2000, in Table 2.6 above. Striking though is the high percentage of people who have had (regular or occasional) such contacts in the past but do not have them any more.

Table 2.7 Contact between civilians and government via Internet, Flanders, 2001

	Regularly	Occasionally	In the past, not any more	Never
Flanders	11.8	17,2	22,3	48,7

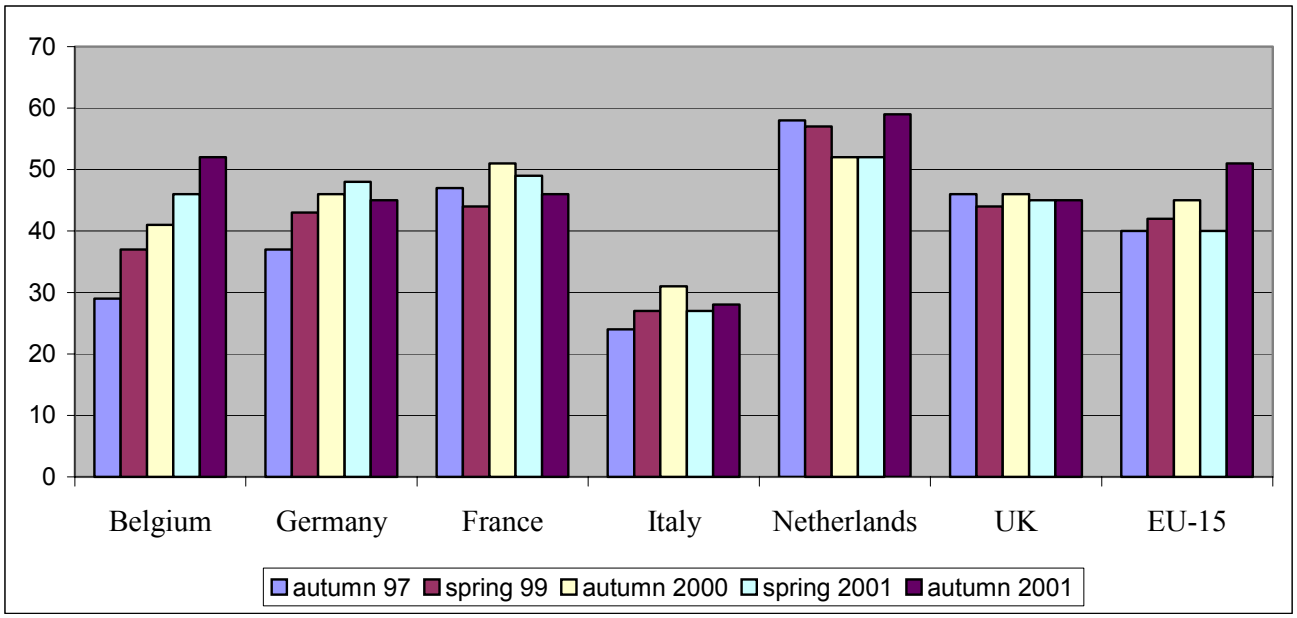
Internet Statistiek Vlaanderen 2001

One item to look at to explain this situation would be that of trust in government institutions. The hypothesis would be that it could perhaps partly explain this. The item of trust in public

institutions in Belgium like the police, the law-system, federal and local administrations, is very much debated, especially since 1996, when Belgium was earthquaked by sordid child abuse affairs that were the start of intense citizens protests against the functioning of the public institutions as a whole. Van de Walle et al. (2003) provide an overview of several data sources dealing with the trust issue (Eurobarometer, European Value Studies and APS). Figure 2.3 shows indeed that in 1997 trust in government institutions was very low in an international perspective, but of course, given the circumstances, such data are probably heavily influenced by the particular climate in the country. Since then, it has increased though, and the latest figures show that the trust is in 2001 even slightly above the EU-average. The increase in trust in Flanders is also recorded by APS.

Based on the figures for Belgium in 1997, Bral (1999) showed that the trust in Flanders was even lower than in the rest of Belgium. The more recent data can not split between the regions of Belgium but can be split according to the language used in the survey. This shows that there are no differences between the Dutch and French speaking respondents.

Figure 2.3 Trust in public institutions in a number of EU countries



Source: Eurobarometer, several years

Figure 2.3 shows that the situation in Belgium is today comparable to the average situation in the EU, i.e. approximately 50% of the population has a problem of mistrust in institutions, which is certainly not favourable for the development of e-government applications.

One question in the Internet-survey for Flanders in 2001 showed that 82% of the people who had used Internet in the past 6 months, would be interested to make use of public service transactions via Internet, if they were available. The problem does not seem to be so much a lack of demand for e-government but rather a lack of supply.

Fear of security problems, and lags in the implementation of the electronic identity card (notably due to the complicated institutional structure) are also likely explanations for this lag.

Finally, the problems in modernising public administration, with notably the failure of the Copernic reform (a tentative broad reform of the public institutions management), are also

important barriers for e-government development. It can even be argued that, without efficient public services in the traditional economy, it is almost impossible to go for e-government.

2.3.2 Behavioural Economics

Behavioural aspects concerning risk-taking, attitude towards innovation, and entrepreneurship should be among explanations for development of the more economic part of the Information Society in Flanders. The availability of reliable and internationally comparable data on this respect is scarce though.

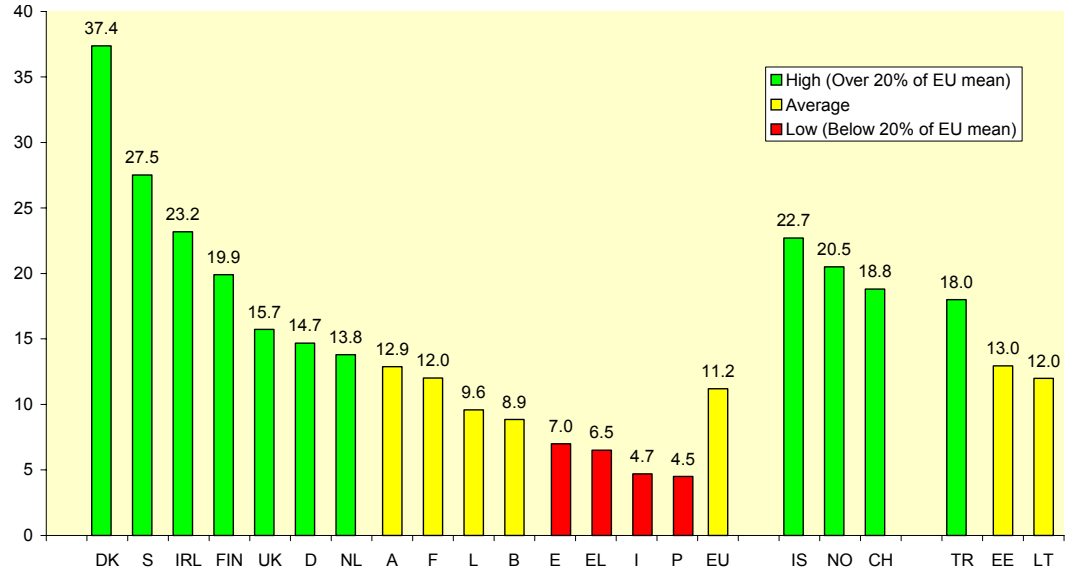
According to the 2001 European Innovation Scoreboard (European Commission, 2001), Belgium ranks at the mid-lower end of the spectrum of innovative performance of EU economies. The "summary **innovation** index" for Belgium is below average; and one major relative weakness of Belgium within Europe lies with the innovative capacity of its SMEs. Table 2.8 shows that, for the three indicators capturing innovative behaviour of companies, all extracted from the Community Innovation Survey (CIS) results, Belgium is consistently scoring poorly, below EU average. Experts' views from Agoria-ICT (the industry association of ICT companies) are that SMEs in Flanders have not yet taken up fully the networking and co-operation spirit, which seems so important in developing towards a knowledge-based network economy. This is only an opinion, but Figure 2.4 shows this could be true.

Table 2.8 European Innovation Scoreboard 2001: countries scores on innovativeness

Country	SMEs innovating in-house (% of manufacturing SMEs – rank of country)	Manufacturing SMEs involved in innovation co-operation (% of manufacturing SMEs – rank of country)	Innovation expenditures as % of all manufacturing turnover – rank of country
Ireland	62.2 % - 1	23.2 % - 3	3.3 % - 8
Austria	59.1 % - 2	12.9 % - 8	3.5 % - 7
Denmark	59.0 % - 3	37.4 % - 1	4.8 % - 2
Germany	58.7 % - 4	14.7 % - 6	3.9 % - 4
The Netherlands	51 % - 5	13.8 % - 7	3.8 % - 6
Sweden	44.8 % - 6	27.5 % - 2	7.0 % - 1
Italy	44.4 %-7	4.7 % - 14	2.6 % - 11
EU mean	*44.0*	*11.2 %*	*3.7 %*
France	36.0 - 8	12.0 % - 9	3.9 % - 5
United Kingdom	35.8 - 9	15.7 % - 5	3.2 % - 10
Belgium	**29.4 - 10**	**8.9 % - 11**	**2.1 % - 13**
Finland	27.4 - 11	19.9 % - 4	4.3 % - 3
Luxembourg	24.5 - 12	9.6 % - 10	n.a.
Portugal	21.8 - 13	4.5 % - 15	1.7 % - 14
Spain	21.6 - 14	7.0 % - 12	2.4 % - 12
Greece	20.1 - 15	6.5 % - 13	1.6 % - 15

Source: European Innovation Scoreboard 2001.

Figure 2.4 SME's involved in co-operation in innovation (% of manufacturing SME's)



Source: CIS II

However, the reliability of the CIS data are heavily criticised by the actors in charge of their collection. The drop of 50% in the rate of overall innovation in Belgium from one enquiry (CIS 1) over the other (CIS 2), is one example of the fragility of those indicators. Therefore, the "innovation deficiency" thesis can only be proposed here as a hypothesis, to be tested further.

Flemish SMEs suffer from a number of weaknesses linked to their small size, that are however not specific to this region. As evidenced in the analysis carried out recently by (KPMG, 2001) for the Flemish government, SMEs in the region **lack a strategic vision** on the potential benefits of ICT use. The weak awareness about ICT usage is presented as a main limiting factor for the generalisation of "intelligent" use of ICTs by those companies. When such technologies are adopted, it is rarely on the basis of a sound analysis of real needs. The secretive character of SMEs management, the unwillingness to diffuse information outside the company, and the resistance to organisational changes, are among the factors that lie behind the lag experienced by Flemish SMEs in entering the Information Society. And, as already mentioned above, a vicious circle seems at work, in which, because of lack of demand, the formation of an adequate offer for ICT services to SMEs is lagging behind, and because of this lack of appropriate support, SMEs are reluctant to outsource or simply seek advice for their ICT developments.

Another unfavourable factor could be the **entrepreneurial attitude** in Flanders. The scarce data provides a mixed picture, though. The recent General Entrepreneurship Monitor (GEM) study (Manigart et al. 2000) provided data that could indicate that Flemish people are less entrepreneurial than others: this region lies consistently in the bottom league of a panel of 21 countries, even when considering various alternative measures of entrepreneurship activity (Table 2.9).

Table 2.9 Entrepreneurial measures in 21 GEM countries

Country	Total entrepreneurial activity	Start-up activity	New business prevalence rate
Brazil	16.0	12.3	4.4
Korea (South)	13.7	5.3	9.0
USA	12.7	9.8	4.7
Australia	10.9	8.1	3.3
Canada	7.9	6.2	2.2
Norway	7.9	5.5	3.5
Argentina	7.8	6.1	2.1
India	6.3	3.5	2.9
Italy	5.7	3.4	2.6
UK	5.2	3.1	2.2
Germany	4.7	3.8	1.4
Denmark	4.5	3.0	2.1
Spain	4.5	3.2	1.4
Israel	4.2	2.6	1.7
Finland	3.9	1.9	2.5
Sweden	3.9	1.9	2.2
Belgium	*2.4*	*1.4*	*1.1*
France	2.2	1.2	1.0
Singapore	2.1	1.5	0.8
Flanders	**1.4**	**0.8**	**0.7**
Japan	1.3	0.9	0.4
Ireland	1.2	1.0	0.3

Source: GEM (2000).

Other sources and figures seem however to contradict the GEM-study. For example, Flanders has a high percentage of 'self-employed': 'firms' without employees. Also a recent study in Flanders showed that a considerable share of graduated students is interested to start a firm. And finally, one could wonder if the GEM indicators really reflect attitudes, or if they are not rather an indication of an unfavourable regulatory (too much red tape) and fiscal environment, which, according to firms and firms representative, are the key explanatory factors for the low rate of firms creation. Another regulatory factor was found to be highly, and negatively correlated to the rate of entrepreneurship, in the GEM study: the level of social protection, that would discourage would-be entrepreneurs that elsewhere emerge by necessity. With one of the most generous social security system in Europe, Belgium is thus likely to be rated very low in this type of survey.

Apart for the exceptional developments of the electronic banking systems, Flanders lacks **flagship models** linked to ICT production or use (there is no Nokia in the region…). Potentially powerful demonstration effects, particularly interesting to convince "standard" SMEs of the benefits to adopt ICTs, are thus scarce. Even more so, a very negative message was received by the population, with the failure of the Lernhout&Hauspie Flemish "success story" (see above). After the occurrence of this Flemish "Enron"-like case, confidence in ICT-related developments and provision of Venture Capital could have been eroded in the population. However, after the dot com crash in 2000, it could be argued that the L&H story may not be seen as such a particular story, but as a symptom of a more wide-spread phenomenon.

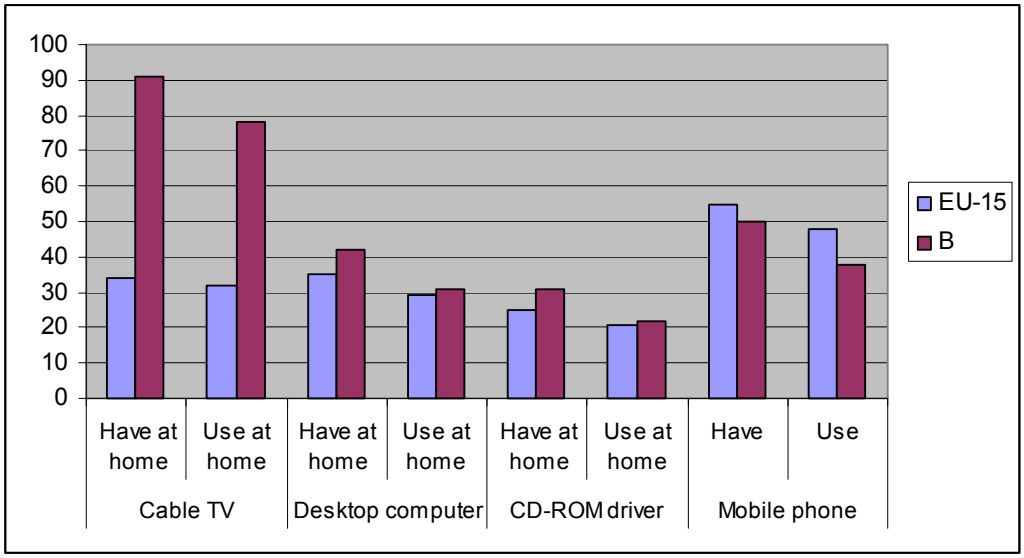
Another possible explanation of the relatively low use of ICT by citizens, could be the relatively recent, and possibly ill-adapted, **IT education at school**. Even if today the rate of PCs and Internet connections at schools is high in Flanders (see section 1), this is probably too recent to account for a significant influence on citizens' familiarity with ICT. And some

argue that even today, too few teachers have a sufficient competence in ICT-use, to be able to take full advantage of their opportunities in the framework of education. Thus, late introduction and lack of competences for ICT in education might act against a wider use of ICT in the population at large. As mentioned in the first section of this report, the good scores of the country in international statistics of education might hide qualitative deficiencies when it comes to deal with the Information Society. The GEM study cited above explains the low rate of entrepreneurial activity notably by an "*educational system where creativity, innovation and risk-taking are not highly valued*", notwithstanding the overall quality of the education system. Similarly, observers of the Belgian labour market have recently stated as a conclusion of a debate that "*the main challenge for our universities and high schools, is to learn evaluate creativity, rather than the capacity to repeat lessons like parrots"* (Eddy Daniels in Imediair, 24.10.2001). This is again a tentative hypothesis, proposed for further exploration.

2.3.3 Cultural explanations for e-behaviour?

As stated before, the level of expenditures on ICT-equipment in Flemish firms and in Flemish households can not explain the low usage of ICT's. But Figure 2.5 shows very well that especially in Flanders there is a difference between ownership and use of ICT-equipment in Belgium: households are well equipped but the rate of use is quite lower. This picture is general throughout Europe, however.

Figure 2.5 Ownership and use of ICT-equipment in Belgium and EU, percentages 2000



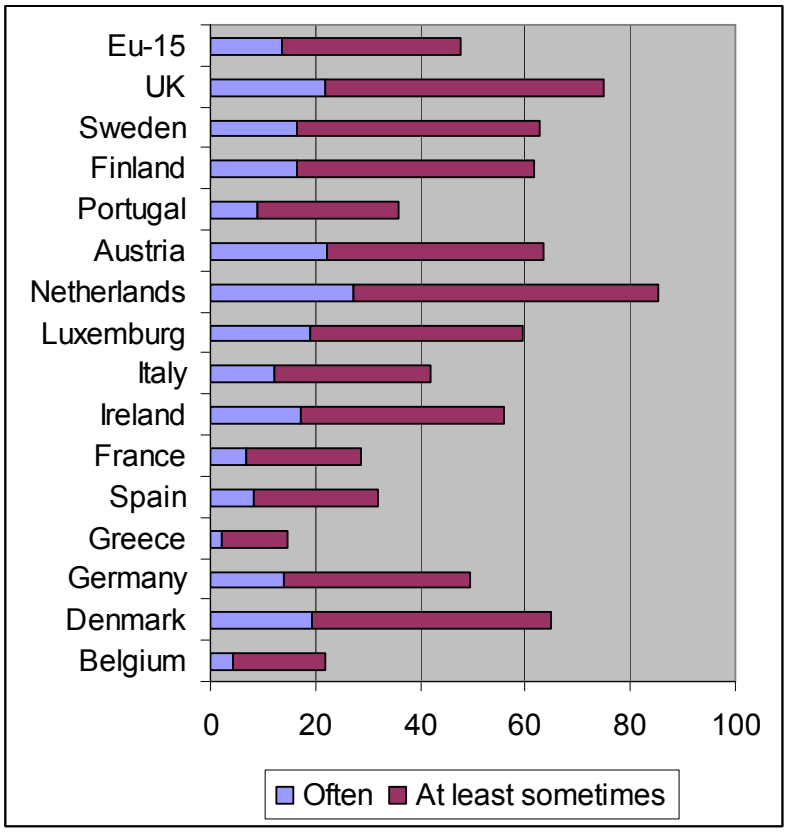
Although Table 2.10 is based on data from a few years ago, the interest expressed in many applications of multimedia use is very low in Flanders compared to the interest in the European countries. Most of the more recent studies measure the actual use, but "not being interested" in the various applications seems an important explanation.

Table 2.10 Interest in multimedia-use for Flanders and 11 EU-countries, 1998

Multi-media applications:	Flanders %	Average 12 EU-countries %	Rank Flanders (among 12)
Watch museum collection	9,3	21,6	12
Political debate/contact	6,6	12,3	12
Courses	26,8	38,1	11
Doctors advice	37,2	43,0	11
Administration, local government etc.	46,5	50,3	8
Prepare travel	38,1	45,9	9
Read news etc.	24,2	32,4	11
Info on products	30,3	37,2	11
Job-search	31,7	43,1	12
Info on consumer rights	24,0	36,4	12
Banking information	29,4	37,7	10
Insurance etc.	11,0	14,4	11

Source: Eurobarometer, November-December 1998, computations Administratie Planning en Statistiek

Figure 2.6 Use of internet as information source for purchases, in %, 2002



Source: Gallup Europe, Flash European Barometer 117, January 2002

Looking at which information sources consumers use to prepare purchases, a difference can be noticed between Belgium and other countries in their information source preferences. In a study conducted for Eurobarometer survey, the question was: "Personally, as a consumer, which information sources do you normally consult to prepare your purchases? Often, sometimes or never". Most respondents did not use any of the sources mentioned. The highest scores for 'often consulted' are 'advertising leaflets, Brochures from manufacturers and consumer publications'. Figure 2.6 shows the percentages for using Internet, often and 'at least sometimes'. The use of Internet as a source in Belgium is far below the one that holds for most countries, showing the unfamiliarity of consumers with this new tool.

International comparisons of the preference for other activities concerning information and communication (Table 2.11) shows that, in Belgium, there is a slightly lower than average participation for in-door leisure activities like watching television, reading magazines or newspapers or books, and a higher participation percentage for outdoor activities like going to a café/pub or to Cinema/theatre/concert (see also Table 2.12).

Table 2.11 Participation percentages for some leisure activities*, in 11 European countries, 1992

	Watching television	Reading magazine or newspaper	Reading books	Meeting friends	Going to café/pub	Going to Cinema, theatre, concert
Belgium	**91**	**62**	**31**	**45**	**18**	**6**
Netherlands	90	87	50	58	10	4
Germany	94	90	30	42	10	4
France	94	82	44	63	4	6
Ireland	93	91	41	75	31	3
UK	94	85	54	68	22	4
Denmark	94	91	45	55	11	5
Greece	90	45	12	69	7	3
Italy	94	53	21	48	15	5
Portugal	82	32	10	34	21	2
Spain	92	40	14	57	17	2
Average for all countries	***92***	***69***	***32***	***55***	***15***	***4***

*Source: Eurobarometer; * Percentage of people saying that they undertook the activity in the previous week.*

This pattern of preference could contribute to an explanation why people in Flanders do not use ICT-equipment that much, compared to for instance people in Nordic countries. Besides a preference this could also be related to the opportunities for out-door activities. For Flanders the very high density in terms of population and leisure facilities (e.g. restaurants and pubs, see table 2.13) adds up to this explanation.

Table 2.12 Cultural participation, percentage of people between 15-75 that visited a concert, museum, theatre in the past 12 months, 9 European countries in the 1990s

	Classical concert	Pop concert	Museum Attendance	Theatre performance
Flanders (1998)	**31**	**27**	**48**	**49**
Netherlands (1995)	16	25	31	27
France (1997)	9	16	32	15
UK (1991)	13	18	32	39
Denmark (1993)	16	.	55	26
Finland (1991)	11	12	43	38
Italy (1995)	10	19	29	18
Spain (19900	7	10	28	14
Average all countries	***14***	***18***	***37***	***28***

Source: Sociaal and cultureel Rapport 2000, Sociaal en Cultureel Planbureau Nederland

Table 2.13 Density of facilities in the catering industry: restaurants and cafes/pubs in 11 European countries, 1997

	Restaurants		Cafés/pubs	
	per million inhabitants	per 1,000 sq. km.	per million inhabitants	per 1,000 sq. km.
Belgium	**2.079**	**690**	**2.934**	**975**
Netherlands	1.239	470	1.253	457
Germany	1.332	305	847	194
France	1.400	147	847	89
Ireland	724	37	2.449	124
UK	1.722	410	1.377	328
Denmark	1.507	183	468	57
Finland	744	11	1.350	20
Italy	1.573	299	2.622	498
Spain	1.486	116	5.400	423
Average	***1.381***	***267***	***1.955***	***324***

Source: Hotrec (www.hotrec.org)

A stronger evidence to support the claim that many people in Flanders would have a preference for the 'real' world, rather than a virtual one, is provided in Table 2.14. Compared to other countries, much more people in Flanders visit a museum, but only 9.3 % of the people in Flanders were interested to use multimedia to watch museum collections on a screen, whereas the average of 21.6 percent of the people in the EU is interested in such 'virtual' museum visits. Of course, lack of interest could simply be a reflection of lack of opportunities and knowledge about this, rather than a real attitudinal disposition.

Table 2.14 Interest in real and virtual museum visits in international perspective

	% of people having visited a museum in past 12 months	% of people interested to use multimedia to watch museum collection (1998)
Flanders (2000)	61	9.3
Netherlands (1999)	33	
Italy (2000)	31	
Greece (1998-1999)	42	
Finland (1999-2000)	29	
Sweden (2000)	46	
EU-15		21.6

Source: APS, 2001; Sociaal en Cultureel Planbureau Nederland, 2000

Conclusion

The general profile of Flanders is very positive. It is a wealthy, centrally-located and well-developed region, as shown by economic and human development indicators. The Flemish population is well educated and households dispose of comfortable revenue. A lot of autonomy has been conferred to the Region, which invests in pro-active development strategies. The profile of Flanders as an Information Society is however unbalanced. Overall, the region seems well placed on the European scene, but we have identified a number of weak and strong points:

- Flanders is strong in ICT infrastructure developments, with notably a leading position in broadband infrastructure and the presence of a regional alternative telecom operator, as well as other aspects, e.g. PC equipment in schools (although the latter is fairly recent);
- Flanders hosts a relatively important ICT sector, as well as relatively high level of R&D in ICT, with IMEC as an important centre of excellence, and interesting spin-offs dynamics in some places;
- These strong positions are not matched with similar rates of ICT-use, notably the use of Internet by households and small companies. Flanders is even at the bottom of the European league concerning the rate of consumers buying on-line;
- Also the development of an e-government, is comparatively less well developed, although a recent policy-push at the regional level seems very promising.

A paradox appears thus, between the favourable context for the development of Flanders as an Information Society, and actual achievements: **potential** for the IST developments in Flanders is stronger than effective and diffused **usage** in the wider population. However, interest in IST-related developments is only justified by the fact that these could bring benefits to citizens, in the form of more productivity, new opportunities, more efficiency, more well being. Thus, the identified weaknesses in uptake and usage, especially for households and SME's, may hamper the level of expected **impact** on the Flemish society, including its economy.

The strong aspects of Flanders could in the traditional linear conceptions be labelled as "input" factors. Obviously, these do not give automatic rise to the additional desired "outputs". Something must go 'wrong' in the system, or to put it in the terms of the FISTE[20] framework, there must be bottlenecks and we have looked beyond a mere technologically and economic determined explanation to find the reasons for this. The present study proposes three "principal dimensions' or "driving forces" across the myriad of elements that influence the evolution towards the Flemish Digital Society:

1. **The "Flemish identity" push: a politico-institutional explanation**. This driving force is linked with the particular situation of Flanders, a region that is pursuing a long-term strategy of autonomy. The process of federalisation of Belgium was at initial time hampering the development of a strong national vision and policy plans of the IS. But then, supported by a strong political will to build on the Flemish identity to

[20] FISTE: Foresight in Information Technologies in Europe, a methodology developed by IPTS in 2002, to balance the identification of supply-side IST trends with demand – side impact analyses.

differentiate from the rest of the country and reach success based on its own forces, the region focused on high-tech development as a way to reach this ambition. Policy awareness and numerous pro-active programs have been developed (with as flagships IMEC and Telenet), but the linear vision on which they were originally founded induced a strong focus on infrastructures and on the "hardware" of the Information Society, rather than a preoccupation for the "software" aspects – mainly the absorptive capacities for such technological developments in the wider public. Progressively, the minds are changing and recent initiatives show a growing attention to users' needs and the recognition of the importance of availability of appropriate applications that could widen the effective usage of ICTs and contribute to regional development in a larger sense. The achievement of a really "holistic" innovation is still a challenge however, as it implies a change in traditional policy and administrative practices.

2. **The telecom market and infrastructure**. A comparative advantage of the region is the availability of a dense cable TV network over the whole territory. Through the creation of Telenet, Flanders made the plan to introduce competition in the quasi-monopolistic telecom market, and exploit new technological opportunities. On the technical side, it is already a success, on the economic and societal aspects, much remains still to be proved. Today, the proportion of broadband users is remarkable in Flanders, but the lack of cheap access to "Internet for beginners" might still be a problem, notably for the poorest and least-aware segments of the population. Even rich populations have their less wealthy citizens, and the digital divide is present in Flanders. A new regional strategy is currently implemented to address this issue, with the development of interactive TV. New challenges may also appear soon, if satellite or mobile technologies introduce more competition.
3. **Behavioural and cultural aspects and Information Society**. The latter driving force concentrates on the cultural explanations for the relative lag in IS progress and for the digital exclusion of a (still too large) number of Flemish SMEs and citizens. One question here is how far the "model" of Information Society proposed is well adapted to the particular habits, preferences and characteristics of the population. The challenge could be to develop a more "Latin" model of Information Society, with room for the important "real" activities, attention to tangible benefits and profits, combination with social aspects, and the integration of various modes of access and use of information. Another issue is the need, as a pre-requisite for successful exploitation of IST-related opportunities, to foster entrepreneurial spirit and innovative behaviour in companies, and create more links between the advanced companies and the more traditional ones. Finally, the education challenge is critical, as IST-developments challenge traditional modes of teaching and learning.

Reminding the FISTE framework, the main conclusion from these three critical factors above is that **the bottleneck in Flanders was on the 'demand-side IST-developments'**. From a strength and policy focus on the supply side developments, Flanders has been catching up by addressing demand-side developments at the regional level with a set of initiatives. The balance between the supply-side developments and the demand-side developments improved and already gave rise to a catching up on several IST-related issues.

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Annex 1 Interviews

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Identifying factors of success and failure in European IST-related national/regional developments

Semiconductor Developments in the Dresden Region

Final Report
Case Study: Dresden (Germany)

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July 2003

Forschungszentrum Karlsruhe
in der Helmholtz-Gemeinschaft
Institute for Technology Assessment and Systems Analysis (ITAS)

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1 Introduction

This study is part of the so-called *Tigers* project. The most general background to the objectives of the Tigers project can be seen in the so-called "Lisbon objectives." At the European Council held in Lisbon in March 2000, the EU15 set a goal for Europe:

"The Union has today set itself a new strategic goal for the next decade: to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion. Achieving this goal requires an overall strategy aimed at:

- preparing the transition to a knowledge-based economy and society by better policies for the information society and R&D, as well as by stepping up the process of structural reform for competitiveness and innovation and by completing the internal market;
- modernising the European social model, investing in people and combating social exclusion;
- sustaining the healthy economic outlook and favourable growth prospects by applying an appropriate macro-economic policy mix.

… The shift to a digital, knowledge-based economy, prompted by new goods and services, will be a powerful engine for growth, competitiveness and jobs. In addition, it will be capable of improving citizens' quality of life and the environment."

These objectives address the economic, the social as well as the ecological dimensions of change which will therefore also be dealt with in this document. The *Tigers* project has the ultimate objective of learning from IT-related development in Western Europe, to develop policies for the EU Candidate Countries. It was felt that analysing IT-related developments in Eastern Germany would make sense, as one would thus investigate change in a former communist society. It did not appear attractive to analyse – with limited resources of 35 days – the whole of Eastern Germany, possibly even including Berlin with its special characteristic as a formerly divided capital and its high subsidies. Rather, it was felt that it would make sense to investigate a smaller cluster in which IT-related developments play a special role.

In Eastern Germany, except for the special case of Berlin, there is a limited number of areas with above-average economic performance. These are Erfurt, Jena, and Dresden (Ragnitz et al. 2002, p. 322). The development of Erfurt is linked to engineering and electronics, Jena is linked to Jenoptik, formerly "Carl Zeiss" in Jena (as opposed to the West German "Zeiss" company), and Dresden is linked to semiconductor production, with the first post-1989 investment made by Siemens. Economists also mention Eisenach and Zwickau as major clusters of development, focusing on the car industry (Opel and Volkswagen respectively), as well as Chemnitz (Volkswagen, other machinery), Leipzig (trade, car and media industries), Plauen, focusing on machine production, and Halle with major chemical plants (Ragnitz et al. 2002, p. 61). In the framework of the *Tigers* project, Dresden was selected as being IT-related. Issues to be addressed, according to the Lisbon summit objectives, and thus according to the objectives of the *Tigers* project, are therefore:

- How can ICT-production provide employment?
- What are the social and ecological effects?
- How can government influence the development?

The methods used to address these questions were, given the limited resources available, to review the most important studies, and to conduct a limited number of expert interviews. Regarding the studies, it turned out that except for limited information on the WWW, the most important studies about Dresden are only available in German, so this study may have added interest for the non-German reader. Regarding the interviews, it was possible to conduct 8

semi-structured in-person interviews with representatives of companies, regional government, research, political parties, trade unions, and environmentalists, in Dresden. Some of the interviews were recorded on tape. Evaluation took place using hermeneutic methods as developed by Kade (1983) and Oevermann (1980).

This document is structured as follows. In Section 2, a statistical overview of general developments in Saxony and in Dresden, as well as on related information society and semiconductor developments is provided. Thereafter, in Section 3 the development of the Dresden semiconductor cluster is described. In that section, early roots of industrial development are mentioned, as they are deemed to be important for understanding how such a cluster can develop (3.1). Subsequently, in Section 4 an assessment of the developments is provided, analysing inputs and outputs and their causes. Thereafter, some open questions are formulated and an attempt is made at drawing conclusions (Section 5). Section 6 provides a summary.

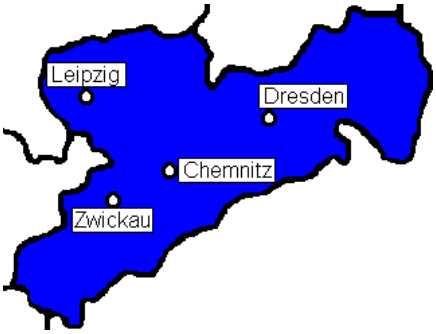
The *Tigers* project took place within the framework of the *European Science and Technology Observatory* (ESTO). It was sponsored by the ICT unit of the *Institute for Prospective Technological Studies* (IPTS) in Seville, Spain, which is part of the European Union's *Joint Research Centre*. The project was led by MERIT, the Maastricht Economic Research Institute on Innovation and Technology (The Netherlands). Other partners were the Austrian Research Centers, Atlantis Consulting (Greece), The Circa Group (Ireland), and ITAS. The project started in 2002 and was completed in 2003. ITAS was responsible for the analysis of the development of the semiconductor production firms in the Dresden region (cf. http://tigers.infonomics.nl).

The author wishes to express thanks to the interviewed experts, to the reviewers, and to all colleagues of ITAS, IPTS and the *Tigers* project partners for help and critical comments on earlier versions of this work, in particular to Marc Bogdanowicz, Waltraud Bruch-Krumbein, Jens Drews, Dietmar Edler, Werner Esswein, Thomas Hänseroth, Hermann Härtig, Torben Heinemann, Karin Jeltsch, Inka Klotsche, Jürgen Krake, Gabriele Müller-Datz, Peter Nothnagel, Michael Rader, and Jörg Urban.

2 Statistical Overview

In this section, a mainly statistical overview of general developments in Saxony and in Dresden, as well as on related information society and semiconductor developments is provided.

Location, population: We start with general information about the location, and show in Figures #1 and #2 that Saxony is located in Eastern Germany; its capital Dresden has a relatively Eastern position. Saxony borders on Poland and the Czech Republic.



Figures #1 and #2: Germany, Saxony (source: European Commission 2002).

After re-unification in 1989, about 120,000 people left Saxony in 1990. During the following years that figure of emigrants became smaller. In 2001, Saxony had the highest absolute shrinkage of population among all German states (Statistisches Landesamt Baden-Württemberg 2002). In 2002, the city of Dresden had about 470,000 inhabitants, down from 518,000 inhabitants in 1988 (Röhl 2001, p. 245). Table #1 shows how the population of Saxony developed. After 1989, there was a sharp decrease in births, due to the new economic situation. The number of births has recovered somewhat since.

Saxony	1989	1995	2001
Population, millions	5.0	4.6	4.4
Births	55,857	24,004	31,943

Table #1: Source: Statistisches Landesamt des Freistaates Sachsen, 2002.

Employment: Some key facts and figures for the former GDR (German Democratic Republic), Saxony and Dresden are, at the end of GRD-times:

- In Saxony, 1.136 million employees worked in manufacturing in 1988 (Röhl 2001, p. 28).
- In the whole GDR, 120,000 employees worked in microelectronics (European Commission 2002, p. 18). The centre of microelectronics research was Dresden.
- The major semiconductor research centre was Forschungszentrum Mikroelektronik with about 3,300 employees, who were, e.g., piloting the 1 Mbit memory chip in 1988 (Specht 1999, p. 208).
- Major Dresden industrial companies, including the Forschungszentrum Mikroelektronik, had a total of about 30,000 employees in 1989 (Niemann 1996).

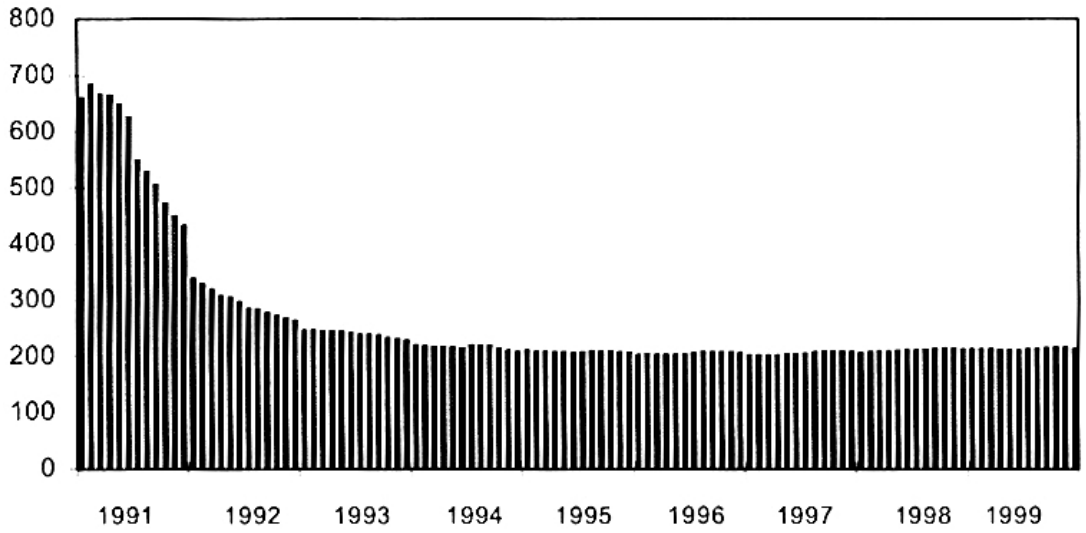


Figure #3: Employees in manufacturing in Saxony, in thousand, monthly values (Röhl 2001, p. 249).

Some key facts and figures from after 1989 are presented below:

- In 1994, only 216,000 employees worked in Saxonian manufacturing (Röhl p. 28, cf. Figure #3).
- By 1992, 25,000 of the 30,000 jobs in Dresden industrial companies had been abolished (Niemann 1996).
- In Eastern Germany, employment shrank to about 65 % of its GDR level.
- The semiconductor companies AMD (Advanced Micro Devices), Infineon (formerly Siemens) and ZMD (Zentrum Mikroelektronik Dresden, formerly Forschungszentrum Mikroelektronik) in late 2002 employed about 7,100 people in Dresden. Their partners and other semiconductor companies employed about 3,500 people in the region, including about 1,000 in nearby Freiberg.
- In Saxony, the general unemployment rate in October 2002 was 17.8 % (in Dresden it was 15.1% and in Germany as a whole 10.5%).
- In Saxony, 44.587 people worked in ICT including the printing industry, in the year 2000 (Freistaat Sachsen, Telematikbericht, 2001, p. 55, below quoted as "Telematikbericht 2001") .

Employment in Saxony	1989	1995	2001
Economically active (million)	2.24 (1991)	2.00	1.94
Unemployment rate	0 %	14.4%	19.0%

Table #2: Source: Statistisches Landesamt des Freistaates Sachsen, 2002.

Employment in Dresden	1993	1999
Economically active	241.000	216.000
Unemployment rate	11.6 %	15.6 %

Table #3: Source: Blien et al. 2001, p. 65; Landeshauptstadt Dresden 1999, p. 53

GDP, Wages: Though difficult to measure in a period of significant transition, GDP grew considerably after 1989, see Table #4 and Figure #4. The Figure does, however, also show that growth rates in Eastern Germany had become much smaller after 1995 and approached the relatively low West German levels. However, in 2001, East German *manufacturing* industries increased their output by 5% (Ragnitz et al. 2002, p. 12). *Saxonian manufacturing* is developing particularly well, with a growth of 8.4% in 2001, in particular for the production of vehicles and machine tools (Schommer 2002).

GDP and Wages in Saxony	1989	1995	2001
GDP bn €	34.8	67.0	74.3
GDP bn € (1995 prices)	47.1 (1991)	67.0	71.5
Wages €	13,179 (1991)	23,306	25,580

Table #4: Source: Statistisches Landesamt des Freistaates Sachsen, 2002. Wages = remuneration of employees.

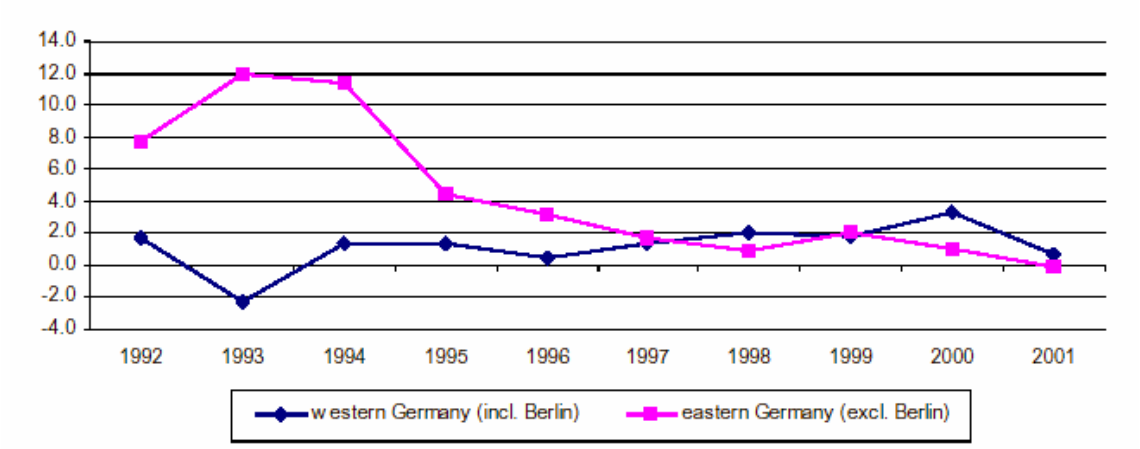


Figure #4: Annual change in real GDP in East and West Germany, in percent (1995 prices; source: European Commission 2002, p. 17).

Access to Information Technologies: A few figures will provide a very rough idea of the availability of information technologies.

- In 1989, there were about 500,000 telephone lines in Saxony, in 1997 already more than 2 million. In 1989 25% of all households had telephone access, in 1998 the figure was 93 % (Röhl 2001, p. 62).
- The mobile telephony infrastructure also grew significantly: in 2001 75% of all Saxonian households had a mobile phone (Telematikbericht 2001, p. 30f).
- In 2001, 36 % of Saxonian households, i.e. 740,000, had Internet access. Almost 90% of companies[1] had Internet access in 2001 (Telematikbericht 2001, p. 20 and 82f). In 1998, only 4% of companies had access (IRIS-I 1998).[2]

[1] The State of Saxony's "Telematikbericht" (2001) states on page 82 that "almost 90%" of SMEs have online access, no precise figure is provided. Assuming that the relatively few large companies are all connected, the statement in the text above should be justified.

[2] The Telematikbericht (2001) provides a comprehensive overview of ICT-related developments, but includes industries such as printing in many of its statistics, therefore its figures are not readily comparable to other ICT-related figures used in the *Tigers* project.

3 The Development of the Dresden Semiconductor Cluster

3.1 Saxony and its Capital from the Middle Ages to 1989

3.1.1 The Origins of the Saxonian Industry

The historical development of Dresden must be seen in the framework of the development of the state of Saxony. Saxons inhabit the northern slopes of the Erzgebirge – the "Ore Mountains" – where Chemnitz (called Karl-Marx-Stadt during GDR times) and Zwickau are situated, and some less mountainous areas to the north (with Leipzig) and the east (with Dresden).[3]

The Ore Mountains are basically a relatively cold and humid area, and thus, by nature, a poor area. This changed, slowly, with the development of industries. Metal crafts started to develop around 1100 (Keller 2002). Most famous is the discovery of silver in Freiberg, which is situated between Dresden and Chemnitz. Many other mines sprang up all over the Ore Mountains. Also the glass industry developed, e.g. at the site of Glashütte, just south of Dresden. Furthermore, the wood industry developed, including the production of relatively small and precious items, such as toys and violins, in family-owned enterprises. Last but not least a textile industry developed. All these industries required trade, and allowed some economic development of the area.

At the end of the medieval ages, Saxony and Thuringia were home to the protestant movement. Prior to that movement, there had been only few professions or vocations, mainly those of the priest and of the physician. With Protestantism, activities to the benefit of other humans were ranked equally. I.e. vocational work in a certain field was highly ranked as a valuable human activity, conducted in order to live in a religious way. This appreciation is in line with the increasing importance of the different trades mentioned above. The emergence of the vocation as a core element of human life is part of the same cultural change which took place in the Italian renaissance. In Florence and elsewhere, life on earth, with craftsmanship and science, was put into the centre of living. It has been said that with Luther "vocational work appears as the outward expression of brotherly love" (Weber 1905, p. 68; cf. Jaeger et al. 1987). This attitude means that doing one's work perfectly is to the benefit of others. The idea which developed is that if everybody behaves like this, this will be to the benefit of all.

Modern scientific mineralogy was developed in the Ore Mountains. Georgius Agricola (Georg Bauer) published *de re Metallica*, a treatise on mineralogy and mining technology, in the 16th century[4]. During the 19th and 20th century, Saxony became Germany's leading industrial centre. In 1799, a water-power driven spinning mill was operated by the Bernhard Brothers. Machine industries started in the 1820s (Feldkamp 2000), only little later than in the United Kingdom. Initially, the continental blockade imposed against the UK by Napoleon in 1806 provided favourable conditions. The first German Jacquard looms and steam locomotives were built in Chemnitz, in 1828, and in 1848, respectively.

In 1904, August Horch built cars in Zwickau, in a company later to become Audi. Leipzig became an effective marketplace for selling Saxonian goods. The result of engineering, hard work and trade was that the area between Chemnitz, Freiberg and Zwickau became the most industrialised in Germany from the first half of the 19th century until World War II. In 1936,

[3] Actually the history of the Saxons is more complicated, with the Anglo-Saxons living now in the British area, and Slavic origins of part of the people in today's area of Saxony, but this is not relevant in our context.

[4] Agricola was born in the 15th century, in the author's hometown of Glauchau, Saxony.

East Germany (in today's boundaries) had a per capita income of 27% above that of West Germany (Richter 2000; Sinn, Westermann 2000).

3.1.2 Origins of Dresden

Dresden has a tradition as a residence for Electors (Kurfürsten), Kings and other nobles. In the middle ages, it had already become a city with many local craftsmen, working to a significant degree for the nobles. Under the rule of Friedrich August I. ("Augustus the Strong"), 1694-1733, Dresden was turned into a beautiful baroque city. A famous example of the production of luxury goods is that of porcelain, which had been produced in China since the 13th century. Augustus the Strong ordered to uncover the secret of its production. In 1707/08, Johann Friedrich Böttger and Walther von Tschirnhaus (re-)invented the white, European hard porcelain in Meißen, 20 km north-west of Dresden. Dresden is still full of precious remainders from that era, such as Raffael's Sistine Madonna which was acquired from Italian priests. Most of the buildings were destroyed in 1945, but the Baroque panorama is still visible (Figure #5).[5]

Figure #5: View of the Baroque city centre of Dresden: Ständehaus, Hofkirche, Schloß, Semperoper (from left to right, October 2002; photo: Arnd Weber).

[5] See http://www.dresden-congresscenter.de/eng/eng_1.htm for a nice interactive map of the cultural highlights.

3.1.3 Dresden Industries from the Beginning to 1945

The Dresden area was, compared to Chemnitz, relatively late with industrial development, starting around 1870, though its Technical University was founded in 1828 (Königlich Technische Bildungsanstalt). Since 1878, Burkhardt built computing machines (originally invented in Colmar) in near-by Glashütte, where also watches were built. In Dresden, industries developed such as the glass industry. "Through the Siemens brothers, Dresden became one of the originating points for the industrial revolution in the glass industry", producing, e.g., bottles (Mauerhoff 2002). Also the camera and optical industries developed. In this report, the latter industries will be addressed in a kind of side-track, for three reasons:

(1) Their large relevance in Dresden until 1989.

(2) Their relevance for the production of semiconductors.

(3) Their relevance in recent global developments such as video cameras, digital cameras and cameras in mobile phones, key technologies for creating data on mobile networks.

Examples of early achievements of these industries in Dresden are:

(1) The development of industrialised camera production in the Ernemann factories, which after mergers became the Zeiss-Ikon AG, second only to Kodak in the 1920s (Gerber 1998).

(2) The production of leading-edge lenses. For example, a high speed lens of f/1.8 was created by Ludwig Bertele in 1924, at a time when neither Zeiss nor Leitz were able to build similar lenses. Bertele later contributed to the Biogon wide angle lens, a design which was used for making pictures on the moon during the Apollo flights, and is still produced by Carl Zeiss, West Germany. He also contributed to the Sonnar lens, which has very few reflection-producing elements, variants of which are used in Sony digital cameras (Vario-Sonnar).

(3) The production of the first single lens reflex camera for 35mm cine film, the Kine Exakta, built by Exacta in 1936 (Hummel 1997), and the production of the first camera with a pentaprism, providing a life-size, upright image, the Contax S, in 1948 (Zeiss Ikon 1948, see Box #1).

The Dresden area was also home to a significant electrical industry. Examples are the production of electrical motors at the Sachsenwerk, and of high voltage equipment at Koch & Sterzel. In 1923 Koch & Sterzel built the world's first 1 MV transformer (Highvolt Prüftechnik Dresden 2002). In the early 20s, they also built crystal detectors used for radios (Schwarz 2002[6]), which functioned like later diodes. The successor company is now owned by Siemens. Widely known are also Mende radios, e.g. the Third Reich "Volksempfänger".

[6] With thanks to Peter Nothnagel of the State Ministry of Economy and Labour for an email of Peter Schwarz of *Technische Sammlungen der Stadt Dresden* of October 7, 2002.

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Ernemann Ermanox 1924</td>
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Ihagee Kine Exakta, 1936</td>
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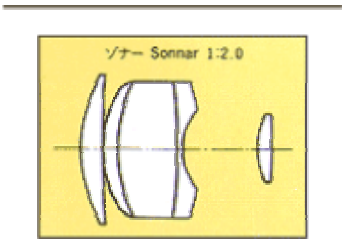
<td> 

Zeiss Sonnar 1:2.0, Bertele 1929</td>
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Zeiss Contax S, 1948</td>
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Box #1: Dresden optical inventions (sources: http://www.pacificrimcamera.com ; http://www.kyocera.co.jp/; http://www.big.or.jp/~kita2/ECC/PENTACONFBM/CONTAXHIS.html).

Dresden also became a place for manufacturing aircraft such as the Junkers aircraft since 1924 in the area of the Klotzsche airfield. Prior to, and during, World War II, military goods were also produced, such as tanks and targetry equipment. Below a description of Dresden by the British Bomber Command is provided, giving an overview of the state of the industry in 1944:

"Dresden is the historical capital of Saxony, its present administrative centre of considerable importance. It is one of the finest residential cities in Germany. With a population of 650,000 it is the chief centre of a populous belt which extends from north-west to south-east along the river Elbe from Meissen to Pirna. Based upon the number of persons employed in peace time, the largest single group of industries is the food and luxury trade (tobacco, confectionery etc.), with about 25,000 workers, but the manufacture of machinery and vehicles occupied 17,000 persons, regardless of the manufacture of iron and metal wares, and optical and electrical apparatus, the last occupying 10,000 persons. Other peace-time industries, in addition to light luxury industries, include textiles, glass, paper, rubber and photographic apparatus. The heavier industries are located in the W. and S.W. suburbs of Dresden, and further out in Radebeul (38,000 inhabitants), (engineering, rubber); Freital (37,000), (coal, glass machinery); Radeburg (16,000), (electrical apparatus, glass, engineering); Pirna (36,000), (artificial silk, glass, machinery); Heidenau (18,000), between Dresden and Pirna (paper, machinery, glass etc.). The industries of Dresden are mainly light industries carried on in small factories, and are not very obtrusive in the aspect of the town except in its Western half." (National Archives 2002)

In 1945, large parts of Dresden, with the exception of certain suburbs and industrial areas such as the Klotzsche airport, were destroyed with more than 600,000 bombs. The number of casualties is unknown as the city was full of refugees. The severity of the allied air strikes is believed to have been in retaliation for the earlier German air attacks on Coventry and London.

3.1.4 Dresden Industries from 1945 to 1989

After 1945, the Soviet government picked the country clean of many valuable assets, even many rails from the railways (Stahl 1996). Later, they took a quarter of the eastern zone's annual economic output as a reparation. Nevertheless, with considerable problems – such as the 1953 revolt – the communists managed the reconstruction of large parts of Dresden, frequently with large pre-fabricated houses, so-called *Plattenbauten*. In this subsection, we essentially only look at industries which are of some relevance for the later semiconductor production, with the exception of our side-track on optics.

Aircraft

Many industries were re-built. Particularly surprising is that in the 1950s, the design of a civilian aircraft was started. The East Germans built a four-engine jet airliner, the Model 152, and flew it in 1959, less than five years after they had begun work. The headquarters of VEB Flugzeugwerk Dresden was at the airfield in Klotzsche on the outskirts of Dresden. VEB means *Volkseigener Betrieb*, literally "business owned by the people". Eventually 25,000 East Germans would be committed to the project. After a crash of the second flight, and no interest from the Soviets in buying, building aircraft was stopped in 1961 (Stahl 1996).

Cameras

Another important industry was the camera industry. VEB Pentacon, named after the pentaprisms in its cameras, had its headquarters in Dresden. In 1989 6,000 employees worked there. VEB Carl Zeiss, headquartered in Jena in the state of Thuringia, became the most important producer of optical equipment.

Electronics and Semiconductors Industries

After its closure, VEB Flugzeugwerk Dresden was split up into several smaller companies. One of these was VEB Elektromat Dresden, which started building equipment for the electrotechnical and electronics industries, such as machinery for manufacturing components, bonding machines, optical equipment, equipment for measurement, etc. (Freydank 2002).

In 1961, also the "Arbeitsstelle für Molekularelektronik Dresden (AMD) as the nucleus of a centre for microelectronics research, development and production [was established; A.W.], to serve the entire Warsaw Pact region. It began as a subsidiary of Dresden Technical University" (Bruner 2001). The AMD was founded in Dresden-Klotzsche. It should not be confused with the US-based AMD company, which became an investor in 1995.

AMD grew and became VEB Forschungszentrum Mikroelektronik. In 1967, the first integrated circuits were developed. Their production started in Frankfurt (Oder), east of Berlin, in 1970. Semiconductor production took also place at Erfurt, Thuringia. Forschungszentrum Mikroelektronik's only task was to conduct research and development and pilot production of semiconductors (Specht 1999).

In 1969, the Kombinat Robotron was founded, a *Kombinat* or combine being a large amalgamated industrial complex, consisting of 5 or more VEBs or factories. Robotron had several locations, one of which was the Zentrum für Forschung und Technik (ZFT) at Dresden. Robotron sold, among other things, complete computing centres, with computers, air conditioning, etc. in the GDR as well as in other countries of the Comecon area. In 1989 it had 4,000 employees.

In 1980 Elektromat Dresden and the Institut für Mikroelektronik Dresden were merged to form the Zentrum für Forschung und Technologie Mikroelektronik (ZFTM). In 1987 the ZFTM was integrated into Kombinat Carl Zeiss Jena. On that occasion, Elektromat Dresden and Institut für Mikroelektronik Dresden were separated again, and the latter formed VEB Forschungszentrum Mikroelektronik.

Also relevant for the semiconductor industry was VEB Spurenmetalle "Albert Funk", founded in 1957 in Freiberg, 30 km west of Dresden. It developed and manufactured high-purity semiconducting materials, particularly germanium, silicon, gallium, arsenic, and similar materials and compounds. In 1989, it had 1,860 employees (according to Sachsen LB [State Bank] 2002; according to Heidtmann (1998) it had 6,500 employees).

In 1976 the SED party convention decided to invest in semiconductor development (Specht 1999).[7] Between 1986 and 1989 27 billion Marks were planned for the production of the 1 Megabit memory chip (Specht 1999, p. 208)[8]. These expenditures amounted to about 40% of all governmental research and development spending. At the time, due to COCOM rules (a list of sensitive goods, specified by the Coordinating Committee for Multilateral Export Controls by the US and its partners), the GDR was not given the opportunity to buy important components for semiconductor production. Hence, its engineers had to re-invent much themselves. The result was relatively inefficient production. According to internal calculations, in 1989, 250 kbit-memory chips were produced at costs of 534 Marks, but they were sold for 16.80 Marks (Ministerium für Staatssicherheit, quoted in Schroeder 1998). Whatever the precise reasons were, it was apparently not possible for the GDR to have a profitable semiconductor production (cf. Barkleit 2000).

In 1988, the first lab prototype of the megabit-chip was ready. "They found themselves producing the world's largest microchip" Jens Drews, spokesman for the new AMD said. But it was the only megabit-chip produced at the time outside of Asia and America.

3.1.5 Concluding Remarks

Dresden was the largest site for industrial research and development in the GDR (Röhl 2001, p. 12[9]). In the GDR, 120,000 employees worked in microelectronics, with the research centre in Dresden.

According to common opinion, the products exported by the GDR were frequently, but not always inferior to the products available on the Western markets. While some products met world quality standards, e.g., machine tools such as those presented at the famous *Leipziger Messe* (trade fair), others met them only in some respects, e.g. Carl Zeiss Jena lenses were good but somewhat heavy. Many goods were competitive only at significantly lower prices than Western goods, e.g. textiles and toys.

The GDR had high birth rates, no hunger, and was relatively well-off compared to other Comecon states. But many factory buildings dated from before World War I, much chemical waste was simply dumped into the ground, buildings used to be brown because of unfiltered burning of brown coal, and lack of paint. In winter time, cities used to be in a yellow cloud for the same reason.

In the early eighties, the GDR ran into financial problems. The so-called "Devisenrentabilität" – cashed-in Western DM compared to spent Eastern Mark – shrank from values such as 0.3 to values of 0.2 and below during the 80s (Heidenreich 1991). In 1989, wage costs in manufacturing were 7% of the west German wage, at the existing exchange rate, according to an estimate by Sinn and Westermann (2000, p.18). Foreign debt increased. In 1989 the GDR had a foreign debt of about $ 21 billion. "In a confidential communication of May 1989 to the SED Central Committee, the then Chairman of the State Planning Commission admitted that the GDR was economically finished" (according to Weber 2000, see also Schroeder 1998, p. 509-512).

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[7] According to Sachsen LB, the state bank, it was the Zentralkomitee der SED, who made that decision in 1977.
[8] Barkleit reports that between 1977 and 1988 14 billion Marks were spent on microelectronics (2000, p. 27).
[9] According to Specht 1999, p. 208, it was second after Berlin.

In May 1989 an increasing number of citizens fled when the Hungarian government opened its borders ("Republikflucht" was a criminal offence). In October 1989 1,300 citizens of Dresden were arrested during a demonstration, but nobody was shot. Nor was anybody hurt at the demonstrations in Leipzig. In November, the SED-government in Berlin resigned and the year after, the GDR accessed the FRG (Federal Republic of Germany).

3.2 The Economic Situation in Eastern Germany after 1989

Early Developments

In theory, after November 1989, one could have turned Eastern Germany into a low wage area, taking into account that with the prevailing production methods, East German goods would only be competitive at low prices. This would have led, however, most likely to large political discontent and a significant exodus, so this was largely believed not to be a politically valid option.

After 1989, East Germans were very interested in buying Western goods, and Western companies were, of course, very willing to sell them. Similar processes took place on the GDR's eastern markets. One immediately sees the challenge the German government faced. Which VEBs might be able to survive? Which could be sold to foreign investors (in this case including those from West Germany)? Which parts were so uncompetitive that they would simply have to be closed down as soon as possible?

Housing Situation

After re-unification in 1990, "economic growth in East Germany was dominated by developments in the construction sector." (European Commission 2002, p. 17). Subsidisation of investments in construction took place by, among other things, a special 50% write-off in private income tax returns of investors, and additionally a subsidy for private homes (Ragnitz et al. 2002, p. 419). This led to a massive construction of new flats and houses, and other infrastructure developments such as industrial parks for attracting investors. Due to the oversupply, rents diminished, and it became uneconomic to renovate the old houses. An estimated 1 million apartments are now deserted (European Commission 2002, p. 46), to a large degree apartments from before World War II, which typically means from the Emperor's time. Of the latter, 30% are empty. The situation is particularly difficult in Saxony because of its large number of houses from the Emperor's time (Ragnitz et al. 2002, pp. 371, 378, 381). Economists today criticise the "very generous fiscal incentives for both business and housing construction" (European Commission 2002, p. 1; Ragnitz et al. 2002, p. 393) and the current "amply dimensioned flat travelling rate for commuters" (Ragnitz et al. 2002, p. 457) which provides a tax reduction typically requested by those commuting from a new house to a remote workplace.

Employment

In 1990, with the currency union, East German marks were converted one to one into West German marks (with exceptions). Economically, this was regarded to be too high, as it meant a significant increase in costs of production, with wages in East Germany about one third of those in the West. The high exchange rate also lead to significant debts for those East German companies owing money. In 1991, West German employers negotiated with the unions a five-year contract with a specified path to wage equalisation (Sinn, Westermann 2000). After 1989 there was also hope that GDR-companies could continue to export to Eastern Europe, but due to the dissolution of Comecon and the following increase of competition on these markets, sales to the East shrank considerably. These developments led to a significant reduction of employment in Eastern Germany. The German Trust Agency (Treuhandanstalt) was set up with the objective to privatise the state-owned companies. Difficulties of privatisation contributed significantly to today's German government indebtedness. It has been estimated that

about DM 500 billion of DM 2,300 billion total government debts in the year 2000 are due to reunification (Mai 2002).

As an incentive to invest, subsidies to investments were then given, and still are, by the government. These ranged from 15% up to 50%, depending on circumstances such as location.

Economists observe that areas close to the West, close to Berlin, and in Saxony develop relatively well, in particular areas around large Western investment, such as Berlin, Eisenach, Erfurt, Dresden, Jena and Zwickau (Volkswagen in Mosel, next to Zwickau; Ragnitz et al. 2002, pp. 140, 142, 322). These form "beacons" of development, which must also be described, however, as different from the remainder of the regions. Actual compensation per employee is about 77% of Western level (European Commission 2002, p. 82). Compared to GDR times, employment has fallen to about 65%. 90% of all job losses occurred in manufacturing (European Commission 2002, p. 31). Many new jobs demanded new qualifications, such as acquaintance with Western technology, marketing skills, etc., which employees did not readily have.
The situation has also been described as a development of a "second Mezzogiorno", with GDP per population at working age remaining around 60% relative to rest of country, from 1995 onwards (Sinn, Westermann 2000, p. 5, see Figure #6). This figure shows a threat: despite all policy support such regions may not "catch up". Reasons for this productivity gap in Eastern Germany are seen in the number of small companies, which are generally less productive, and in the weak position of many East German companies in the market (DIW et al. 1999, p. 128). Yet, these subsidised companies with relatively low wages provide competition to West German employers.

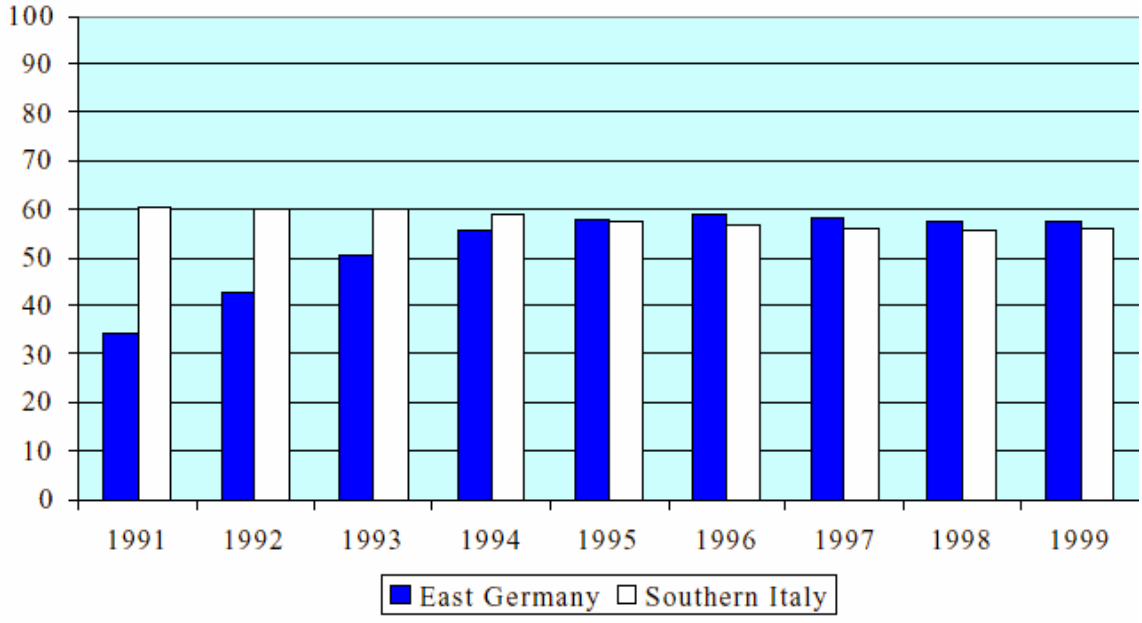


Figure #6: GDP/population at working age, relative to rest of country, in percent (source: Sinn, Westermann 2000).

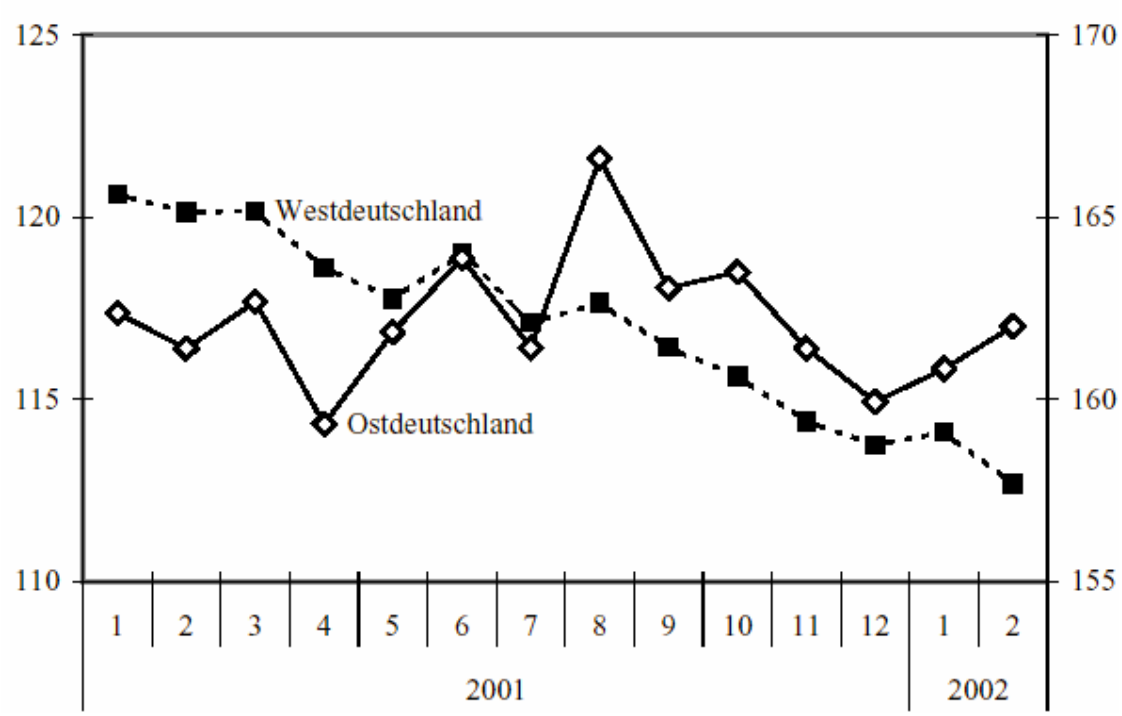


Figure #7: Net production in manufacturing. 1995 = 100. Right hand scale = East Germany (Ostdeutschland); left hand scale = West Germany (Westdeutschland). Source: Ragnitz et al. 2002, p. 16.

In 2001 the manufacturing industries increased their output by 5% (Ragnitz et al. p. 12) and have since doing comparatively better than West Germany (see Figure #7). Most production is done by SMEs (Belitz, Fleischer 2000). Also export from Eastern Germany is starting to develop, essentially from sites of the large investors Infineon, AMD and Volkswagen (Ragnitz et al. 2002 12, p. 107). Economists observe that such major foreign or West German investments prosper above average. These investors typically are big players on the world market. Figure #7 shows that there is a possible trend against the threat of developing a "second Mezzogiorno". While the construction industry is declining, manufacturing is developing above average.

Other industries are supported by substantial transfers from Western Germany to a significant degree, such as retail or finance, and therefore it is unlikely that they will develop into an engine of growth; the construction industry already has a diminishing role. Blien et al. conducted an econometric analysis based on regional data and concluded that relatively high wages contribute negatively to employment (p. 28). It would be desirable to show how this actually took place, e.g. in the chemical and machine tool industries which appear to have been discouraged significantly, according to Blien et al. Their own data show, however, that the region of Dresden with above average wages (p. 65) is among those which is developing best, as they write in their editorial.

With employment at 65% of its former level, and wages at about 77% of the Western level, discontent among the population can be noticed, and around 20% and sometimes more of the electorate vote for the PDS, the successor to the former communist SED party. Birth rates have decreased, and some regions in particular in the north of the GDR are losing most young people.

Concluding Remarks

Much property in Eastern Germany has been given back to its former owners, who typically live in the West. Also, of course, the "foreign" investments from Western Germany or abroad are not owned by locals. Due to the tax incentives to build apartments many of the new apartments also belong to fairly affluent people from Western Germany. Though the East German subsidiaries are not simply "extended work benches " as there is also research and development as in Dresden, there are hardly any headquarters of larger companies. A well-known exception is Jenoptik (formerly Carl Zeiss in Jena, Thuringia). Thus, a large share of East German property is owned by people living in the West. This does not only mean some frustration on the part of the locals, it also means that certain segments of the GDP (spending of profits for luxury goods, domestic services etc.) are underdeveloped. The West German corporations also did not move their headquarters to Eastern Germany. For instance, Siemens who, after the war, reportedly were afraid of Soviet expansionism and had moved to Munich, did not go back to Berlin (which had been nicknamed "Elektropolis" at the beginning of the 20th century). The headquarters of many German companies were, after World War II, moved to different regions of Western Germany, and they have remained there.

The lack of economic activity leads to an annual net transfer of money from taxes and social insurances of about € 65-70 billion, which is about 1/3 of GDP of Eastern Germany, or about € 5,000 per inhabitant (European Commission 2002). About half of these payments are support for unemployed and pensioners (Röhl 2001, p. 31). East German pensioners receive higher pensions from public schemes than West German pensioners (Czada 1998, p. 61). Economists today recommend that the location conditions in Eastern Germany should be improved, such as the transport infrastructure. Subsidies provided to industry should be reduced (Ragnitz et al. 2002, p. 4). It has also been argued that welfare payments to the unemployed should be reduced to make them accept low paid jobs (Sinn, Westermann 2000). Also the European Commission writes that the wages of the low-skilled workers are above their productivity without showing how this was measured (p. 81). It is not discussed, however, whether dismissed persons or young unemployed could pay for rents, food and heating etc., which have approached West German levels, with lower social aid.

"The total consumption of resources by households, companies and the state in 1999 … amounted to 90% of the per capita consumption in the 'old' Federal States. Only two thirds of this was covered by the results of own economic performance." (Weber 2000, p. 10) The difference is paid for by transfers from government and private investors. Given the challenges which emerged after 1989, it can be regarded as a success that employment reached a level of about two thirds of the GDR employment. And even a catching-up process is taking place, as the decline in the construction industries is apparently being offset by a growth in manufacturing (Blum, Scharfe 2000).

3.3 The Development of the Dresden Semiconductor Region after 1989

3.3.1 The General Situation in Dresden

In December 1992, 25,848 persons were still employed on the 168 sites of the manufacturing companies in Dresden employing more than 20 people. This corresponds to about 27% of the November 1990 rate (Niemann 1996). Table #5 shows the change in employment for formerly leading Dresden VEBs.
In Dresden there are plans for the development of several nodes of manufacturing, such as mechanical engineering (Ragnitz 2002, p. 153). Famous is the Volkswagen transparent factory in the „Großer Garten" in which its luxury model Phaeton is assembled (http://www.glaesernemanufaktur.de/). Pentacon was the first large VEB to be closed down by the Trust Agency, stating it had no economic future (Gerber 1998). Only small successor

companies emerged, such as the Noble camera company, producing in the small niche of professional panoramic cameras (see http://www.pentacon-dresden.de/english/kontakt/index.html and http://www.kamera-werk-dresden.de/index.htm). Asta Medica and Smith Kline Beecham took over the city's two pharmaceutical plants, Gruner&Jahr's subsidiary Planeta in Radebeul is active in designing printing machinery, and the Elbeflugzeugwerke are converting passenger aircraft to transport aircraft (DIW et al. 1999, Röhl 2000, p. 17).
Regarding research, many institutes of the GDR's Academy of Sciences were turned into institutes of the Fraunhofer or Max-Planck-Gesellschaften. In 1994, 4,900 people were employed in public research, more than in industrial research and development at the time (Specht 1999).

Many jobs were created in services, last but not least because Dresden is a significant place for tourism with 6 million visitors per year (Niemann 1996).

Company	Products	Employees 1989	Employees early 1992
Robotron Elektronik	Computing equipment	3000	800
Robotron Projekt	Software	1100	430
Zentrum Mikroelektronik	Microelectronic components	3300	1000
Meßelektronik	Electronic instruments	2500	340
Elektromat	Radio equipment	1200	0
Mikromat	Precision machine tools	2000	400
Elektroschaltgeräte/ Elektronik Dresden	Electrotechnical and electronic components	2000	0
Vakuumtechnik	Surface treatment	2000	400
Elektromotorenwerke (Sachsenwerk)	Electric motors	2600	640
Lufttechnische Anlagen	Airconditioning	2500	200
Luft- und Kältetechnik	Airconditioning	1800	700
Pentacon	Cameras	6000	190
Total		*30000*	*5100*

Table #5: Change in employment of formerly leading Dresden companies (source: Niemann 1996, p. 298, according to press articles).

As mentioned above, today Dresden has about 470,000 inhabitants. The region from Pirna to Meißen comprises about 900,000 inhabitants (Niemann 1996). Migration had its maximum in 1989/1990. In 1996, about 52 km^2 land were earmarked for construction (Niemann 1996)[10]. After 1990, the number of enterprises grew from 12,000 to almost 39,000 (www.Dresden.de). Currently, Dresden is one of the few East German areas with a positive net effect of migration (Ragnitz p. 2002, 49). 70,000 new dwellings were built. As a consequence, rents in older apartments in the city recently decreased sharply and many of these old city houses are derelict (Ragnitz, pp. 376, 385). Due to costs of knocking them down, owners typically leave them standing. Between 1990 and 2001, € 54 bn were invested in Dresden, of which € 28 bn in industry (www.dresden.de).

3.3.2 Initial Semiconductor Activities in the Region

In this section the semiconductor activities after 1989 are described in some detail. This description is accompanied by some technical information providing an overview of the produc-

[10] In the Dresden region [likely from Pirna to Meißen; A.W.], plans were made for: „Potentielles Bauland in Flächennutzungsplanentwürfen: 2833 ha. Als Bauland in Bebauungs- sowie Vorhaben und Erschließungsplänen beplant: 1615 ha. Von der höheren Baubehörde als Bauland genehmigt: 827 ha." (Niemann 1996, p. 301)

tion processes involved. As a start, Figure #8 provides an overview of the overall process flow in semiconductor manufacturing.

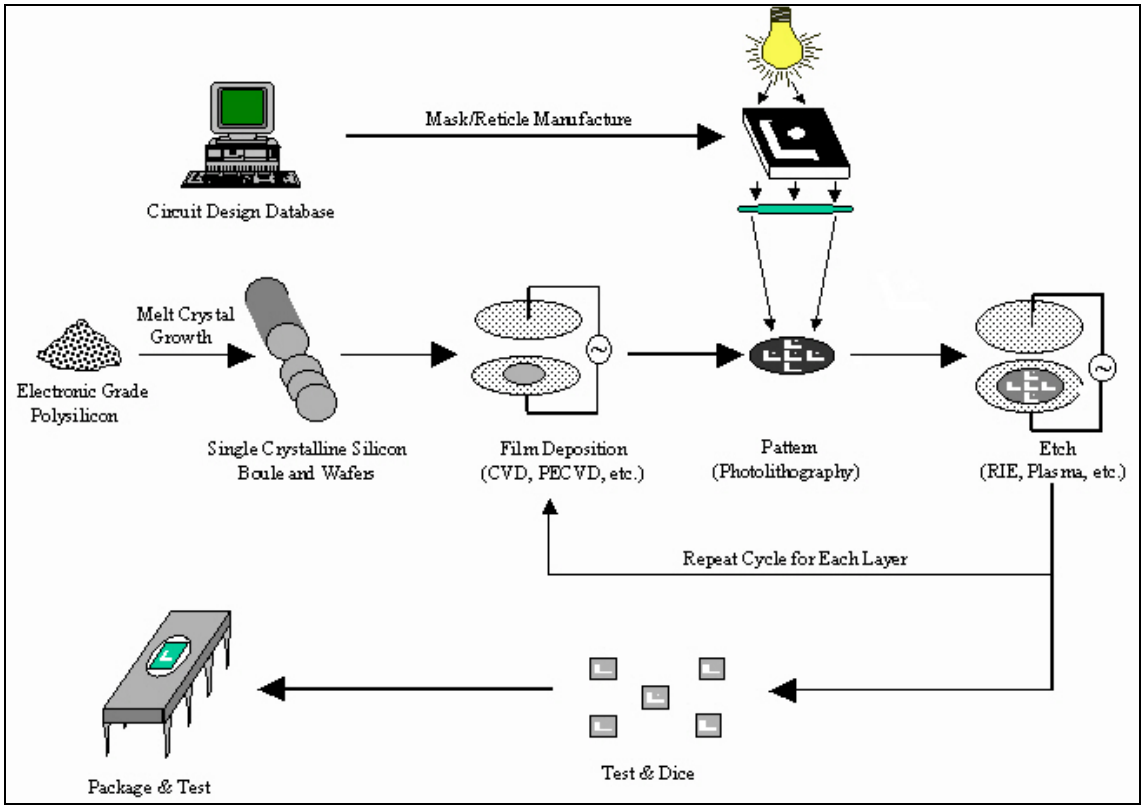


Figure #8: Simplified overall process flow for the manufacture of semiconductor integrated devices. Photolithography is the science of printing the circuit element patterns used for the construction of semiconductor devices. The figure shows a schematic representation of the overall process flow. Single crystalline silicon wafers are manufactured from raw polysilicon. The integrated circuits are then manufactured by repeatedly processing the substrates through a cycle of three basic unit operations: film deposition, lithography, and etch. This cycle builds up the patterned layers (semiconductors, conductors, and insulators) required to make a final device. The overall cycle may be repeated as many as 20 to 30 times. In general, each material, such as metallic conductors or insulators, is deposited as a blanket film over the entire substrate. The substrate is then covered with a protective polymeric material, the photoresist, that can be patterned in the lithographic step to provide patterned access to the underlying film. The patterned photoresist layer is used as a protective mask for an etch process that selectively removes undesired areas of the underlying film. After the etch process is complete, the photoresist layer is stripped away and the process is repeated to build up the various layers (adapted after Henderson Research Group 2002).

ZMD

In 1990, civil servants of the Saxonian Ministry of Economics and Labour had daily responsibility for former companies in the field. They were wondering what to do with ZMD (Zen-

trum Mikroelektronik Dresden, former Forschungszentrum Mikroelektronik Dresden). On the one hand, it appeared to be almost hopeless to keep it alive: their products were inferior to others on the World market, e.g. the chips were larger and more expensive to produce. Their former main market, the Soviet Union, had shrunk. On the other hand, they had many highly qualified employees, such as researchers, engineers and operators in a field which appeared to have a future. There was the danger the that best people could start working elsewhere. The state of Saxony then decided, together with the German Trust Agency, to try to keep ZMD alive. The privatisation of ZMD, which was owned by the German Trust Agency, turned out to be difficult. Investors were hesitant. In 1993, ZMD was a company with 600 employees, not profitable, though employment was down from the original 3,300. "An important signal sent from the state policy was no doubt the 1993 decision to buy the Zentrum Mikroelektronik Dresden GmbH (ZMD) company from the Trust Agency and thus to contribute to retaining specialist qualified human capital in the region." (Edler et al. 2002, p. 57) Today, ZMD is controlled by Westdeutsche Genossenschafts-Beteiligungs Gesellschaft mbH and ZMD produces ASICs (Application Specific Integrated Circuits) for cars and medical purposes (Sachsen LB 2002). ZMD says they are world market leaders in the segments of infrared- and hearing aid-chips (Heise 2002a).

Today, ZMD operates a US subsidiary in Melville, New York. In 2001, the company turned over € 68 mio. (<http://www.zmd.de/>).[11] ZMD expected to become profitable during the year 2002 (Heise 2002b). At the end of 2002, it had 600 employees.

Siemens/Infineon (Part I)

After World War II, the Siemens headquarters were moved from Berlin to Munich, significantly contributing to turning Bavaria from an agricultural state to a German high tech region (Die Zeit 2002). Already in 1952, Siemens started the production of transistors (Schumacher 2002). The transistor had been invented by William Shockley and colleagues in the Bell Laboratories, in 1947 (Mackintosh 1986).

In 1992, Siemens was still hesitating to invest in Dresden. Texas Instruments had withdrawn their interest to invest (Hendel, Spiller 2001). In December 1993, Siemens decided to invest the equivalent of € bn 1.38 into a semiconductor plant (Edler et al. 2002, p. 57). In 1994, the Siemens Microelectronics Center Dresden was founded. Reasons to invest were:

Skills and unemployment: The availability of skilled labour, of both engineering scientists and operators, was a core advantage of the region. Siemens employed many people who had formerly worked for ZMD (expert interview).

Public subsidies: The state of Saxony supported Siemens with a subsidy, which initially amounted to 23% of the supportable investment of the first building phase (Edler et al. 2002, p. 43).

Educational and research institutions: Experienced educational and research institutions, with a good reputation, were in the area, e.g. the Technical University. "[The GDR] had R&D facilities, including assembly and packaging techniques in R&D as well as in manufacturing." (Johann Harter, Infineon, according to Semiconductor Magazine 2001) This item, as well as the skills mentioned above, show that pre-1989 structures, as described in section 3.1.4, played a significant role in the investment decision.

A supportive government: Regarding the planning of the Siemens semiconductor plant at the Dresden location, Edler points out that Siemens had "very positive experience during planning, construction, and ramping up production " (Edler et al. 2002, p. 58).

[11] One can watch their latest plant being built at <http://194.15.148.206> and http://194.15.148.205/.

The latter point needs to be illustrated in some detail. The investment took place in the heath area north of Dresden ("Dresdner Heide"), an area with pine and birch trees on a sandy soil (Figure #9). Since the late 19th century time, the area used to be a military zone. At the end of GDR times, it was turned into a natural reserve zone. The Russian troops reportedly not only left buildings, but also ammunitions etc. During the course of the investment, the area was decontaminated (cf. Hendel, Spiller 2001).
To invest in the heath was controversial from the ecological side. Environmentalists feared the loss of trees and endangered species. During our interviews it turned out that the seemingly obvious idea to invest in a former industrial area was not attractive to Siemens for two reasons:

Figure #9: The Siemens/Infineon fab in the "Dresdner Heide" in the background, with a deserted industrial building in the foreground (October 2002, photo: Arnd Weber).

- Due to the privatisation policy of the Trust Agency, many large areas were no longer available, as parts had already been sold or were still operating, such as ZMD.
- It has also been said that the ground in the area of the Heide has particularly low vibrations.

Once Siemens showed firm interest, the local and state government supported the decisions very quickly. “Due to the close co-operation with officials of the state, district and the city of Dresden, the detailed planning was finished in the exceptionally short time of five months.” (Röhl 2000, p. 13)

Almost every political player supported the investment by Siemens. Only the site was somewhat controversial. A court case by environmentalists was quickly lost (Hendel, Spiller 2001). In 1995 the semiconductor wafer fabrication facility („fab“), was erected. After a fast “ramp up” of production, in 1996 the first 16-Megabit-memory chips were manufactured, in 1998 the first 64-Mbit-DRAM chips, and in 1999 the world’s first 256-Mbit-DRAM-chip.

The costs for a facility of this kind are primarily due to equipment, not to construction. The main proportion of orders for equipment went to foreign equipment manufacturers.

What is a Photomask?

Photomasks are a component in the lithographic process of semiconductor manufacturing. High-purity quartz or glass plates containing precision images of integrated circuits or chips, photomasks are used as masters by chipmakers to optically transfer these images onto semiconductor wafers. Current advanced lithographic tools, such as deepUV steppers, project light through a photomask and a high aperture lens. The intensity of the light casts an image of the device's design – the pattern on the photomask – onto a silicon wafer coated with a light sensitive material called photoresist. Using negative photoresist the unexposed, or masked, portion of this material is then removed so it can either be etched to form channels or be deposited with other materials. The process is reversed using positive photoresist.

Box #2: What is a photomask? (source: DuPont Photomasks 2002).

Below we will continue reporting about the development of Siemens, which later floated its semiconductor operations under the name of *Infineon Technologies*. The descriptions of both Siemens/Infineon and AMD (next section) are split into two parts, in order to present initial considerations related to the investment decisions, and initial results first. This will allow the review of the initial developments of both Siemens and AMD, in Section 3.3.3. Thereafter, in

Section 3.3.5, subsequent developments will be analysed, including aspects of co-operation and emerging economies of scale to be enjoyed by third parties.

AMD (Part I)

AMD (Advanced Micro Devices) is a US company headquartered in Sunnyvale, California. It was founded in 1969. It is the main competitor to Intel, although significantly smaller.

In 1995, representatives of AMD talked to Siemens about their reasons to invest in Dresden. In December 1995, AMD announced its decision to build a semiconductor fab in Dresden and decided against Ireland. "Other places offer money, but to make the operation successful you need the people" Drews, spokesman for AMD, said. An interviewed company expert describes the decision to invest as follows: "Ireland was well advanced when the siting decision was taken. The infrastructure in Dresden was more modern: supply of extremely pure water, sewage, the motorway, an airfield. In Ireland taxes and labour laws are certainly simpler. Not here, but people are the value added."[12] These two statements show that people's skills are the most important factor.

Dresden was the first production plant outside the US (formally it is the AMD Saxony LLC & Co. KG). "Our AMD facility represents an investment of more than $1.9 billion... We were able to get aid from German federal and state governments. They gave AMD an outright grant of about 800 million deutsche marks." (Drews, according to Bruner 2001). Since then, the investment is expected to increase to $ 2.5 billion. (Drews 2003)

The AMD fab was built at the northern border of Dresden, about 2 km from the airport and the motorway, in a formerly rural area (Statistisches Landesamt 2001). The plant is actually placed on a big granite block which is said to be good for reducing vibrations (interview). AMD has a four-lane road leading to Dresden and the airport. A bridge for wild animals has been built across it, reportedly to the surprise of some US visitors (see Figure #10).

AMD experts were impressed by the skills the Dresden engineering scientists had when they flew them to the US. They immediately produced proposals for improvements (company experts). Details have not been made available because they touch on company secrets. The skills were high because they had a very good basic knowledge of physics etc., had learned to anticipate outcomes, and in particular were able to re-engineer Western technology. Representatives of AMD expressed that the willingness to take risks which Americans have fits well with German precision and ability to anticipate results ("passt gut zu deutscher Präzision und Vorausdenken", company expert). This points to the significance of Saxonian and Dresden traditions of metal and electric engineering, which have their roots in the medieval ages, but were still fully existing in GDR times (see sections 3.1.1 and 3.1.3).

[12] „Irland war bei der Standortentscheidung weit gediehen. Die Infrastruktur in Dresden war moderner. Reinstwasserversorgung, Kanalisation, Autobahn, Flugplatz. In Irland waren Steuern und Arbeitsrecht sicher einfacher. Hier nicht, aber der Mensch ist der value added."

Figure #10: The AMD fab in Dresden, with a bridge for wild animals to the right (October 2002, photo: Arnd Weber).

Regarding operators, AMD employs only craftsmen from related occupations: "the employee must at some time have had a job in electronics so that he knows where the plus and minus poles are" (from an interview conducted by Bruch-Krumbein (2000, p. 161)). Initially, two thirds of these had been unemployed (AMD expert), certainly many came from the former VEBs in the technical areas mentioned in Table #5, but no figures are available. The former human resources director of AMD Dresden, Martin Gillo, had previously worked with AMD in the US, but was born in Leipzig. In May 2002, he became Saxony's Minister of Economic Affairs and Labour.

Typically, aluminium is used in semiconductor chips to conduct electricity inside the chip. In 1997, IBM announced the development of a production-worthy process using copper instead. These copper interconnects provide for a faster internal communication with less power needs. AMD decided to use the copper technology to build a very fast microprocessor. One of the problems of using copper is that it is "poison to transistors". Furthermore, it requires different chemical processes (see Box #3 for a description of the process AMD is using). These chemical processes pose new environmental risks. For instance, electroplating and chemical mechanical polishing during the so-called "damascene process" require large amounts of water and create large amounts of acid and heavy metal waste. These require bulk chemical distribution systems and waste water treatment facilities, which can well be built into new fabs (Semiconductor Magazine 2001). AMD had to build its own power plant to provide electricity to the fab (expert).

AMD decided to "bet the company" (Derbyshire 2001) on the copper technology and have its engineers in Dresden try to master the production process. AMD acquired a copper intercon-

nect technology process through an alliance with Motorola. The Dresden fab was designed for the new processes. The copper approach did not only pose the challenges mentioned, it also required very close co-operation with the US engineers involved in designing the chip. It is not the case that the US engineers basically sent a blueprint of a chip to Dresden and had the Dresden engineers solve the manufacturing problems. Not only the copper process was new, but also production with technology for 130 nm features. That is shorter than the wavelength of the light used to project the structures (cf. Derbyshire 2001). This meant, according to company experts interviewed, that international teams had to be formed to re-design the chip, to re-consider the number of layers, etc.

AMD Fab 30 Production Modules

Thin Films

The "Thin Films" module is primarily responsible for the production of layers which are necessary for the "wiring" of transistors in microelectronic circuits. The alternately electrically conductive and insulating interfacial layers are deposited on the entire surface of the wafer by means of physical as well as chemical methods. Conductive layers are produced preferably by means of the so-called sputtering or physical vapour deposition (PVD). In this process, a target is bombarded with ions. This leads to metal atoms such as copper or aluminium being ejected from the target; these atoms deposit on the surface and form the conductive layer. In the chemical processes, also called chemical vapour deposition or CVD, various gases react at or on the surface of the wafers, forming the conductive or insulating layers required. These processes are controlled by factors such as pressure and gas flow and by temperature and plasma conditions. Further depositions of layers occur in the "Diffusion / Implantation / RTA" and "CMP/Cu" modules.

Photo Lithography

For the further processing of the wafers after such depositions of layers on the entire surface, it is necessary to set apart the areas to be processed further from the other areas. For this purpose, the wafers are first covered with a light-sensitive layer (photosensitive resist). This is followed by an optical process which is equivalent to the processes used in photography and in which a chrome-glass mask containing the future chip structures is exposed to the photosensitive resist chip by chip. After this "lacquer exposure", the lacquer mask which is now on the wafer releases certain areas on the layer below for further processing and covers other areas. Such further processing usually consists in the removal of material in the areas defined by the lacquer mask so that electrically conductive tracks can be created (Etch module) or the creation of a certain electrical conductivity, e.g. for implantations at certain points (Diffusion / Implantation / RTA module).

Diffusion / Implantation / RTA

The purpose of this production stage is to achieve the required good electrical conductivity of certain semiconducting areas such as source and drain areas on the transistors by implanting dopants into the wafers. This is done by means of an high-energy ion bombardment. Afterwards, the dopants must be activated electrically by means of thermal annealing. In addition, any irradiation damage to the silicon as a result of the ion bombardment is healed in this process, which, however, must occur relatively fast so that the undesired out-diffusion of the dopants is avoided ("RTA" = Rapid Thermal Annealing).
As has already been mentioned under "Thin Films", conductive and insulating layers are also created in the Diffusion / Implantation / RTA module, in particular the so-called gate oxide by means of thermal oxidation and the actual polysilicon gate by means of an LPCVD process. These are also the major process steps in the production of transistors.

Etch

The purpose of this production module is to remove material from a layer which has been created on the entire surface of the wafer before only in the areas defined by the 100 masks. This is necessary in order to create the actual circuit structures and elements such as transistors, contacts and track con-

ductors out of these layers of different materials or to build them up gradually out of them.

Today, only dry etching processes are used in this production stage; the main principles of these processes are either of physical nature (sputtering-off, pulverization of the material using ions), of chemical nature (in an energetically strongly-excited state, highly-reactive gases create gaseous, volatile reaction products as a plasma with the material to be removed) or a combination of both. Over the plasma parameters such as energy, frequency, the reactor's geometry, the structure of gases and other reaction conditions, e.g. pressure and temperature, the etching speed, the selectivity of the material and the orientation of the material removed by etching (isotropy) can be controlled.

Nowadays, well-known wet-chemical processes involving special etchants (e.g. hydrofluoric acids) are no longer used for the actual transfer of structures but only for the so-called fine purification.

Chemical-mechanical Polishing and CU Electroplating (CMP / Cu)

The CPM module comprises two different principles:

1. Planarizing:
The repeated deposition and structuring of different kinds of layers during the entire circuit production process leads to a gradual formation of a topography on the wafer surface, which would not allow structures to be exposed repeatedly in the Photo Lithography module with the high precision required. For this reason, several polishing steps in which the wafer surface is planarized again by means of chemical or mechanical removal of material (etching or grinding), are provided for in the production process.

2. Structuring of metal tracks and connections (Damascene):
Metal is brought into etched structures. The surplus material is removed by being polished. The result is an electrical track conductor which could otherwise only be produced with difficulties - or not at all (the so-called Damascene process).

As has already been mentioned under "Thin Films", other necessary layers are also created in the CMP / Cu module - most importantly, the so-called circuit wiring is created here by means of electrogalvanic deposition of the copper multi-layer metallization. These are also the major process steps in the production of microelectronic components following the production of transistors. Finally, in a process similar to uniform-depth photogravure, electrical track conductors which could otherwise only be produced with difficulties - or not at all - are produced (Damascene process). For this purpose, materials such as wolfram or copper, which have been deposited in special trenches, are polished.

C4 (Controlled Collapsed Chip Connection)

After the completion of the production of chips on the wafer, the individual chips must be prepared for their future connections to the case. For ICs with a low number of connections, the so-called wire bond technology is still used in the industry in order to connect the ICs to the external pins, whereas for ICs with many I/Os (number of input and output signals, which is the total number of pins), the increasingly widespread flip chip technology is used. In the flip chip process, the front side of the chip is placed on carrier and, as a result, on the lead frames. In the flip chip / C4 process, the chip is prepared by installing so-called bumps on the connecting pads. The bumps are small soldering balls which can be scattered over the entire surface of the chips and which guarantee the electrical connection between the chip and the case later.

Box #3: AMD Fab 30 Production Modules. Source: http://www.amd-jobs.de/

The decision turned out to be a success. “Copper was an experiment. If it had failed, AMD would be dead.“ (expert) In March 2000, AMD had the first GHz-rated Athlon microprocessor available, well ahead of its competitors. In 2000, AMD made a profit of $ mio. 983, as opposed to losses in the other years from 1997 to 2002 (AMD 2003). AMD increased its mar-

ket share from 13% in 1999 to 21% in 2001 (Kharif 2002). By the end of 2001 AMD had produced 20 million Athlon chips. In 2002 the Athlon (XP) was still named as the "Best Computer Product of the Year" (PC World magazine, July 2002) and was used in PCs produced by Hewlett-Packard and Fujitsu-Siemens.

AMD's Fab 30 was awarded "Fab of the Year" for the year 2001 by Semiconductor International magazine in recognition of being the first facility in the world specifically designed to produce microprocessors with copper interconnects. The prize was awarded because of the high speed of erecting the fab, from 1996 to 1999, and because of the need to master new environmental challenges, due to the use of copper. In Dresden, AMD produces wafers; the chips are packaged in Asia.[13]

3.3.3 Summary of What Investors Appreciated

Available skills: As mentioned above, decision makers emphasised the skills of the local people. They are attributed to the German system of vocational training. "We have an old traditional system for vocational training in Germany that provides two years' education after young people leave secondary school," Günter Metzger of Saxony Economic Development Corporation emphasises (according to Bruner 2001). He continues: "People are dedicated to the job. They don't see it simply as a way to go in and do the work and get their paycheck and then go home. They see it also as trying to 'dedicate myself and all my strengths to thinking how I can foster and contribute to the success of this workplace.'" This does not appear to be only PR. Also in our interviews, the vocational orientation to do work perfectly showed up. The motto from GDR-times seemed still to be alive: "My hand for my products" („Meine Hand für meine Produkte", interview). It has been said to be an inner conviction ("innere Überzeugung"), rooted in culture (expert).

Regarding GRD-times, it was said: "The educational system in GDR was good. A high share of the population had university or technical college degrees" (expert). There was a "qualified education of craftsmen in GDR." A company expert: "Qualifications in natural sciences were better in East German plants" than in West German ones. "I always bought textbooks for mathematics and natural sciences in Eastern Berlin, they were better." "Basic research was excellent. Peoples' education was excellent. School education was excellent, much oriented towards technology." (another company expert)

In the early 90s, it was possible for the investors to select among top-class applicants, coming from the GDR companies. The gap between unemployment and employment was not too large. There was a "high willingness to contribute to productivity improvements. In Munich mostly only unskilled workers apply for a job. In Dresden, there has never been a shortage of applicants." (company expert)

Another expert: There was "an absolute urge to move things" [14]. Yet another: "Personnel was very committed and motivated. There were many excellent people in one place. They were good, motivated and had ideas." This led to the "very positive experience during planning, construction, and ramping up production."

Regarding the operators it has been said: "This is boring work for bad money. But you have to work free of error. People here in Dresden did such work in the past."

Regarding the engineering scientists, they were said to have a very good capability to anticipate possible outcomes of new technical approaches, as in the area of copper use. "No one can

[13] At <http://www.amd-jobs.de/> a nice virtual tour through the fab is available.
[14] „Absoluter Drang, etwas zu bewegen."

copy German engineers." Others referred to "German precision engineering" and "German thoroughness."

Summarising one can say that all experts and the literature point out that technical education in general (schools, craftsmen, engineers) was very good in Eastern Germany. In particular it has been said that much of the operators' work is repetitive, though it needs months of training. Many operators in Dresden are craftsmen in related electrical professions. Due to their skills, and of course also due to the unemployment in the region, they are able and willing to work very carefully, and contribute to achieving a high yield.

Public subsidies: Subsidies have been provided by the state and federal governments. Part of these funds originate from the European Union's "European Regional Development Fund" (ERDF), under the responsibility of the Directorate-General for Regional Policy (see <http://europa.eu.int/comm/secretariat_general/sgc/aides/thema/feder_en.htm> and <http://europa.eu.int/scadplus/leg/en/lvb/l60015.htm>). The objective of these funds is to enhance "economic and social cohesion" for "catching up on structural imbalances in the regions." According to a government expert, two thirds of the subsidies provided are ERDF-funds.

Larger subsidies require approval by the European Commission which makes sure they are in line with EU competition policy (see Official Journal, C 107 of 07/04/1998 pp. 0007-00012, according to Edler 2002, p. 43). In 2002, funding in Dresden was limited to 35%, as opposed to, e.g. the upper Ore Mountains, where rates are up to 50%.

The decisions by Siemens and AMD "cannot be explained with the massive public funding alone, as other locations like Scotland offered financial subsidies on a similar scale" (Röhl 2000, p. 13), i.e. the human factor was essential. It should be noted that the subsidies cover only a fraction of the total investment costs.

Educational and research institutions: In the Ore Mountains area, there are technical universities in Dresden, Freiberg, Chemnitz and Zwickau. All these universities contribute to supplying staff to the semiconductor industry, but of course also to other industries. A noteworthy development is the "dualer Studiengang" (dual course of studies) in Zwickau, providing a combination of practical work and theoretical education for students who are employees of Infineon. Since 1999 AMD has co-operated with the "Berufsakademie Sachsen" in various fields, e.g. Electrical Engineering, Computer Engineering, Business Administration. This co-operation combines theoretical lessons and practical phases that help students to become good engineers.
Besides the universities, there are numerous other research organisations, as mentioned above.

A supportive government: As reported in the literature, and confirmed in our interviews, the investors talked very positively about the local administrations. As mentioned above, the approval and planning for the investments took place very speedily: "The companies never had to wait for a permit" (interview). In the state parliament's voting, only one member from the Social Democrats was against the decision to subsidise Siemens. All others, including the Green Party, agreed. Also the improvements of the motorways and the airport were appreciated and probably deemed indispensable by the US investors. Bruch-Krumbein summarised in 2000: „In all, a highly energetic policy has been pursued." (2000, p. 284) She mentions the consensus-oriented policy of the former Saxonian Prime Minister Kurt Biedenkopf, who aimed at obtaining support from both investors and workers.

High acceptance in the population: Another factor which is in favour of the region "seems to be the high acceptance of large scale investment in the population", as Röhl put it (2000, p. 13).

Natural resources: Sufficient clean water from the ground was appreciated, and clean air.

3.3.4 Subsequent Semiconductor Activities in the Region

Siemens/Infineon (Part II)

In the year 2000, Siemens Halbleiter was floated and renamed *Infineon Technologies AG*. Together with Motorola and Wacker, Infineon developed, in Dresden, a technology for wafers of the size of 300 mm. The 300 mm development was supported by the German Ministry of Education and Research which had shown significant interest in economically improving semiconductor production in Germany (expert). The ministry supported the initial development with € 95 mio. (BMBF 2002, p. 11), the state of Saxony gave another € 61 mio. (Edler et al. 2002, p. 62). "Infineon had always said it would do it to drive down the cost curve." (Semiconductor Magazine 2001). This is particularly relevant in the DRAM business, as this is a very competitive market with relatively low revenue per wafer, as opposed to, e.g., the market for specialised chips (Leachman, Leachman 2003).

The 300 mm Infineon fab costs amounted to € 1,1 bn. It will be subsidised with € 229 mio (Edler et al. 2002, p. 44). The latter subsidy was authorised by the European Commission (press release IP/02/517 of 9. April 2002, see <euo.dk/euidag/rapid/IP_02_517_0_RAPID/>). The Commission had investigated whether the market was in decline ahead of giving its approval.

M+W Zander, a subsidiary of Jenoptik, participated in the planning and construction of the 300 mm fab (http://www.jenoptik.com/). "The 300 mm production was introduced with breathtaking speed" (expert interview). The world's first 300 mm product was produced, a 64-Mbit-DRAM chip. Volume production of 300 mm wafers started in 2001 (Infineon 2002). Infineon was awarded the "Fab of the year prize" of the year 2000 by Semiconductor International magazine for the 300 mm pilot line.
The Siemens/Infineon investment is one of the rare cases in Eastern Germany in which "foreign" investment is combined with research (Belitz, Fleischer 2000, p. 290). Infineon Technologies has partners and co-operations in many countries. One focus are co-operation projects with smaller companies, universities and institutes in the local area. This is part of the tasks of the "Memory Development Center" (MDC) founded in 2002, which took over this responsibility from the former "Center for Development and Investigation" (CDI). The MDC is responsible for joint development projects and has the possibility to share clean room area with other companies or institutes.
In 2002, fabrication in Dresden is taking place with 200 and 300 mm. On the 300 mm-wafers, technologies with 140 nm structure and less are used, 70 nm is under preparation. Important products are logic IC´s (e.g. for communication) and DRAMs. Infineon claims cost leadership due the 300 mm production (Schwarzer, Preissner 2002). For future DRAM chips Infineon will use their "trench" technology to provide for superior storage capacitors.

Figure #11: Part of the Infineon fab (source: Infineon 2002).

In 2001, the global semiconductor market declined. In its fiscal year 2001, Infineon made a loss of € 1.02 billion. 5,000 of its 35,000 jobs were lost. Short time work was introduced in Regensburg and Munich (Infineon 2002b). Investments in Regensburg were reduced to "practically zero", as CEO Schumacher said (EE Times UK 2001). Regensburg had short time work in 2001, while Dresden had none. A new fab in North Tyneside, UK, had already been closed in 1998, representing unneeded capacity. The fab in Richmond, US, is already also using the 300 mm technology. Employees in the two 300 mm fabs compete against each other ("benchmarking").

In its fiscal year 2002, Infineon made a loss of € 1.14 billion, with a turnover of € 5.21 billion, 8% less than in the previous year. In the autumn of 2002, Infineon employed 4,600 people in Dresden. Siemens had originally planned for only 1,450 (Edler et al. p. 58). Infineon will build, together with the Taiwanese Nanya Technology Corporation, a new 300 mm fab in Taiwan (Infineon 2002[15]). Infineon believes to be able to achieve profits in the DRAM market with its 300 mm production, e.g., on the growing Chinese market. Early in 2003, they announced to have returned to profitability on their memory products (Infineon 2003).

AMD (Part II)

Dresden became AMD's only processor fab. AMD founded the Dresden Design Center as a product development centre. It is developing, e.g., chipset ICs, which connect processors with peripherals. It is also participating in developing "Personal Connectivity Solutions" such as Web tablets, mobile computing devices and automotive systems.

[15] This does not appear to represent the concept of a foundry, which is a „fab" working for „fab-less" companies (or companies without sufficient in-house capacity). Leachman and Leachman (2003) report about Taiwanese foundries and state that they provide „excellent customer service" while compensating their workers and engineers better than almost anywhere else. However, the foundry typically does not need to have the latest technology, as it is needed in the DRAM market.
STMicroelectronics, Philips Electronics, and Motorola will jointly operate a 300 mm fab in Crolles, France, in order to share the costs of 1.4 bn $ (IEEE Spectrum 2003).

AMD's global share of the processor market decreased to 11.6 % in the autumn of 2002 (FTD 31.10.2002). AMD made substantial losses in 2002 of $ 1.3 bn, with a turnover of $ 2.7 bn, down from $ 3.9 bn in 2001. Its competitor Intel made profits of $ 3.1 bn, with a turnover of about 23 bn, in 2002.

Economic sustainability hinges on whether AMD will become profitable with new processors and products from its other businesses, e.g. the production of flash memory for phones and cameras. It intends to return to profitability with new products, such as a 64-bit processor. This "Hammer" line of products, branded "Opteron", was launched in April 2003 and will be used by server producers, e.g., by Cray, who have already published plans to deliver to the US Sandia National Laboratories, and by Newisys, founded by a former CTO of IBM (http://www.newisys.com). In Dresden, AMD plans to continue investment and reach a total of $ 2.5 billion in 2003. In October 2002, AMD employed about 2,000 people in Dresden, of whom fewer than 10% are engineers. In November 2002, AMD announced a reduction of its staff by about 2,000, or approximately 15 % of its global workforce. As of writing in early 2003, no reduction of permanent employment is planned for Dresden.

3.3.5 Contractors for Semiconductor Production

AMTC

In May 2002, AMD, Infineon and DuPont Photomasks founded AMTC, the Advanced Mask Technology Center. The next generation of lithographic masks for the exposure of silicon wafers will be developed there (see Box #2 "What is a photomask?"). This is a significant step towards establishing Dresden as a world centre of semiconductor research, a "sensation" according to one expert interviewed. According to <De.Internet.com>, it will lead to the closing of Infineon's mask production in Munich.

Figure #12: Drawing of planned AMTC plant, being under construction in 2002 (source: www.amtc-dresden.de).

Wacker Siltronic

VEB Spurenmetalle in Freiberg was bought by Wacker, Munich. In late 2002 it had about 560 employees. In October 2002 it was announced that it would open a 300 mm wafer factory in Freiberg. The quality in terms of purity, flatness and crystalline quality will be high enough for production of below 100 nm structures. The plant will cost an estimated € 430 million, it will be subsidised with € 25 million (de.internet.com) and is planned to start production in 2004. It will deliver wafers to Infineon Dresden and customers worldwide. Wacker Siltronic plans an additional 600 jobs. Wacker, Munich, was, in 2002, the only manufacturer, besides Shin-Etsu and Sumitomo Mitsubishi, who was capable of producing 300 mm wafers in large quantities.

Figure #13: Wacker Siltronic production (source: http://www.sachsen.de/de/bw/hightech/).

Freiberger Compound Materials

Freiberger Compound Materials (FCM) is another offspring of the former VEB Spurenmetalle. It continues the GaAs business and had about 200 employees in late 2002. Experts interviewed said these are faster than Silicon chips and in particular used for military purposes. "Freiberger" claims it maintains technological leadership in the world market for gallium arsenic semiconductor wafers (see Figure #14). Since 1997 it has been owned by Federman Enterprises, Israel (87.5%) and Infineon (12.5%).

Figure #14: Freiberger GaAs crystal (source: http://www.fcm-germany.com/).

Equipment Manufacturers

The total of all equipment purchases by the Dresden semiconductor companies between 1995 and 2002 was predicted to amount to approx. € 5.5 bn. (Edler et al. 2002, p. 104). 30 international equipment manufacturers opened sales and services offices in Dresden (Edler et al. 2002, p. 11). Many contractors settled in Dresden only after AMD went there. It must be noted that by far the largest share of equipment is produced abroad. An example of a foreign equipment manufacturer is Tokyo Electron (<http://www.tel.co.jp/index_e.html>), who still have their main German office in Munich (<http://www.tel-europe.com/info/ted.htm>). Other examples mentioned are KLA-Tencor, one of the largest semiconductor equipment companies of the world, which produce process control systems. They have a subsidiary in Dresden. Another example mentioned is Nikon, producing, e.g., lenses and scanners, with a subsidiary in the Frankfurt (Main) area. Yet another example is the Dutch equipment provider ASML which produces scanners for exposing wafers (www.asml.com). ASML is the fifth largest equipment producer in the world and has offices in Dresden ("An der Flutrinne"). In their scanners they use, e.g., lenses from Carl Zeiss, Oberkochen, West Germany. Zeiss in turn contracts IMEC to develop production processes, see Box #4 (cf. Carl Zeiss SMT AG 2002).

Planning and construction of fabs was done by M+W Zander, a subsidiary of Jenoptik.

Lithography

Lithographic lenses: By example, a figure of a Zeiss Starlith lens, usable for creating masks with 100 nm structures. It has a maximum aperture of f/0.45 for a wavelength of 193 nm (source: http://www.zeiss.de/de/semicon/home.nsf/Inhalt-FrameDHTML/67A3FE8AF0A749E041256A680035CD78). Zeiss is currently working on developing an optical system for achieving a resolution of 35 nm.

Measurement equipment: By example, a Nikon measurement system for checking exposures. Measures mask images with a low-aberration optics and achieves a precision of 2 nm, about the size of the molecules (source: Nikon 2002b).

Box #4: Lithography.

Some new equipment manufacturers who started business in the area are:

- DAS (Dünnschicht Anlagen Systeme) is a ZMD spin-off from 1991. It is one of the fastest growing regional suppliers. It invented an innovative process for the environmentally safe disposal of poisonous wastes associated with semiconductor manufacturing. They produce, e.g., systems which treat all pyrophoric, toxic and environmentally hazardous gases used or generated in semiconductor manufacturing. They employ 120 people, most of them in Dresden.
- Another example is FHR Anlagenbau (Röhl 2000, p. 17). FHR Anlagenbau was founded in 1991. It is working in the field of high-rate sputtering for microelectronics (<http://www.fhr-ab.de/html/overview.html>). By 2000, FHR had 45 employees.

- Then there is, e.g., the new company Karl Süss, founded by a former director of VEB Elektromat (Plattner 2001). The government writes about the company: "The Saxon company Karl Süss brought the world's first analytical prober for 300-mm wafer and sub-µ-processes on the market. The Karl Süss Dresden GmbH is in high demand as an equipment manufacturer for the semiconductor industry. With the PA 300, the company achieved the development of the world's first analytical prober for the 300 mm wafer technology. In its year of foundation in 1990, two employees worked at Karl Süss – today there are more than 100. This measure of success is also reflected in the continued growth of the export sector which currently amounts to more than 80 % of the total turnover. The Saxon company supplies its customers all over the world. These include such well-known names in the semiconductor industry as Siemens, IBM, Daimler Benz, Intel, Sony and Toshiba." (www.sachsen.de; cf. www.suss.com)

Edler et al. noticed that it would be desirable for the region to have more equipment development in the area. It should therefore be investigated, Edler wrote, whether pilot production such as with the Centre for Micro- and Nanotechnology Innovation (MINATEC, cf. www.minatec.com) in Grenoble should be publicly supported (p. 160f).

3.3.6 Other Semiconductor-related Companies in the Region

In this section, we mention a few more companies, for example:

- One case is a successful one, the case of KSW (see Box #5). An interviewed expert pointed out the case of KSW to illustrate not only a successful case, but also that policy makers should make more efforts to support the development of promising companies.
- Another company, Silicon Vision, ran into a shortage of cash (see Box #6).
- Then there is Systemonic (http://www.systemonic.com/). The company was founded in 1999. It produces chips for wireless communication. For instance, they produce a chipset which provides complete coverage of both IEEE 802.11a, b and g standards. Thanks to their innovative products, they have been named one of "Europe's 50 Hottest Tech Firms" by Time Magazine. One interviewed expert said "the importance of Systemonic cannot be overestimated, as they are doing world class developments there." The company has obtained support from Raytheon und Sony. At the end of the year 2002, they had 89 employees in Dresden and in San Jose, California. In 2003, Philips took over the company.
- Yet another company to be mentioned is Solarworld in Freiberg, which produces solar cells (http://www.solarworld.de) with about 300 employees.

It is not possible to mention the activities of all companies now active in the field. According to Gitta Haupold, of the industry club "Silicon Saxony", there are about 200 companies in the area of Dresden active in the area of semiconductors (Sachsen LB 2002). Production is concentrated in the Dresden and Freiberg areas, related training in particular in Dresden, Freiberg, Chemnitz and Zwickau. Beyond semiconductor production, there are of course other companies involved in the larger field of microelectronics. Figure #15 provides a geographical overview.

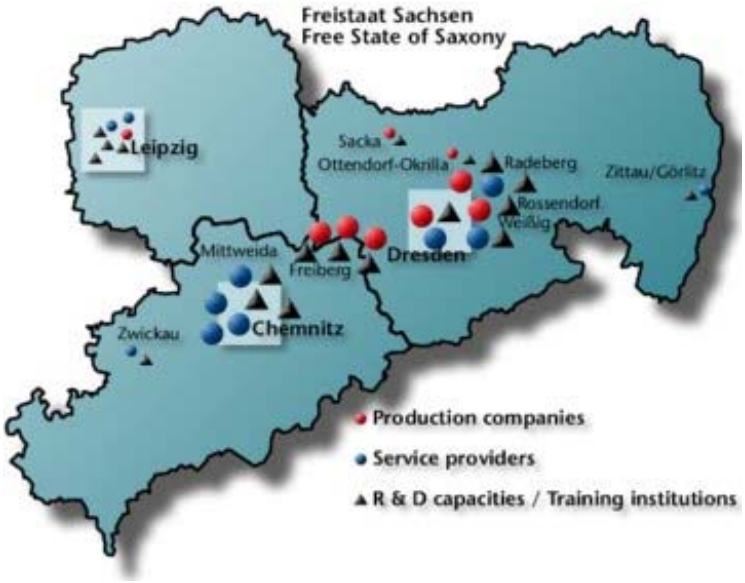


Figure #15: Microelectronics in Saxony (source: www.sachsen.de).

The Case of KSW

"In GDR times, there was a leading assistant called Mr Seidowski. In 1990 he was scheduled to be appointed professor. At their appointment, the rector told him, 'We're reconsidering everything. I can't appoint you.'
When machines from the institutes were decommissioned, he stored them in his own basement. He was active in the field of packaging, where they make chips out of wafers. He then specialised on labels for transponders [KSW Microtec]. You have to think of it this way: you have a paper label with a small antenna stuck onto it, and in one corner is a tiny chip. The manufacturer sticks this thing into a suit and you can then drive a container through a gate with an antenna and can identify every single suit. In contrast to barcode you can write on the chips. Something they've developed lately is a novel battery which is completely flat and also soft. This has the advantage over competing products, such as one from Varta, that you can dispose of it in an environmentally friendly way in household refuse. The chip can also do such things as measuring the temperature. For instance, when transporting meat you can measure the temperature afterwards.
He didn't get any outside capital at the time. Of course, over time he received the usual financial support for company founders and investment subsidies. About two years ago, he got venture capital. They now have a new factory with a clean room built on a meadow in Klotzsche.
The man made it, but that was luck because he's an innovator, a workaholic with good international contacts, but he isn't immune to advice. He almost went to Boston because they wanted to prescribe the colour of his windows here on the industrial estate.
In GDR times, the packaging department at the TU Dresden was a world wide leader. The university chairs in this area have practically been scrapped. They're jumping on the upstream areas of chip manufacturing, but they do that everywhere. In that way, they are neglecting the areas where medium size companies have their opportunities. Capital need for chip manufacture is too large. That's one of the deficits here. Seidowski is something of an exception, he's the most successful. By the way, he extended his contacts to Russia. He is doing research with them, also buying from them. This is completely alien to West Germans." (source: expert interview).
Reportedly, KSW has 40 employees (http://www.bizzcontact.com/).

Flexible Smart Label Inlays (source: Heinrich, http://www.tu-dresden.de/vd51/trabrief/012002/s22.html)

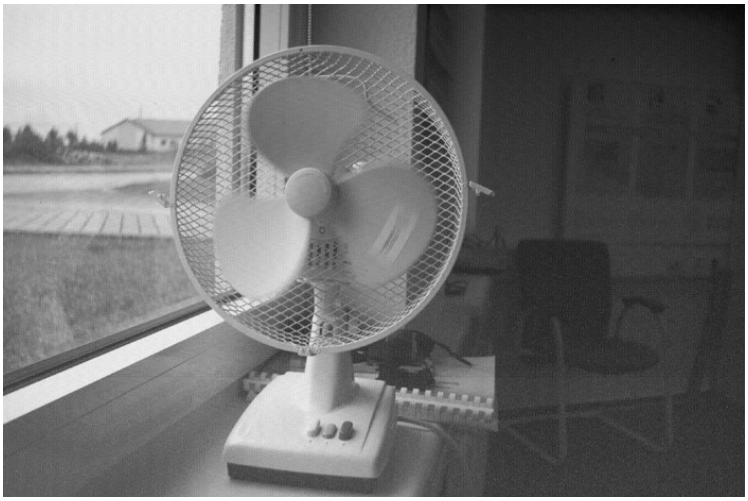
Box #5: The case of KSW.

The Case of Silicon Vision

Silicon Vision AG is engaged in the development, fabrication and marketing of powerful digital image sensors. The devices are made in Thin Film on ASIC technology (TFA). An amorphous silicon photodiode is positioned on top of a crystalline silicon ASIC (Application Specific Integrated Circuits). Compared to other CMOS or CCD image sensors this hybrid provides several advantages.

Very good Quantum Efficiency and High Sensitivity
TFA sensors employ a-Si:H thin film systems as the photosensitive devices. Amorphous silicon has a higher absorption coefficient than crystalline silicon and its spectral response is closer to that of the human eye, which is in the range of about 350 nm to 750 nm. Beginning with short wavelengths (380 nm, violet) the sensitivity of a monochrome LARS III for instance TFA/CMOS sensor reaches its maximum value of about 255mA/W at 530 nm (green). In the region of longer wavelengths the sensitivity falls again, since the photon energy decreases and a complete absorption is not possible any more.

100 % efficient Global Shutter
When confronted with the task to capture a fast moving or a rotating object CCD imagers have some limitations due to their concept. The rolling shutter read-out leads to distortion of the objects. Because the integration of the signal cannot be stopped in a standard CMOS pixel even those "Global Shutters" do not fulfil all expectations.
Only the separation of diode and ASIC and the specific design of a Silicon Vision TFA/CMOS pixel electronics provides a shutter efficiency of 100%. Because a transistor controls the integration it really stops when the electronic shutter is closed (the description so far is based on information available on the Silicon Vision server).



Sample image of a fan rotating at 1,800 rpm. There is no distortion and no background shining through the blades (source: http://www.siliconvision.de/)

In June, 2002, the company opened a new headquarter in Moritzburg / Boxdorf near Dresden with a new fab of 1,056 m². Sales, however, did not develop as expected, prices declined, partner Agfa withdrew, as well as banks (Gesco 2002). The company had to declare insolvency in August, 2002 (Finanzen.net 2002). Infineon plans a takeover of parts of the company (Heise 2003).

Box #6: The case of Silicon Vision.

4 Assessment

4.1 Assessment of Individual Dimensions

Employment

The Dresden Semiconductor Beacon

Both, expenditure by firms as well as the number of employees, increased during the last years, more than initially expected (Edler et al. 2002, p. 6 and 66). AMD, Infineon and ZMD alone employed about 5,000 people in 2000. This has been estimated to increase to 6,300 during the year 2002 (Edler et al. 2002, p. 123). In autumn 2002, however, for the big three companies we obtained figures which add up to about 7,100 (see Table #6). That does truly give the impression of a beacon.

Semiconductor Employment in the Dresden Region	
Infineon	4,600
AMD	2,000
ZMD	500
Wacker	560
FCM	200
Solarworld	300
Other related companies in the region	2,500
Total	~ 10,700

Table #6: Employment in 2002 (source: own computation, "other related companies" is the figure provided by Edler for "other suppliers" Edler et al. 2002, p. 119. It has been renamed in order to take into account of employment with companies such as KSW. Edler's figure excludes companies in Freiberg, therefore Wacker, FCM and Solarworld are mentioned separately).[16]

Table #6 shows that a total employment of more than 10,000 persons has been achieved. It is difficult to estimate the actual figure more precisely. For instance, one expert pointed out that employees of subcontracted catering companies would have to be counted in addition, another pointed out that increasingly individuals receive the status of "self-employed". Furthermore, the spending of income leads to additional employment which was estimated to be about 2,300 persons (Edler et al., p. 123).

Besides semiconductor production, there are also other microelectronics-related companies. After 1989, Kombinat Robotron was split into several firms. One example is Schäfer IT-Systems who produce PC and server housing and deliver, e.g., to IBM, Hewlett-Packard and Fujitsu Siemens. They have more than 600 employees (Sachsen LB, Saxonmail).[17]

[16] In June 2002, Edler et al. computed the employment effect of the semiconductor fabs in the Dresden region as follows: 6,300 direct jobs, 2,572 with suppliers, 401 for construction, and 2,341 as an effect of income spending (p. 123).

[17] The city of Dresden publishes a figure of 20,000 people working in the areas of microelectronics and IT (www.dresden.de). The state's "Telematikbericht" (2001) provides a figure of 44,587 for the whole of Saxony, including the printing industry. Whether the city's figure is a bit high cannot be judged here. There is of course considerable related employment outside Dresden, in Chemnitz, e.g., there is the IBM-subsidiary "IT-Services and Solutions" which has 1,500 employees alone.

Unanimous relief about the employment development initiated by Siemens and AMD can be noticed when talking to ordinary citizens in Dresden and experts alike. There has been a five-fold increase in turnover according to the statistics for radio-, TV-, and communication technology production in Saxony between the years 1995 and 2000 (Edler et al. 2002, p. 127). According to Edler (personal communication), this is to a significant degree due to the Dresden semiconductor fabs.

However, the situation needs to be framed by regarding the total situation in Saxony. On the one hand, Dresden has so far developed better than the similarly large city of Leipzig (see Figure #16). As there is a lack of company headquarters, and a lack of large companies, it is understandable that the Saxonian government encourages large investments to address these deficits. For instance, there is the car "beacon" of the investment of Volkswagen in Mosel (Zwickau). In 2001, BMW announced its intention to invest in Leipzig. As mentioned earlier, there are reports about relatively increasing industrial production in Saxony. On the other hand, the general unemployment level remains at about 19%.

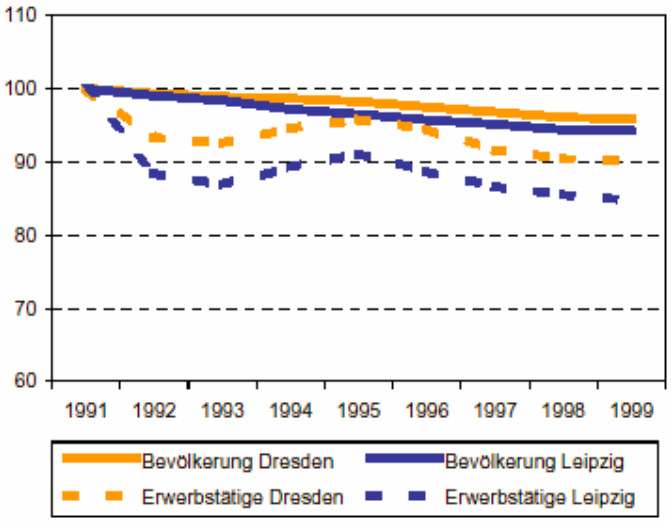


Figure #16: Population (Bevölkerung) and economically active population (Erwerbstätige) in Dresden and Leipzig, 1991 = 100 (source: Blien et al. 2001, p. 42).

Government Spending and Revenue

According to estimates by Edler et al., the government subsidies, as big as they may appear, will lead to even higher tax payments in the form of (1) income tax paid by employees, (2) social security payments, and (3) taxes paid by the companies, though the latter will likely be the smallest:

- The total government subsidies to the semiconductor companies between 1994 and 2010 will probably be € 1.2 bn.
- Total revenues to the government from the subsidised companies will be around € 2 bn in taxes and € 3.9 bn in social insurance contribution (including savings due to reduced unemployment, Edler et al. p. 141).

The creation of about 10,000 jobs with about € 1 billion subsidies comes down to a subsidy of about 100,000 €/job, without taking into account effects through spending of incomes and social insurance.

In the literature, and in the interviews, the following issues arose:

1. Semiconductor production has a strategical role for Germany, as visible from projects supported by the Federal Ministry of Education and Research, e.g. the MEGA-project of the 1980s (cf. Reger et al. 1999) or the recent push of the 300 mm-technology. From that point of view, grasping the opportunity of having underemployed specialists available becomes understandable.
2. Companies with less need for equipment, e.g. a software company, should not be given similar amounts. That would not be justifiable (expert interview).
3. Large investments by solid investors show a tangible effect – "there is something substantial on the meadow to be shown by the government" – and are less risky (expert interview).
4. Supporting "enlarged workbenches", as done earlier by the Trust Agency, is not good enough. "Independent substance is more important" ("eigenständige Substanz", company expert).
5. Entitling every investor to a subsidy can lead to huge costs, and windfall gains. Too many apartments were built after 1989. Also the subsidisation of mobile investment goods in the East may have led to windfall gains at Western headquarters (see Ragnitz et al.).
6. To achieve more employment, the government may have to support more risky investments. That would be difficult for traditional civil servant thinking, but it was said to be a chance to develop more locally based industries (expert interview). Also, today only very mature proposals would be approved by the government, and the rules were said to be too complicated for some investors (company expert).

Summarising one can say that the government subsidies contributed to a positive development in terms of both employment and future government revenues. The "only" question remains whether the government could have done even better.

Job Quality

The existing studies hardly address the quality of the jobs. The burden on operators probably is not negligible, due to extensive shift work, the special behaviour needed in clean rooms, such as wearing special clothing ("bunny suits"), no make-up, the need not to smoke before work, etc. According to Edler, wages of operators are about € 29,000 per year, while wages of university degree holders are about € 56,000 (Edler et al, 2002, p. 109).

In expert interviews it turned out that due to the general situation of the global semiconductor industry, continuous productivity improvements take place, which may even lead to outplacements (Infineon galaxy June 2002). In 2002, the companies noticed that people's willingness to move has become larger, and the number of qualified unemployed jobseekers has increased (interviews). Increasingly, job contracts are of limited duration, or subcontracts are being used. The flexibility of staff to accept or invent changes in production reportedly is higher than in Munich or Regensburg. In Dresden, employees who work with one of the large semiconductor companies are clearly envied by the rest of the population. One of the investors at one time received about 1,200 applications per month.

Education and Research

The semiconductor companies in the area, in particular Infineon, are actively developing educational processes. They anticipate that future needs for well-educated engineering scientists can hardly be met in the area, e.g. because of decreasing birth rates. Therefore, they participate, e.g., in the development of new professions, such as "mechatronics", in creating new

types of tertiary studies, such as the "dualer Studiengang" (dual course of studies) mentioned above. Recently, the "Dresden Chip Academy" has been created as a framework for such vocational training (cf. Buss, Wittke 2000), offering the degree of a bachelor.

Nevertheless, it is anticipated that in the future, more engineers "will need to be recruited in the Czech Republic and in Poland" (interview). The expert who said that was pleased about the knowledge of the German language of applicants coming from these countries. Concluding one can say that the traditional education in Eastern Europe, here in Eastern Germany, in natural sciences, at ordinary schools and at universities alike, was seen as a highly important factor for the creation of the semiconductor cluster. Players see that efforts must be made to retain that level.

Ecology

The ecological aspects are not only dealt with because the EU addresses them in its official objectives. After the severe flooding of Dresden in August 2002, it was felt to be impossible to avoid checking if there is any relation between the semiconductor investments and the floods.

Floodings: The fabs were not been by the floods of the Elbe river and the smaller rivers in the area. The floods, during which the river Elbe approached 8.77 meters (normally about 2 meters), have been estimated to have caused damage of about € 6 billion or more in Saxony (Badische Zeitung 4.11.2002), which, by the way, is roughly the total value of all "fabs" (Edler et al. p. 65). With their constructions sealing the soil, the fabs contributed marginally to the floodings further down the river Elbe. Causes for the floods must on the one hand be seen to be natural, as similar floods occurred, e.g., in 1845 and 1897 (Merian 1999, Mende 2002), and on the other hand they must be seen to be man-made, as water dams, erected for protection, were used as reservoirs in the "upstream" mountainous areas of Germany and the Czech Republic and were filled for purposes of electricity generation and tourism. Further man-made causes are rivers being diverted or made navigable.

Hazardous Chemicals: The ecological effects of the semiconductor production itself are not addressed in the scientific literature about Dresden. The issues themselves are obviously dealt with, see the above remarks on AMD's copper production and the protective equipment produced by DAS.

Water supply: Production may have an effect on the water supply, as ground water under the fabs is tapped, but it was not possible to investigate any long-run effects.

Energy consumption: This is another area not discussed in the literature about Dresden and only scratched in Mazurek (1999, p. 49).

Traffic: It is understandable that investors preferred locations in proximity to the motorway and the airport. For semiconductor production, areas with clean air, water and low vibrations are particularly attractive. The issue arises, however, why it has not be possible to construct new sites close to the city centre to avoid new traffic, i.e. in the former industrial areas. For the moment, this does not appear to be a severe issue, as we are only talking of about 10,000 jobs. But if economic activity reaches a level as in West German cities, or as in the Dublin area, car traffic may increase significantly. A major reason appears to be that the Trust Agency said it made no industrial policy and therefore did not consider to keep large scale production areas intact, or systematically reserve them for large investments. A frequent result of this are split ownerships of territories. It has also been pointed out by one environmental expert that US investors may find proximity to motorways and airports a more obvious need

than to historical city centres: "They look at that on maps in America, look for motorways and airfields. They have a different idea of town centres, prefer to live close to the motorway."[18]

Quality of Life

Is the quality of life in Dresden, the attractiveness of the city an important factor? On the one hand, one might believe unemployed skilled engineers and operators and public funding are the essential factors. On the other hand, there is evidence that the attractiveness of the area is important for two reasons:

- To attract investors in the first place: According to our interviews, investors have been shown attractive parts of Dresden, such as the Baroque scenery next to the river Elbe, the fine residential areas in the hills above the river, next to vineyards and floodplains, to make them interested in the area (see Figures #5 and #17).
- It has also been reported that a high quality of living is necessary to be able to attract specialists (Edler et al. 2002, p. 161).

Figure #17: One of the finest residential areas in Dresden (October 2002, photo: Arnd Weber).

Neither the „Plattenbauten" nor the large number of deserted houses contribute to making the city particularly attractive. The university with its good reputation as well as the new Dresden International School for young pupils, with already 220 pupils, certainly do (<http://www.dresden-is.de/SchoolFrameset.htm>). To give an impression, one investor at one time chartered an aircraft to fly in 25 foreign specialists and showed them the city (company expert). Nine of them remained. Another company expert reported, about the global

[18] „Die gucken sich das von Amerika aus auf der Landkrate an, gucken nach Autobahn und Flughafen. Die haben eine andere Vorstellung von Innenstädten. Sie wohnen lieber in der Nähe der Autobahn."

situation: “In some areas, there are a dozen or so specialists. You won’t get these specialists to a city [on the Balkans]”.

Economic Sustainability

Arguments in Favour of Sustainability

On the one hand, the semiconductor area appears to be flourishing extremely well:

1. Large construction activities continue, such as for the Mask Centre or at ZMD’s premises.
2. Employment keeps developing better than anticipated.
3. According to one interview it can be expected that the difficulties of producing in the 100 nm range or below will make it increasingly necessary to have very close co-operation between designers of products, designers of production processes and operators of pilot production lines.
4. Well skilled, available, relatively cheap craftsmen co-operate intensively with highly skilled engineering scientists. This combination is not easily available elsewhere. Regarding operators it has been said: “They have to work free of errors. Here in Dresden, people have done such work in the past” (expert) Workers in accession countries would not necessarily be used to that.
5. Investors increasingly conduct research in the Dresden area.
6. EU enlargement will contribute to easing any shortage of engineers. Engineers from accession countries would be as good as German ones (expert).

One group of researchers even concludes that the Dresden development is unrivalled by developments in Western Germany (Blien et al. 2001, editorial). Some respondents expressed that the general level of skills of potential operators in the Candidate Countries is somewhat lower, and that sometimes local governments in these countries are less transparent and efficient. These issues have not been investigated in any detail, but it would mean that the Candidate Countries are no real rivals for the time being.

Arguments Against Sustainability

On the other hand, some critical issues may need to be watched:

1. The large investors made losses in 2002. The main reason was the global situation of the semiconductor markets, see Figure #18. The figure makes the large relative changes visible which the companies have to deal with. “The top 25's semiconductor sales dropped from more than $167 billion to just less than $112 billion [in 2001]”, according to Electronic News 2002. Regarding AMD, currently their main competitor Intel is much more profitable, with a profit of $ 3.1 bn in 2002. Yet, AMD will need to make large investments in order to remain competitive, $ 5 billion have been mentioned (interview). Regarding Infineon, due to tough competition they had also incurred losses. They compete against, e.g., Hynix (a merger of Hyundai’s and Goldstar’s semiconductor operations). Hynix has a “position [which] remains positively dire at best, buried under a mountain of debt and desperate to raise cash. Technically bankrupt, it is being kept alive due to indirect support from the Korean government.“ (Future Horizons 2002, p. 32). Infineon has been pressing the EC to file a case with the World Trade Organization charging the Korean government with violating global trade rules through its connection to the Hynix rescue package (Robertsen 2001). Early in 2003, the EU reportedly threatened to impose a 25% import tariff as a sanction against Hynix. Infineon also competes against Samsung, who are profitable (cf.

Table #7; according to iSupply, Samsung became number two semiconductor producer in 2002).

2. EU enlargement may lead to reduced public subsidies for new investments in the long run.

Ranking	Company	$ billion
1	Intel	23.9
2	Toshiba	6.8
3	STMicroelectronics	6.4
4	Texas Instruments	6.1
5	Samsung	5.8
...		
9	Infineon	4.6
...		
12	AMD	3.9
...		
18	Hynix	2.5
...		
Top 25		112

Table #7: Semiconductor sales in 2001. Source: Electronic News 2002.

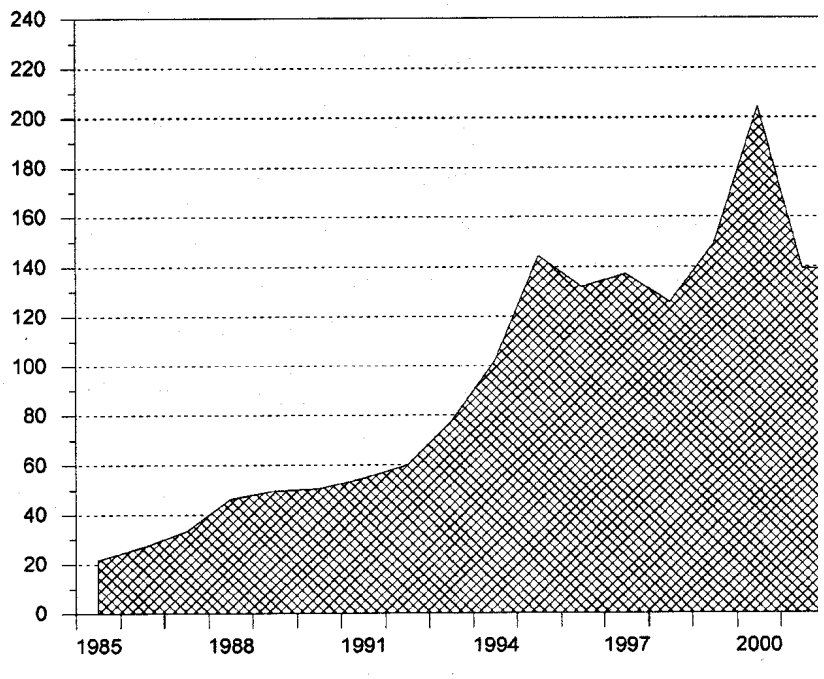


Figure #18: World semiconductor market, billion US-$ (source: Edler et al. 2002, p. 52).

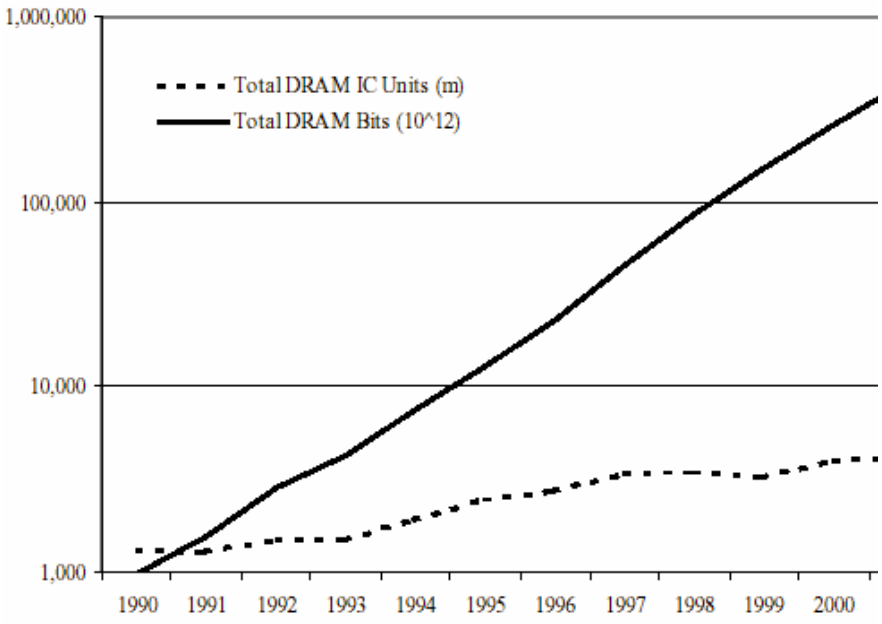


Figure #19: DRAM Unit & Bit Demand, 1990-2000 (source: Future Horizons 2002, p. 14).

Conclusions

1. Economic sustainability will largely depend on whether the major investors will be able to make substantial profits in the future as they did in past booms. Due to the large "sunk" costs, during downturns, investors have to continue production even at revenues below average costs. Therefore, the timing, size and duration of the next boom will be essential. Figure #19 shows that the demand for memory, in terms of bits, so far kept growing all the time. It is expected that, in the near future, it will be in particular the Asian markets which will grow, possibly at about 20% per year in terms of value (World Semiconductor Trade Statistics 2002). Infineon claims cost leadership due to the 300 mm technology, so this should become visible as soon as demand increases. AMD is preparing new products, as reported above (Section 3.3.4). Government funds will only play a minor role in achieving profitability in Dresden, as the subsidies cover only a small share of the investment costs.[19] The author expects that if profitability can be regained, investors will not move in the foreseeable future.

2. A possible perspective for the area, as well as for Germany, becomes visible in remarks made by Schumacher, CEO of Infineon. He reportedly suggested that Germany should consider a branding such as "researched and developed in Germany", to take comparative advantages of Germany into account. That thought can be interpreted to mean that Germany essentially provides scientific engineering, while production could take place in low-wage countries. However, jobs are also needed in Germany for people without a scientific degree in engineering...

[19] Also the case of BMW shows that subsidies do not generally lead to supporting unprofitable businesses. BMW will be given subsidies for their Leipzig investment. Yet, they are making profits.

4.2 Some Relations to the Whole Region of Saxony

In this section, an attempt will be made to view the semiconductor "beacon" from the perspective of Saxony as a whole.

- Regarding employment, income is created by the fabs and their partners and this is spent again and creates more income. This may sound trivial, but is of course not unimportant, see the computation of Edler et al. who estimate that about 2,300 jobs are created indirectly.
- The semiconductor beacon is one of several beacons, in particular there is also the car "beacon". I.e. Saxony has several developing areas in terms of products and regions. As mentioned earlier, Saxony is developing particularly well in the area of manufacturing. This contributes to offsetting the shrinking role of the construction industries.
- Ragnitz et al. conclude that "it is questionable if a concentration of the instruments for regional support policy on poles of growth does indeed lead to the desired broad scale impulses for development." (2002, p. 69) This study has not been the place to investigate whether there has been any significant concentration. However, Ragnitz et al. put the issue on the table whether the "non-beacons", so to say the "darker" areas, have received sufficient attention.
- It has not been possible to analyse, in this study, to what degree the semiconductor manufacturers have relations to customers in the area, such as in machine tool or car production. This would be of special interest, as the Dresden region reportedly has some disadvantage concerning marketing: "In the interviews, there was again and again the message that the region is the ideal location to generate knowledge, but not to implement this knowledge in new products" (Specht 1999, p. 218). The big investors with their global product developments and marketing probably do not experienced any such obstacles. However, increased local relations in general and by smaller companies in particular would certainly be economically helpful.
- Regarding research, non-semiconductor companies are also active, of course. Only 1/3 of the annual subsidies of the state of Saxony go into microelectronics. The remainder is for the car industry, biotechnology, etc. (government expert).
- Regarding education, it can be said that the semiconductor companies contribute to the need for good education on natural science topics, from the primary to the tertiary educational levels.
- Regarding ICT use, in line with general industrial development, and with the general strength in research and education, Saxony has higher rates of ICT use compared to other East German states (Telematikbericht 2001). Of course, the semiconductor cluster re-enforces this somewhat by students studying related subjects, more parents buying PCs, etc.

4.3 Summary of Critical Factors

In this section, an attempt is made to provide an overview of the main effects and the main factors by which they have been created. The objective of this exercise is to ease comparability of the Dresden case study with the other case studies made in the *Tigers* project. Accordingly, there is a differentiation between "output" factors, i.e. results, and "input" factors.

Input Factors
Regarding the development of the semiconductor companies, the analysis made in particular in section 3.3 can be summarised as follows:

1. Highest skill levels maintained for generations at the levels of craftsmanship and science are the most important "input". Achievements such as the mastering of the copper process, the fast ramp-up of production and high yields produced have been attributed to skills achieved before 1989, i.e. due to education which took place even earlier. It should be noted that these skills have been described as being vocational or ethical, and were maintained and developed in very different political regimes (i.e. are not caused by "democracy"). It is, of course, important that people with such skills were available, i.e. not fully employed. Many scientists know each other, i.e. form a network or cluster. After 1989, the new companies were founded or run by people who had already worked for Forschungszentrum Mikroelektronik, Elektromat or Robotron (Bruch-Krumbein 2000, p. 169ff).
2. "Foreign" direct investment in particular from West German and US investors has been a major force to light the "beacon".
3. Public funding through state, federal and EU governments is another important factor, as emphasised by the investors.
4. Local speed of government decision making has been said to be important, as opposed to e.g. processes for obtaining permits which take years.[20]
5. The provision of a high-quality infrastructure (motorways, airport, cables, water) was also mentioned as important.

Output Factors
Regarding the semiconductor "beacon", the main results are:

1. Development in terms of employment in the semiconductor industry is above expectations.
2. Profitability needs yet to be achieved.

[20] Fast and transparent decision making by public authorities is by no means trivial or ubiquitous in Germany. Recent reports in the media indicate room for improvement in a ongoing semiconductor investment by Intel and the Emirate of Dubai in Frankfurt an der Oder, in the East German state of Brandenburg. The investors founded "Communicant Semiconductor Technologies". One objective is to produce semiconductors for mobile Internet applications with a particularly low power consumption, based on a Silicon/Germanium/Carbon technology (SiGe:C) developed at Frankfurt an der Oder. Here, decisions have been delayed, the state government reportedly found it difficult to provide € 38 mio. as a subsidy (Heise 2002c), and finally the Minister of Economics, Wolfgang Fürniß, had to resign after reports that he obtained privately $ mio 1.5 from a Dubai Sheikh (Spiegel 2002).

5 Open Questions and Policy Conclusions

In this section, some open questions which emerged during the course of the work, are listed. Furthermore, an attempt is made to draw conclusions, in particular for the Candidate Countries.

5.1 Open Questions for Further Research

During the course of the short *Tigers* project, a few issues could not be addressed or emerged as issues for future research. These are listed below in no particular order.

1. **Development of high skill levels:** Consider the following simple calculation: an engineering scientist with good qualifications as appreciated by AMD must have started his professional work in the 1970s or 1980s, and his engineering education must therefore have started in the 1960s or 70s. The teachers of these engineers must have had their education at least about 30 years earlier. In other words: It takes at least one or two generations to build up such skills, unless one were taught by foreigners (which was definitely not the case in the GDR). In sections 3.1.1-3.1.3 it was shown that the engineering tradition is more than 100 years old, and the vocational tradition is even about 500 years old. If we take one or two generations as a hypothetical minimum time span to fully develop qualifications in a region, does the case of Ireland show that such a development can take place much faster? Or are skill levels as in the case of Dresden rather a local factor which can only be developed elsewhere within generations?[21] A more in-depth investigation of vocational ethics and levels of skills would certainly be helpful for underpinning any such analysis.
2. **Comparison of skill levels:** Two experts expressed that the general level of skills of potential operators in the Candidate Countries is somewhat lower and that some investors already withdrew from such countries. This is another issue to be investigated.
3. **Design and evaluation of government policies:** One issue which emerged is that policies could ideally be based on achieving objectives such as the Lisbon objectives for competitiveness, high quality jobs, social cohesion and environmental sustainability. In 1998, the Saxonian Audit Court raised the question if the government could have done better. For instance, they wrote that the government should have objectives such as "We want to reduce the rate of unemployment by 4 % over the next 3 years", or "We want to create 5,000 more jobs for …" They requested a study which was made by Dresden university. These researchers brought up questions such as: "Were the right clusters of technological development selected?" and "Were the resources distributed in the right way?" (Sabisch, Esswein 1998). The question thus arises whether government policies as a whole are designed in a way to achieve such objectives. Likewise, in a recent communication by the European Commission the issue was brought up that an "impact assessment of legislative and political initiatives [should be made] to measure likely effects of policy options on various categories of stakeholders." (Commission 2002, p. 24; cf. Beutel 2002). Similar demands for assessments of expected costs and benefits have been demanded by Fier and Harhoff (2002) to evaluate government spending on research. They argue that both benefits of discrete measures as well as windfall effects of general measures should be estimated before a decision is made, and after. Thus, three questions arise: (1) Are policy options assessed with respect to the Lisbon objectives? (2) Are they evaluated accordingly? A sub-question would be: (3) What is justifiable support for labour-intensive industries, as

[21] The still famous Sonnar lense design was created by Bertele of the Ernemann factory (mentioned in section 4.1.3), in 1929 (Kyocera 2002). How did it happen that Japanese engineers of Nikon apparently outperformed it already in 1950, by producing the sharper Nikkor lenses, using barium flint glass (Nikon 2002a)?

e.g. the software industry, which does not heavily invest in buildings or equipment? The scope of such assessments should be at the European scale, at least.

4. **Solutions for marketing new ideas and improving local sales relations:** The area of Dresden is at some distance to leading markets. This is not a problem for the major investors operating globally. However, in the interviews the issue arose that emerging local companies would need to do better in developing their markets. In the field of microelectronics, networks would be needed with both American and Asian players. As quoted above, Specht summarised his interviews by stating that "the region is the ideal location to generate knowledge, but not to implement this knowledge in new products". It would be interesting to know more about the existing local relations between chip producers and their regional customers e.g. in the production of computers, machine tools and cars. Answers could be sought to questions such as: Why do mobile phones not contain digital cameras produced in Dresden? For public policy, the generic question is: How could an emerging industrial core such as the Saxonian one be better supported to become more successful on the world market? Note that even Ulrich Schumacher, Infineon's CEO, pointed out that his company increasingly needs to know more about end-users: "we are currently learning to talk to the end-user, our customers' customer, to get to know his desires and needs, to anticipate which products and solutions he might need tomorrow, or might wish." (Schumacher 2002).
5. **Reasons for different profitability:** What is the reason why another European-based semiconductor manufacturer, STMicroelectronics (a merger of Thomson Semiconducteurs and SGS-Microelettronica), is more profitable? The company made a turnover of $ 6.3 billion, in 2002, with net earnings of $ 439 million (cf. Table #7). Another question is: How do Infineon and Samsung compare in terms of costs and profits of producing DRAM chips?
6. **Transparency of government decision making:** Two experts remarked that sometimes governments in the Candidate Countries are less transparent and efficient than the Saxonian. This issue could be investigated as well. Identifying "best practice" was recommended by one of the experts.

5.2 Policy Conclusions

In this section, some conclusions for government policies are presented. The whole report showed the significance of government action. This became visible when discussing early roots, such as Dresden as the residence of the Saxonian Elector. It also became visible when during communist times education and research in the field of electricity and later electronics were maintained. Finally, it became visible in the post-1989 government policies in East Germany in general, and in particular in the supportive policy of the city and state governments in favour of the semiconductor investments starting in the 1990s. This does not imply that the author thinks the government is the most important factor, see the list in section 4.3. In a theoretical world economy without government subsidies, the author would bet the investors would still have gone to Dresden because of the skills.
Given the above evaluation, it appears policies should exactly address the Lisbon economic, social and environmental objectives. More concretely:

- Economic objectives, in particular GNP growth, employment, and profitability, which do not necessarily move in parallel.
- Social objectives, such as achieving a high job quality, low needs for migration, low inequality or sufficient birth rates.
- Environmental objectives, such as preventing flood risks.

With the Candidate Countries in mind, the analysis of the case of Dresden points out that to pursue such a policy can actually mean:

1. **Foresight activities:** An analysis would be beneficial which explores the future economic, social and environmental effects of government policies. Certainly the economic aspect is very important, i.e. policies should aim at producing "most bang for the buck". But the social and environmental quality of regions should be taken into account as well. The foresight activity should address effects across borders as well, such as brain-drain, re-location of industries, soil sealing, etc.
2. **Controlling activities:** Such activities should take place in order to later check whether the objectives are met and whether investments bear their costs in terms of education, infrastructure, etc.
3. **Support of industries in competitive areas***:* The Dresden experience points out that special efforts are needed to sustain areas of a region's comparative expertise. It appears that it will be extremely difficult to copy the Dresden semiconductor developments, given the significant role of the pre-existing cluster. The areas of comparative advantage in Candidate Countries need not necessarily be the usually assumed high-tech areas, but can be in other fields, e.g. other knowledge-based industries, forest-based industries, tourism, etc.
4. **Support of companies with local ties rather than of "enlarged workbenches":** Several experts pointed out that "enlarged workbenches" do not only tend to require only a relatively low level of skills, it was also pointed out that in case of a crisis, disinvestments may happen quickly.[22] Therefore, companies with strong local roots, embedded both in local co-operation and in global markets would be needed, to provide lasting employment. It would therefore be good if Candidate Countries could produce something which is new or close to unique on the world market. If a region has no tradition in an area such as microelectronics, other industries in which the region could become competitive should possibly be supported. Furthermore, one expert suggested that governments should improve local ties, e.g., by creating the motivation for increasing contacts, by supporting regional industrial meetings, by supporting international procurement and sales contacts and public relations such as booths at fairs, and by supporting high quality external consultants.
   The same expert stated that concepts which are not yet completely mature could possibly be subsidised earlier. Such case-specific investment support may have an arbitrary element. It was said, however, that decision makers could possibly be encouraged to subsidise concepts which are less mature based on the proposer's merits and reputation. This is in some contrast to textbook recommendations according to which the government should keep out of such decisions as the markets can make them better, but it denotes a possible type of actions governments can take if funds are available.
5. **Support of education in competitive areas:** A solid educational system is certainly needed to retain global competitiveness. The Dresden experience points out that special efforts are needed concerning a region's comparative advantages and expertise.[23]

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[22] In interviews made for the ESTO-project *MAB*, national experts from Candidate Countries pointed out that certain investors who had moved to European transition economies in 2002 moved towards China. For instance, in Estonia there is the *Elcoteq* company, assembling phones for Ericsson and Nokia. "During the last two years the number of people has decreased. *Elcoteq* moved its construction site to China, it is building its mobile phones and other products there, because it is cheaper there." (interview) Similarly, a Hungarian expert pointed out that *IBM Storage* is moving its production to China (Weber, Wehn 2002).

[23] This may also apply to Germany, in which the relatively poor scoring in the OECD's "PISA" pupils assessments was discussed widely. While Germany as a whole still is a strong exporter in many sectors, since 2001 a sense of crisis emerged, with dismissal of employees in many companies, and tax returns below expectations. Therefore effectively developing vocational ethics and resulting skills can become the clue to success, see Schumacher's remarks at the end of Section 4.1.

6 Summary

Objectives, Method

This study takes the European Council's objectives as agreed at the Lisbon summit as a starting point: "The Union has today set itself a new strategic goal for the next decade: to become the most competitive and dynamic knowledge-based economy in the world capable of sustainable economic growth with more and better jobs and greater social cohesion." It was decided that it would make sense to investigate a development in Eastern Germany, which is a transition economy, yet already part of the EU. As opposed to analysing a large part of Eastern Germany, it was felt that it would make sense to investigate a relatively small cluster in which IT-related developments play a special role, i.e. the Dresden cluster of semiconductor production, in order to see whether it gets closer to meeting the Lisbon objectives. The methods used were to review the most important studies, and to conduct 8 expert interviews in Dresden.

Statistical Overview

In Section 2, a statistical overview of general developments in Saxony and in Dresden, as well as of related information society and semiconductor developments is provided, stating, e.g., that Saxony has a shrinking population of 4.4 million inhabitants, with unemployment of about 19 %.

The Development of the Dresden Semiconductor Cluster

In Section 3 the development of the Dresden semiconductor cluster is described. In that section, early roots of industrial development in Saxony are mentioned, as they are deemed to be important for understanding how such a regional cluster can develop. Saxony was the most industrialised area in Germany before World War II. The Dresden region manufactured such items as watches, computing machines, high-volt transformers, crystal detectors, optical lenses and cameras before World War II. An important factor is the Dresden Technical University which has its origins in 1828. During GDR times, aircraft, cameras, and even whole computer centres were produced. Dresden was the GDR's largest research centre, e.g., piloting semiconductor production such as for Europe's first Megabit memory chip in 1988.

In the course of the re-unification of Germany, employment shrank considerably. After an initial boom, growth rates later reached the relatively low West-German levels. Therefore it makes sense to analyse the so-called "beacons" of development. Major beacons are the car production factories in Eisenach and Mosel, and semiconductor production in Dresden.

For the latter, the decision by Siemens, made in 1993, to invest the equivalent of € 1.38 bn into a semiconductor plant was essential. In December 1995, AMD announced its decision to build a semiconductor "fab" in Dresden and decided against Ireland. The fabs were subsidised with public funds. These subsidies cover only a fraction of the total investment costs of about € 6.5 bn (by 2002). The decisions by Siemens and AMD to invest and keep investing cannot be explained with public funding alone, as other locations offered financial subsidies on a similar scale. Rather the human factor was essential. For example, AMD was impressed by the skills of the German engineers, and the precision the operators were used to in their work. In 1999, Siemens in Dresden produced the world's first 256-Mbit-DRAM-chip. After floating of Siemens Halbleiter in the year 2000, it was renamed Infineon. With support from the German Ministry of Education and Research (BMBF), a technology for wafers of the size of 300 mm was developed by Infineon, Motorola and Wacker. The world's first 300 mm product was

produced in 2001, a 64-Mbit-DRAM chip. Infineon was awarded the "Fab of the Year" prize of the year 2000 for the 300 mm pilot line.
AMD decided to use a technology for copper interconnects to build a very fast microprocessor. One of the problems of using copper is that it is poison to transistors. With the first GHz-rated Athlon microprocessor produced in 2000 using the new technology, the AMD made a profit of about $ 1 billion. The fab was awarded the "Fab of the Year" prize for the year 2001.

With the decision of AMD to invest in Dresden, other players saw that Dresden is developing into a global centre of development. In May 2002, AMD, Infineon and DuPont Photomasks founded AMTC, the Advanced Mask Technology Center, as a global research centre. For about 30 international equipment producers, the major investments made it economic to open permanent offices themselves. Also new producers started business such as DAS who design processes for the environmentally safe disposal of poisonous wastes. The decision by Wacker Siltronic to produce silicon crystals for 300 mm wafers in near-by Freiberg has been another important step. A few successful new companies emerged, producing new products, such as KSW and Systemonic.

Assessment

About 10,000 semiconductor-related jobs were created in the region, more than initially expected. Government subsidies of about € 1.2 billion will probably be much smaller than the expected social insurance and tax payments, which should be about € 5.9 billion, by 2010.

Both AMD and Infineon are currently making losses, due to the downturn of the global semiconductor market. Economic sustainability will largely depend on whether these investors are able to make substantial profits in the future, just like they made in past boom times. Due to the large "sunk" costs, during downturns, investors have to continue production even at revenues below average costs. Therefore, the timing, size and duration of the next boom will be essential. It is estimated that the largest market growth will be in Asia.

The most important "input" and "output" factors of the Dresden developments are:

Input Factors

1. Highest skill levels maintained for generations concerning craftsmanship as well as scientific skills, with such people being "available", i.e. unemployed.
2. "Foreign" direct investment in particular from West German and US investors.
3. Public funding through state, federal and EU governments.
4. High speed of local government decision making.
5. A high-quality infrastructure (motorways, airport, cables, water).

The main results are:

Output Factors

1. Development in terms of employment in the semiconductor industry is above expectations.
2. Profitability needs yet to be achieved.

Regarding the East German transition process as a whole, it can be said that the "beacons" such as the car production in Eisenach and Zwickau, and the semiconductor production in Dresden, contribute to offsetting negative effects such as of the shrinking turnover in the construction industries.

Conclusions

In Section 5, first some open questions are enumerated, such as that the building up of skills over centuries in Dresden contrasts with recent faster "Tigers" processes as in Ireland. In particular the question is raised how new companies with new business ideas could be better supported, and whether the lack of closeness to end-user markets is an issue.

Finally, the following conclusions for policies regarding the Candidate Countries are drawn:

1. **Foresight activities***:* An analysis would be beneficial which forecasts the economic, social and environmental effects of government policies, to provide a basis for the selection of policies.
2. **Controlling activities:** Such activities should take place in order to later check whether the objectives have been met.
3. **Support of industries in competitive areas***:* The Dresden experience illustrates that special efforts are needed to sustain the field of a region's comparative expertise, e.g. metal or wood industries, or tourism.
4. **Support of companies with local ties rather than of "enlarged workbenches":** Several experts pointed out that "enlarged workbenches", as they have been emerging in the Candidate Countries, do not only tend to require only a relatively low level of skills, it was also emphasised that in the case of a crisis, disinvestments may happen quickly. Therefore, companies with strong local roots, embedded both in local cooperation and in global markets would be needed, to provide lasting employment.
5. **Support of education:** A solid educational system is certainly needed to support a region's comparative expertise.

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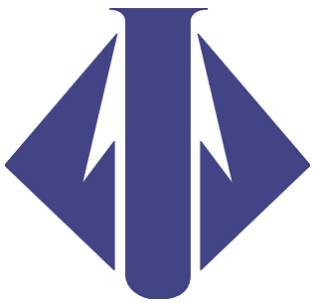
Identifying factors of success and failure in European IST-related national/regional developments

Final Report
Case Study: Greece

Effie Amanatidou
Tonia Damvakeraki

December 2002

ATLANTIS CONSULTING S.A.



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Introduction

When did the Greek Information Society emerge? What has been done to promote the idea that IS developments are a challenge and a possibility for future welfare and prosperity? What are the difficulties / problems that stand on the way of progressing into a full fledged IS? What are the issues that need to be tackled in order to become a "peer" amongst the rest of the IST developed EU countries?

This report[1] answers the above questions by presenting historical evidence, by explaining the statistics in depth and by identifying - with information provided by distinguished experts - the most important socio-economic and IST-related factors that explain the situation of the current IST development in Greece.

The study is based on bibliographical and statistical review (from national, EU and international sources) as well as Internet search, articles, study reviews and on interviews with Greek IST experts, economists, academics, government representatives, and journalists.

The first section features Greece's performance measured by common key indicators, along with a description of the situation they represent. Interesting issues emerge concerning factors affecting the IS development in the country falling however outside the IS-specific sphere. The degree of urbanisation and the morphology of the country coupled with the ageing population hinder the even distribution and inclusion of all in IS development. The 'dualism' characterising the structure of the economy, with some dynamic high-tech enterprises alongside mostly traditional, technology-laggard, industries, is affecting the diffusion of and investment in new technologies. On the other hand, the increasing importance of the tourism sector for the Greek economy along with the banking, insurance and real estate services gives positive signals for a sector to target in order to have a high impact of IS development in the Greek economy.

The key indicators however describe only a part of the picture of socio-economic development in Greece. The second section examines the wider socio-economic and cultural environment in relation to IS developments and reveals other factors affecting IS development again not being IS-related like education, language, labour and social mobility.

After analysing the wider socio-economic and cultural environment and its influence on IS development, the current IST-related conditions and factors as well as hurdles are examined, thus complementing the picture of IS development in Greece.

In the fourth section, the policy responses towards IS development are examined since they are substantial factors influencing future course of IS visions in the country.

Finally, conclusions are presented in the last section.

[1] The present report was prepared by ATLANTIS Consulting S.A. as a contribution to the ESTO TIGERS project. Comments in preparing the report and previous deliverables were also provided by Ken Guy (Wise Guys Ltd.)

1. ***Key Indicators for the IST in Greece***

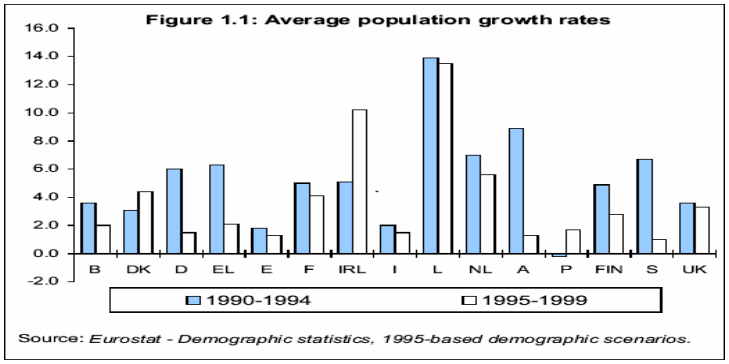
This section presents Greece's figures for certain key indicators, relating directly or indirectly to the IST development, which were decided to be common in all the five case studies. The situation that the indicators present is described shortly after the table and first attempts are made to make hypothesis in order to identify its influence on IST development in Greece.

Greece	Dimension	1998	2000-2001
Population		10,259,900	10,964,000
Population density	Inhabitants*1000/ square km	0,077	0,083
Degree of Urbanisation	% of inhabitants living in cities, source world bank : world development indicators	≈45%	>60,1%
GDP/capita (in real market prices)	In euros *1000	10,058	11,923
Unemployment rate	In % of labour force	10,76%	10,2%
National Debt/GDP	Ratio	108.7%	99.7%
Date of birth of the nation	Year	1913 (Greece established its current borders)	
EU accession	Year	1981	
% of employment in Agriculture (and fisheries and farming)	As a % of total employment	15.8%	14.37%
% of employment in Industry (manufacturing, mining, electricity/ gas, constructions)	Idem	20,56%	20,51%
% of employment in (market + non market) Services	Idem	52.8%	54.93%
Ranking in UNHD index		23rd	
ISI Ranking in other index	Rank	25th	
% Of employment in the ICT sector (services as well as manufacturing)	As a % of total employment	2%	2,5% (1999)
% Of population (15+ - 65) having access to Internet technologies		1.97%	13,21%
ICT value added % in GVA		5% (1995)	4.5% (1999)

Greece's current boarders were established in 1913 after the Balkan War. Greece became EU member in 1981. In 2000 it also became a member in the European Monetary Union, after meeting all the necessary pre-conditions set by the EU. Geographically, Greece is a peripheral country of the European Union, in its south-eastern edge, with a total size of 131,957.413 square kilometres.

Greece presents one of the highest population growth rate decreases in the EU (after Austria and Sweden). The average population growth rate dropped to 2% in 1999 from 6% in 1994 and the density of the population only increased from 77

people per square km in 1998 to 83 people per square km in 2001[2]. The population in 1998 was about 10,259,900 people while in the latest census in 2001 it was 10,964,000 people. This is relatively a small increase for a ten-years period. What is not indicated in these numbers is the number of immigrant that came to Greece as refugees since the beginning of the 90's from the neighbouring countries (Albania, Former Yugoslavia, Bulgaria, Russia, Ukraine, etc) which has denatured the structure of the population.



The population is also growing old. According to EUROSTAT, in 1999, 16.9% of the total population in Greece was over 65 years old and this percentage rose to almost up to 19% according to the 2001 Census.

The degree of urbanisation, according to the National Statistics Service, in 1995 was more than 45%. Based on the same source this percentage grew to 60,1% in 2001. It is a fact that more than half of the population of the country lives in Athens (around 5 million people) and Thessaloniki (around 1,2 million). There is also a large percentage that lives in other, smaller urban centres, but it is clear that the countryside is being abandoned.

The low population growth and the increasing ageing population play a role for IST development in the country if we consider that it is mainly the new generations that are more attracted to new and innovative technologies. It is very difficult to expand ICT technologies to the elder population. According to the EUROBAROMETER survey (2000) the age groups above 55 years old have a very small tendency in using the Internet and the new technologies.

The high degree of urbanisation, on the other hand, may facilitate high impact of IST development efforts in these areas provided that high-quality infrastructure and services are also at place. However, if we consider that around 34% of the total population (based on the 1991 census) lives in disadvantaged areas[3], which occupy above 75% of the Greek land, where suitable infrastructure and services are hard to provide and the income is below 75% of the country average, then the possibility for the IST development to be homogeneous and reach high levels becomes limited.

The GDP per capita (in real market terms) rose from 10,058 EURO in 1998 to 11,923 in 2001[4]. Since 1995 the GDP growth rate has been steadily higher than the EU average. Real GDP growth during the period 1995-2001 for Greece was

[2] Ref. "Greece in Numbers 2001"National Statistics Office
[3] Based on EU Directive 81/645 or 268/75 and modifications till 1992 disadvantaged areas include mountainous areas, areas with income lower than 75% of the national average, island areas and border areas.
[4] Source: National Statistical Office 2002

3,5% which was similar to the cases of Portugal (3,4%) and Spain (3,7%). However, in absolute terms GDP per capita in Greece remains the lowest in the EU, similar to Portugal and Spain. Additionally, GDP per capita in terms of PPPs is also at the lowest level. This combined with the fact that the cost of "ICT goods" is at the same level with the rest of the EU countries, makes such goods more expensive for Greek people to afford.

Concerning labour productivity the average annual growth for the period 1995-2001 was also above EU average and similar to Portugal (2,7% and 2,9% respectively), while for Spain it was 0,9%.

Table II.2: Growth of real GDP in EU Member States, US and Japan in 1975-2001

(average annual growth in per cent, ranked accor ding to per formance in 1995 – 2001)

	1975-1985	1985-1990	1990-1995	1995-2001
Ireland	3.5	4.6	4.7	9.1
Luxembourg	2.4	6.4	5.4	6.1
Finland	2.9	3.3	-0.7	4.9
Netherlands	1.9	3.1	2.1	3.7
Spain	1.6	4.5	1.5	3.7
Greece	2.1	1.2	1.2	3.5
Portugal	3.0	5.5	1.8	3.4
Sweden	1.5	2.3	0.6	2.9
United Kingdom	1.9	3.3	1.6	2.8
Belgium	2.1	3.1	1.5	2.8
Denmark	2.1	1.3	2.0	2.6
Austria	2.4	3.2	2.0	2.5
France	2.4	3.3	1.1	2.5
Italy	3.0	2.9	1.3	2.0
Germany	2.2	3.4	2.0	1.8
EU-15	2.3	3.2	1.5	2.6
United States	3.4	3.2	2.4	3.9
Japan	3.8	5.2	1.5	1.1

Source: Commission services.

Table II.4 : Labour productivity in EU Member States, US and Japan in 1975-2001

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

	1975-1985	1985-1990	1990-1995	1995-2001	Labour productivity in 2001 (US=100)
Ireland	3.5	3.5	2.7	3.9	87
Luxembourg	2.3	5.0	4.9	3.4	145
Portugal	3.3	4.4	2.3	2.9	48
Finland	2.4	3.0	3.2	2.9	76
Greece	1.0	0.5	0.7	2.7	59
Austria	2.3	2.5	1.9	1.9	70
Sweden	1.0	1.2	2.8	1.9	67
Belgium	2.5	2.1	1.7	1.6	92
United Kingdom	2.2	1.5	2.5	1.6	72
Denmark	1.6	1.2	2.5	1.5	76
France	2.3	2.2	1.2	1.3	78
Germany	2.0	2.0	2.3	1.2	71
Netherlands	1.4	0.8	1.0	1.0	72
Italy	2.2	2.0	2.0	0.9	82
Spain	3.2	1.2	2.0	0.9	65
EU-15	**2.2**	**1.8**	**2.0**	**1.3**	**73**
United States	1.2	1.2	1.5	2.5	100
Japan	2.9	4.1	0.8	1.1	67

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

Source: Commission services.

Based on these two important economic indicators, it can be concluded that the Greek economy is developing fast with growth rates above EU average, starting however from quite low positions in relation to the other EU Member States.

In parallel, inflation in Greece, after decades at 2-digit level, has now a trend around 3% - although the introduction of Euro in the economy in the last few months has resulted in a tendency for an increase around 4% - which is a very encouraging push for the domestic products' competitiveness. Long-term fiscal deficits have been converted into surpluses, which is a very significant push for the de-escalation of the public sector debts. Similarly, inflation for Spain and Portugal is stable around a trend of 2% and 2,8% respectively since they were together with Greece in the effort to achieve convergence to the European Monetary Union.

The National Debt as a percentage of the GDP, after a significant increase from 87,9% in 1992 to 111,3 in 1996, started decreasing gradually and in 2001 dropped to 99,7%[5]. Greece is now at a steadily improving course as the projections for 2002 and 2003 are 97,8% and 95,1% respectively.

The high development rates, have also led to an increase of employment although in this area significant scope for improvement remains. Unemployment in Greece has decreased the last couple of years (10.2% in 2001 and 9,6% in 2002) but its percentage remains one of the highest in the EU together with Spain (10,6% in 2001 and 9,5% in 2002), while in Portugal the rates are much lower (4,1% in 2001 and 5% in 2002)[6].

However, it is very important to stress that although unemployment was high the last eight years in Greece, mainly due to the financial purification of the public sector, the real income of the households was raised significantly (increase of the real salaries – about 3% annually for the last 5 years)[7].

[5] Source: "Eurostat – European Commission Economic Data Pocketbook"
[6] Ibid.
[7] Source: Greece in the Information Society 2002

Table II.5: Employment and labour productivity growth, 1995-2001

		Employment growth		
		< average	Close to average	> average
Labour productivity growth	< average		Italy	Spain
	Close to average	Germany Japan	Belgium UK Denmark France	Netherlands
	> average	Greece Portugal Austria	US Sweden	Ireland Finland Luxembourg

Note: On both axes, countries are compared to the average annual growth rate in EU-15 in 1995-2001. Total employment growth in the Member States ranged from 0.4 per cent to 5.1 per cent p.a. The category 'close to average' includes countries with a growth rate of +/-0.4 p.p. around the EU average of 1.2 per cent.
Labour productivity growth ranged from 0.9 per cent to 3.9 per cent p.a. among the Member States. The category 'close to average' includes countries with a growth rate of +/-0.3 p.p. around the EU average of 1.3 per cent.

Source : Commission services.

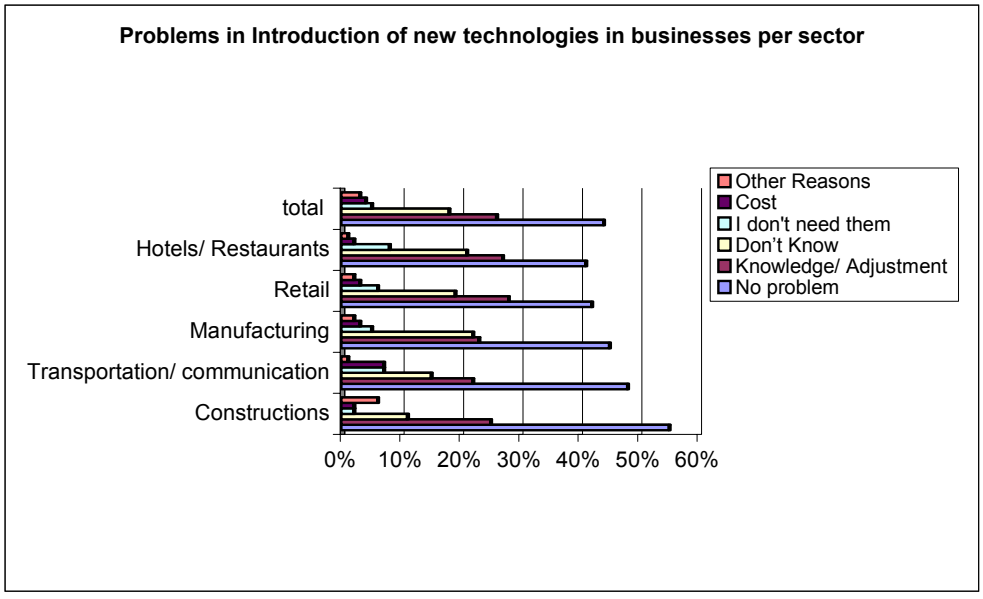
In 1998, 15.8% of the active workforce was occupied in agriculture, farming and fisheries. In 2002 this number dropped to 14,37% and it keeps decreasing. People appear to be discontent with the insecurity that accompanies the agricultural occupations. Besides, more and more young people claim that they prefer the industry and services sector and leave the countryside for a “better” life.

Employment in industry (manufacturing, mining, electricity/ gas, constructions) was 20,56% in 1998 and remains stable in 2001. In Greece, the industrial sector has not grown significantly over the years. It is mainly traditional, occupied by textiles, foods and beverages. There are few high-tech industrial units with little expenditure in new technologies and re-training of their personnel.

On the other hand, more than half of the total active workforce (52,6%) was employed in services (trade, restaurants and hotels, transportation, warehousing and communications, banking, insurance, real estate, other services) in 1998 while in 2001 the percentage rose even higher (54,93%) with the main increase noted in trade, restaurants and hotels (21,28%) and in banking, insurance and real estate (7,36%).

	1998		2001	
	Employees in numbers	%	Employees in numbers	%
Agriculture, Farming and Fisheries	704200	15,84%	627000	14,37%
Mining	18300	0,41%	17800	0,41%
Manufacturing	578000	13,00%	557400	12,78%
Electricity, Gas	35300	0,79%	34300	0,79%
Constructions, Civil Works	282300	6,35%	284800	6,53%
Trade, Restaurants, Hotels	916900	20,63%	928200	21,28%
Transportation, Warehousing, Communications	244800	5,51%	250000	5,73%
Banking, Insurance, Real Estate	290500	6,53%	320900	7,36%
Other Services	896700	20,17%	897100	20,57%
Employed	3967000	89,24%	3917500	89,81%
Unemployed	478500	10,76%	444700	10,19%
Total Workforce	4445500	100%	4362200	100%

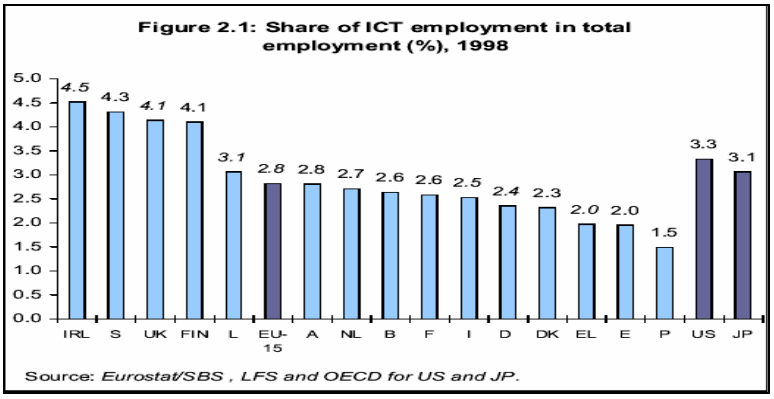
The services sector is increasingly important for the Greek economy in terms of employment especially due to the tourism sector. Thus, it may be considered the sector to address and introduce new technologies in achieving a high impact of IST development in the economy. However, it is actually these sectors that present the most problems in introducing new technologies. These problems mainly relate to lack of knowledge and difficulties in adjusting to them and less to lack of necessity for them or acquisition costs.[8] Additionally, whether these sectors should have priority over others in IS development needs to take into consideration the seasonal character of the tourism sector. Actions to broaden its development are crucial. Nevertheless, it seems an area worthy of investigating.



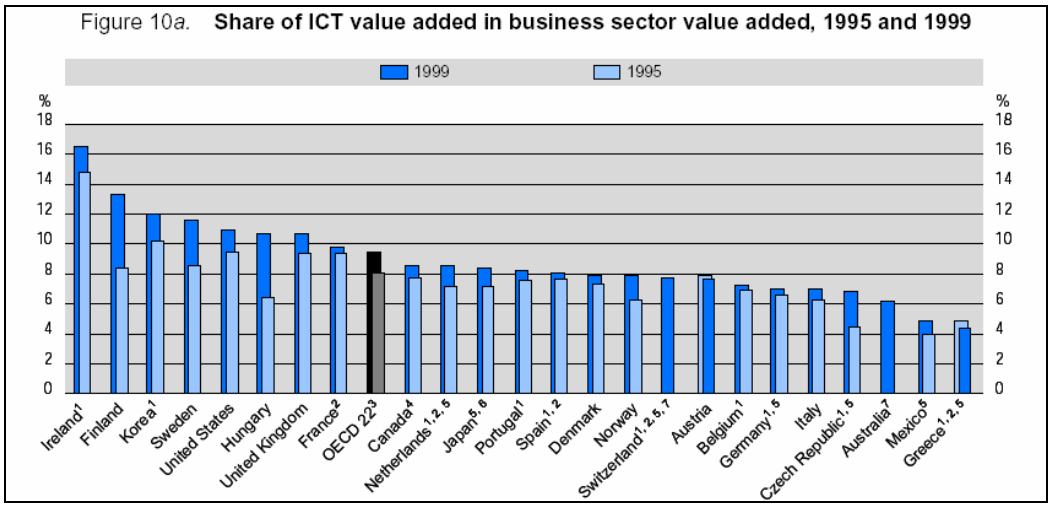
The percentage of employment in the ICT sector in relation to the total employment was around 2% in 1998 while in 1999 it rose to around 2.5% (as an average of the ICT employment in manufacturing and in services). However, the

[8] Ref. "Greece in Numbers 2001" National Statistics Agency

share of ICT employment in total employment in Greece still remains among the lowest in the EU. ICT employment in Greece consists mainly of employment in telecommunications services and in other ICT manufacturing than computer and office machinery. The increase in ICT employment can be partly attributed to the creation of several IT companies such as Internet providers and mobile telephony services.

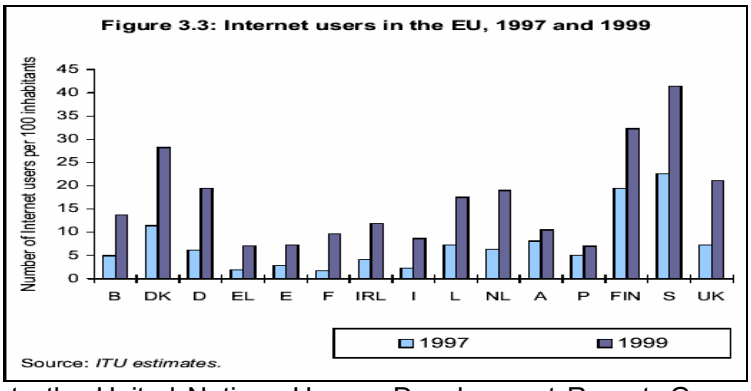


According to OECD the total ICT value added in the business sector in 1995 was about 5% while in 1999 it dropped at about 4,5%. This decrease mainly occurred in the ICT services value added, which from 1995 to 1999 presented a negative variation (-0,9%).



The percentage of the population (15-64 years old) having access to the Internet technologies was 1,97% in 1997 while in 2001 the respective percentage reached 13,21%.[9] This growth was achieved mainly due to the improved infrastructures, the digitisation of all telephone lines and also the creation of many access points (many of which are free of charge).

[9] Source: Greece in the Information Society 2002



According to the United Nations Human Development Report, Greece in 1999, ranked 23rd among 162 countries as far as technology achievements, investment in technology creation, and diffusion of technology (in agriculture and manufacturing as well as in Information and Communications).[10]

The above analysis of the key indicators (common for all five case studies) shows that IS development in Greece is taking place at a slow pace, but in a fast improving economy, which is however characterised by some of the lower figures (in absolute terms) in comparison with the rest of the EU Member States.

From this first analysis certain hypothesis can be made about the factors influencing IS development in Greece.

The degree of urbanisation and the country's morphology can be considered as a factor influencing IS development. The high urbanisation reveals potential for significant IS development impact in these areas if supported by another factor, i.e high-quality ICT infrastructure and services. On the other hand, the fact that most of the rest of the population lives in disadvantaged areas (mountainous, island or border areas and areas of low income) limits the degree that IS can be developed as well as the homogeneity of IS development in the whole country. The low income, characterising these areas, as compared to the national average, and the high costs of providing ICT infrastructure and services in remote mountainous and island areas deter the even distribution of IS development. In tackling the regional disparities the regional authorities play a major role. The regional authorities' role in comparison with the role played by the central administration in IS development is examined in section 2.

The ageing population of the country is another factor hindering IS development if we consider that it is mainly the new generations that are attracted to new technologies and ICT use.

The structure of the economy in terms of sectors is also a factor influencing IS development. The Greek economy is characterized by a 'dualism' with a thin sector of dynamic high-technology intensive companies alongside traditional, technology-laggards sectors. It is mostly based on traditional sectors of production such as agriculture and fisheries, while the "heavy industrial sector" is also represented by traditional industries such as textiles. This affects the

[10] The Human Development Index measures the overall achievements in a country in three basic dimensions of human development — *longevity, knowledge and a decent standard of living*. It is measured by life expectancy, educational attainment (adult literacy and combined primary, secondary and tertiary enrolment) and adjusted income per capita in purchasing power parity (PPP) US dollars. The HDI is a summary, not a comprehensive measure of human development. As a result of refinements in the HDI methodology over time and changes in data series, the HDI should not be compared across editions of the *Human Development Report*.

percentage of diffusion of the new technologies in the processing industry as well as the research and investment in new technologies.

On the other hand, the increasing importance of the 'trade, restaurants and hotels' and 'banking, insurance and real estate' sectors reveals potential for IS development and high impact in the economy. But first the problems faced by these sectors for introducing new technologies have to be tackled, which may be the reason for the limited ICT added value in services. In addition, the fact that these problems mainly relate to lack of knowledge and difficulties in adjusting to them reveals the central role of education and training.

The key indicators show part of the picture of IS development, describing the wider economic environment where efforts for IS development take place, but explaining the situation to a limited degree. Therefore, we feel that other aspects of the wider socio-economic environment need to be examined like research and innovation performance, education as well as certain social and cultural features characterising the wider environment. These additional elements are analysed in the following section.

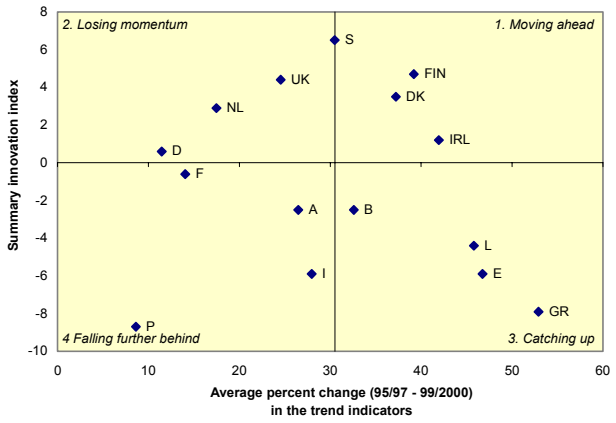
2. ***Other Economic and Social Conditions***

Research and Innovation Performance

The hypothesis tested here is if and how does overall performance in research and innovation in Greece affects IS development.

Concerning innovation performance, the 2001 Innovation Scoreboard places Greece and Spain in the 'catching up' phase of development and Portugal in 'falling further behind'. Based on a trend analysis of past years Greece appears among the EU leaders in public R&D levels, in high-tech venture capital and in ICT market share in GDP. Spain is among the EU leaders in business R&D levels, high-tech EPO patents, high-tech USPTO patents and ICT market shares in GDP.

Fig. 1 Overall country trends by innovation index



The major strengths as presented in the 2001 Innovation Scoreboard are for Spain finance of innovation and new-to-market products while the weaknesses are noted in the still low levels of public and business R&D, high-tech patenting and Internet access. Greece presents similar strengths (innovation finance) and weaknesses (also including limited presence of innovative SMEs in the economy). The major strengths for Portugal on the other hand are ICT expenditure and product innovation while the weaknesses also lie in the areas of public and business R&D, innovative SMEs and high-tech patenting and also in education. As far as major trends are concerned Greece is characterised by increasing public R&D and ICT investments but also by declining business R&D. Portugal by increasing R&D but limited improvement of trend indicators. Spain on the other hand is characterised by increasing business R&D and USPTO patenting.

Despite the positive trends and progress in the specific indicators in the past years the cohesion countries are still in the last positions as compared to the other EU Member States and quite far from the EU average in most innovation indicators:

INNOVATION SCOREBOARD 2001	YEAR	E	GR	P
Human Resources				
1.1 S&T graduates / 20-29 year old population	99	≅		-
1.2 % economically active pop. with 3rd level education	00	≅	**-**	**-**
1.3 % working pop. in life-long learning	00	-	-	-
1.4 % employment in high-tech manufacturing	99	-	**-**	**-**
1.5 % employment in high-tech services	99	-	-	-
Knowledge Creation				
2.1 Public R&D funding / GDP	99	-	-	**-**
2.2 Business expenditure R&D/GDP	99	-	-	**-**
2.3 EPO high-tech patents/pop	99	-	-	-
2.4 USPTO high-tech patents/pop	98	-	-	-
Transmission and application of knowledge				
3.1 % SMEs innovating in-house	96	-	-	-
3.2 % SMEs in co-operative innovation	96	-	-	-
3.3 % innovation expenditure / total sales	96	-	-	-
Innovation Finance, output and markets				
4.1 % venture capital/GDP	00	-	-	-
4.2 % new capital / GDP	99	+	+	
4.3 % new-to-market products/total sales	96	+		≅
4.4 Home internet access	00	-	-	-
4.5 % ICT markets/GDP	00	≅	≅	≅
4.6 Change 1993-1997 high tech/value added	97	-		

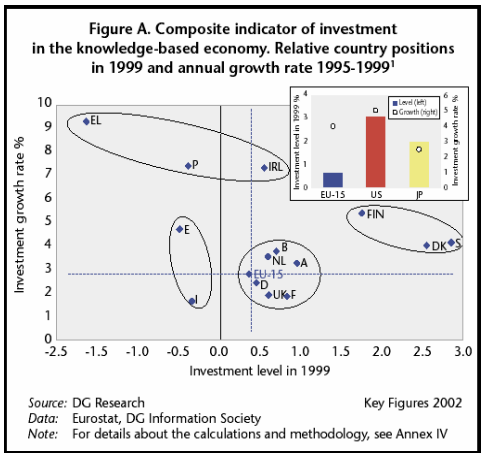
'-' means below 20% of EU mean
'≅' around EU average
'+' means above 20% of EU mean
Source: 2001 Innovation Scoreboard (Annex 4)

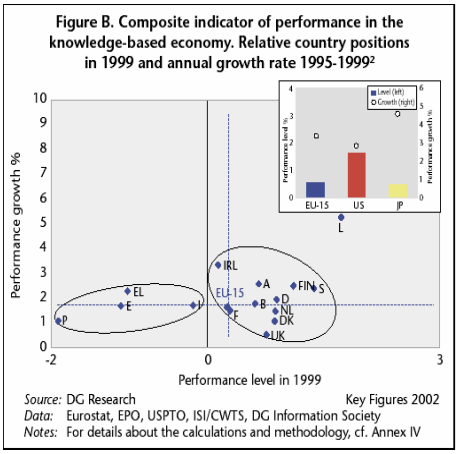
The weaknesses facing the cohesion countries were also noted in the 2001 Enterprise Policy Indicators: limited business and government expenditure and number of high-tech patents for Spain; the same for Greece along with weakness in human capital (education, training and computers in schools). All the above for Portugal complemented by weakness in access to finance (stock market capitalisation, new listed companies, and total venture capital).

Investment and Performance in a Knowledge-based economy

Although being the country with the lowest investment levels in the knowledge-based economy[11] in 1999, Greece presents the highest investment growth rate together with Portugal and Ireland. Being also among the countries with the lowest performance levels in the knowledge-based economy[12] in 1999 (together with Spain, Italy and Portugal) Greece presents the highest performance growth (similar to Austria, Finland and Sweden) as a result of the strong efforts and investments made during the 1990s.

[11] The indicator of investment in the knowledge-based economy is a composite indicator consisting of the following sub-indicators: a) total R&D expenditure per capita, b) number of researchers per capita, c) new S&T PhDs per capita, d) total education spending per capita, e) life-long learning, f) e-government, and g) gross fixed capital formation (excluding construction).
[12] The indicator of performance in the knowledge-based economy is a composite indicator consisting of the following sub-indicators: a) GDP per hours worked, b) European and US patents per capita, c) scientific publications per capita, d) e-commerce, and e) schooling success rate.





In general, Greece presents a positive course with some of the higher growth rates in all related benchmarking indicators starting however from the lowest places in relation to the other EU Member States[13].

From the above-mentioned country's weaknesses, the ones that affect directly the IS development is the still limited Internet access as well as the weaknesses in human capital: education, training and computers in schools. [14]

On the other hand, it has to be noted that the still low but growing levels of high-tech venture capital in Greece, which affects directly the IS development by supporting the creation of high-tech start ups, are mostly spent on biotechnology and health-related research. [15]

The limited presence of innovative SMEs in the Greek economy may form another reason for targeting the tourism and services sectors in IS development, which in turn requires tackling of the problems they face in introducing new technologies. As these problems primarily concern knowledge and adjustment difficulties, the role of education and training is again revealed.

Therefore it is important to examine the role of education and how it affects the IS development in Greece. Along with this hypothesis we believe it is also important to test if the language factor and specific cultural aspects of the population play an important role, as they seem to affect adaptability to change and research and innovation performance. These elements were mainly examined during interviews with people from all involved fields (policy makers, researchers, academics, industry, media) and were also based on available data, literature and related articles. Internet access and computers in schools are analysed in the following section along with all the other IST-specific indicators.

Educational System – Setting goals and priorities

Education is one of the most important factors that affect a country's development and progress. During the last decade, there has been a perpetual reform in the structure and the content of the educational system in Greece. Throughout these years there have been many changes, which however present limited continuation or coherence.

[13] European Commission, DG Research, Key Figures 2002
[14] Additionally, the rest of the weaknesses (still low levels of R&D intensity, limited high-tech patenting and presence of innovative SMEs in the economy) and the low position in many non IST-related indicators may also affect the IS development indirectly since these indicators present high figures in the IS-advanced countries. However, further research is needed to develop and examine any arguments relating to IS development.
[15] Ref: Greece in the Information Society 2002.

Furthermore, there is limited link to the market needs. The system is not clear of what the requirements of the market are and how they should be dealt with. As one interviewee put it, "...*We keep on "producing" professions for which there is no demand in the market"* (high-skill unemployment).

In relation to IS development education is characterised by the following deficits:

- There is reluctance – from the educationists - when it comes to receiving extra training in order to overcome the barriers for using new technologies.
- In certain technical high schools (secondary level) there are tutors that have acquired IT knowledge and IT training skills empirically and not through the relevant tertiary education.

In addition, not much attention has been paid to the needs for training in Information and Communication technologies, especially in tertiary education. There are few experts with relevant teaching experience to undertake the courses taught there. Therefore, in general, professors who come from different disciplines (applied mathematics, applied physics, etc.) are performing the teaching of these courses.

Nevertheless, it has to be noted that significant efforts were made all through the '90s for ICT integration in primary and secondary schools. Special ICT courses and ICT labs were established first in secondary schools and the integration now continues to the primary schools with courses for enhancing the teachers' ICT skills. Significant efforts were also needed to reverse the initial reluctance and unwillingness of teachers to participate in these courses. The use of ICT in education is analytically presented in the following section.

In parallel, it is worth mentioning that progress has been made concerning the average years of total education of the population. In 1960 the average years of education were 4,6. In 1980 they increased to 6,6. Recent data indicates that in 1999 the average number of years of education were 8,5[16] (primary and secondary education adds up to 9 years in total).

Additionally, since 1980 the rate of participation in tertiary education has grown significantly: from 17% in 1980 to 47% in 1997[17], while the rate of the population that has attained at least upper secondary education was 71% between the ages 25 –34 in 1999[18].

Another thing that might be considered as encouraging concerning the development of an IS in the country is the creation (in early 90s) of the National Network for Research and Technology (EDET) for Universities and Research Centres. Since the mid-90s, a number of Institutes, research centres and universities started to develop and exploit new technologies. The people involved were researchers, students and professors, all with a young, innovative, and adoptive spirit. They created a network that put online all universities and research centres in order for researchers to be in contact and exchange ideas and views. This way an infrastructure and a culture started being built. This culture is now the accelerator that will help introduce the new technologies to the broad public.

[16] Ref. "BARRO-LEE 2000"
[17] Ref. "World Development Index 1997"
[18] Ref. OECD 2000

The Language Factor

Knowledge of English plays an important role in the diffusion of IT and use of the Internet. Only 54% of the students were taught English (in school), which is the main language for ICT use.[19] The EU average for the same time period was 90% while the respective percentage for the IS-advanced but non-English speaking countries was close to 100%.

Table 1.4: Foreign languages learnt by pupils

	EU-15 [1]	B (f)	B (vl)	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	US	JP
Average number of foreign languages [2], 1996/97																			
Primary education	**0.4**	0.4	0.3	0.3	0.1	0.5	0.7	0.4	-	0.4	1.8	0.2	0.6	1.0	0.8	0.7	:	:	:
Secondary education	**1.3**	1.4	1.9	2.0	1.2	1.5	1.2	1.6	1.0	1.1	2.9	1.2	1.2	1.0	2.5	1.7	:	:	:
Foreign languages chosen by students in general secondary education (%), 1997																			
English	**90.0**	63.0	71.0	100.0	94.0	54.0	96.0	95.0	.	76.0	77.0	94.0	98.0	75.0	99.0	100.0	:	:	:
French	**22.0**	2.0	95.0	15.0	24.0	46.0	23.0	.	70.0	34.0	98.0	12.0	13.0	24.0	13.0	21.0	:	:	:
German	**10.0**	5.0	24.0	76.0	.	5.0	1.0	26.0	25.0	3.0	98.0	14.0	.	0.0	1.0	44.0	:	:	:

(1) Average of available data only; (2) Data refer to foreign languages studied by each pupil in 1996/97 as opposed to those studied throughout their schooling.

Notes: B (f) french-speaking Community which includes German speaking community, B (vl) Flemish-speaking community. F, A :1997/98, F including students from technological education. IRL: Full time only. NL, P: 1995/96. S: ISCED 2 general and vocational only. Source: *Eurostat - UOE (Unesco-OECD-Eurostat) questionnaire on education statistics - 2000.*

Table 1.5: World's online population by language (%)

	English	Non-English	European (Non-English)	German	Spanish	French	Italian	Portuguese	Scandinavian (Total)	Dutch	Total Asian
March 2001	**47.5**	**52.5**	28.9	6.1	4.5	3.7	3.1	2.5	2.2	2.1	23.5

Source: *http://www.euromktg.com/globstats/index.php3.*

Cultural Aspects of the population

National culture, defined by Hofstede (1991) as the collective software of mind, which distinguishes the members of one group or category of people from another, explains sufficiently how a society behaves, how it perceives the future and how it considers the relationship between its members. According to Hofstede (1984), societies that are characterized by low social mobility and static environment usually do not rest on technological change for their economic growth. On the other hand, societies with high social mobility are characterized by their belief on systems and organizations and invest in new technologies (goods or processes) when the system fails to solve problems. [20]

The cultural aspects of the population in any country can play a crucial role to the way people anticipate and react to changes, reforms, innovation, new technologies, and consequently affect the development in Information and Communication Technologies. Greeks, although adaptive, appear to be more traditional than other European Nations; they tend to be risk averse and they react conservatively and suspiciously against new technologies and developments, even though the younger generations have proven to be more innovation adaptive in relation to the older ones[21].

This reluctance to change is also found in the public services, where a large number of civil servants face the courses taught in order to make them accustomed to the use of computers or other ICT equipment with certain unwillingness. Some interviewees mentioned the 'life-time' employment status of the civil servants in this case as a disincentive to learn new things and improve their working conditions.

[19] Ref: Eurostat 1999 as quoted in "Greece in the Information Society 2002"
[20] Ref. "The Impact of patent protection, economy openness and national culture on R& D investment: a cross-country empirical investigation" – Nikos C. Varsakelis, Research Policy, September 2000
[21] Ibid.

In parallel, the Power Distance Index (PDI) can also help in understanding how culture affects the innovation aspects of a population.[22] Both low and high PDI countries have hierarchies but they mean something else. In high PDI societies people are the first to blame for anything wrong in the system whereas in low PDI societies the system is to be blamed. In fact in high PDI societies change in the system means change in top management of organizations or government services. So, we can conclude that the higher the PDI is the higher the adjustment cost.

Organizations or government services in low PDI societies are oriented towards the implementation of new processes in order to change the system. The low PDI societies invest more on R&D when they want to overcome the problems. As a conclusion we may say that the lower the PDI of a country is, the higher the R&D investment intensity. Indeed, being characterised by high PDI, Greece, Spain and Portugal have very low RTD intensities, and very few patents.[23]

RTD intensity and investment in technology and knowledge also seem to be affected by social mobility. Hofstede states that the social mobility and the mobility of the middle class are stronger in low PDI societies than in high PDI. A key variable for this mobility and development is technology, since people need to invest in technical skills and knowledge in order to improve their status. Societies with high PDI are characterised by low social mobility and hence the need for personal and societal investment in technology and knowledge is low. [24]

The above evidence suggest that the deficits of the education system, the knowledge of the English language as well as the cultural aspects in terms of social mobility and reaction to changes, reforms, innovation, and new technologies, also affect the development of IS in Greece.

Before examining the IST-related indicators in the following section, it is worth going back to the regional disparities to see how they have affected IS development in Greece so far and examine if the regional authorities abilities for intervention play a role in the development of IS in Greece.

Peripheral Disparities and Regional Authorities

Greece is a country with great geographical diversification. Thus, it is natural for the development course of the regions to be characterized by complexity and incongruity. Without overlooking the fact that there are a lot of common characteristics, the Greek regions can be divided in three categories[25]:

1. In the first category Attica and Central Macedonia are included, which include the two large urban centres of the country. These regions are characterized by demographic dynamism, relatively high rate of unemployment, relatively high standard of living in comparison with the average of the country and they gather the largest part of the decision making centres for the largest economic units in the manufacturing and services sector as well as the most of the educated and experienced work force.

[22] PDI is a measure of the interpersonal power or influence between the superior and subordinates perceived by the subordinate. According to Hofstede, power distance defines a general societal norm, a value system shared by the majority in the middle classes in the society. The PDI norm deals with the desirability or undesirability of inequality and of dependence or interdependence of society.
[23] Ref. "The Impact of patent protection, economy openness and national culture on R& D investment: a cross-country empirical investigation" – Nikos C. Varsakelis, Research Policy, September 2000
[24] Ibid.
[25] Source: Greek Centre for Programming and Economic Research

2. In the second category regions like Crete and the South Aegean are included and to a smaller degree the Ionian Islands that present dynamism in the development of tourism. These regions are characterized by low rates of unemployment, relatively high and growing standard of living, dynamic and fast developing sectors of economic activity and gradual improvement of the economic structure. However, it is important to take measures to ensure the continuation of this progress and to prevent regression effects due to the instability of tourism.
3. In the third category all the remaining regions (Epirus, Continental Greece, Western Macedonia, Western Greece, Peloponisos, South Aegean, Eastern Macedonia – Thrace and Thessaly) are included which are characterized to a small or larger degree by a relatively low productivity of the primary sector, lower living standard, insufficient presence or even absence of dynamic development sectors and by limited potential for the local entrepreneurs to undertake serious economic initiatives.

On the other hand, the introduction and strengthening of the Regional Administration and Local Government in Greece has a very short history, and the current situation can only be considered a transitional one still facing resistances related to radical restructuring. The upgrading of the regions to administrative units took place in 1994 (Law 2218/94) while only in 1997 (Law 2503/97) the role of the 'region' was re-defined as a decentralized administration unit, aiming to contribute to the national planning and programming and the implementation of economic and cultural development policies.

The morphology of the country and the consequent uneven distribution of socio-economic development combined with the still weak regional administration and local government to take initiatives for local development affect negatively the balanced ICT development in Greece. The peripheral cities and especially the islands also have to face major problems regarding the poor quality and the high costs of the services provided due to the haulage cost and the still limited competition in the national ICT market.

On the other hand, the high centralisation of the national government's services and of the decision centres in industry and services mainly in Athens and Thessaloniki has made a large part of the population move from the peripheries to the big urban centres (better infrastructures, better services, more investments, better paid jobs, higher living standards, etc.).

The trend to move to large urban centres still continues although to a smaller degree than in the past. There is clear reduction of the regional inequalities in the tourism and health sector, as well as in basic 'living conditions' indicators (consumption of electricity, bank accounts, private cars and telecommunications). However, the *"vicious cycle"* hindering the even distribution of not only ICT but also socio-economic development in the country still needs serious attention.

According to the above, one might have expected Athens and Thessaloniki to be growth poles for the Information Society. The fact that this has happened to a still limited extent suggests that there are also other factors at play that hinder IS development even at the country's most developed areas. These factors are the lack of the right kind of players within the urban conurbations – large IT Firms, significant number of dynamic / innovative SMEs, forward looking municipal authorities, lack of innovative ideas, lack of daring entrepreneurs. Thus we may

conclude that there is a link between the weaknesses in Greece related to innovative performance and entrepreneurship and the IS development.[26]

The examination of the wider socio-economic environment where IS development takes place in Greece revealed several non IS-related factors affecting this development:

- The degree of urbanisation and country's morphology;
- The still 'weak' regional authorities;
- The still low but increasing family incomes and GDP;
- The problem of the ageing population;
- The dualism in the structure of the economy;
- The deficits in the education system;
- The limited knowledge of the English language;
- The low social mobility and cultural aspects forming a certain attitude towards changes, reforms, innovation, and new technologies.

It is now worthwhile to analyse the specific performance in IST-related indicators that may reveal additional factors of success and failure, thus completing the whole picture of the current situation.

[26] Interviewees' views.

4. IST related Conditions[27]

Total Expenditure in ICT

Information and Telecommunications Technologies have been significantly developed in Greece the past few years. The total expenditure in information and telecommunication technologies as a percentage of the GDP is almost in convergence with the EU average (1,5% of the GDP). However, ICT expenditure per inhabitant is still a small proportion of the GDP (¼ of the EU average). It is encouraging though that it is increasing faster than the EU average since the 2001 crisis.

Telecommunications can be considered as the backbone for ICT development. Therefore, before studying specific ICT indicators it is worth examining the telecommunications market in Greece and the costs and quality of telecommunications infrastructure and services.

Telecommunications Market in Greece

The telecommunications market in Greece has steadily growing tendencies and holds the most important role in ICT sector in Greece, by representing 75% of the ICT market, while in the EU it represents 50%. The per capita expenditure in telecommunications is almost at the same level with the EU average. The recent liberalisation of the sector has transformed the market by increasing the number of new enterprises (as a percentage of the GDP, they are above the EU average) and has led to substantial cost reductions and to further improvements in the quality and range of services offered. The cost of services for consumers is relatively low but for the private sector they still remain relatively high.

The liberalisation of the national market combined with the intense global competition in mobile telephony has resulted in a significant increase of mobile telephones in Greece. Mobile telephony penetration in Greece was close to the EU average in 2000, and is characterised by a fast growing market with further margins for growth as costs decline further. The number of mobile phones per 100 inhabitants presented one of the highest increases in Greece since 1995 together with France, Spain and Belgium.

Table 3.4: Mobile phone penetration

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	US	JP
Mobile phone subscriptions (in 1 000)																		
1995	**21 160**	235	822	3 750	273	944	1 024	158	3 925	27	513	347	341	1 039	2 025	5 736	33 786	11 712
1997	**52 663**	974	1 444	8 170	938	4 338	5 817	533	11 734	67	1 717	1 160	1 507	2 162	3 169	8 933	55 312	38 254
1998	**90 145**	1 756	1 931	13 925	2 057	7 051	11 210	946	20 489	131	3 351	2 293	3 076	2 947	4 108	14 874	69 209	47 285
1999	**150 580**	3 193	2 628	23 470	3 904	12 300	21 434	1 655	30 296	209	6 900	4 206	4 672	3 364	5 165	27 185	86 047	56 849
2000 [1]	**235 209**	5 610	3 511	48 145	5 932	24 289	29 681	2 398	42 246	296	9 917	6 120	6 665	3 767	6 575	40 057	112 000	59 417
Mobile phones per 100 inhabitants																		
1995	**5.7**	2.3	15.8	4.6	2.6	2.4	1.8	4.4	6.9	6.6	3.3	4.3	3.4	20.4	23.0	9.8	12.9	9.3
1997	**14.1**	9.6	27.4	10.0	8.9	11.0	9.9	14.6	20.4	16.1	11.0	14.4	15.2	42.1	35.8	15.2	20.8	30.7
1998	**24.1**	17.2	36.5	17.0	19.6	17.9	19.1	25.6	35.6	30.8	21.4	28.4	30.9	57.3	46.4	25.2	25.7	37.5
1999	**39.1**	31.3	49.9	28.6	31.4	31.2	36.3	37.5	52.6	48.7	43.8	52.5	46.8	66.8	57.9	40.4	31.7	45.0
2000	**62.6**	54.8	65.9	58.6	56.2	61.6	50.5	63.5	73.2	67.9	62.5	75.6	66.7	72.8	74.2	67.2	40.9	47.0
Mobile phone subscriptions: % digital																		
1999	**96.0**	100.0	96.0	99.0	100.0	94.0	100.0	90.0	90.0	100.0	100.0	95.0	100.0	100.0	94.0	98.0	40.0	100.0

(1) 2000 data for Germany, France, Portugal: national regulatory bodies and operators, other countries: Mobile Communications.
Source: *ITU (year-end figures).*

[27]The data presented in this section are drawn from the "White Paper: Greece in the Information Society: Strategy and Actions" 1999.

Telephone charges

In September 2000, telephone charges at pick time were equal to the EU average, while off peak time charges exceeded the EU average, being among the highest in the EU after Portugal and Luxemburg. Nonetheless, both figures have been dropping during the past years; the peak time charges presented a decrease close to the EU average and the off peak time charges presented one of the highest decreases in the EU after Germany, Austria and the UK and similarly to Ireland.

Table 4.4: Monthly basket of local telephone[1] residential charges (US PPP) in households, 1998 and September 2000

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	US	JP
20 hours/Month with discount plan																		
Peak, 1998	**64**	98	54	68	60	42	72	80	42	73	63	100	61	23	48	70	40	52
Off-Peak, 1998	**46**	47	32	68	60	42	48	51	36	53	40	64	46	20	37	46	40	52
Peak, September 2000	**42**	52	31	34	42	46	34	54	32	59	50	45	47	30	35	41	21	35
Off-Peak, September 2000	**32**	36	31	34	37	28	34	31	26	38	35	32	46	28	24	27	21	35
Change 1998-2000 (%)																		
Peak	-34	-47	-44	-50	-30	8	-53	-33	-24	-20	-20	-55	-23	5	-26	-42	-46	-31
Off-Peak	-30	-23	-4	-50	-39	-33	-30	-39	-26	-29	-12	-49	-1	40	-34	-42	-46	-31

(1) Public switched telephone network (PSTN).
Source: *OECD Communications Outlook 2001.*

Quality and range of telecommunications infrastructure and services

Recently the quality and range of telecommunications infrastructure and services in Greece have improved considerably. The proportion of digitisation of the network has increased to 95% in urban centres and 74% for the country as a whole. The density of telephone connections in Greece is close to the EU average, while the telephone lines are 100% digitised and ISDN connections are steadily increasing starting however from the lowest level.

Table 3.5: ISDN lines

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	US	JP
EU penetration rate of ISDN channels [1]																		
1997	:	1	3	9	0	1	4	1	2	8	5	3	2	8	2	2	:	:
1998	:	2	6	12	0	1	5	2	3	14	10	5	3	10	4	3	:	:
1999	**8**	3	12	16	1	2	6	5	7	20	15	9	5	15	7	5	:	:
% ISDN channels / total number of lines																		
1997	**6**	2	4	14	0	1	5	2	2	10	8	5	3	8	2	3	:	:
1998	**7**	3	6	17	0	2	6	4	4	13	12	7	4	9	4	4	:	:
1999	**9**	4	10	19	1	3	7	6	7	17	14	9	6	11	6	5	:	:

(1) Penetration rate of ISDN channels per 100 inhabitants: channels permitting the use of the Internet and keeping the telephone line free simultaneously. Source: *ESIS (Nov. 2000).*

Table 3.6: Top 10 ISPs ranked by subscribers, September 2000

	AOL (US)	T-Online (D)	EarthLink (US)	Nifty (JP)	Juno (US)	Chollian (KR)	Terra (E)	Tin-it (I)	Hitel (KR)	Unitel (KR)
Number of subscribers (Mio)	24.6	7.0	4.6	4.0	3.7	3.7	3.5	3.5	3.4	3.4

Source: *ITU, 2001 adapted from company reports.*

It seems however that the cost reductions and improved telecommunications infrastructure and services have been an accelerating factor more for mobile telephony and less for Internet access and use.

Internet penetration in households

Internet penetration prerequisites the existence of a PC in a household. According to a Eurostat Survey in April 2000 (as quoted in “Greece in the Information Society 2002”) only 19% of the households used a PC, while

according to national sources[28], in 2001 this percentage rose to 25%. Despite the increase since 2000, the rate remains low especially in comparison to the EU average (45%). In Spain the rate for 2000 was 39% and in Portugal 25%. The encouraging fact about this indicator is that there is a high market propensity given also the steadily increasing family incomes along with the availability of consumer loans during the past few years and of advantageous 'package' deals offered to university students for buying basic electrical and electronic equipment (including PCs).

In terms of Internet penetration, in October 2000, the proportion of the Greek households having an Internet connection was the lowest in the EU (11.7%). In Spain the households having Internet connection were 15.7% and in Portugal 18.1%. However, during the period March 1999 – October 2000 Greece presented the fifth highest increase rate after Austria, Portugal, France and Ireland.

Table 4.2: Internet connections in households

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	US [1]	JP
Households having an Internet connection (%)																		
March 1999 [2]	**8.3**	8.2	24.6	7.1	2.9	5.0	3.9	8.4	6.1	14.0	19.6	6.8	3.4	17.2	39.6	10.7	:	:
April 2000	**18.0**	20.0	45.0	14.0	6.0	10.0	13.0	17.0	19.0	27.0	46.0	17.0	8.0	28.0	48.0	24.0	38.0	:
October 2000 [2]	**28.4**	29.2	51.6	27.1	11.7	15.7	19.0	35.5	23.7	36.3	54.8	38.0	18.1	43.5	53.8	40.9	41.5	:
Households using an Internet connection (%)																		
April 2000	**15.0**	15.0	41.0	11.0	5.0	7.0	11.0	14.0	14.0	18.0	42.0	16.0	7.0	23.0	43.0	22.0	:	:
Households having an ISDN line (%)																		
April 2000	**5.0**	4.0	9.0	12.0	0.0	1.0	2.0	1.0	3.0	12.0	13.0	8.0	1.0	6.0	4.0	4.0	:	:
Households using an ISDN line (%)																		
April 2000	**1.0**	1.0	1.0	2.0	0.0	0.0	0.0	0.0	1.0	0.0	0.0	1.0	0.0	0.0	0.0	1.0	:	:

(1) August 2000; (2) Eurobarometer 50.1, March 1999 and Flash Eurobarometer 88 "Internet et le grand public", October 2000.
Source: *Eurobarometer 53, Spring 2000*.

Indeed, Greeks use the Internet mostly at work and Internet cafes, rather than their own homes, with a frequency corresponding to the EU average. It is also true, as shown above, that the average Internet user in Greece pays more than the average European for access to the Internet, due to the still high, but rapidly decreasing, costs in a still developing market. The still high off-peak time charges may be one of the reasons for the still limited access and use of Internet.

On the other hand, the moderate charges during peak time and the decreasing trends of both figures (peak and off peak time charges) may be the reasons for the high growth rates in access and use of Internet. It is encouraging that although the percentage of Internet users in Greece remains low as compared to EU average (at similar levels with Portugal) it presents a high increasing rate[29].

Nevertheless, Internet use is not affected only by costs of PCs or Internet access charges. It is interesting to test the hypothesis that the type of on-line services provided and the types of needs the users try to cover also affect IS development.

The average Internet user in Greece is young (18-24), with high monthly income and lives in an urban centre. Online services are mainly used by most Internet users in order to find information and make online queries. E-mail and online newsletters are the most often used online services while online transactions

[28] Greece in the Information Society 2002
[29] Source: EUROBAROMETER 2000

account for a small fraction of Internet services. Intention to pay seems to be highest for medical services, while in 2001, the most often used categories for information search were tourism and medicine.

Since the main reason for using the Internet is the retrieval of information, the limited knowledge of English plays a significant role. However, this obstacle is being gradually removed with the increasing volume of information and WEB sites in Greek especially concerning news and local tourism.

On the other hand, the fact that the categories for information search are mainly tourism and medicine forms another reason for giving priority to the tourism sector in IS development.

In parallel the types of public services provided through the Internet also affect Internet use. The transactions with the public sector are quite positive. Almost one in two users of the Internet have visited government websites, a figure corresponding to the European average. Government online services are growing rapidly while recent research by the European Commission ranks services relating to taxation as the most complete online public services in Greece[30].

However, the types of services provided through the Internet also include private services and it is true that Internet penetration in businesses and e-commerce activities are still quite limited in Greece. Making additional services available and addressing the needs of a wider age group of people is of major importance.

Internet penetration in businesses

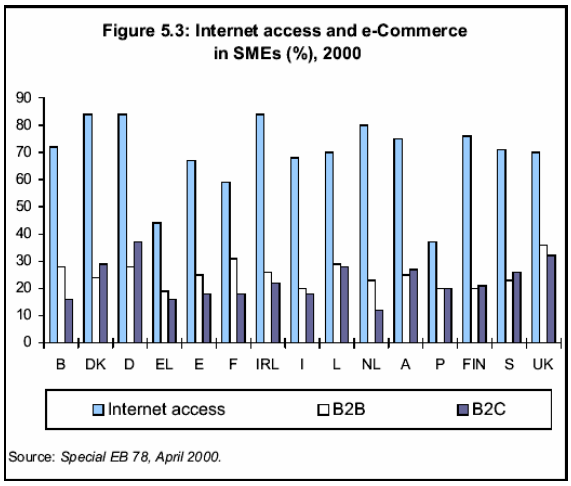
Internet penetration prerequisites the existence of PCs. Use of PCs in employment in Greece is still at a low level (25%) in relation to the EU average (45%) and there are significant variations according to the size, the sector and the activities of the enterprises. In Spain and in Portugal, the use of PCs in employment is closer to the EU average (35% and 30% respectively).

In line with the limited use of PCs in employment, Internet access by Greek enterprises was the lowest (32%) in the EU in 1999 but presented an increase rate of 28% similar to the EU average between 1998-1999. In Spain the percentage of enterprises having Internet access was 46% with a growth rate around 44%, while in Portugal the figures were 47% and 47% respectively.

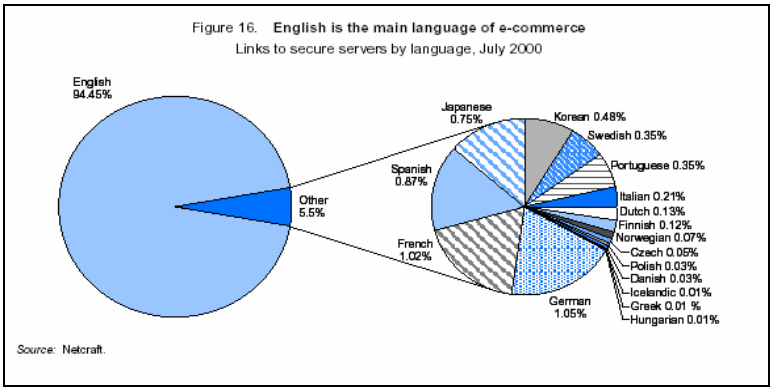
E-commerce in SMEs

In Greece, only a small number of SMEs use e-commerce for purchase and a slightly larger percentage (approximately 5%) for sales. The respective rates for Spain and Portugal are similar (5% and 3% respectively). B2B and B2C activities in SMEs are limited in several European countries. B2B in Greek SMEs presented one of the lowest figures in 2000 comparable to Italy and Portugal, while B2C was even lower, but above Netherlands, and similar to Belgium, Spain, France, Italy, and Portugal.

[30] However, one of the important problems faced (mentioned by an interviewee) in order to implement the Information Society Strategy, especially in the Public Sector, is the fact that not all of the official, public records and documentation in Greece as well as the necessary public documents of every day use for the citizen yet exist in a digitised form. A specific example refers to the creation of the Centers for Serving the Citizens (KEKs), which are authorized to issue certificates of all kinds and elaborate the transactions of the citizens with the public sector. Despite the good intentions, there is inefficient planning and lack of all the necessary elements in order to succeed in their main goal (there are no electronic signatures of the respective authorities for each Public service, no electronic stamps, most official documents not in electronic form).



The main benefit expected from e-commerce by Greek enterprises is better access to customers while the most important hurdles for entrepreneurial activity via the Internet are expensive equipment, the inefficient legal framework, the lack of suitability of products and services, the small number of potential customers and the language used.



On the other hand, infrastructure for e-commerce has improved. The percentage of secure web servers presented the highest growth rate in the EU between 1998-2001 (twice than the EU average) but still remains the lowest in the EU and far from the EU average together with Portugal, Italy and Spain.

Table 5.1: Number of secure servers

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	US	JP
Number of secure servers																		
July 1998	**3 004**	52	44	492	8	239	222	56	167	11	127	98	27	68	145	714	14 674	429
February 1999	**4 676**	117	73	1 083	30	367	449	65	306	18	245	187	51	128	298	1 259	24 532	962
March 2000	**10 914**	240	210	2 835	69	619	1 058	177	619	37	462	344	89	281	631	3 243	47 056	1 946
July 2000	**16 588**	268	289	3 761	87	759	1 297	245	795	44	541	447	116	343	811	4 404	65 565	2 900
Growth of the number of secure servers (%)																		
July 2000/ July 1998	**452**	415	557	664	988	218	484	338	376	300	326	356	330	404	459	517	347	576
Number of secure servers per 1 million of inhabitants																		
July 1998	**8**	5	8	6	1	6	4	15	3	26	8	12	3	13	16	12	55	3
February 1999	**13**	11	14	13	3	9	8	18	5	42	16	23	5	25	34	21	90	8
March 2000	**29**	24	40	35	7	16	18	48	11	87	29	42	9	54	71	55	170	15
July 2000	**44**	26	54	46	8	19	22	65	14	101	34	55	12	66	92	74	239	23

Source: *Netcraft, OECD.*

Despite the limited on-line commercial transactions, use of Internet shows increasing trends, which are also reflected by the increase in IP addresses and Internet hosts. Hosting stations have increased from 0,1 per 100 inhabitants in 1995 to 1,3 per 100 inhabitants in 2001. In fact, Greece, together with Italy, Spain and Portugal, presented one of the highest increases in Internet hosts during 1995-2001. Nevertheless, the respective figures for all these countries remain below the EU average in 2001.

Table 3.2: Internet hosts

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	US	JP
									Number of Internet hosts [1] (in 1 000)									
1995	**1 894**	31	51	474	8	51	151	13	75	2	172	53	12	216	145	440	6 055	269
1996	**3 063**	65	107	620	17	113	239	27	148	4	271	89	24	314	238	719	10 113	734
1997	**4 652**	107	169	1 132	28	196	355	40	254	5	391	108	42	487	349	988	20 624	1 169
1998	**6 417**	209	298	1 450	50	307	511	56	387	8	626	173	56	460	379	1 449	30 489	1 688
1999	**8 488**	339	338	1 635	75	470	1 233	64	302	10	959	263	78	462	523	1 739	53 167	2 637
2000	**10 193**	300	327	2 006	111	356	1 118	111	976	12	1 523	483	63	533	596	1 678	80 558	4 641
2001	**11 363**	329	378	2 373	141	450	1 161	123	873	13	1 889	536	113	733	572	1 678	:	:
									Internet hosts per 100 inhabitants									
1995	**0.5**	0.3	1.0	0.6	0.1	0.1	0.3	0.4	0.1	0.5	1.1	0.7	0.1	4.2	1.6	0.8	2.3	0.2
1996	**0.8**	0.6	2.0	0.8	0.2	0.3	0.4	0.7	0.3	0.9	1.7	1.1	0.2	6.1	2.7	1.2	3.8	0.6
1997	**1.2**	1.1	3.2	1.4	0.3	0.5	0.6	1.1	0.4	1.1	2.5	1.3	0.4	9.5	3.9	1.7	7.7	0.9
1998	**1.7**	2.0	5.6	1.8	0.5	0.8	0.9	1.5	0.7	1.8	4.0	2.1	0.6	8.9	4.3	2.5	11.3	1.3
1999	**2.3**	3.3	6.4	2.0	0.7	1.2	2.1	1.7	0.5	2.2	6.1	3.2	0.8	8.9	5.9	2.9	19.6	2.1
2000	**2.7**	2.9	6.1	2.4	1.1	0.9	1.9	2.9	1.7	2.7	9.6	6.0	0.6	10.3	6.7	2.8	29.4	3.7
2001	**3.0**	3.2	7.1	2.9	1.3	1.1	2.0	3.2	1.5	2.9	11.8	6.6	1.1	14.1	6.4	2.8	:	:

(1) The source for USA and JP is ISC. For USA they include country code Top Level Domains (TLDs) and generic TLDs eg .com

Source: RIPE. Figures refer to EU for end of the year, except for 2001; March figures. RIPE figures on hosts account for country code Top Level Domains (TLDs) only. Generic TLDs like .com, .org, etc. are not counted as part of EU-15 domains.

The use of IT in households and in businesses is also directly affected by the use of IT in education. If people get acquainted with IT and their respective capabilities from the early years at school they may be more positive in introducing IT in their every-day lives and they may even be the 'pushing' mechanism for greater integration of IT in the private and public sectors. Indeed, the use of ICT in education in Greece is still low however growing fast and comprising one of the major policy priorities.

Use of ICT in education

As far as secondary education, IT courses have been taught since the mid-80s at 85% of the country's high schools, but the instruction periods and textbooks took some time to reach a satisfactory level. Furthermore, PC laboratories were established, and this has significantly improved the relationship of students with computer use (both in secondary and primary education).

According to Eurostat, in 2001 there was an analogy of 1,5 computers per 100 pupils in primary education and 6 per 100 pupils in secondary education. In Spain there were 6,9 computers per 100 pupils in primary education while in secondary education the computers per 100 pupils were 7,4. Respectively in Portugal there were 3,8 computers per 100 pupils in primary and 5,7 computers per 100 pupils in secondary education.

According to the same source, in 1999, only 1% of the primary education schools and 18% of secondary education were connected to the Internet. Respectively in Spain the rates were 80% and 90%, while in Portugal, 42% and 100%. Based on the information published by the Ministry of Education, in 2002, all schools in secondary education have access to the Internet.

Table 6.3: Schools with Internet connection

	EU-15	B	DK	D	EL	E	F	IRL	I	L	NL	A	P	FIN	S	UK	US	JP
Computers per 100 pupils at primary and secondary school level (%) [1]																		
Primary	**6.8**	9.0	23.5	4.3	1.5	6.9	6.4	8.6	4.5	45.8	11.9	9.3	3.8	13.4	10.1	8.5	:	:
Secondary	**11.3**	12.4	66.9	7.1	6.0	7.4	10.5	12.1	11.1	16.0	11.0	11.7	5.7	14.8	23.1	15.5	:	:
Schools linked to Internet (beginning of academic year 1999-2000) (%) [2]																		
Primary	**59**	70	94	56	1	80	30	80	75	25	38	63	42	90	57	86	97 [3]	:
Secondary	**89**	95	100	81	18	95	84	90	90	100	86	100	100	95	99	98	100 [3]	:
Computers connected to the Internet per 100 pupils at primary and secondary school level (%) [1]																		
Primary	**2.8**	2.7	11.3	1.6	0.7	2.6	2.1	2.7	1.7	17.7	2.8	1.4	1.1	9.2	6.6	3.9	:	:
Secondary	**6.4**	6.4	30.0	4.4	1.7	3.3	4.6	6.1	5.2	14.9	5.4	8.8	2.5	13.6	20.9	10.6	:	:

(1) eEurope 2002 based on Eurobarometers Flash 94 "Headteachers" of June 2001.
(2) ESDIS, February 2001 (Ministries for Education).
(3) National Center for Education Statistics, 2001.

In Universities and Technical Colleges, IT applications and networks have been developed to support education and research, and these cover a proportion of more than 1/3 of the 300.000 members of the academic community. With the implementation of the university network (GU-net), interconnection and direct international communication possibilities have upgraded and extended to all the institutions (18 universities and 14 technical colleges), through the addition of high-speed lines that provide advanced digital telephone services and access to world-wide sources of information. These were implemented via the backbone network of the National Network for Research and Technology (EDET) and international connections in the context of the EU projects TEN-34 and TEN-155[31].

In addition, we should not forget the deficits in the education system mentioned in the previous section.

The examination of the wider socio-economic environment as well as of the IST-specific environment and indicators have revealed a number of factors that affected the IST development in Greece:

- The degree of urbanisation and country's morphology;
- The still 'weak' regional authorities;
- The still low but increasing family incomes and GDP;
- The problem of the ageing population;
- The dualism in the structure of the economy;
- The deficits in the orientation of the education system and in ICT education;
- The limited knowledge of the English language;
- The cultural aspects forming a certain attitude towards innovation and change

- The fast growing telecommunications market;
- The fast decreasing telephone charges;
- The continuously improving quality and range of the telecommunications infrastructure and services;
- The still low e-commerce activities but improving e-commerce infrastructure;
- The increasing use of ICT in education and ICT courses.

To complete the picture the policy responses over the years should also be examined both for identifying any additional factors and also for examining if efforts are made to tackle the issues identified above. As shown in the next section, limited efficiency and experience of the public sector in programme administration and implementation as well as specific characteristics such as fragmentation or weakness in maintaining the "integrated" character that the information systems usually have, seem to have played a major role in the development of IS in Greece.

[31] Source: Greece in the Information Society 2002

4. Policy responses

The Greek government has made efforts to exploit ICT and IS advances in both previous Community Support Frameworks. Apart from the improved telecommunications infrastructure, the first CSF (1989-1994) approached the IS as a means to improve the computerization and automation of the public service. A programme under the name "Kleisthenis" was adopted, providing opportunities for purchase of equipment and training in all public and semi-public authorities. These efforts however were of limited success. There was low absorption and efficiency - the lower of the whole first CSF. The most important factors for the limited success were mainly internal organizational matters and the inefficiency of the public sector in the administration and implementation. [32]

During the 1994-1999 programming period telecommunications infrastructure further improved and reached satisfactory levels for the first time while mobile telephony grew rapidly. The programmes of the second CSF had a higher absorption and were considered overall more successful than those of the first. However IS policies were fragmented and composed of specific measures within sectoral programmes. This, in combination with the lack of coordination (each ministry or secretariat managed its own programme without any exchange of views, resulting to the lack of synergies) resulted in several duplications, overlapping and gaps.[33]

In more detail, according to the ex post evaluation of the IS related programmes and actions of the 2nd CSF, the implementation suffered specific problems[34] like: fragmentation, delays mainly in the beginning of the projects, uneven development of projects, weakness in the execution of innovative interventions, legal and organizational barriers, little experience of the bodies responsible for designing, monitoring and managing the projects, weakness in maintaining the "integrated" character that the information systems usually have, underestimation of the need for human resources training and weakness in the operation on the mechanisms for monitoring the projects.

The most successful of the broad applications under the second CSF was the TAXIS net service, which offered the possibility for electronic submission and clearance initially of access to certificates, then VAT and finally tax revenue declarations. The service was reviewed and accepted as a European best practice model in 60 out of 282 proposals submitted in the framework of the monitoring of the e-Europe actions.

The relatively limited success of the first programming period in terms of applications led the Greek government to the decision to put together all the elements of previous national programmes, which needed/envisaged the enhancement of the IS, into one new sectoral programme called the Operational Programme for the Information Society (OPIS). This programme includes practically all the IS elements of the previous programmes plus some new ones and tries to coordinate them in the framework of the e-Europe logic. The underlying approach is that as the IS becomes a key priority for the competitiveness of the Greek economy and its social cohesion; it should have a vision and a common tool for coordinating, monitoring and supporting individual

[32] Source: Technopolis Report – Case Study: Greek National Operational Programme for the Information Society (OPIS)
[33] Ibid.
[34] Source: Ex Ante Evaluation of the OPIS (http://www.infosoc.gr/news/1/docs/ex-ante-engl.doc or http://www.infosoc.gr/news/1/docs/OPISch5.doc)

activities with synergetic effects. The Operational Programme for the Information Society (OPIS) might be considered as the most ambitious and innovative programme in the 3rd CSF and the largest programme of its kind in Europe[35]. The ambition in the Operational Programme is obvious from both short-term as well as long-term goals set. The overall aim is to reach a level of IS development by 2006 that will place Greece at the same ranking as the rest of the IS developed countries in Europe. Additionally, it is very important to stress the fact that this programme (with a budget of 3 billion Euros) is the first attempt ever in Greece to put together horizontally a plethora of objectives and actions that will help develop an Information Society.

This programme, OPIS'[36], is the main policy instrument for developing the Information Society in Greece in the following years and was created in order to coordinate and activate a series of actions to this end. The actions included are particularly wide ranging and cover the fields of education and culture, citizens and quality of life, growth and employment, and communications. Important institutional activities take place in parallel with and in addition to the Operational Programme's intervention axes. New organisations were created and old ones were put into a new perspective, emphasising on the new process and the need for coordination and synergies.

The two general strategic objectives of the OPIS for the period 2000-2006 are[37]:

The first general objective falls under the heading "Citizens and quality of life". This relates to improvement in the quality of life for the average citizen by actions in a range of critical sectors such as public administration, health, transport and the environment. Intervention in these sectors will improve the services offered through integrated information and communications systems.

The second objective falls under the heading of "Economic development and human resources". This relates to the creation of conditions appropriate for supporting a process of economic and social development in which technology and knowledge are the main instruments for increasing productivity and competitiveness, incomes, employment and the skills of the labour force. It includes developing telecommunications infrastructure, supporting economic mechanisms and employment by adopting the most of new technologies, creating an education and training system adapted to the needs of the 21st century, and promoting Greek culture.

To achieve the above general aims, the OPIS sets a series of special objectives:

1. Education and Culture: Equipping, networking, training teachers and preparing digital material for the creation of an educational system for the 21st century, and using new technologies for the documentation and promotion of Greek culture. (With 15% allocation of the total budget)
2. Citizens and quality of life: Using ICTs for improved services to the public in critical sectors of the public administration, and improving of the quality of life through the introduction of new technologies in the areas of health and welfare, the environment and transport. (With funding 31% of the total budget)
3. The Digital Economy and Employment: Creating conditions for conversion to the new "economy", through the promotion of e-commerce, e-business and

[35] Source: Technopolis Report – Case Study: Greek National Operational Programme for the Information Society (OPIS)

[36] The Operational Programme was essentially the materialization of the strategy and actions proposed in the 1997 government document "White Paper – Greece in the Information Society, Strategy and Actions".

[37] Source: OPIS – Greece in the Information Society 2002 (www.infosoc.gr)

research and its relationship to production, skills upgrading, employment and tele-work. (With funding 32% of the total budget)

4. Telecommunications: Supporting the market liberalisation process and developing telecommunications infrastructure in remote areas for the provision of advanced services at low cost and points of access to the IS for the public. (With 20% allocation of the total budget)

OPIS seems to be addressing all the important issues hindering IS development in Greece: IT in education, use of ICT by the public, use of ICT in businesses, further development of the telecommunications market and improvement of the telecommunications infrastructure in remote areas.

OPIS also addresses the uneven distribution of IS development because of the peripheral disparities within the country, by asking for the first time all the regions to include elements for the enhancement of the IS in their Regional Operational Programmes. The priority areas and regional budgets are subject to decision in each region. The regional programmes are monitored by the Regional Monitoring Committees but the use of funds for the IS is subject to scrutiny by the OPIS Special Secretariat and Management Authority[38] to assure compatibility with national targets and avoidance of overlapping and duplication.

The quality of the description of the IS activities and measures in the Regional Operational Programmes Complements varies. As a result one may say that while the regions complied with the central guideline to design IS applications, their skills and resources to do so were in most of the cases totally inadequate. The importance of work on the knowledge based society and e-business are priorities in all regions, while cheaper faster Internet, youth participation and research networks are correctly neglected, as being national and not regional priorities. At the same time one can see that some regions have clear priorities and decide to totally neglect areas irrelevant for their development, while in other regions most e-Europe priorities are considered as important, indicating a reluctance or inability to make choices.

The result of the Programme Complements was judged unsatisfactory[39] for the OPIS Secretariat and in an effort to get better coordination and more efficient implementation the national administration has funded each region with 130000 Euro to produce a detailed business plan for the IS components of their programme. These business plans are in the process of being submitted and their quality varies. The plans include in general a good outline of the current situation but fail to take a proactive role, consult the regions based on international experiences and link well the current situation with priorities and measures. The process is still ongoing.

The improved design and integrated activities of the OPIS in addition to the positive wider economic environment and the positive trends in most IST development indicators create an optimistic background for the development of Information Society in Greece and especially for the achievement of the specific targets set under the programme:

[38] The OPIS Secretariat and Management Authority was created in order to ensure that there wouldn't be any lack of quality and coordination for the implementation of the programme as in the previous CSFs.
[39] Source: Technopolis Report – Case Study: Greek National Operational Programme for the Information Society (OPIS)

INDICATORS	STARTING POINT	VALUE AT STARTING POINT	OBJECTIVE 2006
Internet Users per 100 inhabitants	2000	5	50
No of pupils per PC	2000	51	10
% of schools connected to the Internet	2000	5	100
No of PCs per 100 civil servants	2000	15	50
% of health centres connected	2000	0	100
% of SMEs doing e-commerce	2000	?	15
% of population covered by systems of frequencies spectrum control	2000	5	80
% Increase of employment posts in the IS domain	2000	48,750	80, 000
IS expenditure as % of GDP	2000	4,1	6,2

Additionally the priorities and aims of the OPIS are compatible with the more general priority policies at the EU, national and regional levels:[40]

- In accordance with the general framework of European employment policy and the policy of the Greek National Employment Action Plan, increasing employment, skills and equality of rights represent central objectives of the programme. These are pursued through a variety of actions aimed at increasing entrepreneurship, the creation of new jobs, the upgrade of skills, and the inclusion of disadvantaged groups in the labour market.
- The emphasis of the protection of the environment is evident in a series of actions of the OPIS. The OP includes actions related to the use of management systems for the environment and transport, with direct positive consequences for the environment. In parallel, actions for e-commerce, tele-work and/or the use of new technologies for production contribute to the creation of a model of economic development compatible with "sustainable development".
- Production and diffusion of new technologies throughout society reduces social exclusion and provides increased potential for employment and for serving people with special needs. The promotion of tele-work helps disadvantaged groups become part of the workforce. It also promotes equality between men and women, both by increasing the number of jobs in the service sector and by improving opportunities for education, information and civil participation.
- IS activities have marked regional and local dimension and are compatible with EU and national policies for decentralisation. The aim is to create conditions for a more active participation of all regions of the country in global economic activity. This is achieved by increasing the scope of the regions in designing their own IS actions, and by formulating a plan for each area that concentrates on reducing isolation, accentuating local features, supporting infrastructure and improving the quality of life.

[40] Source: OPIS – Greece in the Information Society 2002 (www.infosoc.gr)

5. Conclusions at case study level

IS development in Greece started later than in most of the other EU Member States. The first and second CSF had a major contribution in building the telecommunications infrastructure, in computerising the public services and in developing mobile telephony in the country. However, the success could have been much greater if these efforts were not hindered by internal organizational matters like limited experience of the public sector in the administration and implementation, lack of coordination, delays, etc.

The current situation, comparable to Portugal and Spain and characterised by some of the lowest figures in IS-related indicators is, however, supported by some of the highest growth rates.

Identification of factors of success and failure needs information and data covering as wide time periods as possible. Due to the recent development of IS in Greece some indicators cover only a short period of time (1-2 years). Keeping that in mind, a number of hypotheses have been made and tested according to the available data and information. Nevertheless, it should be stressed that to produce safe conclusions these hypotheses should also be tested in the near future and particularly in 2006 since implementation of the OPIS is expected to change the situation radically.

The factors that have been identified to influence the development of IS development in Greece are both directly related to IS as well as indirectly belonging to the wider socio-economic and cultural environment that IS development takes place.

Information Society is taking place within an economic environment marked by high growth rates, low inflation and interest rates, and the elimination of public sector deficits. Since 1995 the GDP growth rate has been higher than the EU average. In 2002 Greece's economy is considered to be the fastest growing economy in the European Union.

High development rates led to an increase of employment. Unemployment in Greece has decreased the last couple of years but it remains one of the highest in the EU – zone. Despite that, the real income of the households was increased but the GDP in terms of PPPs show that it is still more expensive for Greek people to buy ICT goods.

Although real salaries were increased, the labour cost per unit has been steadily decreasing, with labour productivity growing fast, approaching the absolute levels of other developed economies, a fact undoubtedly related to the major increase of investments over recent years. Labour productivity growth in Greece in 2002 is expected to be one of the highest in EU.

Overall expenditure in ICTs, as a percentage of the GDP, is almost in convergence with the EU average. It is encouraging that GDP expenditure per inhabitant is also increasing faster than the EU average since 2001. Additionally the range, the quality and cost of telecommunications infrastructure and services in Greece have improved considerably. The proportion of digitisation of the network has increased mainly in urban centres but also in the country as a whole, while the quality of services is improving steadily. However, the cost of services for the private sector remains high, whereas for consumers it is low. The rapid completion of the liberalisation process has also lead to substantial cost reductions and to further improvements in the quality and range of services offered. Telephone connections in Greece are close to the EU average, while

ISDN connections are steadily increasing and all telephone lines are digitised. In addition, mobile telephony penetration in Greece is in line with the EU average, supported by a fast growing market.

Great potential for the increased use of ICTs also exists in the public administration, schools and workplaces, and at present this potential has not been fully realised. Despite the considerable effort and capital expended, the public administration in Greece is still characterised by a small number of installed IT systems, most of which are management systems available for administrative information and services offered to the public. An increasing number of employees have access to e-mail. Considerable efforts have been made to upgrade the skills of the labour force by means of further training programmes, but these do not fully meet the new needs that are appearing in the IS.

The picture relating to the use of the Internet for transactions with the public sector is quite positive. Almost one in two users of the Internet have visited government websites, a figure corresponding to the European average. Government online services are growing rapidly while recent research by the European Commission ranks services relating to taxation (TAXIS-net) as the most complete online public services in Greece.

The increase of information technology services provision in Greece is about the same level as in the rest of the EU countries and the market for software products appears to be very dynamic. The telecommunications market is also characterised by fast growing trends and considerable dynamic.

In relation to infrastructure for the Internet, hosting stations increased significantly (70%) for the period 1998-2000, while a major increase has also been noted in unique IP addresses as well as websites. Online transactions continue to account for a small fraction of Internet services, with e-mail and online newsletters being the most often used online services. According to recent figures, about 13% of the population in Greece now have access to the Internet (2001) but the number of users is increasing annually. As for the development of e-commerce, Greece is lagging in the creation of appropriate infrastructure with an average number of secure Web servers much lower than the EU average.

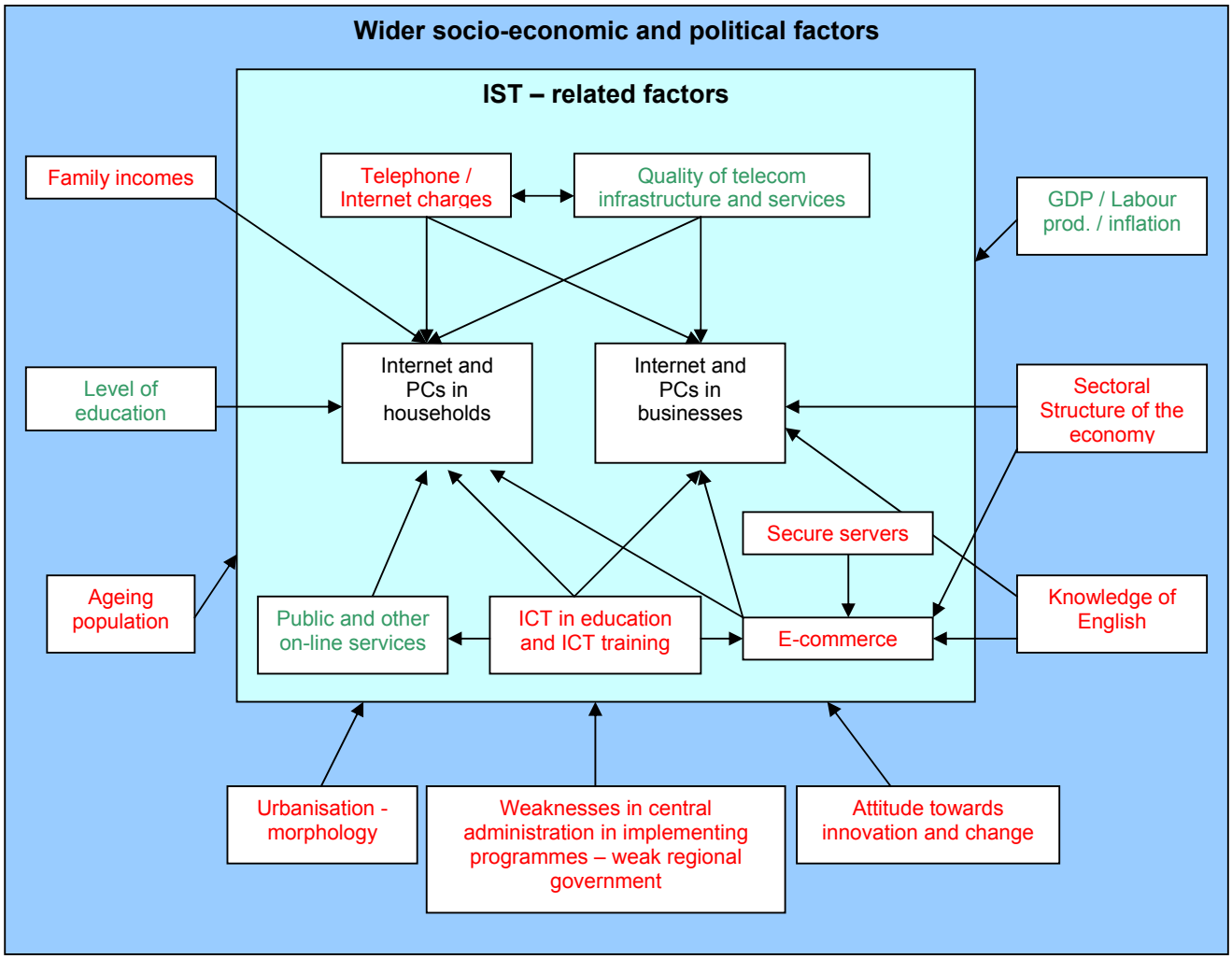
The educational system is being transformed gradually by the introduction of new ICTs. In secondary education, information technology has been taught since the mid-80s at most of the country's high schools, but the instruction periods, textbooks and laboratories have taken some time to become sufficient. The average number of pupils per PC is decreasing at both levels (primary and secondary) but is still high, while access to the Internet has now reached 100% at secondary level. In Universities and Technical Colleges, IT applications and networks have been developed to support education and research, and these cover a proportion of more than 1/3 of the academic community.

However, the cost of Internet access and use (connectivity) is more expensive in relation to other European countries. This is mainly due to the developing market and the limited competition in Internet providing services as well as the low income per capita in relation to the EU average. Nevertheless, the development of some new business initiatives focused on new technologies, research work at universities and the steady and more widespread acceptance of many new technologies by consumers are signs of a new dynamic. On the other hand, there is a small proportion of trained personnel among the total workforce and limited development in new types of work, such as tele-work.

In addition there are some other factors considered important for the development of IS in the country which are not directly related to the IS.

- Educational System: the lack of linkage of education with the market's needs, the reluctance of educationists in embracing the new technologies, the lack of ICT specialists as teachers.
- Low birth rate and ageing population: the tendency for older people to use new technologies and the Internet is limited.
- Cultural aspects of the population forming a certain attitude towards creativity, innovation and change.
- Language: only 54% of the students were taught English (at school), which is the main language for ICT use as well as for the most of the sites available on the Internet.
- Peripheral Disparities: the morphology of the country as well as the still weak regional authorities affects the uniform development of IT across the country.
- The 'dualism' in the structure of the economy, with some dynamic high-tech enterprises alongside mostly technology-laggard, industries, is affecting the diffusion of and investment in new technologies. On the other hand, the increasing importance of the tourism sector for the Greek economy along with the banking, insurance and real estate services gives positive signals for a sector to target in order to have a high impact in IS development. Whether these sectors should have priority over others needs to take into consideration issues like the seasonal character of tourism. Nevertheless, it seems an area worthy of investigating.

The factors identified above can be presented in the following picture along with the interconnections among them. Without overlooking the significant improving trends noted in the recent years, an attempt is made to categorise the factors that seem to have affected IS development in Greece till now as of 'having facilitated' (green fonts), and as of 'having hindered IS development' (red fonts).



In conclusion, Greece is starting from a very low position and the gap to fill in concerning the development of IS is significant in comparison to the other EU member states. However, the improved design and integrated approach of the OPIS, the positive actions taken to improve implementation and increase its effectiveness as well as the positive wider economic environment and the improving trends in the factors affecting the IS development in Greece noted in the past years, give encouraging signals and create optimism in achieving the targets set.

Annex I: Examples of IS related National and Regional Programmes and initiatives

The past few years there have been many programmes implemented or are under way at National or regional level directly or indirectly related to the IS development. Some indicative examples of such programmes are:

1. "Politeia" (related with the public administration reform)
2. "Kleisthenis" (related with the public administration modernization through technical, organizational and educational interventions)
3. "Syzefxis" (related with the creation of the national public administration network and aims at the creation of a uniform technical and operational communication environment for public services with other public services and with citizens and firms)
4. "Ariadne" (related to the e-version citizen guide, 1464 call centre, Asterias project for the promotion of IS development in the islands, the creation of One-Stop Shops and e-forms, the simplification of administrative procedures, etc)
5. "Odyssey" (related with teacher training in ICT)

These Programmes were implemented under the 2nd CSF and as mentioned in the case study, although some were judged as successful, others failed to deliver completely the goals set.

The Ministry of Development and the General Secretariat for Research and Technology, in the framework of the Operational Programme for the Information Society have launched two initiatives for the submission of proposals for R&D as well as Demonstration Projects for "e-business" or "e-learning". The main purpose of these initiatives is to support research associations (enterprises, educational institutes, research centres or other bodies) for the development of innovative (technologically) products and services for e-business and e-learning.

Another initiative by the Ministry of Development is the programme Go Digital under the Operational Programme for Competitiveness Programme. The main aim of this initiative is to help about 50,000 SMEs become familiar with the digital economy, to help them exploit the potential and opportunities through the Internet and more generally, to motivate entrepreneurs in using the new technologies in the Information Society. The programme is under implementation for the period 2000-2003 with a total budget of EUR 117,4 million.

In parallel, the European Regional Development Fund - RISI I Programme (Regional Information Society Initiative) (1994-1999), funded two projects for the Greek regions: one with the title RISE (Regional Information Society Strategy for Epirus) implemented by the region of Epirus and the other with the title ATHINA (Regional Information Society Strategy for the region of Attica).

The main challenge for RISE was to cause a transition in the regional development planning process:

- From start-up position of very low awareness about Information Society encompassing the whole of the private and public sector of the region with very few exceptions of ICT consultants and specialists in the academic institutions of the region and managers of a few enterprises among the larger SMEs of the region;
- To the position it finds itself now where there is considerable awareness and understanding of what Information Society means for all facets of regional development, which is hared among a substantial, and critical, portion of the

private and the public sector of the region and a concrete strategy and plan of practical action, which is owned by the key regional actors together with the necessary funds, for undertaking an integrated Information Society intervention in the region over the substantial planning period (2000-2006).

The central obstacle of this transition was the very low start-up position of the region and the resulting difficulties in attracting people without direct experience of ICT services to become interested in Information Society, make an informed contribution at the level of policy as well as at the level of practical actions, and in the case of politicians commit resources to Information Society actions. There was no single solution for dealing with this obstacle but a combination of means: analytical work at user level which produced tangible trust relations, between the key regional development actors-politicians- and the RISE team of specialists; a background of prior work in regional development; and last but not least, gestation time.

The position the region finds itself now is another start-up position in the regional development process proper, i.e. with respect to implementation of the Regional Strategy and Action Plan. The challenge that the region faces nor is to close or minimise its distance and gap from the rest of Greece and the EU and cause a transition from its very low present position, in terms of actual take-up and usage of ICT services, to a position of a full participation of the region in the Information Society and its exploitation for the economic and social development planning approach, including effective monitoring, review and evaluation procedures, and a substantial improvement over established development planning and management practice.

As far as the ATHINA project is concerned, it had four principle aims:

- Advise regional and local authorities and other public and private sector bodies in issues pertaining to the Information Society
- Contribute to the consensus building process, coordinated by the European Commission, together with our European partners
- Act as a catalyst for the accelerated development of Attica's and Greece's Information Society
- Inform and educate about its possibilities to the widest possible extent

Under this project a comprehensive analysis of the current situation in the region of Attica was achieved with regards to the Information Society. The analysis included financial, legal, public policy, and application issues. The ATHINA project is currently working towards the establishment of a comprehensive Strategy Plan for the region of Attica, focusing on "mature" projects and organisational reform.

Under the RISI II programme, another project was funded with the title TEMeTeN (Towards a European Medical and Teleworking Network). This was a project for the creation of a network and more than one countries were involved (Greece, Italy, Spain, Finland). The two Greek regions that took part in the project were the regions of Crete and Epirus.

The project TEMeTeN aimed at improving the quality of health care at regional level in normal and emergency situations for residents and visitors of Crete, and also reducing the cost due to unnecessary repatriations. Another important objective was to equip "Resort Offices" to help improve the attractiveness of the regions involved.

Although RIS projects are focused on a single region, form the outset, significant emphasis has been placed on widening the perspective of regional stakeholders when developing their strategies and action plans. In this respect, the RIS- RITTS Network, funded by DGXIII/D (Innovation Programme), has facilitated the exchange of experience, carried out benchmarking activities and supported thematic sub-groups of RIS-RITTS regions (industrial, urban, tourism, etc.)

Finally under the European Regional Development Fund Innovative Actions programme adopted by the European Commission on January 2001, 13 programmes were approved for implementation for all 13 regions of the country: Western Greece, West Macedonia, Thessaly, South Aegean, Peloponneses, Northern Aegean, Ionian Islands, Epirus, Eastern Macedonia–Thrace, Crete, Continental Greece, Central Macedonia, and finally Attica. This programme has a long-term character (2000-2006) and the projects for the 13 Greek regions are still under implementation.

"Western Greece Region Objective 1 Programme": the European Commission approved for the period 2000-2006 an operational programme for the region of Western Greece. The programme represents and overall amount of EUR 781,4 million, of which EUR 478,45 million (65% of the total budget) will be financed by European Union's Structural Funds. Main priorities of the programme are:

- Enhancing and valorisation of the region's positions as the country's western gateway
- Cultural and Tourist development – deriving maximum benefit from the Games 2004
- Restructuring and expanding the region's industrial base and promote innovation
- Improving urban infrastructure –enhancing the quality of life
- Maintaining employment and specialisation of human resources
- Sustainable rural development
- Technical assistance

"West Macedonia Objective 1 Programme": the European Commission has approved an economic and social development programme for the Greek region of West Macedonia. The total cost of the programme amounts to around EUR 581 million. Out of that amount, the European Structural Funds will provide EUR 372 million. Main priorities of the programme are:

- Greater opportunities for job creation and the reduction of unemployment
- Improved trans-European networks linking the Region's productive centres
- Upgrading of the urban areas
- The restructuring of the trades in crisis in the total economy and support for export initiatives to new markets
- Sustainable development of rural areas
- Integrated development of mountain areas and areas near lakes
- Technical assistance

"Thessaly Objective 1 Programme": the European Commission has approved a programme for the development of the Region of Thessaly for the period 2000-2006, which involves Community Support Funds nearly EUR 563,38 million. The European funding will attract a further EUR 187,79 million in investment from the public sector and EUR 177,66 million from the private sector creating total resources of EUR 928,66 million. The main priorities of the programme are:

- Productive environment
- Integrated rural development
- Quality of life
- Exploitation of the Region's central geographic position and promotion of the region's as "network junction"
- Human resources
- Technical assistance

"South Aegean Objective 1 Programme": the Commission has approved a regional development programme worth almost EUR 609,51 million for the South Aegean islands. Of that amount, EUR 372,21 million will be financed by the EU Structural Funds, with the remainder coming from the public and private sectors (EUR 22,07 million and EUR 113,21 million respectively). The main actions of the programme are:

- Alleviating the problems caused by the region's insular nature –basic infrastructures
- Environmental protection and management of natural resources
- Monitoring and redirecting the development of tourism
- Strengthening and upgrading dynamic island centres
- Rural and economic development of those islands with low development potential
- Technical assistance

"Peloponneses Objective 1 Programme": the Commission has approved an economic and social development programme for the Peloponneses region for the period 2000-2006. Funding for the programme amounts to almost EUR 698,69 million, of which EUR 457,19 million come from the EU Structural Funds. The private and public sector will contribute EUR 89,09 million and EUR 152,41 million respectively. The main priorities are:

- Exploiting the region's immediate vicinity to the metropolitan region of Attica.
- Sustainable rural development
- Strengthening and improvement of tourism
- Improvement of urban and semi-urban centres
- Support and development in the field of human resources
- Technical assistance

"Northern Aegean Objective 1 Programme": the European Commission has approved a regional development programme for the Greek region of the Northern Aegean. This programme for a total amount of EUR 547,905 million over a total period of seven years (2000-2006) will be financed by Community assistance of EUR 361,59 million, with EUR 120,53 million form the public sector investment and EUR 65,78 million by the private sector. The main priorities of the programme are:

- Reversal of demographic contraction and of the marginalisation of the economy of the islands through the use of new technology and local advantages
- Urban development
- Diversification of the economy of the islands and reinforcement of competitiveness through the use of the information society and the development of innovation
- Support of agricultural development –rural development
- Technical assistance

"Ionian Islands Objective 1 Programme": the Commission has approved a programme of economic and social development of the region of the Ionian Islands in Greece for the period 2000-2006. It provides the total amount of EUR 375,14 million for financial assistance. Of this sum, EUR 244,68 million (65% of the total budget) will be sourced through the European Union's Structural Funds. Public money will account for EUR 81,56 million of the programme, with the private sector contributing a further EUR 48,9 million. The main priorities of the programme are:

- Infrastructure investment to improve quality, quality and supply in the tourist sector
- Protecting and developing the environment
- Reducing development disparities between regions
- Improving and safeguarding urban and semi-urban areas
- Combating unemployment
- Developing and protecting the smallest islands
- Technical assistance

"Epirus Objective 1 Programme": the European Commission has approved an economic and social development programme for the Greek region of Epirus for the period 2000-2006. The programme will receive the financial volume of approximately EUR 680,07 million, of which EUR 435,98 million of the total budget will come from the EU's Structural Funds. The public and private sectors will supply the remainder. The main priorities of the programme are:

- Providing infrastructures and support for private investment aimed at promoting the role of the region and encouraging innovation
- Enhancing the value of urban areas, providing environmental and social amenities and implementing integrated measures
- Underpinning the tourism sector and protecting and enhancing the various natural and cultural resources
- Ensuring sustainable development for rural, mountain and less favoured areas
- Developing human resources
- Technical assistance

"Eastern Macedonia-Thrace Objective 1 Programme": the European Commission has approved a regional development programme for the Greek region of Eastern Macedonia – Thrace, which is lagging behind in its development. The total cost of the programme amounts around EUR 1,1 billion, of which European Structural Funds will provide 733,4 million. The main priorities are:

- Rural development
- Innovation and competitiveness
- Exploitation of the geographical position of the region
- Urban development
- Reduction of intra-regional social disparities and development of human resources
- Technical assistance

"Crete Objective 1 Programme": the Commission has approved an economic and social development programme for the Greek region of Crete, for the period 2000-2006. The cost of the programme will be about EUR 730,31 million, with EUR 67,74 million (64% of the total budget) which come from the EU Structural Funds. Main priorities of the programme are:

- Strengthening the region's role as a technological development regional centre, moving innovation forward and strengthening competitiveness
- Safeguarding the environment and narrowing the disparities between coastal and interior regions
- Promoting the region's gateway in the context of international transport networks
- Improving business activity and enhancing living conditions in major urban centres
- Developing mountain and rural areas
- Creating jobs –promoting equal opportunities
- Technical assistance

"Continental Greece Region Objective 1 Programme": the European Commission has approved fro the Greek region of Continental Greece ("Sterea Ellada") for the period 2000-2006. The programme resources amount to around EUR 873,11 million. From that amount, the Structural Funds of the EU will provide EUR 532,61 million. Main priorities of the programme are the following:

- Reduction of intra-regional differences with emphasis in mountainous areas
- Environmental protection, increase in value and rational management resources, improvement of cultural and historical advantages and of the tourist promotion
- Basic and social infrastructure and the reinforcement of the development of urban centres
- Reinforcement and modernisation of the enterprise sector: establishment of links to the local economy
- Human resources
- Technical assistance

"Central Macedonia Objective 1 Programme": the European Commission has approved a development programme for the Greek region of Central Macedonia. This programme has a total financial volume of approximately EUR 1,460 million, of which EUR 903,4 million will come from the European Union's Structural Funds. The public and private sectors will supply the remainder. The main priorities of this programme are:

- Support for private investment to promote Thessalonica's role as a metropolitan centre
- Protection and development of the environment
- Reduction of intra-regional disparities
- Encouragement of innovation and entrepreneurial spirit
- Alleviation of unemployment
- Development of the upland, the interior and the less favoured areas
- Technical assistance

"Attica Objective 1 Programme": the European Commission has approved a regional development programme for the Greek region of Attica for the period of 2000-2006. The programme represents a volume of nearly EUR 1,534 million, of which EUR 1,119, 96 million (i.e. 73% of the whole amount) comes from the European Union's Structural Funds. The public and the private sectors will finance the remainder (EUR 327,47 million and EUR 71,9 million respectively). The main priorities of the programme are:

- Strengthening of the international role of the capital
- Improvement of the quality of life and the environment
- Alleviation of unemployment and social exclusion
- Reduction of the disparities within the region
- Rehabilitation of the sites affected by the earthquake of the 7th of September 1999
- Technical assistance

OPIS

The European Commission has approved a major development programme in Greece for the period 2000-2006, entitled the Operational Programme "Information Society". This programme involves Community support for all the Greek regions within the framework of "Objective 1" (regions lagging behind their development. The total budget of the programme is around EUR 2,8 billion and the Community assistance amounts to 1,7billion (approximately 8% of the total assistance granted to Greece under the Third Community Support Framework). Action Priorities:

- Education and Culture
- Services to citizens and improvement of the quality of life
- Employment and the digital economy
- Communications Technical assistance

"Competitiveness", Objective 1 Programme

The European Commission has approved the Operational Programme "Competitiveness", a major development programme in Greece for the period of 2000-2006. This programme involves Community support for all the Greek regions within the Objective 1 framework (regions lagging behind in their development). Community assistance amounts to 1,97 billion Euros, approximately 9% of the total Community Support Framework (CSF) for Greece, and is expected to mobilise a total investment worth more than 6 billion Euros including public and private funding. Action Priorities:

- Improving and simplifying the business environment
- Supporting the creation of new businesses
- Strengthening the quality-orientated, sustainable competitiveness of businesses and their participation in the changing global market
- Improving the research and technology transfer and its relation to business needs
- Upgrading, diversifying and promoting Greek tourism
- Securing the energy supply and promoting energy market liberalisation
- Energy and sustainable development
- Upgrading human resources
- Technical assistance

The Politeia Programme

The "Politeia Programme" was set up in May 2000 and outlines the general direction of the on-going public administration reform. This framework is completed by the Operational Programmes "Management by Results" and "Evaluation and Performance Indicators". The Politeia Programme as presented and implemented to date covers the policy principles and basic actions that have been developed for the transformation of the public administration (and local government) in Greece. Law 28800/2001 concerns the mechanisms for implementing and monitoring this policy and for evaluating its application.

The second CSF Operational Programme "Kleisthenis"

The Kleisthenis Operational Programme for the Public Administration was implemented in the framework of the 2nd Community Support Framework. The main objective of this programme was to create the conditions for continual modernization of the administration through technical, organizational and educational interventions. The programme had a total budget of 96.4 million drachmas for the period 1994-1999, and financed:

The public administration network -SYZEFXIS

The "Syzefxis" project relates to the creation of the national public administration network and aims at the creation of a uniform technical and operational communication environment for public services with other public services and with citizens and firms. The Informatics development Service of the Ministry of the Interior, Public Administration and Decentralization is implementing the project in the Framework of the "Kleisthenis" program. After the completion of the first pilot phase of the project (connecting certain ministries and regions), its full implementation will start in 2002.

The Ariadne Programme

In the light of the need for e-government actions, many parallel initiatives have been grouped together in this program: these include the electronic version of the Citizen Guide, the 1464 call centre, the "Asterias" program, the creation of One-Stop Shops and e-forms, the simplification of administrative procedures, etc. The "Ariadne" programme is designed to improve communications with the public and the quality of service the citizen receives from the country's public services. It signals the collaboration between the central public administration and local government authorities, and will be implemented through both central and decentralized actions. The citizen will be able to access administrative information and data (e.g. e-forms) in the following ways:

- By telephone
- Via the Internet
- Through service infrastructure on the local level

These structural, providing a total of about 1000 service points, have already begun to be set up in local government authorities across Greece. These 1000 citizen service points will also be public Internet access points.

Teacher training Programmes

Primary Education

In primary education, actions relating to ICT training have included the "Uniformity of Diplomas" project, in which about 5000 teachers received training, the pilot project "Isle of the Phaeacians", which was part of the "Odyssey" programme and involved 15 primary schools, and the pilot project "All-day School", in which 560 teachers received in-school training in the 28 all-day schools.

Secondary Education
Teacher Training programmes were developed in the framework of the "Odyssey" Project, while the seminars conducted by the Ministry of Education's Regional Training Centers provided training in the use of computers and office applications to about 3000 educationists.
Within the framework of the "Odyssey" programme, three of Greece's universities (The National Kapodistria University of Athens, the Aristotle University of Thessaloniki and the University of Macedonia) developed one-year post-graduate programmes to train educationists in aspects of the introduction of ICT in education, preparing them for Ministry of Education senior staff training positions in this sector. A total of 120 cadres have been trained in this way, and are already being used in training.

The e-learning initiative

The initiative "e-learning: thinking the education of tomorrow" was approved by the European Commission on 24 May 2000. This initiative, following the conclusions of the Lisbon European Council, presented the principles, goals and lines of actions of e-Learning, which is defined as the "use of new multimedia and Internet technologies for improving the quality of learning and facilitating access to resources and services, as well as exchanges and distance collaboration". The e-Learning initiative received a very favourable response from the Ministers for Education and from the Feira European Council in June 2000.

Greek Open Source Software Initiatives

The Greek initiative for Open Source Software/ OSS is designed to promote the use of OSS in Greece (http://www.open-source.gr). This initiative is primarily addressed in those involved in primary, secondary and post-secondary education (pupils, students and teachers). The advantages of OSS go beyond no-cost acquisition and upgrading, and may be summed up in four points:
- The availability of the source code ensures the possibility of adapting it to the needs of the user as required
- The source code can be studied, thus improving collective technical knowledge
- The fact that open source user permits allow free modification of the software contributes to the creation of better quality software
- The philosophy of the open source movement is closer to the spirit of collaboration and study for the achievement of better results, an attitude inseparable form the educational process

The initiative that has been developed in this direction has already launched endeavours to translate popular software products into Greek in an attempt to create a fully user-friendly working environment. The basic parameters for the selection of software for translation are its user-friendliness, operational stability, ease of learning and ease of adaptation to it. In addition, international examples of the application of OSS in education are being studied so as to benefit from international experience and achieve optimum results.

ANNEX II: List of Interviewees

1. Ioannis Kaloghrou, Special Secretary for the OPIS
2. Ioannis Karabasis, Director of the Information Society S.A.
3. Sofia Korogiannaki, Researcher, author of the reviews for the Regional Business Plans
4. Evagelos Kratsas, Editor of the PC Master Magazine
5. Vasilios Laopodis, EU Official detached to the General Secretariat for Research and Technology (Ministry of Development
6. Dimitrios Mardas, General Secretary of Commerce, Ministry of Development
7. Marie Panopoulou, PhD Research Fellow, Center of Planning and economic research
8. Vasilios Tsakalos, PHD, JRC PRAXIS, Co-ordinator
9. Nicolaos Varsakelis, PhD, Adjunct Professor of Economics in the Aristotle University of Thessaloniki

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Identifying factors of success and failure in European IST-related national/regional developments

Final Report
Case Study: Ireland

December 2002

Dublin, Ireland

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Executive Summary

Important early foundations for the information society in Ireland can be traced back to a number of events:

- In 1958: Initial consideration given to Foreign Direct Investment (FDI) as means of creating employment and driving the modernisation of the economy;
- In 1967: from the decision to expand the national education system initially at second level and then at third level;
- In 1973: Year of Accession to the EEC, now EU

More recently, it was against a backdrop of emigration, un-employment and national indebtedness in the 1980's that led to the first of a series of *National Partnership Agreements* in 1987 which laid the foundations for the economic turnaround of the early 1990's. Through the combination of factors from the mid-1990's, the country was in the fortunate position of having a young educated workforce, a strong presence of FDI companies – particularly in those industries which would be relevant for the Information Society (e.g. IT, Software), and the fiscal resources to make strategic investment. In effect, the those factors which caused the *Celtic Tiger* period from the mid 1990's also provided a fertile ground in which to launch an information society initiative.

Ireland's Information Society initiative commenced with a report to Government in 1996 which defined a vision for the country in the information society as follows:

Vision

Ireland is a unique community,
rich in culture learning and creativity,
Where the information society is embraced
To support the talents of our people,
To create employment, wealth and vibrant inclusive communities
And where citizens participate more actively in Government

The report further highlighted five key areas ('pillars') supporting the vision, and needing to be addressed, namely: Awareness, Infrastructure, Learning, Enterprise and Government. A wide range of required activities were identified within this framework in the report.

Following the publication of the first Information Society report, Government quickly recognised the potential of the Information Society in its own right, and as an important vehicle with which to address other key policy areas: for example Employment, Competitiveness, Inclusion, Regional Development. As a result, delivering the Information Society agenda became an integral part of Government policy which was underlined by the prominence attached to the Information Society in the most recent National Partnership Agreement: the *Programme for Prosperity and Fairness.*

Several recent international benchmark studies suggest that, notwithstanding the significant momentum behind the Information Society, the activities have not been sufficient to propel the country to become a leading Information Society. Moreover, in two of the recent benchmark studies, Ireland's relative standing has deteriorated between 2001 to 2002 suggesting that there may be reduced momentum behind the national Information Society agenda.

From the analysis of data, and the feedback of interviewees, a synthesis of the key factors and other important factors contributing to the success and failures of the Information Society in Ireland is set out overleaf.

- **National Education System**: The maintenance of a high quality national education system which is responsive to the needs of Industry during a period of significant expansions in from 1970's through the 1990's
- **FDI:** Ireland has been able to successfully leverage the presence of the FDI companies in Ireland, many of whom were involved at the forefront of the technological revolution driving the Information Society.
- **Government** has played a key role in embracing the Information Society agenda by implementing mutually interlocking and reinforcing actions across a range of activities from Taxation, Healthcare, Education, Legislation, Research and Enterprise development.

The factors contributing to failure of the Information Society in Ireland include:

- **Inclusion:** The Information Society exists against a persistent backdrop of social exclusion. Without appropriate interventions, the Information Society can exacerbate the exclusion problem.
- **Infrastructure**: While larger enterprises and cities are reasonably well served with modern telecommunications infrastructure, access to high-speed/low-cost bandwidth by smaller enterprises, by home users – particularly those based in the regions – is more problematic. Hence Ireland's internet presence, as measured by Internet users and hosts, does not compare favorably internationally.

A wide variety of lessons can be learned from the Ireland experience implementing the Information Society (IS) agenda. Because it impacts in so many areas, it is important to be able to address many issues simultaneously: e.g. Inclusion, Education, Ecommerce, and in developing the necessary Legal & Regulatory Framework.

FDI companies can play a useful role the developing the national IS agenda. However in order for them to do so, it is necessary to implement supporting policies & processes aimed at engaging the management of FDI companies so as to leverage and diffuse the insights they can contribute. Exemplar Projects that are led by empowered local communities can deliver efficient, cost effective, locally relevant projects (e.g. Farming Communities, Older people, and Disabled people); successful projects should be scaled up nationally to extend reach and impact.

Government itself plays a key role in ensuring that a proper balance is maintained between the *needs of enterprise*, and the *needs of individuals and the wider community* in the Information Society. Government should take a *client-centered* approach to re-engineering and delivery public services so that they can better serve the community in a more efficient and effective manner.

The availability of a modern, cost-competitive telecoms infrastructure is also an essential ingredient for the development of the Information Society. Securing such an infrastructure nationally in a deregulated market requires that early investments are made, notwithstanding the difficult investment environment which currently exists in the industry.

1. An Introduction to the Study

1.1 Purpose of this report

Fundamentally, this study, which is one of five[1] parallel studies, seeks explore those lessons that can be learned from the success and failure of the Information Society initiative in Ireland, such that they can help stimulate IST-related developments in the EU Candidate Countries.

1.2 Sources of Information

Quantitative Research:

The report draws on various regional, national and international data, derived from a wide range of sources, but predominantly from relevant EU, Government departments, State bodies and International research reports. CIRCA has made particular effort to identify or compile the most current country data, published up to and including December 2002.

Qualitative Research

To complement and augment the desk research, CIRCA interviewed representatives from public and private sectors. The interviews covered members of the original Information Society steering committee, members of the Trade Union movement, from the enterprise sector (both Indigenous and Foreign-owned), from Government and Semi-state bodies and from community organisations. The interviews were particularly valuable in enabling CIRCA to develop a narrative for the Information Society in Ireland: past, present and future.

1.3 Structure of the Report

Chapter 2:

Outlines the important historical context of the Country prior to and during the development of the Information Society agenda that first emerged in 1996.

Chapter 3:

Seeks to trace the development of the IS agenda in Ireland to the present. It highlights the original Agenda, overall progress, and Ireland's relative standing via à vis other countries using international benchmarks, including the IDC World times information imperative index.

Chapter 4

Provides an assessment of Information Society developments in Ireland. It explores those factors which have contributed to the successes and failures of the initiative, seeking to understand how and why these occurred.

Chapter 5

Attempts to draw some conclusions derived from both qualitative and quantitative information sources, and sets out some of the current challenges that remain.

Chapter 6

Defines some key messages from the Ireland Information Society experience that might be useful to others in devising and implementing national Information Society initiatives.

[1] Other parallel studies are taking place in Greece, Austria, in the Dresden region of Germany and Flanders region of Belgium.

2. Ireland's Strategic context

It is impossible to understand the development of Information Society in Ireland without first considering the wider contextual environment and issues which pertained in the country prior to during and since the launch of the first Information society report, completed in December 1996[2].

Anyone returning to Ireland in the year 2000 after a 10 years gap would encounter a dramatically different country. One could sense a palpable atmosphere of economic activity, of a developed affluent country, an increasingly self-assured people, confident about themselves and about a prosperous future. It was an Ireland transformed from the country featured on the infamous cover feature on *The Economist* in the late 1980's that described Ireland as 'the sick man of Europe'.

By 2000, following a period of unprecedented economic success, it seemed that Ireland, had, at last, turned the corner and in the process solved those most in-tractable problems which had plagued the country since its foundation eighty years earlier: namely emigration and un-employment. Table #1 below provides a brief overview of key statistics for the country.

Population:	3.91m [Source: Census 2002]
Land Area	70,280 Sq.Km.
GDP [2002]	€124.6bn [2002][3];
Un-employment Rate	4.5% [Source: CSO , November 2002]
Economic Growth Forecast	GDP +3.8% (2002) and +3.8% (2003)[4]
National Debt to GDP Ratio	33.8% at end of 2002
Consumer Price Inflation	5% p.a. to January 2003
Government Budget [2002[5]]	Receipts: €33.078bn; Expenditure €33.214b n
Year of Accession to the EU	1973
Independence	6 December 1921 (from U.K. by Treaty)

Table #1: Ireland in 2002

2.1 Ireland's *Vicious Circle*

For nearly 40 years after independence in 1921, Ireland experienced what has been described as a 'post-colonial type growth without development', indicated in Figure #1 overleaf. The lack of opportunity at home - particularly in rural Ireland, caused many young people to emigrate, thereby removing much of the essential vitality required by the country to develop. For many that left the country up to the 1980's, theirs was a *one-way-journey.*

[2] Information Society Ireland : Strategy for Action [December 1996]
[3] Source: ESRI Quarterly Economic Commentary , Winter 2002
[4] OECD Autumn 2002 Economic Forecast
[5] General Government Receipts & Expenditure Source: Department of Finance December 2002

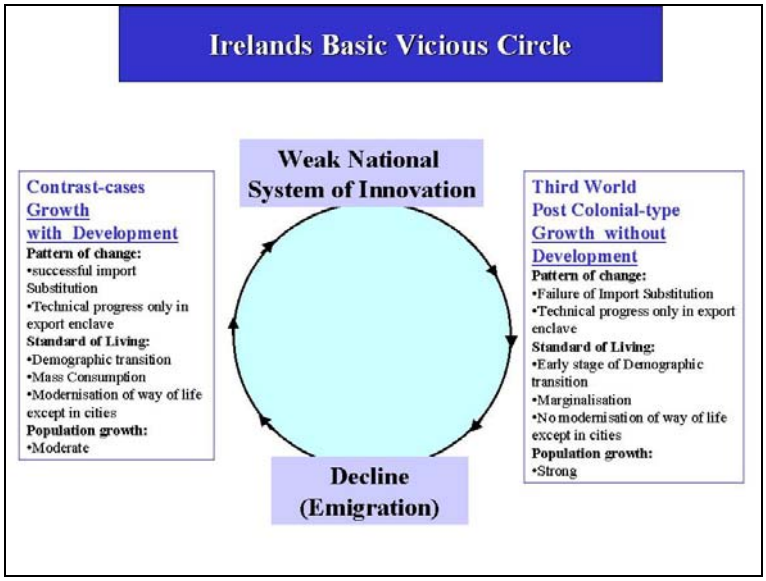

Figure # 1:[6]

Up to the 1950's, the country retained a strong dependence on the UK as a trading partner, operated protectionist economic policies, and continued to be heavily dependent on the Agriculture sector. However a new development model was pursued in the period after 1958 which involved the opening up and modernisation of the economy, the preparation of the country to join the EEC, and the beginning of the effort to attract foreign investment.

Joining the EEC in 1973 was a particularly important milestone in Ireland's recent history. On becoming a member, Ireland also became a convenient point of entry for many US multinational companies looking to expand their operations into Europe. Membership also afforded Ireland an opportunity to learn from the policies of the EU and of partner countries. Net inflows of European funding contributed to the development and modernisation of the country at a pace that the country could not afford to self-fund, and in the process helped to break the *Vicious Circle* outlined earlier. The slow *Europeanisation* of Ireland has followed, where the country has gradually moved toward European norms (e.g. birthrate, economic structure, and urbanisation).

2.2 Population, Demographics & Migration

For many years, one of Ireland's greatest exports has been its people. From the time of the foundation of the modern state in 1921, the population declined steadily from 4.22m (in 1926) reaching an historic low of 2.81m people in the 1961 census. Other than for short periods in the 1970s, and late nineties, emigration has been and enduring feature of the country both before and since independence. To illustrate the extent of the *Irish Diaspora*: in the 1841 census, the population of the island of Ireland (which at that time was part of the UK and included Northern Ireland) was 8.175m. During the period 1820- 1945, an estimated 4.5 million Irish emigrated to

[6] A strategy for competitiveness, Growth & Employment NESC November 1993 pp107

the US, comparable in magnitude to the population flows from Britain and Italy[7], creating an Irish-American community thought to number somewhere between 20 [8] and 40 million people today.

The constant haemorrhaging effect of emigration was not just a question loosing so many young economically active people who could contribute to Ireland's development; it impacted on the psyche of country. It posed a fundamental question: Would it ever be possible for Irish people to build a future for themselves and their families in Ireland, or was it the perennial destiny of the country to loose many of its young people through emigration.

The most recent census [2002] reveals a rather different trend, summarised in Figure #2 below: it shows that the population of the Republic of Ireland[9] has risen to 3.91m[10]. During the period between 1996 and 2002, while the natural population increase (birth over deaths) was 139,182 the actual increase in population in the same period was 291,249. The main cause of the difference is explained by a new phenomenon of *net immigration* of 153 thousand, or about 25,000 per annum during the period. In 2002, the net migration rate of +0.68% was the highest of the 44 members of the Council of Europe[11].

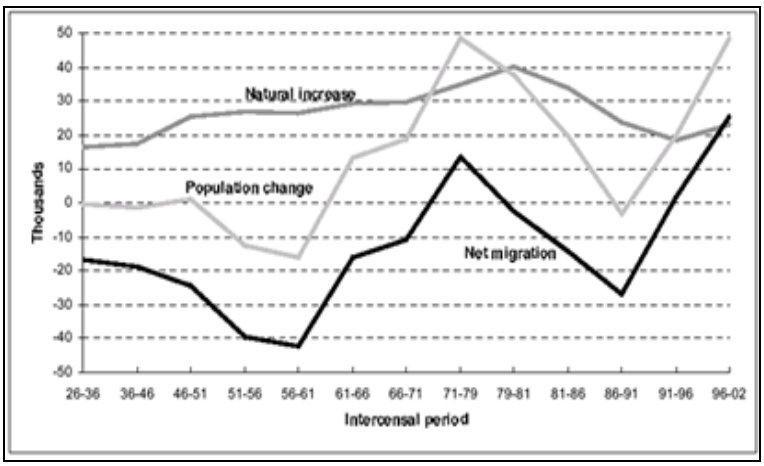

Figure 2[12]

2.3 Dublin & the Regions

Ireland is a country of contrasts: by some estimates as much as 40% of the population is concentrated in the greater Dublin area, comprising an area roughly 50 Km North to South and 15Km East -West. The country's three other main cities are small by international standards: only one city (Cork) has a population greater than 100 thousand people, while only two cities have populations greater than 50 thousand (Limerick and Galway). The balance of the population is

[7] The economy of Ireland ; policy and performance of a european region ed W. O Hagan pp20 ; numbers do not include emigration to other destinations : UK, Canada & Australia
[8] US Census bureau report for 1990 indicates 22.7m Americans claim Irish ancestry and that 62.3% of them were in managers, professional or technical , sales & admin occupations. The number is usually stated as 40 m .. Without a source
[9] Population of Northern Ireland is 1.6m; [Source : UK Census 1991]
[10] Source CSO : Census 2002
[11] Source : Council of Europe Demographic Yearbook 2002
[12] Source CSO

distributed around many small towns and villages, but also comprising many individual dwellings.

As well as emigration, there have also been considerable levels of internal migration *within* the country, mainly from rural areas to the larger cities, notably to the greater Dublin area, but also to Galway, Cork and Limerick (Ref Figure #3). The decline in income derived from farming (11.4% in the period 2001/2002)[13] has caused many young people from rural Ireland to come to the cities, often to college initially, and then into the workforce.

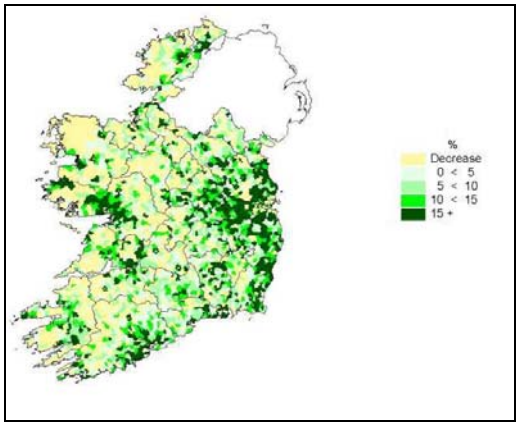

Figure #3[14]

The population movement into Dublin and surrounding counties recent years has contributed to considerable problems with traffic congestion, house price inflation, and in mobilising necessary infrastructure (childcare, Schools, Utilities) leading to an erosion in the capital city's *Quality of Life*. A further consequence of this migration has been to alter the population profile of many rural areas such that sustaining services like Post offices, Schools and Hospitals have difficulties achieving a scale required to remain viable. Hence one of Government's current key initiatives is to devise and implement a national spatial strategy[15] which has the benefit both of reducing the pressure of population inflows to Dublin, while also establishing a more sustainable, regionally-balanced form of economic development.

2.4 Employment & Un-Employment

Between 1980 to 1987 Ireland's unemployment rate increased steadily to over 18%, and continued upward to 21% in 1992 (279,300 people)[16]. As recently as 1995, at a time when Ireland's unemployment rate had reduced slightly to 15.4%, the ILO was still predicting an un-employment rate of 17.9% by 2000. Behind the overall figures some other trends emerge, such as *long term un-employment* (defined as those without work for more than 1 year). By the late 1980's, the proportion of un-employed men classified as long term unemployed was close to 50%.

[13] Source: Eurostat December 2002
[14] Source: CSO Data
[15] On November 28, 2002 Government published a report '*People, Places and Potential'* designated nine regional 'gateways', including Dublin , Cork, Galway, Limerick/ Shannon, Waterford, Sligo, Dundalk, Letterkenny, and Athlone/ Mullingar/ Tullamore
[16] A change in the calculation method lowered the headline number from 20% to 16.9% in 1993

Fortunately, un-employment began a dramatic decline until during the first half of 2001, reaching a low of 3.8 % - the lowest level since the foundation of the state. The full-year average for 2001 was 4% showing that unemployment began to edge upwards during the second half of that year.

1997	1998	1999	2000	2001	2002
9.8	7.4	5.5	4.1	3.8	4.6[17]

Table #2 seasonally adjusted annual Un-employment rates [Source CSO].

Ireland's employment level had remained almost flat between 1961 (1.05m employed) and 1986 (1.08m employed). There followed an unprecedented growth in employment of 25% during the period 1993-1998. By mid 2002, employment levels had risen still further to 1.827 m, an increase of 200 thousand people at work since 1998.

Year	Q1	Q2	Q3	Q4
1998	1621.6	1621.1	1688.6	1650.7
1999	1650.1	1688.1	1770.3	1736.1
2000	1732.1	1745.6	1815.6	1779.1
2001	1775.5	1781.9	1866.1	1825.5
2002	1825.4	1827.0		

Table #3 Labour Force All Persons (in 000)

Several other factors are worth noting in the context of changing nature of Ireland's workforce:

- The much greater level of female participation in the workforce: during the period 1988-1998, women's employment grew on average of 6% per annum, compared to 2% growth rate for men – although starting from a low base. (In the 1999 EU Labour force Survey , Ireland had ranked only 11th of the 15 EU in terms of female participation in the labour force)
- Rapidly expanding FDI: Over 1200 foreign-owned companies are now employing more than 300 thousand people[18];
- Changing Occupation: for example a continuing decline in employment in agriculture offset by increases in Professionals and of people involved in other sectors (ref Appendix #1)
- The largest growth in employment took place in services, particularly in market services, and services often mediated by ICTs;
- Manufacturing employment, which had declined during 1980s, expanded again in the 1990s.

2.5 Economic Crisis Late 1980s:

By 1986 the national debt had grown to IR £24bn (€30.48bn[19]), three times larger than in 1980 representing 125% of annual GNP. Interest repayments alone had risen from 7% of GNP in 1980

[17] Unemployment level per November 2002 Central Statistics Office Quarterly Household survey published on November 28 2002. The ESRI Quarterly Economic Commentary (QEC) of the summer 2002 has forecast an annualised rate at 4.6% in 2002, reducing slightly to 4.5% in 2003.
[18] Source: IDA Ireland
[19] Converted at Standard EMU conversion rate of €1.27 to Ir £1.

to 12% in 1986.[20] The backdrop of chronic unemployment and servicing large debt presented a particularly difficult starting point for the new Government returned by a slender margin in 1987.

The extent of the *sense-of-crisis* can be gauged from the fact that the incoming Government secured the tacit support of the main opposition party to pursue the austerity measures required to restore confidence in the country. It also led to the conclusion of the first of a series of *National Partnership Agreements* which have existed right through to the present time (December 2002).

2.6 The 'Celtic Tiger' period: Mid 1990's to 2001

From 1994, the momentum of a turnaround started to build into a rapid economic expansion that would become known as the '*Celtic Tiger' (ref* Table #4*).* At this time there was greatly increased consumption as a result of the low personal tax/Low Interest rate regime in the domestic economy, combined with significant export-led growth.

National Income (Current Market Prices)				
Gross Product	**1998**	**1999**	**2000**	**2001**
GDP – Value (€m)	77,569	89,770	102,910	114,479
GNP – Value (€m)	68,187	76,552	87,934	96,802
GDP - per capita	20,936	23,971	27,175	29,820
GNP - per capita	18,404	20,441	23,220	25,216

Table #4

While the rate of economic growth has slowed in the past 18 months, the forecast for the next two years continue to show an expansion of the economy above the EU average.

Economists consider that Ireland's remarkable economic progress from the late 1990's to 2001[21] was caused, not by one, but by a broad range of factors, including:

- Strong supply of educated young people;
- Success in attracting many leading US firms, particularly in the in the 'high tech' (Information and Communications technologies or *ICT*) & pharmaceutical sectors;
- Ireland's well established 'Social partnership' model , which among other things, contributed to predictable public policies;
- In-flow of funds from the EU;
- Improved performance by indigenous Irish companies, both in the manufacturing and service sector; one economist explained it in the following terms: ' the scale and durability of this [sic] improvement is without precedent in 20th century Ireland'[22]
- Social change that increased greater flexibility in the workforce and greater participation of women in the workforce;
- Significant organisational change in adopting more modern high performance work practices.

[20] Source European Employment & Industrial Relations glossary : Ireland [1994]: Publ European Foundation for the Improvement of living and working conditions, pp4

[21] It is commonly accepted by economic analysts that Ireland's boom period has passed and that more modest growth will pertain in the short term

[22] ESRI Quarterly Economic Commentary April 1998: The revival of Irish Indigenous Manufacturing 1987-1997 by Eoin O'Malley

It is important to note that Ireland's information society agenda first emerged in the 1996/1997 period during Ireland's 'boom years'. During this time, Ireland's Government, enjoying the luxury of an exchequer surplus for the first time in 50 years, had both the mind-share and the necessary resources to devote to more strategic issues. As Ireland's economic growth slows, the strength of commitment to the *Information Society* agenda will be measured by the manner in which the agenda is pursued during times when the public purse is more constrained.

One manifestation of the *'Celtic Tiger'* has been the impressive export performance (Ref. Table #5). After Singapore and Hong Kong, Ireland registered the highest per capita merchandise exports in the world in 2000[23], exporting merchandise goods worth € 21,824 for every man, woman and child in the country.

The export performance of the ICT industry based in Ireland has been equally impressive: during 2000, exports from the ICT sector accounted for €22.1bn or equivalent to half the ICT exports of Germany; Ireland's ICT trade surplus that year at €7.14bn was the largest of any EU country.

Balance of Trade Year	Imports	Exports	Trade Surplus €m
1993	18,900	25,179	6,279
1994	21,945	28,891	6,946
1995	26,181	35,330	9,149
1996	28,480	38,609	10,129
1997	32,864	44,868	12,004
1998	39,715	57,322	17,607
1999	44,327	66,956	22,629
2000	55,909	83,889	27,980

Table #5

2.7 Context Summary

On the eve of the Information Society agenda, a fertile ground existed in which to launch such an initiative in Ireland. The national partnership model had begun to pay dividends in terms of improved competitiveness and economic stability. With the amelioration of the pressing problems of emigration, un-employment and debt, Government could afford to adopt a more strategic approach to investment.

Both in terms of employment and value creation, the indigenous and foreign enterprise sectors had grown rapidly, particularly in those industries that would be relevant for the Information Society: namely ICT industries, Software and Finance. There was increasing recognition of the need for more regionally balanced form of economic development and that the new Information and Knowledge enterprises could become an important part of that development.

Finally, there was an increasing level of national self–confidence that the country had the potential to become, not just a peripheral player, but a central player in the emerging global Information and Knowledge economy.

[23] Source: Forfás' International Trade and Investment Report 2001

3. The Information Society in Ireland

3.1 Foundations of the information Society Agenda

The idea of the Information Society formally emerged in Ireland via the *Bangemann Report*[24] in 1994. The following year, Ireland's leading economic policy think tank, Forfás, was completing a seminal policy document, S*haping our Future*, which first promoted the idea of a national information society initiative.

3.2 Lighting the Fuse- The original Information Society Report:

In March 1996 an expert steering group comprising 21 people drawn from a wide variety of backgrounds was appointed by Minister Richard Bruton with the following *Terms of Reference*:

- Identify the issues associated with the emergence of the IS;
- Assess Ireland's preparedness;
- Identify appropriate strategic responses and actions required to derive maximum benefit from the Information Society.

The steering group made its report to Government in December 1996. Their report described the irresistible nature of the Information society, and the significant challenges that lay ahead for Ireland in effecting a transition into a successful Information Society. The report identified Ireland's strengths and weaknesses at that time regarding the Information Society (Ref Table #6 below)

Strengths	Weaknesses
❑ Success in attracting industry as the heart of the IS ❑ Cluster of Information Intensive industries in Ireland ❑ Success of call centres illustrates attractiveness of Information Services ❑ Indigenous Software sector ❑ Irelands share of ICT Trade ❑ Ireland creative flair ❑ Fibre telecoms backbone ❑ Culture places strong emphasis on education ❑ People are open to the potential of new technologies	❑ Low levels of awareness ❑ Lack of competitively priced bandwidth for the enterprise sector ❑ Broadband to the home ❑ Low integration of ICT into teaching practice ❑ Emerging skills shortage in ICTs and languages ❑ Low levels of Investment in training by Irish firms ❑ Absence of telecom regulator ❑ Legal framework

Table # 6

[24] Europe and the global information society – Recommendations to the European Council; May 1994

The report established a *Vision* for Ireland in the information Society toward which all other supporting frameworks, strategies and actions were directed.

Vision

Ireland is a unique community,
rich in culture learning and creativity,
Where the information society is embraced
To support the talents of our people,
To create employment, wealth and vibrant inclusive communities
And where citizens participate more actively in Government

The report further highlighted five key areas ('pillars') supporting the vision, and needing to be addressed as shown in Figure #4 below.

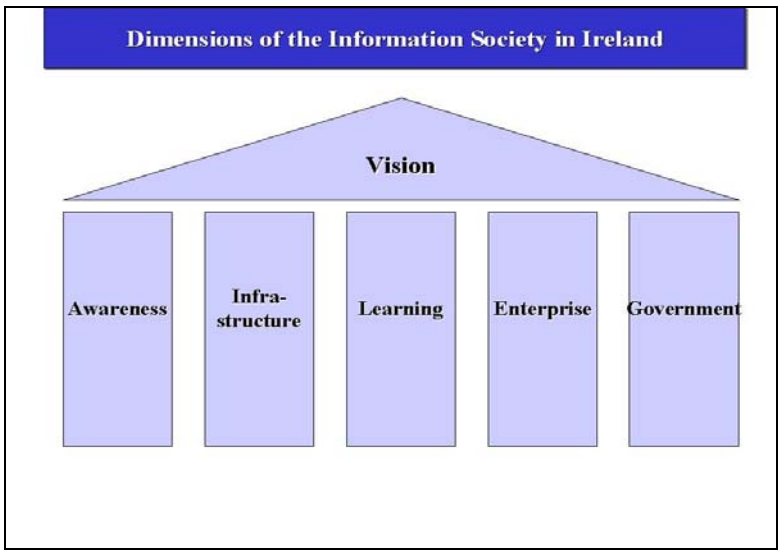

Figure #4

For each of the five 'pillars', a series of objectives were defined, and strategies supporting each objective, as set out in Table #7.

Pillar	Objectives
Awareness	❑ Secure a high level of public understanding of the full potential of the Information Society (***IS)*** in working and living ❑ Provide every citizen and enterprise with affordable access to information networks and services ❑ Facilitate the enterprise sector in becoming alert to and ready to exploit the opportunities presented by advanced technologies and services
Infrastructure	❑ Create a fully competitive telecoms market ❑ Provide widespread access to low-cost , high capacity bandwidth ❑ Provide access to broadband services for the majority of Irish Households
Learning	❑ Provide all citizens with access to technology-mediated education & training designed to equip them for LLL[25] in the ***IS*** ; ❑ Encourage third-level institutions to act as enablers of the Information society; ❑ Ensure an inclusive ***IS*** through the widespread adoption of Lifelong learning ❑ Create a culture of *Learning Organisations* among enterprises in Ireland
Enterprise	❑ Secure the full adoption and use of ICT's by the enterprise sector ❑ Secure a strong leadership position for the Irish content industry ❑ Support the development of Indigenous software enterprises ❑ Maximise the job potential of the ***IS***
Government	❑ Promote the widespread adoption of the ***IS*** by all sectors of Irish society ❑ Ensure the full application of advanced technologies to public services ❑ Foster the creation of an inclusive ***IS***

Table # 7

In addition to setting out this *five-pillar strategic framework*, the report made specific recommendations about those actions requiring immediate attention, particularly:

- ❑ Establishment of a new body, the *Information Society Commission* to monitor and oversee implementation of the report's findings;
- ❑ Implementation of a series of Awareness Campaigns (TV Show, Conferences, Events);
- ❑ Establishing an Independent Regulator for the Irish Telecoms industry (ODTR since renamed COMREG);
- ❑ Developing Exemplar projects: Virtual Cities, Net TV, Cyber Schools;
- ❑ Skills: Enable people to realise their potential: FAS[26] programmes, and Higher education authority to expand ICT graduands.
- ❑ Creation of a *Digital Park* : An Exemplar bandwidth–rich business location in which the potential of the Information Society could be demonstrated.

[25] LLL: Lifelong learning
[26] FÁS Is Ireland's Training & Development Agency http://www.fas.ie

Despite a change of Government in early 1997, the incoming government moved quickly to implement the policy framework and actions set out in the Information Society report.

One important reason for this continuity was that the *link between the Information Society and many other key policy issues had been firmly established*. The agenda set out in the Information Society Report appeared to under-pin many other important elements of the national policy agenda, for example:

- It afforded both the employment & wealth creation potential so needed by the country;
- It supported new 'service' employment which has expanded rapidly in recent years;
- It could help overcome Ireland's 'peripherality' with respect to the rest of Europe, and the additional peripherality experienced by Ireland's regions, and hence contribute to a more regionally balanced form of economic development;
- It could enhance the overall competitiveness of the economy;
- It was consistent with emerging thinking from within the EU, and also within the US administration (e.g. Global Information Infrastructure initiative led by Vice-President Gore)
- It facilitated the development of other high potential industries: e.g. Financial services and Multimedia;

A very wide range of activities flowed from this framework; these are presented in summary form, by year, in Appendix # 2.

3.3 Information Society Status 2002

At the time of announcing the new Commission in November 2001[27], which comprised completely new members, Government highlighted the following achievements since 1997:

- An increase from under 5 percent to over 40 percent in the level of internet access amongst the general population[28];
- A rise to 80 percent in the number of companies recognising that information and communication technologies (ICTs) are very important or essential to their business[29]
- The publication of the first Government Action Plan on the Information Society;
- The liberalisation of the telecommunications market;
- A fifteen-fold increase in Ireland's international connectivity via the Global Crossing project[30]
- The linking of all primary and secondary schools to the internet. By early 2001 post-primary schools had an average of 42.7 computers per school while primary schools had an average of 8.6 and special schools 10.7.
- The general availability of access to the internet through public libraries[31]
- The adoption by Government of the Public Services Broker model for integrated delivery of public services through multiple access channels.

[27] The term of the first *Information Society Commission* expired in December 2000.
[28] *How the General Public is adapting to the Information Society in Ireland,* Information Society Commission (October 2000)
[29] *How the Business Community is adapting to the Information Society in Ireland,* Information Society Commission (September 2000)
[30] Global Crossing Project: A contract (won by Global crossing) to deploy additional undersea cable to enhance connectivity off the island of Ireland.
[31] Now over 1400 internet access points, up from 108 in June 1999

In March 2002 Government published a new action plan for the development of the Information Society. The plan is divided into two parts: Key infrastructures and supporting frameworks, per Figure 5.

Key Infrastructure provide the necessary basis for progressing as an information society

- **Telecoms Infrastructure** developing the capacity necessary for delivery of advanced telecommunications services;
- **Legal & Regulatory Environment**: ensuring a secure and predictable legal framework for electronic transactions which provides the necessary confidence for both business and consumers;
- **eGovernment**: a key leadership role for Government in driving wider engagement with ICT's through its own business processes and service delivery arrangements.

Supporting frameworks: to address the frameworks where its necessary to

- **ebusiness:** To support and underpin the competitiveness of business, particularly indigenous enterprise, in meeting the challenges of a new competitive environment
- **R&D**: providing a basis for innovation through science and technology to support knowledge-based economic activity
- **Lifelong learning:** to ensure the availability of knowledge and skills , to support the process of adapting to ongoing change, and to build on the potential of ICT's to enable new ways of learning
- **eInclusion:** to ensure that Ireland's development as an information society is inclusive and builds on the potential of ICT's to address issues of dis-advantage and exclusion

[Source: New Connections Action Plan, March 2002; pp4-5]

Figure #5

3. 4 Assessing Ireland's Progress

3.4.1 Gains & Losses

There is no doubt that considerable progress has been made in advancing the national Information society agenda. However, there is also a sense that more remains to be done to effect the anticipated 'breakthrough' that would propel the country to a leadership position in the Information Society. Table #8 (overleaf) summarises positive and negative issues across a range of factors.

Factor	Positives	Negatives
Connectivity	Improved Off the Island	Access to broadband especially 'always-on' services. Cost of services in the regions
Entrepreneurship	Improving, especially in the ICT area	Very Low overall score (GEM)[32]
Inclusion	Greater levels of overall awareness	Information Society exists against a backdrop of social inequality
Technology use	Mobile telephony ; growth in internet use	Relatively Low levels of Internet access, and internet hosts per capita
High-Tech Industry	Very Strong FDI presence; High Value add contribution	Excessive reliance on FDI?; shifting pattern of FDI into Europe
Education & Training	Relatively modern, flexible & efficient system ; future output of technical graduates slowing	Many people never experienced the modern system; expected shortage of technical graduates.
Driving the IS Agenda	Regional / Local initiatives increasing	National momentum weakening; reduced funding situation
Research	Investment starting from a low base but increasing rapidly especially in ICTs.; Investments in SFI[33] and MLE[34]	Time taken to grow the R&D base , assumes no funding interruption; Expected future shortfall of Graduates in ICT area
Exemplar Projects	Some good : Tramlines[35], CAIT[36]	Slow to scale up nationally; Availability of funding to do so
E-commerce	Progress on Legal Framework	Ireland not yet a major e-hub
Government	Progressive, proactive approach. Action across most Government activities	Increasingly constrained by budgets. Challenging change agenda (e.g. re-engineering public service). Reduced momentum.

Table #8

3.4.2 International Benchmarks

The acid test of Ireland's progress can be found using International benchmark studies. One particularly useful benchmark is one used in the original 1996 Information society report (IDC / Information Society Imperative Index) which placed Ireland in 23rd position of countries evaluated and in the *Third Division*. By 2002, Ireland's relative position on that scale had improved only 2 places (a decline from 2001) into the *Second Division* (Ref. Figure #6).

[32] GEM Global Entrepreneurship Monitor
[33] SFI : Science Foundation Ireland http://www.sfi.ie/home/index.asp
[34] MLE: Media Lab Europe – the European arm of MIT's Media Lab http://www.mle.ie
[35] ATraining initiative that originated in Ballymun , Dublin aimed at providing a chance for dis-advantaged youngsters to learn about IT and to gain employment in the IT industry.
[36] Community based in initiative

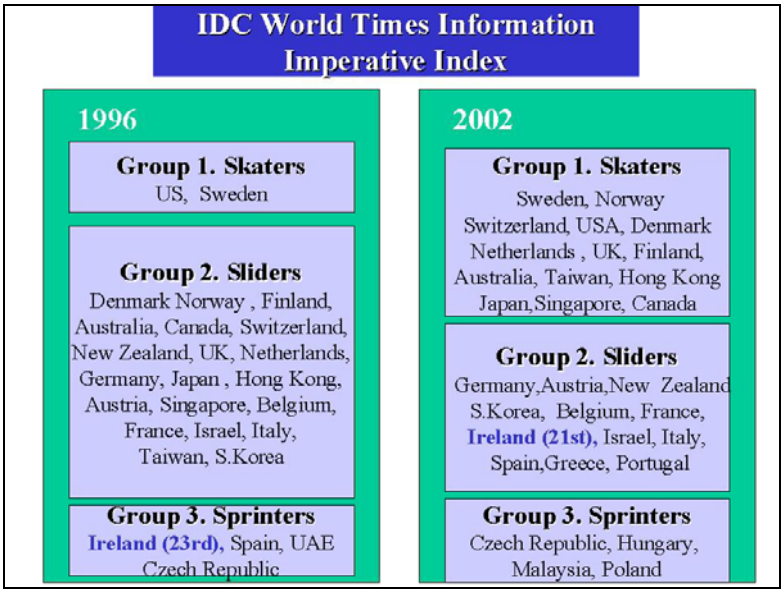

Figure #6

There are other measures which provide useful inter-country progress comparisons :

- The Economist's eReadiness Index ranked Ireland in 15th place from 60 countries surveyed in 2002[37], a reduction of one place on its position in 2001;
- The Harvard Networked readiness Index rated Ireland in 19th place in 2001[38] of 75 Countries surveyed.
- In the most recent report of Ireland's Information Society Commission[39], Ireland was ranked 9th of 14 EU countries (excluding Luxembourg).

The picture which emerges from these benchmark studies suggests that while there has clearly has been a great deal of activity to progress the Information Society Agenda in Ireland, these activities have not yet been sufficient to propel the country to a status as a leading Information Society.

Moreover, in two of the benchmarks studies, Ireland's relative standing has deteriorated between 2001 to 2002, suggesting that there is reduced momentum behind the overall national Information Society programme – a view which was underlined during the interviews conducted in the course of completing this assignment.

[37] Source: http://store.eiu.com/index.asp?layout=pr_story&press_id=430000643&ref=pr_list
[38] http://www.cid.harvard.edu/cr/profiles/Ireland.pdf
[39] Source Building the Knowledge Society , pp28 ; Published December 2002

4. Factors of success and failure that have influenced Information Society developments in Ireland

From the analysis of data, and the feedback of interviewees, a synthesis of the key factors and other important factors contributing to the success and failures of the Information Society in Ireland is set out in Table # 9 below.

Factor	Success	Failure
Key	❑ National Education System ❑ FDI ❑ Pro-active Government	❑ Inclusion ❑ Infrastructure development:
Other	❑ Demographics ❑ Proactive Implementing body: Information Society commission ❑ Favourable Macroeconomic Environment ❑ From 'Crisis' to Sense of Confidence and self belief ❑ Being *Multi-media ready* through presence of Core industries : Animation, Music	❑ Breakthrough Irish indigenous companies ❑ Spatial distribution of the population (connectivity)

Table #9

The *other factors* are shown merely to provide the reader with an insight into those factors which emerged from the research/ interviews but were not, in the final analysis, considered to be as vital. The remainder of this chapter is devoted to exploring the *key factors* in greater detail.

4.1 Factors Contributing to Success:

4.1.1 National Education System

The development of the national education systems, in the 1960's through to the 1980's is seen as a key catalyst for the development of the country[40]. The introduction of free secondary education in 1967 opened up second level and then third level education to people who, heretofore, would not have been in a position to attend. While completion rates of secondary education are now at a high level by international standards, the relatively late introduction of universal second level education has one noteworthy consequence: there remains a significant cohort of people with only primary education still in the workforce. Of the 279k males only achieving primary level of education, some 162k of these males are in the 45-64 age category.

In thousands	Male	Female	Total
Primary	279.4	250.2	529.6
Lower Secondary	311.7	277.8	589.5
Upr. Secondary	312.6	348.1	660.7
Further Education /Training	114.5	125.6	240.1
Third level (non degree)	68.7	88.6	157.3
Degree or above	140.7	127.7	268.4
Other / Not Stated	24	24.2	48.2
	1251.6	1242.2	2493.8

Table #10: Highest level of Educational Achievement Age Category 15-64 years

[40] since the 1960's, the share of national income devoted to Education has doubled.

Another important recent trend is the much greater level of female participation in the Education system, at all levels, causing changes the gender balance in many historically male-dominated professions such as Medicine and Engineering.

	15-24	25-34	35-44	45-54	55-64
Primary	44.1	22.1	40.3	71.5	73.3
Lower Secondary	100.5	45.6	55	49.8	26.9
Upr. Secondary	114.4	85.4	77.1	46.2	25
Further Education / Training	24.4	42.4	30.6	17.8	10.3
Third level (non degree)	16.3	29.9	20.9	14.1	7.4
Degree or Above	19.9	47.1	32.1	19.2	9.4
Other	1.9	4.5	3.6	2.9	1.4
Not Stated	1.5	2.4	1.8	2.4	1.8

Table #11 Source: Female Population 15-64 Estimated level of Educational Attainment (Q2 1999)[41].

According to FĀS, the proportion of the workforce with only a primary level education in 1991 was 22%, slightly more than the 21% who had a third level qualification. By 1997, however, the proportion of the workforce with a third-level qualification was almost twice as large as those who had only attained primary level of education at (29% vs 15%)[42].

The structure of Ireland's second level education, where students pursue a broad rather than narrow subject range, is also seen as a key differentiator:

> *Ireland's system of broad-based secondary education. [..] produce a large number of young people every year who have a knowledge of languages, history, geography, mathematics, art and music and sciences. This broad base, upon which the third level education system can build, is agreed to be one of Ireland's strengths.*[43]

The Primary and secondary school system moved quickly to address shortcomings highlighted in the 1996 Information Society report, through initiatives like the Information Age schools project (sponsored by Telecom Eireann[44] the incumbent national Telecom Operator) , and by establishing the *National Centre for Technology in Education.* By January 1999 every school had been provided with a computer and 96% have a physical Internet connection (of which 16% were ISDN).

Figure #7 overleaf indicates that since the mid 1970's, ever increasing numbers of children were completing second level education qualified to attend college: the transfer rate from secondary to tertiary increasing from 28% in 1985 to 50% in 1995.

[41] Published in Appendix #1 of the *Learning for Life : White Paper on Adult Education* , July 2000
[42] Source FĀS Strategy Document.
[43] ICSTI (1999). *Technology Foresight Ireland: Report from the ICT Panel.* Dublin: Forfas. p17.
[44] Now re-named Eircom

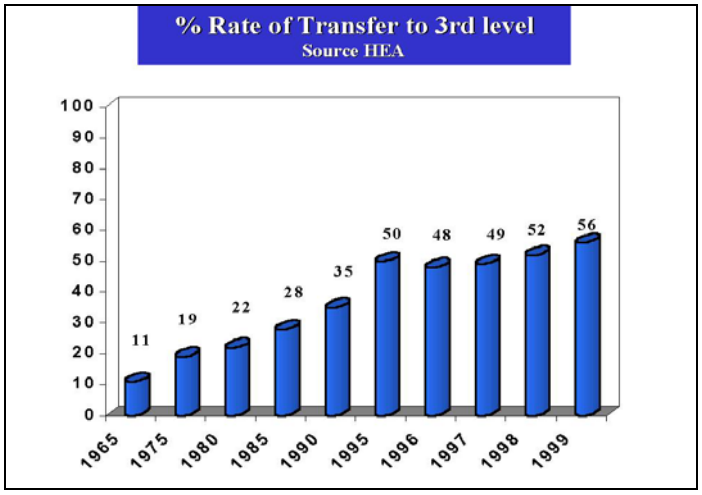

Figure # 7 [45]

Hence, it became essential to further develop the third level system, both through expansion of the Universities and by establishing a new Institutions called *Regional Technical Colleges* (RTCs[46]) around the country from the early 1970's, and continuing to the establishing of further Colleges / Institutes[47] in recent years.

One of the effects of this expansion was that much of the focus of Ireland's third level system was geared toward managing under-graduate numbers while maintaining quality standards. There was considerably less focus on developing academic research: in 1997 Ireland spent only 0.27% of GDP on Higher Education[48] R&D (HERD), the second lowest in the EU, and considerably further behind the 0.83% spent by Sweden.

The demographic structure of the country at that time and since has led to significantly increasing numbers attending secondary[49] level. Moreover, a greater transfer rate from second level education into third level created a ready supply of qualified people ready to take roles that would eventually emerge in Celtic tiger period of the 1990's.

Ireland's Third level Universities and Colleges have made significant contribution toward developing Ireland's Human capital. They have provided the Managerial, Technical and Professional talent capable of developing a leadership position for employers. They have been instrumental in expanding the output of technologists to the extent that Ireland now ranks third in the EU for numbers of Science and engineering graduates (20-29 age group), and considerably ahead of the output levels of Japan and the USA.

[45] The rate of transfer is estimated by taking total annual intake to all third level colleges as a percentage of the estimated population at age 17. Some persons entering third level may have previously entered. Mature students and entrants from outside the State are also included in these figures
[46] Ireland's *Regional Technical Colleges* (RTC's) have since been re-branded as *Institutes of Technology*
[47] Institutes of Technology established in Tallaght, Blanchardstown and Dub Laoghaire (1997)
[48] Source: Higher Education Authority http://ww.hea.ie
[49] Secondary school would normally be attended by those in the age category 12 – 18 years

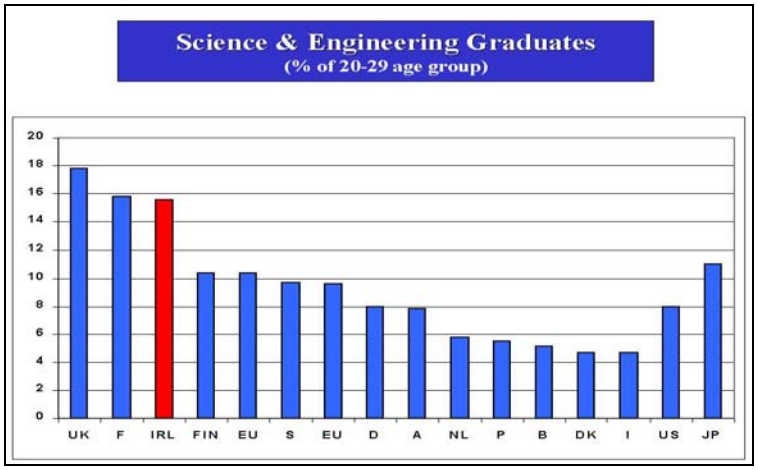

Figure #8

In addition to providing pure science, engineering and business under-graduate courses, many colleges have developed innovative under-graduate programmes that cross traditional 'faculty boundaries' but which fulfilled specific needs of industry for example:

- Combined Computing & Language degrees prepared graduates for the localisation companies,
- Combined Computing & Business degrees produced commercially oriented technologists;
- Computing & Design degrees: graduates for Media & Multimedia

At the post- graduate level, Ireland's colleges have also been creative in designing new courses:

- Rapidly expanding ICT graduate numbers by developing fast-track 'conversion' degree and diploma programmes aimed at helping graduates from non-technical backgrounds work in the ICT Industries.
- Introducing Europe's first MBA programme (started in University College Dublin in 1964).
- Launching an M.Sc. Programme in Technology Management (influenced by the equivalent MIT programme) have been introduced in University College Dublin and online via the *Atlantic University Alliance*[50] .
- In developing flexible, distance & online learning models: OSCAIL, RACEE and Atlantic University Alliance[51]

Ireland's Education system at both second and third level has proven itself somewhat capable and adaptable. There are still significant challenges ahead with declining student numbers arising from demographic changes, declining interest in Sciences and globalisation of the learning market. A further challenge arises from the need to re-engage with those mainly middle-aged and older people who did not experience a modern education.

[50] A consortium involving the three Universities on Ireland's western seaboard: University College Galway, University of Limerick, and University College Cork

[51] Details on : http://www.oscail.ie and http://www.aua.ie/content.asp?id=1 and http://www.racee.ie/index.html

4.1.2 FDI & the US Connection

The development agencies responsible for Ireland's inward Investment[52] has been particularly successful at attracting large numbers of multinational companies to Ireland, especially those involved in the Information and Communications technologies industries, but also in Biotech, and in the Financial services arena. The FDI statistics for Ireland are revealing:

- By 2001, Ireland's FDI Stock had risen to stood at $74.8bn, or about 3% of the FDI stock of the EU;
- The country has won 25% of all ICT-based FDI coming into Europe in the last 10 years[53].
- Inward flows of FDI increased more than threefold between 1998 and 2000, rising from €7.9bn to €26.1bn in 2000.
- Ireland was the tenth largest recipient of FDI inflows among developed countries in 2000,
- Ireland's top three exporters (Intel, Dell Computer and Microsoft) are all US multinational companies, and accounted for 22% of manufactured goods exports and 18% of the country's total exports in 1998.
- More than 300 thousand people (or 16% of the workforce) are employed by foreign companies;
- 48 % of all Ireland's FDI originates in the US, with UK in second place with 12%[54]
- The worlds largest industrial Biotech facility (The Wyeth BioPharma Campus) is currently under construction outside Dublin;
- In little over a 10 years, and starting from a very small base, Dublin has established an International Financial services (Funds) industry that has become the 6th largest[55] in Europe managing assets of €430bn and employing 11,000 people[56].
- The share of ICT Employment 4.5% vs. an EU average of 2.8%[57]

The scale of FDI investment Stocks and net flows is shown in Tables 12 and 13 below.

FDI Flows	1985-1995	1997	1998	1999	2000	2001
Inward ($m)	656[58]	2743	11035	14929	24117	9775
Outward ($m)	420	1008	3906	4267	3973	5396

Table #12 [59]

FDI Stock	1980	1985	1990	1995	2000	2001
Inward FDI ($m)	1657	2557	3410	9614	65056	74800
As % of GDP	7.9	12.5	7.2	14.4	68.2	

Table #13[60]

[52] IDA Ireland is the main agency responsible; a separate body : Enterprise Ireland, is charged with the development of the Indigenous enterprise sector
[53] Source Brendan Butler, Director ICT Ireland in interview with Sunday Business Post Oct 20, 2002
[54] Source: North Ireland Economic Research Centre.
[55] Fitzrovia its 8th annual Funds Encyclopaedia
[56] Source: Dublin Funds Industry association (DFIA)
[57] Source: Eurostat Statistics in Focus Theme 4- 34/2001
[58] Both Inward and outward numbers represent an annual average during the period

[59] Source: UNCTAD: World Investment Report 2002
[60] Source: UNCTAD: World Investment Report 2002

The year 2000 was a record year for inward FDI flows into Ireland with Inward flows rising to €26.1bn. As in previous years, the US was the largest single source of inward investment flows. The country was ranked 6th out of the 20 economies for the largest gains in FDI market share between 1985 and 2000.

While the experience for most FDI companies with a presence in Ireland has been mainly positive, it is important to recognise that there has always been some level of attrition of companies and employment. For example: the closure of Gateway 2000, downsizing at Digital Equipment, Xerox & Tellabs. For the most part net job creation has been mainly positive, although IDA Ireland reported a net decline of 2.2% in employment in FDI companies in 2002 - the second consecutive overall jobs decline in fifteen years[61].

Who are the Companies?

Many of the of the most important global companies from the ICT industry have come to Ireland over the years including Apple, IBM, Motorola, HP (and Compaq), Nortel Networks, Oracle, Sun Microsystems, Siemens, Xerox[62]. Three of the most important companies in this sector: Dell, Microsoft and Intel have a substantial presence in Ireland are profiled below.

Dell in Ireland[63]

Dell is ranked as Ireland's second largest company in the Business and Finance Top 1000 listing, March 2002. The Company employs a total of 4,700 people at its locations in Ireland which include Dell's European Manufacturing operation located in Limerick City as well as Sales and Support centres in the greater Dublin area. It has been estimated that Dell contributes over 5% of Irish exports, 2 % of GDP and over 4 % of all expenditure in the Irish economy. Dell's annual total salary bill in Ireland is €111.5m.

Microsoft[62] in Ireland

Microsoft first established a presence in Ireland in 1985 through its European Operations Centre, which includes the area manufacturing and distribution. Since that time the Irish operations have grown and developed to the point where Microsoft Ireland is the one of the largest employers in software in Ireland, employing over 1500 staff. Within three years of its arrival in Ireland, the company expanded its activities to include software localisation for European markets. Today, over one hundred different software products are localised into twenty-seven different European and South American languages at Microsoft's European Product Development Centre (EPDC) in Dublin. Exports in 1999 amounted to 5.5 % of the total Irish exports of goods and services.

Intel[64] in Ireland

The Intel Ireland campus, located outside Dublin City, is Intel's fourth largest manufacturing site overall, and the largest outside the US. Since starting operations in 1990, the company has grown to employ over 3,000 people with a further 1,000 employed with long-term subcontractors. In April 2002, Intel announced the resumption of construction on their latest semiconductor facility known as 'Fab 24' in Ireland. The new facility, costing $2bn, will utilize 90-nanometer technology enabling the development of microprocessors capable of operating at speeds greater than 3 GHz.

[61] 11,700 new jobs were created with 14,700 jobs lost in 2002 ; Source: IDA End of Year Statement 2002
[62] All company Trademarks and Copyrights acknowledged
[63] Information on the companies sourced from their respective company websites.
[64] All company trademarks and copyrights acknowledged.

Why do they locate in Ireland ?
While every foreign company will have its own reasons for coming to Ireland, the most common reasons cited include:

- Easy point of entry to European markets;
- Low tax rates ;
- Low cost base - although this argument is becoming less sustainable;
- Skilled People: young, knowledgeable, adaptable with a 'Can do' attitude;
- Highly supportive state infrastructure: Government, Development agencies;
- Platform of High education;
- Grant Assistance: e.g. Training, Equipment

In the FDI context, Ireland has been able to establish for itself an important intermediary role between the US and Europe because of its strong historical, political, social and cultural connections in both directions. While the presence of FDI companies is important in its own right, it is Ireland's ability to leverage the presence of the FDI Companies that makes a vital difference. Many of the FDI companies located in Ireland are managed by Irish people, not people transplanted from international headquarters. These managers have been ready to contribute their insight and know-how in support of Information Society agenda, to network locally with other companies and colleges on the basis that it would create an environment favourable to their business, and to their community. Thus it has been possible for executives from these FDI companies to have a more influential voice in aspects of national technology and economic policy than is possible in other countries.

A New Focus on higher Value-Add

Historically, much of the focus of development agencies like IDA Ireland has been directed toward *maximising employment creation of FDI companies.* That focus is changing toward *developing new higher value-added work*, including R&D. Underpinning this transition is the need to rapidly expand the country's research capability. Ireland's expenditure on technological Research and Development (R&D) in the business sector (BERD) amounted to € 784m in 1999, was equivalent to 1% of GNP according to the most recent report published by Forfás. While there has been an increase in recent years, Ireland's investment is lower than both the EU and OECD averages of 1.2% and 1.5% respectively.

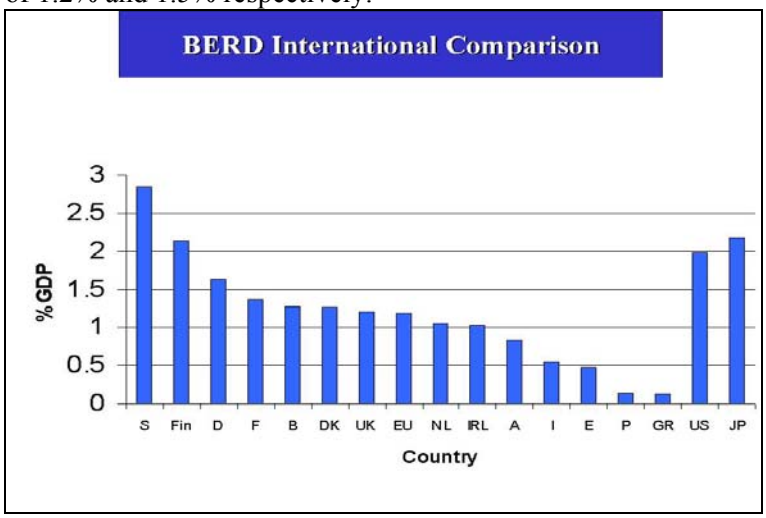

Figure #9

The following table summaries Ireland's relative R&D performance as reported in Ireland's Annual competitiveness report 2001.

FACTOR	POSITION / TOTAL
Government Spending on R&D as % of GDP	22/24
Increase in R&D Spend as proportion of GDP increase	21/25
# Researchers per unit population	9/21
Business Spending on R&D as % of GDP	13/27

Table# 14 [65]

A similar picture is evident regarding Patents. Ireland's Patent Application performance, while growing 12.8% in the period 1990-1998, still places Ireland 11th of 15 EU Countries with a performance of 124 per million people employed. The country's patent performance is less than half the EU Average of 261, and approaching one quarter the level of Germany and Sweden (493 and 478 respectively)

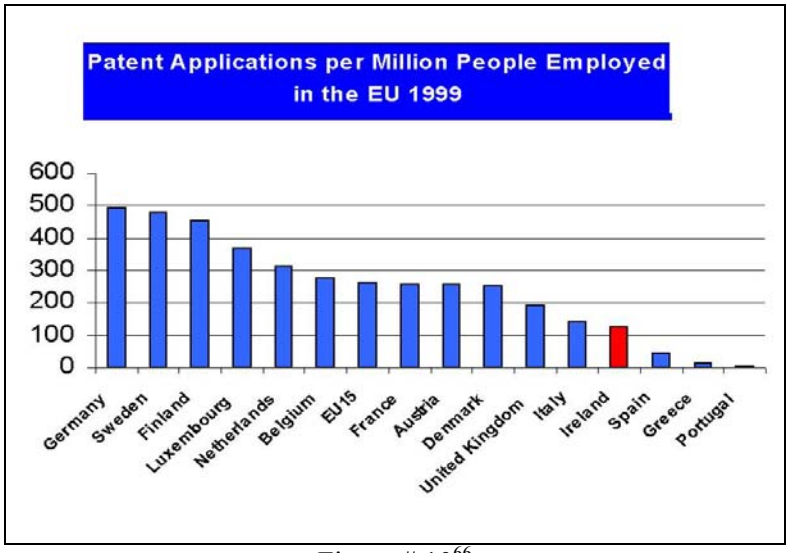

Figure # 10[66]

Government has moved decisively to improve the Irelands R&D standing by making a number of strategic investments including:

- The Technology Foresight fund, managed by the Science Foundation of Ireland,
- Digital Hub is considered Irelands leading enterprise development project for the digital media district with funding of €83.5m in the period 2001-2003.
- Media Lab Europe (MLE), the european arm of MIT's Media Lab, functions as high-tech research centre, receiving funding of €35.55m in the period 2000-2003.

[65] Source: Annual Competitiveness Report 2001 , National Competitiveness Council 2001 compiled form OECD data from report of ICT Ireland *'R&D: Securing the future of ICT Ireland*

[66] Source: Eurostat, Statistics in focus, Science and Technology, No 4/2001, "Patent activities in the EU: international, national and regional perspectives".

Building up the country's research capability to support the transition to higher value-add work will take time. It remains to be seen if the country can create new higher value-add FDI activities (e.g. R&D) at a rate faster than the country's rising cost base erodes the viability of low value-add activities.

4.1.3 Proactive Government

Government has been a key player in progressing the Information society agenda by

- Establishing and maintaining the partnership process right to the present day;
- Making the connection between Information Society and wider Government policy agenda;
- Using the insights from both the EU and the US

While various forms of national wage agreements had existed prior to 1987, the difficulties faced by an incoming Government that year necessitated a unique response. The Government initiated a new more broadly–based discussion framework with the Trade Union movement [67], the national employer's organisation IBEC[68] and national farmer bodies, which have since become known as the *National Agreement*[69]*s*. There have been five successive agreements:

I. Programme for National Recovery (1/1/1987 to 31/12/1990)
II. Programme for Economic and Social progress (1/1/1991 to 21/12/1993)
III. Programme for Competitiveness & Work (1/1/1994 to 31/12/1996)
IV. Partnership 2000 (1/1/1997 to 31/3/2000)
V. Programme for prosperity & fairness (Period 1/4/2000 to 21/12/2002)

The bedrock upon which the first and subsequent agreements were concluded was that

- Only through collective, holistic and co-ordinated action could the problems faced by the country be addressed;
- A much greater level engagement between 'opposing groups' and the enhancement of mutual understanding was needed than existed heretofore.
- *Proactive, Problem-solving approach* : Agreements were not inert documents re-visited every 5 years but continually progressed throughout the term of the agreement ;
- The idea that *Everything & everyone is included* characterised the discussions leading to the national agreements, and hence each partner was free to bring forward any topic they wanted addressed within the context of each agreement.

The agreements have focussed principally on incomes, fiscal, social, economic and competitiveness policies negotiated between Government and the 'Social partners'. Without the partnership framework, which was established almost 10 years before the Information Society agenda first emerged at the end of 1996, it is doubtful that the *Information Society* agenda could have progressed to the extent it did.

The most recent manifestation of Partnership programmes in Ireland is the *'Programme for Prosperity and Fairness*[70] *2000-2002'* or PPF addressed five operational frameworks and featured

[67] ICTU: Irish Congress of Trade Unions: the umbrella organisation for most trade unions in Ireland http://www.ictu.ie
[68] IBEC: Irish Business and Employers Confederation http://www.ibec.ie
[69] In formulating the current Naional Agreements, a fourth group The community and voluntary sector became a partner for the first time
[70] http://www.nesc.ie/41213_benchmarking_ppf.pdf

for the first time, the Information Society agenda : The PPF identifies the importance of the Information Society setting as its policy goals (Framework IV, 4.4)

- "*To build the human capacity to manage and shape the emerging Information Society and to participate in eBusiness, eOrganisations and eGovernment.*
- *To foster affordable and inclusive Information Society infrastructure and services*
- *To enable the participation by those currently* excluded."

The prominence given to the *Information Society* agenda in the current national agreement testifies to the importance attached by all the social partners. It marks a polarity shift in thinking about the Information Society and the ICTs enabling the Information Society, where the *Information Society* agenda was no longer perceived as just the preserve of a 'vertical industry' but had become an important 'horizontal' agenda which had profound implications in multiple other areas of public policy including national Competitiveness, regional development, Employment and Social Inclusion.

Government has shown a willingness to take a holistic approach to the Information Society, and to move on many fronts simultaneously: e.g. New legal framework, deregulating the telecoms market. It has been able implement a complementary, interlocking and mutually reinforcing policy agenda (Information Society Commission, Science Foundation Ireland, National Competitiveness Council, Expert Group on Future skills needs). During the announcement of the establishment of a Media Lab (Media Lab Europe) in Dublin in December 1999 Mr. Nicolas Negroponte of MIT 's media lab reflected the quality of government thinking:

"I am extremely impressed with the Irish government's clear understanding of the need to develop a flexible, far-sighted program to attract tomorrow's digital entrepreneurs. The MIT Media Lab's decision to work with Ireland to establish MediaLabEurope reflects our view that Ireland provides the kind of intellectual, economic and governmental environment ideally suited for this ambitious international effort…..

4.2 Failures:

4.2.1 Inclusion

Ireland remains an increasingly unequal society: a recent UNDP[71] shows contradictions in wealth & poverty. In the study, Ireland had 4th highest per capita GDP in the world, but has 15.3% of its people living in poverty - the second worst score of 17 countries surveyed (only the US, at 15.8% had a worse score). To underline the in-equality, the report further noted that the richest 10% of the population in Ireland is 11 times wealthier than the poorest 10%. Given that the most economically advantaged members of society are also those most likely to derive the benefits of the Information Society, there is a danger that Ireland's economically 'excluded' people are likely to become even more excluded in the Information society. The lack of progress has been noted by the

[71] Human Development Report 2002 Deepening Democracy in a Fragmented World

National Economic and Social Council (NESC) in its study *National progress indicators for sustainable economic, social and environmental development,* published in March 2002 in the context of the most recent national partnership agreement, which noted *'....Little or no change has been experienced in relation to a number of the social indicators*[72]'. Within the overall community, those people understood to be at greatest risk of exclusion would include the 'late adopters' category shown in Table 15 below.

Characteristics of Early adopters	Characteristics of Late adopters
Young	Older
Urban	Rural / Deprived urban
Employed	Outside workforce (e.g. Housewives)
Professional	Non-professional (e.g. farming, manual workers)
High-Income	Low Income
High educational attainment	Low educational attainment

Table #15[73]

Ireland's Education system had been focussed to a large extent on people in the age group from junior school (age 5 years old) to University graduate (normally aged 21/22 years). It is only since the late 1990's that consideration has been given to issues like the needs of older people, atypical learning, *second-chance* learning to the many people still active in the labour force who did not have the opportunity to benefit from a modern secondary education.

Because of the presence of powerful other actors – notable Industry, it has been argued that their interests have been given greater priority to the extent that the needs of individuals and communities, particularly dis-advantaged individuals and communities, have not been sufficiently addressed.

4.2.2 Widespread Availability of Low cost / High Speed network

As a result of de-regulation of Ireland's telecom industry, there was an expectation that major improvements in the availability of high-speed low-cost infrastructure throughout the country would follow.

The continued presence of large multinationals, especially in the larger urban areas, suggests that their bandwidth needs are being satisfied, for example via leased lines. However, there is evidence to suggest that the needs of smaller users (e.g. Home users, small business) especially those in the regions are not

Moreover, Ireland's overall standing relative to other countries regarding the level of development of its telecom infrastructure has dis-improved, for example:

[72] Source: NESC Press Release of March 8 , 2002
[73] Source: Third Report of Ireland's Information Society Commission , December 2000, pp16

- According to a report by the National Competitiveness Council in November 2002, The country ranks 15th out of 16 countries surveyed for access to broadband lines, and is the seventh most expensive of 16 countries for telecommunications costs;
- Ireland is the last EU country to move on 3G licenses; the license competition results were announced spring 2002, following a delay of almost 12 months; hence 3G networks are in-complete in Ireland when they are becoming operational elsewhere in Europe;
- Ireland is among the slowest countries in the EU to progress un-bundling the local loop[74].
- 'Always-on' access is not available: internet is still, for the most part, metered on a per minute basis, hence internet usage is only half the level which exists in Sweden;
- Enterprises in the regions outside Dublin experience particular difficulties securing access to high speed networks.

The cost of access to & use of the Internet for citizens in Ireland remains one of the highest in the EU[75] , published in the recent EU Telecoms Regulatory Package Implementation Report .Hence one of the main reasons that Ireland's Internet usage pattern is considerably lower than that in the UK and US (Ref Table #16).

	USA	Ireland	UK
Number of Sessions per Month	21	8	14
Number of Sites Visited	46	25	42
Time Spent per Month	11:06:06	3:38:43	6:56:56
Time Spent per Surfing Session	31:39	25:46	28:58
Duration of a Page viewed	00:54	00:43	00:47
Active Internet Universe	104m	588k	16.3m
Current Internet Universe (Est)	166.4m	1.32m	29m

Table #16 Source: Nielsen/ NetRatings

At present, small users, including many small businesses, still have limited access to broadband services, while the costs that bigger users face varies considerably depending on location. Mr Brian Patterson, Chairman of Ireland's National Competitiveness Council summarised the problem in 2001 as follows:

'We have set ourselves the objective of being a hub for e-business',
'But how can that be possible when we do not have competitive broadband access at this late stage.'

While updating an earlier report "Broadband Investment in Ireland" Forfas noted that while significant progress has been made over the previous three years in opening the Irish telecommunications market for investment, the desired outcome of establishing a world class

[74] Source: ECTA ULL scoreboard 2001
[75] Source EU Telecoms Regulatory Package - VIII Implementation Report, Annex I December 2002 : Chart 72: 20 hours Off peak residential charge was 35 Euro per monthy

broadband services and coverage at prices among the most competitive in the OECD had not been achieved. The difficulties faced by people and businesses in the regions in accessing affordable broadband services was further highlighted in a study of infrastructure for the Southeast region of Ireland[76] which reported

> *.....existing provision of advanced broadband services was extremely limited because of infrastructural deficiencies (e.g. limited availability of 'dark fibre', both in the backbone network and at the level of the 'local loop' or 'access network',. Lack of access, or inequality of access, to high-speed, broadband telecommunications facilities across the region…*

A similar picture emerges in Ireland's western region. The report "An Update on Telecommunications in the Western Region"[77] makes recommendations to tackle the growing 'digital divide' which is threatening to leave the west of Ireland seriously disadvantaged in terms of telecommunications infrastructure and services. It cites problems like poor service, low levels of competition among telecommunications companies, high prices and significant delays in providing basic services. In terms of Internet hosts *.ie hosts* per capita is one of the lowest in the EU, and compares poorly with countries of similar population like New Zealand and Singapore which have between 3 and four times the number of hosts per capita.

	Internet Hosts (000)	Pop. (m)	Internet Hosts per 1000
Fin	986.29	5.17	190.73
Dk	872.33	5.33	163.66
Se	1187.94	8.86	134.08
NL	2150.38	16.15	133.18
At	720.59	8.03	89.71
Be	832.85	10.31	80.79
UK	2508	58.79	42.66
De	2923.33	82.44	35.46
Fr	2052.77	59.34	34.59
Pt	266.91	10.36	25.78
Ie	96.97	3.91	24.80

Table 17[78]

In effect, a picture emerges in which it appears that the bandwidth needs of large companies, especially those located in the cities are being satisfactorily addressed, while the needs of smaller users (Residential and small business) are not. Similarly, while Internet usage has increased quickly albeit from a relatively low base, the country has yet to establish an Internet 'presence' comparable to EU or international best-in-class.

[76] Source: SEISS
[77] Source: Western Development Commission
[78] Compiled by CIRCA using current population data from populationdata.net and Internet host data from the Internet Software Consortium from September 2002

5. Conclusions on the Ireland Case Study

5.1 The reasons for Ireland's Progress

Ireland's recent progress as an information society can be traced not to one, but to a confluence of factors, some planned, some fortuitous, including:

- The influence of FDI, particularly companies active in the ICT industries from the United States, and the ability to leverage the presence of these companies through developing additional high value activities and clustering with indigenous companies;
- The effect of successive national partnership agreements, extending over a period of 15 years, which gave significant focus to the Information Society agenda across Business, Community, Government, Farming and Trade Unions constituencies;
- The Country's demographic structure, especially when compared with other EU countries, constituted a relatively youthful population open to the new ideas and opportunities afforded by the Information Society;
- Previous and ongoing investments in the state's Education system provided a relatively large cohort of young people with a recent quality education relevant for the Information Society;
- Government momentum: In particular embedding the Information Society agenda as an important vehicle supporting the implementation of many Government policies for example Public service efficiency , National Competitiveness, Employment, Regional development ;
- Existence of a nucleus of indigenous and multinational Information Industries: IT, Animation, Audio-visual, Financial, Software, localisation made Ireland a 'multimedia ready';
- Active presence of a hard-driving steering body, the Information Society Commission
- Increasing national sense of self-confidence and self belief, and, crucially,
- To a period of almost unprecedented economic progress which provided Government with both the mindshare and finances to pursue the Information Society Agenda.

There is no doubt that considerable progress has been made that might otherwise have happened without an information society initiative. However, that progress does not, as yet, constitute a 'breakthrough'. Ireland has yet to fulfill its promise of becoming a truly world class Information Society.

5.2 Current Challenges for the Information Society in Ireland

The context in which the current Information society agenda is being addressed has deteriorated considerably at the end of 2002, for example:

- **FDI:** Flows into Ireland have reduced, and several established Multinational companies already located in the country are undergoing consolidation (Xerox, Nortel Networks) or even closure (e.g. Gateway 2000, Tellabs). Further planned investments are 'on hold'. A recent Ernst & Young report[79] showed that Ireland won only 26 new projects in the first half of 2002, compared to 36 projects the same period in 2001; the report also indicates that the countries of central and eastern Europe are winning much of the new FDI investments in Europe. Ireland also remains dependent – in the view of some - excessively dependent - on US foreign investment, and thus on the overall US economic climate.

- **Ireland's rising cost base**; Ireland has gained the dubious distinction as one of the most expensive economies in the EU; this, combined with the accession to the EU of new countries with lower cost base in 2004, suggests a much more competitive environment for new FDI investment into the future. With Inflation levels at 5%, it is possible that wage demands in excess of that figure become the norm during 2003, adding further upward pressure on costs.

- **National Partnership Agreement:** The current partnership programme expired in December 2002, with no new follow-on agreement in place. It is un-certain whether a new agreement can be concluded, or if so, what shape it might take, and whether the Information society agenda will feature as prominently as it has in the past;

- **Infrastructure:** Financially troubled Telecom operators are un-likely to incur front-loaded costs associated with adding new networks capacity. For many businesses and people, the much-heralded benefits of open liberalised markets have yet to materialise;

- **Forward Momentum from the Information Society Commission**: Government waited almost 11 months to appoint a new Commission to replace that whose term expired in December 2000, creating a perception that the initiative has *'lost'* some of its earlier momentum';

- **Public Finances:** The share of public expenditure in national output has fallen from 58% of GDP in 1986 to 46% in 1996. By 2001, Ireland's public expenditure had reduced to 31.8% one of the lowest in the EU - 10% below the EU average. By starting from a smaller funding base than in other countries[80], Government is more likely to encounter tradeoff decisions between other competing funding priorities, including Information Society.

- **Economic slowdown & cutbacks**: The economic tide has slowed considerably in the past 12 months, leading to Ireland's Finance Minster to declare recently that the '*Celtic tiger is over'*[81], with real GDP growth reduced to 4.2% in 2002, reducing further to 3.8% in 2003[82]. In the context of the emerging exchequer shortfalls, it remains unclear the extent to which longer term initiatives like the Information Society are sacrificed on the altar of short-termism. The recently published Book of Estimates[83], published as a precursor to the

[79] Ernst & Young European Investment Monitor , November 2002
[80] In 1999, Tax receipts represented only 31.2% of Irish GDP; [Source OECD in Figures 2002 pp35]
[81] Minister Charles McCreevy TD Speaking at a function 14/10/2002
[82] Source: ESRI Quarterly Economic Commentary , Winter 2002
[83] Published by Irelands Minister for Finance November 14, 2002

Government budget, set out a wide range of cutbacks within the Information Society programmes , including:

- Regional Broadband were reduced from €44m to €32.5m
- Department of Communications has reduced its allocation to Information Society & telecoms by 57%
- eCabinet initiative is being reduced from €2.5m to €1.6m
- eCommerce spending is being reduced from €6.7m to €3.4m
- 86% reduction off an allocation to community-based IT projects
- Dept of Social Community & Family affairs reduced its allocation to Comhairle for a project on e-Government.

Emerging shortage of skilled people in the ICT industry

The current cohort of children in secondary school are increasingly deciding to study non-science subjects, and those who do choose science based subjects in school, are not pursuing ICT qualifications at third level. The adverse effect of the 'dotcom' bubble, combined with high profile industry layoffs & downsizing has created a negative impression of the ICT industry, making young people less disposed to pursue qualifications & careers in the sector. A recent report *IT Practitioner skills in Europe*[84] found that Ireland could face an un-satisfied shortfall of up to fourteen thousand IT professionals. For the intake in September 2002 to Irelands colleges and universities, applications to ICT courses in Science and Engineering were down 25% on previous years[85].

Research Spending:

A major weakness is via publicly funded research where Ireland is ranked last in EU in terms of Public expenditure on R&D (0.29% of GDP vs. EU Average of 0.66%). Similarly, Ireland's patent performance is well below the EU average, while the country is not rated as a Top ICT Research area, suggesting that the country's ICT industry remains excessively reliant on research carried out elsewhere. While this deficit is beginning to be addressed via major new investments, the benefits of these investments will take several years to flow through.

Ireland's competitiveness The country's competitiveness has bee eroding over recent years. In April 2002, the IMD World Competitiveness Scoreboard 2002 ranked Ireland 10th place from a high of 5th place in 2000. More recently The *National Competitiveness Council's* Annual Competitiveness Report[86] reviewed Ireland's current relative position under a number of benchmarks: revealed a number of worrying trends.

Becoming a net contributor to EU:

Since accession in 1973, Ireland has been a net recipient of significant levels of EU funding; in the period between the 1980's and mid 1990's, Ireland's net receipts from the EU stood at 6% of GDP. As national per capita income levels have now surpassed the EU average, net inflows under the Community Support Framework will no longer apply to the country as a whole.

[84] Source:Dr Matthew Dixon, CEPIS : Council of European Professional Informatics Societies May 2002
[85] CAO: Central Applications Office – the Bureau that co-ordinates all applications to Ireland's Third level Universities and Colleges
[86] Published November 2002

6. Applicable Lessons from the Ireland's Experience with the Information Society

A Multi-faceted Agenda:
Because the Information society changes so many aspects of the economic and social life of a country, delays or failures implementing the *Information Society agenda* could significantly impact national competitiveness, employment and social cohesion. In the case of eCommerce for example: a country's poorly developed legal infrastructure could neutralise the benefits of a well-developed telecom infrastructure.

FDI:
Multinational corporations can contribute greatly to the development of Indigenous Industry and the developing IS agenda. However in order to do so, it is necessary to implement supporting policies & processes aimed at engaging the management of FDI companies so as to leverage and diffuse the Technical, Organisational and commercial insights they can contribute.

Exemplar & Pilot programmes:
These can be particularly useful in addressing the issue of people-centred IS, and in relation to the issue of inclusion. Initiatives that are led by empowered local communities can deliver efficient, cost effective, locally relevant projects which can be scaled up nationally to extend reach and impact.

Benchmark Progress:
It is important to track progress both qualitatively and quantitatively – for example using international measures, and to be constantly alert to discovering and embracing international best practice.

Education:
The National Education System needs to be constantly updated to reflect changing needs, otherwise it is at risk of becoming irrelevant to the needs of citizens & employers. Because there are multiple learning contexts – (Formal education system, learning in and for the workplace, and learning in the community) the national Education system should address a broad agenda in the Information Society including: equipment provision and service, teacher training, curriculum relevant courseware; remedial , second chance and Lifelong learning.

National Demographics
Demographics are an important consideration in the approach to the issue of Inclusion. Young people teenagers/ young adults are, almost invariably, 'early adopters' of emerging information technologies behind the information society. Specific effort should be made to identify potential 'late adopter' groups within the community, and then implementing targeted programmes designed to engage these groups.

Role of Government:
While many actors ultimately determine a nation's successful transition into an Information Society, Government, and the extent to which it adopts modern progressive practices in relation

to the ICTs can have a decisive influence in building momentum or, indeed, be a powerful brake on progress. Governments should adopt a holistic approach to the Information Society by ensuring that initiatives taken are consistent, interlocking and mutually reinforcing. Only Government can ensure that a proper balance is maintained between the *needs of enterprise*, and the *needs of individuals and the wider community* in the Information Society.

Telecom Infrastructure:
The availability of a modern, cost-competitive telecoms infrastructure is an essential ingredient for the Information Society. Securing such an infrastructure in a deregulated market is challenging, particularly in the light of the recent telecom industry downturn. Ensuring that the necessary Telecoms infrastructure available when needed require a creative approach to ensure investments are made perhaps before a sound business case has been established.

Economic Climate:
The economic climate which pertains during the implementation of the Information Society programme can have an over-riding effect on the progress of the Information Society Agenda. However, in times of economic downturn, it could be argued that progressing the Information Society agenda is even more imperative. Indeed, Information Society benchmarks may be seen as an important proxy measure for modernity and competitiveness of the wider economy;

Focal Point:
A strong proactive *Focal Point*, preferably with own resources, is essential to lead, report, plan, research, to communicate and to orchestrate all those activities necessary to advance the IS agenda nationally. A Key part of this role lies in educating the political, economic and social leadership about the changes likely to occur in the new world of the Information Society.

Regular On-going Communication:
There is real value in keeping the Information Society agenda to the fore in the public consciousness in order encourage greater community awareness of and active involvement. This can be achieved through a variety of Conferences, Local Events, Reports, best Practice Awards and *Branding.*

In-equality & Exclusion
The Information Society will almost invariably tend exacerbate existing social inequality, since better-off members of society are better placed to benefit. However with appropriate targeted interventions, it is possible to mitigate these effects.

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Appendix #1

Employment by Occupation
Trends and Forecasts[87]

Employment by Occupation, 1993-2005					
Occupational Group	1993	1997	2005	Change 1997-2005	
		(000)		(000)	%
Agricultural	136	131	109	-22	-16.8
Managers	75	92	138	46	50.3
Proprietors in Services	43	40	47	6	15.9
Professionals	152	163	215	53	32.5
Associate Professionals	63	83	113	30	35.7
Clerical	156	178	216	37	21.0
Skilled Workers (Maintenance)	51	63	85	22	35.2
Other Skilled Workers	90	114	152	37	32.7
Production Operatives	91	115	145	30	26.0
Transport & Communications	47	59	79	19	32.2
Sales Workers	95	104	157	53	50.6
Security Workers	32	35	46	11	31.8
Personal Service Workers	83	113	161	48	42.4
Labourers	38	47	54	7	14.3
Total	1151	1338	1716	378	28.2

[87] Source: Central Statistics Office

Appendix 2.1
Information Society Timeline
Period 1979-2000

Summary Timeline

Year	Activity / Event
1979	Government decision to build a national Digital telecoms network
1994	Third 'National Partnership' agreement is established: *Programme for Competitiveness and Work* Europe and the Global Information Society: Recommendations to the European Council (The Bangemann report)
1995	*Shaping our Future* : original reference to Information Society in Ireland
1996	Abolition of Fees for those partaking in full-time under-graduate education December: original Information Society report completed
1997	❑ *Information Society Commission* Established ❑ May : *National Competitiveness Council* was established as part of the partnership 2000 agreement ❑ National Telecom Regulator ODTR[88] established on July 1st 1997.
1998	❑ Second 2G mobile phone license (ESAT Digifone) ❑ May 98: Good Friday Agreement in Northern Ireland (Referendum) ❑ Enterprise Ireland identifies Multimedia opportunity in Ireland ❑ December 1; Liberalisation of telecom market ❑ The Higher Education Authority (HEA) co-ordinating the allocation of a new £180m (€230m) Programme for Research in Third-level Institutions (1999-2001)
1999	❑ June Flotation of telecom Eireann resulting in formation of Eircom ❑ Project to enhance connectivity off the Island of Ireland via new $80m undersea fibre-optic connection connection to the UK managed by Global Crossing; ❑ Announcement of agreement to establish Media Lab Europe based in Dublin; ❑ Reach agency established to develop strategy for integration of public services and delivery of eGovernment;
2000	❑ BT acquires ESAT Telecom, Ocean ; option to buy ESAT Digifone ❑ Learning for Life: White paper on Adult Education ❑ July : e-commerce Act gives legal recognition to e-signatures and econtracts ❑ November: New Copyright Legislation

[88] ODTR: Office of the Director of Telecom Regulation http://www.odtr.ie

Appendix 2.2
Information Society Timeline
Period 2001-2002

Year	Activity
2001	❑ Feb; BT acquires Esat Digifone, since re-branded O_2 ❑ Meteor (2G) mobile service launched ❑ Eircom sells mobile arm (Eircell) to Vodafone ❑ New Information Society Commission Formed ❑ GPRS services launched ❑ Ennis Information Age town voted one of 7 Intelligent Communities in the world in 2001 by the Intelligent Communities Forum ❑ The Equalskills initiative will provide an introduction to computers for 100k people in the South West of Ireland ❑ New eGovernment services launched : Basis (for business) Oasis for citizens[89]
2002	❑ 'I-stream' DSL based high speed service launched by Eircom ❑ Legislation establishing the Digital Hub ❑ March Government announces significant strategic investment initiative to deliver broadband infrastructures and services in 19 towns, to be extended to 67 ❑ March: Government publishes New Connections Information Society action Plan ❑ First trial use of electronic voting at General Election (May), Nice Referendum (October) ❑ Decision on 3G mobile networks : only 3 of 4 licenses awarded ❑ Chambers of Commerce of Ireland launch eBusiness training initiative targeted at SME's ❑ New Forfás report published 'A Strategy for the Digital Content Industry in Ireland' ❑ Ministerial directive on Flat rate Internet access (24/10/2002) ❑ Telecom regulator changes from ODTR to ComReg ❑ Announcement of National Spatial Strategy: People , Placed and Potential

[89] www.oasis.gov.ie, and www.basis.ie