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Explanation of symbols

.	= figure not available
*	= provisional figure
x	= publication prohibited (confidential figure)
–	= nil
0 (0,0)	= less than half of unit concerned
blank	= not applicable
<	= fewer/less/smaller than
>	= more/greater than
2005–2006	= 2005 to 2006 inclusive
2005/2006	= average of 2005 up to and including 2006
2005/'06	= crop year, financial year, school year etc. beginning in 2005 and ending in 2006

Because of rounding, some totals may not correspond with the sum of the seperate figures.

Preface

Statistics Netherlands (CBS) has been publishing data on information and communication technology (ICT) by companies and households for a considerable period. The research results on the years 2005 and 2006 form the core of the sixth edition of the publication *The Digital Economy*.

We see the Netherlands emerge as a country that compares well in ICT with the other benchmark countries. In broadband the Netherlands belongs to the international top. Dutch expenditure on ICT is high, internationally speaking. Dutch and Danish people have the most internet skills within the European Union. Still, there is room for improvement. The score of the Netherlands in e-commerce is very average.

The aim of this publication is to describe ICT use in society in some detail. Apart from information about companies and households, the description focuses on the ICT sector. The publication also makes use of information on ICT that is available outside CBS.

Beginning from the fifth edition, published in January 2006, the publication includes extra information about the telecommunication infrastructure. In addition, a number of benchmark countries was selected, so that ICT developments in the Netherlands could be placed in an international perspective. This expansion was made possible by the cooperation with TNO and the financial support of the Ministry of Economic Affairs. Since all parties were positive about the expansion, extra data on telecommunication and on the benchmark countries were again included in this edition.

The amount of information about ICT increases every year. To prevent this publication from becoming too big, we decided that part of the methodological and statistical contents would only be made available on-line on the CBS website. Thanks to this decision we could add an entirely new chapter in this edition: the Capita Selecta in which authors outside CBS discuss several topics addressed in this publication in more depth.

The Director-General
of Statistics Netherlands

G. van der Veen

Table of contents

Figures and tables

Summery and conclusions

ICT and the economy

In 2005, the Dutch economy grew by 1.5 percent, so the modest economic recovery that started in 2004 continued. Still, economic growth was too low to completely halt the drop in labour volume, although in the course of the year the number of jobs started to increase. The labour productivity in the market sector strongly increased in 2004 and 2005 with 4.5 and 2.9 percent. The economic growth recovered further in the first six months of 2006, the number of jobs rose and unemployment fell (see paragraph 2.1).

ICT is high on the national and European agenda. ICT is seen as a means to raise productivity and efficiency. Current European policy is based on the third eEurope Action Plan *i2010: A European Information Society for growth and employment*. The national policy is an elaboration of it (see paragraph 2.2).

The ICT sector seems to have recovered since 2004 from the crash after the internet hype. Investments by ICT companies are on the increase, as are production and value added. There is a clear distinction, though, between the ICT industry and the ICT services sector. Things are still not well with the production of the domestic ICT industry, whereas the situation has clearly improved in the ICT services sector (specifically for computer service bureaus) as off 2004 (see paragraph 2.3).

The ICT sector depends on the ICT expenditure of companies, households and government. The ICT expenditure of the Dutch is different from a decade ago. The share of the ICT services in the total has increased during this period. The households now have a larger share of the ICT expenditure. Internationally speaking Dutch ICT expenditure is quite high with 7.6 percent of GDP in 2005 (see paragraph 2.4).

Research and development (R&D) is very important for the competitive power of an economy. Traditionally the ICT sector is very R&D-intensive. To illustrate: in 2005 the share of the ICT sector in the value added of the Dutch private sector was 5 percent while the sector accounted for no less than 29 percent of the total R&D expenditure (see paragraph 2.5).

In the Netherlands almost half of the European patent applications are for ICT. The Netherlands is in third place in the European Union in patent intensity (the number of patents granted per million inhabitants), only Germany and Finland are doing better. The highest share of patents for ICT is found in Finland, and the Netherlands

Key indicators of the digital economy, national, 2001–2006

	2001	2002	2003	2004*	2005*	2006*
	% volume change on previous year					
ICT and the economy						
ICT investments	2.2	–10.5	–0.3	8.0	.	.
Intermediate consumption of ICT goods and services	9.1	5.3	1.2	–2.9	2.3	.
Consumption of ICT goods and services	11.4	8.7	4.2	2.1	3.5	.
Gross value added ICT sector	3.8	0.8	4.2	1.9	1.0	.
of which ICT industry sector	–29.2	–20.9	0.9	–1.5	–10.7	.
ICT services sector	11.8	4.2	4.5	2.3	2.2	.
	number					
Companies in the ICT sector						
Total	22,650	23,845	23,920	25,220	24,235	.
New companies	3,095	2,530	2,455	2,730	3,450	.
Bankruptcies	419	511	406	327	300	.
	x million euro					
R&D expenditure in the ICT sector [1)]	1,767	1,650	1,693	1,464	.	.
	number (x 1,000)					
ICT and employment						
Employed labour force working in an ICT profession	269	288	271	273	266	.
Vacancies in the ICT sector	9.0	2.2	2.4	6.0	8.9	.
Informatics graduates from higher education [2)]	2.56	3.02	3.38	3.76	4.06	.
	number (x million)					
Telecommunication infrastructure						
Fixed telephone lines: PSTN	6.6	6.3	6.1	5.9	5.5	.
Fixed telephone lines: ISDN [3)]	1.4	1.5	1.6	1.5	1.4	.
Telephone connections via rtv cable	0.2	0.2	0.2	0.3	0.5	.
Mobile telephone connections	12.0	12.0	13.3	15.9	16.3	.
Broadband connections: cable	0.5	0.8	1.0	1.3	1.6	.
Broadband connections: ADSL	0.1	0.3	0.9	1.8	2.5	.
	% of total					
ICT use by households and individuals						
PC ownership, households [4)]	.	76	76	80	83	84
Internet access, households [4)]	.	63	65	71	78	80
Broadband access, households [4)]	.	15	22	34	54	66
Shopping on-line, individuals [5)]	.	40	45	52	55	61
	% of total number of companies					
ICT use by companies [6)]						
Companies with computers	94	95	94	94	100	.
Companies with external data communication	86	89	88	90	97	.
Companies with internet access	84	86	87	90	97	.
Companies with broadband internet	23	40	55	70	81	.
Companies with a website	49	60	65	72	79	.
Companies ordering of goods/services electronically [7)]	29	31	29	36	45	.
Companies receiving orders electronically [7)]	29	26	20	23	27	.

[1)] R&D carried out by own staff.
[2)] Graduates who have successfully completed higher professional education (vocational college) or university; 2001= study year 2000/2001 etc.
[3)] The number of ISDN connections. One ISDN connection may consist of 2 or more lines. These figures differ from those in the previous edition of *The Digital Economy*, as they refer to the number of connections, not the number of lines.
[4)] Private households with at least one person aged 12–74 years.
[5)] Percentage of persons with an internet connection.
[6)] Companies with 10 or more employees (2001)/employed persons (2002–2005).
[7)] Because of changes in questions, figures are not completely comparable over the years.

Source: Statistics Netherlands; TNO (telecommunication infrastructure).

is in second place in the European Union. Dutch companies make relatively many patent applications compared to the expenditure on R&D (see paragraph 2.6).

International trade in ICT goods has increased sharply in the past decade. The Netherlands has benefited from this. The import value increased from 23.9 billion euro in 1995 to 62.6 billion euro in 2005 whereas the export value nearly tripled. Much of the increase is due to re-exports. In 2005 over 90 percent of the total export of ICT goods consisted of re-exports. Not the domestic ICT industry, but the trade and transport sector benefit from this (see paragraph 2.7).

The number of ICT professionals employed in the Netherlands rose by over 50 percent since 1997. After a major dip at the start of this century, the number of vacancies in the ICT sector has soared again in recent years. The vacancy rate in the ICT sector is twice as high as that in the rest of the economy. Internationally speaking there are relatively many ICT professionals working in the Netherlands (see paragraph 2.8).

Dutch higher education trains relatively few ICT professionals. The Netherlands even scores below the EU average. The number of ICT graduates at the college level has more than doubled since 1990/'91 while the number of ICT university graduates increased by a mere 20 percent (see paragraph 2.9).

Globalisation is becoming more and more important in the global economy. The shift in production capacity and employment to low-wage countries is not new, but the scale of it is. At first the ICT sector mainly shifted the production of ICT goods, from which China benefited in particular. Offshoring, with India as the main location, has recently become much more common in ICT services (see paragraph 2.10).

Telecom

The telecommunication sector is very important for the Dutch economy, in fact above average, internationally speaking. Although the labour volume fell in recent years, gross value added rose. Despite their diminishing share, fixed and mobile telephone still account for most of the turnover of telecom companies. However, the internet is becoming more and more important (see paragraph 3.1 and 3.2).

The Netherlands belongs to the European top in terms of internet use. Nevertheless, internet use is still increasing, as is shown by the spectacular increase in the volume of the flow of the internet. This increase is strengthened by the fast rise of broadband. The use of broadband internet raises new issues, such as how to guarantee copyright in digital multimedia files (see paragraph 3.3).

The relative number of telephone connections to fixed landlines is falling as more people only phone with their mobile. Phoning via cable and the internet are also becoming more common. In the first quarter of 2006 there were already over 620 thousand cable telephone connections. In 2005 there were 460 thousand telephone connections through the internet (see paragraph 3.4).

Analogue television via cable was still common in 2005, but there is growing interest in digital television. This is on offer in many forms: ether, satellite, cable and the internet all provide digital television. In December 2005 there were 1.2 million digital television connections (excluding digital television via internet), which is a 60 percent increase on 2004 (see paragraph 3.5).

The main development in telecom is undoubtedly the convergence of services. Telephone, radio, television and the internet can now be bough in a bundle via a single network and a single provider. The advantages of the package cited by consumers were convenience and the low costs. (see paragraph 3.6)

ICT use by companies

In 2005 some 96 percent of Dutch companies were connected to the internet, and 81 percent had broadband. Almost 80 percent of the companies in that year had a website, mainly to present themselves to the outside world. 43 percent of people employed had internet available at their work place in 2005, which is well above the EU average (see paragraph 4.1).

In 2005, almost two thirds of all companies had an ICT system for order processing. Over 90 percent of these companies had this system linked to one or more other internal computer systems. The most common link in all sectors of industry is one between the order processing system to the invoicing system. For the other kinds of links there are much greater differences between the sectors of industry (see paragraph 4.2).

The percentage of companies with broadband internet has increased enormously in recent years. Only 23 percent of the number of companies with internet had broadband in 2001, whereas this has increased to 81 percent in 2005. Over 60 percent of the companies in the EU with internet had broadband by the end of 2004. The Scandinavian countries ranked highest, namely over 80 percent. The Netherlands ranked third among the benchmark countries, right behind Finland and Denmark (see paragraph 4.3).

The share of e-commerce in the total turnover of the private sector increased from 3.4 percent in 1999 to 9.1 percent in 2005. In recent years the growth rate in the Netherlands keeps levelling off. Within the European Union, Irish companies had

the highest turnover percentage from on-line sales, namely 20 percent in 2004. The share of e-commerce of Dutch companies in 2004 equalled the average for the EU-15 (see paragraph 4.4).

In 2005 almost all companies had antivirus software installed (98 percent). 87 percent also protected their ICT system against outside intruders with a firewall. Despite the use of these firewalls and other security measures, some 7 percent of the companies faced security problems in 2005 (see paragraph 4.5).

Compared to other sectors of industry, the financial sector makes more intensive use of ICT. In 2005 financial companies had internal networks more often than other companies. Intranet was used twice as often, relatively speaking, by financial companies, and the difference was even greater for extranet. Financial companies pay a great deal of attention to security. Despite this 10 percent in 2005 was plagued by security problems (see paragraph 4.6).

The ICT use of small and medium-sized companies lags behind that of big companies, both quantitatively and in terms of complexity. Therefore the government in 2002 started stimulating ICT use in small and medium-sized companies. This paid off because in comparison with other benchmark countries the small and medium-sized Dutch companies are doing well. Still they lag behind the big companies. However, it is not always necessary for a small company to have the same level of ICT provisions as big companies (see paragraph 4.7).

ICT use in the public sector

The Dutch municipalities offer more and more services on-line. Visitors still value municipal websites lower than a visit in person to a city hall. Internationally speaking, the Netherlands performs average in making electronic services available, but scores fairly high in the use of e-government services (see paragraph 5.1).

Over 80 percent of the elementary school teachers regularly use computers in class. These are often used for practical training. Computers are used less often in class in secondary education (47 percent). But over 90 percent of the teachers indicated that they gave students homework that required the use of the computer at home. Many teachers are unhappy with the ICT provisions in school (see paragraph 5.2).

Health and social work are not the most advanced users of ICT even if they are a knowledge-intensive sector. Both ICT investments and the percentage of ICT professionals lag behind other sectors of industry. This does not mean, however, that the use of ICT tools in care is any lower than in the other sectors of industry (see paragraph 5.3).

ICT use households and individuals

By June 2006, 84 percent of the households had a personal computer or laptop available at home, 80 percent had internet and 66 percent of the households had broadband internet. Within the European Union the Netherlands has the highest share of households with internet and with broadband. Denmark and Sweden score high as well. Most new member states and the Southern European countries are below the EU average in this respect (see paragraph 6.1).

Three quarters of the people who use the internet regularly use the internet almost every day. Young people use the internet more often than older people do, and they have more skills. Men have more internet skills than women, and highly educated people have more skills than people with low levels of education. The Danes and the Dutch have most internet skills within the European Union (see paragraph 6.2).

Communication (emailing, chatting and increasingly phoning) is the main activity of internet users. Downloading newspapers and magazines and listening to the radio or watching television through the internet became more popular in the last few years. Generally speaking, people who use the internet, are engaged in more and more different internet activities (see paragraph 6.3).

61 percent of the internet users in the Netherlands sometimes bought or ordered something on-line. Only in the Scandinavian countries is on-line shopping more common than in the Netherlands. In 2006, 44 percent of the goods bought on-line consisted of travel, holidays and accommodations. 67 percent of the internet users is involved in on-line banking. This is 9 percent more than a year ago (see paragraph 6.4).

In 2006, 53 percent of the population using the internet looked for government information on the internet. Finland and Sweden are the only other countries in the European Union where this happens more. There is a group of people who indicated that they do not wish to complete dealings with the government via the internet. 45 percent of the internet users indicated that birth and marriage certificates are not the sort of thing they wish to apply for on-line (see paragraph 6.5).

Two thirds of the internet users received spam, and over 40 percent of this group also had viruses. In 2005, on average 35 percent of the internet users in the European Union had trouble with viruses, ranging from almost 50 percent in Spain to less than 15 percent in the Czech Republic. Over 8 in 10 internet users have antivirus software installed (see paragraph 6.6).

ICT competences in the private sector

Each year there are 29 thousand new vacancies for ICT professionals, of which 10 thousand are hard to fill. These hard to fill vacancies require highly educated

people mostly. The problem is often the lack of experience and the right competences. Companies also expect many vacancies for ICT users over the next few years. Most companies invest in the development of competences and training in ICT of their own personnel (see paragraph 7.1).

Interorganizational cooperation and ICT among companies

Cooperation between companies influences the efficiency of ICT investments. Two characteristics are important: the degree of coordination within a network and the way in which the network influences the competitive power of the company. Companies benefit most from their ICT investments in a kind of cooperation that is loosely organised and strengthens competitive power (see paragraph 7.2).

Key indicators of the digital economy, international, 2002–2006

	EU-15	EU-25	Denmark	Germany	France	Netherlands	Finland	UK	Canada	Japan	USA	South Korea
	%											
ICT and the economy												
ICT expenditure as % of GDP, 2005 [1]	6.4	6.4	6.5	6.2	6.0	7.6	7.0	8.0	.	7.6	6.7	.
Share of ICT professionals in total employment, 2004 [2]	3.0	.	4.0	3.0	3.1	4.2	4.0	3.1	4.0	.	3.7	.
Share of ICT sector in R&D expenditure private sector, 2003	.	.	31	22	31	37	64	24	39	34	35	55
Share of ICT patents in the total number of patents EPO, 2002 [3]	29	29	25	25	32	49	58	35	41	44	37	57
Share of high-tech products in total exports, 2003 [4]	18	18	13	15	20	19	18	23	.	22	27	.
ICT education												
Share of ICT diplomas in higher education diplomas, 2004 [5]	4.4	4.0	4.7	3.6	3.6	3.7	4.3	4.9	.	.	4.9	.
	number per 100 inhabitants											
Telecommunication infrastructure												
Fixed telephone connections (including ISDN), 2005 [6]	.	50	64	67	53	59	44	56	64	45	59	55
Mobile telephone connections, 2005 [7]	.	99	97	95	73	100	102	109	49	74	69	77
Broadband connections, 2006 [8]	.	14	29	15	18	29	25	19	22	19	19	26
	number per 100 households											
Use of an rtv cable, 2004 [9]	.	29	55	50	14	88	46	13	61	51	58	91
Use of multiplay, 2006 [10]	.	18	25	17	25	21	14	25	.	.	.	.
	%											
ICT and government, 2006												
On-line public services for business [11]	89	86	100	85	91	86	91	82	.	.	.	.
On-line public services for citizens [12]	72	68	77	66	81	73	80	94	.	.	.	.
ICT use by companies, 2004												
Companies with a broadband internet conection [13]	65	63	82	62	49	71	81	65	.	.	.	.
Percentage of turnover generated by electronic sales [14]	10	9	12	13	.	9	14	16	.	.	.	.
Companies experiencing security problems [15]	29	29	27	21	.	22	56	.	.	.	.	.
ICT use of households and individuals, 2005												
Households with an internet connection [16]	53	48	75	62	34	78	54	60	.	56	.	86
Households with a broadband internet connection	25	23	51	23	.	54	36	32	.	.	.	.
Persons with average or advanced computer skills [17]	52	48	76	56	.	69	50	60	.	.	.	.
Persons who had shopped on-line in the preceding 12 maanden [17]	28	24	48	42	.	43	38	44	.	.	.	.

1) EU-15: excluding Luxembourg; EU-25: excluding Luxembourg, Cyprus and Malta.
2) As a percentage of the employed labour force; Canada: 2003.
3) Patents registered at the European Patent Office (EPO), by date filed.
4) EU exports do not include intra-EU exports.
5) Disciplines in ISCED 481; Finland and France: 2003.
6) Netherlands: 2004.
7) Canada and South Korea: 2004.
8) Excluding mobile connections, June, except in EU-25: end of first quarter.
9) Finland, France and Japan: 2003.
10) Percentage of households with a package of at least two services from one provider, December 2005 or January 2006.
11) 8 selected public services for businesses surveyed in all countries.
12) 12 selected public services for citizens surveyed in all countries.
13) France: 2002.
14) Companies with 10 or more employed persons; Denmark: 2003.
15) Companies with 10 or more employed persons experiencing one of the following security problems in the 12 months preceding the survey: virus attack, unauthorised access to ICT systems or extortion.
16) France, Japan and South Korea: 2004.
17) Persons aged 16–74 years.

Source: Eurostat; OECD for ICT professionals and patents; European Commission for multiplay; TNO for other indicators telecommunication infrastructure; Capgemini/Eurostat for ICT and government.

1. Introduction

1.1 Introduction

New technology can lead to major economic and social changes. A classic example is the invention of the steam engine. Information and communication technology, or ICT, currently produces large-scale changes in economic and social relations. Information is increasingly digitalised and distributed via networks that can easily be interlinked.

In the late nineties people believed that ICT would open up unlimited possibilities, especially in the commercial uses of the internet. This caused a boom; the share prices of ICT companies soared and investments and employment in the ICT sector doubled within a few years time. In 2000, people realised that their expectations were unrealistically high, which burst the bubble of the internet hype. People were quite disappointed in the rate at which existing processes could change under the influence of ICT, and the speed with which new technology could be turned into cash. Now, six years on, we may conclude that e-commerce is growing steadily but it has not yet reached the volume predicted at first. Neither have the enormous profits in the telecommunication sector materialised. Although the belief in ICT was shaken at the end of the internet hype, the ICT sector seems to be staging a comeback. In 2006 things are looking up for the ICT companies. The technology itself, developments of possible applications and their actual use are still promising. Therefore new ICT-related policies are being developed nationally and at the European level. Without the exaggerated expectations to live up to, it turns out that ICT can play a major role in improving efficiency and productivity.

The relationship between ICT and productivity is studied nationally and internationally. In the Netherlands, for example, a special issue on ICT and productivity was published in September 2006 in *Economisch Statistische Berichten* (ESB, 2006), where well-known scientists like Van Ark and Bartelsman share their visions on the subject.
It is now clear that the use of ICT alone is not enough to raise productivity. ICT investments need to go hand in hand with other measures, such as adapting the organisation structure and training the workforce, before a company can fully benefit from the positive effects of the technology.

With *The Digital Economy*, Statistics Netherlands wants to help quantify the role ICT plays in the economy and society. In this publication, the Dutch situation is compared to the developments in other countries. A list of the benchmark countries in this publication is found in paragraph 1.2.

The website of Statistics Netherlands (www.cbs.nl/digitale-economie) has another five methodological documents available. They provide a helicopter view of several topics that may be important in understanding the influence of ICT on society. Included are: information and communication technology, ICT goods and services, defining the ICT sector, the telecom infrastructure, and the influence of ICT on society.
The website also includes the statistical annex of this publication with detailed tables on various subjects, sorted by chapter.

The terminology used in this edition is partly based on international agreements with other statistical bureaus in the European Union (EU) laid down by Eurostat (the European Bureau of Statistics) and on the definitions and classifications of the Organisation for Economic Co-operation and Development (OECD) and the United Nations (UN). This makes it possible to compare the Dutch figures with data from other benchmark countries. There is much demand for such international comparisons.

1.2 Layout of the publication

This edition consists of self-contained chapters, which can be read on their own. Chapter 2 focuses on the role ICT plays in the economy. Because the ICT sector is very sensitive to economic fluctuations, paragraph 2.1 provides an overall view of the Dutch economy in general. Paragraph 2.2 details the national and European policies aiming to promote the use of ICT. The next paragraph outlines how the ICT sector works, looking at developments in profits, employment and investments. Paragraph 2.4 looks at developments in ICT expenditure by companies, government and consumers. Research and Development (R&D) in the ICT sector is addressed in paragraph 2.5. Inventions due to R&D are protected by patents, which are the focus in paragraph 2.6. The international trade in ICT goods and services is discussed in paragraph 2.7. It is important for an internationally competitive ICT sector to have a highly-trained workforce. Therefore paragraphs 2.8 and 2.9 deal with ICT-related employment and education. Chapter 2 ends with a paragraph on globalisation and the role ICT plays in it.

The focus of chapter 3 is on telecom. Paragraph 3.1 sketches a general picture of the role of the telecommunication sector within the Dutch economy. Paragraph 3.2 looks in more detail at the telecom sector itself. What are the main products and services, and what is their share in turnover. Paragraphs 3.3 through 3.5 highlight the main services of the telecom sector: internet, telephone, radio and television. The discussion of the internet looks specifically at the development of broadband. At the end of the chapter, in paragraph 3.6, the convergence of the various services is discussed and the consequences this has for the telecom companies and consumers.

ICT users

In chapters 4 through 6 follows a description of the main users of ICT. Chapter 4 details ICT use in the private enterprises. After a brief review of the ICT infrastructure of companies (paragraph 4.1), the in-house data communication of companies is examined in paragraph 4.2. Paragraph 4.3 deals with external data communication. The latter includes linking ICT systems (e.g. order processing systems) with clients and suppliers. The penetration of broadband internet in the private sector is also discussed. Paragraph 4.4 sketches the role of ICT in buying and selling goods and services. The development of e-commerce and e-business in the Netherlands is compared over time and with other countries. The use of computers and the internet is not without its dangers for companies. Paragraph 4.5 discusses security measures companies take to prevent improper use of their ICT systems. The chapter ends with two aspects that merit special attention. Paragraph 4.6 deals with ICT use in the financial sector, where many activities take place (processing, managing and providing information) which are well suited for the use of ICT tools. The Dutch government has had a policy to actively stimulate the use of ICT within small and medium-sized enterprises (SME) since 2002. This is a good reason to take a closer look at developments in the small and medium-sized enterprises.

Chapter 5 shifts the focus to the public sector. The Dutch government greatly values sophisticated ICT use within the public sector. Paragraph 5.1 looks at the performance of e-government. This not only looks at the percentage of government services that can be accessed on-line, but also at user satisfaction. ICT is also used widely in education. This is addressed in paragraph 5.2. Paragraph 5.3 deals with the health and social work sector. It is often said that ICT could play a major role in cost cutting and efficiency gain in this sector.

Chapter 6 is about ICT use by households. After an inventory of the ICT provisions in paragraph 6.1, paragraph 6.2 switches to the ICT use and ICT skills of individuals and households. Paragraph 6.3 lists the main activities that the internet is used for. The internet applications gaining in popularity in recent years are on-line shopping and on-line banking (paragraph 6.4). Paragraph 6.5 lists the use and experiences of households and individuals with on-line government services. Households also run security risks when they use the PC and the internet. Information about this is provided in paragraph 6.6.

Capita Selecta

For the first time in its history, this publication includes a chapter with Capita Selecta. The chapter is meant to increase the insight into one or more topics discussed in this edition by including contributions by experts outside Statistics Netherlands. The current chapter has two papers. The first is 'ICT competences in business' which discusses the ICT skills of the Dutch workforce. The emphasis is on the question if there are enough people with sufficient ICT skills to make modern

society function properly. This study, carried out by ITS (the Institute for Applied Social Sciences of Nijmegen University), was commissioned by the Ministry of Economic Affairs. It looked at ICT specialists and people using ICT at work, who we will call ICT users.
The second paper looks at the influence of inter-organisational networks. These networks influence the relationship between ICT investments/ICT capital and productivity. During this study, carried out by the Delft University of Technology and Statistics Netherlands, the emphasis was on the influence of two specific characteristics of cooperation between companies, namely the degree of coordination within the network and the influence of the network on the competitive edge an individual company has.

International benchmarking

In the previous edition of this publication, we started observing ICT developments in other countries, partly at the initiative of the Ministry of Economic Affairs. The aim of benchmarking is to provide a framework in which to place the situation in ICT supply and use in the Netherlands. When possible, we will present one or more internationally comparable indicators per paragraph. Moreover, these indicators will be gathered for a fixed group of countries, which contributes to the comparability throughout the publication, and makes it easier to draw general conclusions about the position of the Netherlands within this group of benchmark countries.
The emphasis in benchmarking is on showing the most up-to-date situation and the interrelationship between countries rather than on presenting time series.

The various indicators are selected on pragmatic grounds, that is, they are selected from the available indicators. The main sources for these indicators are Eurostat and the OECD. Eurostat presents outcomes of the harmonised surveys about the ICT use of companies and households. The OECD releases many regular and one-off publications based on underlying databases with data on the spread and use of ICT in OECD countries. The value of the OECD data lies in the greater diversity in indicators, and also in the fact that data is gathered from major non-EU countries such as the USA, Japan, Canada and South Korea.

Generally speaking it is easier to make a wide-ranging international comparison between EU countries than it is at the world-wide level. This is because the EU has a system of harmonised statistics, made under the supervision of Eurostat. It is often difficult to find comparable data about countries outside the EU. Therefore we have opted for the following approach in this publication. A broad comparison is made per indicator with a number of selected other EU countries. When possible, we add several leading countries outside the EU. The selection of benchmark countries is based on the desire to compare the Netherlands with countries with a high degree of ICT spread and use. Therefore the Netherlands does not always come out on top. On

the other hand, it is not very useful to compare the Netherlands with countries that are not as advanced in ICT, such as Portugal and Lithuania. In addition, it is important to limit the number of benchmark countries somewhat so that the data can be presented clearly.

These considerations have lead to the selection of the following benchmark countries: Denmark, Germany, Finland, France, the United Kingdom (all EU), the USA, Canada, Japan and South Korea, plus the averages of the EU-15 and EU-25. We also include figures about India and China because of their increasing importance in the ICT sector and in the global economy. Because these two countries do not belong to the OECD, however, it is difficult to find reliable figures about them. The statistical annex, available at www.cbs.nl/digitale-economie, includes the results per subject for all individual EU countries.

2. ICT and the economy

The Dutch economy showed signs of recovery in 2004 and 2005. The growth rate was higher than during the 'lean years' 2002 and 2003, but the recovery was not robust. The economy had not recovered enough to fully stop the slump on the job market, although there were more new jobs. In the first half of 2006, the economy looked a lot less bleak. Economic growth recovered and unemployment is starting to fall. Part of the recovery is due the ICT sector.

The ICT sector is very important for the Dutch economy, due to its innovative force. The government makes a great effort to see that the sector performs well. Nationally and internationally there were quite a number of policy initiatives to raise the role ICT plays in society.
However, the ICT sector is quite dependent on the general economic situation. The sector was hard hit during the recent economic slump (2001–2003), but there are clear signs of improvement due to the current economic recovery. There are great differences within the ICT sector though. In recent years the telecom sector continued to do well despite the economic dip. In 2004 and 2005 this sector of industry seems to have run out of steam in terms of growth. Computer service bureaus on the other hand have gone through the opposite development over the last five years. The years 2001–2003 were difficult, but things seem to have picked up since 2004. The ICT industry is the only one that structurally lags behind in the ICT sector.

For its income, the ICT sector depends on the ICT expenditure by companies, government and consumers. On balance expenditure fell during the period 2003–2005.
There were two structural changes. In the last decade the share of the ICT services increased at the expense of ICT goods. At the same time the share of the household consumption increased.

Thanks to its innovative character, the ICT sector traditionally spends a lot of money on research and development (R&D). The share in total R&D of the private sector is considerably higher than expected on the basis of the size of the ICT sector. Internationally, the Netherlands is quite average with a share of 36 percent in 2003; in most benchmark countries the share of the ICT sector in the total R&D of the private sector lies between 30 and 40 percent. In the Netherlands over 80 percent of the R&D expenditure within the ICT sector is generated by the ICT industry. However, in recent years the share of the ICT services is also growing.

Inventions made thanks to R&D activities can be protected by patents. Over the last twenty years the number of patents has constantly risen, with an increasing share of ICT patents. In 2004 this share came close to 50 percent. The Netherlands has fairly many patents, internationally speaking. Within Europe there is quite a high correlation between the R&D expenditure of a country and patent intensity.

The imports and exports of ICT goods, services and software have risen sharply in the period 1996–2004. The Netherlands benefited from the fast growing world trade of the period. However, there is some distortion since a large part of Dutch imports and exports consists of re-exports. The Netherlands does earn money from re-exports, but less than from domestically produced goods and services.

Employment in the ICT sector is starting to improve again after a number of bleak years. In 2005, the number of employed ICT professionals fell slightly, but the number of jobs in the ICT sector increased. The rise in the number of vacancies shows that things are better with the ICT sector. For computer service bureaus (a major part of the ICT sector) the vacancies are back to the level of the internet hype.

Internationally speaking, the Netherlands has many ICT professionals: with 4 percent of the employed labour force it has the highest score of the benchmark countries. These ICT jobs require capable, well-trained people. Since the mid 1990s the number of first-year ICT students has been on the increase. There was a dip at the end of the internet hype, but in 2004 and 2005 things picked up. Internationally speaking, the share of ICT professionals in the total number of university and college graduates is fairly low.

A key development for the world economy, in particular for the ICT sector, is globalisation. Policy makers focus on reducing the disadvantages and making full use of the advantages. In the ICT sector production capacity has been shifted to low-wage countries for some time. In recent years offshoring services is also becoming common. As a consequence, ICT now has new global superpowers such as India and China.

2.1 The Dutch economy

In 2005 the Dutch economy was recovering at a modest pace, with a growth rate of 1.5 percent. This was still well below the long-term average since 1970. Yet the economy was doing better than the figures make it look at first sight. For instance, in 2004 the growth rate levelled off mainly due to incidental factors. Furthermore, economic growth started speeding up in the course of the year and in the first half of 2006 the economic recovery seemed to continue. GDP volume over the first 6 months of 2006 was up by 2.9 percent on the year before.

Exports in 2005 were the main driving force of the Dutch economy. No less than two thirds of the economic growth was determined by exports. The export volume in 2005 was up by 5.5 percent on the year before. The growth rate in 2004 was even higher, namely 8 percent. Investment also made a positive contribution to GDP developments in 2005. Fixed capital formation rose by 3.6 percent after a three year dip. Consumer expenditure still lagged behind in 2005. Both household and government consumption grew slightly in 2005, and therefore contributed slightly

Table 2.1.1
Volume changes in categories of expenditure, 2000–2005

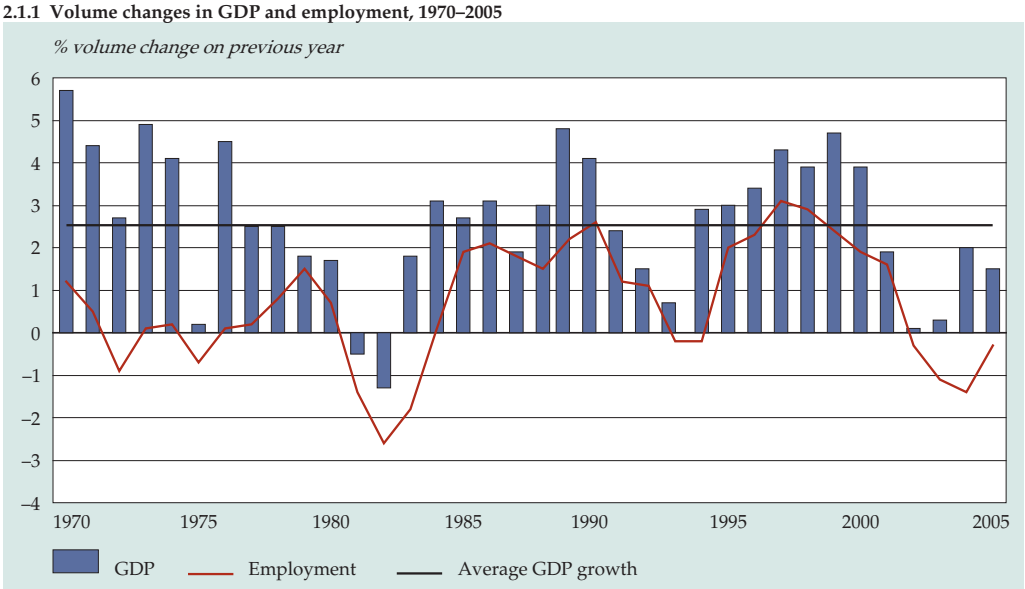
	2000	2001	2002	2003	2004*	2005*
	% volume change on previous year					
Consumption expenditure	3.2	2.7	1.7	0.8	0.5	0.6
Households	3.7	1.8	0.9	–0.2	0.6	0.7
Government	1.9	4.6	3.3	2.9	0.1	0.3
Fixed capital formation	0.6	0.2	–4.5	–1.5	–0.8	3.6
Exports of goods and services	13.5	1.9	0.9	1.5	8.0	5.5
Imports of goods and services	12.2	2.5	0.3	1.8	6.4	5.1
Gross domestic product (GDP)	3.9	1.9	0.1	0.3	2.0	1.5

Source: Statistics Netherlands, National accounts 2005.

to GDP growth. However, in the second half of the year consumption also showed a recovery, a trend that continued in the first part of 2006.

In figure 2.1.1 we show economic growth and employment since 1970. Periods of substantial economic growth and years of stagnation follow one another. The last boom period was in the late 1990s. In the period 1996–2000 economic growth averaged 4 percent. This period of above average economic growth was mainly due to the rise of the ICT sector, especially in the ICT-services sector.

2.1.1 Volume changes in GDP and employment, 1970–2005



Source: Statistics Netherlands, National accounts 2005.

After 2000, economic growth slowed down and during 2002 and 2003 it nearly came to a grinding halt in the Netherlands. This was mainly caused by the end of the internet hype. Investments in the ICT sector fell, and telecom companies were confronted with sizeable debts from buying UMTS licences and expensive takeovers.
In 2004 and 2005, the Dutch economy started to perk up, although there was no real recovery yet. In the first six months of 2006 the economy is up and running, and consumer and producer confidence are picking up.

Figure 2.1.1 shows both economic growth in terms of GDP volume and the development of employment. The previous economic dip influenced the job market. In the period 2002–2005 employment fell each year. The worst year was 2004 when employment in full-time equivalent jobs (fte) fell by 1.4 percent. This comes down to over 94 thousand full-time equivalent jobs. In total, employment fell by over 3 percent in the period 2002–2005. Employment was also down in 2005, but the negative growth was a lot smaller than the year before. In the first half of 2006 the higher GDP growth rate was increasingly expressed in growing employment.

The result of economic growth and employment is labour productivity. Productivity rises when GDP grows faster than the employed labour force (in fte). In figure 2.1.1 labour productivity is shown as the room between the tops of the bars and the line. The analyses mainly focus on labour productivity in the market sector. Figure 2.1.1 shows that a dip in labour productivity is very rare, although the growth in labour productivity can fluctuate enormously. This is because the job market reacts to economic development with some delay. This is shown clearly in the Netherlands in recent years. In 2004 economic growth started to recover in the Netherlands while employment fell substantially. This led to a huge increase in labour productivity (in the market sector) of 4.5 percent. In 2005 labour productivity increased significantly by just under 3 percent. Such a sharp increase of labour productivity is not unusual in times of economic recovery. When the economy is in decline, labour productivity increases very slowly.

2.2 *ICT and policy*

ICT is an indispensable part of society in the year 2006. The remainder of the chapter will show how important ICT has become in the Dutch and the global economy. ICT makes it possible to change production processes and increase productivity. Even though much of the diffusion of ICT in society goes pretty much automatically, there are quite a few aspects where well-directed policy can make a big difference. Therefore the integration of ICT in society is stimulated nationally and internationally. This paragraph lists the main policy initiatives currently under way at the national and European level.

Current international policy

ICT policy in Europe is based on the third 'eEurope action plan'. This plan: *i2010: A European information society for growth and employment* (EC, 2005) dates back to 2005. i2010 stand for European Information Society 2010, meaning a EU-wide action plan for ICT in the period 2006–2010. In this document the policy initiatives are grouped around three aims:

- a common European information space for affordable and safe broadband communication, offering rich and varied contents and digital services;
- world-level performance in ICT research and innovation, closing the gap between Europe and its main competitors;
- an inclusive information society, stimulating high quality government services and the quality of life.

The i2010 action plan is not on its own. During the spring summit of 2005, European government leaders emphasized the importance of ICT for the Lisbon strategy. When ICT is properly applied, it can boost economic growth in the European Union.
i2010 is of course also important for the Netherlands. The Netherlands has a good information infrastructure that offers opportunities for extra economic activity and increasing productivity. ICT is still high on the Dutch political agenda in order to give its international competitive edge a chance. The action plan i2010 is a major guideline for future ICT policy.

i2010 is the successor of the first two eEurope action plans formulated in the period 2000–2004 by the European Commission. Both action plans stated several concrete aims for ICT. These are described in paragraph 2.2 of *The Digital Economy 2005* (Statistics Netherlands, 2006), which sketches the chronology of Dutch and European government policy since 1999. In the current edition, we look at ICT policy in the last couple of years, both nationally and internationally.

The government-wide ICT agenda

Dutch ICT policy is mainly based on the 2005 paper *Beter presteren met ICT: Vervolg rijksbrede ICT-agenda 2005–2006* (Ministry of Economic Affairs, 2005a). This is a detailed follow-up of the Ministry's paper *De rijksbrede ICT-agenda* (Ministry of Economic Affairs, 2004a). Both specify European ICT policy. The aims for ICT are formulated for a limited period in the European action plans. The Dutch government aims primarily to get the Netherlands to the European top of ICT use.

The Dutch ICT policy, as discussed in the two papers, distinguishes between the use of ICT and strengthening the ICT basis. In terms of policy, the use of ICT is classed into three groups: companies, the (semi)public sector and citizens. Below we will outline the specific policy for each group:

– *Use by the private sector.* This policy aims to raise productivity and competitive power by integrating ICT applications into the business processes. Special attention is paid to early adopters and small and medium-sized enterprises.
– *Use by the (semi)public sector.* ICT plays a major role in modernising government and solving social problems. This can be achieved by a combination of new ways of working and the organisation, deregulation and better use of ICT.
– *Use by citizens.* ICT offers citizens the opportunity for development and participation in information society. For this, the digital networks must be accessible and provide reliable information and a varied content.

Three areas for strengthening the ICT basis are distinguished, namely communication infrastructure, ICT know-how and innovation en ICT preconditions. Below we describe the policy in these areas:

Radio frequency identification (RFID)

RFID (Radio Frequency Identification) is a technology that enables the unique identification from a distance of products, people and animals. Although the technology was developed during World War II, technical and economic barriers so far made a breakthrough impossible. But as technology progresses, these barriers are rapidly broken down. The technology promises a revolution in efficiency, convenience and security. RFID applications are expected in the next few years in many sectors like logistics, transport, retail, care, defence and education. A list of possible applications can be found in the paper *Onderzoek RFID-toepassingen* (KU Leuven, 2006).

Politicians and the private sector are positive about the introduction of RFID. But opinions differ. Consumer and civil rights organisations point out what negative consequences RFID can have for privacy, because with large-scale applications in products it is possible to obtain personal information on consumers. Therefore it is seen as crucial that the private sector, government and consumer organisations inform the consumers. Equally crucial is the cooperation between government, providers, users and social organisations. Much needs to be done before RFID can have large-scale applications. The Dutch Ministry of Economic Affairs is very active as is manifest by its publication of January 2006 *RFID: kans of bedreiging?* (EZ, 2006b).

In August 2006 the first electronic passport was handed to the Minister of Government Reform and Kingdom Relations. This new passport has a RFID chip that can be read out from a distance in order to counter fraud.

The chip has data stored such as a passport photo, name, sex, nationality, social security/ fiscal registration number, validity and birth of date. The data on the chip are also printed on the document. The chip and the data on it are a new feature to authenticate the travel documents. As of 2009 the fingerprints will also be stored on the chip.

– *Communication infrastructure.* The Netherlands has a good starting position in this area. The policy is to benefit from this and strengthen and expand this position.
– *ICT know-how and innovation.* The policy is to strengthen the ICT knowledge base and optimal use of the knowledge developed there. This helps realise innovation and higher productivity.
– *ICT preconditions.* The policy aim is to build enough confidence and know-how to handle ICT. This requires a proper operational infrastructure as well as policy protecting privacy and dealing with cyber crime. ICT must be used to prepare pupils and students for their participation in the job market.

Further details of the general ICT policy of the government are found in the paper *Nederland in verbinding: Beleidskader voor de elektronische communicatie (BEC)* (Ministry of Economic Affairs, 2006). This paper specifically deals with electronic communication. The cabinet aims to keep up the Dutch global position and strengthen it. The paper lists the guiding principles for future policy for e-communication distinguishing six accents:
– social dimension and position of consumers;
– transition to full competition;
– room for convergence;
– ICT as an innovation axis;
– intensifying security policy;
– relation between environment and electronic communication.

The cabinet want to realise this policy by actively seeking cooperation with its public and private surroundings. The action points from BEC are specified by the end 2006 in an update of the government-wide ICT agenda.

The contents of the BEC are also influenced by the discussion whether or not the Netherlands benefits enough from its ICT investments. This recently resulted in the *ESB-dossier ICT en economische groei* (Economisch Statistische Berichten, 2006) about the relationship between ICT and productivity. Statistics Netherlands is currently deeply involved in national and international studies on this topic. Expectations are that the first results will be presented in the next edition of this publication.

The ICT agenda and current policy

Recent Dutch ICT policy is clearly influenced by the government-wide ICT agenda. The focus in developing the (tele)communication infrastructure is on spreading broadband internet. In the *Breedbandnota* (Ministry of Economic Affairs, 2004b) the government emphasized the role of broadband as the driving force behind future economic growth. Currently the Netherlands is doing well in terms of broadband connections, being second behind Denmark in the selected benchmark countries with an average of 28.8 connections per 100 inhabitants. This percentage also indicates that the roll out of broadband has not been completed. Broadband is a

'moving target', dictated by the applications that are being developed. Therefore the term 'broadband' should not be defined statically in terms of bandwidth, but rather in terms of functionality: if it is not possible for the user to have all applications 'running', it is not broadband. A wide use of broadband increases the potential for applications and has a positive effect on the economy and productivity.

One precondition for ICT use is dealing with cyber crime, as stated in 2004. This is not surprising, because the security of computers and the internet still leaves a lot to be desired in 2006. Irritations and dangers of the internet vary from unsolicited email (spam), viruses and spyware, to pure fraud like phishing. [1)] These problems will never be solved entirely because the legislator can only react after the fact. It is almost impossible to predict what methods hackers and internet criminals will use and anticipate them. Certain user groups will always be scared of these dangers, preventing them from making more advanced use of the internet. In 2006, the government made an important step in fighting cyber crime and in making computers and the internet safer by imposing stricter regulations (see box on the second law on computer crime).
2006 also saw various initiatives in the area of ICT use by the (semi)public sector. In the spring, the Minister of Government Reform and Kingdom Relations discussed

Law on computer crime (Wet computercriminaliteit II)

In May 2006 the proposed second law on computer crime was approved by the Dutch senate. The law, a stricter update of the 1993 law on cyber crime, came into force on 1 September. One key change was the redefinition of 'hacking'. All deliberate, illegal entering of computer systems is now subject to penalties regardless if a form of security has been hacked.

People who purposely enter a computer system risk a year in jail. If they steal information, they face a maximum of four years. Other computer crimes, such as spreading viruses or serious nuisance like spam are punishable by a year in jail. Preparing computer crime can now be punished, including selling, making, or possessing tools to commit cyber crimes. Dutch police and the legal system have more powers to tackle cyber crime. Suspects of cyber crime can be taken into custody, and measures like repossession and phone taps can be used. The public prosecutor can order an internet provider to keep certain data for some time for a judicial enquiry.

Most types of computer crime are now punishable in the Netherlands when a Dutch person commits them elsewhere. This is due to the Budapest Cyber Crime Treaty signed by many countries in November 2001. Most countries are members of the European council, but Canada, Japan, South Africa and the USA also signed the treaty. The aim of the treaty is a common criminal prosecution policy in order to protect society from offences with electronic networks. Main issues are the development of proper legislation and strengthening international cooperation.

the use of open source software and open standards with higher education. Government also tries to improve access to government websites. The on-line access of the government must be approached in the same way as the physical access of government buildings (see also paragraph 5.1 of this edition). One obstacle is that knowledge and experience within the public sector is widely scattered.

Spearhead policy 2005–2006

Within general ICT policy, the government defined spearhead policies each year. For 2005–2006 these are:

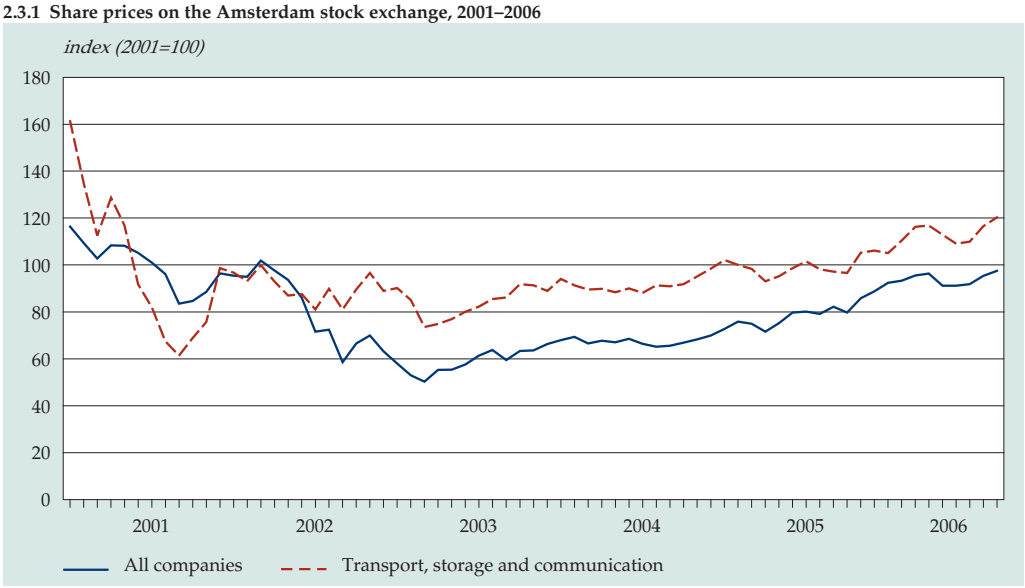
- one-off supply of data on citizens and companies to the government;
- electronic identification;
- faster internet for a comparable price;
- raise security and reliability of the internet and ICT provisions;
- facilitating data exchange with and within government by standardising;
- consumer policy (freedom of choice, know-how, privacy and arbitration);
- stimulate ICT use in specific sectors such as care, mobility, security and education.

2.3 *The ICT sector*

Between 1995 and 2000 the ICT sector boomed. The ICT services grew fast, and therefore the ICT sector made an above average contribution to the economy, investment and employment in the Netherlands during this period. The telecom sector during this period spent much money on electronic networks and UMTS licences. Takeovers of other (telecommunications) companies were very popular. However, income did not keep pace with expenditure. In 2000 a severe dip started with the stock market crash and ICT and telecom companies taking hits. With hindsight, the expectations about how fast people could cash in on the new technology were exaggerated.

In the period 2001–2003 investments of the ICT sector and employment fell. Other sectors of industry, the users of ICT, were more reluctant to invest in computers and software. Everyone took a breather. In 2004 the ICT sector started to recover. The financial situation of the telecommunication companies has improved, and the applications and use of ICT are expanding. The expectations about the ICT sector seem a bit more realistic. This is shown in the share prices of the ICT and telecom companies on the stock exchange. The recovery of the ICT sector has led to a rise ever since 2003. The valuation of the companies, as indicated by the price-gains ratio, averages between 15 and 20. [2)] In general, this is expected to be a realistic valuation for future profit and turnover growth rates. In the late 1990s it was not unusual to see price-gains ratios over 200. Figure 2.3.1 shows that as of 2003 share prices of the ICT and telecommunication sector keep an even pace with the total stock market. The ICT sector is seen more and more as a normal economic sector.

2.3.1 Share prices on the Amsterdam stock exchange, 2001–2006



Source: Statistics Netherlands, StatLine.

The ICT sector consists of de ICT industry and ICT services. The exact definition of these two are laid down internationally and detailed in table 2.3.1. Below we will discuss certain aspects of the ICT sector.

The ICT industry

The Dutch ICT industry has been performing modestly in recent years. Since 2000 production, value added, investments and labour volume of the sector have been

Table 2.3.1
Definition of the ICT sector

SBI93	Description of activities
ICT industry sector	
3000	Manufacture of office machines and computers
3130	Manufacture of insulated wire and cable
3210	Manufacture of electronic components
3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
3230	Manufacture of audio and video equipment
3320	Manufacture of instruments and appliances for measuring, checking and testing
3330	Manufacture of industrial process control equipment
ICT services sector	
6400	Post and telecommunication
7200	Computer service and ICT bureaus, etc.

Source: OECD/Statistics Netherlands.

falling sharply, making the share of the ICT industry in the total ICT sector dip. The share of the ICT industry in the production value of the ICT sector dipped from 43.6 percent in 1995 to 24.6 percent in 2005. Even during the boom in the trade of ICT goods (late 1990s) the Dutch ICT industry showed no more than average growth. Much of the required ICT goods, such as computers and peripherals, are imported. The Netherlands plays a major role as distributor for these products. Much of the imports and exports of the Netherlands consists of re-exports. These are goods imported from other countries and distributed to other countries after perhaps some minor processing. The international trade in ICT goods is many times greater than that of ICT services. The year 2005 was not great for the ICT industry: gross value added and the production value fell sharply (by 10.7 and 5 percent), while the labour volume also diminished (–2.7 percent).

The image of the Dutch ICT industry is influenced more than the ICT services sector by a number of multinationals. These partly belong to the Dutch ICT industry, but also partly fall outside the description of the Dutch economy because of units being located in the low-wage countries. Items such as production, investments and employment are only considered part of the domestic ICT sector when they refer to Dutch-based companies or business units. Not all costs and results of the multinationals are therefore expressed in the description of the Dutch economy. This can lead to a distorted picture for the ICT industry, where the costs of research en development (R&D) are made and observed in Dutch company units, whereas the results of the R&D, the actual production of the new or improved ICT goods, takes place elsewhere. The CPB (Netherlands Bureau for Economic Policy Analysis) studied the issue. The expectation is that part of the poor performance of the Dutch ICT industry can be attributed to the effects described above (Minne and Van der Wiel, 2004).

Computer service bureaus

Computer service bureaus have become increasingly important within the ICT sector over the years. Between 1995 and 2005 the share in the production value of the sector of industry went up from 17.4 percent to 29.1 percent. Of the three sectors that make up the ICT sector (ICT industry, computer service bureaus and the telecommunication sector), computer service bureaus grew fastest in the period 1996–2000. Turnover of the sector consists mainly out of developing and implementing information systems, management and exploitation of systems, advice and auditing and outsourcing ICT staff. The turnover is mainly gained on the domestic market. As such, computer service bureaus depend for their turnover on the investments in software and demand for computer service bureaus, by companies, households and government in the Netherlands.

After a boom period in 1996–2000 the worsening economic situation also created a less favourable market situation for computer service bureaus. The production value dropped in 2002 and 2003, and subsequently recovered. The turnaround came

Table 2.3.2
The ICT sector compared with the Dutch economy, 2001–2005

	2001	2002	2003	2004*	2005*
	% volume change on previous year				
Production value					
ICT industry sector [1)]	–7.8	–12.2	–1.6	–1.9	–5.0
ICT services sector	12.9	2.3	1.4	0.9	2.7
of which: post and telecommunication	16.3	9.0	4.5	0.4	1.4
computer service bureaus	8.0	–7.5	–3.7	1.6	4.8
Total ICT sector	6.1	–2.0	0.6	0.1	0.7
Netherlands	1.9	–0.8	–0.6	1.5	1.6
Gross value added					
ICT industry sector [1)]	–29.2	–20.9	0.9	–1.5	–10.7
ICT services sector	11.8	4.2	4.5	2.3	2.2
of which: post and telecommunication	15.5	14.1	8.7	2.4	0.8
computer service bureaus	7.6	–6.8	–1.2	2.1	4.3
Total ICT sector	3.8	0.8	4.2	1.9	1.0
Netherlands	1.9	0.2	0.5	2.0	1.6
Investment					
ICT industry sector [2)]	–3.8	–16.5	–10.6	–7.4	.
ICT services sector	–17.9	–42.1	–15.2	10.5	.
of which: post and telecommunication	–21.2	–44.9	–19.4	10.4	.
computer service bureaus	12.6	–23.0	6.5	11.0	.
Total ICT sector	–15.6	–37.2	–14.1	5.8	.
Netherlands	0.2	–4.5	–1.5	–0.8	3.6
Labour volume of employees					
ICT industry sector [1)]	0.6	–3.8	–7.4	–6.2	–2.7
ICT services sector	5.4	–6.3	–5.7	–3.8	–1.2
of which: post and telecommunication	4.2	–8.0	–8.8	–6.3	–4.0
computer service bureaus	6.5	–4.8	–2.9	–1.7	1.1
Total ICT sector	4.0	–5.6	–6.2	–4.5	–1.6
Netherlands	1.6	–0.3	–1.1	–1.4	–0.3

1) 2004 and 2005 are estimates.
2) For investment the ICT industry sector is defined as SBI groups 30–33. The figures on investment are not detailed enough to be able to be compiled according to the internationally agreed definition of the ICT industry sector.

Source: Statistics Netherlands, National accounts 2005.

in 2005 with the production value increasing by close to 5 percent. Investments always react strongly to changes in the economic climate. This is clearly shown by the investment figures of the computer service bureaus in the period 2001–2004. In 2001 (and the period before) investments rose sharply. In 2002 the mood changed, resulting in a 23 percent drop. The rapid recovery of the investments soon followed. Comparing the figures from table 2.3.2, it shows that computer service bureaus started doing better in 2004, as is expressed in the gross value added. After dropping in 2002 and 2003 this variable became positive again as of 2004. In 2005 gross value added already increased by over 4 percent, indicating that the profitability of the computer service bureaus improved. This is partly due to cuts in staff. In the years

2002–2004 the labour volume at computer service bureaus fell by 9.2 percent. The fact that the sector is recovering from difficult days is also shown by growing employment in 2005, which was up by 1.1 percent. Another measure of how the computer service bureaus are doing is the number of unfilled vacancies. The vacancy rate started rising again after reaching its lowest point in the third quarter of 2003 (1,500 vacancies) reaching 9,500 in the second quarter of 2006. The latter is only 1,000 vacancies less than during the millennium boom.

Telecommunication sector

The telecommunication sector is the only ICT sector that consistently increased its annual turnover in the period 1996–2005. Although the economic dip of 2002 and 2003 more or less passed the sector by, it seems growth is loosing its elasticity. In 2005 the gross value added of the sector only grew by 0.8 percent. Although turnover and profits stayed up, employment in the telecommunication sector has been falling for years. After the 2001 high, the labour volume of people employed fell by close to 25 percent. So the telecommunication sector turned out to be better able than the ICT industry and computer service bureaus to generate more production and value added with fewer employees. A key reason is the much higher capital intensity of the telecom sector.

It is not hard to see why the telecommunication sector has sustained the period of growth, with the spectacular growth of the use of mobile telephones and the internet. Due to this increase in data exchange, the turnover of the telecommunication companies stayed up. Moreover, telecom companies get a fair share of their turnover from the consumer market. The consumers substantially contributed to the growth of the domestic telecommunication market.

However, the ongoing development of ICT is also a threat to telecommunication company turnovers due do the rise of 'disruptive technologies'. One example is free phone calls through the internet, at the expense of the turnover of the traditional telecommunication companies. They try to counter this development by providing packages with different services, such as 'triple play', which is a package of internet, telephone, radio and television. By providing combined packages at a lower price, telecom companies try to prevent the loss of clients. More about this can be found in chapter 3 of the current edition.

International

The share of the ICT sector in the value added of the Dutch private sector in 2003 was 9.8 percent, which was higher than the European average, see figure 2.3.2. The average of the EU-15 in 2003 was well over 8 percent. Of the large European countries (Germany, France and the UK) only the UK is well above the EU average. At the absolute top is Finland, where the ICT sector in 2003 contributed almost 15 percent to the value added of the total private sector. In the period 1995–2003 this country was also the fastest grower, as the importance of the ICT sector in the economy increased from over 8 to nearly 15 percent. In all countries, in fact, the share

of the ICT sector in the private sector increased between 1995 and 2003. The lowest growth rates were found in Denmark, France and Japan.

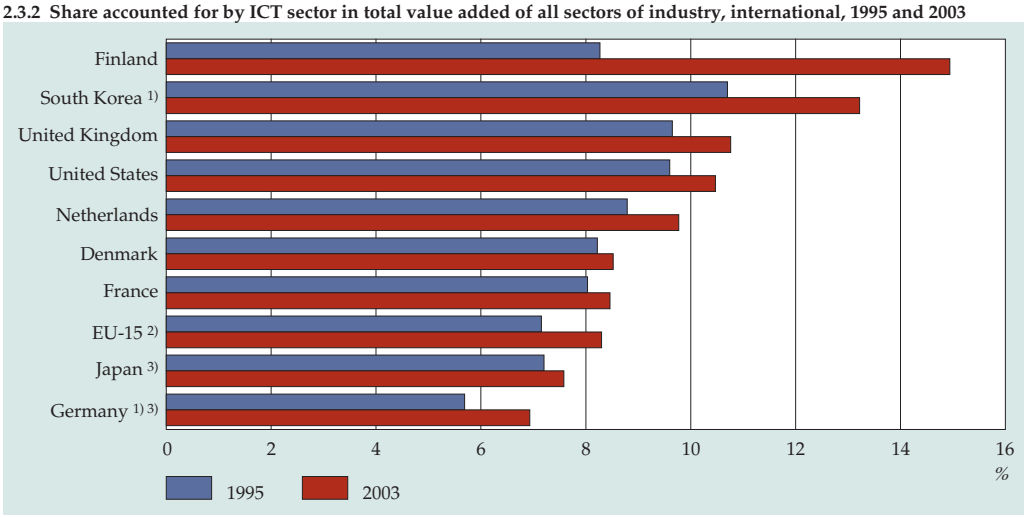
The size of the ICT sector in a country is important economically. The international ICT market is still growing fast, and a strong domestic ICT sector makes it possible to benefit from the growth. This applies mainly for the ICT industry sector selling ICT goods on the international market. The market for ICT services focuses mainly on the domestic market, but this is changing. This is due to outsourcing and offshoring, terms discussed in paragraph 2.10. Secondly, the size of the domestic ICT sector is positively correlated with R&D expenditure. Greater R&D-expenditure generally eventually results in faster economic growth.

Not only the size of the ICT sector is important, but also the set-up. In Finland, South Korea and Japan the domestic ICT sector is dominated by the ICT industry. In France, Germany, Denmark and the Netherlands the ICT services sector is the most important (OECD, 2002). In general R&D intensity in the ICT industry is greater than in the ICT services sector (see also paragraph 2.5). On the other hand, the growth of the ICT sector was mainly caused by the services over the last decade.

Steady increase in the share of the ICT companies

The increased importance of the ICT sector is also shown by the rising number of companies in the sector. The share ICT companies in the total number of companies nearly doubled since 1995. Figure 2.3.3 shows the steady upward trend between 1995 and 2004. In 2005, the share of ICT companies in the total dropped for the first time since 1995. The gradual development of the total figure, however, hides much

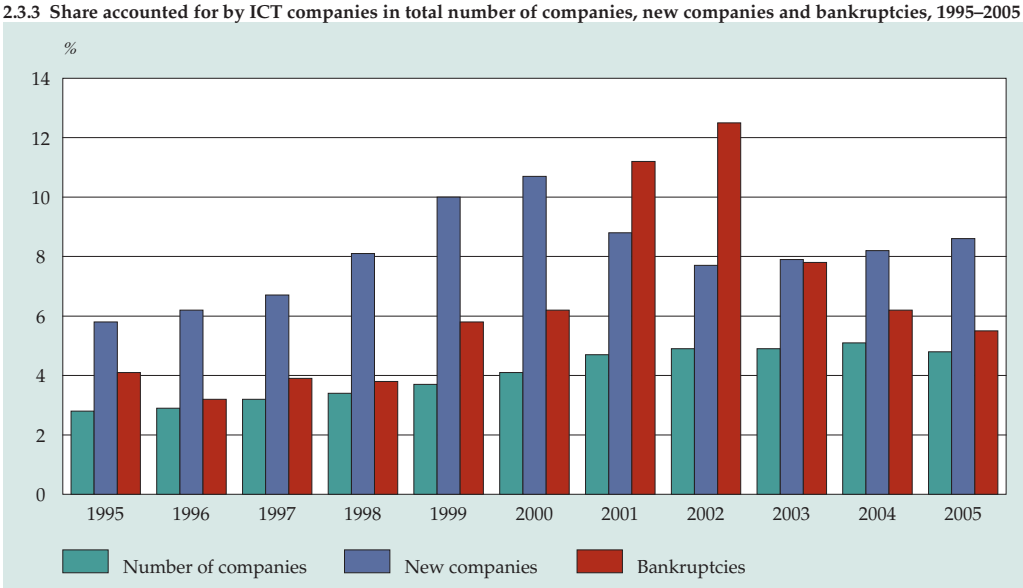
2.3.2 Share accounted for by ICT sector in total value added of all sectors of industry, international, 1995 and 2003



1) Figures on lease of ICT goods are not available.
2) Excluding Luxembourg.
3) Figures on wholesale of ICT goods are not available.

Source: OECD, Information Technology Outlook 2006.

2.3.3 Share accounted for by ICT companies in total number of companies, new companies and bankruptcies, 1995–2005



Source: Statistics Netherlands.

of the underlying dynamics. The dynamics are shown by the high percentage of births and bankruptcies of companies in this sector. The development of the number of ICT companies is mainly dominated by computer service bureaus. The almost continuous increase in the number of companies in the last 10 years did not result in more employment in the ICT sector. The newly started companies in the ICT sector are often small, and the employment they create is no match for the job losses at major companies.

The development of the share of the ICT companies in the total (see figure 2.3.3) is a good measure for how things are going in the ICT sector. Until the end of 2000 things went well in the sector and the number of starting companies grew continuously. In 2001 and 2002 this changed. The number of births fell and many more companies went bankrupt. In 2003 it stabilised. In 2004 and 2005 the percentage of starters rose above the percentage of bankruptcies. Since the number of companies outside the ICT sector in 2005 grew faster, relatively speaking, the share of the ICT sector in total fell. The absolute number of starters in the ICT sector was always much greater than the number of bankruptcies. In the period 1995–2005, the number of starts was over eight times greater than the number of bankruptcies.

The hefty increase in the number of bankruptcies in the economic slump of 2001 and 2002 was mainly caused by young companies. In 2001 almost 40 percent of all bankruptcies in the ICT services sector was caused by companies that had existed for less than three years, as opposed to 25 percent for the whole Dutch private sector. Part of the development can be explained by the low threshold for starting in the ICT

services sector. This threshold, including costs, to start a company in the ICT services sector is lower than for an industrial company. The internet hype apparently attracted a few too many 'gold diggers'.

2.4 ICT expenditure

In the previous paragraph we discussed characteristics of the ICT sector like production value, gross value added and investments. In this paragraph we look at clients of the ICT sector. Domestic expenditure on ICT goods and services come in three categories:
– investments of companies and government in ICT capital;
– intermediate consumption by companies and government;
– household consumption.

Domestic expenditure on ICT goods and services only partly benefit the domestic ICT sector. ICT services mainly involve the domestic market, that is, companies, households and government in the Netherlands mainly buy services provided by companies located in the Netherlands. This is different for ICT goods. The domestic ICT industry has lost more and more of their market share to foreign imports. Many ICT goods come from abroad so that the development on the demand side and the supply side of the ICT market differ quite a bit.
Domestic expenditure on ICT goods and services in the period 1996–2000 grew fast each year. When the economic climate changed, in 2001, this had consequences for domestic expenditure on ICT goods and services. Between 2001 and 2004 it fell by 2 percent. Investments in ICT capital suffered in particular: between 2001 and 2003 they fell by almost 20 percent. This dip was mainly because the expenditure on electronic networks by the telecom companies fell.
There has been a change in how the domestic expenditure on ICT goods and services is structured in the last decade. The share of the ICT services increased at the expense of ICT goods. Household consumption became more important as well.

Investments in ICT capital

In the period 1995–2000 investments in ICT capital saw an explosive growth of 6.7 to 15.1 billion euro, an increase of more than 125 percent. This was stimulated by the major investments of the telecom companies in laying, expanding and modernising electronic networks for internet and mobile telephone services. These investments have been falling since 2000. Between 2000 and 2003 investments in ICT capital fell by nearly 20 percent. This was mainly because the investments in networks fell by no less than 60 percent between 2000 and 2003. Investments in hardware and software, mainly by the private sector (ICT users), was far more stable in recent years. After a slight decrease investments in computers started picking up in 2002. Investments in software dipped in 2002 and 2003, but recovered in 2004. Two things are noticeable

Table 2.4.1
Investment in ICT capital, 2000–2004

	2001	2002	2003	2004*
	million euro			
Computer hardware	4,368	4,027	4,277	4,558
Software	6,570	6,291	6,148	6,404
Electronic networks	3,873	2,398	1,755	1,970
Total ICT	14,811	12,716	12,180	12,932
Total investment in the Netherlands	94,673	92,862	92,848	93,454
	%			
Computer hardware	29	32	35	35
Software	44	49	50	50
Electronic networks	26	19	14	15
Total ICT	100	100	100	100
% of total investment in the Netherlands	15.6	13.7	13.1	13.8
	% volume change on previous year			
Computer hardware	24.1	7.3	20.5	12.9
Software	4.1	–5.5	–3.7	2.7
Electronic networks	–13.9	–39.1	–26.4	14.6
Total ICT	2.2	–10.5	–0.3	8.0
Total investment in the Netherlands	0.2	–4.5	–1.5	–0.8

Source: Statistics Netherlands, National accounts.

when investments in ICT capital are compared with total investments in the Netherlands. First, the investments in ICT capital fluctuate more than in the total economy. In the late 1990s the rise was explosive, after 2000 the dip was dramatic. The economy as a whole showed a similar development but not as pronounced. In addition, investments in ICT capital are a bit ahead of total investments. In 2004, total investments were still negative whereas more was spend already on ICT capital.

The share of investments in computer hardware in the total investments in ICT capital fell between 1995 and 2004 from 41 to 35 percent. Software on the other hand became more important, with its share rising from 34 percent in 1995 to 50 percent in 2004. Software can be seen as a measure of how advanced ICT use is. New software often means new or improved ICT applications, so it is not surprising that people and companies keep investing in new possibilities of using ICT. The relative

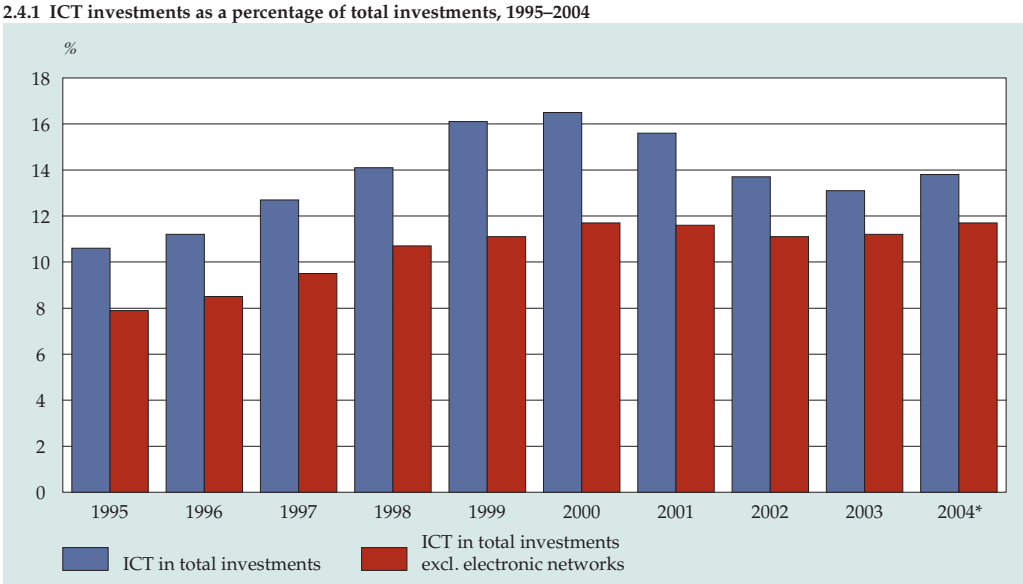
decrease of the importance of computers in the investments is partly caused by the fact that computers rapidly became cheaper in recent years. Investments in networks fell sharply in recent years. In 2000 some 29 percent of the investments in ICT capital was spent on networks. In this period telecom companies spent much money on the roll out of networks. After 2000, the investments in networks dipped to 15 percent in 2004.
The share of the investments in ICT capital in total investments increased from 10.6 percent in 1995 to 16.5 percent in 2000. After 2000 this share fell somewhat to almost 14 percent in 2004 (more information can be found in the statistical annex on the internet, see www.cbs.nl/digitale-economie).

The current economic recovery is expected to bring further increases in the investments in computers and software. It is harder to predict what the investments in electronic networks will do. These are very specific investments by a limited number of players, so the investments can fluctuate greatly from one year to the next. Furthermore, it is unnecessary to invest as much each year in modernising existing networks and creating new networks.

ICT investments important for the economy

The share of the ICT investments in the total investments fluctuated in the period 1995–2004, see figure 2.4.1. Between 1995 and 2000 the share increased from 10.6 to 16.5 percent, followed by a dip to 13.1 percent in 2003, and after that a recovery. The investments in electronic networks actually distort the picture because they were

2.4.1 ICT investments as a percentage of total investments, 1995–2004

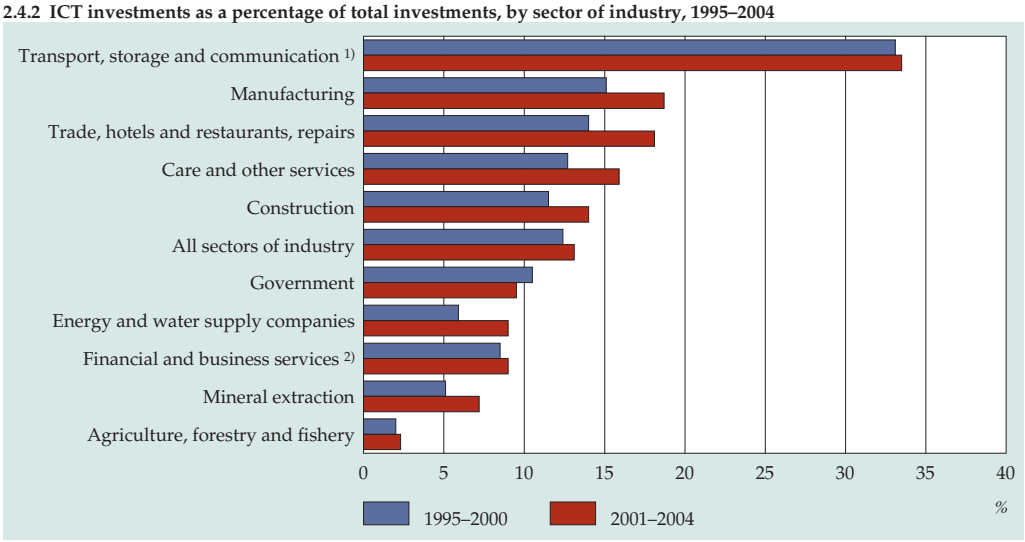


Source: Statistics Netherlands, National accounts.

huge in 1999 and 2000, taking up about 5 percent of the total investments of the Netherlands. When the investments in electronic networks are left out of the equation we see the underlying trend. This is that (excluding networks) the investments in ICT capital as of 2000 saw a rather limited decrease, hovering around an 11 to 12 percent share. During this economic dip, the investments in ICT capital (excluding electronic networks) suffered no more than investments in other capital goods, such as business real estate, machinery and means of transport.

The share of ICT investments in total investments differs substantially per sector of industry. The sector of industry transport, storage and communication scores highest. In the period 2001–2004 the share of the ICT investments in this sector of industry was close to 34 percent, see figure 2.4.2. It is not surprising that this sector of industry scores relatively high in ICT investments, since telecom companies and computer service bureaus, where ICT investments make up the lion's share of the total, belong to it. The share of ICT investments of computer service bureaus is close to 80 percent, and for telecom companies it is even close to 90 percent. Other sectors of industry with above average ICT investments in the total are industry, trade, hotels and restaurants and repairs, health care and social work and other services, and finally construction. They stay at quite a distance, since the share of the ICT investments of the four latter sectors is just half of those in the sector transport, storage and communication.
Lagging behind are mining and extraction and agriculture, forestry and fishing. In the latter only 2.3 percent of the total investments are in ICT goods and services.

2.4.2 ICT investments as a percentage of total investments, by sector of industry, 1995–2004



1) Including post and telecommunication.
2) Including computer service bureaus.

Source: Statistics Netherlands, National accounts.

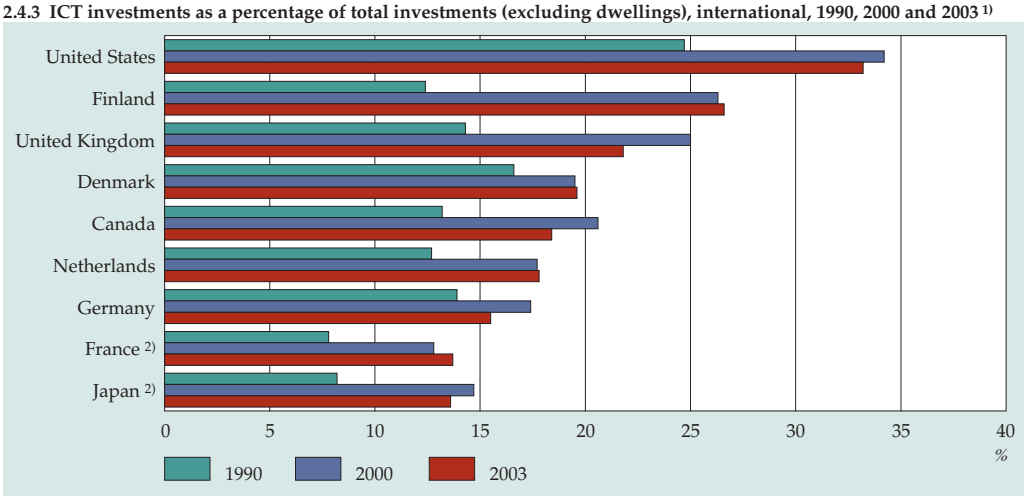
The share of ICT investments in the total has clearly increased in the past decade. Except for government where the percentage in the period 2001–2004 was lower than in the period 1995–2000, the rest of the sectors of industry showed increases. Extraction and energy, water and gas supply companies were the fastest growing sectors. Except for the specific investments in electronic networks, the ICT investments are now a structural part of the total investments of Dutch companies, moving in line with the general fluctuations in the levels of investment. However, they are certainly not the first category to be cut.

The Netherlands in the middle internationally

When looking at the trends of a number of selected benchmark countries we see the same development of the share of ICT investments in the total. The share of the ICT investments has increased since 1990 in all countries observed. The USA is the first in ICT investments where, in 2003, a third of all investments consisted of ICT goods and services. At the top in ICT investments within Europe were Finland with almost 27 percent and the UK with almost 22 percent. The Netherlands takes a middle position within the benchmark countries. The situation was quite different in 1980, when the Netherlands and Germany were among the front runners right behind the USA. However, both lost the advantage.

The economic life of ICT investments is short compared to other capital goods. ICT investments from the 1980s and 1990s have evaporated completely. A country must keep investing in ICT to have the latest hardware and software available.

2.4.3 ICT investments as a percentage of total investments (excluding dwellings), international, 1990, 2000 and 2003 [1)]



[1)] ICT hardware is defined here as computers, office machines and communication equipment; software comprises purchased and self-engineered software. Software investments in Japan are probably underestimated because of different methods used there.
[2)] 2002.

Source: OECD

Intermediary use and consumption of ICT goods and services

The investments in ICT capital by companies and government form part of the total amount in the Netherlands spent on ICT. Intermediary consumption by companies and government (such as expenditure for the maintenance of hardware, IT consultancy etc.) and consumption of households are included.

The ICT expenditure (intermediary and final consumption) in 2005 was almost 2.5 times as high as 10 years before. The ICT expenditure on goods and services rose explosively between 1996 and 2000, tapering off as a consequence of the economic dip, but ICT expenditure kept rising until the end of 2003. In 2004 there was a modest decrease. When comparing the ICT expenditure of 2005 with 1995 we see two shifts. First, the share of the ICT services rose further. In 1995 57 percent of ICT expenditure consisted of services, in 2005 this had risen to 74 percent. The share of household consumption increased from 25 percent in 1995 to 29 percent 10 years later. Household expenditure on ICT goods (mobile telephones, televisions, digital cameras and of course computers) and on ICT services rose in the past decade.

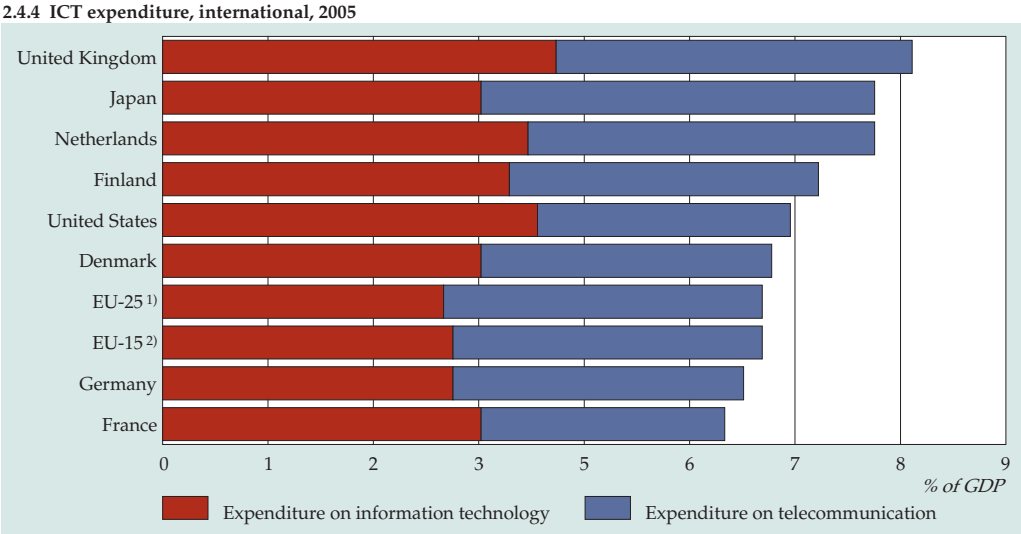
Table 2.4.2
Intermediate consumption and consumption of ICT goods and services, 2001–2005

	2001	2002	2003	2004*	2005*
	million euro				
Total ICT expenditure [1]	41,183	42,926	43,120	41,426	41,431
Intermediate consumption	30,351	31,083	30,838	29,227	29,293
Consumption	10,832	11,843	12,282	12,199	12,138
Total ICT goods [1]	12,799	13,147	12,639	11,052	10,731
Intermediate consumption	9,623	9,931	9,523	8,148	7,883
Consumption	3,176	3,216	3,116	2,904	2,848
Total ICT services	28,384	29,779	30,481	30,374	30,700
Intermediate consumption	20,728	21,152	21,315	21,079	21,410
Consumption	7,656	8,627	9,166	9,295	9,290
	% volume change on previous year				
Total ICT expenditure [1]	9.7	6.2	2.0	–1.5	2.7
Intermediate consumption	9.1	5.3	1.2	–2.9	2.3
Consumption	11.4	8.7	4.2	2.1	3.5
Total ICT goods [1]	1.7	6.7	2.0	–5.7	4.5
Intermediate consumption	0.4	5.9	0.4	–9.1	2.7
Consumption	5.9	9.0	7.0	4.6	9.5
Total ICT services	13.7	6.0	2.0	0.3	2.0
Intermediate consumption	13.7	5.1	1.5	–0.1	2.2
Consumption	13.8	8.6	3.2	1.3	1.6

[1] 2004 and 2005 are estimates.

Source: Statistics Netherlands, National accounts.

2.4.4 ICT expenditure, international, 2005



1) Excluding Cyprus and Malta.
2) Excluding Luxembourg.

Source: OECD.

The volume growth shows a shift from intermediary use to consumption too. In addition, the shift from ICT goods to services can be seen. The volume growth of ICT goods in the last five years was clearly lower than that in the ICT services. The rise in services was partly due to the popularity of the telecom services. The growing use of the internet and mobile telephones (mainly by consumers) generates much data exchange, leading to more expenditure on telecom services and an increase in the share of the consumption in total ICT expenditure.

ICT expenditure compared internationally

The total ICT expenditure (investments, intermediary use and consumption) in the Netherlands are high, internationally speaking. In 2005 only the UK and Japan had more ICT expenditure. In most countries expenditure for information technology and for communication technology are about equal. France, the USA and Japan are exceptions. In the first two countries the share of the information technology is much higher whereas in Japan most is spent on means of communication. The share of the ICT expenditure in the European GDP was 6.4 percent in 2005. In most benchmark countries the share of ICT expenditure in GDP has been quite stable in recent years.

2.5 *R&D expenditure of the ICT sector*

Research and development (R&D) is important in creating knowledge. R&D may lead to innovations that make it possible for companies to work more efficiently or

market new products. Such innovations may be patented. In paragraph 2.6 we provide more information on ICT patents. R&D and innovation can generate a lot of earning potential. A country or sector of industry that can make efficient use of structural R&D activities will regularly see innovations. This is good for competition. One alternative is to use innovations by others. Companies may have to pay for the use of these, for instance by buying licences, or being able to use an innovation well after it has been released. In this way companies are more dependent on the indirect 'purchases' of know-how. There is a danger, however, in this approach since companies found it very hard to restart R&D activities successfully after years of neglect. Expenditure on R&D is a standard for the level of ambition of a country or a sector of industry.

Table 2.5.1
R&D expenditure (own personnel) by companies in the ICT sector and in other sectors, 1996–2004[1)]

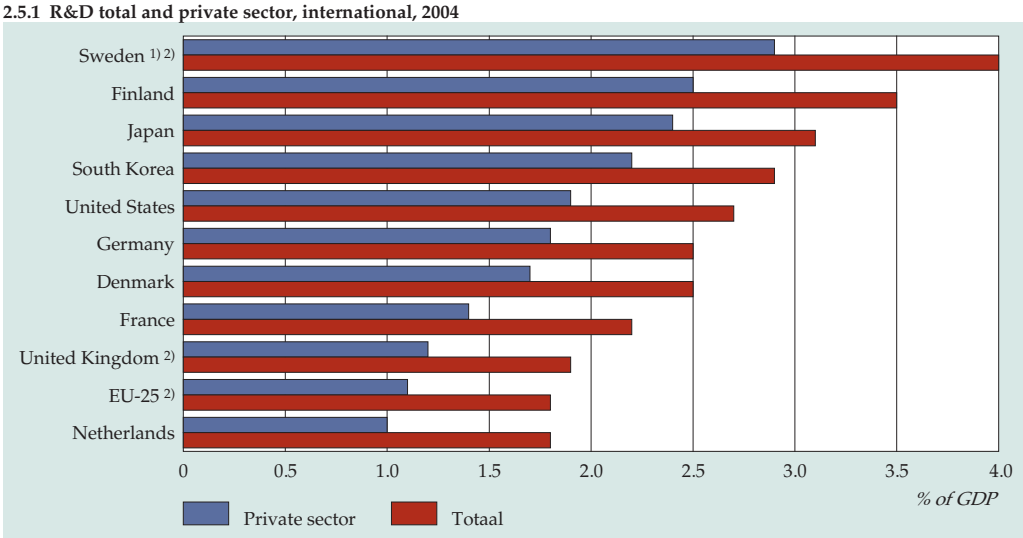
	1996	1997	1998	1999	2000	2001	2002	2003	2004
	index (1995=100)								
Total ICT sector	112.5	119.6	115.7	135.8	161.9	170.6	159.2	163.4	141.3
ICT industry sector	108.7	113.6	111.4	128.3	143.8	150.9	142.5	155.2	137.1
ICT services sector	149.0	178.1	158.3	209.4	338.9	363.3	322.5	244.8	183.6
Other sectors	103.9	118.2	120.4	136.3	132.7	140.6	138.1	148.5	170.6
Total private sector Netherlands	106.7	118.7	118.8	136.2	142.4	150.5	145.1	153.4	160.9

[1)] Companies with 10 or more employees (1996–2001)/employed persons (2002–2004).

Source: Statistics Netherlands, Survey R&D and Innovation by companies.

One aim in the Lisbon agreement is that 3 percent of the gross domestic product (GDP) in 2010 should be spent on R&D. Two thirds should come from the private sector. Currently it looks like the Netherlands will not make the 3 percent target in 2010. In 2004 R&D expenditure was 1.8 percent of the GDP. This is a drop compared to 1995. The percentage of R&D expenditure by the Netherlands is just under the EU-25 average. Some major European countries (like the UK and France) will also have to work hard to be able to meet the Lisbon target by 2010. Top performers in Europe are Sweden and Finland, see figure 2.5.1. In 2004, the shares of the R&D expenditure, in terms of the GDP in these countries, were 4.0 and 3.5 percent. The share of the private sector in the total R&D of a country internationally is about 65 to 70 percent. In 2004 South Korea was the positive exception, where 76 percent of its R&D was performed by the private sector. The Netherlands was at the other side of the spectre, where only 58 percent of the R&D was executed by the private sector in 2004. The rest was done by research institutions and the universities.

2.5.1 R&D total and private sector, international, 2004



1) For private sector R&D 2003 instead of 2004.
2) For total R&D 2003 instead of 2004.

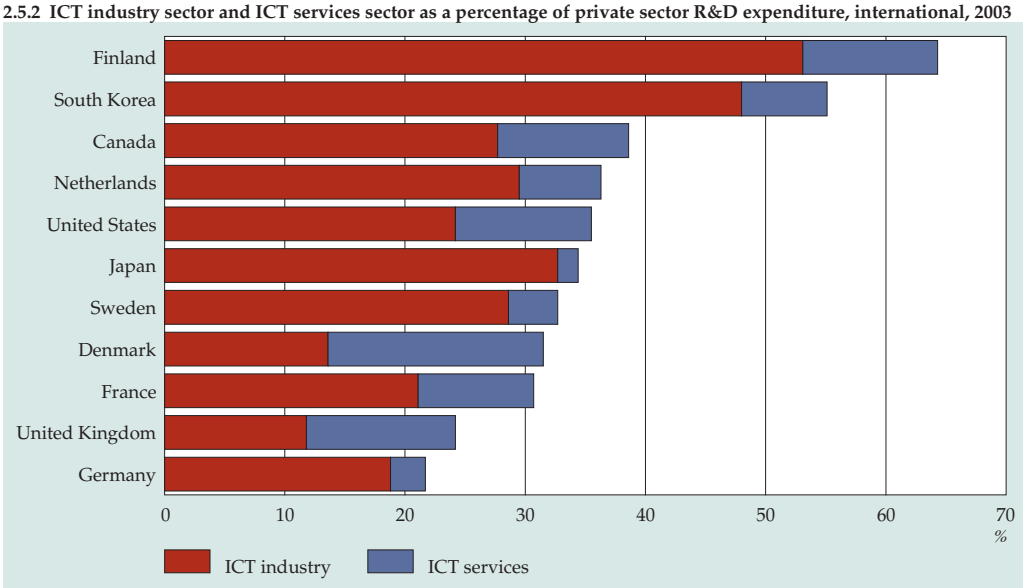
Source: OECD, MSTI 2006-1.

R&D expenditure by the ICT sector

The ICT sector traditionally has a relatively large share in the total R&D expenditure of the Dutch private sector. The share of the ICT sector in the value added of the Dutch private sector in 2005 was 5 percent, while the share in the total R&D expenditure was over 29 percent. This share increased fast in the period 1995 through 2004. One explanation is that the ICT sector is more R&D-intensive than the rest of the private sector. As the ICT sector grew, so did the share in the R&D expenditure of the private sector. In the Netherlands much (over 81 percent in 2003) of the R&D expenditure of the ICT sector was paid by the ICT industry. When these figures are compared internationally, it turns out that the ICT industry in the ICT sector in most countries takes up most of the R&D expenditure. Exceptions are Denmark and the UK, where most R&D expenditure is paid by the ICT services sector. In all benchmark countries, the share of the ICT sector in the total R&D expenditure of the private sector has increased since 1995. The development of the total R&D expenditure between 1995 and 2004 differs for the various benchmark countries. On balance, this results in a slight increase of the OECD average. In the Netherlands the share of the total R&D expenditure in terms of GDP fell slightly during this period.

The share of the ICT services sector in the Dutch R&D expenditure increased in recent years. This increase is due to computer service bureaus rather than the technological telecom sector. This implies that there has been an increase in R&D activities in ICT applications in recent years. However, R&D expenditure of the

2.5.2 ICT industry sector and ICT services sector as a percentage of private sector R&D expenditure, international, 2003



Source: OECD.

ICT-services sector seems to be more sensitive to economic fluctuations than the R&D expenditure of the ICT industry.

The R&D activities of the companies in the ICT sector need not necessarily be fully in ICT. Moreover, non-ICT companies can also engage in R&D activities in the area of ICT. Several universities and institutions have R&D in the technology domain of ICT. The last time companies were asked to classify their staff working in R&D by area of technology was in 2001. At the time three quarters of the R&D in the area of technology information technology was realised by the ICT sector, a fifth was done by companies outside the ICT sector, while universities and institutions accounted for about 5 percent of the total (CBS, 2004).

Increasing R&D expenditure in the ICT services sector

The developments outlined above can be found internationally as well. Since 1995, in all benchmark countries, the share in R&D expenditure of the ICT services sector within the ICT sector has increased. In Denmark and the UK the share of the ICT services sector in the R&D expenditure of the ICT sector was over 50 percent in 2003. In various other benchmark countries the share of the ICT services sector was very low though: Sweden, South Korea, Germany, Finland and the Netherlands all had ICT services sectors with a share of less than 20 percent in the total R&D expenditure of the ICT sector. However, in these countries the share of the ICT services sector is also on the increase.

The R-square concept

R-square, or correlation efficient, is an indicator of the strength and the direction of a correlation between two variables. The correlation efficient varies between 0 (no correlation) and 1 (perfect correlation). The further R-square is from 0, the more accurate one can predict the outcome of one variable based on the other variable.

A common correlation classification is:
– Weak: 0.1–0.25;
– Moderate: 0.25–0.50;
– Strong: > 0.50.

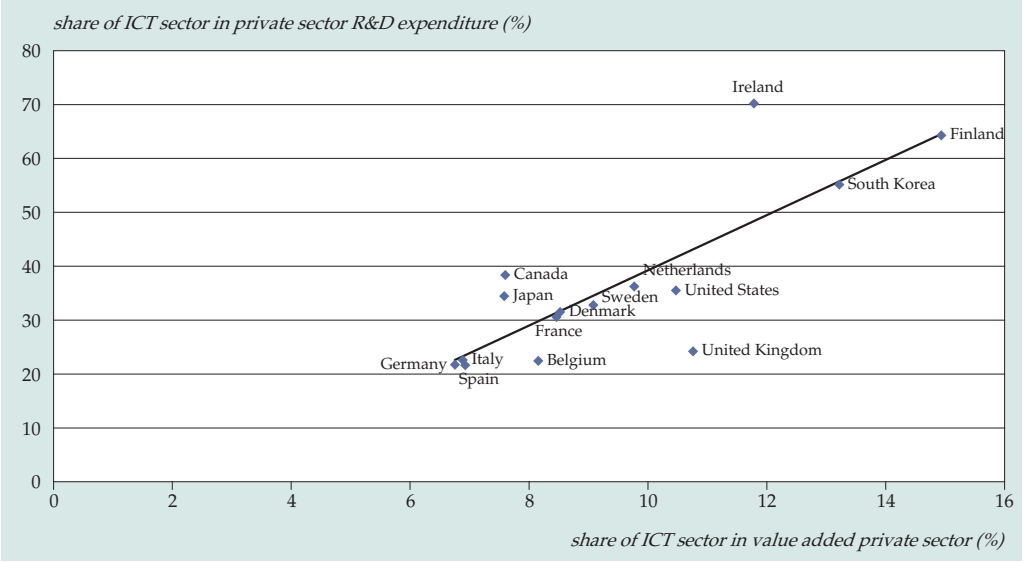
There are reasons to be careful in using the results. The exact interpretation of R-square of a correlation depends on the context and the aim of the analysis. For instance, in measuring a law of nature with precision instruments an R-square of 0.9 may be very low, whereas that value would be considered very high in other analyses.

In figure 2.5.3 the share of the value added of the ICT sector in the domestic private sector is plotted against the share of the ICT sector in the total R&D expenditure of that very same domestic private sector. It shows that the ICT sector is a R&D-intensive sector: the contribution of the ICT sector to R&D expenditure in a country is always larger than its contribution to the economy. Although there are differences between the selected benchmark countries, there is a clear correlation between the two variables (R^2=0.66). The trend line shows the average correlation between the variables for the selected countries.

Two countries, Ireland and the UK, stand out in the figure, because they deviate quite a lot from the trend line. Ireland is well above the line. This means that the R&D expenditure of the ICT sector is higher than expected on the basis of size. One explanation is that many foreign companies, mainly American, are located in Ireland. So R&D is partly imported and not assigned to the domestic ICT sector. The rise of the multinationals means that the location where the R&D activities take place is increasingly divorced from the place production takes place. These decisions by large multinationals influence how the ICT sector is statistically described. The R&D activities of the ICT sector often take place in a Western country, whereas the output is realised elsewhere.

On the other end of the spectre we see the UK where the R&D expenditure of the ICT sector is relatively low. This may be due to the large share of the services in the British ICT sector. In general the R&D intensity of ICT services is lower, which is what pushes the average of the UK down.

2.5.3 Size of ICT sector versus R&D expenditure of ICT sector, international, 2003



Source: OECD.

2.6 ICT and patents

R&D may lead to new inventions, which can be protected by patents, as discussed in the previous paragraph. In this paragraph we describe the developments in the area of patents. The patent offices of the three main economic regions are: the European Patent Office (EPO), the United States Patent and Trademark Office (USPTO) and the Japanese patent office. In this paragraph we discuss patent applications in Europe and the USA, and patent submitted to all three offices, the triad patents.

There are various ways of calculating patents. The OECD looks at patents granted while Eurostat looks at patent applications. Both look at the year in which the first patent application for the invention was made anywhere in the world. These figures only become known after several years, because it takes time to grant a patent. [3)] The figures of the patents submitted are slightly higher than those of the patents granted. This is logical because applying for a patent is expensive, so companies and individuals will only apply when they are almost sure that it will be granted. The applications and patents granted show how innovative a country is.

The number of patent applications has grown over the last decades. Moreover, ICT patents make up more of the total. In 2002 almost half of the European patents that the Dutch applied for were ICT inventions. In 1977 this was only 13 percent.

Patent applications rising

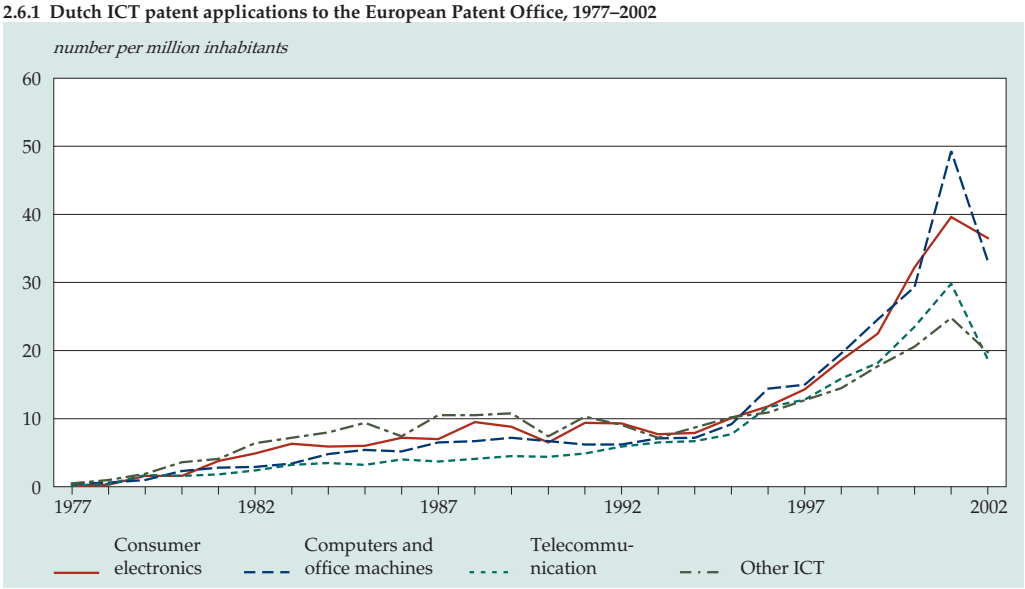
In 1977 there were 9 patent applications per million inhabitants at EPO by the Dutch, while currently there are about 250. Growth has speeded up since the mid nineties, but in 2002 the number of patent applications fell. The final 2003 figures are not available yet, but it looks like there is another increase.

Almost half of the patent applications of the Netherlands have to do with ICT. ICT patents are divided into four groups: consumer electronics, computers and office equipment, telecommunication, and the group 'other'. The last group includes measuring equipment, traffic control systems and semiconductors. The Netherlands is active in all four areas. In recent years most patent applications involve consumer electronics and 'computers and office equipment' and less are in the other two areas (see figure 2.6.1). Since the mid nineties there has been a substantial increase in patent applications for ICT. Until 1995 a maximum of about 10 patent applications (per million inhabitants) a year were made for each of the four groups. In the top year 2001 this was 40 (consumer electronics), 49 (computers and office equipment), 30 (telecommunications) and 25 (other).

Relatively many European patents for the Netherlands

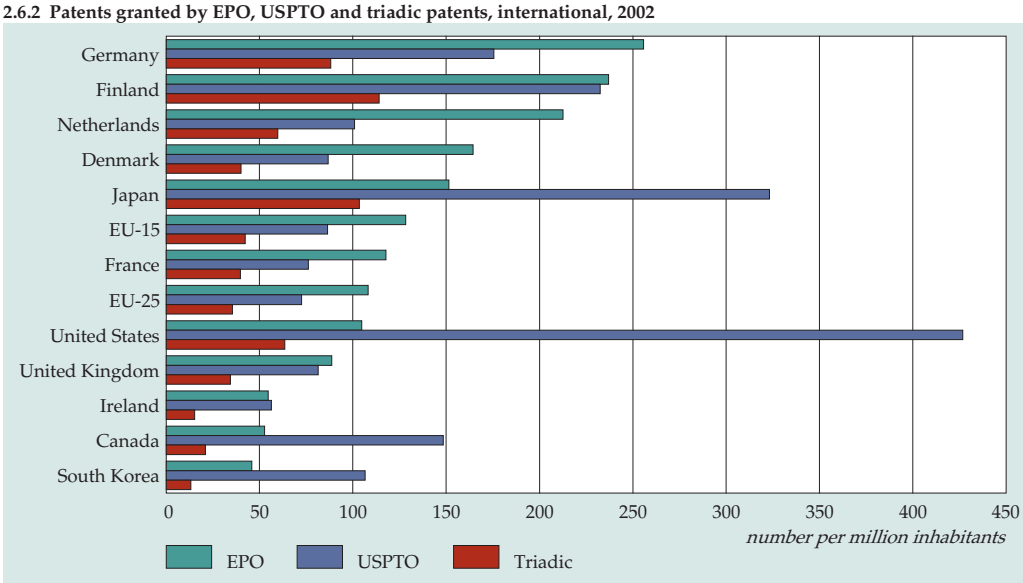
Figure 2.6.2 shows that Dutch companies have relatively many European patents. Only Germans and Fins have more. Of the European countries the inhabitants of the UK and Ireland have relatively few patents, possibly because they do not see the need to protect their inventions in this manner. The US has most American patents.

2.6.1 Dutch ICT patent applications to the European Patent Office, 1977–2002



Source: Eurostat.

2.6.2 Patents granted by EPO, USPTO and triadic patents, international, 2002



Source: OECD, Compendium of patent statistics, 2005.

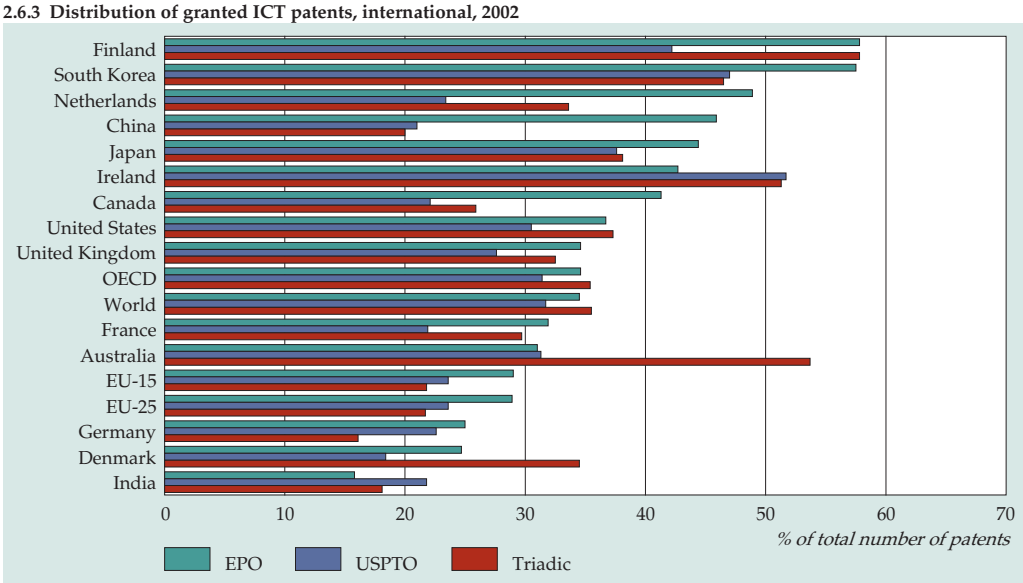
The Japanese also have American patents, since the USA is a major trading partner for Japan. Canada and South Korea apply also for more US than European patents. Remarkable in the list is Ireland, which, as a European country, has more US patents than European ones. One explanation is that Ireland is a popular location for US ICT companies. These are companies focusing more on the domestic US market.

Finland and Japan are the front runners in triad patents. For most European countries the number of triad patents is barely a third of the number of European patents. The Japanese market is less important for Europe. South Korea also has relatively few triad patents. Apparently the US market is more important for South Korea than the Japanese market.

Finland ahead in European ICT patents

Finland is the country that in terms of European patents concentrates most on ICT. The Netherlands comes second. Of the emerging economies China is the most active in ICT, especially for the European patents. India has a reputation as an ICT country, but the patents they apply for deal mainly with other topics and just 20 percent concerns ICT inventions. Within Europe, Germany and Denmark have a low share of ICT patents. This does not mean that these countries do not do much in ICT, because figure 2.6.2 shows that these countries apply for relatively many patents. When the number of ICT patents per million inhabitants is calculated, Finland and the Netherlands are at the top, while Germany and Denmark follow as the European countries with the most European ICT patents.

2.6.3 Distribution of granted ICT patents, international, 2002

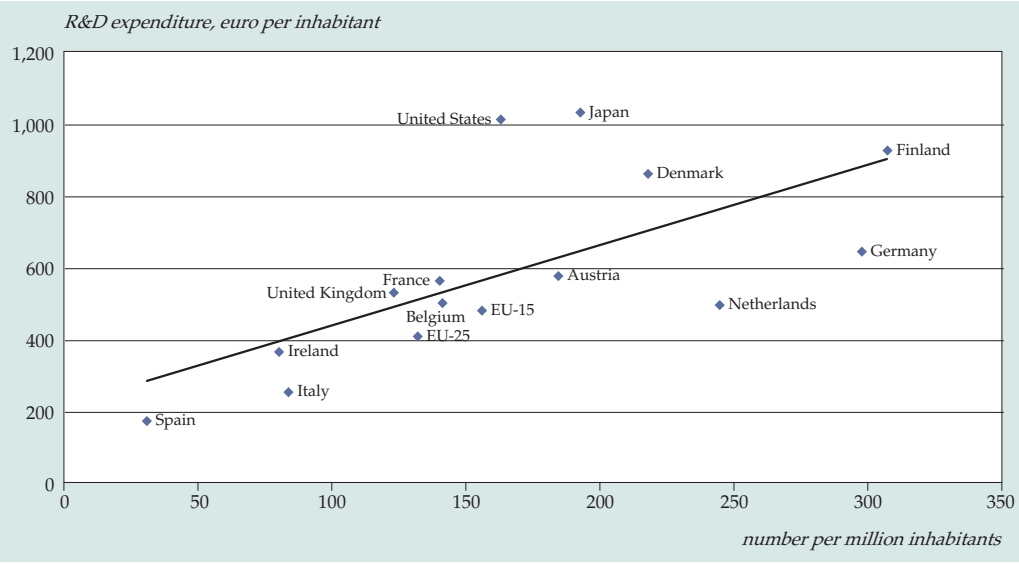


Source: OECD, Patent database.

Finland: many patents, much R&D

There is a clear link between R&D expenditure and applications for European patents. The US and Japan naturally mostly have patents in their own countries and fewer European patents, but these countries have extensive R&D expenditure, which makes them stand out in the figure below. Within Europe, Finland performs

2.6.4 European patent applications and R&D expenditure, international, 2002



Source: Eurostat.

best with many patents and much R&D expenditure. For European countries there is a strong link between R&D and European patent applications (R^2=0.7). This means that the differences in R&D expenditure can explain 70 percent of the variance in the number of patents. The Netherlands and Germany are well below the line, with relatively many patents linked to low R&D expenditure. This may mean that the R&D in these countries is very efficiently done, or that there is a culture of applying for patents.

2.7 *International trade in ICT*

The international trade flows in ICT goods are huge. Since these goods can be transported in large quantities, production pretty much takes place in countries where costs and wages are lowest. There is a lot of international competition on this market. For example: in 1996 some 71 percent of the global production of ICT goods took place in the OECD countries. In 2004 this was down to 58 percent. In the same period the value of worldwide ICT imports (expressed in US dollars) grew by 72 percent. Shifting production leads to more international trade, because the markets supplied do not shift to the same extent (OECD, 2004b).

Table 2.7.1
Imports and exports of ICT goods and services, 1995–2005

	1995	2001	2002	2003	2004*	2005*
	million euro					
Imports						
ICT goods	21,702	56,013	48,956	48,649	54,368	57,090
ICT services	2,223	5,100	4,947	5,201	5,324	5,515
Exports						
ICT goods	4,505	7,131	6,092	6,263	5,769	5,638
ICT services	2,176	6,022	5,638	6,016	6,171	6,571
Re-exports						
ICT goods	15,421	48,534	43,548	42,883	48,566	53,056
ICT services [1)]	94	433	457	439	581	559
	%					
Composition of exports of ICT goods and services:						
ICT goods	20	11	11	11	9	9
ICT services	10	10	10	11	10	10
Re-exports	70	79	79	78	80	81
Total	100	100	100	100	100	100
Share of ICT goods and services in:						
Total imports	14.6	22.2	20.1	19.9	20.6	19.9
Total exports	3.7	4.4	3.9	4.1	3.7	3.5
Total re-exports	31.6	46.1	43.7	41.4	42.0	41.5

[1)] In practice only software on CD-ROM/tape.

Most ICT services are still produced in the (geographical) market where they are purchased, but this is also changing. The influence of outsourcing and offshoring is growing rapidly. We will discuss the globalisation of the ICT sector in paragraph 2.10.

Imports and exports by the Netherlands

The Netherlands has clearly benefited in the last decade from the blossoming international trade in ICT goods and services. The import value of these goods in the period 1995–2005 increased from 23.9 to 62.6 billion euro. The value of the total exports (including re-exports) almost tripled in the same period. Although the import and export volume of ICT services is much smaller than that of ICT goods, the ICT services show sharp increases. The international trade in ICT services, for instance, is hiring foreign computer service bureaus to supply computer services (offshore outsourcing; see also paragraph 2.10). There is also the use of networks of foreign (mobile) telephone suppliers for handling international telephone traffic. International competition in outsourcing/offshoring is also on the rise in the market for ICT services. Given the expected developments, the share of ICT services in total imports and exports of ICT goods and services will probably increase in the near future. The Dutch trade balance of imports and exports of ICT services was over a billion euro positive in 2005.

The Netherlands as a re-exporter

At first glance the import and export figures of the Netherlands (particularly of ICT goods) paint a rather distorted picture. Most ICT goods imported by the Netherlands are intended for re-exports. These are goods that undergo minimal processing (such as repacking computers from containers into boxes) and are subsequently re-exported to the final country of destination. Over 90 percent of the total exports of ICT goods in 2005 consisted of re-exports. The last 10 years saw an increase in the share of re-exports at the expense of Dutch manufactured ICT goods. Although the Netherlands makes money on re-exports, it is far less than on Dutch produced goods. The Centraal Economisch Plan 2002 of the CPB shows that the value added of the export of domestic products is about 65 percent, as compared to 10 percent for re-exports. In other words: per unit of domestic product it takes 6.5 units of re-exports to get the same economic effect. Most money in re-exports is made in trade and transport margins.

The share of ICT goods and services in total re-exports also shows that the Netherlands is a real transition country for ICT: in 1995 it was almost 32 percent. Over the next ten years the share of Dutch re-exports of ICT goods and services only increased. In the last few years this percentage was reasonably stable at just over 40 percent. All this leads to the somewhat curious conclusion that it is not the Dutch ICT industry that benefits from the enormous growth in international trade in ICT goods, but rather the Dutch trade and transport sector.

International

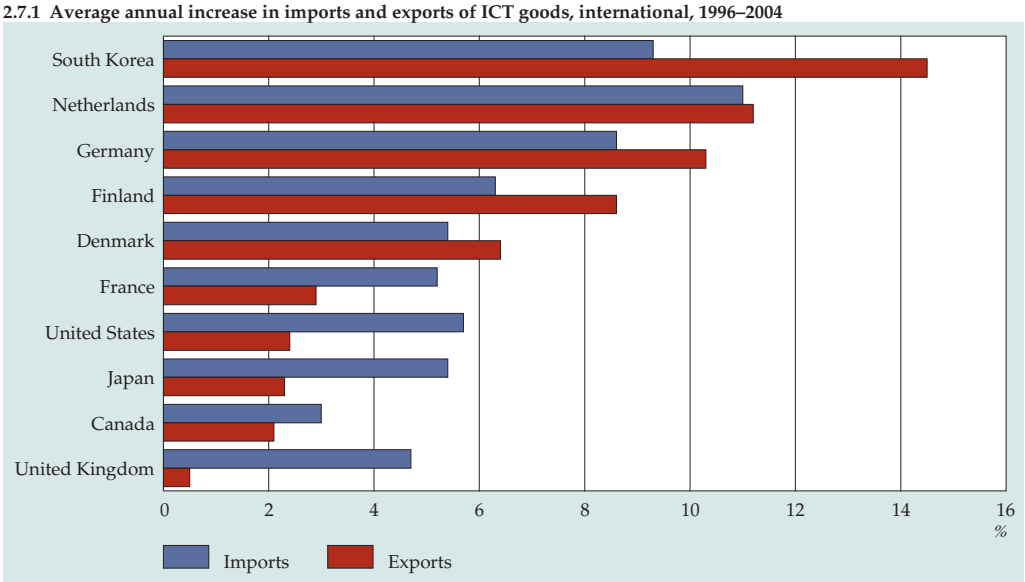
We sketch the developments in the international trade in ICT goods, software and ICT services in the period 1996–2004. Worldwide the trade in these products grew substantially. We show per country which market realised the highest growth. Was it the trade in ICT goods or the market of ICT services?

We must note that the international trade in ICT goods is many times greater than the value of the traded software and ICT services.

ICT goods

In the past 10 years, the trade in ICT goods worldwide has shown spectacular growth. At the same time it has not become any easier to interpret the developments, mainly due to globalisation. In the case of the Netherlands, re-exports distort the picture. In Ireland much of the export is generated by the production units of foreign companies. So high growth figures are not always a sign that the domestic ICT sector is booming, but they can be made because foreign companies were attracted by the positive business climate. Although in both cases the production, employment and investments in the country increase, the degree to which the economy benefits is much greater in the first than in the second case. In addition, the continuity of foreign company units is a lot less certain. A foreign parent company may decide to move a unit to another country if conditions there are better. However, the ease with which a company unit can be moved depends on the type of work.

2.7.1 Average annual increase in imports and exports of ICT goods, international, 1996–2004



Source: OECD, Information Technology Outlook 2006.

The export growth of South Korea, Germany and the Netherlands in the period 1996–2004 was very high, internationally speaking (see figure 2.7.1) since exports on average grew by over 10 percent a year in this period. Remarkably, the same three countries had the highest import increase in the period 1996–2004 as well. The simultaneous growth of imports and exports of the Netherlands can be explained by the fact that a large part of the imports is destined for re-exports: imports and exports go hand in hand.

In all three countries, exports increased more in the period 1996–2004 than imports. The USA shows the opposite trend, since imports there increased faster than exports in recent years. This is partly because of increasing imports of ICT goods from foreign-based holdings of American parent companies. So in fact these are imports of ICT goods from their 'own' multinational companies, which shifted production from the USA to elsewhere (see also OECD, 2004).

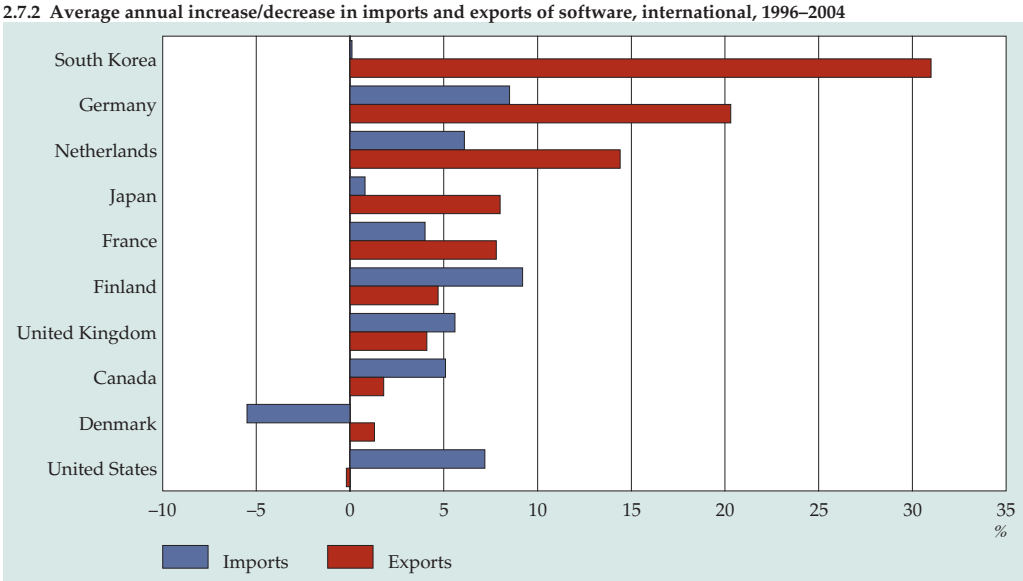
Software

In comparison with the trade in ICT goods the worldwide software market is not yet very impressive, although the growth rate is substantial. Figure 2.7.2 shows that several countries benefit from this in particular. By far the fastest growing country is South Korea where software exports grew from 27 million dollar in 1996 to 231 million in 2004. This is an annual growth rate of no less than 31 percent. Germany, with an annual growth rate averaging over 20 percent, and the Netherlands (+14.4 percent) also performed above average. The software market sees very few re-exports, so in this case Dutch exports do come from the domestic ICT sector. In software US imports also perform much better than exports. The imports of the USA increased by an average of over 7 percent a year in the period 1996–2004. The exports of software in the same period saw a minimal drop.

The figures presented about the software require some explanation. Measuring the international trade in software is complex. In so far as software does not have the character of a good, which is increasingly the case, the trade is only shown to a limited extent in the traditional trade statistics. Furthermore, software is often sold together with hardware. This leads to an overestimate of the hardware traded and an underestimate of the software traded. In addition, the traditional trade statistics cannot deal very well with the trade of a single original of a software application that is multiplied and distributed many times over in the country of destination and income is guaranteed through copyright. On-line trade and supplies in software (downloads for example) are not well observed in the statistics (see also OECD, 2004).

To give an indication of developments in the international trade in (standard) software anyway, the best alternative is observed, namely the trade in the physical software carriers such as CD-ROMs, to at least provide a rough picture of developments in this area.

2.7.2 Average annual increase/decrease in imports and exports of software, international, 1996–2004



Source: OECD, Information Technology Outlook 2006.

ICT services

The last part of the international trade in ICT that we will discuss here involves the ICT services. The market for it is, just as with software, much smaller than that of ICT

2.7.3 Average annual increase/decrease in imports and exports of ICT services, international, 1996–2004

Source: OECD, Information Technology Outlook 2006.

goods. To illustrate this: in 2004 the total trade in ICT services (to and from OECD countries) was 175 billion dollar, whereas the trade in ICT goods in the same year was 1,669 billion dollar. Although the trade value of ICT services is considerably lower, the market does grow very fast. In the period 1996–2004 the average annual growth rate was 13 percent. Countries with above average export growth rates in ICT services in that period are: the Netherlands (averaging 23.5 percent a year), the UK (19.7 percent), France (19.3 percent) and Germany (14.8 percent). In contrast to the exports of ICT goods and software, the export of ICT services of the USA did grow substantially between 1996 and 2004. Furthermore, a number of specialised hardware countries, like Finland, Japan and South Korea, lag behind in the international trade in ICT services.

Conclusions

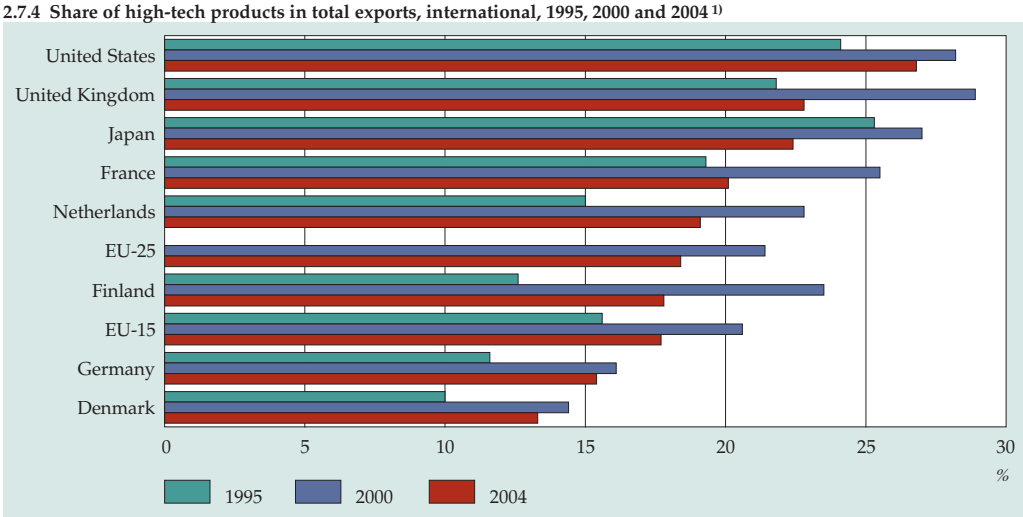
After studying the three figures above, we concluded that the international trade in ICT goods, software and ICT services in the period 1996–2004 saw a substantial increase. Especially in the software and ICT services some countries show growth rates of more than 20 percent a year. Germany and the Netherlands perform well in all three markets. For the Netherlands this is caused by several things. In ICT goods it is the growth rate of re-exports that generated the above average performance for the Netherlands. In software and ICT services there is autonomous growth caused by the domestic ICT sector. South Korea scores well on two of the three markets, with an export growth rate in ICT goods and software that exceeded all other benchmark countries in the period 1996–2004. The explosive development is in sharp contrast with the dip of exports in ICT services as of 1996. One explanation is that the exports of South Korea largely consist of computers and communication equipment. These require software to operate. Such software is increasingly made in South Korea itself.

The study of the three figures also showed that the growth rates of imports and exports of ICT products are a bit higher for the European countries than for the USA, Canada and Japan. Possibly this is due to the single European market, which led to an increase in trade between the European countries.

High-tech products

Another measure for a country's competitive power in the area of R&D-intensive products is the development of the share of high-tech products in total exports. The European countries, but also the USA and Japan, have relatively high wages and must compete in knowledge. This knowledge is used to develop products or production processes with high profit margins. This knowledge-based advantage keeps low-wage countries at bay, because competition on labour costs alone means a great many countries are cheaper than most European countries. So it is a race between knowledge-intensive labour and high wages versus less knowledge-intensive labour and lower wages. The EU has to work hard to maintain the advantages in knowledge.

2.7.4 Share of high-tech products in total exports, international, 1995, 2000 and 2004 [1)]



[1)] High-tech products: products for the aircraft and aerospace industry, computers, office machines, electronics, instruments, pharmaceuticals, electrical machines and weapons. EU exports do not include intra-EU exports.

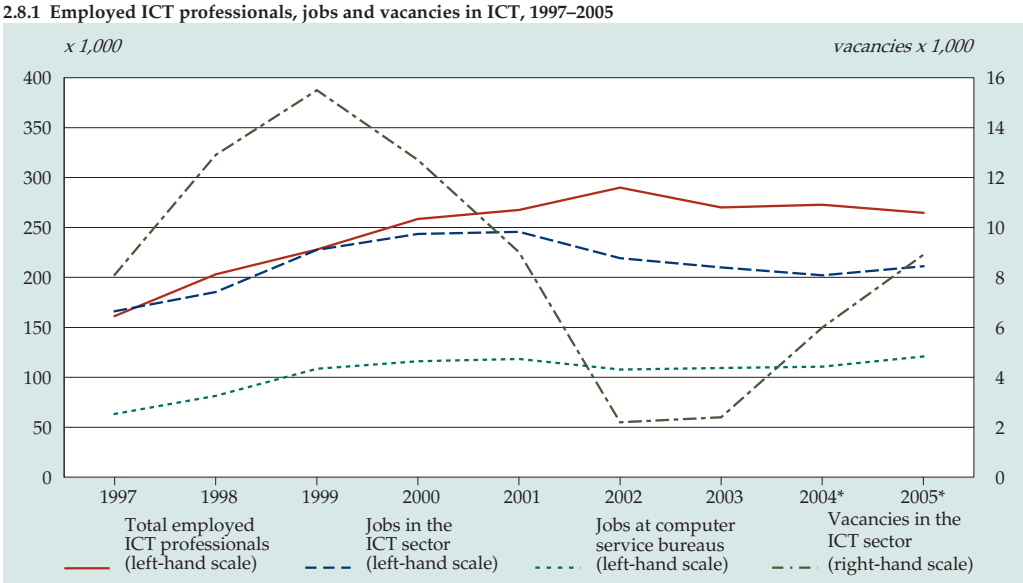
Source: Eurostat.

The share of high-tech products in the total exports of selected benchmark countries shows the same pattern without exception since 1995. Between 1995 and 2000 the share of high-tech products in total exports soared. In 2000 over 25 percent of the exports of the UK, the USA, Japan and France consisted of high-tech products. Once the internet hype had ended, this share fell. In 2004 only US exports still consisted for more than a quarter of high-tech products. The dip between 2000 and 2004 for the entire EU-25 was twice that of the USA. The UK saw the greatest dip, seeing its share of high-tech products fall from 29 to 23 percent between 2000 and 2004.
Finally, the share of high-tech products in the EU-25 is on average slightly higher than in the EU-15. One explanation is the shift of the production of computers and communication equipment to Eastern Europe.

2.8 *ICT and employment*

As we discussed in the previous paragraphs, things are picking up for the ICT sector. This is shown by the number of jobs and the increasing number of vacancies. The total number of ICT professionals employed fell slightly between 2004 and 2005, but there are more jobs in the ICT sector and therefore also in computer service bureaus (part of the ICT sector). The figures on the employed labour force and the total number of vacancies are in the statistical annex, which can be found on the internet at www.cbs.nl/digitale-economie. The number of ICT professionals employed has risen by over 50 percent since 1997, while the total employed labour force increased

2.8.1 Employed ICT professionals, jobs and vacancies in ICT, 1997–2005



Source: Statistics Netherlands, Labour force survey, Labour accounts, Vacancies survey (third quarter).

by a mere 8 percent in the same period. The number of vacancies in the ICT sector is very sensitive to the economic fluctuations. In 2005 the number of vacancies in the ICT sector was again at the level of 1997 (before the high) and 2001 (when the level had started to fall).

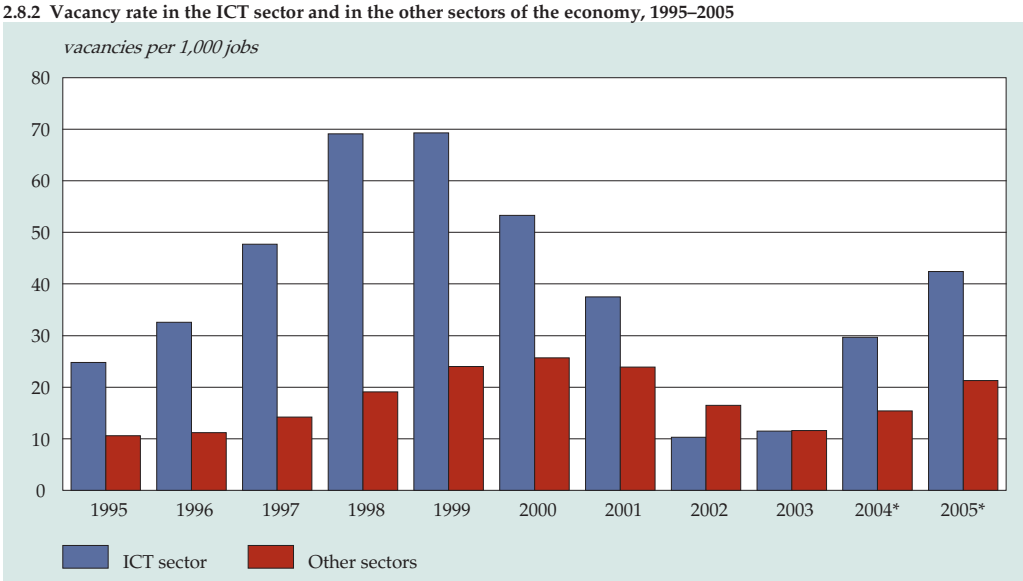
The profile of ICT professionals is different from that of the average Dutch employee on several scores. ICT professionals work more often in steady jobs and far less often as flex workers or independent entrepreneurs. They also often work 35 hours a week or more (85 percent versus 63 percent of the total). The ICT professionals are slightly younger and their level of education is higher than that of the total employed labour force. The greatest difference is in the percentage of women working in these professions: 42 percent of the total employed labour force consists of women, but among ICT professionals this is just 11 percent.

ICT professionals are not spread evenly across the sectors of industry. Computer service bureaus of course employ many ICT professionals: two thirds of their employees are ICT professionals. Financial institutions also employ relatively many ICT professionals (9 percent). The sector agriculture, forestry and fishing hardly employs any ICT professionals, just 0.2 percent.

Vacancies in ICT up again

The number of vacancies per thousand jobs, the vacancy rate, is rising fast in ICT. The vacancy rate is also rising in the rest of the economy, but not as fast. In general,

2.8.2 Vacancy rate in the ICT sector and in the other sectors of the economy, 1995–2005



Source: Statistics Netherlands, Vacancies survey (third quarter), Employment and earnings survey.

the vacancy rate in the ICT sector is substantially higher than in the rest of the economy. In 1998 and 1999 the situation was extreme, when there were 70 vacancies per thousand jobs. This extreme scarcity in the market for ICT professionals was caused by the ICT boom. After the turn of the century the vacancy rate fell to 10 in 2002, which was even lower than the vacancy rate in the rest van de economy (see also figure 2.8.2). In 2005 the vacancy rate in ICT was up again to 42, whereas it is just 21 for the rest of the economy.

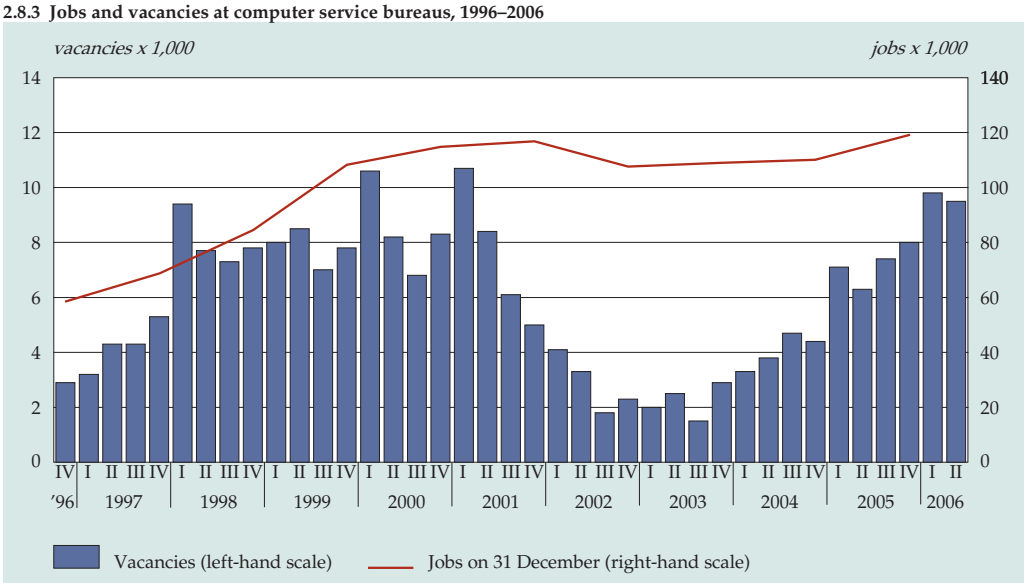
More jobs again at computer service bureaus

Computer service bureaus play a major role in the ICT sector. Included in this category are: hardware and software consultancy, computer centres, data banks and service and repairs of computers and office equipment. The number of jobs in computer service bureaus was quite stable for several years, but currently it is back up to 120 thousand. This is the same as at the end of 2001. Between 1996 and 2001 the number of jobs in this sector doubled. Vacancies showed an even greater difference, increasing from 3 thousand at the end of 1996 to almost 11 thousand at the start of 2001, during the ICT boom. In 2003, the lowest point, there were just 1.5 thousand vacancies. In the first quarter of 2006 the number of vacancies at computer service bureaus was back up to 10 thousand.

Many Dutch ICT professionals

In the Netherlands over 4 percent of the employed labour force was employed as ICT professionals. [4)] Finland, Canada and Denmark also have shares of ICT

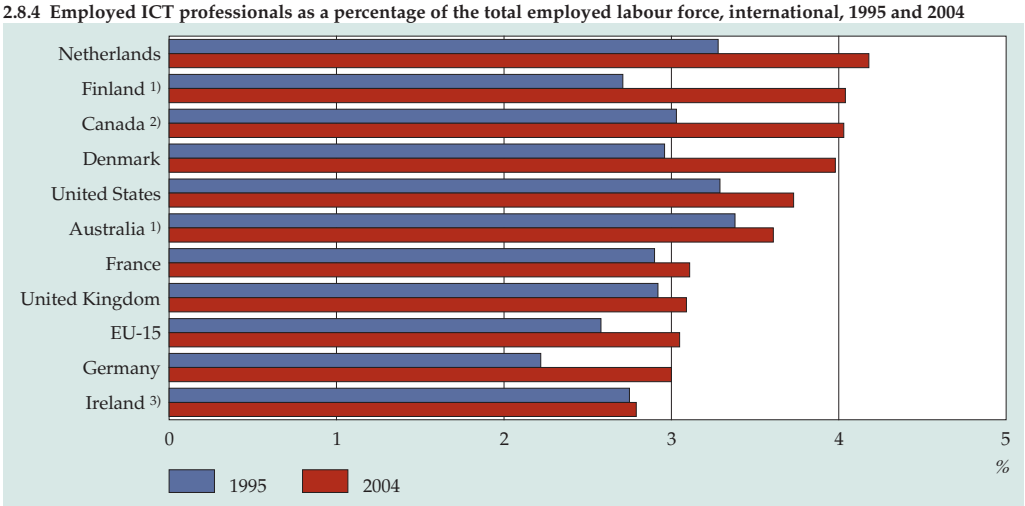
2.8.3 Jobs and vacancies at computer service bureaus, 1996–2006



Source: Statistics Netherlands, Quarterly vacancies survey private sector, Employment and earnings survey.

professionals close to 4 percent. There is remarkable strong growth in Finland. The share of ICT professionals in 1999 was well under 3 percent, so the growth rate in this country was fastest. Ireland, that has a major ICT sector, has the least ICT professionals of all selected benchmark countries.

2.8.4 Employed ICT professionals as a percentage of the total employed labour force, international, 1995 and 2004



1) 1997 instead of 1995.
2) 2003 instead of 2004.
3) 1999 instead of 1995.

Source: OECD, Key ICT indicators.

2.9 ICT education

ICT is an indispensable part of society. But are we educating enough ICT professionals? In the Netherlands people are trained for ICT jobs at university, the college level (hbo), and the secondary vocational level (mbo). It is difficult to distinguish ICT students at the mbo level, which is why this education level will not be discussed in this paragraph. In the colleges and universities there has been an increase in the number of ICT graduates in recent years, see table 2.9.1. In absolute numbers the number of ICT graduates is higher than in any year since 1990. At the college level the number of ICT graduates has more than doubled since 1990/'91, whereas at the university level the increase is about 20 percent.

Most college graduates are 22 years old. University graduates are about 24. In order to be able to relate the number of graduates with the number of young people who could potentially study at this level, we opted to compare the total number of graduates with the number of people aged 23. In this way we see that in 1990/'91 about 23 percent of the young people graduated from higher education, whereas this was 43 percent in 2004/'05. This is almost double the percentage, but in absolute

Table 2.9.1
Graduates from higher education, total and informatics, 1990/'91–2004/'05 [1)]

	Vocational college			University			Population aged 23 years	Graduates as a percentage of 23 year-olds
	Total	Informatics	Percentage informatics	Total	Informatics	Percentage informatics		
	number		*%*	*number*		*%*	*x 1,000*	*%*
1990/'91	38,570	1,350	3.5	19,100	600	3.1	250.3	23.0
1991/'92	42,300	1,380	3.3	20,720	640	3.1	252.5	25.0
1992/'93	43,830	1,410	3.2	22,590	710	3.1	264.9	25.1
1993/'94	46,750	1,700	3.6	24,710	760	3.1	257.8	27.7
1994/'95	48,880	1,670	3.4	25,360	690	2.7	245.7	30.2
1995/'96	51,170	1,710	3.3	28,290	690	2.4	231.9	34.3
1996/'97	50,500	1,580	3.1	25,400	630	2.5	212.3	35.7
1997/'98	50,090	1,580	3.2	22,170	480	2.2	203.8	35.5
1998/'99	50,130	1,620	3.2	20,490	410	2.0	194.8	36.2
1999/'00	52,230	1,790	3.4	20,240	420	2.1	193.0	37.5
2000/'01	53,130	2,100	4.0	20,420	460	2.3	191.2	38.5
2001/'02	56,060	2,550	4.5	21,290	470	2.2	194.7	39.7
2002/'03	57,960	2,810	4.8	22,130	570	2.6	194.0	41.3
2003/'04	59,590	3,100	5.2	23,720	660	2.8	200.3	41.6
2004/'05*	58,940	3,330	5.6	25,910	730	2.8	197.5	43.0

[1)] The data include Vocational college bachelors and University 'doctoraal' and masters.

Source: Statistics Netherlands, Education statistics, Population statistics.

numbers the number of graduates grew a lot less (from 58 thousand to 85 thousand) due to the steep decline of the number of young people in the country.

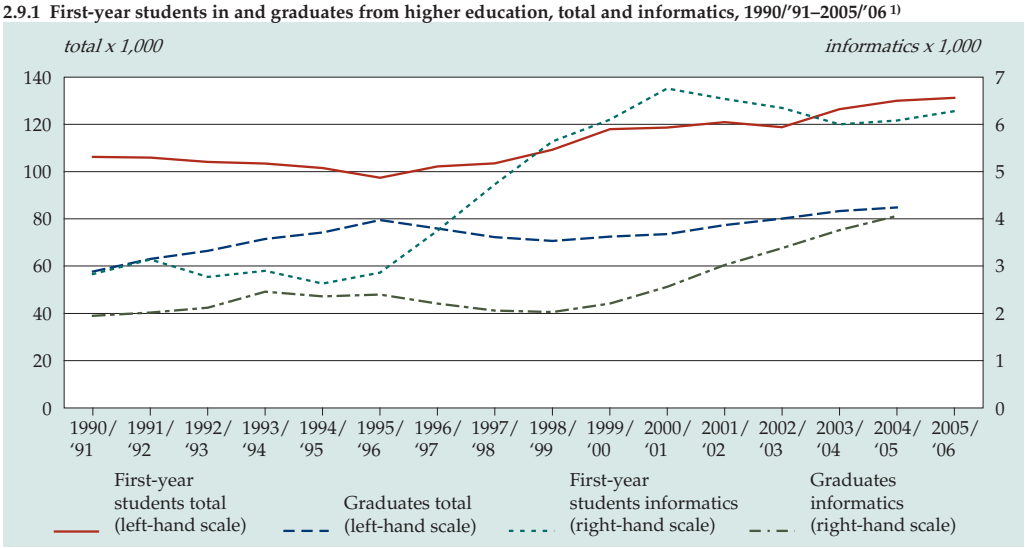
End of the internet hype: slight dip in first-year ICT students

The number of first-year students in ICT almost tripled between 1994/'95 and 2000/'01, see figure 2.9.1. In 2001/'02 the number of first-year ICT students fell, probably because the future looked bleak for the sector at that time. In 2003/'04 we see an increase again and the prediction is that the number of first-year students will soon be as high as in 2000/'01. The number of first-year ICT students rose much faster than the number of first-year students in higher education in general over the last 15 years. In 1990/'91 about 2.5 percent of the first-year students did ICT, while currently the figure is close to 5 percent. There is no visible effect yet of the end of the internet hype in the number of graduates. But this is logical because the current graduates started their study at the height of the hype. At that moment it was not clear what the future would bring for the sector, so it had no effect on the field students then chose to study. But in the next few years we can expect a slight drop in the number of ICT graduates, since there was a drop in first-year ICT students several years ago.

The Netherlands has relatively few ICT graduates

Many countries have relatively more ICT graduates than the Netherlands, see figure 2.9.2. [5)] The Netherlands has even less than the EU average. Ireland has an enormous number of ICT students: over 8 percent of the graduating students took ICT.

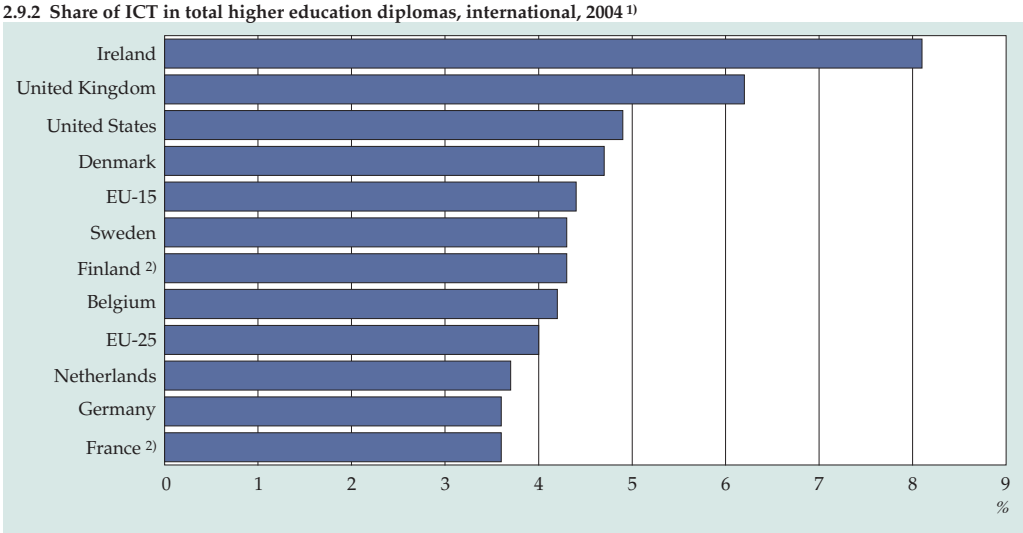
2.9.1 First-year students in and graduates from higher education, total and informatics, 1990/'91–2005/'06 [1)]



[1)] The total number of first-year students in and graduates from higher professional education (vocational colleges) and university.

Source: Statistics Netherlands, Education statistics.

2.9.2 Share of ICT in total higher education diplomas, international, 2004 [1)]



1) Disciplines in ISCED 481; table 2.9.1 and figure 2.9.1 include ISCED 481 and 523.
2) 2003 for Finland and France.

Source: Eurostat.

Germany and France have the same modest performance as the Netherlands with 3 to 4 percent ICT students among the graduating students in higher education. Scandinavia is the front runner with the internet and ICT, yet there are remarkably few ICT graduates in Finland and Sweden.

2.10 *Globalisation*

In the past decade world trade grew much faster than worldwide economic growth. Global trade in ICT goods and services grew even faster. This was a consequence of the amazing rise of ICT, and also increasing globalisation in the ICT sector and elsewhere. Globalisation is largely driven by the hunt for efficiency gains.

The new technological developments make producers of ICT goods and services less dependent on geographic location. The assembling and more technical production is often shifted to low-wage countries, and offshoring of ICT services is rising fast. Within Europe this is expressed by a shift of activities to Eastern Europe. At the global level it is mainly India and China that are the up and coming nations.
In first instance the activities shifted concerned ICT goods, but in recent years the worldwide trade on the market of ICT services has also been increasing. Globalisation is expected to play a larger role in the global economy and the ICT sector. This will have its consequences for the Dutch economy, for instance, shown in the loss of ICT jobs in the Netherlands. Many expect that this will concern

low-skilled jobs in first instance, but once the low-wage countries have caught up in terms of knowledge, the highly skilled jobs requiring higher education will also be under threat. It is understandable that people worry about job losses due to the shift of activities to other countries. Never before have the opportunities for shifting activities at a global scale been so great. Yet the way globalisation is reported does emphasize the disadvantages more than the advantages. And globalisation is also beneficial for the Netherlands. Below, we will discuss the trade between the Netherlands and China. This trade leads to savings for households and a growing number of jobs in the Netherlands. Furthermore, the Netherlands is quite active in globalisation.

It is hard to describe the globalisation phenomenon because the development of its observation is not very advanced yet. Still, in this paragraph we will try to quantify the globalisation concept with international figures that come mainly from the OECD. The focus will of course be mainly in developments in the global ICT sector.

What is globalisation?

The OECD took the initiative to construct a conceptual and methodological framework for gathering quantitative facts on the globalisation phenomenon. This work led to the Handbook on Economic Globalisation Indicators (OECD, 2005). In this handbook three forces are named that contribute to the process of globalisation. The first is liberalising capital flow and deregulating financial services. Secondly, opening up markets for trade and investments, which stimulates international competition. Third is the central role ICT has started to play in the economy.
Relativity is a good thing in discussing globalisation. Although this process greatly influences the global economy, there is nothing new under the sun. The geographic shift of production factors (capital, labour) has a long history. Due to aspects mentioned above, it is the size and scale (number of companies involved at the global scale) that has increased.

The media often emphasize the shift of jobs to other countries, but economic activities also shift within the national boundaries. National outsourcing is a lot more common than international outsourcing. Shifting activities abroad and outsourcing have occurred in the manufacturing industry for years, but recently the services sector is catching up. The main reasons are the improved possibility to trade services due to liberalising trade, and rapid technical developments, including the possibility to code routine ICT work in programs and standardise them. This makes the production of many service activities less dependent on location, as was the case with goods earlier. A company that wants to shift its activities has several options. Table 2.10.1 shows the various forms of shifting commercial activities as used by the OECD and the Dutch Ministry of Economic Affairs. We will use the same concepts in this paragraph.

Table 2.10.1
Outsourcing of economic activities, by location and ownership

	Netherlands	Abroad
Outsourcing	domestic outsourcing	offshore outsourcing
Insourcing	domestic supply, insourcing	international insourcing

Source: Van Welsum and Vickery (2005); CPB (2005a).

In table 2.10.1 we make a distinction between two dimensions of economic activities: the geographical location and legal ownership. The activities may take place within or outside the Netherlands. Furthermore, a company may keep the activity (investing) or outsource it.

The Netherlands and globalisation

In 2004 and 2005 a study was carried out, commissioned by the Ministry of Economic Affairs, on the influence of globalisation on the situation in the Netherlands. Berenschot looked at the nature, size and motives of shifting activities by companies located in the Netherlands (Berenschot, 2004). The CPB looked at the macro-economic effects for the Netherlands (CPB, 2005). In its own study (Ministry of Economic Affairs, 2005b), the Ministry of economic Affairs concluded that shifting business activities is painful for those who are directly involved. However, when the shift takes place for solid economic reasons (optimal allocation), both the Netherlands and the host country benefit in terms of extra economic growth.

Berenschot also looked for an answer to the question about the risk the Netherlands runs to loose out to low-wage countries. A production line using low-skilled labour is often cheaper to run in a low-wage country than in the Netherlands. On the other hand, a country like the Netherlands, with a highly educated, productive population, as a rule has a more favourable starting position to produce high-quality products or services. The results of this and other studies show that the advantages of globalisation can be realised, but mainly at the macro-economic level. At the micro level there are of course always people who pay the price, for instance by losing their jobs.

The Netherlands is very active in globalisation

It is certainly not the case that globalisation is something that just happens to the Netherlands. The Netherlands is actively involved as is shown in figure 2.10.1. The shares of GDP of the inflow and outflow of foreign direct investments (FDI) show this. [6)] The outflow of FDI is a measure of how much money a given country invests in the rest of the world. In this period where the production of goods and services is shifted to low-wage countries this says something about the contribution of a

country to globalisation. The inflow of FDI says something about how attractive a country is to foreign investors. So the countries that benefit from globalisation are characterised by a high influx of FDI and a much lower outflow.

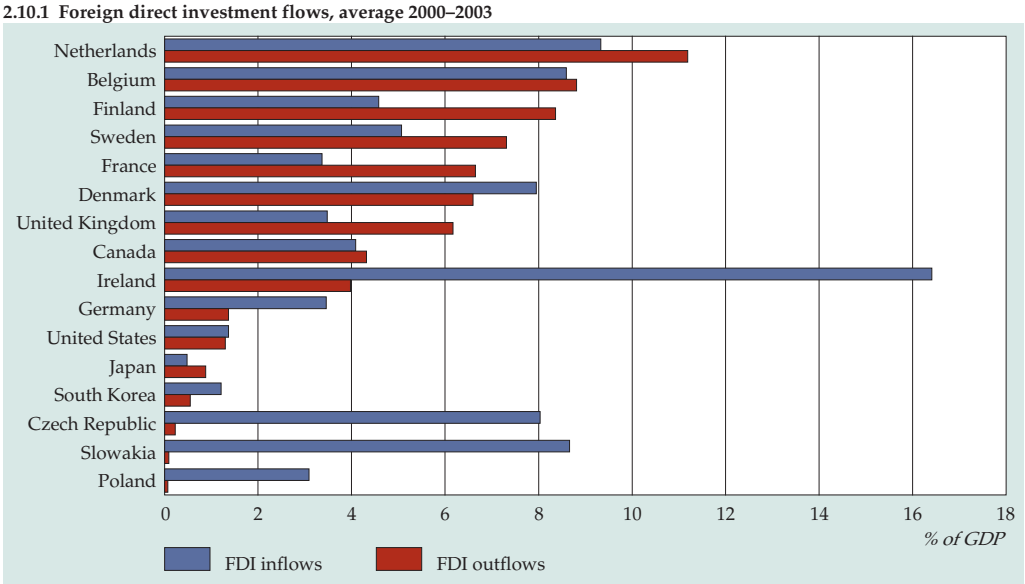
In the period 2000–2003 the outflow of direct foreign investments of the Netherlands was the highest of all benchmark countries observed. In that period more than 11 percent of GDP was invested abroad in this way. Remarkable was the high level of foreign investments in the Netherlands at the same time. Other countries with a great outflow of FDI are Belgium and Finland.

Of course there are also countries receiving foreign investments, such as the Czech Republic, Slovakia and Poland (see figure 2.10.1). The lower labour costs makes that the production of goods and services in increasingly shifted to this type of country. Another remarkable country is Ireland, where the FDI flowing in during the period 2000–2003 was more than 16 percent of GDP. This is much higher than in the other benchmark countries. One explanation is the influx of US ICT companies, who see Ireland as an attractive location from which to access the European market.

Trade with China favourable for the Netherlands

The private sector in the Netherlands spends a lot of money on foreign direct investments. The CPB report China and the Dutch Economy (CPB, 2006), however, shows that these activities have a positive influence on the Dutch economy. For instance, according to CPB calculations, the trade with China yielded 23,000 jobs for the Netherlands. Furthermore the market share of cheap Chinese import products keeps increasing, saving the average Dutch household some 300 euro a year. There

2.10.1 Foreign direct investment flows, average 2000–2003



Source: OECD, Economic Globalisation Indicators 2005.

are different ways in which the trade with China leads to more jobs in the Netherlands. First of all, Dutch producers benefit from the supply of cheap Chinese semi-manufactured goods. Secondly, Chinese investments in the Netherlands are growing. In 2005 these investments were already yielding 3,000 fte. Later in this paragraph we will discuss the rise of China as a global power in trade. We will focus on China's role as an ICT producer.

Globalisation in the ICT sector

ICT plays two roles in the globalisation process. As is described in the rest of the paragraph, the ICT sector (like other sectors in the economy) is the subject of globalisation. The shift in production of ICT goods has been going on for quite a while, and currently international competition in ICT services is growing. ICT also plays a role as a driving force, since the rapid technological developments make it easier to shift the production of goods and services to countries where labour costs less.

The figures below are largely from the OECD publication Information Technology Outlook 2006 (OECD, 2006). This publication comprises many figures that allow the effects of globalisation to be quantified. However, all figures are expressed in US dollars, which means that the picture may be somewhat distorted due to recent developments in the exchange rates. In addition, the figures available only deal with trade to and from OECD countries. Trade between OECD countries and between OECD and non-OECD countries are measured, but not the trade between non-members. As a consequence some of the global trade in ICT goods and services is not observed. However, this does not change the overall picture.

The trade in ICT goods to and from OECD countries in 2004 was worth 1,669 billion dollar, as compared to 1,005 billion in 1996. The trade in ICT services is much smaller but grew faster, relatively speaking, from 70 billion dollar in 1996 to 175 billion dollar in 2004.

Apart from the continuous growth in the international trade in ICT goods and services, the effects of globalisation on the global ICT sector are starting to become manifest. In 1996, 71 percent of the ICT imports of OECD countries came from within the OECD, whereas this had fallen to 58 percent in 2004.

The ICT sector in 2004 was very much globalised. Worldwide there were almost 70 thousand multinationals with over 690 thousand foreign locations. In total, these companies employed about 57 million people. The ICT sector plays a major role in the global economy. In 2004 the foreign direct investments in the sector amounted to 648 billion dollar, over 7 percent of worldwide investments.

Foreign direct investments increasingly important in globalisation

In describing the Dutch situation, we already mentioned the role of foreign direct investments. They seem to gain in importance as globalisation progresses, while

international trade seems to become less important. Furthermore, the way foreign direct investments are made up seems to be changing in recent years, shifting to emerging markets. Furthermore, within the ICT sector the services are becoming more and more important. Between 2001 and 2003 foreign direct investments in ICT services was almost three times as high as in ICT goods (UNCTAD, 2005).

Foreign mergers and acquisitions are the main kind of foreign direct investment. The ICT sector plays a major role in this by accounting for 20 percent of all foreign mergers and acquisitions. Foreign direct investments have the great advantage that they allow a quick 'start', due to access to existing production capacity, business relations and markets.
In the period 1995–2005, the USA had a share of 30 percent in worldwide mergers and acquisitions in the ICT sector. Second was the UK with 18 percent, followed by Germany (11 percent) and the Netherlands (6 percent).

Below we will discuss the trade in ICT goods and services in more detail, focussing on ICT services because they have been the most dynamic area in recent years.

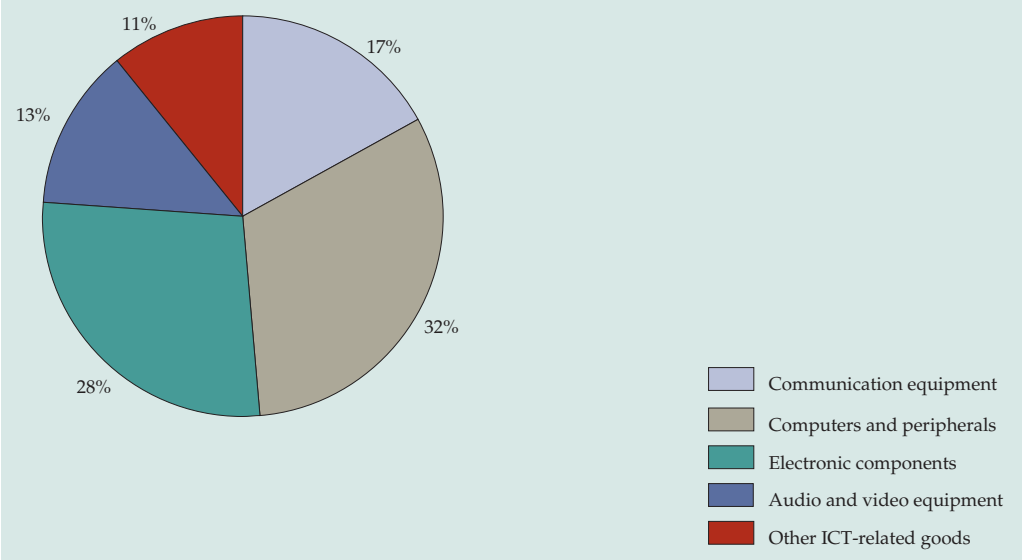
ICT goods

In 2004, China with 180 billion dollar was the largest exporter of ICT goods, followed by the USA (149 billion dollar) and Japan (124 billion dollar). The Chinese export of ICT products exceeded that of the entire EU.
The role of China and India in the international trade in ICT goods has expanded rapidly in recent years, confirming growing globalisation in the ICT sector. Later in the paragraph we will discuss how China is an example of a country benefiting from the shift in production capacity.
Apart from the emergence of China and India, we also see a shift within Europe where the Czech Republic, Hungary, Poland and Slovakia are rapidly expanding their production capacity for ICT goods.
Figure 2.10.2 shows how the international trade in ICT goods for the year 2004 is made up. The main categories are computers and peripherals (32 percent) and electronic components (28 percent). Compared to 1996, there has not been much change in the shares of the different commodity groups. The share of communication equipment increased, while the share of computers and peripherals and of electronic components fell slightly.

ICT services

The international trade in ICT services is currently the most dynamic. The market may be ten times as small as that of ICT goods, but the growth rate is much higher. In 2004, the total trade in ICT services to and from OECD countries was 175 billion dollar. Most OECD imports of ICT services (83 percent) in 2004 came from other OECD countries. Still, the influence of globalisation is noticeable since the top 10 of major exporters of ICT services in 2004 included Hong Kong and China.

2.10.2 Composition of international trade in ICT goods, 2004



Source: OECD, Economic Globalisation Indicators 2005.

Despite a relatively late start, the globalisation of ICT services is currently well on its way. The Baltic states, some Eastern European countries, India, China and Brazil are fast growing export countries. This means they are popular countries for offshore activities.

Many countries with high export rates in ICT services also see their imports growing at the same time. Globalisation of services is a two-way street that may benefit all parties involved.

Conditions important for globalisation of services

Decisions by companies to locate their activities abroad, and where, depend on a number of ICT-related conditions such as the physical infrastructure (availability and quality), prices and existing and required ICT skills. The political and economic arguments also play a key role, such as macro-economic stability, the protection of intellectual ownerships, and legislation in general. [7)]

The availability and quality of the ICT infrastructure determines what is a favourable offshore location for service activities. Most offshore countries have vast potential, but a lot still has to happen before they can compare to most OECD countries in terms of ICT infrastructure. Still, the relatively low costs for production factors and the presence of a highly educated workforce often convince companies to shift their activities to these countries.

Security and legislation

Data protection remains one major problem in offshoring ICT services. This makes it a lot more complicated than offshoring ICT products. The problem determines whether or not it is possible to offshore. In offshoring services the offshore countries eventually do increasingly complex activities, increasing security risks. These are risks in data access, storage and transport.
Although offshoring by foreign companies is on the increase, the OECD figures show that most work is done by units of the mother company. This makes them easier to manage and control so that it is easier to reduce the risks outlined.

The population in countries involved in offshoring is becoming much more critical about the privacy risks pertaining to information about health, insurance, tax and banking. Moreover, many offshore countries have no clear privacy or cyber crime legislation. The legislation of the countries often predates the offshore era and is not geared to handle it.

The Indian global delivery model

India provides a good example of a well-planned approach to benefiting from the increase in offshoring. The Indian *global delivery model* can be a source of inspiration for other emerging markets.

In the global delivery model Indian ICT professionals are stationed with foreign clients. They mostly facilitate (negotiating, gathering and submitting information, overseeing and implementing systems), while most programming is done by colleagues in India. Over time, the model has become increasingly complex, with people working at several locations. Hence the term global delivery model.

The potential savings this approach may yield are huge, because most of the applied work is done by people in India, where the salaries are much lower. The model is currently seen as a sustainable and cost-effective way of offshoring ICT services.

In future the major Indian ICT companies will increasingly operate at a global level and compete more and more with companies from OECD countries. To compete, the Indian companies need to strengthen their knowledge, expand their service package and expand their physical presence in the countries of their clients.

The Indian model shows that with a basis of extensive skills and a good business mentality it is possible for companies from emerging economies to compensate for poor infrastructure, low wages and other disadvantages. As a result the companies can supply advanced services in a globally competitive way.

Source: OECD, Information Technology Outlook 2006.

But the offshore countries are making progress, and many are working on stricter legislation. These countries are also increasingly active in national and international cooperation to reduce cyber crime. The offshore countries are motivated by enlightened self-interest, realising that much of their growth in the future depends on this.

Another way of avoiding problems is by having solid contracts. These can include detailed agreements on privacy and security and how the data will be categorised, sent, accessed, used, stored and shared. Furthermore, certification (ISO 17799 or the British equivalent BS7799) is often used. The use of standards has grown dramatically over the last decade.

China driving force in global economy

The Chinese economy is currently one of the driving forces behind global economic growth. Over the last two decades the average growth rate in GDP was no less than 9.5 percent a year. Much of this was due to the emergence of the Chinese ICT sector. In the last decade, China has become a major producer and user of ICT products. The country is a key location for ICT production and is currently the main producer of ICT goods worldwide, with an export value of 180 billion dollar in 2004. The country imports primarily electronic components and exports mainly computers and peripherals.

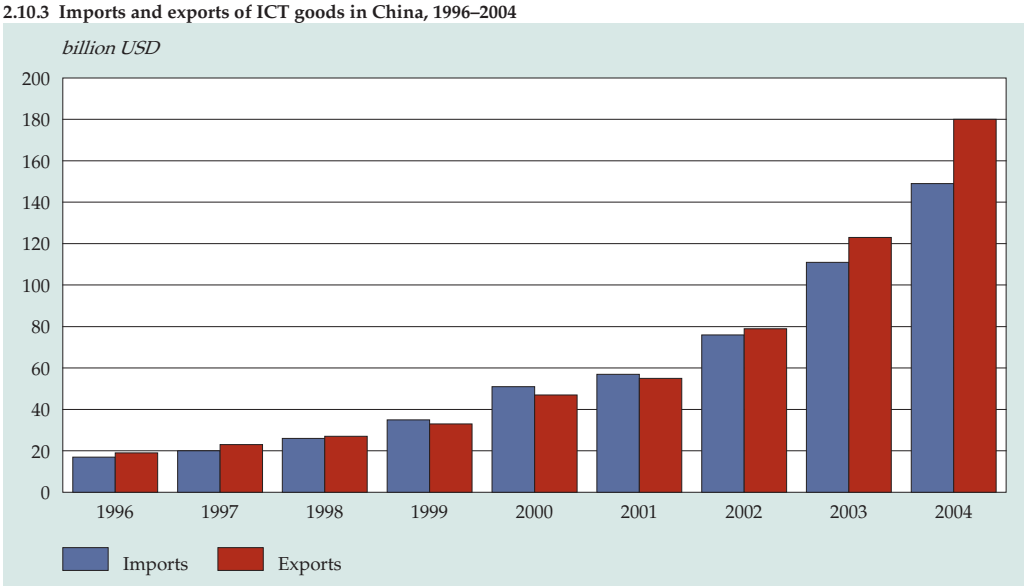
In terms of a market of ICT products China has reached sixth place, but the market for ICT services is still lagging behind. China has enormous potential as a market. Increasing disposable income means increasing penetration of personal computers and the internet. E-commerce is also rapidly expanding (OECD, 2006b).

Chinese ICT sector: largest worldwide exporter

China has burst onto the market for ICT goods and developed into a global player on it since the mid nineties. In 2004 China's total international trade in ICT goods was close to 329 billion dollar, as compared to 35 billion in 1996. In 2004, China was the largest exporter of ICT goods, valued at 180 billion dollar. As an importer, China took third place worldwide in 2004 (149 billion dollar), behind the USA and the EU-15 (see also figure 2.10.3).

China primarily emerged after the internet hype as an exporter of ICT goods. At the start of the 21st century companies started to move their labour-intensive and low-margin ICT work to China on a massive scale. This consists of making televisions, computers, telephones and DVD players. One reason to move to China is the low wage level there. Also the Chinese government tries to entice foreign companies through tax cuts, premiums and cheap credit. China also abandoned import and exports duties in January 2005 after agreements between China and the World Trade Organisation (WTO). This has undoubtedly given a new positive impulse to the development of Chinese ICT imports and export (OECD, 2006b).

2.10.3 Imports and exports of ICT goods in China, 1996–2004



Source: OECD, ITS database.

The most important import products for China in 2004 were 'electronic components' (65 percent of the total). The main export product was 'computers and peripherals' (46 percent of total exports). Also the export of telecommunication equipment grew rapidly. In 2004 it had a 14 percent share in Chinese ICT exports. Between 1996 and 2004 the export of telecom equipment grew by a whopping 34 percent year.

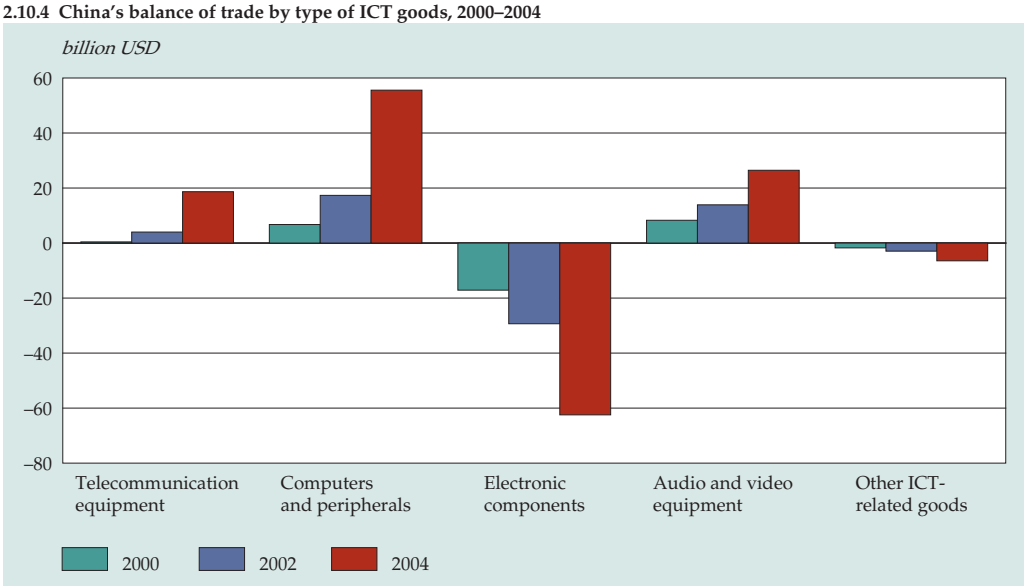
The importance of the ICT sector for the Chinese economy is also shown by the study carried out by Jorgenson and Vu. The contribution to the GDP growth rate in the period 1995–2003 averaged 0.63 percent point a year (Jorgenson and Vu, 2005). The value added of the Chinese ICT sector in 2004 was 118 billion dollar, or 7.5 percent of GDP.

China's trading partners

The main markets for Chinese ICT goods in 2004 were the USA (24 percent of the total), Hong Kong (23 percent), EU-15 (20 percent) and Japan (10 percent). The Chinese imports of ICT goods in 2004 mainly came from Japan (18 percent), Taiwan (16 percent), South Korea (13 percent) and Malaysia (8 percent).

The Chinese trade surplus for ICT goods amounted to 31 billion dollar in 2004. The huge trade surplus is mainly due to trade with Hong Kong, the USA and EU-15. The trade surplus with the USA in 2004 was 34 billion dollar. In that year, 27 percent of all US imports in ICT goods came from China.

2.10.4 China's balance of trade by type of ICT goods, 2000–2004



Source: OECD, ITS database.

Figure 2.10.4 shows the Chinese trade balance for five kinds of ICT goods. The main import and export categories are recognisable here. China imports many electronic components and has a very negative trade balance (62 billion dollar in 2004) for these ICT goods. Half of the exports consist of computers and peripherals, for which China has a major surplus on its trade balance.

The domestic market in China

In 2005 China was the sixth market for ICT products, worth 103 billion dollar. This means an average rise of 18 percent since 2000. In 2004 China was already the biggest market for mobile telephones and second largest for personal computers. The rapid growth of the Chinese ICT market is caused by a high GDP growth rate, major ICT investments by companies, and a major increase in disposable income. Demographic aspects also play a role, since many Chinese are in the 30–40 year age bracket. Therefore, China is generally considered a growing market. In contrast with most western countries, people in China still spend relatively little on ICT services and software (OECD, 2006b).

Despite their limited size and know-how, the production and export possibilities of Chinese ICT companies are rapidly improving. In 2005, their share in the total Chinese export of high-tech products was 12 percent. The Chinese ICT industry must now take the step from 'low-wage products' to advanced products and services. The Chinese government has a policy in place to stimulate this development. The foreign companies located in China seem to be making this step towards more advanced work already. For instance, increasingly new products are designed in China.

The rise and potential of the Chinese ICT sector is also manifest in a study of the top-15 Chinese companies that have the potential to benefit from globalisation. Many are ICT companies (IBM Institute for Business Value, 2006).

Chinese ICT services sector as yet not developed

The Chinese ICT services sector is still in its infancy. This is due to a weak industrial basis and a lack of international competition. The Chinese services sector also mainly produced for the domestic market. The development of this discipline is on the Chinese political agenda.

Due to an active government policy, China has a dynamic market for open source software. The Chinese internet market is also growing fast. Because the technical hurdles are lower than for ICT products or services, the Chinese internet companies are well able to compete with foreign companies on their domestic market (OECD, 2006b).

Foreign direct investments in China

Foreign direct investments in China in 2005 amounted to 60 billion dollar. This brought the total value of FDI to 245 billion dollar. Much consists of ICT-related investments, which were further stimulated by the fact that China joined the WTO in 2004. China is no longer just a cheap production place; more and more companies are becoming interested in the growing domestic market in China. There is also a shift toward services. More and more companies shift their R&D activities to China. In first instance this is mainly R&D intended to support local production and sales, but R&D aimed at product development is rising. This is mainly taking place in areas like Shanghai or Beijing with many highly educated people, science institutes, and a strong industrial basis. Still there are companies that have their doubts about shifting advanced ICT production to China because of the lack of transparency surrounding intellectual ownership rights.

Foreign direct investments by China itself are slowly starting up, due to a policy by the Chinese government promoting the 'go-out' strategy. The outflow is limited, 7 billion dollar in 2005, which is about 12 percent of foreign direct investments in China. The focus of Chinese companies investing abroad is shifting from natural resources to producers of high-tech products.

Notes in the text

1) More on this subject can be found in paragraph 3.5 of *The Digital Economy 2005*.
2) The ratio between share prices and profits of a share is a frequently used standard for valuing shares. Enterprises expecting to grow fast usually have a higher ratio than enterprises growing slowly.
3) The figures presented are estimates from the OECD on 2002 as far as USPTO and triad patents are concerned. The figures on EPO patents are definite.

4) Internationally a slightly different definition is used for ICT professional. It is based on the International Classification of Occupations, which is slightly different from the national classification that we used earlier in the paragraph. The employed labour force is defined internationally as anyone working 1 hour a week or more, whereas the criteria Statistics Netherlands uses is working 12 hours a week or more.

5) The Netherlands seems to be doing better than last year, but this has to do with the introduction of a new education structure at the Dutch universities. With this new BA/MA structure students sit more exams than before (a BA plus an MA exam). In addition, various degrees now take less time to complete, so it is possible that students who took the four-year course now take exams at the same time as people completing the three-year course. This may cause a surge in exam numbers.

6) Foreign direct investments are defined as a long-term investment by a company in a foreign company where the former gains control. Together these form a trans-national company.

7) More information on this subject is published by Statistics Netherlands in *Het Nederlandse ondernemingsklimaat in cijfers 2006*.

3 Telecom

The telecommunication sector is of above average importance for the Dutch economy when it is seen in an international perspective. Although the labour volume was cut in recent years, turnover and gross value added remained stable. Fixed and mobile telephone still generate most of the turnover of telecom companies despite their diminishing share. The internet is increasingly important for this sector, however.
The Netherlands belongs to the European top where internet use is concerned. And, internet use is still growing. This is shown by the spectacular rise in the volume of internet exchanges. The rise is speeded up by the rapid growth of broadband. The innovative use of the internet, however, also leads to new (security) problems such as securing copyrights. This can be achieved with the help of Digital Rights Management (DRM).

The relative number of fixed telephone connections in the Netherlands has been decreasing since 2004. Many people now only use their mobile telephone. Furthermore, phoning through the internet and cable is becoming more popular.
At the end of 2006, the traditional analogue television broadcast via the ether is going to be a thing of the past in the Netherlands. Most people currently have analogue television via cable, although digital television has become popular in recent years. Digital TV takes on a number of forms: people can watch digital TV via the ether, satellite, cable and the internet. There is also some interest in digital radio, but most people use analogue radio.

The most important development in telecom is undoubtedly the convergence of various services. Whereas telephone, television and the internet used to be provided by different providers and networks, these services are now increasingly provided by a single provider and through a single network. The reasons for consumers to opt for a service package are convenience, lower costs and the single infrastructure. Having the one infrastructure is also a major disadvantage, because if the network is down, all services provided through the network are out.

3.1 The role of the telecom sector within the economy

In this paragraph, we will discuss several economic aspects of the telecom sector and compare the sector's performance with that of the Dutch economy as a whole. In this chapter, telecom means the physical infrastructure (e.g. telephone cables, GSM masts), and mobile and fixed telephone, internet, radio and television services. The telecom sector includes telephone companies, internet providers and the cable companies distributing radio and television signals.

Below we present the figures on the sector 'post and telecommunication' because figures on the telecom sector alone cannot be published by Statistics Netherlands for

confidentiality reasons. Since telecom is by far the largest part of 'post and telecommunication', the figures do provide a good description of the situation in the telecom sector.

When a company in the Netherlands wishes to trade in electronic communication, it must register with OPTA, the independent post and telecommunications authority. The number of registrations with OPTA increased in 2006. The number of providers of public online communication networks increased by 37 percent on 2004. [1] The number of providers of an online communication service even increased by 67 percent, see table 3.1.1. [2]

Table 3.1.1
OPTA registered telecom providers, by activity, 2004 and 2006 [1]

	2004	2006
Providing a public electronic communication network	218	299
Providing a public electronic communication service	213	355
Providing related facilities	8	9
Providing qualified certificates	2	4

[1] Survey date 2004: 31 December; survey date 2006: 1 November.

Source: OPTA.

Table 3.1.2
Key figures sector post and telecommunication, 2001–2005 [1]

	2001	2002	2003	2004*	2005*
	million euro				
Post en telecommunication sector					
Net turnover	20,912	22,981	23,000	22,962	.
Gross value added (basic prices)	9,241	10,906	12,101	12,151	11,901
Pre-tax results	–10,809	–10,379	2,859	4,500	.
Fixed capital formation	4,620	2,632	2,098	2,316	.
	full-time equivalents (x 1,000)				
Labour input of employed persons	115.5	106.2	96.9	90.9	87.2
	%				
Share in the total economy					
Gross value added (basic prices)	2.32	2.63	2.85	2.79	2.65
Fixed capital formation	4.88	2.83	2.26	2.48	.
Labour input of employed persons	1.74	1.60	1.48	1.41	1.36

[1] SBI'93 code 64 (Post and telecommunication).

Source: Statistics Netherlands, National accounts 2005.

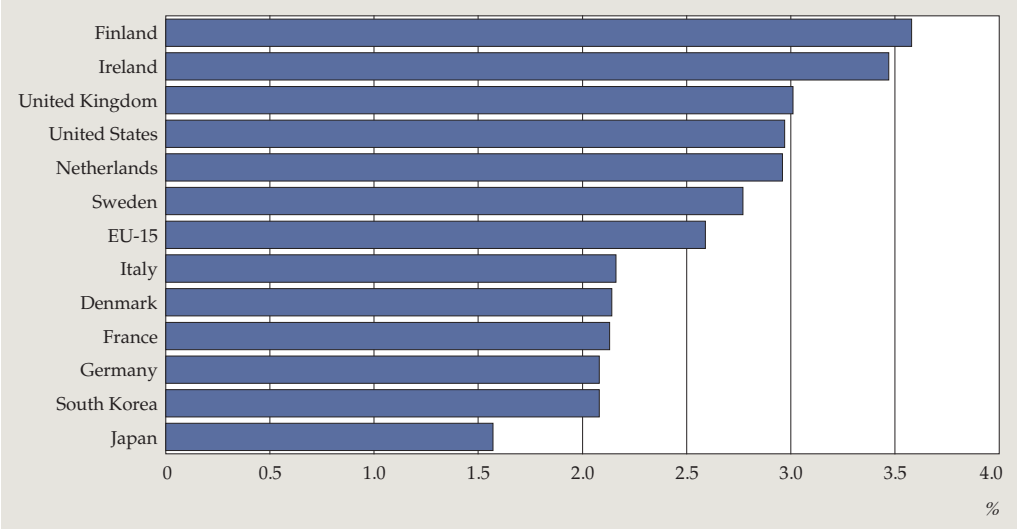
Table 3.1.2 shows several key figures of the sector post and telecommunications and compares them to the Dutch economy as a whole. The sector had a gross value added of 11.9 billion euro in 2005. This means that the sector produced 2.7 percent of the total value added in the Netherlands, so it is a rather important sector in the Dutch economy. The size of the sector is above average in comparison with other countries, but smaller than in Finland (3.6 percent) and Ireland (3.5 percent), see figure 3.1.1.

In 2005 the post and telecom sector employed 87 thousand fte as opposed to 116 thousand in 2001.[3)] So employment shrank by 25 percent in four years time. Despite this, the value added in the sector remained stable.

The pre-tax results of the sector in 2004 reached 4.5 billion euro. This amount must be offset against the major losses suffered by telecom companies in the previous years (up to 10.8 billion in 2001). The losses were mainly due to the high cost of borrowing for the construction of the infrastructure and for buying UMTS licences. The operating result, the result from production activities (the sales of goods and services etc.), was positive.

The investments in post and telecommunication in 1999 and 2000 were three times as high as in 1995. In 2001, after the dotcom bubble burst, investments collapsed and came down to a healthier level. In 2004 there seemed to be a recovery, with a 10 percent increase in investments on the previous year.

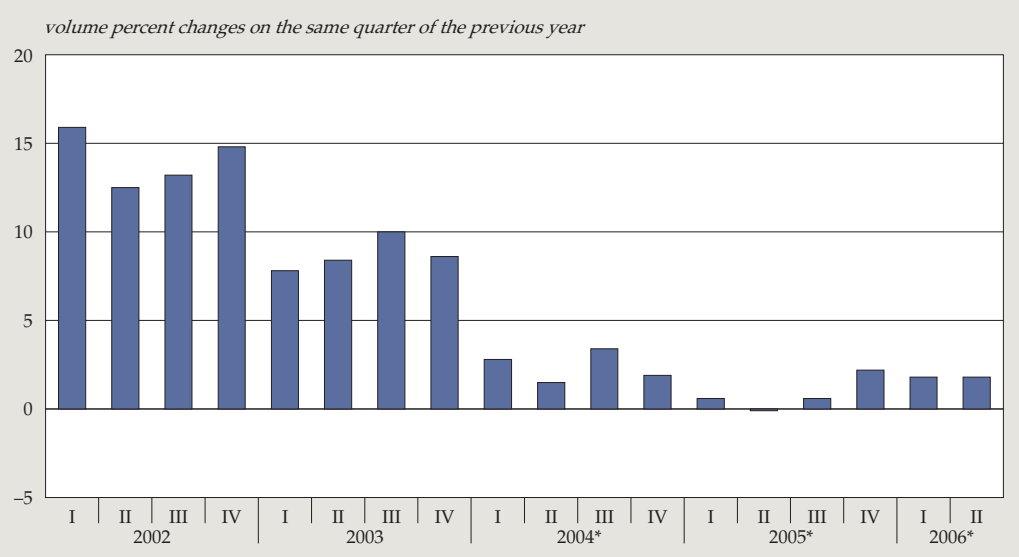
3.1.1 Share of value added of the post and telecommunication sector in the economy as a whole, international, 2003 [1)]



[1)] Figures for Japan and South Korea refer to 2002.

Source: GGDC.

3.1.2 Gross value added post and telecommunication, 2002–2006



Source: Statistics Netherlands, Quarterly accounts.

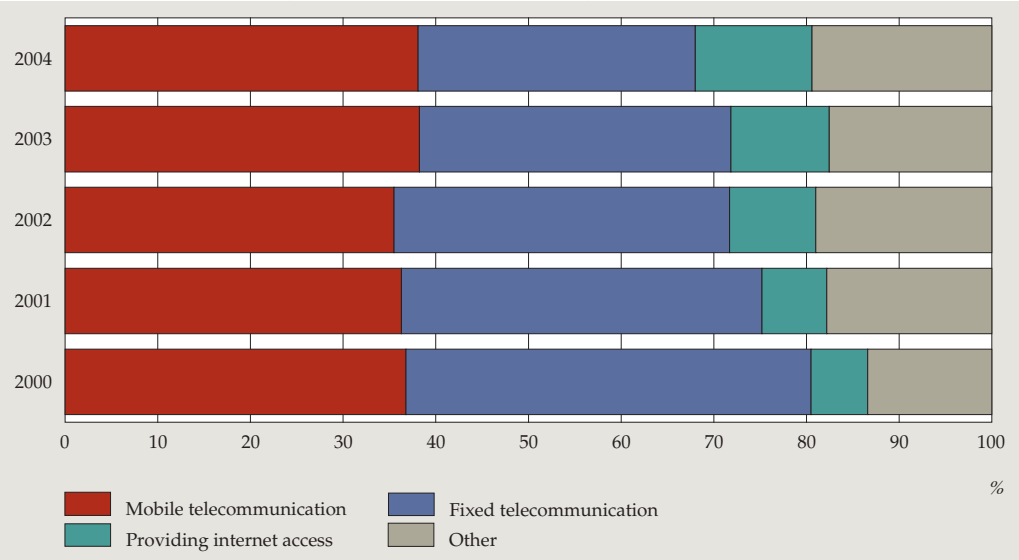
Right before the year 2000, the telecom sector saw stupendous growth. Modern technology such as mobile phones and the internet, up to then used mainly by companies and major institutions, became massively popular among consumers. This development caused a boom. There were growth rates of around 20 percent for several years. These growth rates continued even after the dotcom bubble burst in 2000. Figure 3.1.2 shows the quarterly developments after 2002. In 2002 and 2003 the sector grew fast as well, but since 2004 the growth rate has been limited due to the saturation of the market and the resulting (price) competition.

3.2 *The structure of the telecom sector*

This paragraph deals with the turnover generated by the individual telecom sector services, such as telephone, television and internet services. It is no longer easy to distinguish the services. This is due to the rise of multiplay, where several services are offered in one package, and the technical developments that blur the difference between services (such as telephone through the internet). This will be discussed in paragraph 3.6 which will detail the convergence. The technical developments will be discussed in paragraphs about the internet (3.3), telephone (3.4) and radio and television (3.5).

Figure 3.2.1 shows how turnover is divided between the services offered by the telecom companies in the Netherlands, as it shows which part of the turnover is

3.2.1 Net turnover telecom branch, relative share of different services, 2000–2004



Source: Statistics Netherlands, Production statistics Telecommunication companies.

produced by fixed telecommunication, mobile telecommunication and providing internet access (providing internet). Turnover from the exploitation of cable networks for radio and television, interconnection services (providing access to one's own network for other telecom operators) is recorded in the category 'other'.

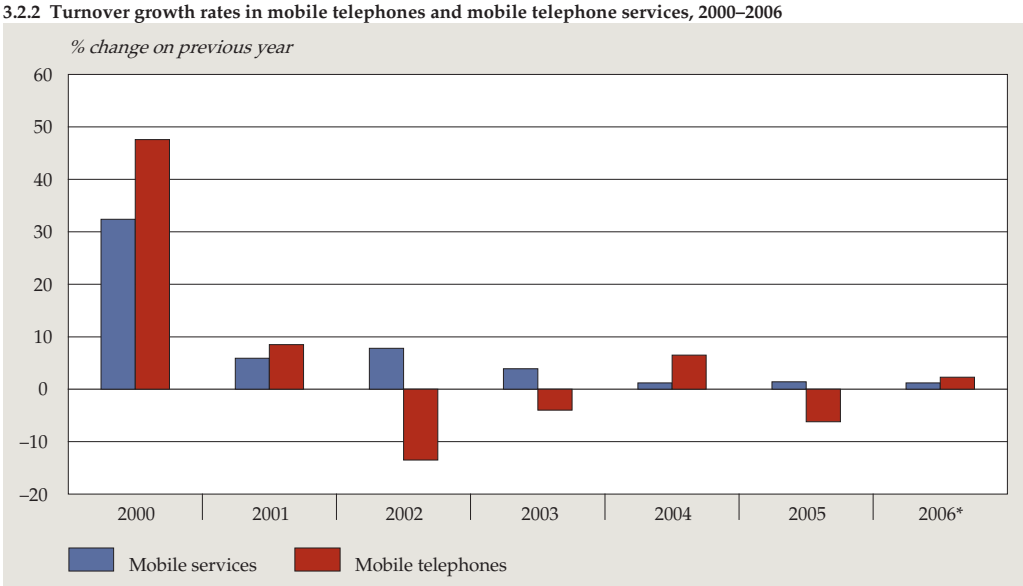
About 38 percent of the total turnover in the telecom branch is produced by mobile telecommunication (mobile telephone and mobile data services like SMS). This share remained stable in the period 2000–2004.

The share of fixed telecommunication in turnover fell by more than 10 percent point in the period 2000–2004. On the other hand, turnover from internet providing boomed. Some 13 percent of the turnover was produced with providing internet in 2004, whereas in 2000 this was only 6 percent. The rise of the internet must be playing a major role in this.

Limited growth in mobile telecommunication

The figure below shows developments in the mobile telephone market. This market saw some modest growth in 2006, see figure 3.2.2. Turnover growth rates in mobile services have been modest for several years (1.2 percent in 2006) now, and are dwarfed by the boom around the year 2000. The turnover in mobile phones fluctuates from one year to the next, but has not grown, on balance, since 2001.

3.2.2 Turnover growth rates in mobile telephones and mobile telephone services, 2000–2006



Source: EITO.

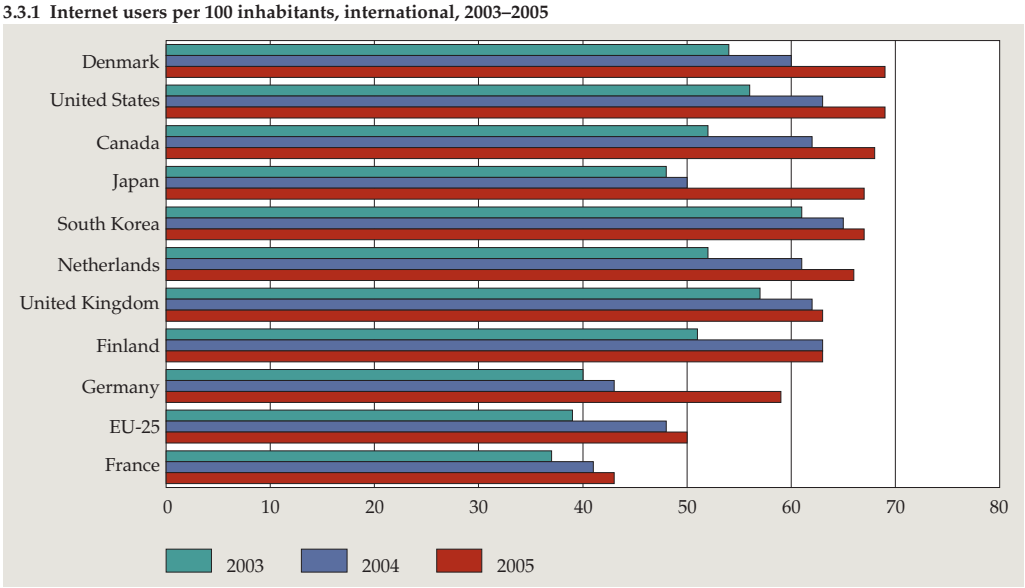
In the last quarter of 2003, most turnover in mobile services (80.8 percent) was generated by providing 'speech' by mobile telephone. Turnover from SMS messages (9.2 percent) and other data services, including the internet (2.2 percent) grew in the period 2001–2003 (OPTA, 2006). There are no figures available yet on the period after 2004, but it is not inconceivable that the ratio 'speech' and 'data' has reversed in the period 2004–2006.

3.3 *Internet*

The paragraphs 3.3 through 3.5 will detail the use of the services provided by the telecom sector in the areas of telephone, radio and television, and the internet. Sometimes it is impossible to distinguish the various services unambiguously, due to such developments as phoning through the internet. This could be considered an internet application, however we opted to classify the services by 'end product', and not by underlying method and technology. This is a change from the previous edition of this publication. In other words, phoning through the internet is discussed in the paragraph on telephone services even though the underlying technology is the internet. The first paragraph deals with the internet. Paragraphs 3.4 and 3.5 will deal with telephone, and radio and television.

The number of internet users in the Netherlands is still increasing, but a large section of the population does not use the internet. In 2000 only 44 in 100 inhabitants used

3.3.1 Internet users per 100 inhabitants, international, 2003–2005



Source: ITU and internetworldstats.

the internet, in 2005 this was 66 in 100. More information can be found in the statistical annex on the internet, www.cbs.nl/digitale-economie.

Placed within an international perspective, the Netherlands has relatively many internet users. The percentage in 2005 is comparable to the highest scoring benchmark countries, headed by Denmark (69 per 100 inhabitants). Not all selected benchmark countries score highly: e.g. France only had 43 internet users per 100 inhabitants in 2005; a share reached by the Netherlands in 2000. The Netherlands is well above the EU average of 50 per 100 inhabitants.

Chapter 6 will specify the characteristics of the internet users in the Netherlands.

Types of internet connections

This overview is not meant to be exhaustive, but more as an explanation of terminology and abbreviations used in the text.

Fixed lines:

Dial-in connection (max. 128 kbit/s). Here an analogue or ISDN modem is used to contact an internet provider through a telephone connection.

Asymmetric digital subscriber line, ADSL (max. 8 Mbit/s download, 1 Mbit/s upload). Internet with ADSL goes through a telephone line to a neighbourhood switchboard, where it is processed by an internet provider. The ADSL signal on the telephone line is placed in a separate frequency band, so that telephone and internet can be used side by side at the same time. The term 'asymmetric' refers to the difference in upload and download speeds. One problem with the use of the telephone line in this manner is that the maximum speed obtainable deteriorates as the copper wire used becomes longer. So the maximum speed obtainable depends on the users' proximity to the neighbourhood switchboard.

Symmetric digital subscriber line, SDSL (max. 2.3 Mbit/s download, 2.3 Mbit/s upload). This technology is comparable to ADSL, but with similar upload and download capacity. While users in households often download much more than they make content available to others, businesses often do the reverse. Since there are no connections with greater upload than download speeds on offer in the Netherlands, such companies may find the 'symmetric' connection the best alternative.

ADSL 2, ADSL 2+ (max. 25 Mbit/s download, 1.3 Mbit/s upload). This is a new type of ADSL with faster download speeds.

Very high bit rate digital subscriber line, VDSL (max. 52 to 100 Mbit/s download, 13 Mbit/s upload). This is the next generation DSL that is not yet on the market. The speed is obtained by using copper only between the home and the street level. After that the signal is transported through glass fibre cables. Expanding 'glass fibre' in the connection between street station and neighbourhood switchboard is planned for 2007 and beyond. VDSL will probably be on the market by then.

Cable internet (max. 35 Mbit/s). The internet flows via the rtv cable, 'next' to the radio and television signals. Theoretically it is possible to transport 35 Mbit/s over rtv coax cable.

Satellite internet (max. 4 Mbit/s). Internet flows are received via a dish from a satellite in orbit around the earth. This is a more expensive technology than the other types, but in sparsely populated areas without a densely cabled network it is often the only option.

Fibre to the Home, FTTH (100 Mbit/s). Glass fibre cables to the home without using telephone or rtv cable. Internet comes in directly through fast glass fibre cables. For this each home must have a new (glass fibre) cable. There are just a few pilots so far and plans to lay FTTH directly with new housing projects.

Mobile connections:

General Packet Radio Service, GPRS (max. 58 kbit/s download, 29 kbit/s upload). Internet flows are transported via the GSM network, the network for mobile telephones. Also known as 2.5G.

Universal Mobile Telecommunications System, UMTS (max. 2 Mbit/s). Also known as 3G (3rd generation mobile network). Internet flows are transmitted and received through the network of UMTS-antennas. See paragraph 3.4.

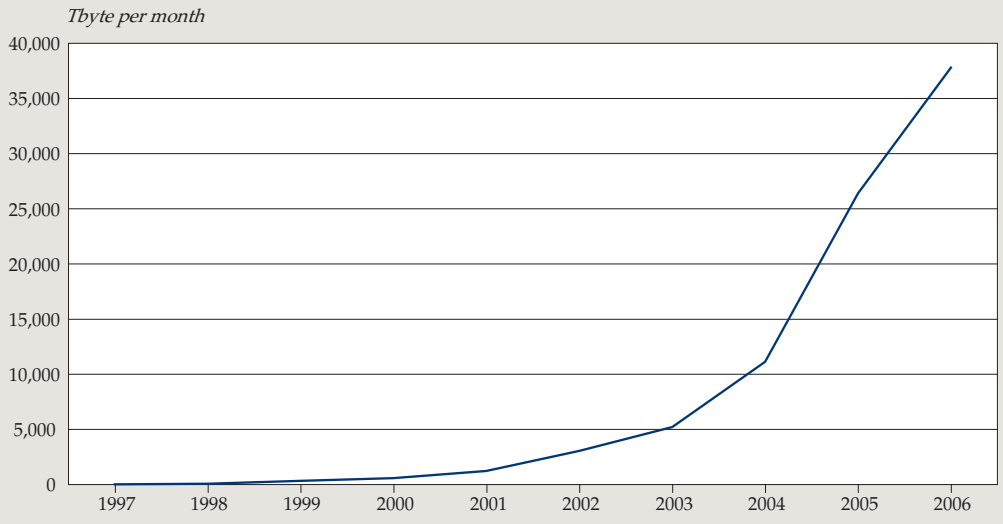
Wi-Fi (max. 54Mbit/s). These connections are used as wireless internet within the home or close to 'hotspots' (antennas in busy places such as railway stations). There is limited coverage. Signals can be received within 30 metres with a regular antenna.

The volume of the internet flow has rapidly increased in recent years. Figure 3.3.2 shows the monthly internet flow via the Amsterdam Internet Exchange (AMS-IX). The AMS-IX is a kind of national interchange where the lines of the various Dutch internet service providers and lines to other countries meet. The AMS-IX is one of the biggest internet exchanges in the world.

The volume of data passing through the AMS-IX indicates the total data volume sent through the internet in the Netherlands. In September 2006 about 38,000 Terabyte were registered at the AMS-IX. One Terabyte is about 1,000 Gigabyte. In September 2005 the data flow was 21,000 Terabyte, so in one year the flow increased by more than 80 percent.

To put these enormous figures into perspective: on average in September 2006 2 to 3 times the equivalent of the full contents of a DVD, that is 2 to 3 complete movies, passed through the AMS-IX each second.

3.3.2 Volume of internet flow through the AMS-IX, December 1997–2006 [1)]



[1)] 2006: in September.

Source: AMS-IX.

There are various reasons for this fast increase. More and more consumers have broadband. The maximum speeds of these connections keep increasing. Modern applications like streaming media (real-time sending sound or video images through the internet) and peer-to-peer flows (sending files between users) require a great deal of bandwidth. Streaming video and audio currently represent 14 percent of the internet flows. The use of web browsers and email is still dominant though: over half of the flow comes from these applications (AMS-IX, 2006).

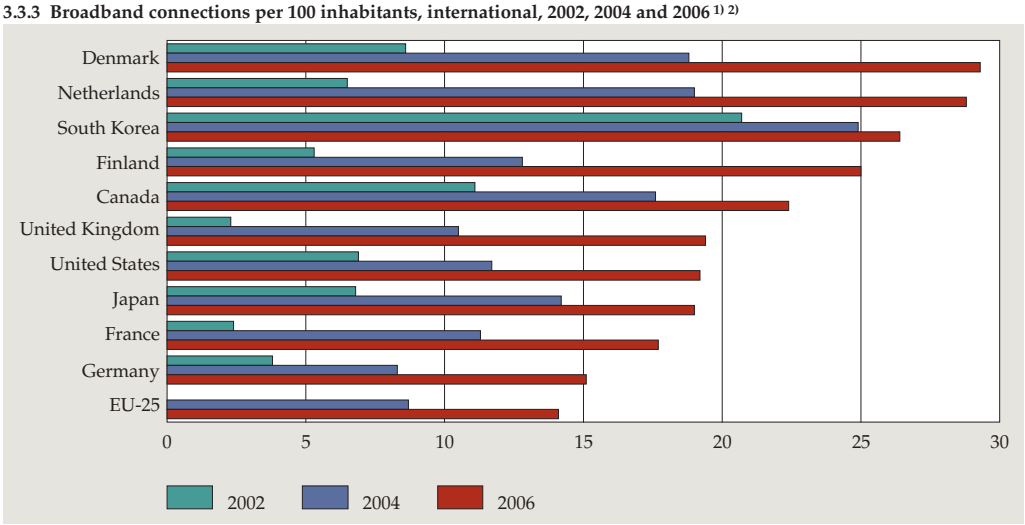
Broadband

The Dutch Ministry of Economic Affairs defines broadband as "a connection allowing high quality video and audio application and the exchange of large data files where the connection is permanently available". The OECD uses a more quantitative definition in its international statistics: broadband connections are connections with the internet with a total transmission capacity (the sum of the up and download speeds) of at least 256 kbit/s.

These broadband definitions cover most modern fixed internet connections, such as ADSL or cable internet, but not dial-in connections through fixed telephone connections. Mobile internet via UMTS does come under these definitions. However, the figures in this paragraph do not include UMTS connections.

Figure 3.3.3 shows the number of broadband connections per 100 inhabitants in a number of benchmark countries. The Netherlands had the second highest number

3.3.3 Broadband connections per 100 inhabitants, international, 2002, 2004 and 2006 [1) 2)]



1) 2006: situation in June, except EU-25: situation end of first quarter.
2) Excluding mobile connections.

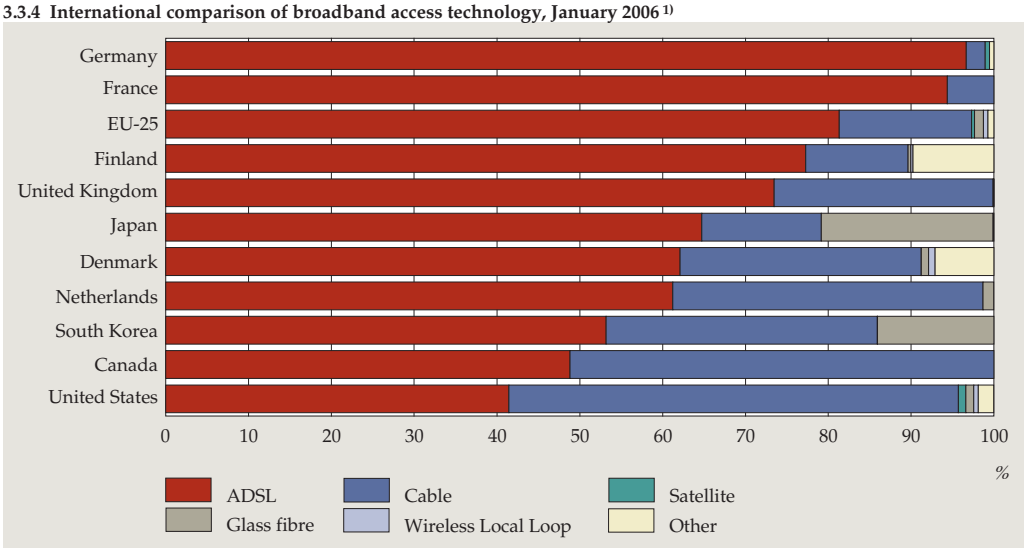
Source: TNO.

of broadband connections per 100 inhabitants (28.8) in June 2006, right behind Denmark. South Korea was in first position for years, but was overtaken in the first half of 2006 by Denmark and the Netherlands. Germany has a surprisingly low number of broadband connections, barely exceeding the EU average.

Almost all households in the Netherlands have the option of a broadband connection in 2006. The coverage of ADSL is about 99 percent (KPN, 2006). In just a few years all neighbourhood switchboards are fitted out for the transmission of ADSL; at the start of 2001 only 32 percent of the households could get an ADSL connection. The coverage of ADSL2+, required for services like television through the internet (see paragraph 3.5), is just 57 percent in 2006. There is an international comparison of the ADSL coverage in *The Digital Economy 2005*, on page 133.

Figure 3.3.4 shows an international comparison of the technologies used to access broadband in January 2006. In the Netherlands people mainly used ADSL (61 percent) and the internet via rtv cable (37 percent). There are big differences internationally. In the Netherlands many households are connected to 'cable' for television and radio reception, therefore the percentage of households with broadband via cable is rather large in the Netherlands. In less densely 'cabled' countries like France, this kind of broadband access is less popular. Japan and South Korea already use 'Fibre to the Home' glass fibre connections. In Japan 20 percent of the broadband internet connections is through glass fibre from the home.

3.3.4 International comparison of broadband access technology, January 2006 [1)]



[1)] Excluding mobile connections.

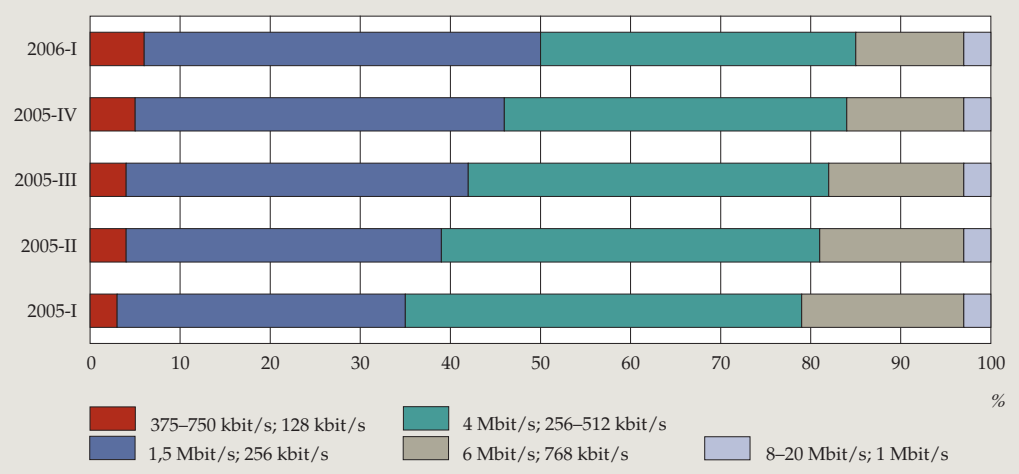
Source: TNO.

The fact that various other countries already finished installing large-scale FTTH glass fibre networks begs the question whether the Dutch market has failed. Several local governments, including the municipality of Amsterdam, have made plans to install their own FTTH. Studies carried out by the CPB (CPB, 2005), however, show that companies have sufficient incentives to keep investing in broadband, partly because of specific regulation of the access to the connector network.

The average speed of a broadband internet connection has decreased in recent years. This does not mean that existing broadband connections have become slower; there is only a relative shift from higher to slower speeds. People who change from a dial-in connection to broadband, often opt for a starter package with slower download speeds. Moreover, when providers offer higher speeds, users of ADSL may opt to keep the old speed (by downgrading and paying a lower rate). Two things are important here. This trend is logical in the light of the activities of internet users (see table 6.3.1). Internet users mainly use applications such as email, looking up information, internet banking, etcetera. These kinds of applications do not require fast download speeds. Moreover, the 'new' broadband internet users from 2005 and 2006 are probably not 'early adopters'. Therefore it is safe to assume that these people will not opt for the 'very best' or 'fastest'. They are more likely to opt for a low rate starter package.

The most popular speed in the first quarter of 2006 is a subscription of 1.5 Mbit/s download capacity, and 256 kbit/s upload capacity. In the first quarter of 2005 the most popular speed was 4 Mbit/s down.

3.3.5 Use of DSL by download and upload speed, 2005–2006 [1) 2)]



1) These are only the speeds of DSL connections through the fixed KPN network. Speeds of connections via rtv cable or other networks are not included.

2) Key: The speeds given are download speed; upload speed.

Source: TNO based on KPN figures.

Costs of a broadband connection

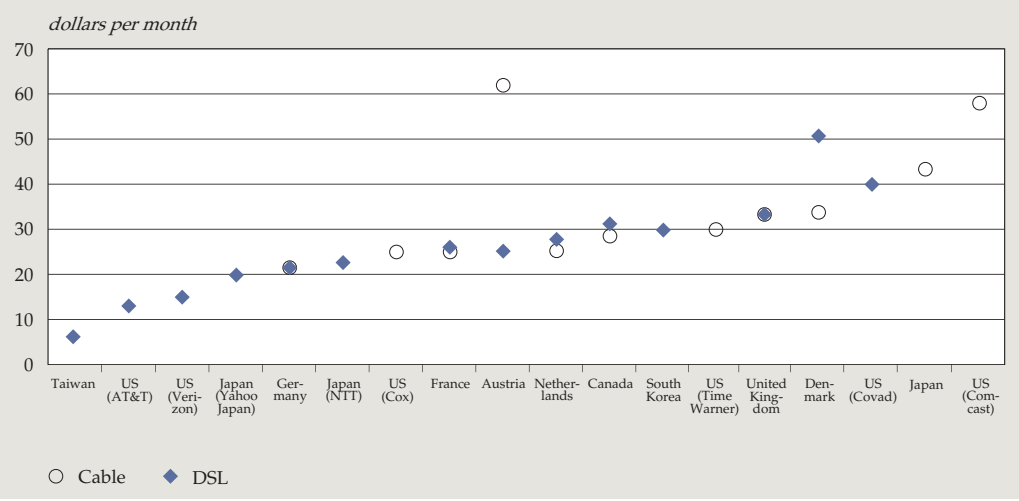
Figure 3.3.6 shows the rates of the starter packages for DSL-broadband and broadband internet through the cable in the benchmark countries. The rates are converted into US dollars to allow for comparison. N.B. this is the starter package. There may be differences between countries as to what is included in the 'starter package' (speed, download limit, extra services). In the Netherlands the broadband subscriptions have been upgraded several times in recent years. The consumer gets a higher speed for the same price. They can also 'downgrade' their subscription and pay less for the old, lower speed.

Dutch rates are average in comparison with the benchmark countries in 2006. In June 2006 a broadband internet starter package via cable in the Netherlands cost 25.20 dollar a month. A DSL connection cost 27.75 dollar a month. There are huge differences between countries: a DSL connection in Taiwan costs just over 6 dollars a month, while people in Denmark pay 50 dollars a month for DSL and 34 dollars for cable. Despite the higher prices, Denmark has relatively many broadband connections (see also figure 3.3.3).

The rates for broadband via DSL or rtv cable are about the same in the Netherlands. This is not the case elsewhere. In Austria people pay twice as much for cable internet than they do for a DSL connection.

Several countries, including Germany and Italy, cut their rates in 2006. In 2005 these countries had relatively high rates. The cuts were probably made for competitive

3.3.6 Cost of starter package broadband DSL and cable, international, June 2006 [1)]



1) The amounts are converted to US dollars based on the exchange rate of 3 July 2006. The countries are ranked by lowest possible rate for DSL or cable internet in that country.

Source: Point-topic.

reasons. In the Netherlands, the rates in June 2006 were up by 3.6 percent (cable) and 4.9 percent (DSL) on June 2005.

Broadband connectivity: new applications and new dilemmas

Since broadband became available to the public at large, there have been several new applications such as sending moving pictures through the internet. These are used for video conferencing, the use of web cams for communication, video phoning (see paragraph 3.4) and also television through the internet (see paragraph 3.5). These paragraphs will discuss the new options in more detail.

Sharing video

One very popular application in 2006 is sharing short, often homemade movies through sites like YouTube ('television by you'), Google Video, or Microsoft Soapbox. The users of these sites can upload movies recorded on their mobile phone or webcam, and watch movies created by other users. This is immensely popular, as is manifest by the fact that users watch 100 million clips a day on YouTube and upload 65,000 new films a month (source: YouTube). One problematic aspect is that users can also upload copyrighted content on these sites.

It is hard to protect copyright in the broadband age where users can exchange music and video fast and simply with broadband connectivity. The classic business model, where film and music companies generate most of their turnover from the sales of CDs, videos and later DVDs in regular (non-internet) shops doesn't seem to work well anymore.

Before the internet became widely popular, people already made 'illegal' copies, that is copying someone else's sound or images without paying the copyright to the owner. This took place on a limited scale, however. Now, with broadband internet it has become much faster and simpler to exchange music and video files. Users all over the world can copy music and video onto their own computer very fast through 'peer-to-peer networks'. Film and music companies indicate that they are losing a lot of money this way.

The film and music companies are trying to use the law to curtail these exchanges. However, this is quite a challenge since it is a worldwide phenomenon, and each country has its own laws. Not all countries prohibit downloading copyrighted material.

In order to generate income from the music and video to which they have the copyright, some companies issue their own downloadable music and video. The

multimedia file can be downloaded via a website, and played on the computer or mp3 player. To prevent the purchased file from being copied for free, the files are DRM protected (see box below). [4)]

In 2006 we find many websites where music can be downloaded legally for a fee. Worldwide online music sales in 2005 amounted to 1.1 billion dollars (OECD, 2006). This is about 6 percent of the total turnover from music sales. In 2003 the percentage was close to zero. In the Netherlands the share of online sales is about 2 percent. The Dutch market for online music takes tenth place worldwide in terms of turnover (see table 3.3.1).

Table 3.3.1
On-line digital music sales, ten biggest markets, 2005

	Share on-line sales in total music sales	Total digital market
	%	*million US dollars*
United States	9	636
Japan	7	278
United Kingdom	3	69
Germany	3	39
France	2	28
Italy	4	16
Canada	3	15
South Korea	.	12
Australia	2	7
Netherlands	2	5

Source: OECD, Information Technology Outlook 2006.

Digital Rights Management (DRM)

DRM is a technology allowing the producer of a multimedia file to make it almost impossible to copy the medium. DRM also makes it possible to allow limited use of the file, so that the user can only listen to the music or watch a video a few times or perhaps within a limited period. The user rents the audio or video file as it were.
One problem with the application of DRM is that there are different standards in use. Sometimes legally downloaded and paid music can only be played on players of a given brand. Media players of a competitor using another DRM standard, or the CD player in the car, may not play the music. These compatibility problems have lead to much discussion between producers and consumer groups about the application of DRM.

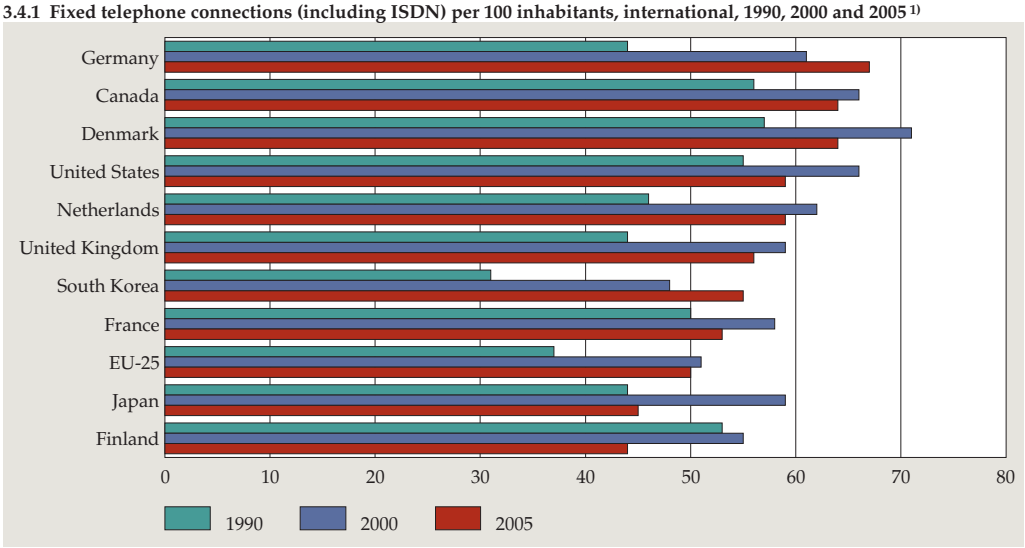
Instead of adjusting and keeping the classical business model described above, it is also possible to use an alternative business model. Such a model, used successfully in 2006 by some, works as follows: a relatively unknown starting band makes its music available on the internet for free. Instead of prohibiting the exchange through the internet, it is encouraged. The rapid exchange creates the possibility to become world famous overnight. Once the band is world famous, it can make money through concerts, merchandise and selling CDs. This business uses the power of the internet, the rapid spreading of information, to its advantage.

Adjusting the current business models to the broadband internet age, or using new business models, is a major challenge facing the film and music industry in the very near future.

3.4 *Telephone*

The telephone market is changing fast. The number of fixed landline telephone connections is falling in favour of alternatives such as telephone over rtv cable, mobile telephones, and phoning through the internet. The first figures to be presented in this paragraph are about the familiar fixed and mobile telephone connections. This is followed by the up and coming telecom technology, such as phoning through the internet. Finally, the services and technology that will shortly come on the market will be highlighted.

3.4.1 Fixed telephone connections (including ISDN) per 100 inhabitants, international, 1990, 2000 and 2005 [1)]



1) 2004 for the Netherlands.

Source: TNO.

Fixed landlines

Virtually all households in the Netherlands can be connected to a fixed telephone connection of the KPN landline telephone network. This network has national coverage and has almost 10 million telephone connections (including ISDN).

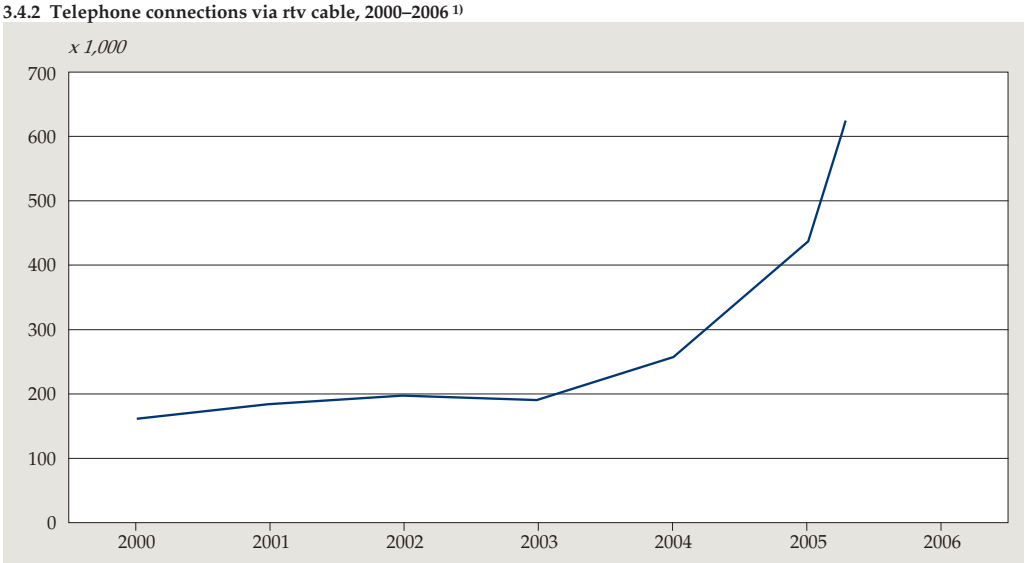
Figure 3.4.1 shows the number of connections per 100 inhabitants in the Netherlands and the benchmark countries. With 59 connections per 100 inhabitants, the Netherlands is fifth behind Germany, but well above the average of the EU-25 countries.

After a long period of steady growth, the number of telephone connections on the fixed landline network is now decreasing. This is explained by the fact that more and more households give up their subscription and only use their mobile phone. The number of households that only used a mobile phone increased to 16 percent in 2005 as opposed to 12 percent in 2004 (TNO, 2006a). Also gaining in popularity are such other possibilities as phoning through the internet or rtv cable.

Phoning through rtv cable

Fixed telephone services (analogue or digital) have been on offer via rtv cable for several years now. Telephone signals are transmitted 'beside' the television signals through the same cable. Figure 3.4.2 shows the increase in the use of phoning via cable. Until the end of 2003 the number of connections was stable around 200 thousand. In 2004 this number started to increase. In the first quarter of 2006 there were already over 600 thousand connections.

3.4.2 Telephone connections via rtv cable, 2000–2006 [1)]



[1)] 2006: provisional figure for the first quarter.
Source: TNO.

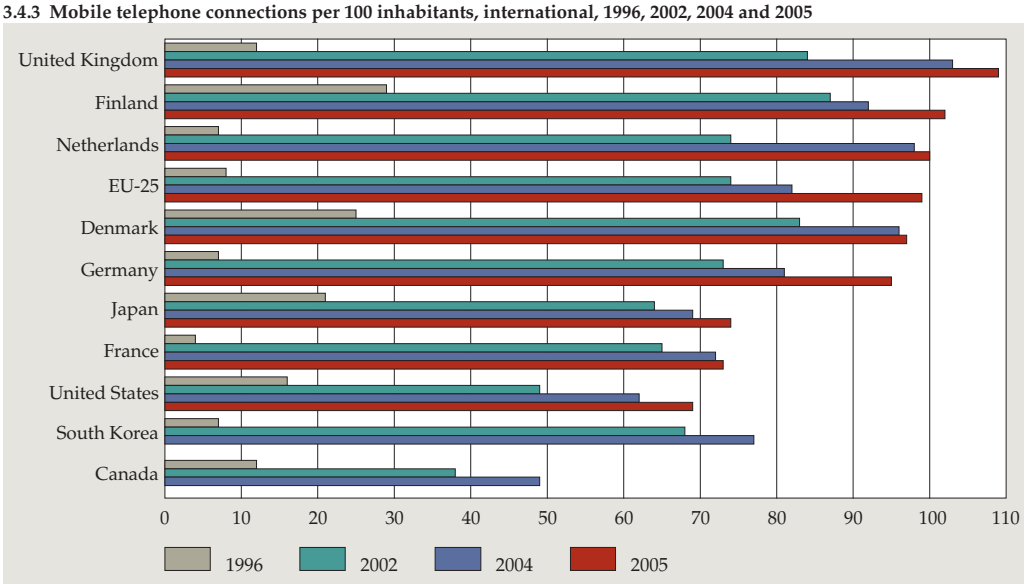
Despite this increase, the number of telephone connections via rtv cable constituted only 7 percent of the fixed telephone network connections, at the start of 2006.

Mobile phones

The number of mobile phone connections rose rapidly in the Netherlands in the period 1995–2000. After stabilising temporarily in 2001 and 2002, the number is growing again. In 2005 there were 16.3 million connections (prepaid and subscriptions), which represents a 1.5 percent increase on 2004. This low growth rate can be explained in terms of market saturation. To make a comparison: the total number of mobile connections is equal to the Dutch population. However, some people have more than one mobile phone, e.g. one at work and one at home. Also included are other devices with a SIM card, such as laptops with a UMTS mobile internet connection.

Placed in an international perspective, the Netherlands has relatively many mobile telephone connections. Figure 3.4.3 shows the number of connections per 100 inhabitants for several benchmark countries. The Netherlands has a position around the EU-25 average, with 100 mobile connections per 100 inhabitants in 2005. In 2004 the Netherlands and the UK headed the list, but in 2005 the number of connections rose fast in several other EU countries, including Germany. The UK has most connections, relatively speaking. France, remarkably, scores well below the EU-25 average.

3.4.3 Mobile telephone connections per 100 inhabitants, international, 1996, 2002, 2004 and 2005



Source: TNO.

The mobile telephone network in the Netherlands has an almost complete national coverage. In June 2006 there were 16,374 GSM antennas across the country. GSM is the most current mobile telephone standard (Antennebureau, 2006).

The number of antennas for UMTS, which succeeds GSM, increased substantially. In June 2006 there were 4,447 registered antennas, a 75 percent increase on the previous year. Once UMTS is introduced, broadband internet access via mobile telephones becomes available, as are other broadband-based services such as the 'video phone', see box below.

The video phone

For a very long time, telephone connections used to be able to transmit speech only. With the emergence of broadband technology it is possible to transmit both speech and images through a fixed or mobile telephone. This means that people not only hear each other on the phone, but they can also see each other. This application is called 'video phoning'.

Modern mobile phones have a mini-camera for recording and a colour screen with a resolution that can show recognisable images of faces. 'Fixed' telephones with camera and screen came on the market in 2006. The PC has provided the option of video phoning with a webcam for a while.

Telephone through the internet

A relatively new technology is phoning through the internet, or another IP-based network, such as a company intranet. The technology is known under several names: Voice over Internet Protocol (VoIP), Voice over Broadband (VoB), IP-telephone, Voice over Digital Subscriber Line (VoDSL). Although there are subtle differences in definition, all deal with phoning through the internet. This technology turns a telephone conversation into digital data packages. These data packages are sent through the internet in the same way as data packages containing email or web pages.

Although this technology was developed several years ago, it started being widely used by consumers in 2005. This was probably after huge advertising campaigns of various providers. The necessary peripherals, such as internet routers with an analogue telephone port or special IP telephones, are widely available in the shops in 2006. In 2005 there were 460 thousand subscriptions to internet telephone services (TNO, 2006b).

Phoning through the internet has several advantages. The main advantage for consumers is the price: phoning through the internet is often cheaper than through a regular fixed telephone connection. A phone call with someone who also phones over internet is often completely free.

The advantages for companies are cheaper and simpler maintenance. The company just has one communication infrastructure to maintain, which can transmit both speech and data services. [5] It is also relatively simple to connect the telephone switchboards of two locations through the internet. Moreover, it offers extra possibilities for teleworking.

In 2006 about 20 percent of the companies with 50 or more employees used telephone over the internet (Telecommagazine, 2006). About 60 percent of these companies use internet telephone services within one location. About 60 percent uses internet telephone between locations. Only 17 percent of the companies using internet telephone services indicated that they used it to allow teleworking.

Phoning over the internet also has some disadvantages compared to the classic telephone line. As a relatively new technology, especially for consumers, the service is not yet over its teething troubles. Although these are likely to be solved relatively fast, consumers are used to very reliable telephone connections.

Something that could become a major problem is SPIT (SPAM over Internet Telephony), the telephone equivalent of SPAM. While electronic mail makes it easy to send huge volumes of advertising to a great many people at once, the digital telephone offers the possibility to do the same thing with voice messages with ads.

Digital telephone technology has been used for a while by telecom operators, to cut costs with expensive lines to other countries or via satellite. The connection between consumer and telecom company is analogue, but the part between the telecom company in the Netherlands and the foreign telecom company is digitalised. This is not something the consumer would notice. The current 'digitalising' mainly occurs in the end of the network, namely between telephone switchboards and individual connections in households or companies.

3.5 *Television and radio*

Traditional analogue radio and television

1951 saw the first (analogue) television broadcast in the Netherlands. To receive television it was necessary to place a huge antenna on the roof of the house and pick up signals from the air waves (terrestrial television). Despite the availability of cable television and more up-to-date technology, 74 thousand households in the Netherlands still only watched analogue terrestrial television in 2006. In total, some 222 thousand households use terrestrial analogue reception in second television sets, or on camping grounds. [6]

In the fifties and sixties the first households were connected to rtv cable. 'Cable' gave better sound and picture quality and more channels. In 2006 cable is still the most

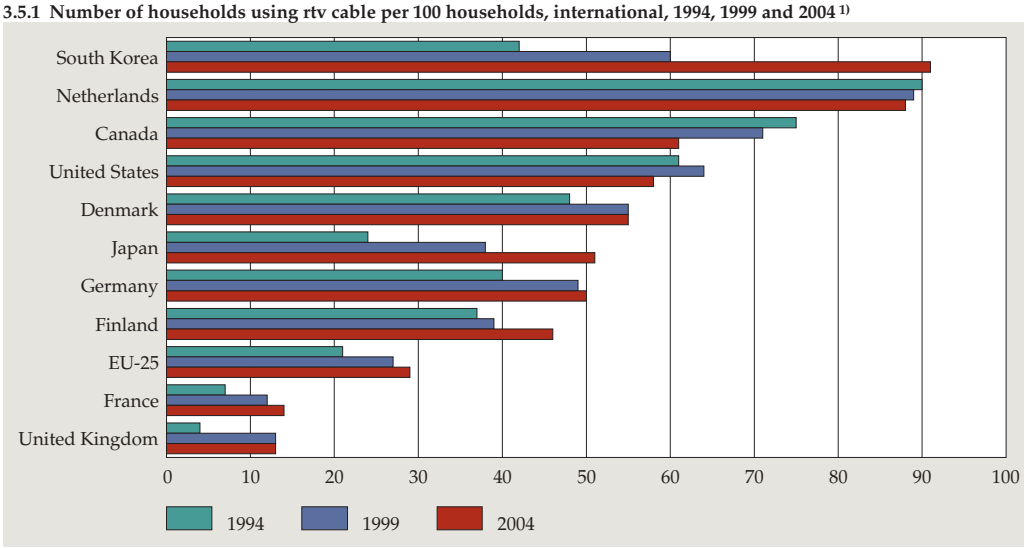
common way to receive television. In 2004, 88 percent of all Dutch households had an rtv connection available. This makes the Netherlands one of the most densely cabled countries in Europe.

Figure 3.5.1 shows the number of cable connections per 100 inhabitants in a number of benchmark countries. South Korea and the Netherlands headed the list in 2004 with about 90 connections per 100 inhabitants. In South Korea the number of connections has increased greatly since 1994 whereas the Netherlands already had a relatively high number of connections in 1994. France and the UK have a much lower percentage of cable connections. The coverage of the cable network plays a major role in this: many households simply cannot get cable.

Whereas only a few people still watch analogue terrestrial television, terrestrial analogue radio is still very popular. Think of the many car radios and mobile radio receivers (not only the old transistor radios but also modern mobile phones with built-in radio receivers). One major problem is the scarcity of frequencies for terrestrial FM stations. The number of stations that can broadcast is smaller than the number that would like to broadcast. Government therefore auctions off terrestrial frequencies for considerable sums of money.

Analogue television signals are transmitted via rtv cable, often together with analogue radio stations. Although cable offers more room for radio stations than the air waves, there is scarcity here as well.

3.5.1 Number of households using rtv cable per 100 households, international, 1994, 1999 and 2004 [1)]



[1)] 2003 for Finland, France and Japan.

Source: TNO.

There are disadvantages to the use of analogue signals. Disturbances in the signal are quite clear, occurring as noise, 'snow' or ghosting effects. This problem occurs mainly in analogue terrestrial signals, but loss of quality also occurs in analogue cable television.

The second problem is the limited amount of space available for the stations. Only a few air frequencies (or frequency bands) can be used to transmit radio or television. Only a limited number of stations can be broadcast via rtv cable.

These problems occur to a lesser degree in digital television and radio. We will discuss digital television and radio below and show various reception options.

Digital television

In digital television the information in pictures, or the various television stations, are not transmitted as continuous analogue signals but as discrete data packages. This is because digital data can be compressed, so that less bandwidth per station is needed, making it possible to have more digital television stations through the same transport medium. Generally speaking the bandwidth used by one analogue station can transmit 4 to 5 digital stations, while the quality remains the same. [7)] Another option is to have a higher resolution signal rather than more stations. This brings us to HDTV. See box 'Extra options with digital television'.

Digital television is rapidly gaining popularity. In 2004 only 740 thousand households had digital television. By the end of 2005 this had gone up to 1.2 million, an increase of more than 60 percent. The price of a digital subscription is often the same as for analogue television. People usually have to pay extra for additional stations, or HDTV. Furthermore they have to buy a special digital receiver and a 'smartcard'.

The standard for digital television signals used in Europe is called 'Digital Video Broadcasting' (DVB). There are variations to the internationally agreed standard. For digital television on air the USA has its own standard ATSC and Japan has its own ISDB.

In 2006, households receive digital television in several ways: classic rtv cable, the air waves, satellite or the internet. Below we sketch the possibilities and differences between the various methods and show figures about their use when possible.

Terrestrial digital television

Digital television via the air waves is the successor to watching television with a classic analogue TV antenna. Whereas a huge antenna on the roof used to be required for a decent reception, terrestrial digital television can make due with a small 20 cm high antenna that can be placed indoors. Reception depends on the

available bandwidth and is of DVD quality, which is better than used to be possible with the analogue antenna. People with an analogue antenna used to only get the Dutch TV stations *Nederland 1, 2 and 3*, and regional stations in much of the country. With terrestrial digital television they can receive more stations including the well-known commercial Dutch language channels.

Terrestrial digital television is also known as DVB-T (Digital Video Broadcasting – Terrestrial). Currently the reception of this type is only possible in part of the Netherlands, mainly in the Randstad (the area including Amsterdam, Rotterdam, The Hague and Utrecht). There will be a roll out by the end of 2006, after which coverage is expected to be nationwide.

Given the expected national coverage of terrestrial digital television and the limited number of households receiving analogue television with a terrestrial antenna, the old analogue television broadcasts are expected to be terminated by the end of 2006. This makes the Netherlands one of the first European countries to only broadcast terrestrial digital television. The digital versions of *Nederland 1, 2* and *3* and the regional channels will be available for free to air, once the analogue signal is stopped. However, consumers have to buy a digital decoder and a proper antenna. Radio broadcasts will remain available on air for a while.

In the first quarter of 2006 there were 207 thousand subscriptions to terrestrial digital television in the Netherlands. This had increased to 230 thousand in the second quarter.

Several other European countries started broadcasting terrestrial digital television. In the UK, for example, 73 percent of all households can receive terrestrial digital television (Ofcom, 2006), while 29 percent of the households actually use it. Its popularity is probably due to the limited availability of cable television in the UK and the availability of various free-to-air digital channels in the terrestrial. In more densely cabled Germany, also 70 percent of the households could receive terrestrial digital television in June 2006. Here 13 percent of the households had bought a DVB-T-set (DVB-T Mitteldeutschland, 2006).

Digital television via satellite

Besides terrestrial cable television and television via the air waves, there is the option of receiving television via satellite, which generally allows for the reception of more channels. The disadvantages are that a dish antenna has to be placed on the outside of the house, which is not always allowed or possible, and that the dish must have a direct 'line-of-sight' with the satellite.

All satellite broadcasts by Dutch channels in 2006 can only be received digitally. Nearly all foreign satellite stations have switched to digital technology in recent

years. There is little difference between analogue and digital television reception with a satellite dish and receiver in terms of infrastructure. Consumers who own a satellite dish can simply switch to digital television; usually it is enough to place another receiver.

Digital television through satellite is broadcast with DVB-S standard (Digital Video Broadcasting – Satellite). These satellites cover an enormous area. One satellite can broadcast to an entire continent. The coverage in satellite reception is 100 percent in principle, provided that there is a 'line-of-sight'.

In 2005 670 thousand households in the Netherlands watched digital television via satellite. This was the most popular way of receiving digital television in 2005. However, in 2006 digital television via cable is growing fast.

Watching television on the mobile phone

In 2005 there was a large test about television reception on handheld devices, such as mobile telephones or PDAs. A terrestrial digital signal is specially adapted for reception on handhelds (DVB-H format).
This 'broadcast' technology differs from the available technology for sending images via UMTS. An UMTS link involves a two-way connection between telephone and antenna. The image is then transmitted to each individual user. This would lead to an enormous burden on the UMTS network when there are many users. With DVB-H there is one terrestrial signal broadcast, which every mobile phone simply 'grabs from the air waves'.

Watching television in the car

Until quite recently it was only possible to receive radio in the car. The DVB-T standard makes it possible to receive digital television while driving a car. This service has been on offer since 2006. Good reception requires just two small antennas.

Digital television via cable

In digital television via cable, the digital television signals enter the house through the rtv cable. For reception consumers must have a digital receiver (also called a decoder, tuner or 'set-top-box'). This converts the digital signal to a format fit for regular TV sets. No extra antennas or dishes are required. The standard for digital television via rtv cable is called DVB-C (Digital Video Broadcasting – Cable). In comparison with analogue cable television it is possible to broadcast more channels and/or a higher definition.

The disadvantage of this method is that, in contrast to analogue cable television, only one television set can usually be connected to a digital tuner. Sets without an extra digital receiver can still receive the regular analogue cable signal transmitted together with the digital signal.

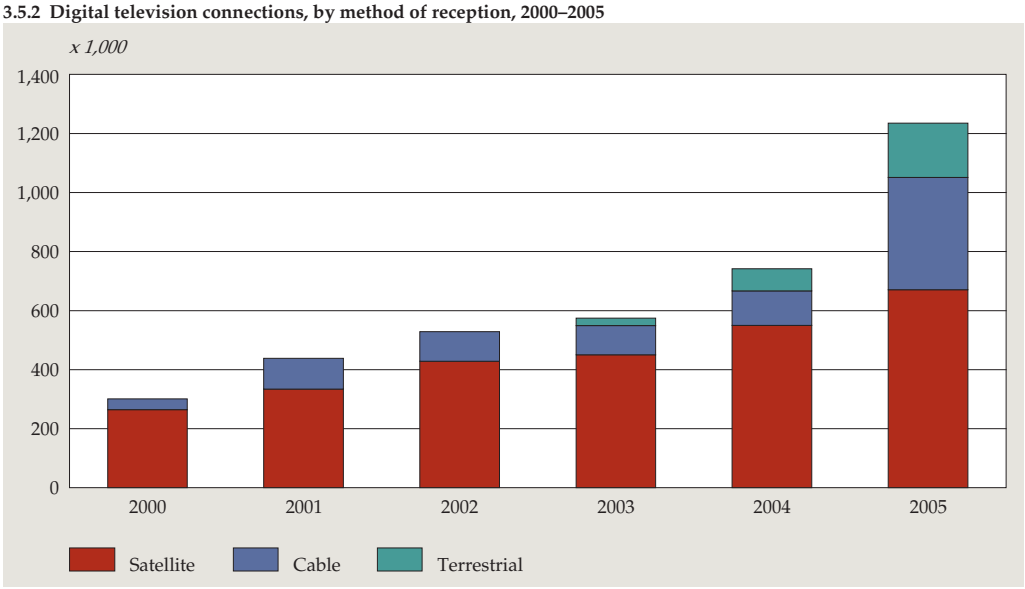
The number of households receiving digital television via cable tripled between 2004 and 2005. At the end of March 2006 there were 604 thousand digital cable television connections.

Figure 3.5.2 shows developments in the use of digital television by method of reception: terrestrial, satellite or cable. IPTV (see next paragraph) is not included. Although satellite currently has the greatest number of connections, reception by rtv cable and terrestrial is growing fast. In 2005 there were over 1.2 million digital television connections in total.

Digital television through the internet/IPTV

A fourth option is to receive digital television on the internet, also known as IPTV (Internet Protocol television). It is possible to use a DSL line with sufficient capacity to transmit an entire television channel with a high quality. One advantage of this form of digital television is that the only channel transmitted is the one the user has tuned into. This in contrast with most other types of broadcasting, where all channels are broadcast at the same time and where the television set itself filters out one channel. So the scarcity in frequencies plays no role in this technology; in theory the number of channels is unlimited.

3.5.2 Digital television connections, by method of reception, 2000–2005



Source: TNO.

Possible hitch with this kind of broadcasting is that the internet connection must have sufficient speed. ADSL2 is usually recommended, but not every household in the Netherlands can get an ADSL2 connection yet, see paragraph 3.3.

One company in the Netherlands started to broadcast live football in this way. Since April 2006 the 'regular' Dutch television stations are also transmitted. Other providers are about to experiment with similar services. Exact figures on the number of IPTV subscriptions in the Netherlands are not yet available.

Outside the Netherlands, especially in countries without a dense rtv cable network, people use IPTV quite often. France had 470 thousand IPTV subscriptions at the end of 2005. Within Europe, IPTV had a 1.6 percent share in television services at the end of 2005.

This type of digital television should not be confused with watching television on the pc with a special TV card, where the signal enters the home through (e.g.) rtv cable or with 'downloading' films or programmes from the internet.

Extra options with digital television

Apart from advantages such as a higher definition and more channels, digital television offers various other advantages over analogue transmission. A few examples are:

Pay per view/pay per channel
The signal in digital television can easily be encrypted which makes pay television an option. Here users can chose their own channels or package. A smart card by the television provider must be placed in the digital receiver to decrypt those channels for which the user has paid. Video-on-demand services and paying for specific programs are another option.

Interactive TV
Digital television offers plenty of interactive possibilities, with or without the internet. Users can look at a constantly updated electronic program guide (EPG). Interaction with a live broadcast is another option: this makes it easy for people to vote in quizzes or shows.
Users no longer have to watch a program at the time it is broadcast, they can watch it whenever it suits them through IPTV, or services like 'Uitzendinggemist' by the public broadcasting corporations or 'RTL-gemist' by the commercial television company RTL. These free services place programs or parts of programs in archives so that they can be watched again later.

HDTV
High Definition Television (HDTV) is a standard for television broadcasts in a higher resolution than ordinary broadcasts. The big plasma and LCD televisions created demand for such high resolutions. Regular broadcasts look fuzzy or 'blocked'. The greater bandwidth required for HDTV became available with the introduction of digital television.

Digital radio

Like signal broadcasting in digital television, the signal in digital radio is broadcasts in small digital data packages. It has the same advantages as in digital television: better signal quality (especially compared to analogue terrestrial radio), and the possibility of broadcasting more channels within a limited frequency range. It is also possible to send extra information with the signal, such as traffic warnings or the title of the music played. The radio receiver can show this information on a display or screen. Listening to digital radio requires a digital radio receiver.

A standard for digital radio used in many countries is DAB (Digital Audio Broadcast). Public radio in the Netherlands currently has terrestrial broadcasts in DAB (T-DAB). Commercial radio channels are waiting for a frequency allocation by the government. T-DAB can be seen as the successor to 'FM' technology.

In the Netherlands the T-DAB transmitters cover about 70 percent of the population, especially in the Randstad and the Noord-Brabant province. There are no figures available about the actual number of T-DAB radio listeners. There is an international comparison of the reach of T-DAB in *The Digital Economy* of 2005, page 122. There are no later data yet.

Apart from DAB it is also possible to receive DVB-T radio. The radio transmissions are sent along with the television signals in this technology. Figures about the reach and use of DVB-T are shown in the paragraph on digital television.

An altogether different standard is DRM (Digital Radio Mondiale). [8)] This can be considered the digital equivalent of 'short wave'. The advantage of short wave is that the transmitter covers a much wider area than an FM transmitter. The disadvantage of the short wave technology is interference and lesser sound quality. The noise in sending digital signals can be reduced, so that a transmission of reasonable quality over more than 1,000 km can be achieved. Currently the only Dutch radio station transmitting through DRM is the Wereldomroep.

Digital radio through the internet

Users can listen on the internet to 'streams' of data. Both 'live streams' (direct copies of transmissions of terrestrial or cable broadcasts), and internet-only broadcasts. The worldwide character of the internet makes it possible to listen to stations from all over the world. There is no scarcity of frequencies with this technology, because the only transmission sent through the internet is the program selected.

Furthermore the internet provides the option to listen again to various programs at any time. While good quality television through the internet requires a very fast internet connection, this is not the case for digital radio through the internet. A starter broadband subscription is usually enough.

3.6 *Convergence*

In the past, each service had its own unique transmission method. One institution or company had the monopoly on the service. Speech went through a PTT telephone line, and television was received on the cable of the local cable company. Two major changes took place in recent years. There is no longer a state company monopolising telephone services since other companies can also use the telephone cable infrastructure. And, major new technologies entered the market, such as mobile phones and the internet. The emergence of the internet and the possibility that services that used to be sent separately can now be sent jointly via Internet Protocol (IP) through one infrastructure, has contributed to the convergence of services.

In 2006 many telecom companies offer service bundles via a single distribution method. A company can now supply television, internet and telephone via an rtv cable. Sometimes companies offer one package of services through different distribution methods, such as internet and telephone via an ADSL line plus terrestrial television, or a combination of fixed and mobile telephone.

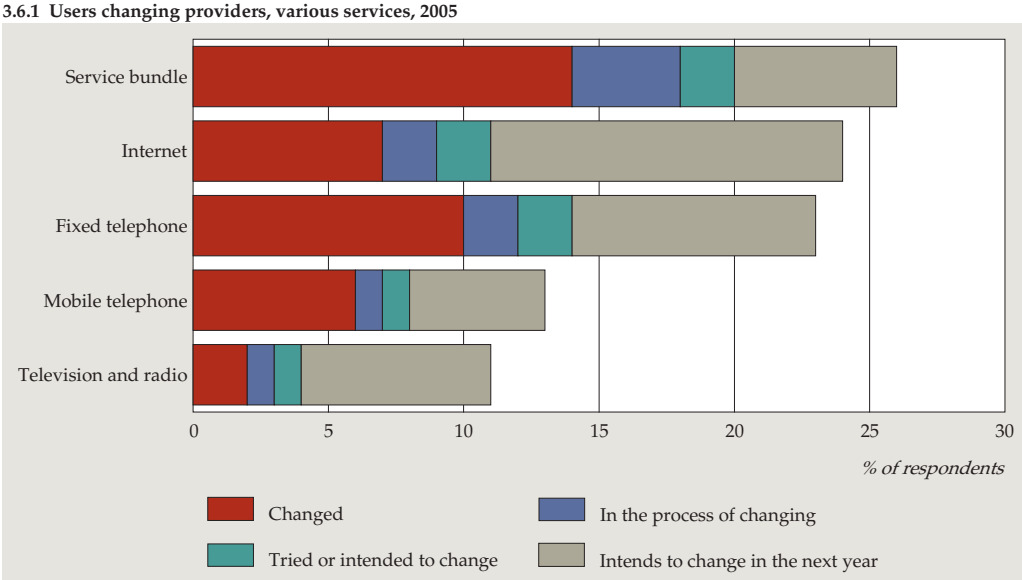
Most households state 'ease' and 'lower costs' at the main reasons why they have a combined service package (EIM, 2006). Having a single infrastructure (one box instead of a separate modem, switchboard) and a single helpdesk are also named as advantages. Disadvantage of having all services via one distribution method, is that when the line goes down all services go down with it. This can be problematic for companies. When email is down for a short while, it is usually no real disaster. However, when a company is cut off from telephone and the internet (email), and there is no communication with the outside world, it could severely hamper business.

The advantages for telecom companies are being able to offer a wider product range to keep old or attract new customers, and lower costs due to the advantages of scale. Classic cable companies, which only used to supply television and radio, are now also offering telephone. To counter the loss of clients, telephone companies now offer television services.

Changing providers is relatively simple these days. OPTA-regulations, for instance the agreements about retaining one's old telephone number, already made the switch to another (mobile) telephone provider relatively simple. Now switching internet, radio and television providers is becoming simpler as well. Switching internet providers used to take weeks, leaving the client without any internet at all. These days it can be done within a day.

Figure 3.6.1 shows the percentage of households that switched or considered switching providers. A distinction is made by telephone, radio and television services and the internet. In 2005 some 10 percent of the subscribers to a fixed

3.6.1 Users changing providers, various services, 2005

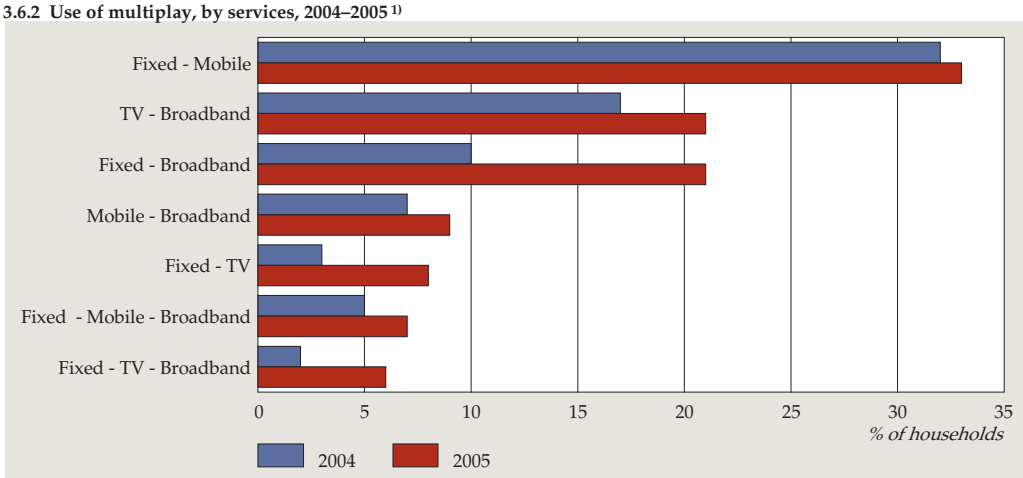


Source: OPTA, Jaarverslag en marktmonitor 2005.

telephone connection switched, while only 2 percent of the respondents needed another television and radio provider.

Figure 3.6.2 shows the purchase of more than one service from a single provider ('multiplay'). Various market parties indicated they wanted to focus on this area.

3.6.2 Use of multiplay, by services, 2004–2005 [1)]



[1)] Percentage of households that purchases these services from a single provider. The term 'fixed' here means telephone via a fixed landline (including VoIP), 'mobile' stands for a mobile telephone connection. 'Broadband' stands for a fixed or wireless broadband internet connection. Combinations not mentioned here hardly occurred in 2004 and 2005 (<1 percent of the households).

Source: OPTA, EIM.

Technical convergence of services

All-IP

Technically speaking the differences between the various services is disappearing. Telephone, radio and television signals can all be sent digitally through the internet with the Internet Protocol (IP). The term 'All-IP' is often used; all services offered are transmitted in the form of IP packages.

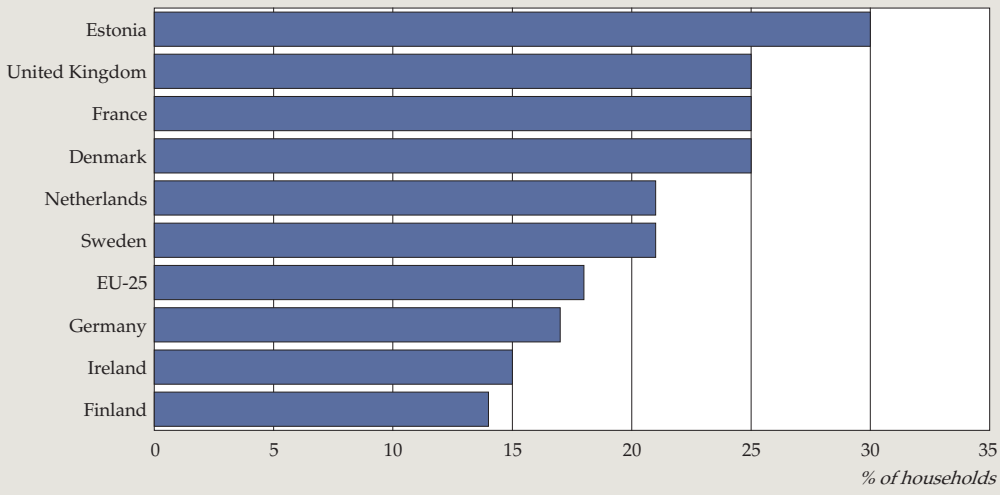
The type of cable through which IP packages are sent is no longer as important. All services can be sent through twisted-pair copper cable (that was used for telephone calls), and coax cable (used to send television signals). Although there may be differences in the technology with which the information is sent, the consumer sees little difference anymore.

Fixed versus mobile telephone

Many consumers have a fixed telephone line at home and carry a mobile phone with them. In 2006 a technology was introduced that allows users to have just one telephone set. This telephone set will use a wireless WiFi connection to contact the (fixed) internet connection in the home as soon as it comes within reach. VoIP-technology is then used to set up a telephone call through the internet connection. In this situation consumers use the lower rates of phoning through a fixed internet connection. When user and telephone are not close to home, the set will automatically connect with GSM or UMTS masts, in which case the user will pay the regular mobile phone rates for their telephone calls.

The most common combination of services is a fixed and a mobile telephone connection (33 percent of the households in 2005). 21 percent of the households have a television subscription plus broadband internet (probably mainly internet via rtv

3.6.3 Use of multiplay, international, 2006 [1)]



[1)] Share of households purchasing at least two services in one package from a single provider. The data refer to the situation in December 2005 or January 2006.

Source: European Commission, 'E-communications Household Survey', Special Eurobarometer 249.

cable) of the same provider. Between 2004 and 2005 the combination of a fixed telephone line plus broadband internet rose from 10 to 21 percent of the households.

A study of the European Commission (EC, 2006) shows that there are major differences within the EU in the use of multiplay, see figure 3.6.3. The percentage of the households that purchased at least two services in one package averaged 18 percent for the EU-25 as a whole. The Netherlands is just above the EU average. Estonia has a remarkably high score of 30 percent.

Notes in the text

1) The definition of a public electronic communication service or network, see *The Digital Economy 2005*, page 118.
2) This is an indication; a limited number of parties with registrations is not active, while other parties have several registrations (e.g. for individual business units or activities).
3) This concerns labour volume: the number of jobs in a year converted to full-time equivalents.
4) Not to be confused with Digital Radio Mondiale, a standard for broadcasting digital radio (see paragraph 3.5).
5) Sometimes old faxes, modems, elevators and alarm systems still require an analogue line so that several infrastructures are required within the company anyway.
6) Source: Ministry of Economic Affairs.
7) When DVB-T is applied. See Dialogic, 2005.
8) Not to be confused with Digital Rights Management, a technology to protect digital rights, such as copyrights on digital music files (see paragraph 3.3).

4. ICT use by companies

Broadband has spread like wildfire among companies in recent years. In 2001 only 23 percent of the companies had broadband internet, versus 81 percent by December 2005. In addition, many more employees have access to the internet at work.

The overwhelming majority of companies (86 percent) had an internal network in 2005. The use of intranet or extranet was considerably less common in small companies than in large ones. Many companies also had interlinked computer systems. The most common link was that of an order to an invoicing system.

Apart from internal data communication, companies also increasingly link their own computer systems to those of their suppliers. Gas, water and electricity supply companies, hotels and restaurants and trade relatively often had such external links in 2005. Computer systems were more often linked to those of suppliers than clients.

The development of e-commerce is not meeting the expectations people had several years ago. The share of e-commerce in the total turnover of companies has been increasing slowly since 2001. The largest share of e-commerce in total turnover is found in the manufacturing industry and trade. Internationally the Netherlands is a very average performer where e-commerce is concerned. The European countries where e-commerce is far more common are Ireland and the UK.

Since the use of the internet continues to grow, security problems continue to be a problem. Most companies in 2005 took measures to keep unwanted visitors out by antivirus software and a firewall. Despite such measures, 7 percent of the companies had security problems in 2005.

The financial sector is one sector of industry where ICT plays a particularly major role. ICT use there is more intensive than in other sectors of industry. The huge amounts of money circulating in the sector make financial companies a target for cyber criminals. The major financial companies paid a great deal of attention to their security in 2005.

4.1 ICT infrastructure

Companies have become increasingly sophisticated in their use of computers. New applications make that companies continue to invest in information and communication technology. The literature tends to distinguish three phases (see OECD, 2006): *readiness*, *intensity* and *impact*. In *readiness* the issue is the availability of the information and communication equipment. How many computers, internet connections, broadband connections, peripherals, etc are there at a given time in a country or company? This says nothing about the use people make of them. In *intensity* the issue is the use of the computers, internet, etc. So how many people or companies use the internet and to what extent? The most interesting are the consequences of this use of information and communication technology: *impact*. [1)]

This is about the question to what extent the use of ICT influences the way people or companies work. Does ICT lead to efficiency gains, or are there new products because of it?

In this paragraph the focus is mainly on *readiness* and the figures on the use of the internet at work tell something about *intensity*. The paragraphs that follow mostly deal with the ways companies work with ICT: the *impact*.

Survey ICT use by enterprises

The survey on the ICT use by enterprises is an annual sample survey among companies employing 10 or more persons that has been conducted by Statistics Netherlands since 1987. The rapid developments in ICT in the last two decades made it necessary to regularly update the contents of the survey. During the first years, the questions focused on the costs of automation, computer personnel, and the ownership of computers. The emphasis has shifted to the use of external networks like the internet. The results of the study on a given year refer to the situation at the end of the year; so figures on 2005 refer to the situation in December 2005.

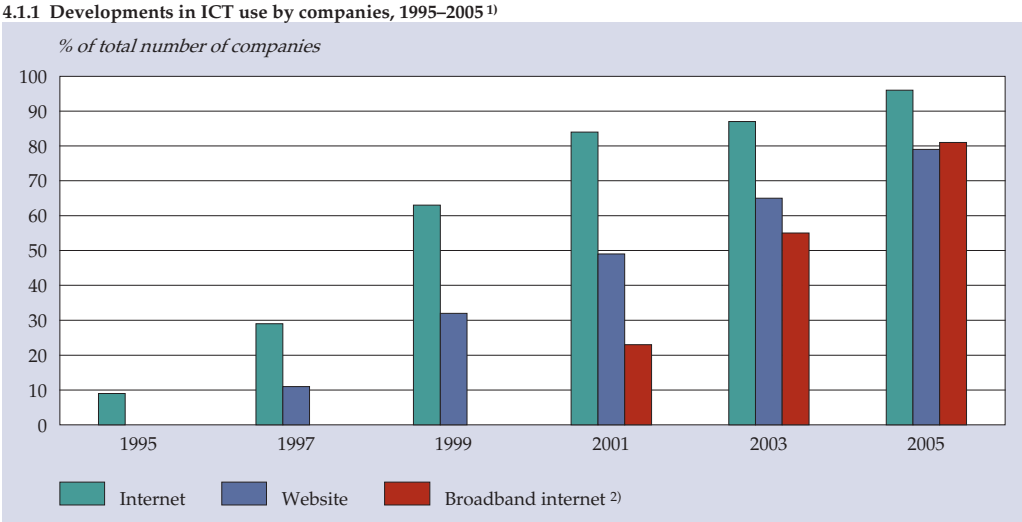
The ICT use in the financial sector stopped being part of the general survey on the ICT use in enterprises in 2003. It is now observed in a separate survey with a slightly different questionnaire. Both surveys are part of the harmonised EU surveys on the use of ICT by enterprises.

The figures show that 96 percent of the companies in the Netherlands had access to the internet in 2005, see figure 4.1.1. Ten years ago this was barely 10 percent. 97 percent of companies had external data communication. External data communication includes the internet and EDI (electronic data interchange).

In the last five years broadband internet really took off. In 2001 only 23 percent of the companies had a broadband connection, versus 81 percent in 2005. The fact that such an overwhelming majority of companies now has broadband internet creates possibilities for new ways of working. Paragraph 4.3 on external data communication will detail the activities for which companies use broadband internet.

In 2005 almost 80 percent of all companies had a website. The main purpose is for companies to present themselves to the outside world. Many companies also use the website to provide information about products and prices. The internet gives them greater reach than the traditional methods. These traditional methods do not necessarily suffer because of the internet. Potential clients may well have a look at

4.1.1 Developments in ICT use by companies, 1995–2005 [1)]



1) Companies with 10 or more employees (1995–2001) / employed persons (2002–2005).
2) Broadband internet is defined here as ADSL, cable and other fixed internet connections with a large bandwidth.

Source: Statistics Netherlands, ICT use by enterprises/ IT survey.

the website for product and price information, compare these to data by other suppliers, and order the products in a traditional way. Other clients may look at a product they want in a shop and then order it on-line from the cheapest supplier (source: Thuiswinkel.org). Paragraph 4.4 discusses the involvement of companies with e-commerce, receiving and placing orders on-line. As it turns out, e-commerce is not yet very common. This implies that the development of e-commerce is a lot slower than was expected during the internet hype.

Internet use at work

In the last five years, the internet has started to play an increasingly important role in peoples' everyday lives. At work the use of the worldwide web is also becoming widely accepted. The percentage of the workforce with access to the internet increased in all benchmark countries, see figure 4.1.2. In 2004 the 'country rankings' were hardly different from 2003.

Finland remains ahead of all other EU countries, with 56 percent of the workforce in 2004 using the internet at work; in 2003 this was 53 percent. In Denmark too over half of the workforce can use the internet at work. The Netherlands ranks third among the selected benchmark countries, behind the Scandinavian frontrunners. Compared to the European average, however, the Netherlands is no longer as far ahead as before. In 2003, a quarter of all Europeans had access to the internet at work, whereas this was 37 percent in the Netherlands. In 2004, the average of the EU-25 was 35 percent, while in the Netherlands 42 percent of the workforce had internet

Ranking e-readiness in 2006

In the annual ranking of the Economist Intelligence Unit (EIU), the research unit of *The Economist*, close to 100 indicators are divided into six categories. These are not just purely technical indicators, such as the number of computer users or broadband connections, but also data on the general economic and political climate. The six categories are: connectivity and technology infrastructure (weight: 25 percent); business environment (weight: 20 percent); consumer and business adoption (weight: 20 percent); legal and policy environment (weight: 15 percent); social and cultural environment (weight: 15 percent); supporting e-services (weight: 5 percent).

The top 15 of the world looks as follows:

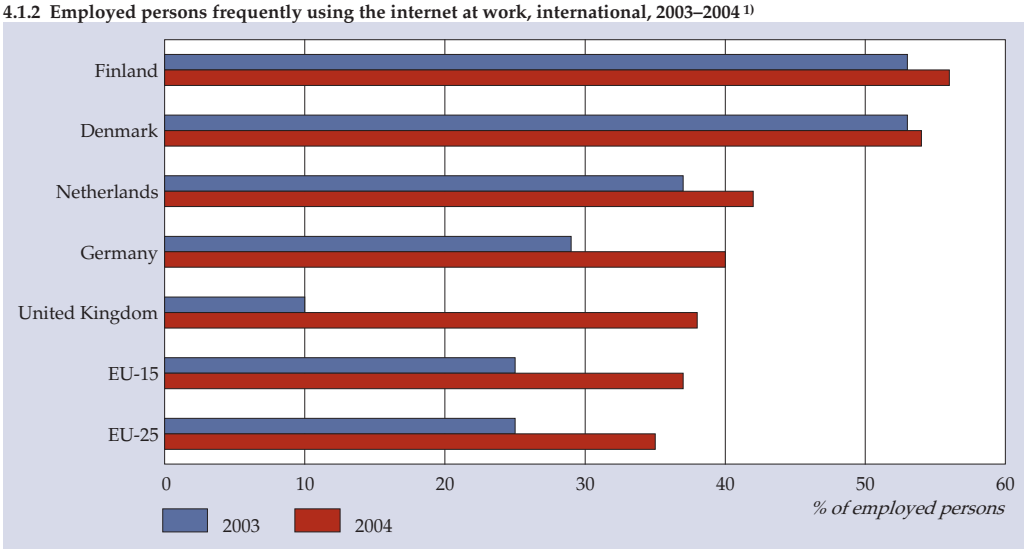
Ranking 2006 (of 68 countries)	Ranking in 2005	Country	E-readiness score 2006 (of 10)	E-readiness score 2005 (of 10)
1	1	Denmark	9.00	8.74
2	2	USA	8.88	8.73
3	4	Switzerland	8.81	8.62
4	3	Sweden	8.74	8.64
5	5	UK	8.64	8.54
6	8	Netherlands	8.60	8.28
7	6	Finland	8.55	8.32
8	10	Australia	8.50	8.22
9	12	Canada	8.37	8.03
10	6	Hong Kong	8.36	8.32
11	9	Norway	8.35	8.27
12	12	Germany	8.34	8.03
13	11	Singapore	8.24	8.18
14	16	New Zealand	8.19	7.82
14	14	Austria	8.19	8.01

The Netherlands ranks sixth in the world. First in 2005 and 2006 is Denmark. The USA is the first of the non-European countries in terms of 'e-readiness'.

The EIU study shows that almost all countries in 2006 have higher scores than the year before, and that countries that are relatively 'behind' are catching up. The Western European countries that are still ranking high may lose their advantage in the future. To stay competitive, existing technologies must be used to innovate, supplying new products and services.

Source: The 2006 e-readiness rankings, Economist Intelligence Unit and IBM Institute for Business Value, 2006.

4.1.2 Employed persons frequently using the internet at work, international, 2003–2004 [1)]



[1)] Companies with 10 or more employed persons.

Source: Eurostat.

access. There are no European figures on 2005 available as we write. In the Netherlands the percentage of the workforce who could access the internet at work went up to 43 percent.

The most striking change took place in the UK. In 2003, 10 percent of the workforce had access to the internet at work, which placed the country well behind in Europe. But this was quickly remedied: in 2004, almost 40 percent of the workforce had access to the internet, which is slightly higher than the average for the EU-15.

4.2 *Internal data communication*

There are computers in almost all companies. Often these computers are linked in a LAN (local area network). 86 percent of all companies have an internal network. Usually, the larger the company the higher the probability of it having a network. 82 percent of the companies employing 10–19 persons or more has a network, compared to 99 percent of the companies employing 100 persons or more.

Intranet

An intranet is a provision to communicate and provide information within a company. It is based on internet technology, but it is only accessible by company employees. This is a means of communication mainly used in large companies. The use ranges from 26 percent among companies employing 10–19 persons tot 83 percent among companies employing over 500 persons. The difference is easy to

explain. Communication and sharing information are easier in a small than in a large company, so large companies benefit more from having an intranet. They also have more means to invest in the set-up of an intranet. Intranet is most common in the gas, water and electricity supply companies, computer service bureaus and research institutions.

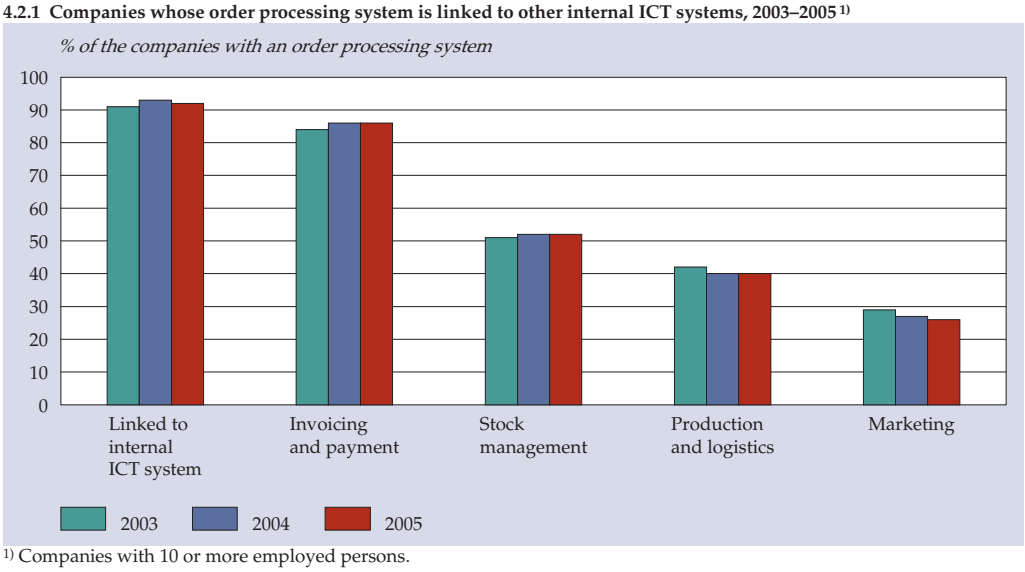
Extranet

An extranet is part of an intranet made accessible to people outside the company, such as regular clients or suppliers. 14 percent of all companies used an extranet in 2005, ranging from 11 percent among the smallest companies to 40 percent among the largest. Many companies with extranet are found among the computer service bureaus, in repairs and trade, post and telecommunication and gas, water and electricity supply companies.

Internal linking of computer systems

In 2005, almost two thirds of all companies had an ICT system for order processing (figure 4.2.1). Over 90 percent of the companies with such a system had linked it to one or more internal computer systems. The most common was linking a system for invoicing and payments; 86 percent of the companies with an order system have the system linked to an invoicing system. In just over half of the companies with an order system, it is linked to a stock management system. And 40 percent of the companies have linked the order system to a system for production and logistics planning.

4.2.1 Companies whose order processing system is linked to other internal ICT systems, 2003–2005 [1)]



[1)] Companies with 10 or more employed persons.

Source: Statistics Netherlands, ICT use by enterprises.

In general, big companies progress further with the integration of computer systems than small companies. The percentage of companies with an order processing system in 2005 was higher among the bigger companies. The same is true for linking other internal ICT systems. The survey shows that the turning point is for companies employing 100 persons.

The 2005 figures do not differ greatly from the 2003 and 2004 figures. About two thirds of the companies also had an order processing system in place, and over 90 percent of the companies with an order system had it linked to another (internal) system. The question is why the figures remain unchanged over the years. In a time of efficiency gains, it is curious that linking computer systems no longer increases. Perhaps entrepreneurs feel that there are better ways to raise efficiency.

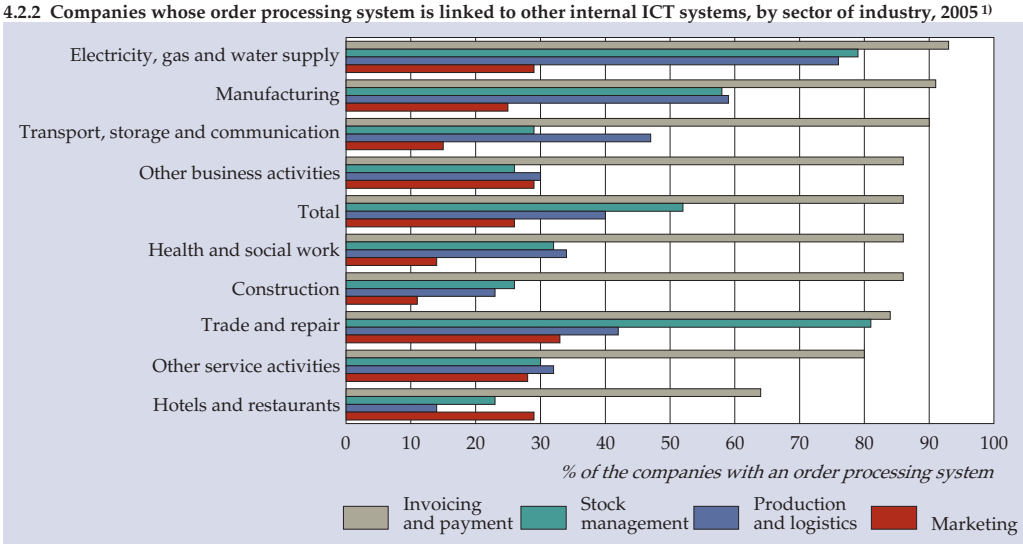
In all sectors of industry the most common link is that between an order processing system and an invoicing system: when an order is being placed, an invoice is made for the client. 93 percent of the gas, water and electricity supply companies have the order processing system linked to the invoicing and payment system. In hotels and restaurants this link is least common, but in 2005 64 percent of the companies had their order processing system linked to an invoicing system, see figure 4.2.2.

The differences between the sectors of industry are much greater when it comes to other internal computer systems. Linking the order system to the stock management system ranks second in popularity. Over 50 percent of the companies in total realised this link in 2005: if an order is placed, stock management is aware that something has been ordered. Stocks can be replenished by ordering new goods directly or when stocks run low. We will discuss links with computer systems of suppliers (and clients) in paragraph 4.3. The link between order and stock management systems is most common in trade, where over 80 percent of the companies used such a link in 2005. It is again least common in hotels and restaurants. Many other sectors of industry stay below the average, such as construction and health and social work where a below average percentage of companies linked their order and stock management systems in 2005. It is easy to explain the low percentage in the services sectors, because the type of work done there is often tailor-made and therefore it is not useful to create stocks – if it is possible at all.

40 percent of the total number of companies linked their order system with a logistics system in 2005. In gas, water and electricity supply companies and in the manufacturing industry most of the companies did so. Hotels and restaurants and construction again lagged behind.

In 2005 less than a third of all companies had an order system linked to a marketing system, for instance to create mailing lists from a client database. In many sectors of

4.2.2 **Companies whose order processing system is linked to other internal ICT systems, by sector of industry, 2005** [1)]



[1)] Companies with 10 or more employed persons.

Source: Statistics Netherlands, ICT use by enterprises 2005.

industry about 30 percent of the companies did so. The sectors of industry construction, health and social work, and transport, storage and communication lagged behind.

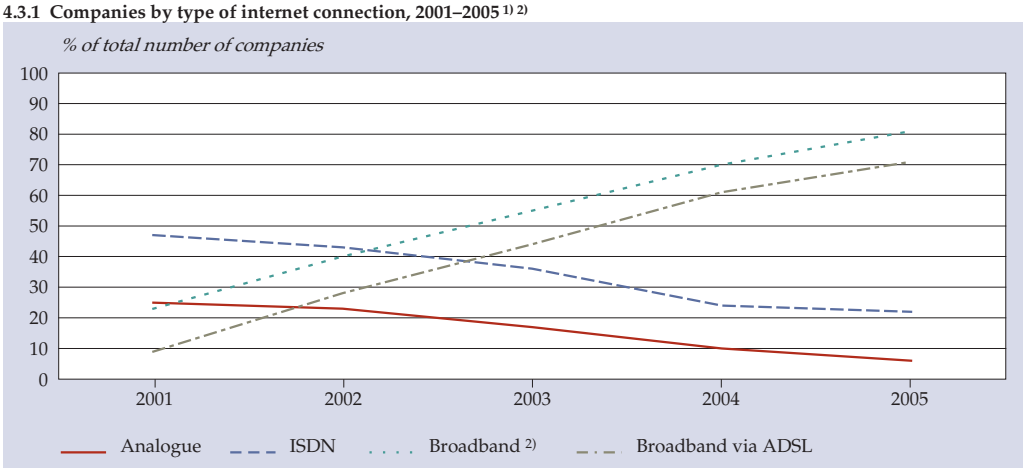
4.3 *External data communication*

Broadband

In the last five years, broadband internet has swept the country. Companies discovered that there are many advantages to having high-speed internet over 'normal' internet. It makes it easier to download huge information files, and to use audio or video on the website, and provide huge quantities of information. The internet is also used for e-commerce. Developments in e-commerce will be examined in paragraph 4.4. The internet technology also provides new ways to communicate and trade with suppliers and clients. This aspect will be discussed later on in this paragraph.

Figure 4.3.1 shows the enormous percentage increase in the number of companies with broadband internet in recent years. When the 21st century started, only 23 percent of the companies had broadband. In 2005 this had increased to 81 percent. Most broadband connections are ADSL, so the share of companies with ADSL matches the increase in the use of broadband.

4.3.1 Companies by type of internet connection, 2001–2005 [1) 2)]



1) Companies with 10 or more employees (2001)/employed persons (2002–2005). The graph shows that many companies have more than one connection. Apparently, companies do not immediately discontinue an older internet connection such as an analogue modem or ISDN when they start to use a broadband connection.
2) Including 'other internet connections'.

Source: Statistics Netherlands, ICT use by enterprises / IT survey.

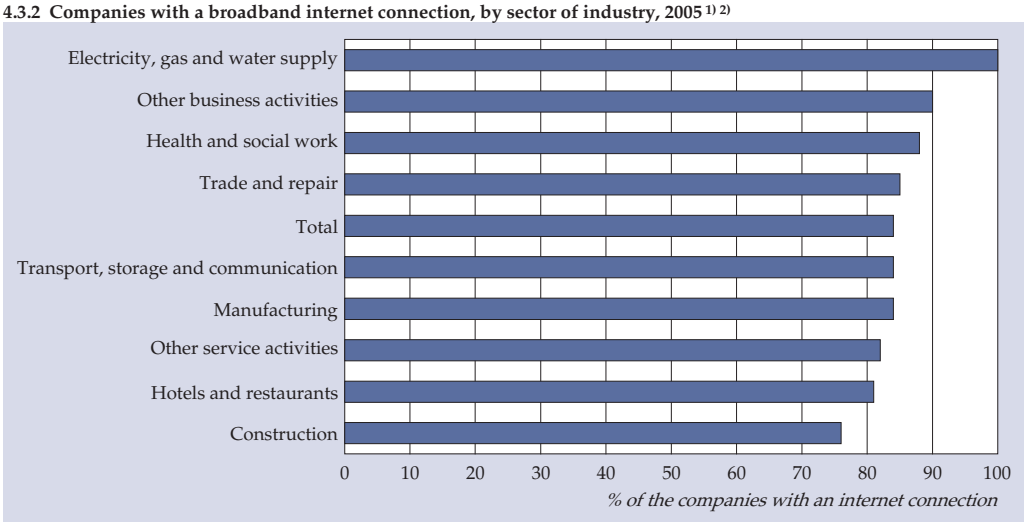
As broadband internet increases, analogue internet connections decrease. Only six percent of the companies with internet still had an analogue dial-up link in 2005. ISDN, a faster digital dial-up connection is still quite popular. Nevertheless, the use of ISDN is decreasing; the percentage of companies with ISDN is in 2005 less than half of the percentage in 2001. One explanation for the fact that ISDN is not fading as fast is that it has several advantages for companies: it offers internet plus the option of several connections on one line (CBS, 2006). So it is possible to use a phone and a fax at the same time. Companies are slightly less willing to loose the ISDN because of this advantage.

When we compare the shares between the sectors of industry, we see that all gas, water and electricity supply companies have high-speed links to the internet, see figure 4.3.2. In most other sectors of industry the degree of penetration of broadband internet is between 81 and 90 percent. Only construction lagged somewhat behind with the use of broadband in 2005.

External links

Linking an order processing system with a computer system of the clients or suppliers is not as common as linking it with another internal computer system. This may be explained by the fact that linking systems within a company is easier, both technically and in terms of organisation. It does not require negotiations and deals with external parties. In some sectors of industry the production process is such that working closely together with suppliers leads to mutual benefits.

4.3.2 Companies with a broadband internet connection, by sector of industry, 2005 [1) 2)]



1) Companies with 10 or more employed persons.
2) Broadband internet is defined here as ADSL, cable and other fixed internet connections with a large bandwidth.

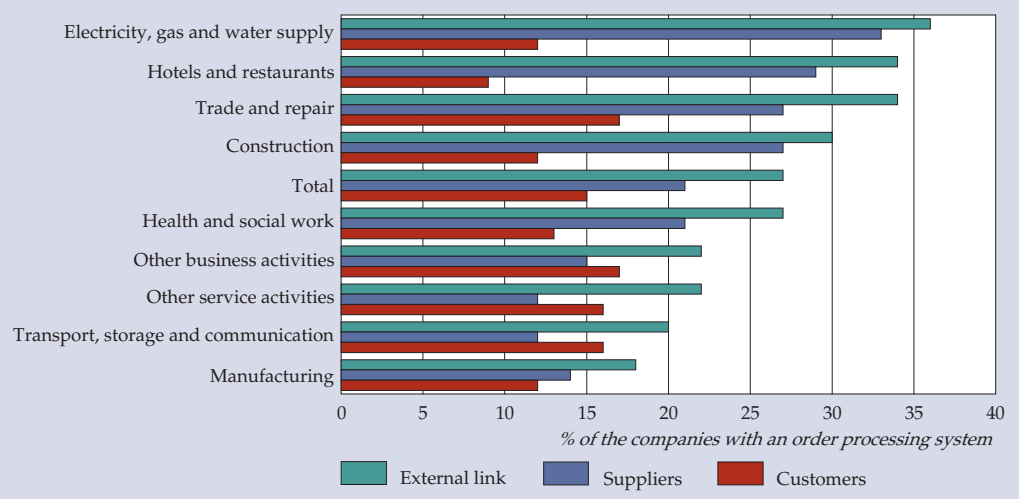
Source: Statistics Netherlands, ICT use by enterprises 2005.

The survey shows that in 2005 a link with suppliers was more common than a link with clients in most sectors of industry. This is shown in figure 4.3.3. In the gas, water and electricity supply companies, hotels and restaurants and in repairs and trade over one in three companies in 2005 linked the order processing system with that of a clients and/or supplier. In most sectors of industry 30 percent of the companies with an order processing system had an external link in 2005. The average for all companies was that 27 percent had an external link; 21 percent of the companies with an order system had a link with a supplier and 15 percent with a client. In general, as size class increases so does the probability of having an order processing system linked to that of clients or suppliers.

In the hotels and restaurants it is useful to link up with a supplier's computer system because, given the perishable nature of many of the goods, they cannot be stored for long periods of time. The link between the hotels and restaurants and the supplier allows for 'just in time' deliveries to replenish stocks. In trade this is used in restocking supermarkets. Supermarkets often have advanced stock management systems.

In some sectors of industry, namely renting and business services, in culture, recreation and other services and in transport, storage and communication, it is more common to have a link with clients than with suppliers. The explanation is that it is common in business services to have long-standing relationships with the

4.3.3 Companies whose order processing system is linked to ICT systems of suppliers or customers, by sector of industry, 2005 [1)]



[1)] Companies with 10 or more employed persons.

Source: Statistics Netherlands, ICT use by enterprises 2005.

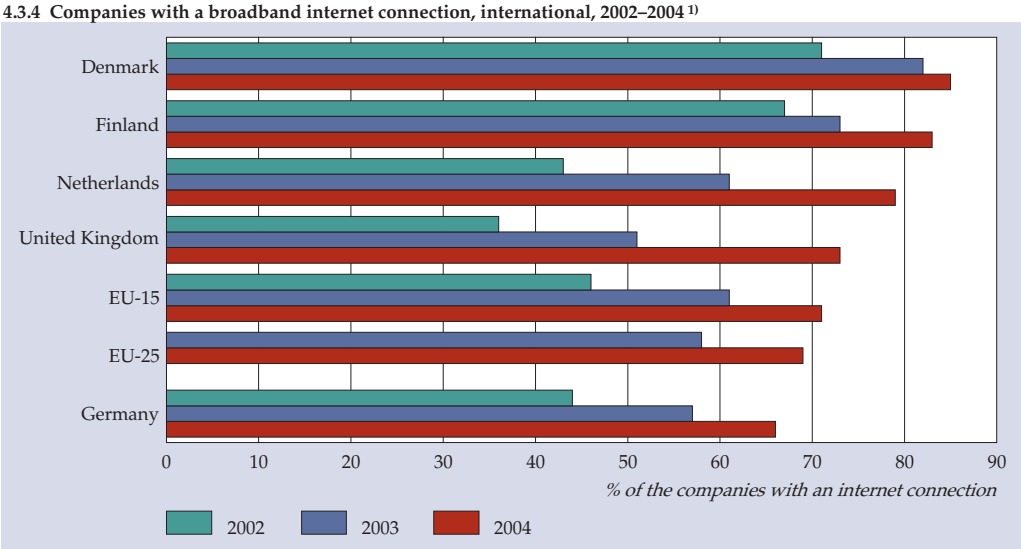
clients, and to have the already mentioned tailor-made solutions. It may also be due to the fact that these branches are less dependent on raw materials/semi-manufactured goods.

Broadband international

The European Union (EU) actively pursues a policy to get everyone and every company to use broadband internet. It is seen as an essential way to benefit from all the options ICT has to offer, and it is expected to contribute to knowledge and innovation as the driving forces behind sustainable economic growth (EC, 2005).

In 2004 almost 70 percent of the companies with internet had broadband in the European Union as a whole, see figure 4.3.4. The highest percentage was found in the Scandinavian countries, namely over 80 percent of the companies had broadband internet. In many of the new member states in Eastern Europe, less than half have advanced internet. However, a number of countries are catching up. Germany, remarkably, is below the EU-25 average. Compared to companies in other European benchmark countries Dutch companies are doing quite well. In recent years Dutch companies developed fast, doubling the number of broadband connections within three years. By the end of 2004 the Netherlands and Belgium were in the sub top, right behind the Scandinavian countries. The statistical annex on the internet, www.cbs.nl/digitale-economie, provides a complete overview for the EU.

4.3.4 Companies with a broadband internet connection, international, 2002–2004 [1)]



[1)] Companies with 10 or more employed persons.

Source: Eurostat.

Substitution

One question one has to ask about the use of the internet, is whether and to what extent traditional mail is replaced by email, internet and extranet. Instead of invoices on paper, a company may e-mail an electronic invoice. Mailings may have been replaced by emailing. In the survey 'ICT Use in Enterprises 2005' the companies were asked about this kind of substitution.

Gas, water and electricity supply was the only sector where over 10 percent of the companies with external data communication indicated that all mail was replaced by electronic communication in 2005. In all other sectors of industry this percentage was below 5 percent. Over one third of the companies in gas, water and electricity supply responded that traditional mail was largely replaced by electronic communication in 2005, and that electronic communication had become the dominant form of communication. In many other sectors of industry about 20 percent of the companies reported that electronic communication now has the upper hand.

These figures lead to the conclusion that traditional mail still played an important role in 2005 in most companies and sectors of industry, except perhaps gas, water and electricity supply companies. The use of electronic communication did increase over the last five years, but apparently traditional mail still fills a need.

An overwhelming majority of companies with external data communication, between 65 and 75 percent in most sectors of industry, indicated that some substitution took place in 2005 but that traditional mail was still the most important.

A minority of companies (varying from 11 to 23 percent in the different sectors of industry) indicated that no substitution of traditional mail by electronic communication had taken place in 2005.

4.4 E-commerce and e-business

E-business seems to have gained its place in business. However the motives are not the same for all parties in the process chain. For companies it is cost cutting and improving service for the clients that dominate. Traditionally the interest of retailers was mainly in face-to-face contacts with their clients who visited their shops. Since the usual clients no longer have to spend their money locally, retailers must compensate by finding clients elsewhere, for instance through the internet. The

Definition of e-commerce

There has long been a lack of consensus about the definition of e-business and the related concept e-commerce. E-business was roughly defined as doing business with the aid of ICT and ICT applications. E-commerce, as part of this, concerned transactions concluded electronically: the actual purchase or sale of goods or services. A distinction can be made between e-commerce among businesses (business-to-business or B2B) and between businesses and consumers (business-to-consumer or B2C). Opinions differed about the issue if e-commerce refers only to the trade via internet, or also via other electronic networks, such as EDI. Since politicians and the media were so interested in e-commerce, it was advisable to put an end to the lack of clarity. This is why the OECD set up an international working party in 1999 to work on a definition of e-commerce that is both relevant for policymaking and statistically reliable and feasible. This has led to two definitions of e-commerce with the following dimensions: the network that functions as the carrier for e-commerce and business processes related to e-commerce. The 'wider' definition of e-commerce is *the buying and selling of goods or services via computer networks, where the activity around purchase and sales refers to an actual order and not to the payment or delivery*. The 'narrow' definition only differs at the issue of the network: the purchase and sales are strictly through the internet.

So there is now international agreement that in e-commerce something has to actually be ordered through an electronic network, regardless of the way it is paid for. In the USA a stricter definition for e-trade with consumers is used, where the thing ordered is also paid for directly at the same website or the same system. A problem with this definition is that payments between companies are generally made well after reception and bundled into a single invoice. If this strict definition were to be used, most electronic B2B trade would not qualify. Consumers often do not have the possibility to pay on-line, for instance because not everyone in the Netherlands has a credit card. Most advantages of e-trade, such as the convenience and the insight in the market, are still there even if payments do not take place on-line.

motives for consumers to engage in e-business are convenience and being able to see what the market is like.
Due to e-business there is a gradual shift in market positions. The position of the consumer, the demand side, seems to be getting stronger because comparing prices and products is becoming easier. The traditional distributive trade has to look at its position because manufacturers can now sell directly to consumers or use other intermediaries such as e-markets. However, it is still too early to predict the consequences of e-business, as they are still being studied.

In 2005 almost one in five Dutch companies was doubly active in e-commerce. They engaged in buying and selling on-line, see figure 4.4.1. In 2003, 12 percent of the companies did so. Furthermore over a quarter of all companies in 2005 placed on-line orders with other companies (electronic purchases), without offering ordering facilities themselves. In 2003, 17 percent of the companies were only active in electronic purchasing, whereas in 2005, a total of 46 percent of all companies made electronic purchases.

Less of more

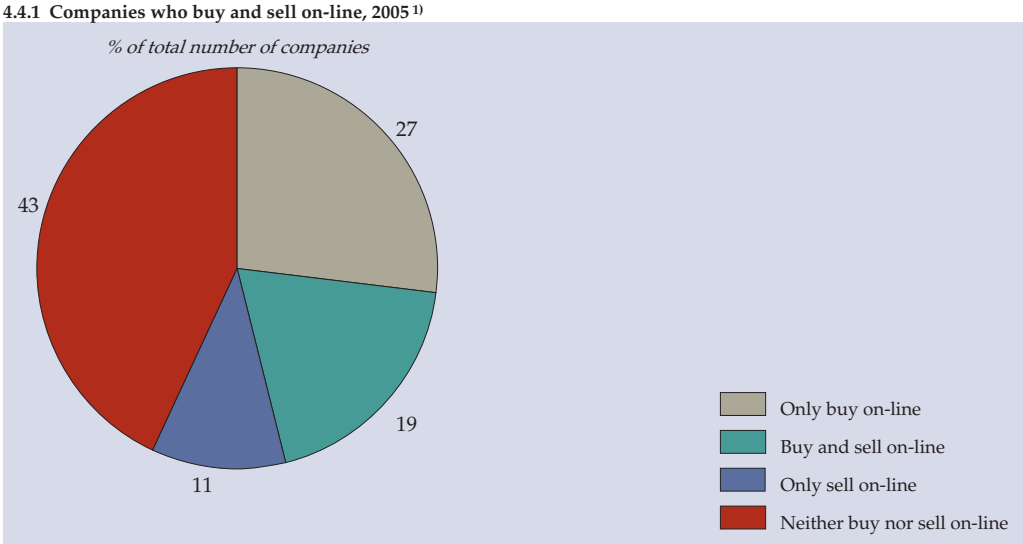
Smart use of the internet cuts the costs of reaching consumers, both in terms of marketing and in supplying products. More and more products such as music, games and videos are cheaply distributed through the internet in digitalised form. Products that are not distributed on-line but can be bought on-line are not stored in expensive shops, but distributed from cheap storage spaces in cheap locations. This changes the market structure. At first everyone bought much of the same, simply because it was not economically feasible for shops to put special products for a limited client range on the shelves. The emergence of internet shows that consumers are buying more products in different small niche markets that used to be hard to reach or were as yet non-existent. The cheap means of production (software, video cameras and printers allowing 'printing on demand') make it easier to create new products ('content').

The conclusion is that we spend our money on more and more products. [1)] This has consequences for the established and the starting retailers. New business models are needed. The question is how to obtain many products and how best to sell them.

The sales curve of products bought on-line is called 'the long tail' in the discussion. The tail is getting longer as the series of sellable products keeps increasing. The question that currently has no answer to it is if consumers eventually will buy more or if they will just shift their expenditure.

1) 'Why the future of business is selling less of more' is the subtitle of the book by Chris Anderson *'The Long Tail'* published in 2006. It is a sequel to an article that Anderson wrote in 2004 in his US magazine on the new media *'Wired Magazine'*.

4.4.1 Companies who buy and sell on-line, 2005 [1)]



[1)] Companies with 10 or more employed persons.

Source: Statistics Netherlands, ICT use by enterprises 2005.

Companies are discovering the convenience of ordering through the internet. Ordering something from another company is easier than selling through the internet, since companies use facilities created by others when they buy something on-line. The only thing they have to do is to fill out an electronic form on the internet. When a company wants to sell on-line, they have to create a website with functionalities, maintain it, and see to it that the orders that come in on-line are processed. All this takes time and resources. Only companies that feel that they can really benefit will make the necessary investments.

The percentage of companies with on-line sales only was 11 percent in 2005, two percent points more than in 2003. There was a 9 percent point increase from 21 to 30 percent of all companies with on-line sales including those that also made on-line purchases. The percentage of companies selling on-line lags behind the percentage that buys on-line. This may be because many companies feel that the benefits of facilitating electronic sales do not outweigh the costs.

Development phases ICT use

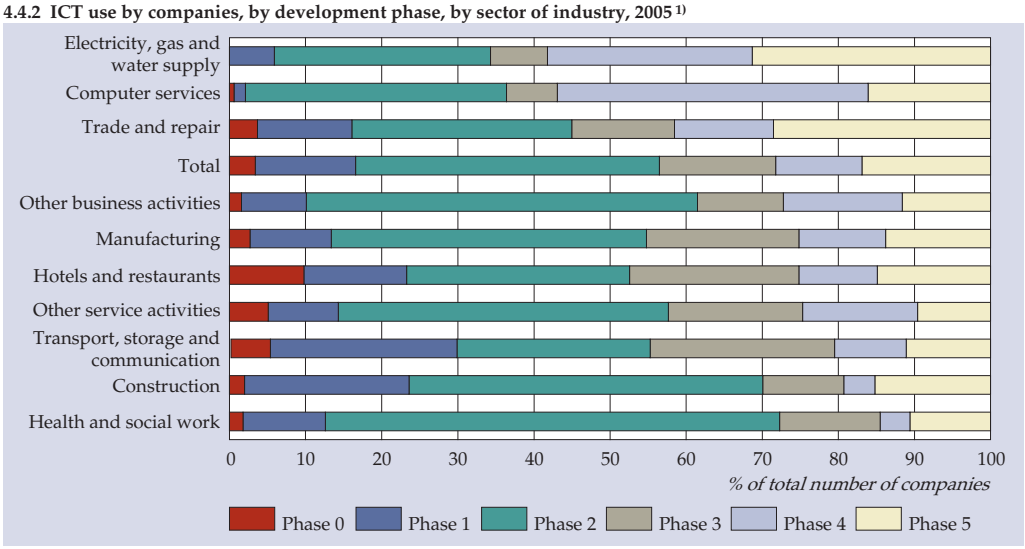
Where exactly are Dutch companies in e-business? To answer this question, we opted for the development phase approach to ICT use. The individual companies are divided into their highest development phase in ICT use, where we distinguish the following stages: information, interaction, transaction, and integration. [2)] Each phase is one step up from the previous phase.

When companies are classified by their 'highest' development phase in ICT use, we get an idea of how sophisticated companies are in e-business. It can also show what the differences are between sectors of industry and small and large companies. In our approach we divide the companies in terms of the following phases in ICT use:
- no external data communication (phase 0);
- external data communication, no website, sales, no on-line after sales service (phase 1);
- website (phase 2);
- electronic sales (phase 3);
- on-line after sales service (phase 4);
- linking company order processing system with that of clients (phase 5).

Figure 4.4.2 shows the state of the art in 2005, where 57 percent of the companies went no further in e-business than being present on the internet with a website (phase 2). About 15 percent of the companies offered the option of ordering products on-line (phase 3). 11 percent of the companies gave on-line after sales service (phase 4). Phase 5, linking the company order processing system with that of clients, was realised by 17 percent of the companies. Compared to 2004 a shift took place from the 'lower' to the 'higher' phases.

The approach of classifying companies by development phase is made from the sales perspective, which presupposes certain logic. Phase 1 is about companies who passively use external data communication, by making use of facilities offered by

4.4.2 ICT use by companies, by development phase, by sector of industry, 2005 [1)]



[1)] Companies with 10 or more employed persons.

Source: Statistics Netherlands, ICT use by enterprises 2005.

others, but without creating their own facilities on the internet. These companies can buy on-line, for instance. In phase 2 companies have a website where they merely give information on the internet. Companies are in phase 3, the transaction phase, when they sell electronically. Companies in phase 4, providing on-line after sales service, communicate with others through the internet. And finally, in phase 5, companies linking company order processing system with that of clients have computerised certain business processes between their own company and third parties. Each phase is more or less 'the next step' in supporting business processes through the use of external data communication. Companies without external data communication are added for the sake of being complete, this is phase 0 in figure 4.4.2. Despite the presupposed logic or time sequencing in the automation process of companies is not the case that a company can only reach phase 4 if it has successfully completed phase one to three. Some companies sell on-line without having a website. This is 'allowed' in our approach.

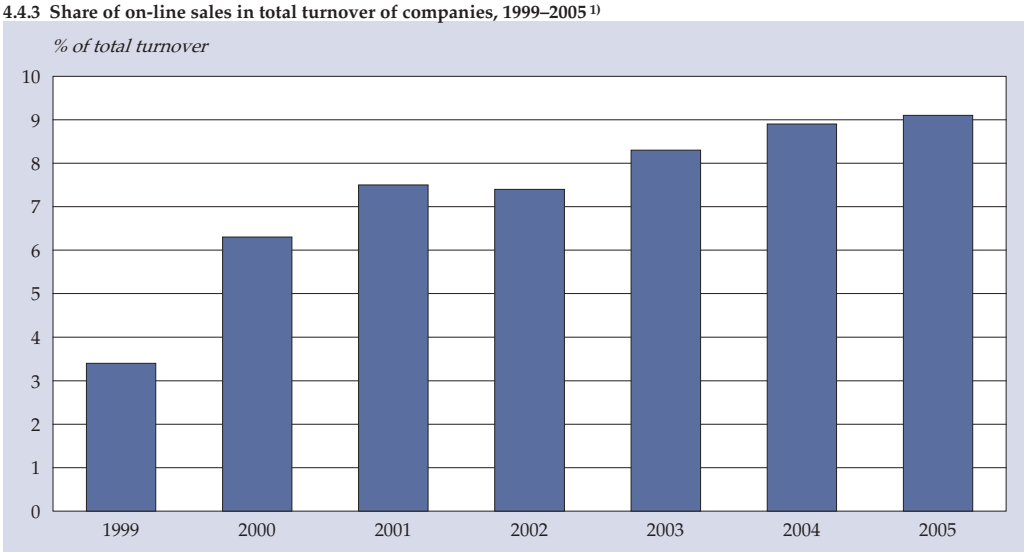
When these development phases are shown by company size, the pattern is unambiguous in 2005: the bigger the company the more advanced its ICT use. There are great differences between the sectors of industry. Almost two thirds of the computer service bureaus had electronic sales, on-line customer support or a computer system linked with clients. This group of companies has the know-how to do so and the right products. At the other end of the spectre there are health and social work and construction. About 70 percent of the construction companies in 2005 did not seem to feel it was necessary to be present on the internet by more than a website. Almost a quarter of the construction companies had no internet, or only used it passively. This is represented in figure 4.4.2 as phases 0 and 1. In health and social work internet was spread even less widely: three quarters of the companies in 2005 came no further than having a website on the internet. Phases 4 and 5 are reached by only a small percentage of the companies in these sectors. E-business has also not penetrated very far in the sectors transport, storage and communication and hotels and restaurants in 2005, where a huge percentage of the companies was in phase 0 and 1.

So the difference in ICT use seems to correspond more to sector of industry than to size class. This is logical. Of course know-how and skills play a role, as does 'seeing' for what applications the company could use ICT. There are also differences in the cultures between construction and computer service bureaus in the way they look at ICT. The network of suppliers and clients in which a sector of industry functions may make different demands on ICT use. So it doesn't seem rational to set the same standards for investing in ICT and for its use for each sector of industry. Anyway: by December 2005 most companies had a website on the internet but did not reach the more interactive phases.

The importance of e-commerce

In recent years the share of turnover through e-commerce increased, as is shown in figure 4.4.3.

4.4.3 Share of on-line sales in total turnover of companies, 1999–2005 [1)]



[1)] Companies with 10 or more employees (1999–2001)/employed persons (2002–2005).

Source: Statistics Netherlands, ICT use by enterprises / IT survey.

The share of e-commerce in the total turnover rose from 3.4 percent in 1999 to 9.1 percent in 2005. The biggest increase took place between 1999 and 2000, a time of great internet optimism. At the time people thought that e-commerce would replace traditional trade, and that ICT would radically alter the way business was conducted. People already started to talk about the 'New Economy'. But in 2000 the internet bubble burst and the euphoria ended. In the next few years the share of e-commerce in turnover increased at a slower pace.

After 2000 there was an increase, but it was not as steep as it had been in 1999 and 2000 and it levelled off over time. The share of e-commerce has only increased slowly in recent years. However, it is too early to draw conclusions about the role of e-commerce in the future. It is possible that companies will discover new possibilities and that the share of e-commerce will rise faster in the future.

It is probably very profitable for some companies to be involved in e-commerce and less so for others. Companies that can benefit most probably recognised the opportunities e-commerce had to offer early on and created the necessary provisions. Companies that do not see the opportunities e-commerce creates will stay in a lower phase of ICT use within the phase model.

E-commerce by sector of industry

In table 4.4.1 we show the figures on e-commerce by sector of industry. The share of electronic sales in the total turnover of companies in 2004/2005 was highest in

the manufacturing industry, where on average 13 percent of the turnover came electronically. The manufacturing industry has been a front runner in on-line sales for years. Between 1999 and 2005 it was consistently the sector of industry with the highest share of its turnover from on-line sales.

Table 4.4.1
Share of on-line sales in total turnover of companies, 1999–2005 [1)]

	1999	2000/2001	2002/2003	2004/2005
	% of total turnover			
Health and social work	0	1	0	1
Electricity, gas and water supply	0	0	1	1
Construction	0	1	1	1
Other service activities	0	1	1	2
Other business activities	2	3	3	4
Hotels and restaurants	3	5	6	7
Total	3	7	8	9
Transport, storage and communication	3	7	9	9
Trade and repair	3	6	9	10
Manufacturing	5	11	12	13

[1)] Companies with 10 or more employees (1999–2001)/employed persons (2002–2005).

Source: Statistics Netherlands, ICT use by enterprises/IT survey.

Another sector of industry where on-line sales play a major part is trade. The share of on-line sales in turnover has been going up since the late 1990s. Trade has an above average share of its turnover from on-line sales.

It may seem strange that the share of on-line sales in the total turnover of gas, water and electricity supply companies is low. Clients can fill out an application through the internet for instance to be connected to the electricity supply. However the long-term contracts resulting from these applications are not considered e-commerce.

Only a very minor share of the turnover in the various forms of business and personal services is made through on-line sales. The main explanation is that such services tend to offer tailor-made solutions. They cannot be captured in a standard order form that can be filled out on the internet.

The overall conclusion seems to be that on-line sales are common in trade and manufacturing, where we deal with tangible goods. In transport, storage and communication the services are relatively standard. However, in the services sector, where the services are often very specific, on-line sales do not yet play a major role.

International comparison

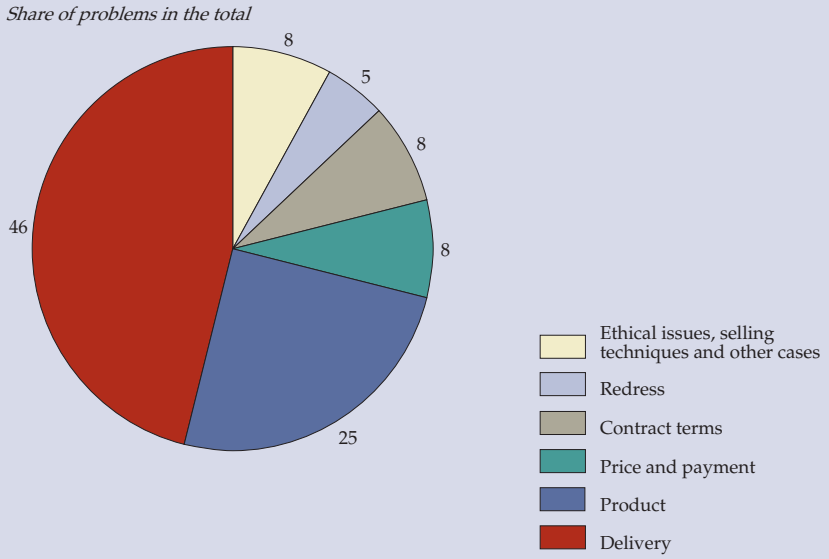
Within the European Union, Ireland was the country where companies had the (relatively) highest percentage of their turnover from on-line sales in 2004 with

20 percent of the turnover gained through the electronic network, see figure 4.4.4. In the UK, the Scandinavian countries and Germany the percentage of e-commerce by companies is above the EU average. There are no 2004 figures available for Denmark, but in 2003 the country was in the European top 5.

Problems with e-commerce across the border

The European Consumer Centre Network (ECCN) is a European organisation with branches in various countries. It registers complaints about e-commerce and informs consumers about their rights. In the report 'The European Online Marketplace' the emphasis is on cross-border e-commerce. 2005 saw a sharp rise in complaints about cross-border e-commerce. The figure below shows some data on the problems.

Types of problems in cross-border e-commerce



Almost half of all complaints are about the delivery of goods, especially common is that consumers paid for things that do not get delivered. The product itself also often has something wrong with it, either being broken or quite different from what the consumer ordered. The ECCN is worried about such things, because if they go unchallenged, they can damage the confidence consumers have in on-line shopping. This may be detrimental to the development of on-line shopping. Therefore the organisation continues to fight for the rights of consumers shopping on-line.

Source: The European Online Marketplace: Consumer Complaints 2005, European Consumer Centre Network, 2006.

The international definition of e-commerce is somewhat different from the definition used by Statistics Netherlands. That is why the international figures are a little bit higher than the national ones. The share of turnover from on-line sales by Dutch companies in 2004 was 10 percent, which was the average of the EU-15. Bringing up the rear are the eastern and southern European member states, where the share of on-line sales in total turnover in 2004 was less than 5 percent. In these countries the situation has not changed much since 2003.

The share of on-line sales had increased in most countries in 2004 on 2003. The greatest increase occurred in Norway, where the share nearly doubled. Other countries where on-line sales increased relatively fast in 2004 were Belgium and the Czech Republic.

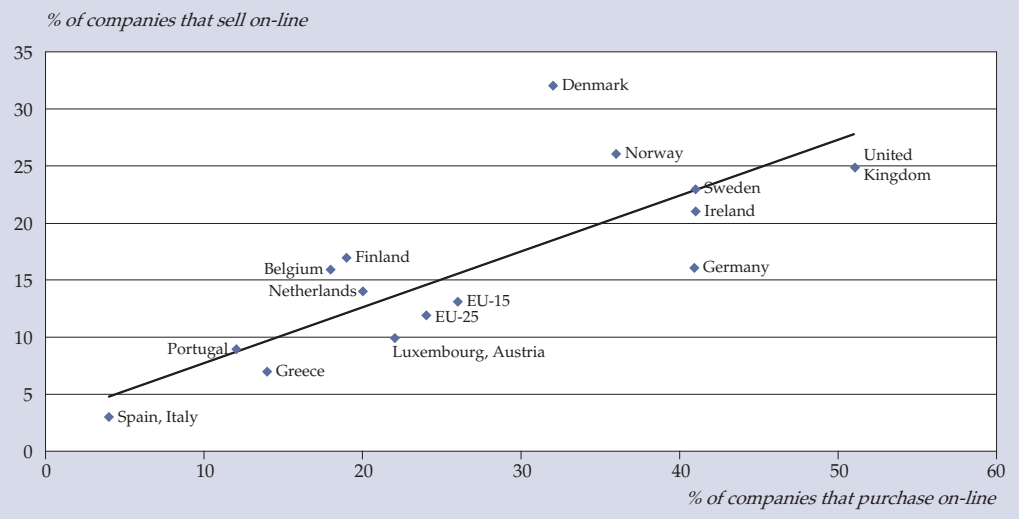
Figure 4.4.5 compares the on-line purchases and sales of the various European countries. In 'purchases' we show the percentage of companies that has made on-line purchases in the calendar year on-line. In 'sales' we show the percentage of companies that received on-line orders in the year. The graph shows that in all countries the percentage of companies buying on-line is higher than the percentage selling on-line. The explanation is that buying on-line is easier than selling on-line, as was explained above. The trend line shows some kind of average. The value of the R-square of the trend line is 0.65. In other words, there is a relatively strong correlation between on-line buying and selling. If the percentage of companies that purchase on-line goes up, so will the percentage of companies that sell on-line.

4.4.4 Share of on-line sales in the turnover of companies in some EU countries, 2003–2004 [1)]

[1)] Companies with 10 or more employed persons.

Source: Eurostat.

4.4.5 Companies purchasing and selling on-line, international, 2004 [1)]



[1)] Companies with 10 or more employed persons.

Source: Eurostat.

In Denmark, and to a lesser degree in Norway, the percentage of companies selling on-line was relatively high in comparison with the percentage that buys on-line. In Denmark almost a third of the companies sold on-line in 2004, in Norway more than a quarter. The UK was the front runner in 2004 in on-line buying, with over half its companies into on-line procurement. The Netherlands was somewhere in the middle as far as percentages were concerned in 2004. In Finland, where information and communication technology is generally used intensively, on-line buying and selling are remarkably not as common as in the other Scandinavian countries.

4.5 *Security*

Many dangers are lurking in a time where almost all companies are connected to the internet. Companies may fall victim to virus attacks, unsolicited intruders in the ICT systems, or blackmail attempts. Most companies are aware of these dangers and have taken security measures. In 2005 almost all companies had installed antivirus software (98 percent). About 87 percent was protected by a firewall against outside intrusions in the ICT system (see figure 4.5.1).

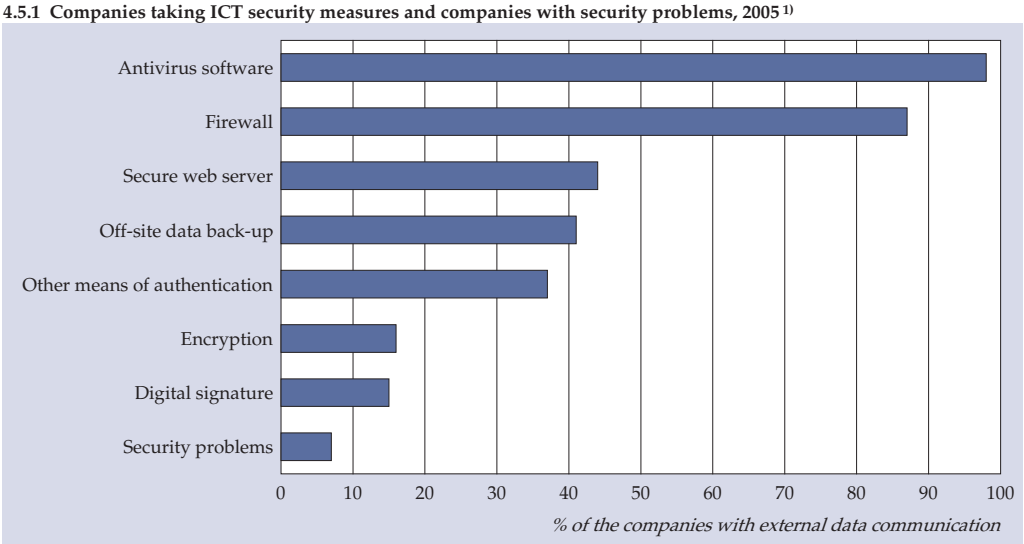
Criminals are trying to find new ways to obtain private information. In this way they may get access to banking accounts or take advantage of a company, or of the clients or suppliers of the companies. There are measures to prevent this, such as the use of secure web servers, encryption of data sent through the internet, and using authentication such as digital signatures.

Secured web servers provide a secure internet place on the basis of the secure http protocol. It can be recognised by the internet address, which starts with https. Over 40 percent of the companies used the secure servers in 2005. Other methods to secure electronic communication with others are less popular. About 15 percent of all companies made use of encryption in 2005 to send data safely along the digital highway. The same percentage of companies used the digital signatures, which is a way to ascertain or verify the identity of someone wishing to gain access. About 37 percent of the companies used other means of authentication, such as passwords, biometrics and the like. Many companies make regular back-ups; over 40 percent of the companies in 2005 made sure their data was stored elsewhere as well. In case the computers of a company are attacked and data is lost, the company still has a 'spare copy' elsewhere. In this way damage can be reduced.

Despite the security measures companies take, the outside attacks regularly result in damage. 7 percent of the companies encountered security problems in 2005.

To what extent are security measures and problems related to company size? Antivirus software is most common in companies of all sizes; almost all companies used it in 2005. For all security measures it is true that the bigger the company the more likely it is that it uses a kind of security. Large companies often face huge financial losses if the company were to fall victim to a security problem. It also leads to damage to the company image. This is less so with smaller companies. Big companies often employ ICT specialists focusing on these problems.

4.5.1 Companies taking ICT security measures and companies with security problems, 2005 [1)]



[1)] Companies with 10 or more employed persons.

Source: Statistics Netherlands, ICT use by enterprises 2005.

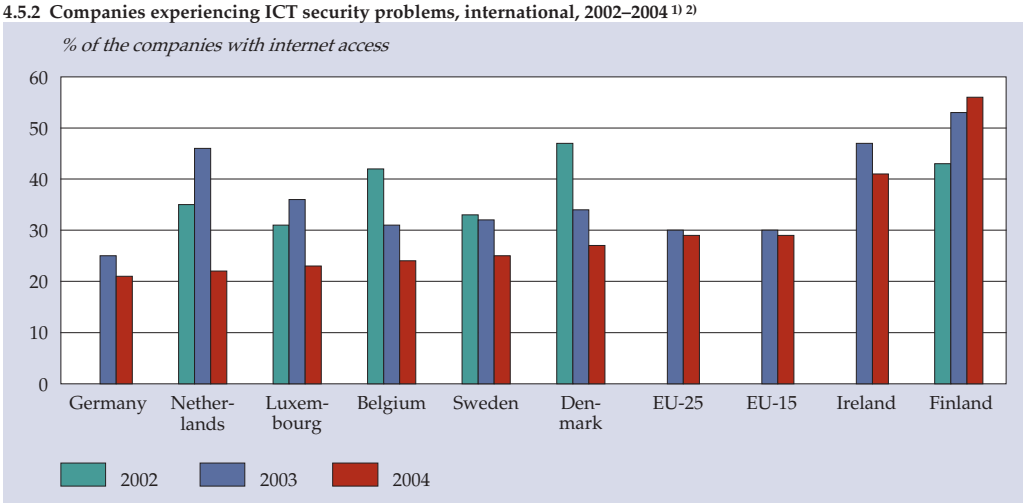
Most security problems are reported by the big companies. In 2005 13 percent of the companies employing 500 persons or more were confronted with ICT security problems. It is not clear if this is because they actually do have more problems or whether they pay more attention to them, and notice problems faster because they are more aware of the possibilities. Perhaps both aspects play a role. Smaller companies that do not report problems may simply not notice that they have viruses or intruders.

International

In 2004 Finnish companies were most active on the internet. At the same time Finland is the country where companies run the greatest risk of being confronted by security problems. 56 percent of all companies with internet access was confronted with viruses, illegal access to ICT systems or blackmail related to the ICT systems, see figure 4.5.2. In Denmark and Sweden the internet is used intensively too, however the percentage of companies confronted in 2004 with e-crime was below the European average.

Of all the benchmark countries companies in Finland had the most ICT security problems in 2003, followed by Ireland. In 2002 the Danish companies were confronted most often with security problems. Almost half of all companies (47 percent) reported a problem. The percentage in Denmark fell to below 30 percent in 2004, probably due to improved security measures.

4.5.2 Companies experiencing ICT security problems, international, 2002–2004 [1) 2)]



1) Companies with 10 or more employed persons.
2) One of the following problems in the 12 months preceding the survey: virus attack, unauthorised access to ICT systems or extortion.

Source: Eurostat.

The average percentage of companies with security problems in the EU member states in 2004 was close to 30 percent. This was lower in the Benelux countries and in most Scandinavian countries (except Finland). One explanation may be that companies in these countries have their security in order.

4.6 ICT use in the financial sector

The financial sector is a very diverse sector of industry. It consists of banks and insurance companies, often big companies, but also financial intermediaries which are often small companies. As is the case in the other sectors of industry, it is the bigger the companies in the financial sector the more intensive their ICT use.

Internal networks

The financial sector is the sector of industry where ICT plays a key role, containing many areas with very intensive usage of ICT. As figure 4.6.1 shows, the financial companies in 2005 had internal networks more often than companies in the other sectors of industry. The use of LAN (local area network) shows a difference of more than 10 percent points. Intranet was used by almost two thirds of the companies in the financial sector in 2005 compared to over a third in the other sectors of industry. The difference for extranet is even bigger.

The (bigger) banks and insurance companies had a higher percentage of companies with a LAN than (smaller) financial companies did. The differences are even more striking in the use of intranet: over 80 percent of the banks and insurance companies used an intranet to exchange information within the company, whereas less than 60 percent of the small financial companies used this. We have to say that using an intranet is not always as useful in a small company as it is in a big company.

In 2005 over 60 percent of all financial companies and companies in other sectors of industry had an ICT system for order processing. In the financial sector, 76 percent of the companies linked this order system to other internal ICT systems. In the other sectors of industry this was done by over 90 percent of the companies. There is not much difference in linking order systems with the systems of clients or suppliers. Especially the (bigger) banks and insurance companies had their order system linked to other internal and external ICT systems. The (smaller) intermediaries and other financial companies did so far less often.

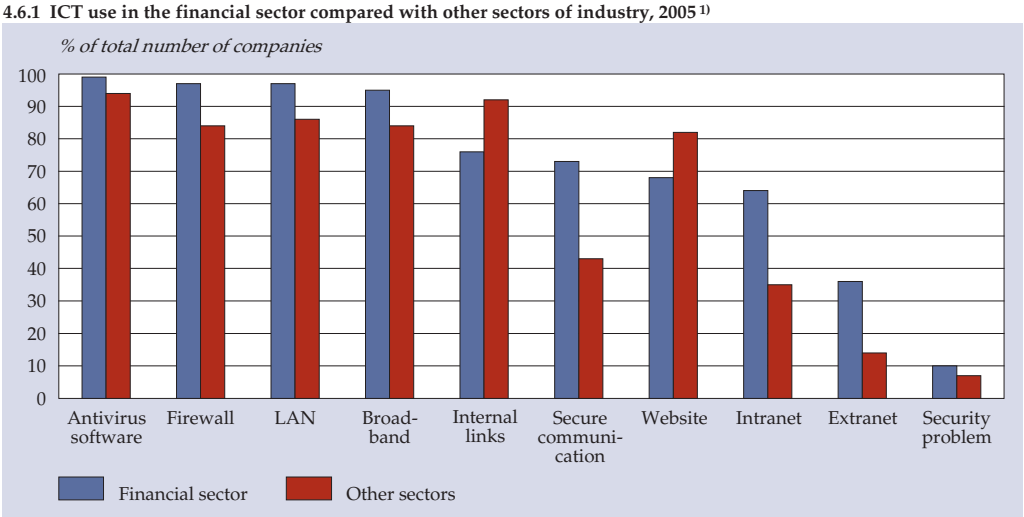
External data communication

All companies in the financial sector used the internet in 2005, of which 95 percent via broadband. The use of broadband is more common than in the other companies where 84 percent had broadband internet. The financial companies conduct much business through the internet. Clients can take out insurance policies or do their

banking on-line. The financial intermediaries often communicate on-line with the insurance companies with which they conduct their business. Having a website is considerably less common in the financial sector than elsewhere. Over two thirds of the financial companies had one, compared to over 80 percent of the non-financial companies. This difference is caused by the small companies. The big banks and insurance companies have websites where clients can take out insurance policies, get information, and do their on-line banking. The financial intermediaries often cooperate with large companies, or they are small independents who do not always have their own website. Within the group financial companies employing 10–19 persons, just over half had their own website in 2005.

Traditional mail is partly replaced by the use of electronic data communication. This occurred on a larger scale in the financial sector than in the other sectors of industry. The figures are specifically about the consequences for external communication. Almost a quarter of the financial companies indicated that a major shift occurred in 2005 away from traditional mail towards electronic communication. This was 17 percent among non-financial companies. 5 percent of the financial companies indicated no shift in 2005, and three times as many non-financial companies did so. The largest shift took place in companies employing 100 or more persons. Of the smaller companies, including mostly financial intermediary companies, about three quarters indicated a slight shift had taken place in 2005 between traditional and electronic communication.

4.6.1 ICT use in the financial sector compared with other sectors of industry, 2005 [1)]



[1)] Companies with 10 or more employed persons. Financial sector: SBI groups 65.12, 65.22, 66.01, 66.03, 67.12, 67.13 and 67.2. Other sectors of industry: SBI groups D, F, G, 55.1, 55.2, I, K, 92.1 and 92.2.

Source: Statistics Netherlands, ICT use by enterprises/financial sector 2005.

Security in the financial sector

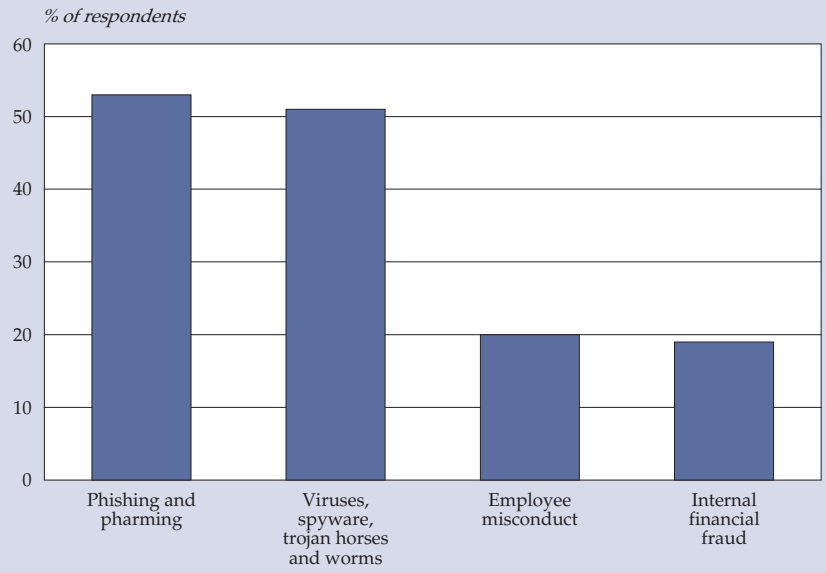
Financial enterprises pay a lot of attention to the security of their electronic data communication. They and their clients run the greatest risk of becoming victims of attempts to defraud, unauthorized access to ICT systems and attempts to steal personal information in order to get to the money of the clients of the financial company. All financial companies protected themselves from outside attacks in 2005. The main forms of protection were antivirus software (used by 99 percent of the companies) and firewalls (97 percent). In non-financial companies the use of these protective measures was 94 and 84 percent respectively.

External data communication can be secured by encryption. Through authentication the identity of the user can be verified through methods such as electronic signatures and biometrics. These methods were used by almost three quarters of the companies within the financial world in 2005, and elsewhere by 43 percent of the

Financial institutions and security problems

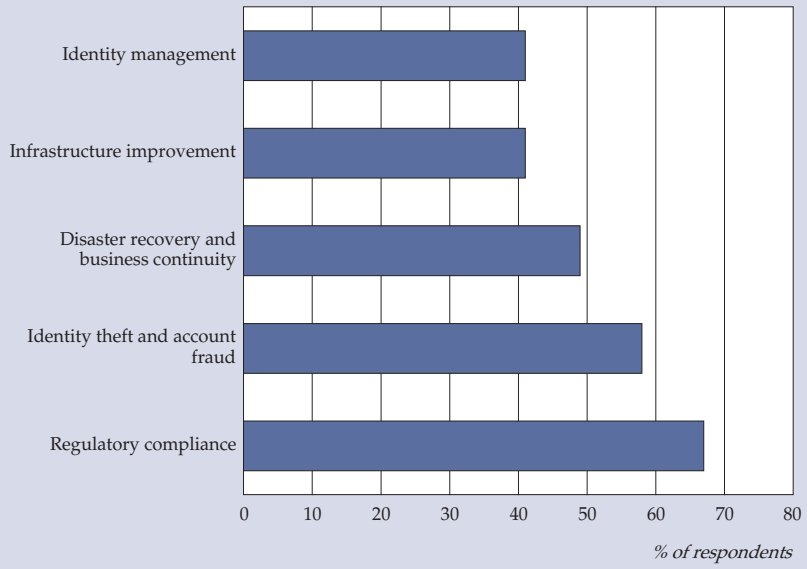
Financial institutions are involved more than other companies with securing sensitive information. There is a great risk that people with criminal intent will try to steal personal information. A survey among the top executives of the biggest financial institutions in the world reveals that most expect new attacks in the near future, involving increasingly advanced tactics. In the figure below we list the main threats expected by the top executives.

Expected threats for financial institutions



Most threats are expected from external forces, while the risks from within are expected to be considerably lower. The financial institutions indicate that the theft of customer identity data and fraud with bank accounts are the major problems at the moment. Almost 60 percent of the financial executives say they will pay extra attention to these issues in 2006 as is shown in the figure below.

Top 5 security initiatives



After 9/11, the tsunami in Asia and hurricane Katrina, the financial institutions are also well aware of the risks involved in natural and other disasters. They are working on measures to secure the continuity of the company.

The main challenge, however, remains everything involved in privacy and personal data. A top priority in 2006 is adhering to the privacy legislation. According to nine in ten respondents, the privacy legislation imposed is the main motivation to pay attention to the issue. Other major reasons are reputation and name, potential liabilities when things go wrong (sentences, fines).

Source: 2006 Global Security Survey, Deloitte, 2006.

companies. In this case too the measures are applied most by the larger companies. The larger companies have a less personal contact with their clients and often do not know them personally. Small intermediaries will know their clients personally and will not need authentication in the same way.

Despite security measures 10 percent of the financial companies in 2005 reported security problems. A well-known phenomenon is 'phishing', where criminals send emails that look like they come from the bank, and lure clients to a phoney website that looks exactly like the real website. The client is asked to fill in personal details such as passwords, after which the criminals can start transferring the clients' money into their own account. As the public becomes more informed, the method is becoming less successful. Therefore the criminals are now trying more advanced methods such as 'pharming' (see box).

Pharming

In pharming unsuspecting internet users are misled because their traffic to one server is led to another server without their knowledge. A DNS server is attacked in pharming and the internet address of a given domain name is changed. The internet user punches in the known web address but lands on the fake site. If this is the site of a bank, the hacker could get sensitive information on that internet user. Pharming is possible because DNS server software is vulnerable.
The term pharming is used in analogy to the term phishing. The method is also used for identity fraud, just like phishing.

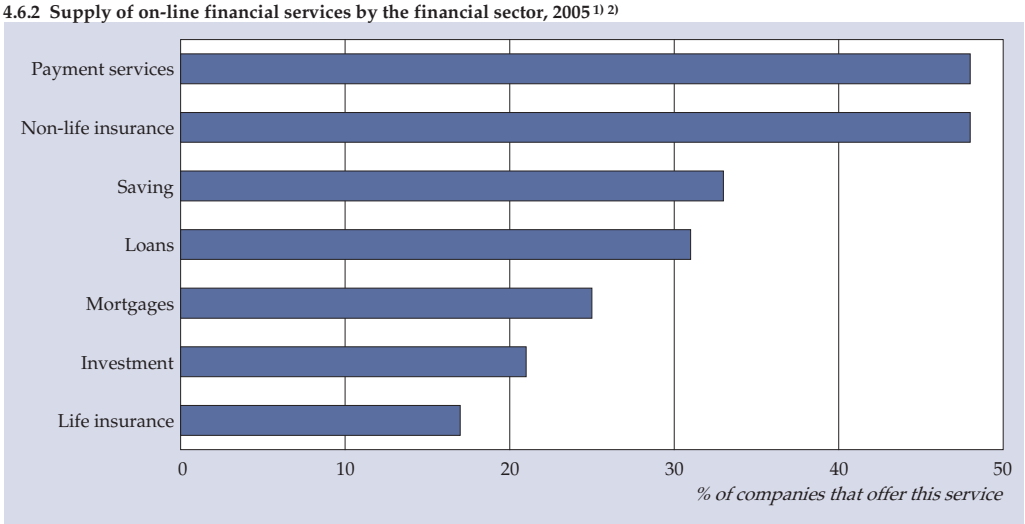
Especially small and medium-sized companies (less than 250 employed persons) in the financial sector were hit by security problems in 2005. The largest companies paid most attention to the various security measures, which is why they suffered less damage by ICT security problems.

On-line financial services

Many financial services can be concluded through the internet. In figure 4.6.2 we show what percentage of the financial services can be concluded on-line. It is expressed as a percentage of the total number of companies offering the service. In 2005, 48 percent of the companies offered payment services on-line. There was a similar percentage for non-life insurances. Savings and loans were offered on-line by one in three in 2005. The percentages were lower for life insurances, mortgages and investments.

In *The Digital Economy 2005* (CBS, 2006) we not only looked at the number of companies that provided a given service on-line. The on-line services were weighted with the number of persons employed in the companies, which means that larger companies weigh more 'heavily' than smaller ones. The underlying idea is that the reach of a given on-line service is determined by whether it is taken up by a small company with a few clients or a large company with many clients. When this weighting is done, it turns out that almost one hundred percent of the persons

4.6.2 Supply of on-line financial services by the financial sector, 2005 [1) 2)]



1) On-line services only refer to the services shown in the figure above.
2) Financial sector: companies with 10 or more employed persons in SBI groups 65.12, 65.22, 66.01, 66.03, 67.12, 67.13 and 67.2.

Source: Statistics Netherlands, ICT use in the financial sector 2005.

employed by companies offering financial services in 2004, worked for a company that provided the service on-line as well. About 87 percent of the people working in institutions providing mortgages worked for companies that provided mortgages on-line as well. These were mainly the bigger financial institutions that provided the on-line services. If employment is an indicator for the number of clients, this means that in 2004 almost all clients could use on-line financial services.

4.7 ICT and small and medium-sized enterprises

The Dutch government has been active in stimulating ICT use within the small and medium-sized enterprises (SME). One reason is that the government finds it important that the small and medium-sized enterprises (less than 250 employed persons) make advanced use of ICT, since they are often the suppliers of the larger companies and since efficiency in the production and distribution chain is important for all users of ICT. Furthermore, the companies are thought to have insufficient skills and know-how to see how they can apply ICT, so that they are unable to articulate their demand for ICT tools and solutions. This makes them vulnerable parties for large ICT providers. Such considerations led to the idea that an independent government program should be a 'buffer' between the small and medium-sized enterprises and the market of ICT providers. In this paragraph, the ICT use of smaller companies in several areas is compared to that of bigger companies. We opted for the most detailed classification in size classes, which

makes it hard to distinguish by sector of industry for statistical reasons. However, the differences between bigger and smaller companies shown in this paragraph can more or less be found in all sectors of industry. It must be said that it is not always useful for small companies to aspire to the same sophistication in ICT use as large companies since the pros and cons may well be different for small companies. In general it is clear that the turning point in ICT use lies with companies employing between 100–249 persons. This is where the companies start resembling the big companies in terms of ICT use.

ICT infrastructure

Do smaller companies lag behind the bigger companies as far as having basic ICT tools? Practically all companies use computers and all companies from the largest to the smallest use the internet. The difference starts when the infrastructure demands become highly sophisticated. Among big companies internet is virtually synonymous with broadband internet, whereas over 20 percent of the small companies have slower internet connections (mainly ISDN). Within the category broadband internet, the big companies often have broadband with download speeds of 2 Mb/s or more. This is mainly because big companies often use a separate fixed high-speed internet connection (such as lease lines), whereas small companies generally use 'normal' ADSL. The bandwidth of the internet connection depends on the company's ambitions. A passive use of the internet does not require the same bandwidth required by companies with the ambition to create all sorts of facilities on the internet, such as on-line sales and payments. In other words, not all companies require the same bandwidth.

Another difference between small and big companies is the use of networks not based on internet technology for external data communication. Apart from the internet almost 40 percent of the biggest companies use another external network. This is often an old form of EDI where a 1-on-1 network was set up with major suppliers or clients, so that a substantial part of the electronic purchases and sales of the large companies is done through such networks. For small companies external data communication is usually limited to the internet.

Most companies have an elementary LAN provision for in-house communication. Only 11 percent of the smaller companies have a more advanced and complex provision like intranet, versus 40 percent of the biggest companies. Here too big companies have much more to gain by supporting the in-house communication through an intranet than companies employing 10, 20 or 50 persons.

ICT use

There are also no great differences between small and large companies in the use of ICT tools in the more general applications. About 70 percent of all companies, big and small, used the internet for financial transactions in 2005. Almost three quarters of the smallest companies had their own website. Although that is less than the

Table 4.7.1
ICT infrastructure by company size, 2005

	Internet	Broadband internet	2 Mb/s or more [1]	Other external network [2]	Intranet	Extranet
	% of total number of companies					
10– 19 employed persons	96	77	40	5	26	11
20– 49 employed persons	96	82	41	7	36	13
50– 99 employed persons	98	90	50	15	50	19
100–249 employed persons	99	92	60	23	63	27
250–499 employed persons	100	96	66	28	72	30
500 or more employed persons	99	96	77	39	83	40
Total	96	81	43	8	35	14

[1] Download speed of the fastest internet connection in the company is 2 Mb/s or more.
[2] Network for external data communication other than internet (e.g. EDI).

Source: Statistics Netherlands, ICT use by enterprises 2005.

95 percent of the biggest companies, it is the overwhelming majority. Large companies also more often used the internet for purposes that are more specific in 2005, for instance for training and education. This has to do with big companies having more training and education programs rather than failure by small companies to use ICT for these purposes. In providing more specific facilities on the internet, the big companies tended to 'score' better in 2005. Examples are providing product or price information through the website and giving electronic customer support. But small companies certainly also provided such facilities.

The small companies, however, had significantly fewer advanced applications such as internal or external linking of the order processing system with other ICT systems in 2005. The pattern, however, is more or less the same. The order processing system is often linked to the invoicing system and less often to the marketing system. In 2005, the largest companies linked the order processing system much more often with ICT systems of suppliers than with ICT systems of clients. With companies employing 50–499 persons as a group, the order processing system is just as often linked to the ICT system of suppliers as clients. The fact that it is more common to link an ICT system with that of suppliers than with that of clients can be explained in terms of the stability of the 'relationships', which are more stable and predictable with certain suppliers than with clients. That the biggest companies link their order processing system most often with the ICT systems of a supplier may be due to the dominant position these big companies have within the chain of distribution. Big companies may have ways to 'compel' suppliers to accept orders according to computerised protocols to gain efficiency.

Table 4.7.2
Companies with ICT systems linked to order processing system by company size, 2005

	Internal ICT systems				External ICT systems	
	Stock management	Invoicing	Production and logistics	Marketing	ICT systems of suppliers	ICT systems of customers
	% of total number of companies					
10– 19 employed persons	28	47	17	14	12	7
20– 49 employed persons	33	56	27	17	12	8
50– 99 employed persons	44	66	43	20	16	14
100–249 employed persons	52	70	52	25	19	20
250–499 employed persons	50	70	46	27	21	20
500 or more employed persons	56	71	46	27	30	19
Total	33	54	25	17	13	9

Source: Statistics Netherlands, ICT use by enterprises 2005.

E-commerce

When it comes to the specific point of on-line sales, there are hardly any differences between the share of small companies (29 percent) and the share of big companies (34 percent) receiving orders on-line. The largest number of companies reaching a share of 5 percent or more of their total turnover with on-line sales was found among companies employing 100–499 persons. There is very little difference between the smallest (16 percent) and the biggest companies (18 percent) in this aspect. So it doesn't look like smaller companies have a higher threshold in providing on-line products than major companies.

This is quite untrue in electronic purchases, which become more and more common as companies grow larger. Major companies seem to have concentrated on the use of ICT for the supply process. This was also evident from the fact that the biggest companies have their ICT systems linked far more often with those of their suppliers than those of their clients. Smaller companies do make on-line purchases that involve more than just marginal amounts or incidental purchases. The share of companies that had 5 percent or more of the purchase value through on-line purchases in 2005 was bigger among small companies than among big companies, relatively speaking. In 2005, 44 percent of the smallest companies engaged in on-line purchasing did so for 5 percent or more of the purchase value, versus over one third for the largest companies engaged in on-line purchasing.

Security problems

Another area where big and small companies can be compared is that of ICT-related security measures and problems. Is the safety of the ICT infrastructure and ICT use

Table 4.7.3
On-line purchases and sales by company size, 2005

	On-line sales		On-line purchases	
		among which: accounting for 5% or more of turnover		among which: accounting for 5% or more of turnover
	% of total number of companies			
10– 19 employed persons	29	16	43	19
20– 49 employed persons	28	16	47	17
50– 99 employed persons	34	17	52	19
100–249 employed persons	35	22	60	20
250–499 employed persons	37	22	59	23
500 or more employed persons	34	18	69	24
Total	30	17	46	19

Source: Statistics Netherlands, ICT use by enterprises 2005.

an obstacle for small companies, preventing them from using ICT more intensively? The overwhelming majority of companies in 2005 had taken the most elementary security measures such as antivirus software and a firewall. Advanced security measures such as a secure web server and off-site data back-up were more common for big than for small companies. Big companies made more use of data encryption and authentication such as a digital signature in sending and receiving their data through the electronic network. The security measures taken, however, are related to how advanced the ICT use is. If a company makes on-line sales, it is logical that it would protect the transaction through encryption and authentication, much more so than when the use of the internet is less advanced. Since this kind of advanced use is more common among big companies, they also pay more attention to this security aspect of ICT use.

This is underlined by the frequency with which security problems in ICT use occur. Despite the higher number of security measures, the biggest companies had more problems (12 percent) than the smaller companies (6 to 7 percent) in 2005. The problems with ICT use seem to correspond less with security measures but more with the intensity of use (although a company will have more problems with equal use but less security).

International

In most EU countries there are specific government policies to stimulate the use of ICT in the small and medium-sized enterprises. The policies seem to have a positive effect in the Netherlands (see box ICT, the small and medium-sized enterprises and government policy). Is this 'success' in ICT use in the small and medium-sized enterprises also shown by the position of the Netherlands in an international

Table 4.7.4
Security measures and problems by company size, 2005

	Secure web server	Off-site data back-up	Digital signature	Other means of authentication	Encryption	Problems
	% of total number of companies					
10– 19 employed persons	35	34	12	31	11	7
20– 49 employed persons	46	41	16	36	15	6
50– 99 employed persons	55	48	20	46	22	6
100–249 employed persons	61	54	19	53	35	6
250–499 employed persons	66	59	21	56	40	9
500 or more employed persons	73	66	28	66	54	12
Total	43	39	15	36	16	7

Source: Statistics Netherlands, ICT use by enterprises 2005.

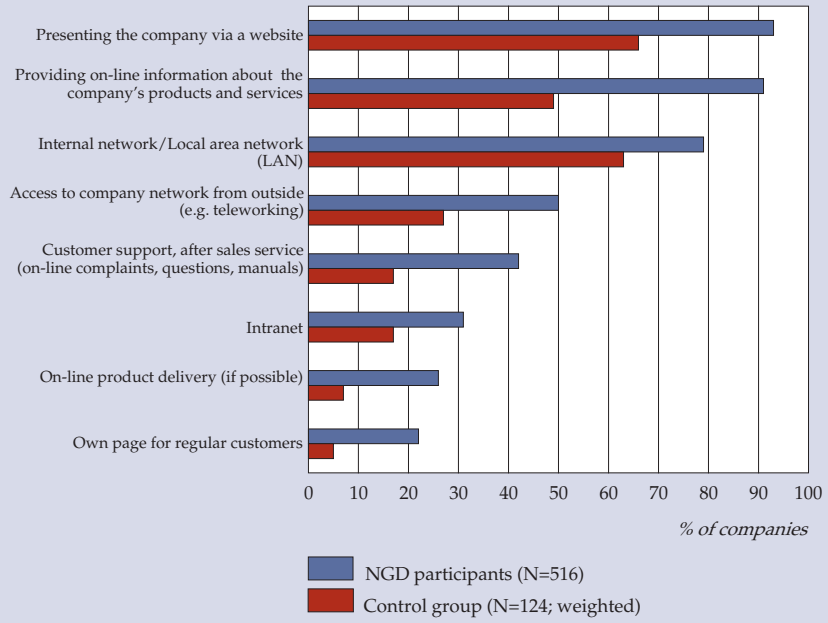
perspective? In figure 4.7.1 we have plotted two indicators. The first is how widespread ICT tools are in small and medium-sized enterprises *(ICT infrastructure)*. The second concerns the use of the ICT infrastructure by small and medium-sized enterprises *(ICT use)*. The two composite indicators are made up of six individual variables,

ICT, Small and Medium-sized Enterprises and government policy

The Dutch government aims to get Small and Medium-sized Enterprises (SME) 'into ICT'. Two major programs are *'Nederland gaat digital (NGD)'* and *'Concurreren met ICT-competenties (CIC)'*. These programs have workshops, seminars, basic and advanced advice, written and digital information sets to stimulate small and medium-sized enterprises directly or through their branch organisations to use ICT. The first program targets all of the SME. The second program focuses on early adopters among the small and medium-sized enterprises. The Ministry of Economic Affairs commissioned a policy evaluation on the first program, which was carried out by Dialogic, and a progress report on the second program.

The figure shows that participants in one or more parts of the NGD program more often have basic ICT in use than companies that did not participate. The evaluation report on the influence of these government programs on ICT use by SME also reflects satisfaction by the small and medium-sized enterprises and their branch organisations about the programs. They underline that non-profit organisations as independent intermediaries between commercial ICT suppliers and SME are useful.
Still, a policy evaluation may be slightly distorted. Companies with ambitions in the area of ICT are more likely to turn to others for help and advice than companies with no such ambition. The former would probably have developed their ICT use with or without such government programs. Nevertheless, the NGD program has undoubtedly made a positive contribution to the ICT use of these companies.

ICT use of participants in the government program 'Nederland gaat digitaal' versus the control group



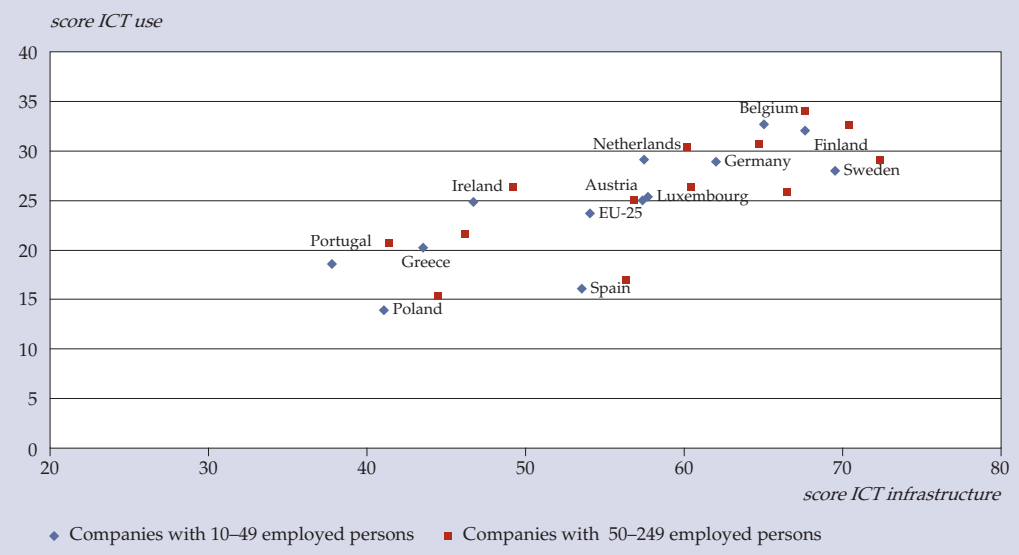
Source: Dialogic, Evaluatie Nederland Gaat Digitaal en CIC Uitstraling/NBDI, Utrecht, 2006.

taken together and recalculated to a weighted average score of these parts (for a detailed explanation see *The Digital Economy 2005* (CBS, 2006).

The first thing that shows up for all countries is that the medium-sized companies have a little more ICT tools and use them slightly more intensively than the small companies. In 2004 the Netherlands came behind Germany, Belgium, Finland and Sweden as far as the spread of ICT among small and medium-sized enterprises is concerned, while in terms of ICT use the Netherlands came behind the selected benchmark countries Belgium and Finland. So there is room for improvement in the spread of ICT tools, whereas the use of the available ICT infrastructure is intensive.

A second approach in ascertaining ICT use among small and medium-sized enterprises is to see what the differences are with big companies. The scores of the companies employing 250 or more persons are not shown in figure 4.7.1 but they are included in the statistical annex, which can be found on the internet at www.cbs.nl/digitale-economie. In 2004 it was true for all countries that companies employing over 250 persons had more ICT tools and used them more intensively. Furthermore the difference in ICT infrastructure and ICT use between the small and

4.7.1 European e-Business Readiness Index 2004



Source: The 2005 European e-Business Readiness Index, European Commission, DG Joint Research Centre (2005).

medium-sized enterprises as shown in figure 4.7.1, is much smaller than between medium-sized and big companies employing more than 250 persons. The differences in ICT infrastructure and use between the small and medium-sized enterprises and the major companies in the Netherlands were average in 2004 when placed in an international perspective. The gap between small and medium-sized enterprises and big companies in terms of ICT infrastructure and use is greater in Austria than in the Netherlands, but smaller in Belgium, Finland and Germany.

Notes in the text

1) In the literature impact usually refers to rising productivity due to the use of ICT. By using ICT companies are thought to work more efficiently. In the micro data, the individual data on all kinds of variables per company, it is possible to show the link between the use of ICT and productivity. The impact also has a qualitative aspect since information and communication technology makes it possible for companies to work in a different manner and to make new products. For instance by setting up the production process in such a way that it becomes easier to meet demands by clients by making production demand rather than supply oriented. By applying ICT, companies can integrate their business processes more, and change the contacts with suppliers and clients. Because it is difficult to measure productivity increases caused by ICT use, this chapter will focus on the qualitative aspects of impact, the set-up of the business processes.

2) The phases are also used by the EVD, the Agency for International Business and Cooperation of the Ministry of Economic Affairs. See also www.evd.nl.

5. ICT use in the public sector

The number of government services available on-line is growing steadily. In December 2005 about 55 percent of the government information for citizens and companies were available on-line. Within the EU, the Netherlands occupies a middle position. Although on-line government services are moving in the right direction in terms of quantity, there is still plenty of room for quality improvement. The on-line government services in 2005 were seen as inferior to the services from the 'old-fashioned' service desk.

Computers and the internet have become increasingly important in education in recent years. There are explicit differences in emphasis between primary and secondary education. In primary education the computer is used very much in school, but few teachers assign homework for which the children have to use the computer at home. In secondary education it is the other way around: the computers are not often used in class, but teachers often assign homework for which the students have to use the computer at home. In recent years, investments in computers and software have increased substantially in education. Still more and more teachers are dissatisfied with the quality of the ICT tools at school.

The health care and social work sector spends a lot of money and processes a great deal of information. The general assumption is that better use of ICT in health and social work would greatly increase efficiency. The development of e-health, in particular its practical application, will be studied with more than the usual attention. An example of a practical application, the Electronic Patient Dossier (EPD), will be discussed at the end of the chapter.

5.1 E-government

The Dutch government set itself the goal to make large-scale use of ICT, and particularly the internet, in its services for citizens, companies, and within the government. This must contribute to a transparent, efficient government. Much of the government services consist of gathering, processing, storing and supplying information to citizens and companies, or deals with it in some way. Most information can be stored and disseminated in digital form, which offers government the opportunity to supply information and services electronically. This may vary from laws and regulations to practical applications such as applying on-line for a birth certificate from the population register. For the citizens and companies – the users of government services – e-government offers great advantages (potentially). Government information and services are more accessible because the user no longer has to stick to the office hours to access the government body. The on-line information and services are available 24 hours a day, every day of the week. The aim of the government is to provide as much on-line information and as many on-line services as possible. Moreover, the government seeks to gather the information

from citizens and companies it needs for its task as public administrator, electronically. This contributes to a decrease in the administrative burden for citizens and companies. In somewhat visionary wordings, the administrative government will eventually operate as one huge computer where everyone can find the necessary information and services and supply the required information.

The process of increased digitalising of the government services can also lead to greater productivity within government itself: more services for the same price, or the same services for less. In the box below we show that the 'sector of industry' public administration, defence, and compulsory social security comprises over six percent of GDP. This is more than the economic importance of many other sectors of industry.

E-government services available

In 1999, the Dutch government set itself the target to have at least a quarter of all government services available on-line by 2002 (Ministry of Economic Affairs, 1999). The target was reached in 2001, and the available e-government services, for private citizens and companies, have increased steadily. In December 2005, 54 percent of the

Key figures on the government

The 'sector of industry' public administration and compulsory social security represented over 6 percent of the gross domestic product and employment in the Netherlands in 2005. This is comparable with the share of the sectors construction and transport, storage and communication, but significantly higher than the contribution of the chemical industry or the supply of gas, water and electricity to the economy. Public administration and social security consists of several layers, ranging from central government to municipalities, and government services ranging from public administration to the fire brigade.

Compared to 1995 the share of the sector public administration and compulsory social security in GDP and employment did not increase. The share in intermediate consumption and investments, however, did increase over the years. The government is a major investor. In 2005 12 percent of all investments were made by the government. About 8 percent of the total remuneration of employees consists of remuneration for government employees. This is high compared to other economic variables. Labour is the main production factor of the government: 70 percent of the value added of the government consists of the remuneration of employees. For the economy as a whole, this share would be over half.

The paragraph on e-government mainly focuses on the use of ICT and the internet by government to improve its services to the population and the business community. For 'physical' services like the fire brigade this is not the area where much can be gained. It is much easier to imagine what ICT and the internet could mean in the general area of public government. Given the amount of money spent on government tasks, efficiency gains in this area could save substantial amounts of money.

Key figures government

	1995	2000	2004*	2005*
	million euro			
Government[1)]				
Production value	29,527	37,452	48,528	50,030
Intermediate consumption	11,365	15,038	20,659	21,323
Gross value added	18,162	22,414	27,869	28,707
Employee compensation	12,944	15,946	19,772	20,169
Investments	6,092	9,585	11,711	11,705
	full-time equivalents (x 1,000)			
Employed persons	368	386	405	398
	%			
Share in the total economy				
Production value	5.1	4.6	5.3	5.3
Intermediate consumprion	3.8	3.5	4.4	4.3
Gross value added	6.6	6.0	6.4	6.4
Employee compensation	8.3	7.5	7.9	8.0
Investments	9.6	10.5	12.5	12.0
Employed persons	6.4	5.9	6.3	6.2

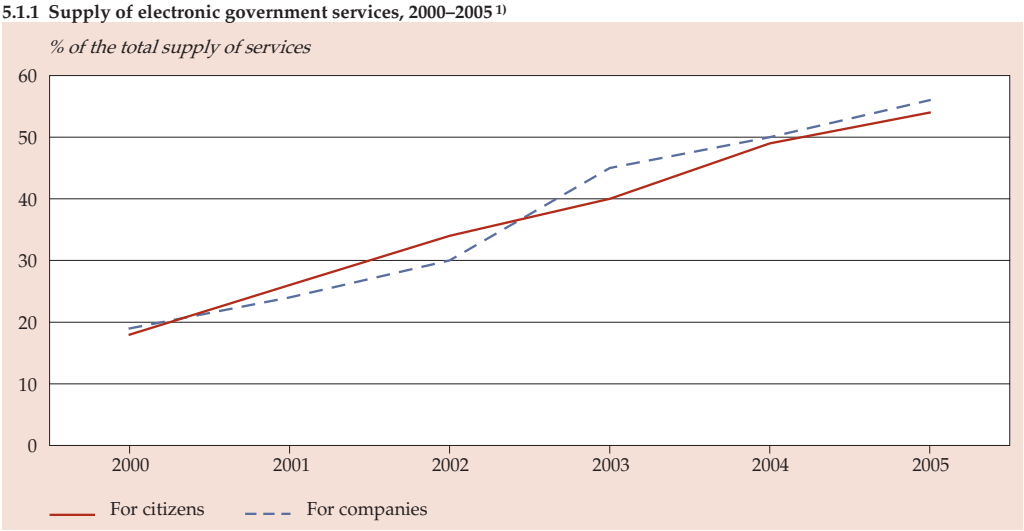
[1)] Goverment is defined as public government and social security. In fact the SBI 75 from the SBI93 (standard industrial classification) excluding Defence (SBI 7522). Goverment also excludes subsidised education and health and social work.

Source: Statistics Netherlands, National accounts 2005.

government services for citizens and 56 percent of the government services for companies were available on-line. In the action program 'Andere Overheid', in which the Balkenende II government stated its views on the relationship between government and society, including targets for the period 2003–2007, the aim is 65 percent on-line services by June 2007 (Ministry of the Interior and Kingdom Relations, 2003).

Figure 5.1.1 shows the available e-services within the Dutch government as a whole. We distinguish the following government layers and bodies when listing the supply of electronic services:
– municipalities (e.g. applying for a building permit);
– provinces (e.g. filing environmental complaints);
– water boards (e.g. protesting levies for land draining);
– police (e.g. reporting a crime);
– central government and autonomous government bodies (e.g. filing income tax).

5.1.1 Supply of electronic government services, 2000–2005 [1)]



[1)] From 2003, the calculations have been adapted to comply with European standards.
The 2003 percentages are therefore not immediately comparable with those of previous years.

Source: Advies Overheid.nl.

The percentage of e-government services is growing steadily. In the meantime many services are made available in some electronic form. This is easiest to realise for government, as it has full control over making e-government services available.

Since 2000 Advies Overheid.nl has been evaluating the performance of e-government in general. Once a year the state of affairs is summarised in the report *Overheid.nl Monitor*. Many of the figures presented in this paragraph are derived from the most recent annual report (Advies Overheid.nl, 2006).
The monitor focuses on all Dutch government institutions. The priority is to make an inventory of the degree to which they make electronic services available.
The monitor shows six aspects of e-government: *transparency*, *services*, *personalised services*, *interactivity and timeliness*, *accessibility* and *user friendliness*. A total score is determined on the basis of the scores on these aspects, which are judged with a checklist that is updated each year to include new developments.

The target for 2005 was 55 percent. This was not reached for the citizens (51 percent) nor for the companies (52 percent). The cause is found when we look at the municipalities and their number of residents. It turns out that small and medium-sized municipalities generally did not meet the target, whereas municipalities with 100,000 inhabitants or more did meet the 55 percent target.

A relevant next question is what percentage of the citizens in the Netherlands has access to adequate e-government provisions. In figure 5.1.2 the population is

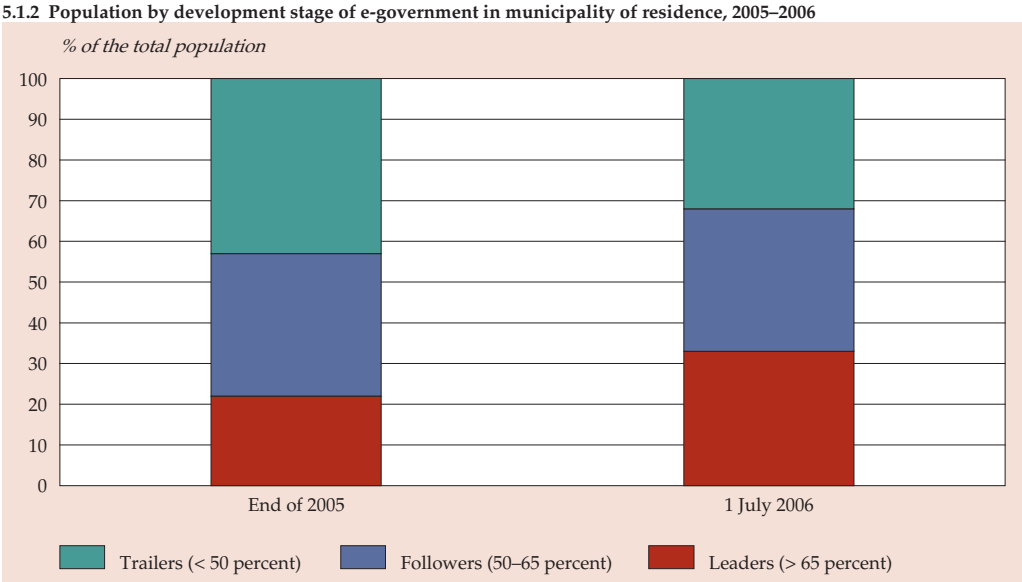
divided into the kind of municipality where they live, as far as the percentage of e-services is concerned. The municipalities are divided into three groups: 'trailers' (<50 percent), 'followers' (50–65 percent) and 'leaders' (>65 percent). Figure 5.1.2 shows that by the end of 2005 over one fifth of the population lived in a municipality that met the 65 percent standard.
No less than 40 percent of the Dutch population lived in a trailing municipality (<50 percent of the government services available on-line). These are mainly smaller municipalities. The situation had improved by July 2006: the percentage of trailers fell by 11 percent, while the percentage of inhabitants of municipalities with >65 percent e-government services increased by the same percentage.

Table 5.1.1 shows the structure per size class of the six aspects for the total score. [1)] The division in quality between large and small municipalities is clearly visible at the size class 50,000–100,000. All large municipalities met the 65 percent target by mid 2006, middle-sized municipalities are often nearly at that target, but the small ones have substantially lower scores except for *accessibility*. The *personalised services* score especially poorly, but this may be explained by the fact that the electronic identification (DigiD) will be rolled out officially in 2006. Only few municipalities had connections to the system in 2005.

Use of e-government services

The quantitative provision of e-government services (by the government itself), however, is only one side of the story. If the citizens and companies make no use of

5.1.2 Population by development stage of e-government in municipality of residence, 2005–2006



Source: Statistics Netherlands, StatLine and Advies Overheid.nl.

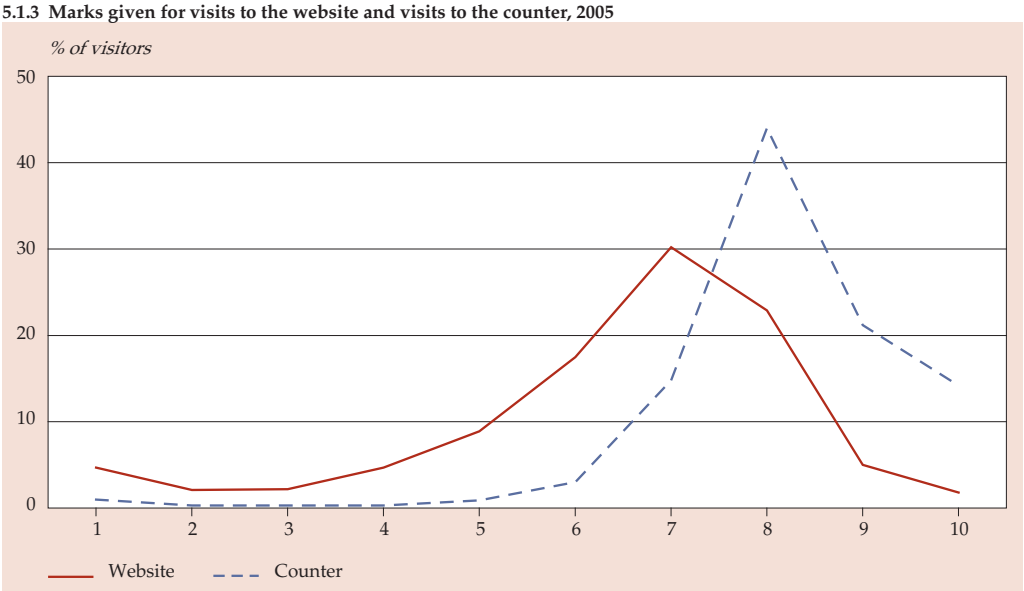
Table 5.1.1
Average scores for some aspects of e-government, July 2006

	User friendliness	Transparency	Interactivity and timeliness	Services	Personalised services	Accessibility	Total score
< 10,000 inhabitants	68	38	62	48	4	59	279
10,000– 50,000 inhabitants	73	51	68	51	9	61	313
50,000– 100,000 inhabitants	89	65	79	56	27	59	374
100,000– 150,000 inhabitants	97	80	92	66	50	62	446
> 150,000 inhabitants	95	87	94	71	56	57	461

Source: Statistics Netherlands, StatLine and Advies Overheid.nl.

them, such aims as transparency and efficiency gains are never reached. Therefore the focus is shifting more and more towards the qualitative aspects of the provision of e-government services. Are the services actually used? And are the users satisfied about the quality of the electronic services? Furthermore, problems were encountered that could be solved with ease in the 'old' world, but which require specific technical solutions when it comes to electronic services. One example is user identity. Does e-government know who they are dealing with, and is the person in question entitled to do what they are doing electronically? To solve this problem the Dutch government started the campaign DigiD. DigiD stands for digital identity.

5.1.3 Marks given for visits to the website and visits to the counter, 2005



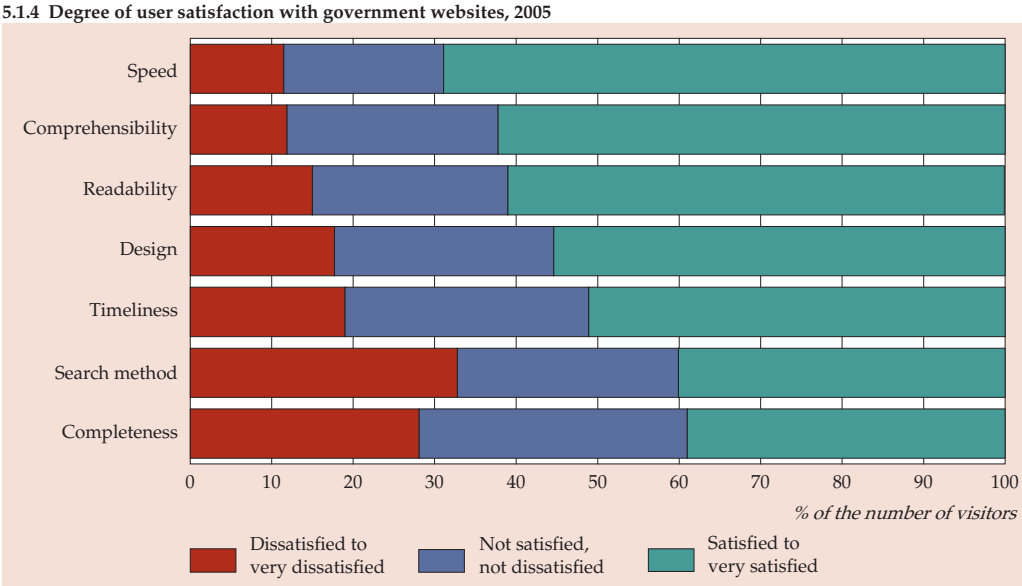
Source: Advies Overheid.nl.

Since 1 January 2005 citizens can communicate on-line with one user name and password and conclude transactions with an increasing number of government institutions. In turn, the government can check the identity of the user of its services. This is just an example of the solutions that have to be found to facilitate the widespread use of e-government services. It also illustrates that implementing technology that has been available for some time in practice always requires additional measures and time before it can be made available on a large scale.

Figure 5.1.3 shows that user satisfaction with the government services differs between people who come to the government building and those who visit the website. The average score for a visit to the counter in 2005 was 8.1 versus an average score of 6.4 for a visit to the website. This is in line with the scores in previous years. Apart from the difference in appreciation, there is also a difference in the underlying score. People who make the traditional visit usually rate it satisfactory or very satisfactory (97.2 percent). This is true for only three quarters of the website visitors. A quarter of the visitors of a government website found the services unsatisfactory. The counter and website visitors can be divided into two rather different user groups. This study is not one where the same people avail themselves of the same services via the website and via a face-to-face visit. The quality of the services is not judged on the basis of the same criteria. One overall conclusion, however, is that some government websites leave room for improvement from the perspective of some of the users. In order to keep these users interested in e-government it seems worthwhile to invest more in the quality of these on-line services. The satisfaction of traditional visitors is so great, that they will not easily change to the electronic version of the same services. Advies Overheid.nl measured user satisfaction with electronic and face-to-face visits through the *Landelijke Servicemeter*. The Servicemeter is a questionnaire that visitors of a website or counter can fill in voluntarily. In websites one of the questions is to rate the ease with which the information can be found, read, and how complete the information is. With face-to-face service at the counter the rating is for waiting and for the speed with which the service was rendered.

What issues can be improved in the electronic services? Figure 5.1.4 shows that a minority of the users of government websites is happy about the search and the completeness of the available information or services. Apparently governments find it difficult to define a search logic that is intuitive for the user. And apparently there are users who, rightly or wrongly, expected more information or services when they visit a government website. This is in line with the finding that only a third of all visitors of government websites in 2003–2005 systematically answered 'yes' to the question *'Did you find what you were looking for on the website?'* Not everyone finds it easy to read and understand the information. These are more general matters that play a role in the relations between government and society, highlighted by e-government and perhaps shown up with greater urgency.

5.1.4 Degree of user satisfaction with government websites, 2005



Source: Advies Overheid.nl.

Despite the areas that could stand some improvement in e-government services, the number of people and companies using the electronic services has risen sharply in recent years. In 2005 seven in ten companies with internet used e-government services. Over half of the people aged over 12 who used the internet in the three months before the survey, made use of e-government services that year. Some government services for citizens and companies are now predominantly done electronically, such as filing income tax returns or requesting information from the land register. The increase in the group of individuals and companies using e-government services is perhaps also an explanation of why the evaluation of the user friendliness of government websites is not improving. There are many new users each year, with their own expectations and skills, for whom the first experiences with e-government do not always turn out positive. The process in which suppliers and users of e-government services 'educate' each other still has some way to go. Paragraph 6.5 looks in more detail at the use of e-government services by individuals. We see that 15 percent of the internet users who reported that they never used electronic government services indicated that they did want to do so. This means that there is demand for more and better e-government services.

International

The European Commission instigated a periodic website survey looking at the availability of e-government services in the different EU countries (Capgemini, 2006). The study looks at selected government services and to what extent these can

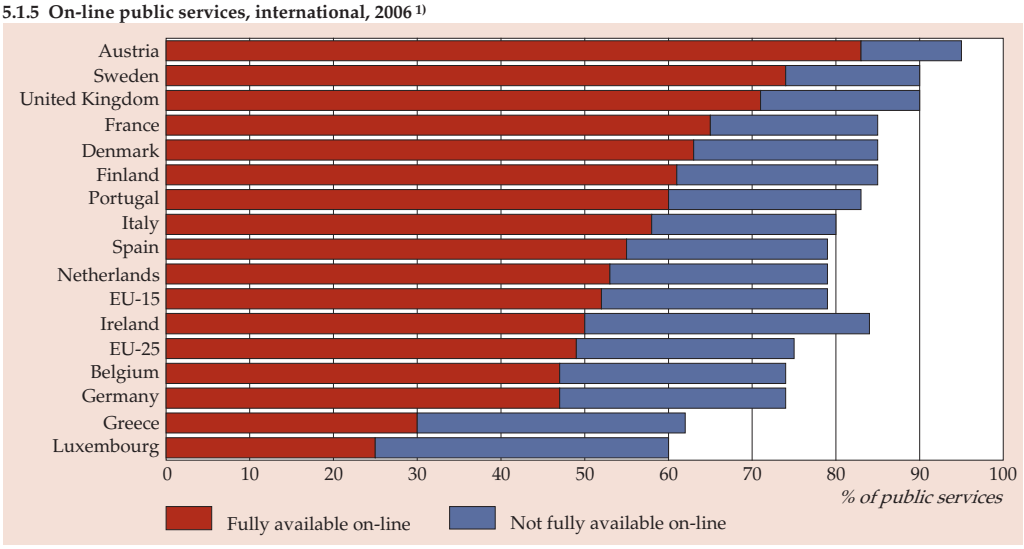
be used through a website. These include twelve services for citizens, e.g. passport applications, and eight services for companies, e.g. environmental permit applications.

The electronic user options of the twenty services studied are divided into the following phases:
Phase 1: The website only shows *information* about the service.
Phase 2: The user can *download* a form, but the form cannot be returned electronically.
Phase 3: The filled in form can also be returned electronically. This means the procedure or service can be started up entirely on-line.
Phase 4: A service can be started and completed, or applied and supplied, on-line.

It is not always possible to reach phase 4. Take for example a passport application: in principle one could apply for a passport on-line, but it cannot be delivered on-line. So the maximum obtainable phase is phase 3. The study took these limitations into account. For each service the actual current phase was offset against the maximum phase obtainable. This yields a percentage that expresses to what extent each service can be completed on-line.

Figure 5.1.5 shows the availability of on-line government services in 2006 for the EU-15. Sweden, Austria and the UK have reached a quantitatively high level of on-line services. Austria already offers many on-line services at the maximum attainable level, so it offers the maximum options to the users. The Netherlands takes up a middle position within the EU-15 in the availability of on-line

5.1.5 On-line public services, international, 2006 [1)]



[1)] 20 selected public services surveyed in all countries (12 for citizens, 8 for businesses).

Source: Capgemini.

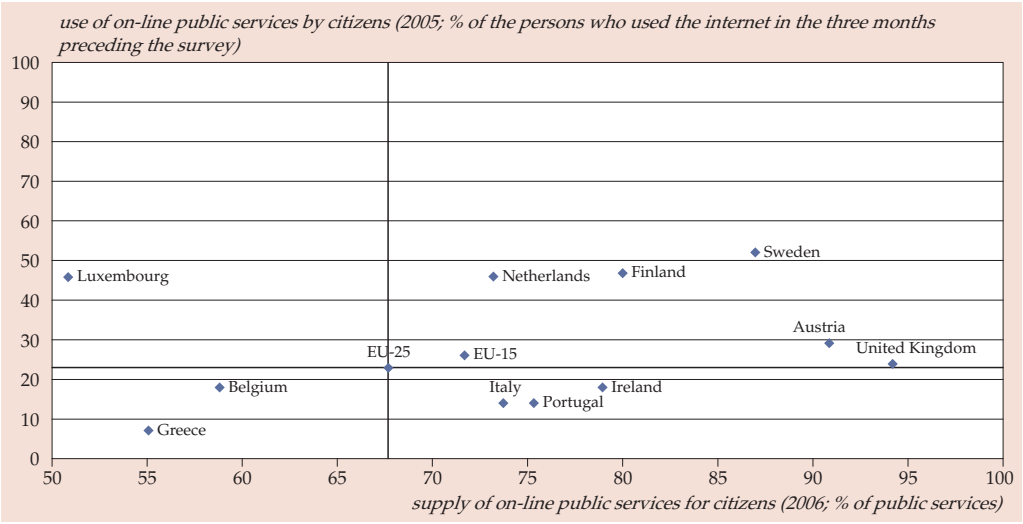
government services. In 2006, 79 percent of the selected government services were available on-line in some form in the Netherlands. This is close to the EU average. The number of services that is fully available on-line is average in the Netherlands compared to other countries. However, in recent years the availability of e-government services in the Netherlands has grown rapidly. In 2002 total availability was just below the average of the EU-15 whereas the number of services that was fully available on-line was way below the EU-15 average.

One question to ask is to what extent does making e-government services available mean that they are actually used? Clearly if no e-government services are available, there is zero usage. But is the opposite true as well? If many government services become available on-line, does this mean they will be widely used right away?

Citizens

In figure 5.1.6 the on-line availability of the twelve selected government services for citizens is plotted against the use of e-government services by citizens. The Netherlands is in the quadrant where the use and availability of e-government services for citizens is above the EU-25 average. Given the availability of services, the use in the Netherlands is comparatively high. The same is true to a more extreme extent in Luxembourg, a country with few e-government services, which are very frequently used. The UK is an example of a country with many available e-government services, but 'trailing' use by the citizens. The governments in Italy, Portugal and Ireland also have above average on-line availability of government

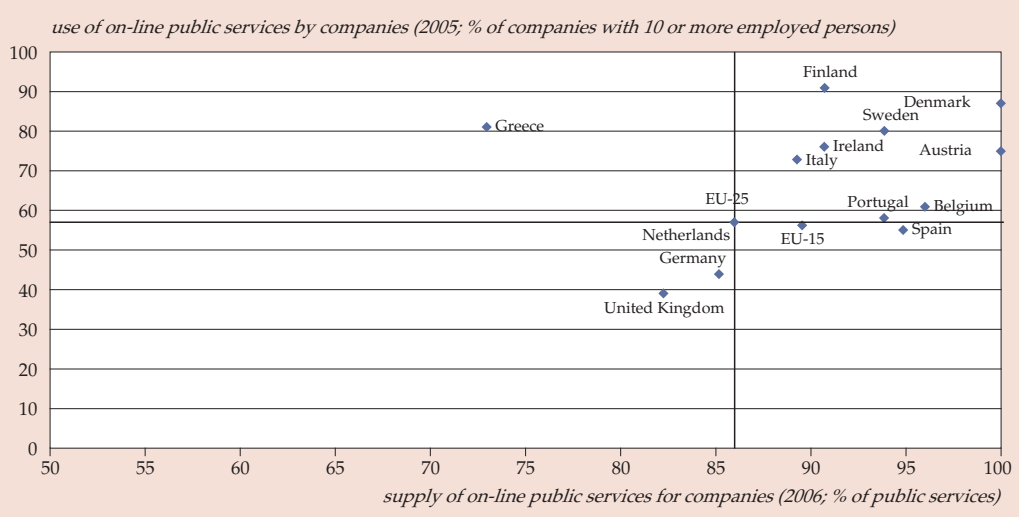
5.1.6 Supply and use of on-line public services by citizens, international, 2005–2006 [1)]



[1)] 12 selected public services available for citizens surveyed in all countries.

Source: Capgemini / Eurostat.

5.1.7 Supply and use of on-line public services by companies, international, 2005–2006 [1)]



[1)] 8 selected public services available for companies surveyed in all countries.

Source: Capgemini / Eurostat.

services, but they are not rewarded by the large-scale use of it. In general the correlation between the actual supply of e-government services and their use is not great. So there must be some other things that influence the use of e-government services, such as the quality, education level of the potential users and how widespread the internet is in society.

Companies

In figure 5.1.7 the on-line availability of the eight selected government services for companies is plotted against the use of e-government services by companies. The position of the Netherlands is close to the average of the EU-25. So it is mainly in the area of the supply and use of e-government services for companies that the Netherlands lag behind most other countries of the EU-15. Sweden, Finland and Austria have high scores for companies and citizens alike. Greece has limited but very frequently used e-government services for companies. Sometimes the frequent use can be dominated by a single highly successful e-government service.

All countries except the UK have developed more of the selected government services for companies than for their citizens.

5.2 ICT and education

ICT applications are playing a major role in education. Teachers use new interactive presentation techniques during classes, and pupils practise the course material with

Key figures on education

Subsidised education in the Netherlands in 2005 represented a gross value added of 20 billion euro. This is 4.5 percent of the total Dutch GDP. Ten years ago the value added (in current prices) was 12 billion euro, which represented 4.3 percent of GDP.

Total expenditure on education in 2005 was 5.7 percent of GDP, while in 1995 expenditure was 5.4 percent of GDP. The growth rate in total education expenditure over the last decade was comparable with the growth rate of the economy as a whole. In 2005 some 5.2 percent of all employees in the Netherlands worked in subsidised education.

Key figures on education, 1995–2005

	1995	2000	2004*	2005*
	million euro			
Subsidised education				
Production value	14,612	19,253	24,517	25,399
Intermediate consumption	2,763	4,056	5,111	5,350
Gross value added	11,849	15,197	19,406	20,049
Employee compensation	10,354	13,398	17,177	17,726
Investments	1,690	1,442	1,813	1,919
	full-time equivalents (x 1,000)			
Employed persons	279	306	332	335
	%			
Share in the total economy				
Production value	2.5	2.4	2.7	2.7
Intermediate consumption	0.9	0.9	1.1	1.1
Gross value added	4.3	4.1	4.5	4.5
Employee compensation	6.6	6.3	6.9	7.0
Investments	2.7	1.6	1.9	2.0
Employed persons	4.8	4.7	5.1	5.2
Expenditure on education [1)]				
Total (billion euro)	16.6	21.2	27.6	28.7
Per capita (euro)	1,076	1,444	1,697	1,759
As a % of GDP	5.4	5.1	5.6	5.7

[1)] Expenditure on education is defined as the total public and private expenditure on households and institutions related to education. The education-related private expenditures to non-educational institutions, for instance expenditure on books, are not included in the total. The public expenditure on households exclude subsidies for tuition fees at universities. This part flows back via the households to the institutions and is therefore part of the private expenditure on institutions.

Source: Statistics Netherlands, National accounts/Education accounts.

specially designed computer programs. Pupils get familiar with ICT, which is very important for their future.

Over the past decade the Dutch Ministry of Education, Culture and Science has conducted a policy of stimulating the use of ICT in education. Between 1997 and 2005 the ministry had a 'major project' for ICT in education. Such a 'major project' is a temporary, complex government project that must lead to a major, permanent shift in the level of government provisions. [2] Several action plans came into force, leading to subsidies for ICT projects in schools, extra ICT provisions in schools, and fast internet in every school. [3] Furthermore the ministry financed the set-up of the organisation 'Kennisnet' to support schools.

In this paragraph we will look at the use and availability of ICT in education in some detail, with the emphasis on primary and secondary education, and on the ICT support schools receive.

In the previous edition of *The Digital Economy*, the paragraph on ICT and education used the international PISA study by the OECD dating back to 2003. This study provided internationally comparable figures about the use of ICT in education. However, the PISA study is carried out once every three years. Therefore this paragraph now includes very few international figures.

Use of ICT tools in education

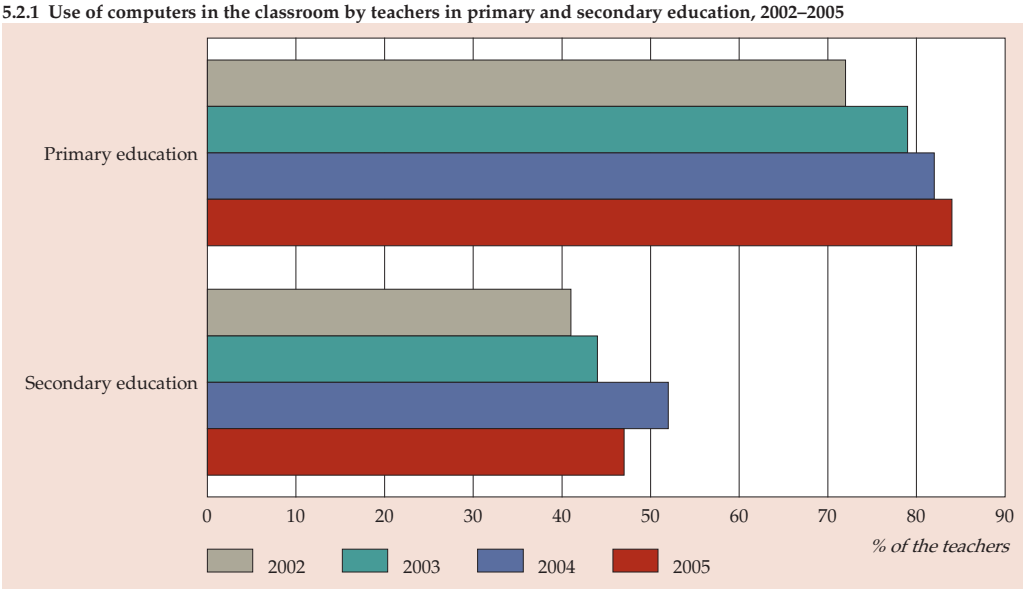
Over 80 percent of the teachers in primary education made use of computers in class in 2005, see figure 5.2.1. The use has been increasing slowly in recent years. In 2002, 72 percent of the teachers used a computer in class. 16 percent of the teachers surveyed made extensive use (more than 10 hours a week) of ICT tools in class. Most teachers (34 percent) used a computer 2 to 5 hours a week.

The study by the organisation *Ict op School*, of which we quote various figures in this paragraph, asked the teachers why they did not use computers in class. In this study, which took place during school year 2005/'06, teachers, school administrators, and ICT-coordinators of elementary and secondary schools were interviewed about the use and availability of ICT tools at their school.

The main reasons not to use ICT in class, according to this study are:
- lack of computers;
- teacher's lack of necessary ICT skills;
- software does not match the method used;
- lack of time.

One striking aspect is that only 47 percent of the teachers in secondary education in 2005 used computers in class, far fewer than in primary education. There are several

5.2.1 Use of computers in the classroom by teachers in primary and secondary education, 2002–2005



Source: Ict op school.

reasons for this. First of all ICT is used for different applications in primary education. Secondly, there is an interaction between the use of computers in class and the use of computers by students outside class, for example for homework assignments. Thirdly, what plays a role is the difference in how adequate the ICT tools are. We will discuss some details below.

Number of pupils and students

In school year 2005/'06 there were close to 3.6 million people in education in the Netherlands. Most (44 percent) are in elementary education. Secondary school students of school types vbo, vmbo, mavo, havo, vwo and their common school years, special secondary education and practical instruction, make up 26 percent of the total. 14 percent are in secondary vocational training (mbo) or secondary general adult education, while 16 percent study in higher professional education (hbo) and universities.

The number of students in higher education has grown fast in recent years. There was a 13 percent increase in the period 2001/'02 - 2005/'06, while the total number of students increased by only 3 percent. The number of students increased substantially in higher professional education, as well as at universities.

Pupils and students in education, 2001/'02–2005/'06

	2001/'02	2002/'03	2003/'04	2004/'05	2005/'06
	number (x 1,000)				
Total pupils and students	3,485	3,506	3,540	3,565	3,594
Primary education	1,604	1,602	1,599	1,599	1,598
Elementary education	1,552	1,550	1,548	1,549	1,549
Special elementary education	52	52	52	50	48
Secondary education	904	914	925	935	940
Joint years 1 and 2	390	398	401	400	393
Vwo, havo year 3 and higher	255	262	271	282	294
Vbo, mavo and vmbo years 3 and 4	229	230	228	226	227
Special secondary education and practical instruction	31	23	25	26	27
Vocational and adult education	483	489	492	487	497
Secondary vocational education	463	473	479	474	482
Secondary general adult education	21	16	14	13	15
Higher education	493	501	523	544	559
Higher professional education	322	323	336	347	357
University	174	180	190	200	205

Source: Statistics Netherlands, Education statistics.

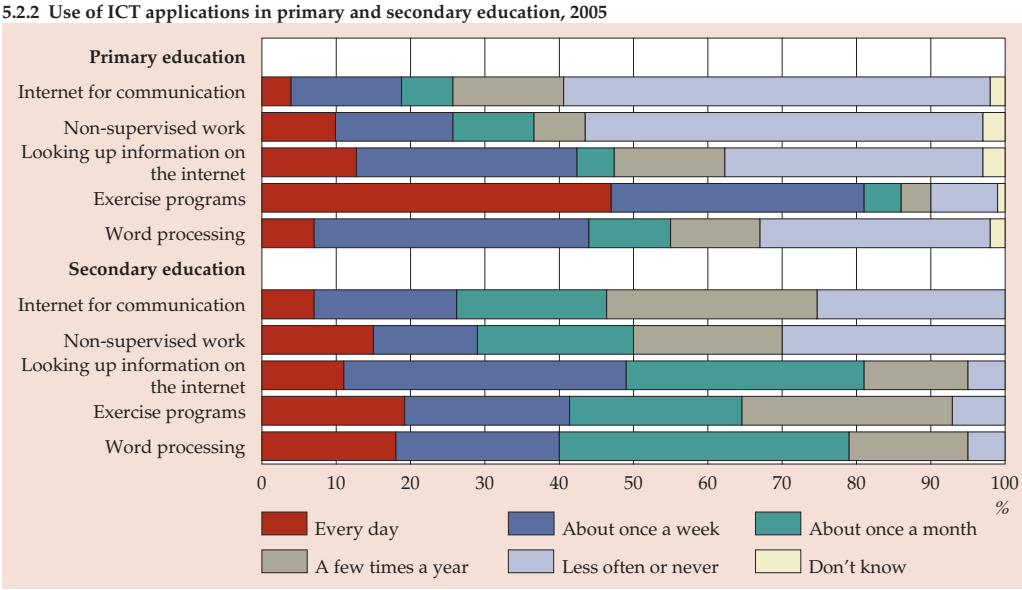
Various ICT applications in education

In primary education computers are mainly used to practise, see figure 5.2.2. Over 80 percent of the teachers let their pupils practise the material taught in class at least once a week. Close to 50 percent do so on a daily basis. Looking up information on the internet, and word processing are also relatively common. Just over 40 percent of the teachers let pupils do this at least once a week.

The use of the internet for communication is less common in primary education. Almost 60 percent of the teachers say they barely use it. 26 percent of the teachers let pupils work independently with computers on a weekly basis, while over half of the teachers indicated that they never do this in class.

About half of the teachers in secondary education make students look up information on the internet at least once a week. Exercise programs are less common than in primary education (41 percent at least once a week). 75 percent of the teachers in secondary education let students use communication through the internet, such as sending email. In primary education this option was not used very often.

5.2.2 Use of ICT applications in primary and secondary education, 2005



Source: Ict op school.

Digital blackboards

More and more schools replace the classical blackboard and chalk by a 'digital blackboard'.

A digital blackboard has a great white screen the size of a classical blackboard, on which computer generated images are projected by a projector/beamer. Teachers or students can write on the board with special pens: the board registers the pen's position, adapts the computer image, and the projector projects the writing on the board directly. Users of a digital blackboard have the impression of writing directly on the board.

The digital blackboard has several advantages over the classical blackboard. For instance, educational programs can be shown directly on the board so that students can work with them directly on the main board in front of the class.

Another advantage is the option to use colour for different content. It is easy to show (digital) maps, or moving images such as video.

Images, presentations or entire lessons can be saved and reused. Digital lessons can be exchanged among teachers. Teachers can easily print elaborate texts and diagrams written on the board. Students no longer have to copy everything written on the board, so they can focus on the explanations teachers give.

Teachers are generally positive about the possibilities and use of digital blackboards. In particular teachers skilled in ICT make good use of these possibilities. Students are also positive, especially if they are allowed to work on the board, and use the interactive applications.

Use of ICT outside classes

Apart from the use of computers in classes, students also increasingly work with computers outside classes. Having access to a computer at home, or in the computer room at school, is almost a necessity for students. In secondary education 90 percent of the teachers reported that they assign homework at least several times a year for which students need a computer. This percentage has gone up in recent years.

In primary education this is not as common. Only 40 percent of the teachers there assign homework requiring a computer on a regular basis. The percentage seems to be decreasing in recent years.

There seems to be a correlation between the use of ICT in classes and the use of ICT for educational purposes at home. In primary education ICT is often used during classes, but pupils do less with ICT outside classes. In secondary education ICT is used less often in classes, but there are more homework assignments requiring a computer.

It is apparently no problem for most students to find a computer to make their homework on at home. The PISA study by the OECD shows that 96 percent of the 15 year olds in the Netherlands had a computer at home in 2003.

Availability of ICT provisions in school

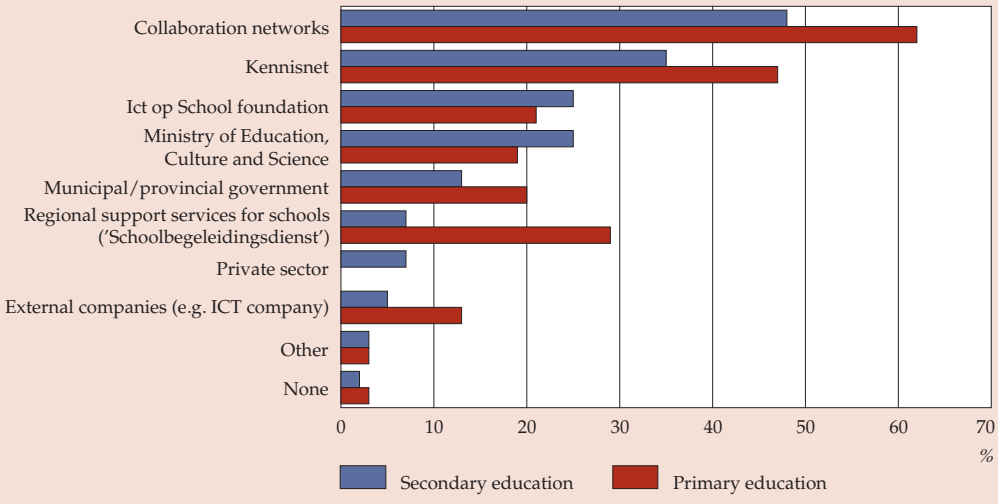
The use of computers in the classroom requires the sufficient availability of computers (hardware), plus proper computer rooms within the school. Then there is the need for adequate computer programs (software) to support the teaching methods used. Many teachers have problems because of a lack in these kinds of ICT provisions.

In 2005 over 60 percent of the teachers in primary education felt the ICT provisions at their school was adequate, 32 percent felt the provisions were fair, and 7 percent felt they were poor. The situation in secondary education is not as good: only 46 percent of the teachers surveyed reported that ICT provisions were adequate, while 18 percent of the teachers called the provisions poor.

The number of teachers who reported they had sufficient ICT tools available fell, both in primary and in secondary education. The teachers seem less and less satisfied with the available ICT tools.

When we look at the ICT investments by subsidised education, it turns out that the amount has gone up over the last five years. The share of ICT in the total investments of subsidised education increased from 26.4 percent in 2000 to 32.5 percent in 2004. So the budget for ICT has gone up, while the teachers find the tools bought with the higher budget less and less adequate.

5.2.3 Support in the area of computer use at school, 2005 [1)]



[1)] Percentage of ICT managers in education who reported that the group/authority concerned has supported the school to an important extent in the area of computer use.

Source: Ict op School.

ICT cooperation

In order to improve ICT provisions in schools, or to improve ICT support, schools regularly work together with other schools or institutions. Many schools have joined ICT cooperation groups. Moreover there are a number of organisations and institutions to support them. The private sector, for example ICT companies, also does ICT support for schools.

Figure 5.2.3 shows the groups or institutions that give schools substantial support. It is the percentage of the ICT managers in schools who feel the group or institution has provided the school with significant support in computer use in 2005.

By far the most support in primary education comes from cooperation between the schools. Over 60 percent of the ICT managers indicated that they received support in computer use from these networks. Such networks are also common in secondary education, although they are used less than in primary education. Almost 50 percent of the ICT managers in secondary education reported that they received support from such networks.

The government provides less and less ICT-related support to education. This is probably due to the ending of a government project. The Ministry of Education carried out a 'major project' between 1997 and 2005 on ICT in education (see introduction of this paragraph), which supported schools. The support by the

Ministry of Education stopped once the project ended. While 32 percent of the ICT managers in primary education were supported by the Ministry of Education in 2002, only 19 percent remained in 2005. This trend is not seen in secondary education (25 percent in 2005).

Kennisnet is a public ICT support organisation established in 2001 for education. It provides an education portal on the internet with information and products for teachers, ICT managers, students and their parents. Kennisnet develops its own new internet applications for education. 47 percent of the elementary schools and 35 percent of the schools in secondary education used the Kennisnet services in 2005.

Ict op School was also founded in 2001 and focuses on the consumer interests of schools in the area of ICT. It supports schools in their choice of ICT products and services, and in the exchange of knowledge and development of knowledge in the area of learning with ICT. Ict op School also studies and analyses ICT developments in education. 21 percent of the schools in primary education indicated they used the services of Ict op School. In secondary education 25 percent of the schools made use of it.

The two organisations joined forces in 2006 in a single organisation called *Stichting Kennisnet Ict op School*.

There are also regional support services for schools, known in Dutch as *'schoolbegeleidingsdienst'* or *'centrum voor educatieve dienstverlening'*. These focus on learning difficulties and have specialised practice materials available. In 2005 29 percent of the schools in primary education reported receiving ICT support by one of these service centres. In 2002 this was 42 percent. Their ICT support services are used less in secondary education (7 percent).

Opinions differ about the effects of the use of ICT in education on the achievements of students. In specific situations the use of ICT will certainly improve achievements. However, it is not clear if students using ICT in school perform better than students who do not.

5.3 ICT and care

Health and social work is not just an important sector of industry in public health, but also in economic terms, given the fact that over 1 million people are employed in it in the Netherlands. In recent years care expenditure has risen substantially, as did employment in health and social work.

In health and social work much information is recorded, processed, and exchanged within and between institutions. This is not only true for the operational management

itself, but also for specific information about patients and clients. ICT can play a key role in the latter. There are important ICT developments in health and social work, which are described in this paragraph.

ICT investments in health and social work

Health and social work offer plenty of room for the improvement of quality and efficiency of the services by means of ICT. However, table 5.3.1 indicates that health and social work (as a knowledge-intensive sector) is no front runner as far as ICT investments are concerned. The ratio of ICT experts to the total workforce is considerably lower than in the other sectors of industry. This does not mean that the use of ICT tools in health and social work lags behind that of the other sectors of industry (see figure 5.3.1).

The use of ICT in health and social work

The survey Statistics Netherlands conducted on the use of ICT by companies gives an indication of the situation for various ICT-related issues in companies employing ten persons or more. These categories are used for all sectors of industry, including health and social work. The specific ICT applications in health and social work are not discussed, but the survey provides a general impression of the ICT use in health and social work in comparison to other sectors of industry.

Table 5.3.1
Investment in health care and social work, 1995, 2000 and 2004

	Health care and social work			All sectors of industry		
	1995	2000	2004*	1995	2000	2004*
	million euro					
Total investment	2,160	2,701	3,776	63,500	91,500	93,454
ICT investment	128	312	392	6,703	15,138	12,932
	euro					
Investment per employed person	2,650	2,858	3,295	8,875	11,294	11,388
ICT investment per employed person	157	330	342	937	1,865	1,576
	% of total					
ICT investment	5.9	11.6	10.4	10.6	16.5	13.8
ICT staff	0.6	0.6	0.7	2.0	3.2	3.3

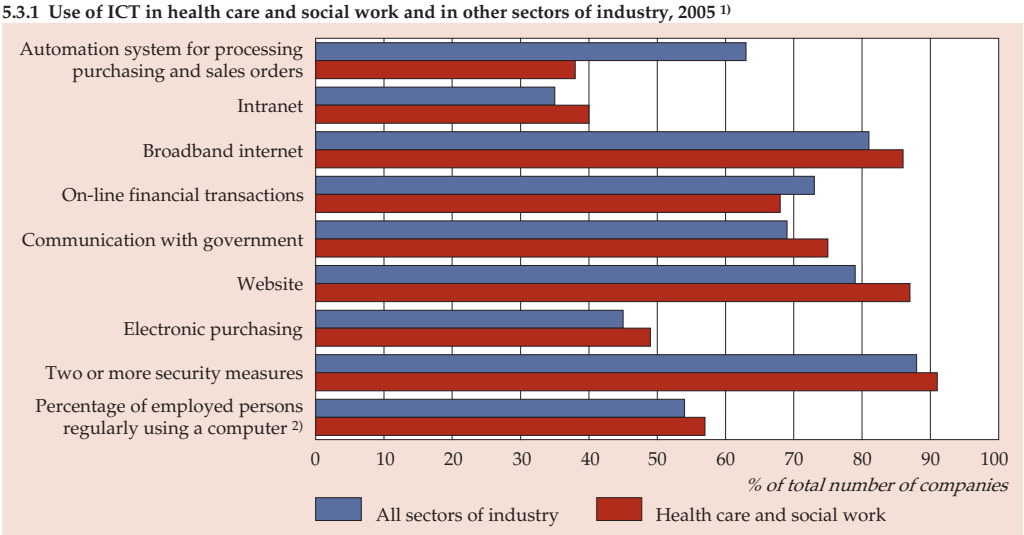
Source: Statistics Netherlands, National accounts and ICT use by enterprises 2005.

We distinguished the following categories of ICT use:
- automation system for processing purchasing and sales orders;
- intranet;
- broadband internet;
- on-line financial transactions;
- communication with government;
- the use of one's own website;
- electronic purchasing;
- two or more security measures (antivirus software, firewall, secured web server, off-site data back-up, authentication and encryption);
- share of people employed who regularly use a computer.

Most care institutions have computers with external data communication facilities. In this respect care is on par with the rest of the economy, as is shown by figure 5.3.1.

The most noticeable thing is that the care sector makes far less use of computer systems for processing of purchasing and sales orders than the private sector as a whole. It is expected that such systems will be used more often in care institutions in the future. There are plans to radically change the current billing system of hospitals because it is unworkable. The key of the new system is that doctors no longer have to enter their own diagnosis-treatment combinations. They can just record the diagnosis and the treatment. The computer will link this to a diagnosis-treatment combination.

5.3.1 Use of ICT in health care and social work and in other sectors of industry, 2005 [1)]



1) Companies with 10 or more employed persons.
2) Percentage of employed persons within the sector, not percentage of companies within the sector.
Source: Statistics Netherlands, ICT use by enterprises 2005.

Key figures on care

In 2005 1,173,000 people worked in health and social work. The labour volume of these employed people was 835,000 fte. The difference is due to working part-time. On average someone working in health and social work in 2005 had 71 percent of a full job. This percentage has barely changed since 1995.

The share of health and social work in the economy as a whole in terms of gross value added was 8.9 percent in 2005. This shows that it is a major economic sector, larger for example than construction or transport.

Health and social work are labour intensive: three quarters of the value added in this sector of industry are labour costs. In 2005 the pay per fte was up by 33.6 percent on 1995. The turnover in the same period increased by 31.1 percent per fte. Total expenditure on care increased, also as a percentage of gross domestic product (GDP).

Key figures on health and social work

	1995	2000	2004*	2005*
	million euro			
Sector of industry Health and social work				
Production value	28,461	37,659	52,786	54,185
Intermediate consumption	7,804	10,423	13,758	14,112
Gross value added	20,657	27,236	39,028	40,073
Employee compensation	15,403	20,680	29,776	30,333
Investments	2,160	2,701	3,776	.
	full-time equivalents (x 1,000)			
Employed persons	575	677	822	835
	%			
Share in the total economy				
Production value	5.0	4.7	5.8	5.7
Intermediate consumption	2.6	2.4	2.9	2.8
Gross value added	7.5	7.3	9.0	8.9
Employee compensation	9.9	9.8	11.9	12.0
Investments	3.4	2.9	4.0	.
Employed persons	10.0	10.4	12.7	13.0
Expenditure on care[1)]				
Total (billion euro)	.	42.1	59.9	61.5
Per capita (euro)	.	2,643	3,676	3,771
As a % of GDP	.	10.5	12.2	12.3

[1)] The expenditure on care is defined as the total of the income generated by the activities of the companies and institutions involved. The expenditure on care is higher than the production value of the sector of industry health and social work, because there are also companies and institutions outside this branch that provide care (for instance pharmacists).

Source: Statistics Netherlands, National accounts/Care accounts.

To further analyse the use of ICT tools in health and social work, the figures are grouped by health care and by social work (figure 5.3.2). Three size classes are distinguished (table 5.3.2).

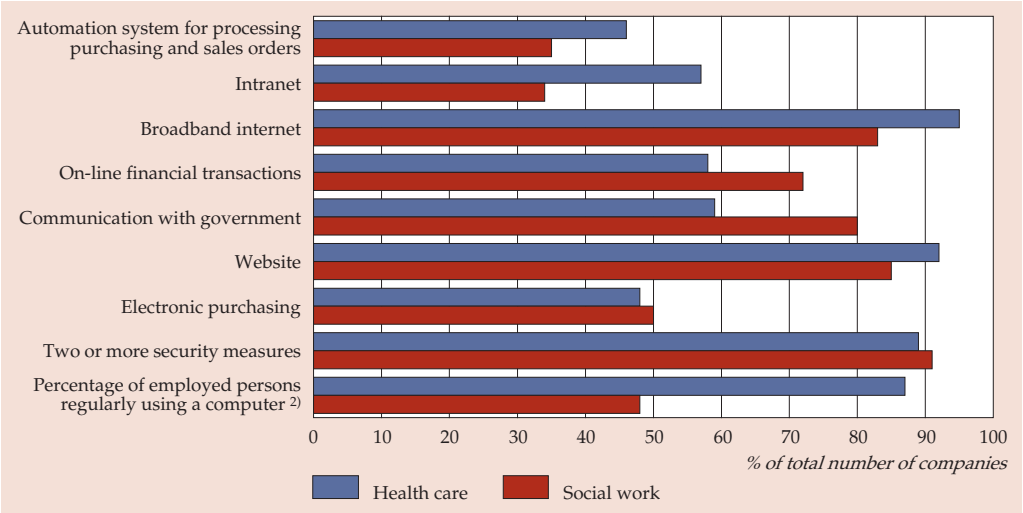
ICT in health and social work

There are more people employed who regularly use a computer in health care than in social work, see figure 5.3.2. In addition, computer processing of purchase and sales orders are more advanced in health care than in social work, although both sectors have not yet reached their full potential in this area. Social work makes more use of ICT in the area of on-line financial transactions and communication with government than health care. The two sectors hardly differ in on-line purchasing. Here too much remains to be done; to fully benefit from the advantages of on-line purchasing (such as cost cutting) a clear policy and proper embedding in the organisation is required.

Table 5.3.2 provides insight in the meaning of size class in health care and social work for the use of electronic tools.

In general the smaller health care institutions are less advanced in the use of electronic tools than the larger ones, but the influence of company size varies. There is a greater share of employees who regularly use a computer in smaller institutions than in larger ones. There is a great difference between small and large institutions in intranet and communication with the government, but company size is less important when it comes to having broadband or a website.

5.3.2 Use of ICT in health care and social work, 2005 [1)]



1) Companies with 10 or more employed persons.
2) Percentage of employed persons within the sector, not percentage of companies within the sector.
Source: Statistics Netherlands, ICT use by enterprises 2005.

In social work the larger institutions are also the more advanced in the use of ICT tools, but the differences are not huge. The most obvious difference is found for intranet and broadband.

Both sectors show that having broadband, websites and security is widespread regardless of size class. Much remains to be done in computerising purchase and sales orders and on-line purchasing. The external orientation this requires, would also be useful in ICT developments that are related directly with care itself, namely e-health.

E-health

The application of ICT in health and social work has expanded rapidly over the last 15 years. Worldwide, governments recognise the possibilities ICT has to raise effectiveness and efficiency in care. Many countries have special policies to develop information systems for health care. One common element is the aim to improve the safety, quality, and efficiency of patient care by making medical dossiers more accessible, and by supporting clinical practice. Also on the agenda are strengthening the patient's own responsibility, and facilitating research and policy with relevant data. The emphasis is to set standards in exchanging and securing data. E-health also focuses on providing the patient with adequate medical information so they can improve self-care.

Table 5.3.2
ICT in health care and social work by size class, 2005

	Health care			Social work		
	Company size (number of employed persons)					
	10–49	50–249	250 or more	10–49	50–249	250 or more
	% of companies					
Automation system for processing purchasing and sales orders	39	31	78	30	37	44
Intranet	39	75	85	27	29	60
Broadband internet	94	96	98	76	87	98
On-line financial transactions	51	65	67	73	73	67
Communication with government	36	95	81	75	84	91
Website	87	100	95	80	88	95
Electronic purchasing	42	51	62	42	60	56
Two or more security measures	81	100	99	86	95	99
Percentage of employed persons regularly using a computer [1)]	90	88	76	50	45	46

[1)] Percentage of employed persons within the sector, not percentage of companies within the sector.

Source: Statistics Netherlands, ICT use by enterprises 2005.

Medical ICT has shifted on the basis of this. At first the emphasis was on hardware, systems architecture and databases. Now the emphasis has shifted toward innovative use of technology for good communication and decision-making. The importance of the human and organisational aspects is recognised more and more.

The term e-health

Looking at the number of publications using the term e-health, we see that the term was hardly used until the year 2000; but after that the use of the term soared. [4)] At the same time ICT penetrated health care. The term 'e-health' was used for this as well, so that the meaning of the term became fairly vague. In part it refers to known matters such as telemedicine, medical informatics and information systems for clinical laboratories under a new name. Although one can define e-health simply as the use of ICT in health care provisions, a study of the definitions used in the literature showed major variations, with health and with technology as the fixed ingredients. The definitions often reflect optimism about the improvements expected in health care due to e-health. Negative connotations were rare. [5)]

Three areas in which progress is expected in e-health are:
- the possibility to communicate on-line with the health care institution where one is or was a consumer/patient;
- improving data exchange between health care institutions;
- new ways for consumers/patients to exchange data among themselves.

A few important aspects for this are:
- *efficiency:* there are all kinds of cost cutting possibilities by avoiding unnecessary double diagnoses and therapies;
- *quality improvement:* through better and faster medical information and benchmarking of the providers of resources and care;
- *fact-based information:* the effectiveness (result) and efficiency of care needs to be proved by hard, scientific data;
- *more control for consumers and patients* by making medical knowledge and personal patient records available on-line;
- *education* of doctors and patients through the internet;
- *standardised data exchange* between health care institutions;
- *ethics:* e-health evokes new ethic problems and resistance about the doctor-patient relationship. This plays, for instance, in professional help offered on-line, privacy and the responsibility a doctor has towards the 'informed' patient;
- *equal opportunities:* making use of e-health requires certain skills and means that are unequally distributed among the population. Without specific policies in place, e-health may increase the social distance between (for instance) high income and low income groups.

What is e-health?

E-health refers to healthcare services and the information pertaining to them, which may be improved or made available because of the internet and related technology. It is an up and coming area characterised by overlaps between medical informatics, health care and professional conduct.

In the wider sense of the word e-health not only refers to a technical development, but also a state of mind: people start thinking in terms of international networks to improve health and social work by using ICT at the local, regional and worldwide level.

Definition by G. Eysenbach, often quoted in the literature.

The electronic patient dossier (EPD) and decision support systems based on it are central in the development of e-health. A study in two states of the USA showed that two years after the full implementation of these systems by medical centres, the advantages showed in terms of the number of patient visits to the doctors of these centres. [6)] In the two regions studied, the number of visits fell by 9 percent (primary

Hospitals and electronic patient dossier (EPD)

About 90 percent of Dutch hospitals use EPD software (a hospital here means the highest organisational unit, not the number of locations). This does not say much about how widely the software is used. When is EPD truly integrated? There are five generations of EPD systems. The first generation only shows subsystems (such as lab, x-rays). These systems were built in the 1980s and 1990s on the basis of the Hospital Information System to support the administration of the hospital, but not the work of medical staff. In the mid 1990s the second generation became available, which allowed entering data. The third generation joins workflow and EPD in one application, and is accessible through the internet (patients can access their dossier; and set dates for treatment online). The fourth generation adds support in decision making. In theory, the most advanced version will inform the user in future about new knowledge that has become available (knowledge management). In the Netherlands most hospitals have first generation EPD, some second, a few are involved with third, and in certain specific cases the fourth generation is being introduced (in dossiers on chronically ill patients). [9)]

The supplier plays a major role in the design and implementation of the new generations EPD systems. A proper supplier will offer adequate support in how the content must be incorporated. Designing and implementing a third generation EPD is hard. The implementation period is at least two years. Additional support can be necessary in the process of change, since the introduction of third generation EPD may have far-reaching consequences for the organisation. Many people will have to change the way they work. Each care provider can do his or her own administration and has access to the administrations of colleages. [10)]

health care 11 percent; specialist health care 5–6 percent), whereas the quality of care stayed the same or improved slightly. The visits were partially replaced by telephone calls.

There are several key developments in e-health, specifically due to the possibility to give advice, monitor and correct from a distance. Therefore fewer visits and hospital stays are necessary. Such developments give the impulse to evaluate and improve processes within the institution. Mostly the patient plays a key role because he or she has to react to certain signals or answer certain questions. There are also variations possible where the role of the patient is minimal. [7)] In some variations the GP plays a central role. [8)]

Preventing errors

One advantage of the proper supply of information in health care is the prevention of errors. ICT is indispensable for this. Research in the Netherlands showed that about 90,000 hospital admissions may be due to errors in medication. [11)] The study *'Fouten worden duur betaald'* ('Expensive Mistakes') shows that there are about 1.3 million medical mistakes in transfers because the patient's medical dossier is not properly updated or unavailable. [12)] Most errors involve the wrong medication,

Digitalising care

There is an ambitious plan for the application of ICT in Dutch health and social work that is starting to show results. In 2006 a national basic infrastructure is realised due to several central provisions: the *Burgerservicenummer* as patient identification, the unique identification number for care providers, and the national information exchange switchboard. This is a nation-wide basic infrastructure that will make it possible to exchange care-related data reliably and safely in the Netherlands.

The first two applications, the first two 'chapters' of the national electronic patient dossier (EPD), that will use the care infrastructure are the Electronic Medication Dossier (EMD) and the dossier enabling GPs to take over patients (*Waarneemdossier Huisartsen*). These are tested in 2006 in pilot regions and rolled out nationwide in 2007. Furthermore, there are new applications being developed (EMD phase II, emergency services, diabetes, on-line children's dossier).

Other desirables where ICT can play a role in care are: secure information, implementation of a large-scale ICT/EPD project, on-line access to patient data by the patient, financing problems and legislation.

From: R. Bekker, Secretary-General of the Ministry of Public Health, Welfare and Social services, 'Digitalisering in de zorg: een hele zorg!' Introduction to the Records Management Convention held 21 June 2006.

failure to treat due to lack of information and wrong operations and treatments. The costs are estimated at 1.4 billion euro a year, of which 300 million euro are direct costs of care. [13)]

Notes in the text

1) In the histogram we show unweighted scores for the six aspects. In the total score these aspects are given a certain weighing factor. *Transparency* (30 percent) and *services* (30 percent) weigh heavily, followed by *personalised services* (15 percent), *interactivity and timeliness* (10 percent), *accessibility* (10 percent) and *user friendliness* (5 percent).
2) Other examples of 'major projects' are the construction of the high-speed rail link HSL-Zuid, the introduction of the 2000 Immigration Law and the project 'group size and quality' (to create smaller classes in primary education).
3) Action plans 'Investeren in voorsprong' (1997), 'Education on-line' (1999) and 'Leren met ICT' (2003).
4) C. Pagliani, D. Sloan, P. Gregor, F. Sullivan, D. Detmer, J.P. Kahan, W. Oortwijn and G. MacGillivray, Journal of Medical Internet Research 2005, 7 (1).
5) H. Ob, C. Rizo, M. Entvin and A. Jadad, *What is e-Health?: A Systematic Review of Published Definitions*, Journal of Medical Internet Research 2005 (Feb 24), 7 (1).
6) T. Garrido, L. Jamieson, Y. Zhou, A. Wiesental and L. Liang, *Effect of electronic health records in ambulatory care: retrospective, serial, cross sectional study*, BMJ 2005 (12 March).
7) The medical centre of the Vrije Universiteit Amsterdam was the very first to implement a heart failure pacemaker with SMS technology in a patient. The pacemaker sends text messages to the cardiologist, who can look on the internet what irregularities in the status are and take action when needed. This renders checkups redundant.
8) Over one thousand GPs already use teledermatological consultations by sending digital photos of the skin to a specialist (Nieuwsbrief Public Health 225, dd. 10 September 2006 at www.Integratedcare.nl).
9) Source: information from Ms. S. Meijer, product manager at Getronics PinkRoccade in Apeldoorn (October 2006).
10) Source: paper by R. van Dijk, cardiologist and ICT advisor, *'Hoe maken we het EPD succesvol?'*, February 2006.
11) Pharmaceutisch weekblad, jrg. 137, 2002, no. 17, pp. 609–612. Quoted in RVZ, '*Standaardisering Electronic Patiëntendossier*'. Briefadvies, 17 February 2005; footnote 1.
12) In 2004 conducted by TNS NIPO commissioned by the Nationaal ICT-Instituut in de Zorg (NICTIZ) and the Nederlandse Patiënten Consumenten Federatie (NPCF).
13) Quoted in RVZ, '*Standaardisering Electronic Patiëntendossier*'. Briefadvies, 17 February 2005; footnote 1.

6. Use of ICT by households and individuals

ICT was just about omnipresent in Dutch households in the year 2006. The personal computer and the internet are fully integrated. Households without internet usually do not want internet. Moreover broadband technology has spread rapidly among Dutch households. Over four out of five households with internet have high-speed broadband. Placed within an international perspective, the Netherlands scores highly in terms of available ICT provisions.

These ICT provisions are not merely available, they are increasingly used by close to 11 million internet users. The diversity of internet use has increased. In 2006, more people engaged in almost all internet activities than in 2005. Although the skills of the internet users leave room for improvement, the Dutch are among the top of the class internationally. Communication is the number one activity in internet use. Almost every internet user emails, and many, mostly young people chat. Telephone calls via the internet are also on the increase. Modern communication technology of emailing and chatting replaces traditional communication such as mailing letters and cards. The internet is also increasingly used for on-line shopping. In 2006 some 4.5 million internet users bought goods on-line in the three months preceding the survey. In 2002 this was 1.9 million internet users. Placed in an international perspective, the Netherlands together with several Scandinavian countries are at the very top when on-line shopping is concerned. On-line banking is also becoming far more common. Over two thirds of all internet users do their banking through the internet. More and more internet users also look up information on government websites, increasingly followed by completing government documents on-line.

The use of personal computers and the internet also has its drawbacks. Spam and viruses cause problems. In 2006 almost two thirds of all internet users is plagued by unwanted email messages. Viruses are less common but they tend to cause greater damage. Internet users receiving much spam also have relatively more damage through viruses.

6.1 ICT provisions in households

It is no longer easy to imagine a society without modern ICT products and services, like computers and the internet. In the last decade their use increased dramatically and the computer and the internet both feature prominently in all aspects of daily life, like education, work, home, or leisure. So it is socially important to monitor how and how often households and individuals use these modern means of information and communication. Statistics Netherlands gathers this information in its study on the use of ICT by households and individuals. Each year over 4,000 individuals aged 12–74 are interviewed. [1)] In this chapter we deal with ICT provisions and their

use, as well as the skills of the users. Furthermore, the focus is on user activities on the internet and the safety of computer and internet use. The international position of the Netherlands is shown regularly.

PC and the internet

PC ownership (desktop and laptop) increased sharply around the turn of the century. In 2002 over three quarters of all households owned a computer. Although the growth rate diminished somewhat later on, ownership increased by 2 percent points a year. In 2006, 84 percent of the households had a computer at home, which is 5.5 million households, encompassing 11.3 million individuals. The share of individuals with access to a computer increased by 7 percent points after 2002 to reach 88 percent in 2006. This spread of the personal computer in the Netherlands means that it is very widely accepted at the moment.

The percentage of households with access to the internet grew twice as fast in recent years than households with access to a computer. While just over six in ten households had an internet connection in 2002, four years later this had increased to eight in ten. In total the share of households with internet increased by 17 percent points in four years time. This means that 5.3 million Dutch households, encompassing 10.9 million individuals, had internet in 2006.
Access to the internet is almost always by computer. Almost all households with an internet connection had the combination personal computer with internet access in 2006. But there is also an increase in the share of households that has other appliances to access the internet, such as mobile phones, palmtops or games computers. These developments are not as fast as assumed several years ago. In 2006 over 900 thousand households (14 percent) had internet access with one or more of these appliances. In 2003 the share was 11 percent.

Internet and broadband

The number of households using broadband internet has seen explosive growth in recent years. In 2002 only 15 percent of all households had access to broadband internet, in 2006 this share had increased to 66 percent. The rapid increase means that in 2006 over 9 million people had a fast broadband connection. Households with children have above average access to broadband. In 2006, three quarters of the one-parent families and eight out of ten couples with children had a broadband connection at home. Access to the internet through broadband is least common among singles. In 2006 half of these households had broadband.

82 percent of the households with internet have broadband. Almost two thirds of these people had the connection via ADSL and over one third via cable. The emergence of broadband internet had substantial consequences for internet via the regular analogue telephone connection. In 2006 only 14 percent of the households still used such connections for the internet.

Table 6.1.1
Persons and households with access to ICT, 2002–2006

	2002	2003	2004	2005	2006	2005	2006
	% of households					*abs (x 1 mln)*	
Households [1]						6.4	6.6
PC (desktop/laptop)	76	76	80	83	84	5.3	5.5
Access to the internet	63	65	71	78	80	5.0	5.3
PC with access to the internet	62	64	70	78	80	5.0	5.3
Other equipment with access to the internet	.	11	14	13	14	0.8	0.9
Broadband internet connection	15	22	34	54	66	3.4	4.3
Other internet connection	48	43	36	24	14	1.6	0.9
	% of persons					*abs (x 1 mln)*	
Persons [2]						12.8	12.8
PC (desktop/laptop)	81	82	85	87	88	11.2	11.3
Access to the internet	69	72	77	83	85	10.6	10.9
PC with access to the internet	68	71	76	82	85	10.5	10.9
Other equipment with access to the internet	.	13	16	15	16	1.9	2.0
Broadband internet connection	17	26	39	59	71	7.6	9.1
Other internet connection	51	46	37	23	14	3.0	1.8

[1] Private households with at least one person aged 12–74 years.
[2] Persons aged 12–74 years in private households.

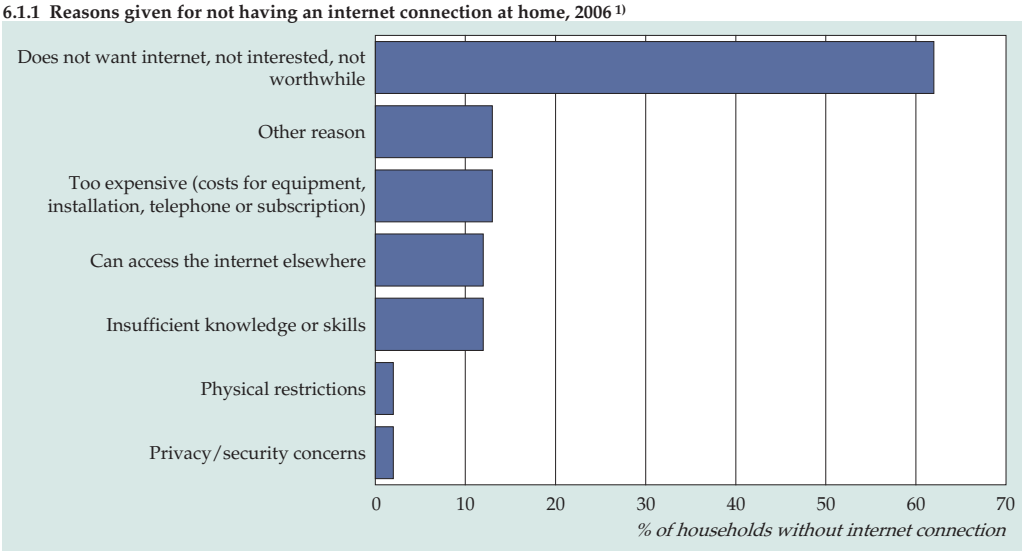
Source: Statistics Netherlands, POLS 2002–2004 and ICT use by households and individuals, 2005–2006.

Why no internet?

Although access to the internet has expanded rapidly in recent years, there were still 1.3 million households without internet in 2006. This is one in five households, encompassing 1.9 million individuals. Most households without internet do not want internet, are not interested or do not think it is useful to them. About 62 percent named these as the reasons not to have internet, which means a 7 percent point rise on 2005. The increase is caused, on the one hand, by a further decrease of the number of households without internet, while the number of households that do not want internet barely changed. In 2006 the latter group consists of 0.8 million households, relatively often people over 55 and poorly educated people.

Another stated reason is that internet is too expensive (13 percent) or that they can access the internet elsewhere (13 percent). Not having the necessary know-how and skills is the reason given by one in eight households without internet. Worries about privacy and/or security are only given by two percent and a similar percentage names physical restrictions as the reason not to have internet.

6.1.1 Reasons given for not having an internet connection at home, 2006 [1)]



[1)] Households without internet connection. More than one answer possible.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

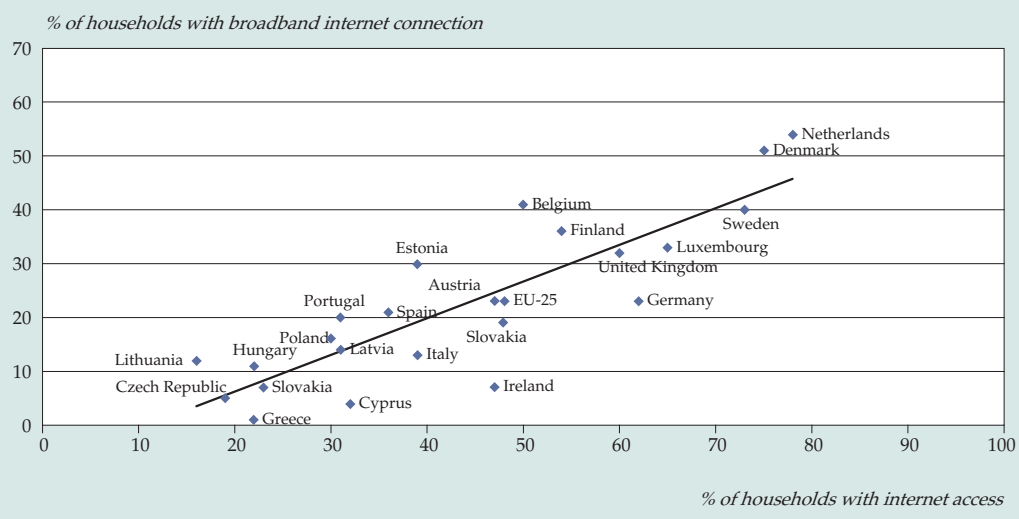
Internet and broadband in an international perspective

Compared to the other member states of the European Union, the Netherlands performs well in terms of internet and broadband use. In 2005 the Netherlands was at the very top of the European Union with a 78 percent share in internet access. Denmark and Sweden were the other countries where more than seven out of ten households had internet. The average for all EU member states in 2005 was that almost 50 percent of the households had internet. The percentage of households with internet access was still quite low in several Eastern and Southern European member states. In 2005 less than 20 percent had internet in Lithuania and the Czech Republic and the share was not much higher in Hungary, Greece and Slovakia. Other countries lagging behind were Poland, Portugal, Latvia and Cyprus.

Countries with a high degree of internet penetration in 2005 usually also had advanced availability of broadband. The Netherlands ranked first in terms of broadband as well. There are great differences in the access to the internet between member states, but the differences are even greater where broadband internet is concerned. Greece and Cyprus hardly had any broadband in 2005. In the Czech Republic, Slovakia and Ireland less than one in ten households had broadband internet. The situation in Germany is surprising because although internet subscriptions are well above the EU average (62 percent), only 23 percent had broadband. On average a quarter of all European households had broadband.

The correlation between access to the internet and broadband is an indication about ICT provisions. In some member states the percentage of households with internet

6.1.2 Internet access and broadband internet connections in the European Union, 2005 [1)]



[1)] No figures available for France and Malta.

Source: Eurostat.

access is still low but many of these households have broadband available. For the EU-25, broadband was available in half of the households with internet access. For the European Union as a whole the correlation between having internet and broadband is fairly strong (R^2= 0.73).

Households in the EU with internet but without broadband stated several reasons for this (Eurobarometer, 2006). In 2006, 22 percent indicated broadband was too expensive for them, while 20 percent was satisfied about the speed of the current analogue connection. A similar size group indicated that they did not use the internet enough to get broadband. There are also technical problems with the availability of broadband. One in seven households stated the lack of the network supplying broadband technology as the reason. Another 13 percent had plans to get broadband within the next two months.

6.2 *Use of ICT and skills*

In the previous paragraph we highlighted ICT infrastructure. In this paragraph we focus our attention on the use of these means and on user skills. It turns out that the computer and the internet are used extensively in 2006. Only 4 percent of the individuals with a computer in the household state they never use it. The share of non-users of the internet is only 5 percent. This means that over 95 percent of the individuals also use the available means.

Frequency of internet use

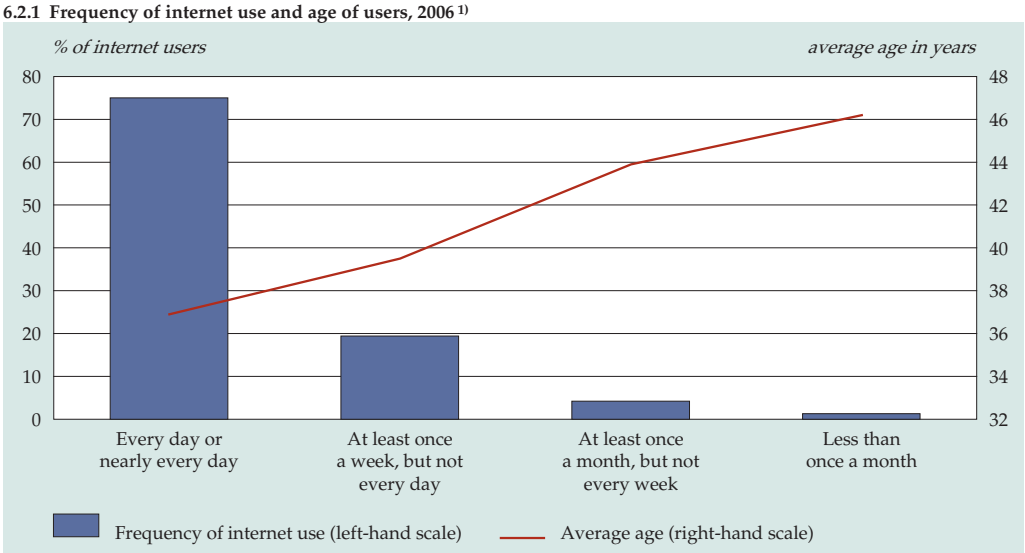
Internet is usually used very frequently. Three quarters of the individuals aged 12–74 used the internet on an almost daily basis in the 3 months preceding the survey, while one in five stated they used the internet at least once a week. Only 5 percent of the internet users used this medium only once a month or less. The intensity of internet use depends on the age of the user, among other things. The people who used the internet on an almost daily basis in 2006 were on average the youngest. Their average age was 36.9 years. With increasing age, the frequency of internet use decreases. Individuals who use the internet once a month or less are on average 46.2 years old.

Place where internet is used

Home is the place to use the internet, this was stated most often, namely 95 percent. But the internet is also used elsewhere. 44 percent of the respondents in 2006 also use the internet at work. Men use the internet more often at work than women. Almost half the men use the internet at work, while four in ten women do so. The use of the internet at work also varies according to the level of education. Internet at work is mainly used by highly educated people, namely over 70 percent. This share is almost four times that of less well educated people.

To a lesser extent people use the internet at somebody else's home or at their school or university. In 2006, 13 percent of the internet users stated that they used the internet at someone else's home (in the previous three months) and 15 percent stated they used it at their school or university. These are mainly young people.

6.2.1 Frequency of internet use and age of users, 2006 [1)]



[1)] Persons aged 12–74 years who used the internet in the 3 months preceding the survey.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

Skills of internet users

The skills of internet users were determined on the basis of the number of activities the users can apply (see box). Based on these criteria, 3 percent of the internet users in 2006 had none of the internet skills studied, while over half had very few skills. 35 percent of the internet users have standard skills, while over one in ten is highly skilled. Internationally, the Netherlands performs well in terms of internet skills. A Eurostat study on 2005 showed that the share of people in the Netherlands without internet skills was among the lowest of the EU-25, while the share of individuals with many internet skills was among the highest. There are no international figures on 2006 yet.

Internet skills

The study included questions about a number of activities related to the use of the internet. We used the activities respondents already engaged in to measure internet skills. This includes the following activities:

- using a search engine to find information;
- sending an e-mail including documents;
- leaving messages in chat rooms, news groups or a discussion forum;
- using the internet to make phone calls;
- sharing maps with others to exchange music, films etc;
- designing a web page.

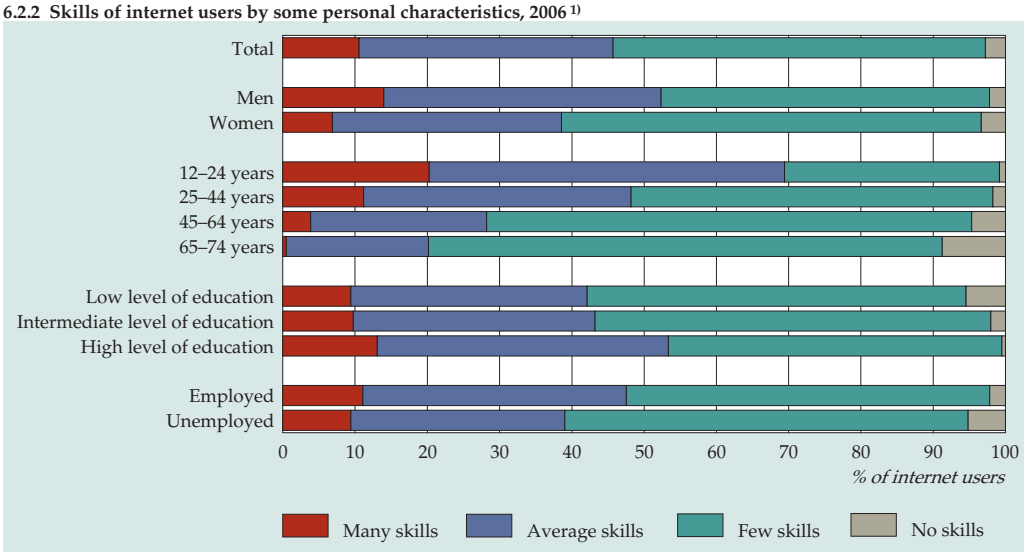
Respondents were classified into the following categories:

No skills	not done any of the activities;
Few skills	two of the activities done;
Average skills	four of the activities done;
Many skills	over four of the activities done.

Age is a major factor when it comes to the skills of the internet user, as well as the other aspects of the use of ICT, frequency and place. Older internet users often have little or no skills. One in ten internet users over 65 indicated in 2006 that they had hardly any of the skills studied, whereas 71 percent belongs to the group with few skills. On the other hand, there are hardly any young people without skills as internet users. Comparatively speaking, this group has most skills. 20 percent of the 12–24 age group has many skills, as opposed to an average of 10 percent among all individuals.

Men have more internet skills than women do. Figure 6.2.2 shows that the share of individuals with many internet skills among men was on average twice as high in 2006 as among women, namely 14 versus 7 percent. In addition, the percentage with average skills is higher among men than among women.

6.2.2 Skills of internet users by some personal characteristics, 2006 [1)]



[1)] Persons aged 12–74 years using the internet. For explanation see box above.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

The skills of internet users also increase with education level. There is hardly anyone without skills among the most highly educated group, whereas 5 percent of the lowest educated have no skills. Nevertheless, 9 percent of the lowest educated is very experienced, versus 13 percent of the highly educated. This is because many young people, who usually are very skilled, are still in school and still count as less well educated. Work also influences the level of internet skills. 52 percent of the employed labour force in 2006 has little or no internet skills, versus 61 percent of the people without employment.

The previous pages showed a relationship between background characteristics and internet skills. When the figures are corrected for this relationship, the picture changes where the internet skills of subgroups in the population is concerned. For instance, the differences between little or no internet skills among internet users in the employed and unemployed labour force disappear when we take the other background characteristics into account: age, sex and education. In this case 53 percent in both groups have little or no skills. The differences between men and women do not change after the figures are corrected for other characteristics.

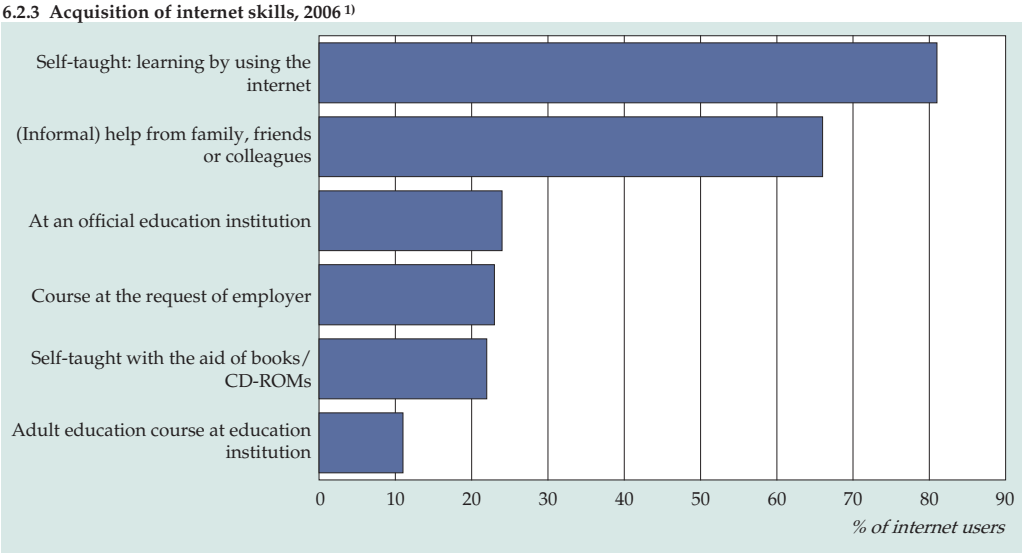
However the strongest correlation is between internet skills and the age of the internet user (see also figure 6.2.2). After correction for sex, education and employment, the share of young people with little or no skills drops from 31 to 21 percent. In the other age groups this share increased by 3 percent points as a result of such a

correction. Education is also influenced by the other characteristics. The share of people with little or no skills increased by 4 percent points among internet users with little education after the correction, while that of the highly educated fell by 6 percent points.

How internet skills were acquired

Most internet users get skills through self-teaching and hands-on practice. This is true for over 80 percent of the internet users. Two in three internet users get help from family, friends or colleagues. Internet users with little, average or many skills acquired their skills in the same ways to the same extent. Internet users with average or many skills also indicate that they also received their know-how from regular education and also by studying books and CD-ROMs on the subject. This is stated mostly by highly skilled internet users with a job. These also include internet users whose jobs or professions involve ICT.

6.2.3 Acquisition of internet skills, 2006 [1)]

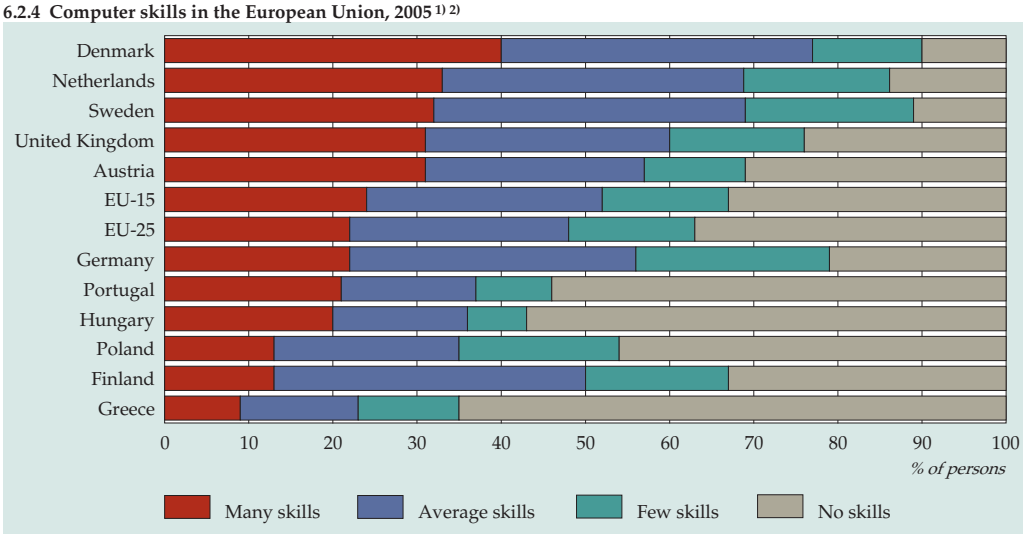


[1)] Persons aged 12-74 years using the internet. More than one answer possible.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

In the year 2005, the computer skills figures for the Netherlands are comparable to those of a number of other EU member states. The Dutch are fairly skilled in computer use. They are on par with the Danes and Swedes, who also score well above the European average. One in three Dutch people in 2005 had many computer skills, whereas 14 percent had no skills. Little or no skills in computer use were common in Greece, Hungary and Portugal. The EU-25 average was that 37 percent of the population had no skills in using the computer.

6.2.4 Computer skills in the European Union, 2005 [1) 2)]



1) Persons aged 16-74 years using and not using a computer.
2) No figures available for Belgium, Czech Republic, Spain, France, Ireland and Malta.

Source: Eurostat.

Computer skills

We used the activities respondents already engaged in to measure computer skills. This includes the following activities:
- using a mouse to open programs;
- copying or moving a map or folder;
- copying or pasting information into a document;
- using simple formulas in a spreadsheet;
- zipping maps or files with WinZip;
- writing a computer program in a programming language.

Respondents were classified into the following categories:

No skills	not done any of the activities, including never used a computer;
Few skills	two of the activities done;
Average skills	four of the activities done;
Many skills	over four of the activities done.

6.3 *Activities on the internet*

Internet is used more and more often, not only because of new users, but also because the diversity of use is growing. In other words, users are engaged in more activities through the internet. Almost all internet activities observed were done

more often in 2006 than in 2005. Internet is especially used to communicate. Looking up information is also popular. Furthermore business activities and the use of services increased in 2006 compared to 2005. In this paragraph we will take a closer look at the use of a number of these internet activities.

Communication

Communication is by far the most important activity of internet users. Almost all internet users communicate in one way or another through this medium. Nine in ten individuals with internet used email in the 3 months preceding the interview, while four in ten chat. Besides email and chat, there is also an increase in the number of phone calls through the internet. Almost one in eight people phone via the internet, which means the share has doubled within one year. The modern means of communication are replacing traditional methods such as writing letters or cards, see also the box below.

Men communicate through the internet just as often as women do. However, the age of the internet user is important. Young people chat more. Over eight in ten internet users aged 12–24 indicated that they chat. This means of communication diminishes in popularity as the age of the internet user increases. Only 15 percent of the people over 65 chatted in 2006. Phoning through the internet is most common among internet users aged under 45 (13 percent). However, also in the higher age brackets, one in ten already used the internet to phone in 2006. Email is so widely accepted these days that there is hardly any difference between the age groups in its use in 2006.

Information, services and entertainment

Apart from communication, people mainly use the internet for looking up information and for entertainment. In 2006 almost nine in ten internet users looked up information about goods and services. Half of the internet users also use services in the travel branch and over four in ten read newspapers and magazines on-line. More and more internet users are looking for on-line entertainment. In 2006, 55 percent of the respondents said they used the internet to play or download games, images or music. This is 5 percent points more than in 2005. Listening to the radio or watching TV on-line has also increased compared to 2005.

On-line sales

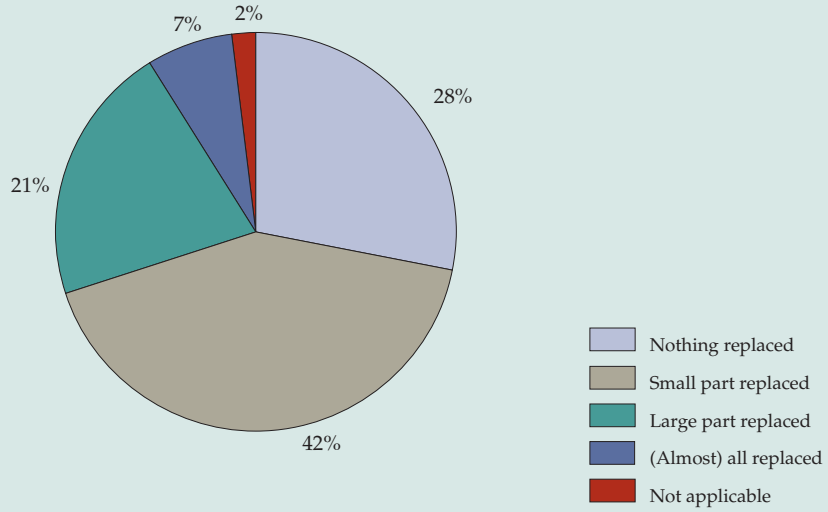
Business transactions, such as on-line shopping en on-line banking are also gaining in popularity. This will be discussed later in this chapter and placed within an international perspective. The sale of goods via the internet is also considered a business transaction. In 2006 over one in five internet users sold goods through the internet. In one year their share increased by 5 percent points. More men than women sell goods on-line. Internet users selling on-line are mainly in the 25–44 age bracket, where almost three in ten sells goods through the internet.

Substitution in communication

The increased use of the available modern means of communication goes at the expense of the traditional ways in which people used to communicate in writing, mainly letters and postcards. We studied to what extent people replaced the traditional mail messages by internet and email messages, and on the other hand, what the emergence of the mobile telephone meant.

Over 70 percent of the people who used the internet in the preceding three months indicated that they have replaced almost all traditional mail by internet or email. Seven percent substituted almost all mail, while 21 percent substituted most. Some 42 percent of the internet users replaced a small part of traditional mail.

Replacement of traditional mail by internet or email messages, 2006 [1)]



[1)] Persons aged 12–74 who used the internet in the 3 months preceding the survey.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

The users of mobile telephones were also asked the substitution question. The mobile phone also leads to a decrease in the use of traditional mail, however, to a substantially lesser extent. Only 2 percent of the mobile phone users replaced almost all traditional mail, whereas two thirds say they have not replaced traditional mail by the use of their mobile phone.

Internet activities for education and courses

The use of internet influences many everyday activities. The internet provides almost unlimited possibilities for looking up information. This makes the internet a great tool in education. Paragraph 6.2 shows that the internet is not only used much

Table 6.3.1
Activities of internet users, 2005–2006 [1)]

	2005	2006
	% of internet users	
Communication		
E-mail	92	93
Phoning via the internet	6	12
Others, e.g. visiting chatrooms	40	40
Information and entertainment		
Looking for information on goods and services	87	88
Playing or downloading games, images or music	50	55
Using travel services	49	50
Downloading or reading newspapers	35	43
Downloading software	27	31
Listening to the radio or watching television	26	35
Applying for or looking for a job	19	22
Transactions		
On-line banking	58	67
Buying or ordering goods or services	40	44
Selling goods or services	16	21
Other financial services, e.g. buying shares	5	8

[1)] Persons aged 12–74 years who used the internet in the 3 months preceding the survey. More than one answer possible.

Source: Statistics Netherlands, ICT use by households and individuals, 2005–2006.

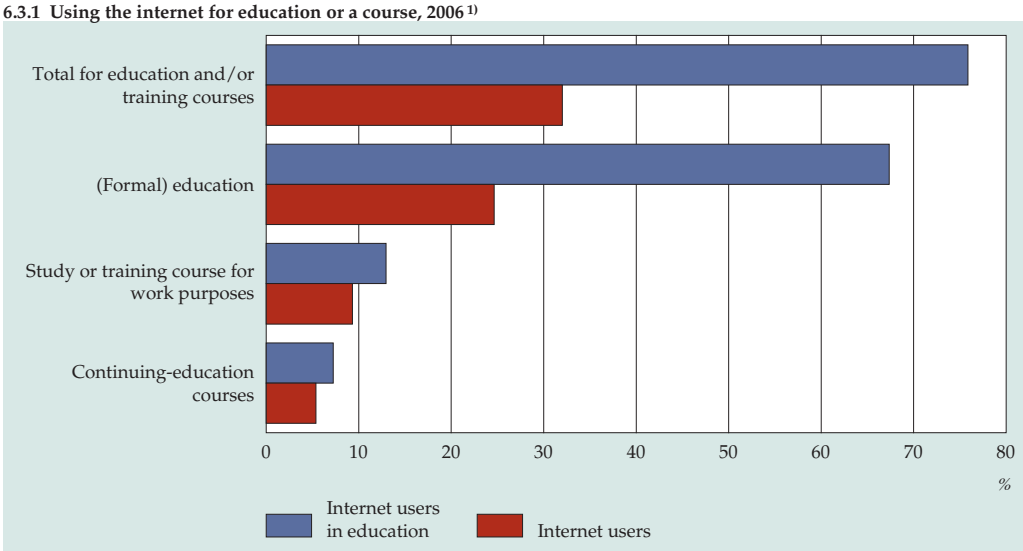
at home but also in schools. This paragraph describes the use of the internet in (formal) education and post-ed courses.

In 2006 almost one in three internet users engages in education-related activities. One quarter uses the internet in (formal) education. 9 percent do so by taking a study or course to improve opportunities at work, while 5 percent take post-ed courses. As expected, mainly young people engage in most internet activities for (formal) education. Of the 12–24 age bracket, two thirds use the internet for education. For work-related education and post-ed courses, the 25–44 age bracket dominates.

To underline the importance of the internet in education, we limited the group of internet users to only those who are currently in education. Figure 6.3.1 shows that internet is now a must in education. Three quarters of the internet users who were in education in 2006 engaged in study-related activities on the internet. This high share is mostly due to internet activities needed in (formal) education.

The share of individuals using the internet in (formal) education in the Netherlands is just above the EU average. In the EU, 17 percent of the people aged 16–74 engaged in education-related internet activities in 2005. This was 21 percent in the Netherlands;

6.3.1 Using the internet for education or a course, 2006 [1)]



[1)] Persons aged 12-74 years who used the internet in the 3 months preceding the survey. More than one answer possible.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

a level comparable to several neighbouring countries, such as Germany and Belgium, but it is well below that of Finland (31 percent). A number of Eastern European member states such as Lithuania, Slovenia and Hungary also have high scores.

Diversity in internet activities

Although the use of the internet increases, many people merely use the internet for a limited number of activities. To gain insight in the diversity of internet use, we distinguished ten types of activities that internet users may have engaged in during the three months before the interview:

- communication, including email, chatting and phoning over the internet;
- looking for information about goods and using travel services;
- following the news, listening to the radio, watching TV, reading or downloading newspapers;
- entertainment, including playing games, listening to music or downloading other software;
- looking or applying for a job;
- financial transactions, including on-line banking and other financial transactions;
- on-line buying or selling goods;
- government services, including looking for information on government websites, downloading and sending official documents;
- education, including activities relating to (formal) education, post-ed courses or work-related courses;
- looking up information on health.

Table 6.3.2
Diversity of internet activities, 2006 [1)]

Number of internet activities	Number of internet users		Share of internet users 2006	Average age of internet users 2006
	2005	2006		
	abs (x 1 mln)		*% cumulative*	*years*
1	0.4	0.3	3	49
2	0.6	0.5	7	43
3	1.0	0.7	14	38
4	1.5	1.1	24	39
5	1.6	1.7	41	37
6	1.5	1.7	57	37
7	1.6	1.8	75	38
8	1.2	1.5	90	36
9	0.6	0.8	97	34
10	0.2	0.3	100	32
total	10.3	10.4		38

[1)] Persons aged 12–74 years who used the internet in the 3 months preceding the survey who carried out specific internet activities.

Source: Statistics Netherlands, ICT use by households and individuals, 2005–2006.

The increased use of the internet leads to more diversity in use. In 2005, there were 1 million internet users who only engaged in two different activities on the internet. In 2006, the number is down to 0.8 million. There is an increase in the number of internet users engaged in several types of activities. For instance, there is a growing number of individuals who do just about every activity we listed on the internet. In 2006, some 1.1 million internet users engaged in 9 or more activities, whereas in 2005 there were just 0.8 million. On average internet users did nearly six (5.9) of the different internet activities, while in 2005 the average was 5.4. As we noted before, there are great differences in the frequency and the skills in internet use between younger and older people. The same is true for diversity. Diversity in the use of the internet is clearly diminishing with age. The average age of the internet users with the greatest diversity in activities is 32, while those with a single activity average 49 years of age.

6.4 *On-line shopping and on-line banking*

On-line purchases

One of the fastest growing internet activities in recent years is on-line buying or ordering goods. The number of internet users buying goods on-line increased by 3 million between 2002 and 2006, reaching 6.6 million individuals. This figure nearly doubled in four years time. Because the total number of internet users in this period

increased by 2 million, the share of on-line shoppers in the total number of internet users increased by 50 percent. In 2002 only 40 percent of the internet users reported that they shopped on-line, whereas four years later this share increased to 61 percent.

On-line shoppers can be divided into two groups, namely frequent and infrequent on-line shoppers. Frequent shoppers are defined as internet users who bought goods on the internet within the last three months. Infrequent shoppers did their shopping more than three months ago. In 2006, two thirds of the group consisted of frequent on-line shoppers, while the frequent shopper group constituted only half of all on-line shoppers in 2002.

The increase in the number and the share of internet users buying or ordering goods on-line can be contributed almost entirely to the group of frequent on-line shoppers. In four years time, the number of frequent on-line shoppers increased by 2.6 million to 4.5 million in 2006. During that same period the number of infrequent shoppers increased by a mere 0.4 million to 2.1 million. Relatively speaking, the share of frequent on-line shoppers increased between 2002 and 2006, while that of infrequent shoppers stayed the same.

Men shop a bit more often than women do. Two thirds of all men bought or ordered goods on-line in 2006, versus 56 percent of all women. On-line shopping is most

Table 6.4.1
Shopping on-line, 2002–2006 [1)]

	2002	2003	2004	2005	2006
	abs (x 1 mln)				
On-line shopper	3.6	4.2	5.1	5.9	6.6
Frequent on-line shopper	1.9	2.2	2.9	3.9	4.5
Less frequent on-line shopper	1.7	2.0	2.2	2.0	2.1
Does not shop on-line	5.3	5.1	4.7	4.8	4.2
Total	8.9	9.2	9.8	10.7	10.9
	%				
On-line shopper	40	45	52	55	61
Frequent on-line shopper	21	24	30	36	41
Less frequent on-line shopper	19	22	23	19	20
Does not shop on-line	60	55	48	45	39
Total	100	100	100	100	100

[1)] Persons aged 12–74 years using the internet.

Source: Statistics Netherlands, POLS 2002–2004/ICT use by households and individuals, 2005–2006.

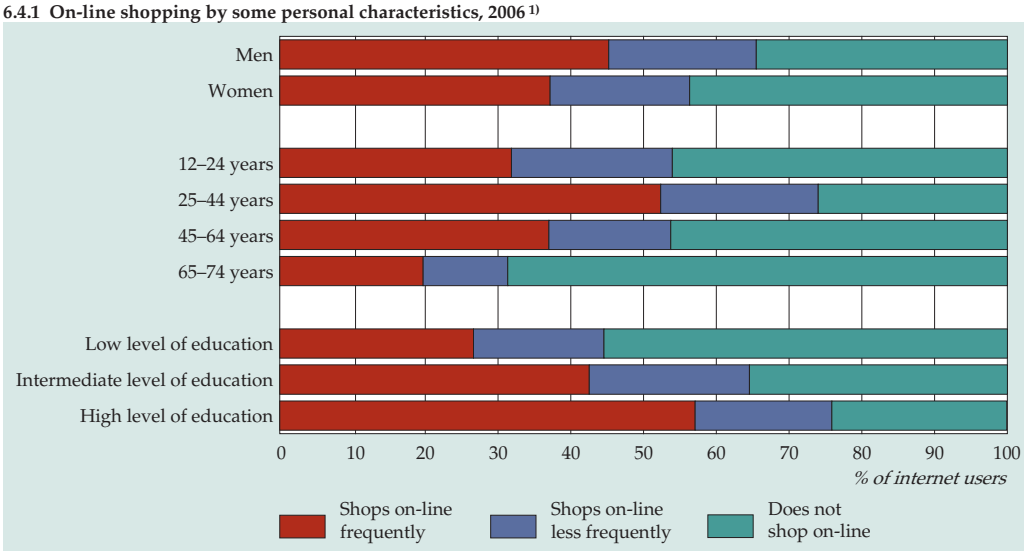
common in the 25–44 age bracket. Over three quarters in this age group buys or orders goods on the internet. So it comes as no surprise that this age group also has the most frequent on-line shoppers (52 percent). However, over one in three internet users in the 45–64 age bracket belong to the frequent buyers. On-line shopping in 2006 is least common among people over 65. Almost seven in ten internet users aged 65–74 never bought or ordered goods on the internet. This piece of data is in line with their limited skills and limited diversity in internet use. Internet users under 15 usually do not shop on-line; three quarters had never bought or ordered anything yet in 2006. They usually possess the skills to function on the internet, but depend on their parents for purchases.

Frequent on-line shoppers tend to be mainly highly educated internet users. Their share among frequent on-line shoppers is twice as high as that of the lowest educated internet users. Because this large difference can also be influenced by the age and sex of the internet user, corrections were made for both characteristics. However, the corrected figure also shows that twice as many highly educated internet users shop frequently on-line as the lowest educated internet users do.

On-line shopping international

The extent to which internet users in the individual member states shop or order on-line depends hugely on the availability of the internet in the household (R^2=0.88). In the Netherlands close to eight in ten households had internet in 2005. The Netherlands

6.4.1 On-line shopping by some personal characteristics, 2006 [1)]

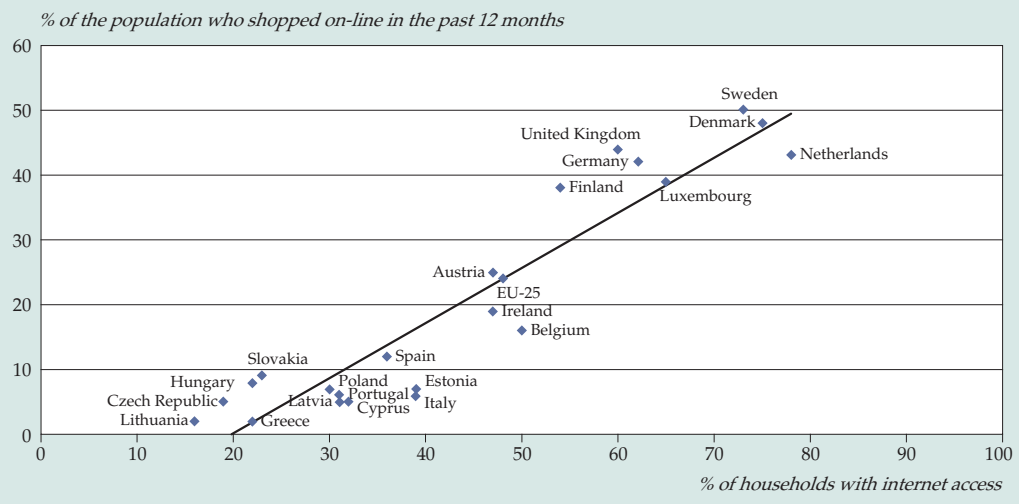


[1)] Persons aged 12–74 years using the internet.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

also scores reasonably well in on-line shopping within the EU context. On-line shopping is most common in several Scandinavian countries. In Sweden and Denmark the share was around 50 percent. The Netherlands, the UK and Germany formed a group of countries where more than four in ten inhabitants make use of on-line shopping. The 2005 EU-25 average was that one in four inhabitants shopped on-line. There was little or no on-line shopping in a great many member states, often the new EU member states.

6.4.2 Internet and on-line shopping in the European Union, 2005 [1) 2)]



1) Persons aged 16–74 years using and not using the internet.
2) No figures available for France, Slovenia and Malta.

Source: Eurostat.

Type of purchases by frequent on-line shoppers

The sharp increase in the number of frequent on-line shoppers in the Netherlands translated into an increase in virtually all kinds of goods and services that are bought or ordered on-line. The increase is greatest in travel, holidays and accommodations. In 2006, 44 percent of the frequent on-line shoppers reported buying or ordering such products or services on-line: 9 percent points more than in 2005. People aged 45–54 often use the internet for this. Apart from holidays, frequent on-line shoppers buy mainly books, magazines, clothes, sports gear and tickets for events. In 2006, the share of on-line shoppers who bought these goods or services was substantially higher than in 2005. The share of on-line shoppers who bought tickets for events increased by a whopping 50 percent within one year. Books, magazines, clothes and sports gear were bought more often by female on-line shoppers.

Table 6.4.2
Products bought on-line, 2005–2006 [1)]

	2005	2006
	% of buyers	
Travel, holidays, accommodation	35	44
Reading (books, magazines)	31	36
Films, music	21	25
Groceries	4	5
Clothes, sports gear	28	35
Household items e.g. furniture, toys, washing machine, etc.	19	21
Electronics	19	22
Hardware	11	14
Software	15	21
Shares, financial services, insurance	5	11
Tickets for concerts, shows, sports events, etc.	22	33
Lottery or gambling	2	5
Other products	6	4

[1)] Internet users aged 12–74 years who bought a product on-line in the 3 months preceding the survey. More than one answer possible.

Source: Statistics Netherlands, ICT use by households and individuals, 2005–2006.

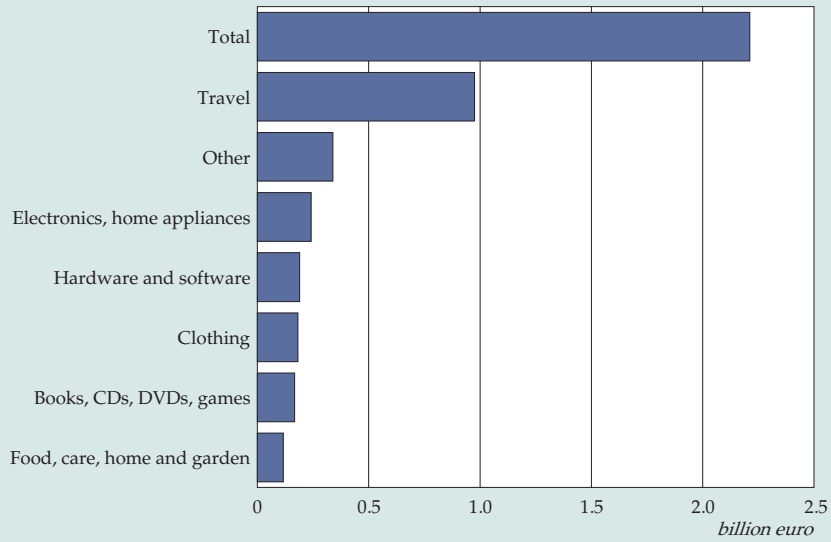
On-line consumer expenditure

The spectacular growth of the number of on-line shoppers made that the home shopping market, which includes on-line sales, benefited greatly. This trend is expected to continue.

Consumers in 2005 spent 2.2 billion euro on internet purchases. This was almost 2.5 times the amount spent in 2002 and seven times as much as in 2000. Most was spent on on-line services (55 percent) in 2005. Most money in services was spent on travel, financial services and tickets. In 2006 there were significantly more people purchasing travel, holidays and accommodations than in 2005. The sales of these services are expected to grow in the next few years. The increase in on-line consumer spending was caused by the increase in the number of consumers shopping on-line, and by the higher amounts of money spent on average. In 2005 consumers on average bought 433 euros worth a year through the internet, whereas in 2002 they spent 318 euro.

With a share of more than two thirds, on-line expenditure has grown into the most important segment of the home shopping market. This came at the expense of traditional sales channels such as catalogues, mail, etc. Most expenditure through the internet is on travel. In 2005 this share was 44 percent. Consumers spent 11 percent on home appliances and electronics, while clothes purchases on-line accounted for 8 percent.

Turnover on-line sales by market sector, 2005



Source: Blauw Research, Thuiswinkel.org, March 2006.

Problems with on-line shopping

On-line shopping has its drawbacks. In 2006, 7 percent of the on-line shoppers had some kind of problem. Of this group of close to half a million individuals, 43 percent reports that the delivery of the goods took longer than agreed, while one in three had the wrong or damaged goods delivered to them. Close to 20 percent of the on-line shoppers with problems had trouble complaining about the goods they purchased and the same number were dissatisfied about the way their complaint was dealt with.

On-line shopping, why not?

We asked the internet users who had never bought or ordered goods, or who did so more than a year ago, what the reason was. Most of these non-on-line shoppers prefer to shop traditionally (63 percent). This share was slightly lower in 2006 than in 2005. Women named this reason more often than men did.

The sense of insecurity turns out to be a major obstacle in on-line shopping. Four in ten non-on-line shoppers is worried about privacy or does not want to supply personal data through the internet. The highly educated non-on-line shoppers have most problems with security.

Table 6.4.3
Problems experienced with on-line shopping, 2006 [1)]

	% of buyers
Problems with on-line shopping	
Yes	7
No	93
	% of buyers with problems
Type of problem	
Delivery later than stated	43
Difficulty finding information about guarantee	5
Concerns about security of payment method	10
Delivery of wrong or damaged goods	33
Delivery costs higher than stated	8
Difficulty lodging complaint/getting compensation	18
Unsatisfactory response to complaints	20
Other problem	71

[1)] Internet users aged 12–74 years who bought or ordered a product on-line in the 12 months preceding the survey. More than one answer possible.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

Table 6.4.4
Reasons not to shop on-line, 2005–2006 [1)]

	2005	2006
	% of non-buyers	
Prefers to shop 'traditionally'	65	63
Does not think it is necessary	38	33
Does not think it is safe, does not want to give credit card information on-line	35	.
Is concerned about privacy, does not want to give personal information on-line	28	38
Does not trust on-line companies with respect to delivery, returning goods or complaints procedure	22	26
Has too little experience, does not know how to shop on-line	14	11
Does not have the means to pay on-line	9	10
Problems with receiving the goods at home	3	2
Thinks it is too expensive	2	.
Internet connection too slow	2	1
Thinks the delivery times are too long	1	.
Other reason	53	53

[1)] Internet users aged 12–74 years who have never bought anything on-line, or whose last on-line purchase was more than 12 months before the survey. More than one answer possible.

Source: Statistics Netherlands, ICT use by households and individuals, 2005–2006.

Another 33 percent indicated that they felt no need to shop on-line, while another 26 percent does not trust the delivery, returns or complaints handling of the goods they wish to buy.

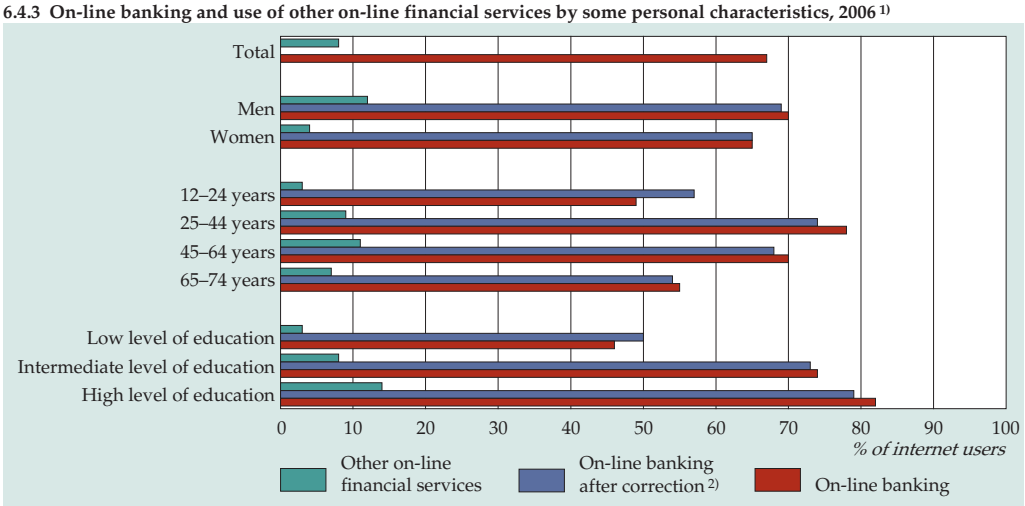
On-line banking

Not only on-line shopping is gaining popularity, on-line banking is also used by more and more people. In 2006, some 67 percent of all internet users use on-line banking, 9 percent more than the year before. On-line banking is quite widely accepted by men and women alike, and mainly popular in the 25–45 age bracket. On-line banking among people over 65 and under 25 falls below the average with 49 and 55 percent respectively. Nevertheless, half of the older internet users did some of their banking in 2006 through the internet. The pattern of on-line banking stays just about the same when the various age groups are corrected for the influence of education and sex. After the correction, the use of on-line banking among young people does not show as great a gap (57 percent), while the gap among people over 65 hardly changes (54 percent).

On-line banking, also after correction, turns out to be used most by highly educated people. About eight in ten highly educated internet users do on-line banking, versus one-half of the lowest educated internet users.

Besides on-line banking, people increasingly do other financial transactions, such as buying shares through the internet. In 2006, some 8 percent of the internet users

6.4.3 On-line banking and use of other on-line financial services by some personal characteristics, 2006 [1)]



1) Persons aged 12-74 years who used the internet in the 3 months preceding the survey.
2) Percentage of internet users who use on-line banking corrected for correlation with the other characteristics. For example: ages is corrected for sex and level of education.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

reported doing so, 3 percent more than in 2005. In contrast to on-line banking, it is mostly men who do these transactions through the internet. Mostly financial transactions are the domain of the older internet users (in the 55–64 age bracket). This is the stage of life in which people tend to have more financial power, which makes them the target of financial enterprises. In general it is the more highly educated internet user who tends to do on-line banking and engage in other financial transactions through the internet.

Safety of financial transactions

The increasing use of the internet for financial transactions means that abuse in this area is also more likely. This can undermine trust, which would be disastrous for progress in the virtual financial world. Banks are aware of this and use the most stringent security measures in money transfers (source: www.veiligbankieren.nl). The data sent on-line is encrypted, after a strict identification check. Banks advise consumers to take their own protective measures when they use computers and the internet in general, and for financial transactions. For instance installing antivirus and antispyware software, keeping access codes secure, and shutting off the internet browser.

Apart from on-line security, it is also important to keep the use of credit cards safe. They are increasingly used in purchases or making reservations through the internet. Banks are working on further improving credit card safety. Currently a signature is still required for confirming a transaction. The expectation is that the signature will be replaced by a pin code, and that new chips will replace the current magnetic tape strip.

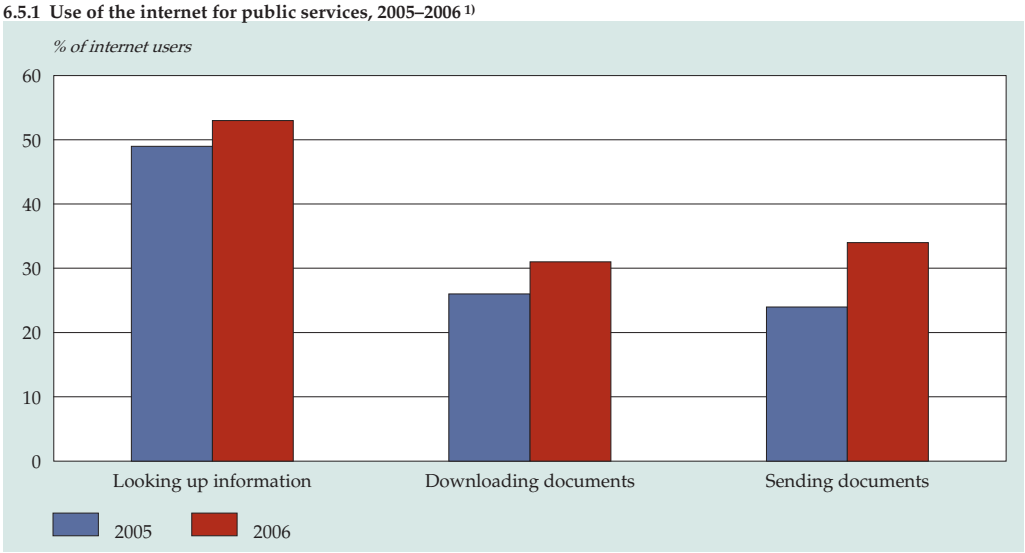
6.5 *On-line government services*

Use of government websites

As internet activities increase, so does the use of government websites. In 2006, some 53 percent of the internet users reported that they sometimes look up information on government websites. A year earlier this was less than half. Downloading, filling in and mailing official government documents is on the increase. Men look up information on government websites more often than women do. Government websites are used well above average by internet users aged 25–54 and hardly ever by 12–14 year olds.

Over half of the individuals who look up information on government websites also use the available services, such as downloading and sending documents. Curiously, the percentage of individuals who mail documents is slightly higher than the percentage that downloads forms. Individuals who use on-line government services mainly submit their tax returns on-line. Dutch tax forms are not only made available on-line but also on computer diskette. The data can then be sent on-line, which may explain part of the discrepancy.

6.5.1 Use of the internet for public services, 2005–2006 [1)]

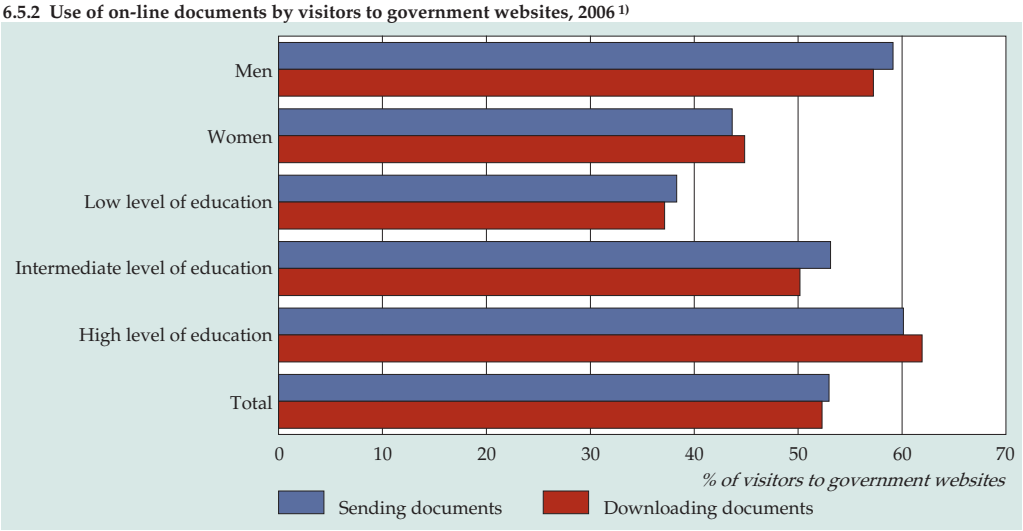


[1)] Persons aged 12–74 years who used the internet in the 3 months preceding the survey. More than one answer possible.

Source: Statistics Netherlands, ICT use by households and individuals, 2005–2006.

Men not only look up information about government services more often than women do, they also follow through more often. Almost six in every ten men who look up information also follow through with the documents. Among women this is slightly more than 40 percent. It is mainly the more highly educated internet users who use the services on offer on the government websites. About 60 percent in this

6.5.2 Use of on-line documents by visitors to government websites, 2006 [1)]



[1)] Persons aged 12–74 years who used the internet and visited a government website in the 3 months preceding the survey. More than one answer possible.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

education category indicated that they used these government services in 2006. Less than 40 percent of the lowest educated internet users make use of the government services on offer.

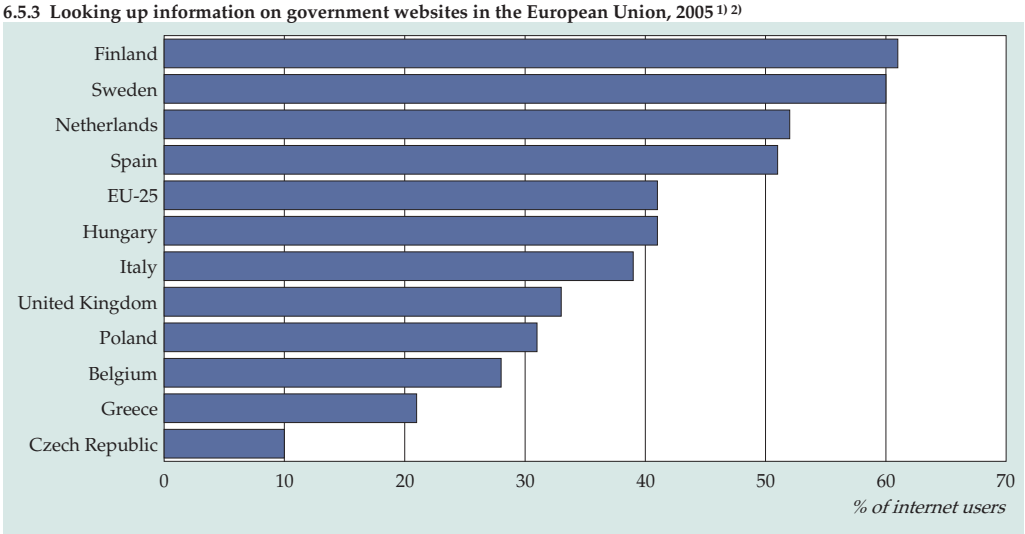
Use of government websites in other European countries

In 2005, an average of 41 percent of the Europeans aged 16–75 looked up information on government websites. The Netherlands' share of more than 50 percent was well above the EU average. In Finland and Sweden the government websites were visited most frequently, with six in ten internet users looking up information on government services in this way. We have concluded before that the Scandinavian countries are frontrunners when it comes to using the options internet makes available. Government websites were visited least in the Czech Republic and Greece. This is not surprising given the rather limited spread of the internet and broadband in these countries. Other remarkably low scores are found in the UK and Belgium.

Internet for government and citizens

It is important for government and citizens that services can be offered and concluded through the internet. This means saving costs for government by cutting administration. Citizens can save themselves time and trouble involved in visiting the right location and traditional completion of government documents. So it is interesting to find which services people are willing to complete on-line. Therefore we asked respondents who had used the internet in the three months before the

6.5.3 Looking up information on government websites in the European Union, 2005 [1) 2)]



[1)] Persons aged 16–74 years who used the internet in the 3 months preceding the survey.
[2)] No figures available for Denmark, France, Germany and Malta.

Source: Eurostat.

interview: Do you sometimes conclude business with government bodies on-line? We named some examples, such as tax returns, applying for a building permit, or registration for a school or university.

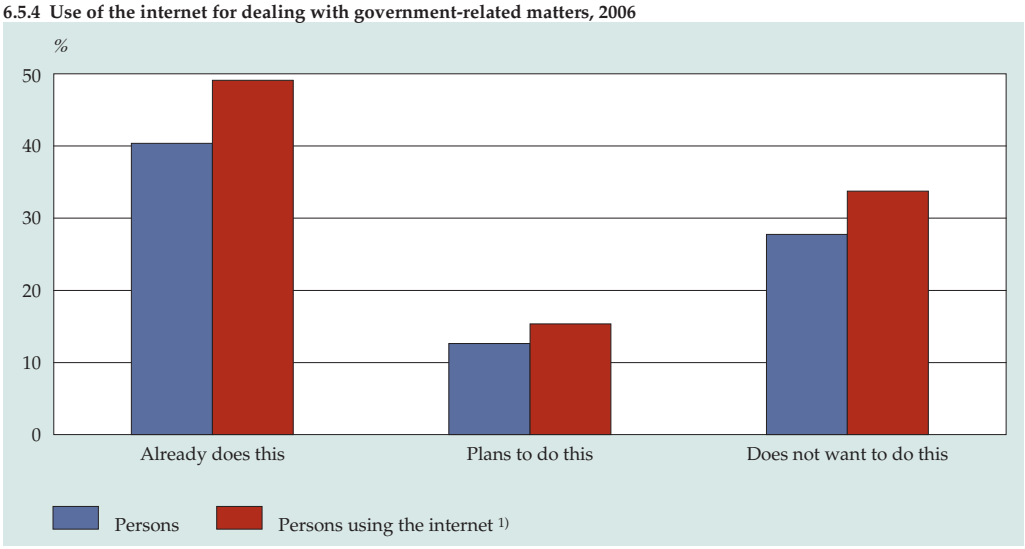
Almost half of these internet users (40 percent of the Dutch population aged 12–74) answered they did occasionally conclude business with government through the internet. Another 15 percent expected to do so. One third does not wish to conclude business with government on-line. Remarkably, relatively many young people aged 12–24 indicated they do not want to do so.

Among the internet users who do not wish to conclude government business on-line, 35 percent gave the lack of personal contact as their main reason. The lack of an immediate reaction (16 percent) and worries about data security (13 percent) are also seen as obstacles to concluding business with government on-line. Perhaps these objections can be countered by technological innovations in the future. The use of webcam and voice in internet activities offers great opportunities to improve on-line contact. For instance, some financial institutions already offer on-line video conferencing on appointment, so that their staff and the client can exchange information or conclude business transactions by video on-line.

Dealing with government on-line

We also looked into what kinds of things people would like to be able to do through the internet as far as government is concerned. Table 6.5.1 shows to what extent

6.5.4 Use of the internet for dealing with government-related matters, 2006



1) Persons aged 12–74 years who used the internet in the 3 months preceding the survey.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

people are interested in doing so. Tax returns are by far the most common thing people handle electronically. 13 percent of the internet users look for work at the Centrum voor Werk en Inkomen (CWI) and 11 percent visit a public library on the internet. Another 8 percent made a crime report to the police through the internet or registered for a school or university.

The current use of the on-line government services mainly involves tax returns and not so much the other possibilities. Substantial groups of internet users indicated that they would be prepared to conclude other government business on-line. Especially submitting changes in address were widely named, with 85 percent wishing to do so on-line. Over 70 percent of the interested users stated that they would be willing to apply for or renew a passport or driving license, car registration or registration for schools or universities on-line. There is also a great deal of interest in the other services on-line, such as the application of marriage and birth registrations and visiting a public library, which has the pros and cons equally divided.

On-line conclusion of various government services turns out to be widely supported by the different population groups. Again, people over 65 reported that they were less interested in on-line services of the government. The relatively limited skills of these older internet users must play a role here, but older people also tend to hold onto traditional ways of doing things.

Table 6.5.1
Dealing with and interest in dealing with public services on-line, 2006 [1)]

	Already done this on-line	Not yet done this on-line, but plans to do so	Not yet done this on-line, does not plan to do so	Doesn't know
	% of internet users			
Tax declaration	70	18	11	1
Looking for work via CWI	13	57	29	1
Application for benefit or subsidy	7	64	28	1
Application for documents (passport, driving licence)	1	74	24	0
Car registration	1	71	27	1
Application for building permit	1	69	29	1
Report to police	8	64	28	1
Visit to public library	11	49	40	1
Application for certificate (marriage or birth certificate)	1	54	45	0
Registration for course	8	73	19	0
Report of change of address	5	85	10	0
Health care services	1	69	29	0

[1)] Persons aged 12–74 years who used the internet in the 3 months preceding the survey who deal or who want to deal with public services on-line.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

6.6 *Securing computers and the internet*

Unsolicited emails (spam)

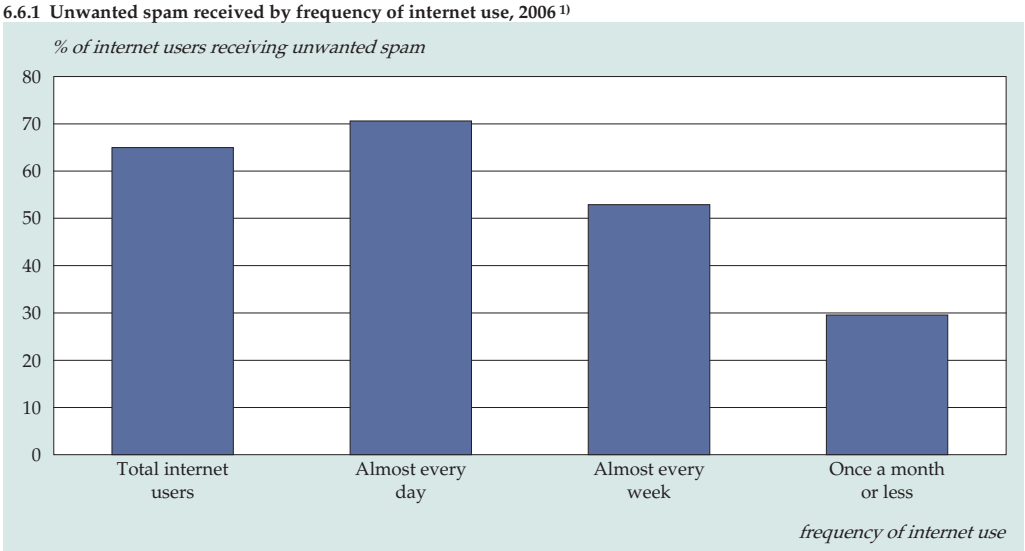
Internet users are often inconvenienced by unwanted email messages. In 2006, 65 percent of the individuals who used the internet over the last three months reported receiving spam. Their share is up by ten percent points on 2005. Frequent internet users have more spam than occasional internet users. Over 70 percent of the individuals who use the internet on an almost daily basis received spam, as compared to just 30 percent among the infrequent internet users (one a month or less).

Damage by viruses

Internet users who receive spam, also have more often damage caused by viruses. In 2005, over 40 percent of the internet users inconvenienced by spam were affected by virus damage. Only 20 percent of the internet users who were not inconvenienced by spam had damage by viruses. In 2005, one in three internet users was plagued by virus damage.

Virus damage is often found among the young internet users aged 12–24, of whom over 40 percent had virus damage. Of the individuals who received spam in 2005 within this age group, as much as 50 percent had damage due to viruses, whereas virus damage occurred in 30 percent of the cases who did not receive spam. The same pattern occurs in the other age groups of internet users. Both virus damage and spam, individually and combined, decrease with the age of the internet user. This is mainly due to the less frequent internet use as age increases (see also paragraph 6.2).

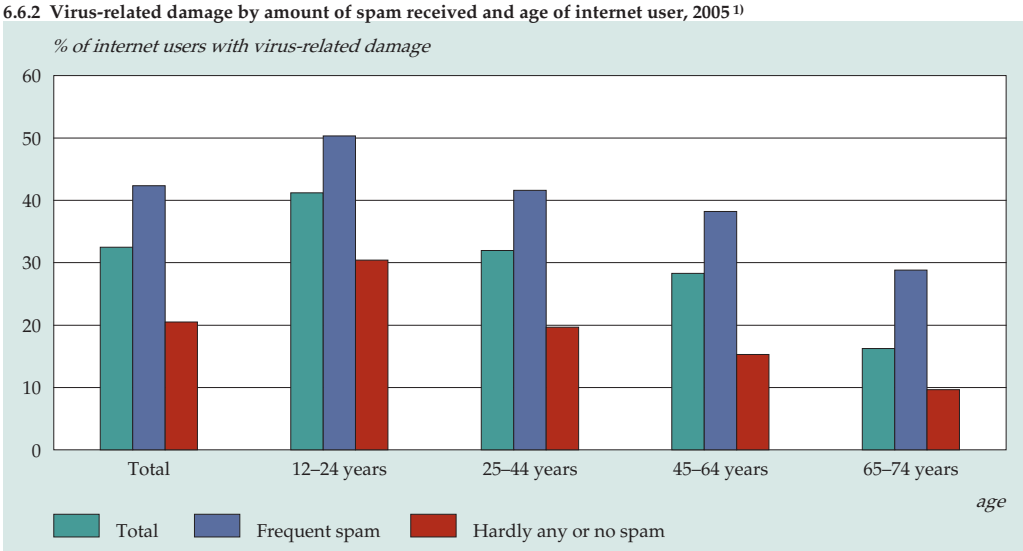
6.6.1 Unwanted spam received by frequency of internet use, 2006 [1)]



[1)] Persons aged 12–74 years who used the internet in the 3 months preceding the survey.

Source: Statistics Netherlands, ICT use by households and individuals 2006.

6.6.2 Virus-related damage by amount of spam received and age of internet user, 2005 [1)]



[1)] Persons aged 12–74 years who used the internet in the 3 months preceding the survey.

Source: Statistics Netherlands, ICT use by households and individuals 2005.

Damage through viruses in other EU member states

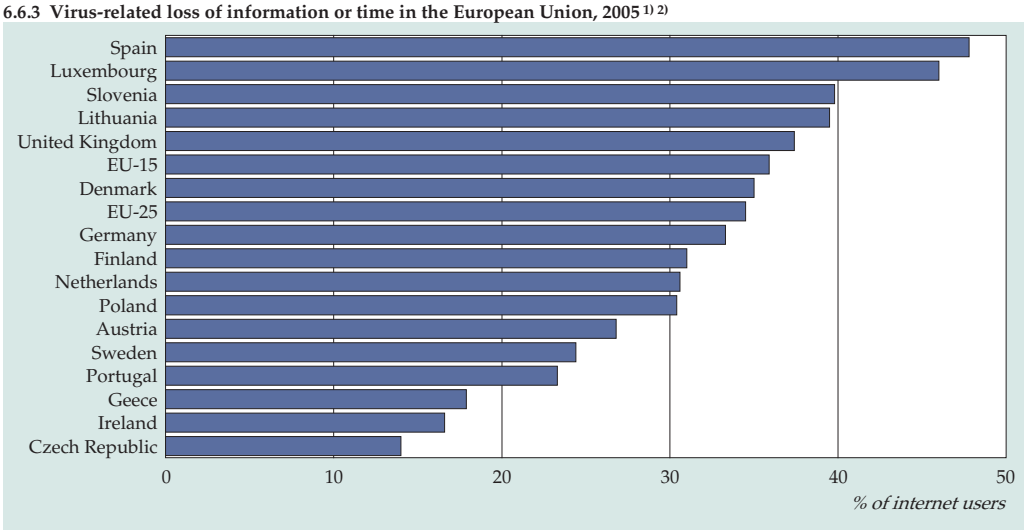
In 2005, an average of almost 35 percent of the internet users across all 25 EU member states suffered damage from viruses. This share was a few percent points lower in the Netherlands. The inconvenience caused by viruses differed greatly between member states. In Spain and Luxembourg almost half of the internet users had to deal with this, and about 40 percent of the internet users in Slovenia and Lithuania. An above average number of internet users in the UK and Denmark suffered damage from viruses. There are only a few member states where the percentage was below 20 percent. These were the countries where the use of the internet is not widespread, so that they are less interesting for those who spread the viruses. This, however, does not seem to be the case for Lithuania.

Antispam and antivirus measures

Despite the inconvenience of spam and viruses, many European households with internet fail to take protective measures. In 2006, 58 percent of the households with internet had antispam software, usually free software. Moreover, 14 percent trust the service of the internet provider to protect them against spam. Over one in five households does not even worry about the inconveniences of spam (Eurobarometer, 2006).

The share of households with internet who protect themselves against viruses is higher than those who protect themselves against spam. In 2006, 82 percent installed

6.6.3 Virus-related loss of information or time in the European Union, 2005 [1) 2)]



1) Persons aged 12–74 years who used the internet in the 12 months preceding the survey.
2) No data available for Belgium, France and Malta; for the Netherlands our own calculation is used.

Source: Eurostat and Statistics Netherlands, ICT use by households and individuals 2005.

antivirus software, and over half paid for the software. Of the households with internet, 5 percent trust the provider to protect them against viruses, while 8 percent does nothing at all.

Note in the text

1) In the ICT study among households and individuals, carried out since 2005 by Statistics Nehterlands, only individuals aged 12–74 are interviewed. ICT outcomes about 2002–2004 come from the Permanent Onderzoek Leefsituatie (POLS) where individuals aged over 12 were interviewed. Moreover, the new ICT survey was designed differently. People were interviewed on the phone, while the POLS survey held face-to-face interviews. The sample size of the new ICT study included 4,000 people, which is slightly smaller than in the 2004 POLS survey. These things have to be taken into account when interpreting the results before and after 2005. For this edition, we made the data for 2002–2004 comparable at the individual level, by recalculating them for the population aged 12–74. At the household level we did not fully correct for comparability.

7. Capita Selecta

7.1 ICT competences in a professional setting

Authors: Dana Uerz, Madeleine Hulsen, Nico van Kessel, ITS.

ICT has become an indispensable factor in most companies and most business processes. This is true not only for the ICT sector, but also for the trade and non-profit sectors such as education and health and social work. Now that the economy seems to be recovering, does the workforce have enough ICT skills to meet the demands of the immediate and more distant future? How skilled is the current workforce? These and other questions were studied by ITS (the institute for applied social sciences) at the request of the Dutch Ministry of Economic Affairs. [1)]

Background

The role ICT plays in society has become more and more important in recent decades. People generally agree that ICT and the ICT sector are important for the development of the knowledge-based economy and see ICT as the innovation axis. The use of ICT is increasing and becomes more and more intensive and advanced. This is reflected in the demand for and supply of ICT competences and their harmonisation. Since 2005 there has been increasing pressure on supply and demand due to the economic recovery. Companies and institutions, especially within the ICT sector, worry about shortages in employees skilled in ICT. Opinions differ, however, about the extent, urgency, expected developments and the role the government might play in solving these problems.

Therefore, at the start of 2006, and at the request of the Ministry of Economic Affairs, ITS started a quantitative study of the experiences with and opinions about ICT competences in the Dutch private and public sector. [2)] The expectations for the future were also surveyed.

Due to the lack of unambiguous national and international terminology, ITS decided to use the definitions of Statistics Netherlands. This means that the lack of ICT competences is measured in terms of vacancies for ICT experts and/or ICT users that are difficult to fill. The focus is not only on the volume of the shortages (number and duration of the vacancies) but also on the kind of problems (quantitative or qualitative).

In the study we distinguished three types of employees:

1. **ICT experts:** ICT professionals whose primary task it is to automate and/or (electronically) facilitate work processes, including systems and network managers, helpdesk staff, software developers, and programmers.
2. **ICT users:** other personnel who use ICT in their own work.

3. **ICT innovators:** specific group of ICT users managing the primary processes in a company, who also try to find creative ICT solutions to innovate these processes and/or develop new products.

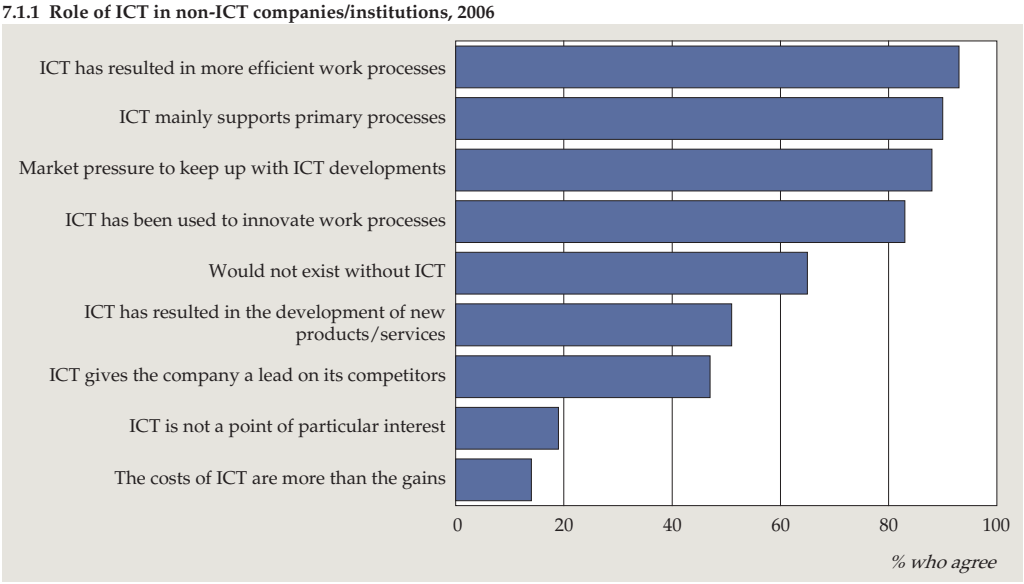
Over 1,500 companies and institutions participated in the study: 353 non-profit institutions and 1,158 profit companies, including 166 ICT companies. These companies employed a total of nearly 460,000 people. They are reasonably well divided over the various company sizes: major companies as well as small and medium-sized companies participated in the study. In the analyses we looked at differences between ICT and non-ICT companies, between the profit and non-profit sector and at company size. We will only describe the relevant differences here.

Importance of ICT

The overwhelming majority of the companies agree that ICT is important for their own organisation. Almost two thirds of the non-ICT companies indicated the company would not exist without ICT. Still there are companies, particularly small ones, which feel ICT is less important for them. One in three small companies indicated that ICT costs more than it earns. Non-ICT companies that agree ICT is vital stated that ICT makes it possible to work more efficiently (93 percent) and that ICT supports the primary work processes (90 percent).

ICT plays a vital role in major companies, non-profit organisations and gas, water and electricity supply companies. The role of ICT is more modest in small businesses and in the sectors agriculture, construction and hotels and restaurants so far.

7.1.1 Role of ICT in non-ICT companies/institutions, 2006



Source: ITS, ICT competenties in de beroepsomgeving, 2006.

ICT and personnel

Most of the non-ICT companies (68 percent), and of course all ICT companies, employ one or more *ICT experts*. In the participating companies, 3.2 percent of the total workforce works as an ICT professional. In the non-ICT sector these are often ICT jobs at the secondary (mbo) level such as management, maintenance and helpdesk. These are usually major companies and non-profit institutions. The ICT companies usually employ ICT professionals as consultants, designers, programmers and software developers. We generally find many university-educated ICT professionals there. Not all companies seek to employ ICT professionals permanently. On average one in three companies in the non-ICT sector indicated that they would rather hire ICT professionals on a temporary basis. These are often very small companies and franchises. Another 33 percent opts for a mix of internal and external.

ICT use is of course not limited to the group of ICT professionals: also non-ICT professionals make frequent use of ICT (*ICT users*). Almost half of the employees structurally use ICT in the primary work processes, and according to the companies this is true for over 60 percent in support work processes. The highest percentages are found in companies where ICT is high on the agenda: the ICT sector, major companies and non-profit institutions.

Over half of all non-ICT companies indicated that they had real *ICT innovators* in their group of ICT users. However, this is not really a result of policy. Research shows that only major companies and the non-profit sector explicitly pay attention to hiring and facilitating ICT innovators.

Shortage of ICT professionals?

In 2005, a quarter of all companies sought to hire ICT professionals. ICT companies had vacancies most often, followed by big non-ICT companies and non-profit institutions. Remarkably, the companies that outsource some ICT tasks relatively often sought to hire ICT professionals. Such companies sought a balanced mix of internal and external; they outsourced specific tasks and kept other tasks in-house. Companies that are not outsourcing ICT activities at all, do not have ICT as high on the agenda, and do not seek to hire ICT professionals as often. Outsourcing ICT tasks and hiring ICT professionals complement rather than replace each other.

The average in 2005 for all companies was 11 vacancies per 100 ICT jobs for ICT professionals; that is a vacancy rate of 11 percent. [3)] In the ICT sector this was 14 percent, while the average in the other sectors was 8 percent. One in three vacancies for ICT professionals required university graduates, half required college graduates and 18 percent graduates at the mbo (secondary) level.

One in three vacancies for ICT professionals was hard to fill, that is, was not filled within three months. The extent of the problem depends on the education level required. It was mainly hard to fill the vacancies for highly educated ICT professionals in 2005 (see table 7.1.1).

Table 7.1.1
ICT vacancy rate and percentage of ICT vacancies that are difficult to fill, by level of education and ICT/non-ICT sector, 2006

	ICT vacancy rate [1]	Vacancies that are difficult to fill [2]
	%	
Total		
Senior secondary vocational education (mbo)	8	11
Vocational college (hbo)	12	38
University	16	42
ICT sector		
Senior secondary vocational education (mbo)	5	72
Vocational college (hbo)	13	46
University	25	36
Non-ICT sector		
Senior secondary vocational education (mbo)	9	6
Vocational college (hbo)	11	32
University	10	51

[1] The number of ICT vacancies per year divided by the number of ICT employees.
[2] The percentage of vacancies not filled within three months.

Source: ITS, ICT-competenties in de beroepsomgeving, 2006.

Recalculating this to the total population, based on the assumption that there are 265 thousand ICT professionals, this comes down to 29 thousand vacancies in the Dutch business community, including almost 10 thousand vacancies that are hard to fill. Listed by education level, there are almost 3,500 hard to fill vacancies for university graduates in ICT, over 5,500 hard to fill vacancies for college graduates in ICT and about 600 for ICT professionals at the mbo level. So the sectors requiring highly educated ICT professionals – the ICT sector and small companies – were faced with relatively many problems.

The companies surveyed expected the total demand for ICT professionals to stay about the same in 2006 and 2007. There may be differences in the education level: the companies expect more vacancies at the college and university levels than in 2005 and a decrease in the number of vacancies for ICT professionals at the mbo level.

Nature of shortages

The shortages would be mainly qualitative, according to the companies. The biggest problem for most companies is the lack of relevant experience in ICT or in working. The candidates also sometimes do not have specific competences and qualifications. The companies named competences required for specific jobs, especially for project managers, advisors, consultants and information managers, and specialist ICT knowledge (SAP, Unix, ASP.NET). However, they also named secondary competences, such as strategic and operational know-how, linguistic skills, knowledge of specific disciplines and practical knowledge and sense.

Companies looking for university graduates in ICT also experience quantitative shortages. They claim there are simply not enough candidates available.

Lack of ICT users?

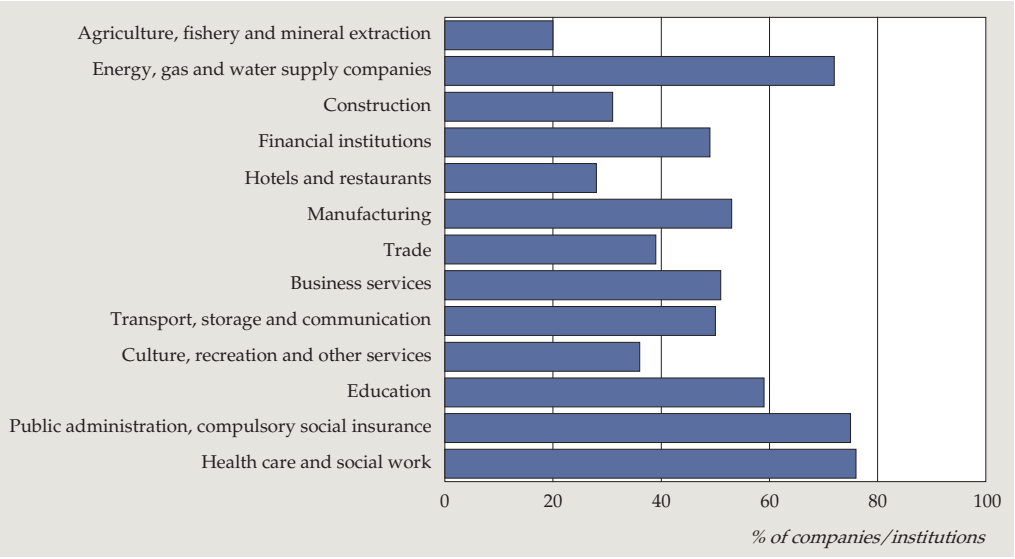
Almost half of all companies formulated vacancies for ICT users in 2005. That is, vacancies asking specifically for ICT competences. Front runners in this area are the gas, water and electricity supply companies and the education sector. Small companies hardly hire ICT users: only 5 percent had vacancies.

Most companies had no major problems filling the vacancies for ICT users. Only 15 percent of the companies had vacancies unfilled for three months. For the sake of clarity: this refers to 7.5 percent of all companies. The ICT sector had particular problems: one in three ICT companies had a hard time filling vacancies for ICT users in support processes.

The companies expect an increase in the number of vacancies for ICT users in 2006 and 2007. The non-profit sector and especially health and social work and public administration expect relatively many vacancies for ICT users. Education lags behind a little. The profit sector expects most vacancies in the ICT sector, major companies and energy and water companies.

Almost four in ten companies expecting vacancies also expect problems filling them. This was considerably less in 2005: only 15 percent of the companies experienced

7.1.2 Percentage of companies/institutions that expect to have vacancies for ICT users in 2007 and 2008, by sector



Source: ITS, ICT-competenties in de beroepsomgeving, 2006.

problems filling the vacancies for ICT users. Especially companies that have ICT high on the agenda expect that it will not be easy to fill the vacancies for ICT users.

Nature of shortages

The problems, according to the companies, are mainly qualitative. Candidates often lack general computer skills. Some of the companies, mainly in the non-profit sector, are worried about the relatively large number of employees without sufficient 'button-pushing skills'. For the near future the companies also worry about the practical and innovative ICT skills of the ICT users.

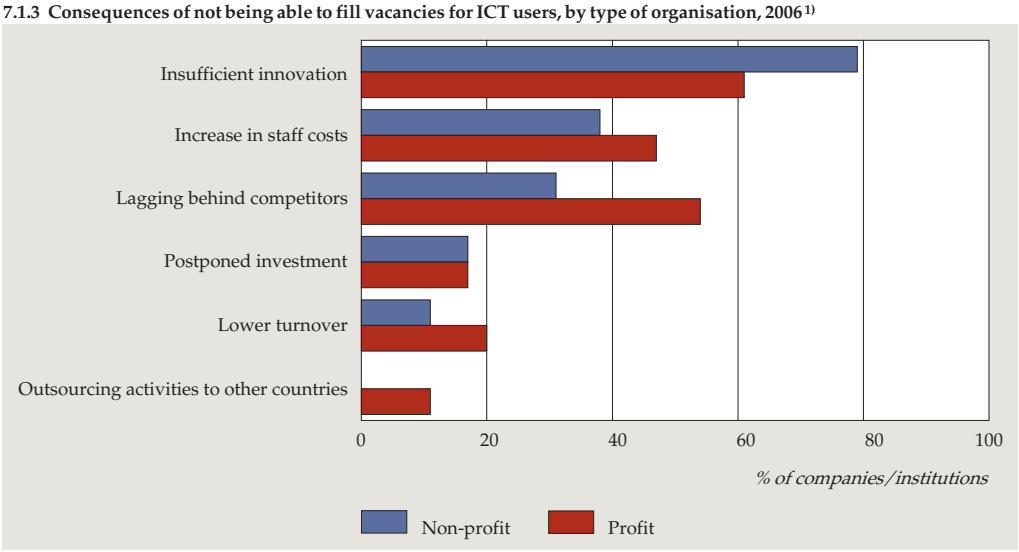
Consequences and solutions

Companies face serious consequences if they cannot fill existing and expected vacancies. The inability to innovate is mentioned most often. Almost three quarters of the companies expecting ICT vacancies, indicated they lost innovative power. In figure 7.1.3 we listed the consequences of shortages of ICT users mentioned by the companies.

Solutions of companies

As expected, companies would like to fill their vacancies for ICT professionals and ICT users with candidates that have the right educational background and working experience. If this turns out to be impossible, companies with vacancies for ICT professionals hire temporary staff, or in the worst case, leave the vacancy open. The latter is especially common for vacancies for jobs at the academic level.

7.1.3 Consequences of not being able to fill vacancies for ICT users, by type of organisation, 2006 [1)]



[1)] The consequences of vacancies for ICT experts that are difficult to fill are comparable with these.

Source: ITS, ICT-competenties in de beroepsomgeving, 2006.

It is highly uncommon not to fill vacancies for ICT users. Companies tend to downwardly adjust their demands for ICT rather easily. Companies seem to be less willing to do so in the near future. They claim they prefer different solutions such as more education, moving jobs in-house, additional training, or outsourcing. However, the question is whether companies, when confronted with vacancies, will actually opt for these alternatives or whether they will again lower their ICT demands.

Formulating vacancies for ICT professionals and ICT users is neither the only, nor the most important measure companies take to maintain ICT competences within their own company. Hiring new employees is in the top five of measures, but not as high as the development of competences and training employees.

Companies hardly ever mention having explicit policies to hire or keep ICT innovators. Even those companies that claim they need more ICT innovators (non-profit sector and major companies) rarely have specific policies in place to attain this.

Although companies indicate they value the development of ICT competences and training, this does not really translate into actual ICT policies. Most of the companies do not have budgets or plans for ICT training. About half of the companies offer training for ICT professionals and ICT users. The front runners here are the ICT sector, non-profit institutions and gas, water and electricity supply companies. Remarkably, half of the companies offering training stated they did not know enough about the current training options for ICT professionals and ICT users on the market.

Table 7.1.2
Top five business policy measures to maintain ICT competencies, 2006

	For ICT professionals		For ICT users	
	% [1]	*in order of top five quotations*	% [1]	*in order of top five quotations*
Investment in development of competence and training of own staff	59	1	66	1
Temporary insourcing via software houses and/or temp agencies	58	2	33	3
Buying in specific skills	42	3	–	–
Employing experienced staff from other companies	40	4	50	2
Working with apprentices/trainees	35	5	33	4
Re-allocating work among staff	–	–	30	5

[1] Percentage of companies that quote the measure in the top five.

Source: ITS, ICT-competenties in de beroepsomgeving, 2006.

Happy with recent graduates

Most companies (90 percent) are happy about the ICT competences of ICT professionals and ICT users coming directly from school. The ICT sector is slightly more critical: almost one in five companies is dissatisfied.

The companies that are dissatisfied or very dissatisfied mainly complain about the 'other' competences of the recent graduates, such as insufficient know-how and practical insight, insufficient customer-friendliness (university), and a lack of insight and creative thinking (college/university). The ICT skills of ICT professionals trained at the mbo level is seen as insufficient and outdated by the dissatisfied companies.

How to deal with shortages

The survey looked at what measures the companies themselves took to deal with shortages, and asked about solutions that went beyond the company or sector. Companies mainly look for solutions by cooperating with other companies, the education sector and government. The suggested solutions focus on three areas:

- Starting early on in secondary education to convince students that ICT is an attractive professional option. Companies tend to see this mainly as a task of government and education;
- Offering training and more flexibility to make ICT jobs more attractive for a wider and different set of people. This is mainly a matter for the companies themselves. The ICT sector is much in favour of this;
- Improving consultations and harmonisation between the business community, education and government about the competences required of ICT professionals and ICT users. Companies indicated they could learn more from each other; further cooperation within the sectors is desirable.

The government should play a facilitating role according to the companies, for instance by subsidising training and by creating facilities for apprenticeship and work-study programs. Companies also considered it useful to reward schools for having an adequate, up-to-date curriculum.

Conclusions

Does the Dutch business community face a shortage of a workforce competent in ICT? The research data do suggest a shortage of ICT professionals and ICT users, but this clearly involves specific sectors and company types. We can summarize this as follows:

- The shortage is mainly of highly educated ICT professionals. This is less of a problem with mbo-trained ICT professionals and ICT users.
- The shortages hit those companies that have or want to have relatively many highly educated ICT professionals, such as the ICT sector itself, small companies, and gas, water and electricity supply companies. The major companies and non-profit institution, which are often looking for ICT professionals trained at the mbo level, have fewer problems.

– The shortages are mainly qualitative. They involve a lack of highly specialised ICT skills, but also ICT skills in combination with other necessary skills such as strategic and operational competencies, customer-friendliness, creative thinking. What is greatly missed in the ICT users are the practical and innovative skills.
– A quantitative shortage is expected for ICT professionals trained at university.
– Companies directly facing vacancies that are hard to fill often opt for short-term solutions, but they wish for more constructive long-term solutions for the future, such as additional courses or structurally outsourcing specific ICT tasks.
– Developing competences and training are mentioned most often as policies to keep ICT competences up to scratch, but companies hardly implement such policies.

The solutions suggested by the companies to solve potential shortages focus on three aspects: stimulating students by making ICT courses attractive, improving the image of ICT as a profession, and improving consultations and harmonisation between the business community, education and government.

These aspects are close to the conclusions of the Taskforce Risseeuw six years ago when there were also shortages of ICT experts on the labour market. The Taskforce concluded then that education needed to change and that ICT should be made attractive for new target groups (women, refugees and others with a foreign background), and that the image of ICT should be improved to prevent shortages. At the time, the conclusions led to the several initiatives that went nowhere due to the economic dip. Any future initiatives/solutions should have their continuity safeguarded regardless of the economic developments.

Notes in the text

1) Directoraat-generaal voor Energie en Telecom.
2) To make the text easier to read we will use the term 'companies' for 'companies and institutions', unless the focus is explicitly on institutions, for instance in the non-profit sector.
3) The survey method may lead to double counting some of these vacancies. When someone leaves company X in 2005 and goes to company Y, and company X wants to fill the vacancy this created, both companies will report a vacancy in 2005. This is also true for the vacancy statistics of Statistics Netherlands. The figures about the number of ICT vacancies of the ITS differ from the figures of Statistics Netherlands presented elsewhere in this volume in terms of the period to which they refer. This difference can be explained. In the ITS study the observation unit is a year, whereas Statistics Netherlands has quarterly surveys. As a consequence, the figures presented here are about four times higher than the figures by Statistics Netherlands.

7.2 *Interorganizational collaboration and information technology of Dutch companies*

Authors: Cees van Beers and Fardad Zand, Faculty Technology, Policy and Management, Delft University of Technology.

In this article we report several results of a wide-ranging investigation into the influence of ICT investments in external data communication on the productivity of companies through interorganizational collaboration. The figures are based on the surveys of the project ICWAS (Internet technology and complex value systems) held by the section Economy of Innovation of the Delft University of Technology in 2003–2005 commissioned by Statistics Netherlands.

Background

ICT has an increasing influence on the way companies produce, buy and sell their goods and services. Companies use computers for computer-aided production processes in manufacturing, on-line buying and selling goods and services, but also on-line payment services. So it is logical to assume that ICT influences the productivity and efficiency of companies. In the USA, and to a lesser extent in the Netherlands, various studies show a positive correlation between ICT capital and the productivity of companies (see also paragraph 4.7 of *The Digital Economy 2005*).

By linking computers to the internet it is easy for companies to communicate. This is done through internal and external networks. Many companies use internal networks to communicate in-house or to link different automation systems. For instance, systems for orders, invoices and stock management can be linked within the company. In external networks, companies may link their computer systems with the computers of clients, suppliers or other producers – competitors and non-competitors. When companies produce composite products together it is important to link their production processes. One example from the services sector is the sales of chemical products in the chemical wholesale trade together with the relevant insurance products.

External data communication comes in various forms, ranging from simply selling products through websites to fully integrated purchase, production and sales relations with third parties. The more extensive and far-reaching the integration with third parties is, the more information sharing is between them. This leads to greater uncertainties than in the case of internal or limited external data communication. More parties involved means more potential for miscommunication, and the need for more advanced ICT applications, which makes that things can go wrong more easily. Therefore external networks are, not surprisingly, quite a bit less common than internal networks.

Interorganizational collaboration and ICT

Companies operate in networks with other companies and organisations. They do not produce everything themselves, but they get their raw materials and semi-finished products from other companies in the value chain. They in turn supply their products to clients. The relationships between companies may lead to collaboration between organisations. This may provide the participating company with access to means, skills and competences that are too expensive or time-consuming to develop within the company itself. Moreover interorganizational networks reduce market risks. It is often more efficient to work together than to do everything alone.

Interorganizational collaboration requires investment in supporting external data communication technology to facilitate the cooperation between parties. Such investments may facilitate the full integration of business processes. Therefore it is logical to expect that investments in external data communication supporting interorganizational collaboration will influence the positive correlation expected between ICT investments and productivity.

Table 7.2.1 shows the response results of a survey among 785 enterprises in the Netherlands. The response is almost 50 percent or 371 companies, of which a major part is in the manufacturing sector. The response fluctuates between 39 and 60 percent (except the one observation in SBI 0).

Table 7.2.1
Distribution of response to the ICWAS survey on external data communication systems and company productivity (number of companies), 2003–2005

SBI sector	Questionnaires sent out	Respondents	Response rate
	number		*%*
0 Agriculture and fishery	1	1	100
1 Mineral extraction and manufacturing [1)]	115	47	41
2 Manufacturing [2)]	309	142	46
3 Manufacturing [3)]	71	28	39
4 Public utilities and construction	84	47	56
5 Trade, hotels and restaurants	81	33	41
7 Business services	124	73	59
Total	785	371	47

[1)] Among other things: food, drink and tobacco; textiles.
[2)] Among other things: wood, paper, metal, machinery and chemical industries.
[3)] Among other things: manufacture of electrical and optical equipment, transport equipment and furniture.

Source: ICWAS project Delft University of Technology.

The questions in the survey deal with the internet use of companies, their collaboration with others, the role ICT plays in this, and the kind of software used, such as middleware and open standards. [1)] In table 7.2.2 we show the percentage of companies that cooperate with other companies. Remarkably the percentage is highest for joint productions. Most companies collaborating with other companies responded that ICT use is important in the collaboration (categories 'plays a role' and 'crucial'). ICT is only really crucial for a minority of collaborations. It is unclear to what extent differences in response lead to a distorted picture.

Table 7.2.2
Collaboration between companies in the Netherlands and third parties and the role of ICT therein (in percentage of total response), 2003–2005

	Companies with collaboration			Companies without collaboration
	ICT is indispensable	ICT is fairly important	ICT is not relevant	
	%			
Purchasing	7	19	17	57
Joint production	9	20	16	55
Sales	9	16	11	64

Source: ICWAS project Delft University of Technology.

Collaboration with other companies requires a great deal of coordination between the parties. The level of coordination will vary for each collaboration or network. A major company in a network with a limited number of small companies will often determine in which software they must invest. There is a limited need for coordination in such cases. A network consisting of many small companies requires a great deal of coordination (Clemons and Kleindorfer, 1992). Coordination refers to the extent to which operational management decisions depend on the collaboration with others. Specific software investments are needed to facilitate coordination. The different demands made of ICT investments depend on the degree of coordination required. If the coordination is strictly ordered, the requirement may be for ICT investments in open standards (such as XML, SOAP, WSDL and UDDI) whereas with less strictly ordered coordination it is possible to use Electronic Data Interchange (EDI) systems.

The level of coordination or coordination intensity is determined by the following three aspects (Venkatraman, 1994):
– ICT adoption;
– Internal integration;
– External integration.

ICT adoption is important because it raises efficiency in the existing organisation structure and routines, and because it improves and facilitates new working methods. *Internal integration* refers to the extent in which ICT systems are integrated and used in the whole in-house business process. The main point is that the advantages of external collaboration through ICT systems can be implemented much better if the companies also work with integrated systems in-house. *External integration* refers to collaboration between various companies that is fully integrated through ICT. This is often called 'business network integration'.

Factor analysis shows that the survey data can be grouped as the three determinants. Table 7.2.3 shows which survey questions belong to these determinants according to the factor analysis. One thing should be noted about table 7.2.3. The factor analysis classifies the question 'are your own business processes integrated with those of your business partners (chain integration)' as part of the factor *Internal integration*. This is curious, given the nature of the question. The explanation is that respondents interpreted this question as one where they were asked to what extent in-house business processes had to be fully integrated before it was possible to build on chain integration.

Table 7.2.3
Determinants of coordination level/intensity linked to the relevant survey questions, 2003–2005

Determinant	Relevant survey questions	Percentage 'yes'
		%
ICT adoption	Do you use the internet to realise binding transactions with (some of) your customers with a minimum of manual processes?	25
ICT adoption	Does your company collaborate with others to purchase goods or services collectively in which new ICT is relevant or indispensable? 1)	26
ICT adoption	Does your company collaborate with others to produce goods or services collectively in which new ICT is relevant or indispensable? 1)	29
ICT adoption	Does your company collaborate with others to market goods or services collectively in which new ICT is relevant or indispensable? 1)	25
Internal integration	If you use the internet for binding transactions with customers, are the applications used linked to the stock system?	37
Internal integration	Are your own business processes integrated with those of your business partners (chain integration)?	34
External integration	Does you company use Customer Relationship Management (CRM) software to exchange information with customers?	40
External integration	Does your company use middleware software for data exchange between ICT systems?	31
External integration	Does your company use web services software which uses open standards and technology?	25

1) New ICT is the use of software which links internal systems with those of business partners using internet technology.

Source: ICWAS project Delft University of Technology.

The effectiveness of collaboration for the performance of the companies involved is indicated by the influence on their competitive power. This is addressed in the question how an external network of collaboration influences the competitive power as an organisational production factor. Porter (1985) distinguished three activities in the value chain that are important for the competitive power of a company:
– product interrelationships;
– market interrelationships;
– support activities.

Product interrelationships are operational and logistic activities within the enterprise. *Market interrelationships* concern market, sales and post-sales activities plus the logistics outside the enterprise. *Support activities* are technology development,

Table 7.2.4
Determinants of competitiveness linked to the relevant survey questions, 2003–2005

Determinant	Relevant survey questions	Percentage 'yes'
		%
Product interrelationships	Is the reduction of stocks and/or operating capital an important motive to apply e-business chain processes?	28
Product interrelationships	Is the management of pricing and purchasing risks an important motive to apply e-business chain processes?	27
Product interrelationships	Is the optimisation of logistics an important motive to apply e-business chain processes?	40
Product interrelationships	Has your company been able to negotiate lower purchasing prices through interorganizational ICT systems?	24
Product interrelationships	Has your company been able to increase production per hour worked through interorganizational ICT systems?	28
Market interrelationships	Are faster sales a motive to apply e-business chain processes?	39
Market interrelationships	Is the negotiation of more favourable sales prices a motive to apply e-business chain processes?	27
Market interrelationships	Is your company able to respond better to demands of suppliers and customers through new ICT? (% who agree) [1) 2)]	30
Market interrelationships	Is your company in a position to supply products with the aid of new ICT which it could not supply before? (% who agree) [1) 2)]	5
Market interrelationships	If you market products jointly with other companies, are these products new for your company?	49
Support	How big do you expect the effect of interorganizational collaboration to be for product improvement? (% big) [3)]	53
Support	How big do you expect the effect of interorganizational collaboration to be for access to new technology? (% big) [3)]	42

1) New ICT is the use of software which links internal systems with those of business partners using internet technology.
2) These questions were formulated as a statement. The answer categories were 'completely disagree', 'disagree', 'neutral', 'agree' and 'completely agree'. The percentage in the third column is the sum of percentages answering 'agree' and 'completely agree'.
3) These questions were formulated as a statement. The answer categories were 'very small', 'small', 'quite big', 'big' and 'very big'. The percentage in the third column is the sum of percentages answering 'quite big', 'big' and 'very big'.

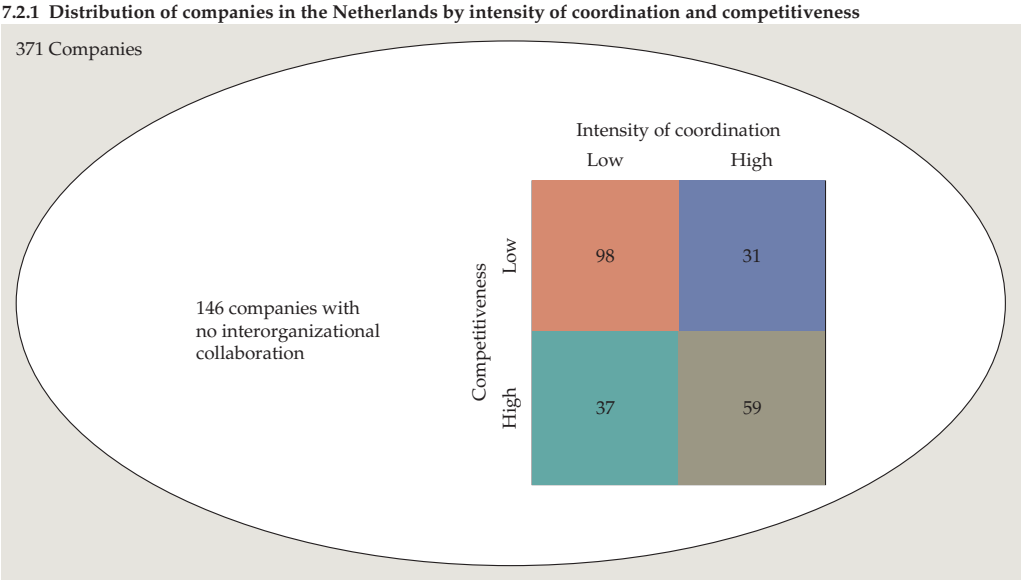
Source: ICWAS project Delft University of Technology.

human resource management, purchase activities and infrastructure. Here too the factor analysis shows that the questions used in the survey can be regrouped in the three factors that can be linked to the concepts of Porter (1985). The relevant questions are shown in table 7.2.4.

With the aid of the factors identified for the coordination intensity and competitive strength, we measured the value of these variables for each company engaged in at least one interorganizational collaboration. This was done with a second factor analysis of the factors identified. The resulting values are normalised whereby the average is set at 0.
We distinguish five categories over which the 371 companies are divided. The categories are (see figure 7.2.1):

0 = company has no interorganizational collaboration (146 companies);
1 = company has interorganizational collaboration which is *not* rigidly coordinated and has *little or no* influence on the competitive power (98 companies);
2 = company has interorganizational collaboration which *is* rigidly coordinated and has *little or no* influence on the competitive power (31 companies);
3 = company has interorganizational collaboration which is *not* rigidly coordinated and has *much* influence on the competitive power (37 companies);
4 = company has interorganizational collaboration which *is* rigidly coordinated and has *much* influence on the competitive power (59 companies).

7.2.1 Distribution of companies in the Netherlands by intensity of coordination and competitiveness



Source: ICWAS project Delft University of Technology.

Figure 7.2.1 shows the four categories that belong to the above mentioned classification of companies *with* interorganizational collaboration. The transition between the categories is formed by the normalised average 0. In this way companies with a negative coordination intensity (categories 1 and 3) can be considered companies that participate in interorganizational networks with little coordination. In case of positive coordination intensity (categories 2 and 4) they are companies that participate in networks requiring a great deal of coordination. For the other variable, the competitive strength, companies with negative values (categories 1 and 2) are categorised as companies where external networks lead to a low competitive strength, while companies with positive values (categories 3 and 4) are seen as enterprises with great competitive strength due to the networks.

Most companies are in category 1. They have fairly loose networks that are helpful to a degree for their competitive edge. Loosely coordinated networks that greatly contribute to the competitive strength of the participating companies (category 3) are the most ideal. This position is only obtained by 37 companies in our sample. In this case companies have a great deal of freedom, which can sharpen their competitive edge. However, in (larger) networks there is always some minimum of coordination required for the participation in the network to have a positive influence on competitive power. These are in category 4.

Interorganizational collaboration, ICT and productivity

There are three reasons to assume that the relationship between ICT capital and productivity growth is positive. In the first place communication costs are cut because the flow of information within the company has become more efficient. Secondly, electronic markets come about, making it easier to match buyers and sellers than in traditional markets. In the third place, which is central in this chapter, there are the effects of integration, that is, efficiency gains by integrating ICT systems and therefore business processes of the different partners in the value chain.

Various studies have tried to measure the relationship between ICT capital in companies and growing productivity. They tend to find positive effects (see Brynjolfsson and Hitt, 1996). The studies barely pay attention to the influence of ICT investments in external data communication on the relationship between networks and productivity. Different forms of collaboration have different goals and different ICT characteristics and these too are different for each enterprise. We distinguished four groups of companies in figure 7.2.1 in order to do justice to these differences.

To see how the classification according to the dimensions coordination intensity and competitive power influences the relationship of ICT investments on productivity, the survey data were linked to the productivity figures (production statistics) in 2003 and the investments in 2000–2003 (investment statistics). The link diminished the number of companies we could use for analysis from 371 to 218.

One limitation of the study is that we could only use relevant productivity figures for the year 2003, which meant we could only estimate the influence on productivity

levels. The productivity level is calculated as the value added per employee per hour worked and is related to the following independent variables:

- logarithm of the volume of work translated as the number of employees in full-time equivalents (fte) in 2003;
- logarithm of non-ICT related stock of capital goods per fte in 2003 corrected for price changes;
- logarithm of ICT capital per fte in 2003 corrected for price changes;
- interaction term between the logarithm of ICT capital per fte in 2003 and the standard for coordination intensity, measuring the effect of how increased coordination demands in the collaboration influence the productivity of ICT capital per fte;
- interaction term between the logarithm of ICT capital per fte in 2003 and the standard for competitive power: this measures the effect of how the competitive edge sharpened by the collaboration influences the productivity of ICT capital per hour worked.

Table 7.2.5
Description of relevant variables: effect of ICT capital and interorganizational collaboration on productivity, 2003–2005

Variable	Manufacturing (SBI 1, 2 and 3)	Construction (SBI 4)	Business services (SBI 5 and 7)
Number of companies	131	30	57
Number of companies in networks	94	14	28
Intensity of coordination			
mean	0.014	–0.468	–0.190
standard deviation	0.629	0.320	0.608
minimum	–0.911	–1.088	–1.041
maximum	2.332	0.457	1.731
Competitiveness			
mean	–0.095	–386.000	–0.239
standard deviation	0.629	0.403	0.663
minimum	–1.079	–1.063	–1.063
maximum	1.884	0.396	1.879
Labour productivity in 2003 (1,000 euro per employee)			
mean	61.22	66.39	48.91
standard deviation	27.36	43.03	23.82
minimum	21.35	26.31	16.57
maximum	169.05	201.99	147.43
ICT capital per employee in 2003 (1,000 euro per employee)			
mean	2.48	1.33	2.92
standard deviation	3.19	2.64	3.83
minimum	0.002	0.009	0.008
maximum	25.49	11.19	23.80
Share of ICT capital in total stocks of capital goods in 2003 (prices of 2000)			
mean	5.01	3.27	8.59
standard deviation	5.87	5.48	8.49
minimum	0.01	0.14	0.02
maximum	26.19	29.76	37.28

Source: ICWAS project Delft University of Technology.

Table 7.2.5 describes several variables. Most companies belong to the manufacturing industry. Moreover, interorganizational collaboration is more common in the industrial sector than in the sectors construction and business services. Both the average coordination intensity and the average competitive power in cooperation are higher in the manufacturing industry than in the other sectors. In addition, the spread is greater in the manufacturing industry, indicating that industrial companies are more heterogeneous than companies in construction and business services. Strict coordination in networks is also more common in the manufacturing industry. Labour productivity per employee in manufacturing and construction is higher than in the services sector, which is to be expected. ICT capital per employee is lower in construction than in the other sectors. Measured as a percentage of the total capital goods stock, the services sector invests more in ICT capital than the other sectors.

In order to measure the influence of ICT capital on productivity per hour worked, we explored the case by estimating the above mentioned variables as independent variables in an ordinary least squares regression model. The results are shown in table 7.2.6.

Table 7.2.6
Multivariate regression analysis of ICT capital on labour productivity (= gross value added) per employee in 2003

Variable	Model 1	Model 2
Constant	2.756 [1)]	2.796 [1)]
	(0.157)	(0.157)
Hours worked	0.159 [1)]	0.149 [1)]
	(0.032)	(0.032)
Non-ICT capital per hour	0.125 [1)]	0.125 [1)]
	(0.022)	(0.022)
ICT capital per hour	0.026 [3)]	0.036 [2)]
	(0.015)	(0.016)
ICT capital per hour x intensity of coordination		–0.049 [3)]
		(0.027)
ICT capital per hour x competitiveness		0.058 [2)]
		(0.028)
R^2	0.293	0.310
Number of observations	218	218

Note: standard errors between brackets.
[1)] Significant at 1%.
[2)] Significant at 5%.
[3)] Significant at 10%.

Source: ICWAS project Delft University of Technology.

The constant reflects the multi-factor productivity and is 2.8. This is the level of value added per fte that cannot be ascribed to the volume of labour and the volume of capital used in the production process. This value is in line with findings of other studies (including Van Leeuwen and Van der Wiel, 2003). The influence of the number of hours worked on labour productivity is 0.149 (model 2). This means that with all other variables being constant (all else being equal) doubling the number of hours worked leads to a 14.9 percent increase in productivity per hour worked.

The coefficient for non-ICT capital is 0.125, meaning that doubling non-ICT capital, all else being equal, leads to an increase of the productivity per hour worked of 12.5 percent. If we assume that an average share of non-ICT capital in gross value added is 86 percent on an annual basis, this leads to a gross yield of 14.5 percent (= 0.125 x (1/0.86)). [2)]
The results also show that doubling the ICT capital, all else being equal, will increase productivity per hour by 3.6 percent. This is in line with the results of other researchers (e.g. Brynjolfsson and Hitt, 1996; Van Leeuwen and Van der Wiel, 2003). If we assume that the average share of ICT capital in gross value added is 2.09 percent on an annual basis (Brynjolfsson and Hitt, 1996), than an elasticity of 0.036 means that € 1 extra ICT capital leads to an increase of labour productivity of € 1.72 (= 0.036 x (1/0.0209)).

The most interesting coefficients are the cross terms. If both the coordination intensity and the competitive power have 0 as their average normalised value, then the marginal contribution of ICT capital is 3.6 percent. The coefficient for the cross term of ICT capital with coordination intensity is –0.049. In other words, a less strict coordination in networks increases the marginal influence of ICT capital on productivity. A move from right to left in figure 7.2.1 increases the positive marginal influence of ICT capital on productivity. The more the coordination intensity increases, the more a company is involved in a fully business integrated network. The economic and technical room to manoeuvre is less in that case because all decisions have to be made together with the partners. This results in losing time and incurring costs. In addition, the position of the companies in the fully integrated business network is more vulnerable to technical hiccups and breakdowns.

The coefficient for the cross term of ICT capital with competitive power is 0.058. A move from high to low in figure 7.2.1 increases the positive marginal effect of ICT capital on productivity. If the effects of both cross terms are combined we can conclude that companies in category 3 (low coordination intensity and high competitive power) have the highest contribution of ICT capital on productivity. The average contribution for the sample as a whole was 3.6 percent. In the specific case of the company in a network with the lowest coordination intensity and the highest competitive power this can rise to 33.6 percent (category 3). In the case of the company in a network with the highest coordination intensity and the lowest

competitive power the effect of 19.4 percent can have a negative effect (category 2). For companies the most profit of ICT investments can be obtained when the networks in which they are used are not tightly coordinated and contribute positively to the competitive power. However, interorganizational networks require a certain minimum level of coordination, which means that companies in category 3 will slowly shift in the direction of category 4.

Conclusions

This paper is a first exploration of how the relationship between ICT investments/ capital and productivity changes due to two characteristics of interorganizational networks that can be influenced by specific ICT investments. These are the degree of coordination in the network and the extent to which the network influences the competitive power of the company.

Both characteristics were traced on the basis of Statistics Netherlands' survey data on information technology and interorganizational collaboration through factor analysis. Then, through simple multivariate regression analysis in a production function we estimated how the two network characteristics influence the positive relationship between ICT capital and productivity per hour worked.

If both the coordination intensity and the competitive power of the interorganizational networks have the average value at the branch of industry level, then a doubling of investment of ICT capital leads to a 3.6 percent increase of the gross value added per hour worked. The interaction between an extra unit of ICT capital and a higher coordination intensity is negative. A stricter coordination in networks reduces the marginal influence of ICT capital on productivity. The interaction between an extra unit of ICT capital and greater competitive powers is positive. External networks that contribute to competitive power strengthen the positive effect of ICT capital. For instance, suppliers of supermarkets can work more productively if ICT integration lets them know what these supermarkets will need in two weeks or two months time. For companies the most benefits from ICT investments can be had when the networks in which they participate are not coordinated too tightly and contribute positively to competitive power. In the extreme that will be difficult to realise because participation in networks in which ICT plays a role will require some degree of coordination. Such shifts of companies, and with it stability of the balances, are the subject of our future studies in this field.

Notes

1) Middleware is software connecting two or more software applications so these can communicate.
2) The marginal product of a production factor is equal to the output elasticity of the production factor times the reciprocal of the share of the production factor in the total output.

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Concepts and definitions used

Some key concepts and definitions used in this publication are explained briefly below.

Basic price

The basic price is the amount receivable by the producer of goods or services after the sale of the product. Trade and transport costs (e.g. shipping costs), product-related taxes (e.g. VAT) and product-related subsidies (e.g. export subsidies) are not taken into account.

Branches of industry

Most tables and figures in this publication include data broken down by branch of industry:

Branches of industry

Description in table	Description and code SBI 93
Agriculture, forestry and fishing	Agriculture, hunting and forestry (01, 02) Fishing (05)
Mining and quarrying	Mining and quarrying (10–14)
Manufacturing	Manufacturing (15–37)
Electricity, gas and water supply	Electricity, gas and water supply (40, 41)
Construction	Construction (45)
Trade, hotels, restaurants and repair	–
of which Trade and repair	Trade and repair of motor vehicles/cycles; retail sale of automotive fuel (50) Wholesale trade and commission trade (51) Retail trade, repair of personal and household goods (52)
Hotels and restaurants	Hotels and restaurants (55)
Transport, storage and communication	Transport, storage and communication (60–64)
Financial institutions	Financial institutions (65–67)
Business activities	–
of which Computer service bureaus	Computer and related activities (72)
Other business activities	Real estate activities (70) Renting of movables (71) Research and development (73) Other business activities (74)
General government	Public administration and defence; compulsary social security (75)
Subsidized education	Education (80 excl. 80.4)
Health and social work activities	Health and social work activities (85)
Other service activities [1)]	–
of which Sewage and refuse disposal services	Sewage and refuse disposal, sanitation and similar activities (90)
Other service activities n.e.c.	Recreational, cultural and sporting activities (92) Other service activities n.e.c. (80.4, 91, 93)

[1)] In the survey 'ICT use enterprises', the SBI groups 80.4 and 91 are excluded from this branch of industry.

Apart from the abbreviated names used in the tables and figures, they are also specified by their SBI codes and full names.

Broadband

High-quality communication connections with the internet such as cable, ADSL and other kinds of DSL connections. In addition, the rented and leased lines with high-speed transmission are included, as is UMTS (mobile broadband). The OECD has the following definition: connections with the internet with a total transmission speed (the sum of the upload and download speed) of at least 256 kbit/s.

Business-to-Business market

The market for electronic shopping where companies sell goods and services to other companies.

Business-to-Consumer market

The market for electronic shopping where companies sell goods and services to consumers (individuals and households).

Capital goods

The total value of fixed capital formation. These are means of production with a lifespan of more than a year, that represent a significant value. These include material (buildings and machinery) and immaterial (software) assets.

Consumer-to-Consumer market

The market for electronic shopping where consumers (individuals and households) sell goods and services to other consumers.

Consumption

Goods and services used for immediate satisfaction of individual or collective needs. A distinction can be made between government consumption and household consumption, and between real individual consumption and real collective consumption.

E-commerce

Placing or receiving orders for goods or services through electronic networks, irregardless of delivery and payment methods. Excluding orders by telephone, fax or conventional email.

EDI

Electronic Data Interchange; exchanging electronic data in a prearranged format. An EDI-network (such as EDIFACT or Ainsi 12x) is a closed network, i.e. not accessible to the public, often used in the trade between companies and involving a set-up with a modem and telephone line.

Electronic shopping

On-line order of goods or services by consumers. Electronic shopping is a form of e-commerce.

Employed labour force

All people working at least twelve hours a week (employees, self-employed, people working in the family business). The figures usually refer to the employed labour force aged 15–64. Internationally the limit is at least one hour of work a week.

EPO (European Patent Office)

The EPO grants patents for the countries that signed the European Patents Treaty. In December 2006 there were 31 countries plus five additional countries (extension states) that recognise the European patents. For more information, see www.european-patent-office.org.

Exports

Exports refer to goods and services sold abroad by a resident of this country. The exports of goods refer to goods supplied abroad from the economic territory of the Netherlands. When trade and transport margins up to the Dutch border are included, this is known as 'free on board' (f.o.b.). Exports also include expenditure by foreign tourists in the Netherlands, people living close to the border and diplomats.

External data communication

The possibility of communication between one or more computers from one company and computers of others.

Fixed capital formation

Fixed capital are means of production with a lifespan of more than one year, that represent a significant value. Produced material or immaterial assets that are used for more than a year in the production process. These include material assets (such as buildings and machinery) and immaterial assets (such as software and major databanks).

Flexible labour relationship

Labour relations that differ from regular labour contracts in the number of working hours and the duration of the contract. Well-known kinds of flexible contracts are temporary work and workers on call.

Goods

Tangible products, such as food, durable consumer items and machinery.

Gross value added and gross domestic product (GDP)

Gross value added against basic prices per branch of industry is equal to the difference between production (at basic prices) and intermediate use (purchase prices). The sum of the gross value added per branch of industry is the gross value added of the total economy (the gross domestic product, at basic prices). Gross here

means that depreciations are not subtracted from the value added. Economic growth is the percentage volume growth of the gross domestic product.

High-tech products

High-tech products are R&D-intensive products: for space travel and aviation, computers, office machinery, electronics, instruments, pharmaceutics, electronic machinery and weapons.

ICT capital

ICT capital (goods) are ICT goods and services used to produce other goods, and which have a life of more than one year in the production process. The most important examples are computers and software.

ICT expenditure

ICT expenditure is expenditure on ICT goods and services consisting of investments by companies and government in ICT capital, the intermediate use of ICT goods and services by companies and the government and the consumption of ICT goods and services by households. ICT expenditure consists of intermediate use and consumption.

ICT market

The ICT market is, in the abstract sense, the total of demand and supply of ICT goods and services. The volume of the market can be expressed as the total turnover of ICT goods and services in a given period. The total turnover of the ICT sector is an indication of the volume of the ICT market.

ICT sector

The definition of the ICT sector here is in line with the OECD definition. It is based on the following concepts:

The sector ICT industry must produce products that:

– are meant to process information and to communicate, including audio-visual means;
– use electronic processing technology to observe, measure, reproduce and check information about physical phenomena and processes.

The sector ICT services must provide services that:

– are meant to support the process of electronic information processing and communication.

The definition used in this publication of the ICT sector is slightly different. There are no data on groups 5151 and 5152 and 7123 because the national accounts are not sufficiently detailed in this area. Telecommunication is observed together with post and courier services for confidentiality reasons.

In terms of ISIC Rev.3.1 this leads to the following classification:

Internationally agreed definition of the ICT sector

ISIC Rev. 3.1 code	
ICT industry sector	
3000	Manufacture of office, accounting and computing machinery
3130	Manufacture of insulated wire and cable
3210	Manufacture of electronic components
3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
3230	Manufacture of audio and video equipment
3312	Manufacture of equipment for measuring, checking, testing, navigating and other purposes
3313	Manufacture of industrial process control equipment
ICT services sector	
5151	Wholesale of computers, computer peripheral equipment and software
5152	Wholesale of electronic and telecommunications parts and equipment
7123	Renting of office machinery and equipment (including computers)
6420	Telecommunications
7200	Computer and related activities

Source: OECD.

Definition of the ICT sector

SBI93	Characterization of the activity
ICT industry sector	
3000	Manufacture of office machinery and computers
3130	Manufacture of insulated wire and cable
3210	Manufacture of electronic components
3220	Manufacture of television and radio transmitters and apparatus for line telephony and line telegraphy
3230	Manufacture of audio and video equipment
3320	Manufacture of equipment for measuring, checking, testing, navigating and other purposes
3330	Manufacture of industrial process control equipment
ICT services sector	
6400	Post and telecommunications
7200	Computer and related activities

Source: OECD / Statistics Netherlands.

ICT workers

ICT workers are the occupations Programmers (514), Technical systems analysts (666), Systems analysts (714) and Informatics experts (914) from the Standard Classification of Occupations.

Imports

Imports refer to goods and services sold abroad to a resident of this country. The imports of goods refer to goods for residents that were brought from abroad to the economic territory of the Netherlands. When trade and transport margins up to the border of the exporting country are included, this is known as 'free on board' (f.o.b.).

The imports of services refer to expenditure by Dutch companies abroad, such as transport costs, banking costs and business travel. Paying for software produced by foreign companies is also considered as importing services.
In government, the imports refer to expenditure abroad by embassies. The imports by households consist of consumer goods and direct consumer expenditure by Dutch tourists, people living close to the border, diplomats and the military abroad.

Informatics studies

In this publication, informatics in higher education is determined on the basis of the international classification of education (ISCED). It includes Informatics (ISCED 481) and Electronics and automation (ISCED 523). The international data (figure 2.9.2) only refer to Informatics (ISCED 481 = ISCED 48).

Intermediate use

Intermediate use (consumption) includes all products used in the production process in the reporting period. These may be raw materials, semi-manufactured goods and fuels, or services such as communication services, cleaning services and services of external accountants. The intermediate use is valued at purchase prices, excluding deductible VAT.

Internet users

People using the internet. Most figures on internet users refer to people who used the internet in the previous three months. In this publication they are internet users aged 12–74. In international data the figures refer to people aged 16–74.

Jobs

A position occupied by an employed person. An employed person may have more than one job at a time. In that case, someone has a main job and a job on the side. In this publication, the jobs are usually main jobs.

Labour volume

The volume of labour used in the production process, expressed in full-time equivalents (FTE) or hours worked. FTEs are calculated by taking all full-time and part-time jobs in a given year and recalculating them into full-time equivalents.

Production

The production includes the value of all goods intended for sale (also the unsold goods) and receipts for services rendered. Production also includes products with a market equivalent produced for the company's own use, such as in-company investments such as software developed within the company for the company's own use. The production is valued at basic prices. The basic price is what the producer actually gets, that is excluding trade and transport margins by others and excluding the balance of product-related taxes (including VAT) and product-related subsidies.

Re-exports

Goods transported via the Netherlands and (temporarily) owned by a resident without industrial processing. Re-exports refers for example to goods that are cleared with customs by Dutch distribution centres and supplied to other (European) countries. Re-exports, unlike transit trade, are part of imports and exports.

Self-employed

Someone who earns an income by working at their own risk for their own account in their own company or in an independent profession, or by working in the business of a family member. Family members working in the family business are considered self-employed unless they have a specific employment contract.

Services

Non-tangible products, such as hotels and restaurants, trade, transport, health care and government.

Spam

Unsolicited email message, often spread in massive quantities to different email addresses. The message often contains a commercial and a link to a commercial internet address.

Turnover

Turnover is the total revenue from the goods and services sold.

Vacancies

An unfilled place of employment that a company or institution is looking to fill with someone from inside or outside, who can start working in the job fairly soon.

Vacancy rate

The number of vacancies per 1,000 jobs (main jobs or jobs on the side) (in paragraph 2.8) or the number of vacancies per 100 jobs (in paragraph 7.1).

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ms. L. Linders	IBM Netherlands
drs. H.P. van der Wiel	CPB Netherlands Bureau for Economic Policy Analysis
drs. M.E. Wolthoff	Independent Post and Telecommunications Authority (OPTA)

Contributors to this publication

Authors

dr. C. van Beers (Delft University of Technology)
ms. dr. M. Hulsen (ITS)
drs. N. van Kessel (ITS)
ir. A.D. Kuipers
G.J.H. Linden
drs. D. Pronk
drs. H. Rietveld (also editor)
ms. drs. M.J. Roessingh
ms. drs. D. Uerz (ITS)
mrs. drs. L. Wielenga-van der Pijl
dr. T.J.J.B. Wolters
ir. F. Zand (Delft University of Technology)

With cooperation of

C.H. van den Berg, D. Boer, H.M.G. Bolleboom BA, ir. H.J. Konen, drs. T.J.T. van Kooten, drs. S.G.E. de Munck (TNO Information and Communication Technology), drs. E.C. van der Pijll, F.J. Planting, ms. S.J. Schaaf, V.M. van Straalen BA, ms. W.J.P. Triepels, drs. G.H. Wassink, and drs. J. Weidum.

Translation

ms. M.B.G. Gircour BA
ms. L.E. Hoeksma