The digital economy 2009

Explanation of symbols

.	=	data not available
*	=	provisional figure
**	=	revised provisional figure
x	=	publication prohibited (confidential figure)
–	=	nil or less than half of unit concerned
–	=	(between two figures) inclusive
0 (0.0)	=	less than half of unit concerned
blank	=	not applicable
2008–2009	=	2008 to 2009 inclusive
2008/2009	=	average of 2008 up to and including 2009
2008/'09	=	crop year, financial year, school year etc. beginning in 2008 and ending in 2009
1998/'99-2008/'09	=	crop year, financial year, etc. 1998/'99 to 2008/'09 inclusive

Due to rounding, some totals may not correspond with the sum of the separate figures.

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Foreword

Statistics Netherlands publishes *The digital economy* annually to give an extensive update of the digitisation of the Dutch society. The series focuses on the widespread use of information and communication technology (ICT).

This – ninth – edition shows that the Netherlands can still hold its own against the leading countries in the field of ICT. The Netherlands ranks top in the European Union in terms of computer ownership and the share of households with broadband internet; a large majority of the population have average or above average computer and internet skills; and the share of companies with a broadband internet connection has increased to almost 90 percent in recent years.
ICT is increasingly penetrating the public sector: for central and local government services, in schools, and in the care sector. The book also presents information on the ICT sector and the economy, where possible taking the present economic situation into consideration, as well as the role of ICT in this.
In terms of ICT knowledge, the Dutch ICT sector accounts for one third of private sector R&D spending, and a relatively high number of patent applications.

Collaboration with TNO and financial support from the Ministry of Economic Affairs have made it possible to include information about the telecom infrastructure and a large number of international comparisons in this edition, alongside information from other organisations and research institutes.

This edition concludes with the capita selecta, four contributions addressing specific ICT subjects in detail: electronic payment, ICT skills, mobile services and high-speed internet.

Because the volume of information on ICT increases every year, some of the methodological and statistical information is published only on
www.cbs.nl/digital-economy.

The Director-General
of Statistics Netherlands

G. van der Veen

Contents

Figures and tables

Summary and conclusions

This book consists of an introductory chapter, six statistical chapters and the capita selecta. This summary describes the main findings for each subject. For a large part, it follows the structure of the chapters, but occasionally we have departed from this structure to place the themes in their context.

Introduction

Technological innovations often entail significant economic and social changes, and this is certainly the case for ICT (information and communication technology). Statistics Netherlands launched its *Digital Economy* series to help quantify the role of ICT in the Dutch economy and society.
Dutch government policy is directed at promoting the expansion of ICT in a broad sense, with the aim of making the Netherlands one of the top countries in Europe. It already occupies a top position in several domains, such as the use of broadband internet. Key priorities in Dutch ICT policy are e-skills and e-government.
This book is structured along the lines of a model based on the supply and use of ICT, in which the ICT sector and ICT infrastructure play an important role.
The book's chapters examine the relationship between ICT and the economy, the ICT sector itself and the use of ICT in society. The role of ICT knowledge is also discussed.

ICT and the economy

The Dutch economy grew by 2 percent in 2008. However, the credit crisis caused a significant economic downturn in the first three quarters of 2009. Following several years of growth, the ICT industry also appears to have been affected by the decline. In 2008 both production value and value added in this sector fell. Since 2007 the ICT services sector has grown only very modestly, particularly in terms of production value and investment spending. Computer services are the driving force in the ICT services sector: in 2008 their turnover grew for the fifth consecutive year.
The crisis did not noticeably affect employment in the ICT sector in 2008; it continued to rise, and the number of vacancies in the sector also increased considerably. Value added in the telecom sector decreased from the third quarter of 2008, although the number of registered telecommunication companies continued to grow.
ICT investment is relatively high in the Netherlands, although lower than in the leading countries in this field. The Netherlands is catching up, however.

International trade in ICT goods and services has picked up after a decline at the beginning of the century. The value of Dutch ICT exports nearly doubled between 1998 and 2008. In 2008 Germany was the main trading partner for imports and exports of ICT, but east European countries are becoming increasingly important in this respect.

Telecom

The Netherlands is one of the world leaders in terms of coverage of high-speed and very high-speed internet connections. The volume of internet traffic continues to rise. High-speed networks such as the glass fibre network are also expanding rapidly. Connections with a speed of more than 50 Mbps are making the web an even more visual medium, for example via HDTV. High-speed internet is also increasing communication capabilities further and high upload speeds make it easier for consumers to contribute to website content. The Dutch infrastructure is ready for future applications requiring very fast internet connections. The number of very high-speed internet subscribers accounted for only a few percent in 2009, however.

Internet telephony (VoIP) grew substantially in 2008, and the 2.9 million connections at the end of 2008 exceeded the number of regular analogue phone connections for the first time.

In international terms, the Netherlands has a relatively high number of mobile telephone connections. The use of mobile services grew in the period 2007–2009, but this growth stagnated in 2009. In 2009 calls and sending text messages (SMS) were the two most used features of mobile phones. Fewer people used their mobiles to send photos and e-mails or to access the internet. Compared with Finland, the Netherlands is several years behind in this respect.

The number of subscriptions to digital television continues to grow. Although digital cable television is most popular, digital terrestrial television is growing relatively faster, probably because of lower subscription costs.

Dutch government policy stimulates digital terrestrial radio. It has the same benefits as digital television: better signal quality and the possibility to broadcast more channels within the limited frequency spectrum.

A significant development in recent years has been the convergence of various telecom services. Telephony, television and internet are increasingly supplied in packages through one network by the same provider. This phenomenon grew strongly up to 2007, but stabilised in 2008.

ICT use by companies

In international terms, Dutch companies use ICT less than companies in the leading countries. Companies in other north European countries in particular – Denmark, Finland and Sweden – use ICT more intensively. In addition, Dutch companies were not exactly early adopters of the various ICT applications. A few years ago, they were still only average users of broadband internet and electronic purchases and sales compared with the rest of the EU. In 2008, however, they were above average users, and now most Dutch companies have broadband internet and their own website. This means there is a critical mass for advanced, large-scale ICT applications.

In the Dutch manufacturing industry, ICT used to support business processes focused more on the production and distribution chains. In the services sector, it focused more on marketing and customers.

One in five Dutch companies were using open source operating software by December 2008; these were mainly large companies and companies in the ICT sector, probably because they have more knowledge about how to work with open source software.

Automated data exchange (ADE) offers advantages in terms of efficiency and service and product standardisation. Large companies in particular use ADE: 47 percent of companies with more than 500 employed persons used it in 2008, for example to send purchase orders to suppliers.

Supply chain management is mostly the domain of large companies in trade and industry: 41 percent of the largest companies used some form of supply chain management at the end of 2008.

Levels of electronic sales differ substantially between sectors of industry. Two-thirds of businesses providing overnight accommodation and travel agents used electronic sales. Indeed, accommodation, transport and holidays are among the products consumers have increasingly booked online in recent years. More companies buy than sell products electronically, possibly because of the lower investment costs involved.

While e-commerce accounted for just over 3 percent of total turnover by companies in 1999, this had risen to nearly 12 percent in 2008. Large companies and companies in the transport and storage sector in particular generate a large proportion of their sales through e-commerce.

Radio frequency identification (RFID) – using radio waves to identify people or objects – is an emerging technology, and not yet widely used. Larger companies in particular use this technology: about a third of companies with more than 250 employed persons. One common application of RFID technology is for access cards, although the transport and storage sector also uses it to track goods.

ICT use by households and individuals

In 2009, nearly eight in ten Dutch people had access to a broadband internet connection at home. The explosive growth that took place until 2007 has come to an end. Fast internet connections are not equally common in all provinces; there are relatively more in Utrecht and Noord-Holland than in Limburg. ADSL is by far the most common type of internet connection.

Fewer and fewer households have a desktop computer, as laptops are taking their place. In 2009 more than six in ten households had a laptop with internet access. Internet access via mobile devices has increased: 30 percent of internet users in 2009 occasionally went online using a mobile device.

The Netherlands is the leading EU country in terms of computer ownership and percentage of households with broadband internet. In 2008, 88 percent of Dutch households had a computer. Nearly twelve million people in the Netherlands regularly use the internet. Communicating with other people was still the most important internet activity in 2009. Nine out of ten internet users looked for information online in 2009, and more than half played or downloaded games. People aged between 25 and 65 years are most likely to use these services frequently. More and more people are also using the internet to listen to the radio and watch television. Nine out of ten internet users aged 25 to 45 years use online banking services, as do 64 percent of the over-65s.

The share of e-shoppers grew strongly in 2009, to 74 percent of internet users. The Netherlands is one of the top countries in Europe in this respect. The average e-shopper is a man aged between 25 and 45 years with a degree in higher education. The share of internet users booking transport, holidays and accommodation online grew significantly in 2009, to almost 60 percent. Just over four in ten e-shoppers had spent between 100 and 500 euro online in the three months preceding the survey; nearly a quarter of e-shoppers had spent more than 500 euro.

More than three-quarters of people who shop online also pay for these purchases online via their bank, while a third pay with a credit or debit card. Just over a quarter of online shoppers pay without using the internet; these include a relatively high percentage of people aged over 65.

Electronic payment is also increasingly popular for products not bought online. In 2008 consumers used debit cards to pay for nearly 55 percent of the amount of money spent in shops. Ten years ago, this share was about one quarter. Almost all Dutch people had a debit card in 2008, around 86 percent of Dutch people aged 15 years and older used them both to withdraw cash and to pay for goods. Consumers are more likely to use a debit card to pay larger than smaller amounts, but the average purchase amount of electronic payment has decreased rapidly, especially since the second half of 2008. More and more retailers now accept debit cards and do not charge extra for electronic payment.

ICT in the public sector

The Dutch government makes extensive use of ICT to provide services to citizens and companies, and within the various layers of government itself. One precondition for a comprehensive level of service provision is an electronic signature, and for this reason DigiD was introduced some years ago. On 1 January 2009, approximately 40 percent of the Dutch population had an active DigiD. Fewer people living in the coastal provinces had a DigiD than in many parts of Limburg and Flevoland. DigiD holdership is strongly affected by age-related regulations, such as those on pensions and study grants, and by income tax returns.

In 2009, 53 percent of Dutch internet users who needed government information looked for it on the internet; this percentage has hardly changed since 2006. The share of internet users who complete and send in government forms online is also relatively stable, at around 56 percent. Downloading government documents is still increasing on the other hand.

In education, the number of pupils per computer has decreased over the years, and nearly all PCs in primary and secondary education had an internet connection in 2009. Nearly 90 percent of primary school teachers used a computer in the class in school year 2008/'09. For secondary education this was 61 percent. According to the schools, ICT contributes significantly to various educational goals.

ICT presence in the care sector is similar to that in the rest of the economy. In relative terms, many more health care workers than social and welfare workers used a computer and the internet regularly in 2008.

E-health is an up-and-coming field, which combines medical informatics, health care and business processes. The best-known application is the electronic patient file. In 2007, 89 percent of Dutch GPs used a diagnostic decision support system, putting the Netherlands just behind the leading countries in this respect.

ICT knowledge

ICT has been instrumental in bringing together information, communication and knowledge, and ICT research contributes to the development of new knowledge. The ICT sector is a major player in R&D by the Dutch business sector.

Although R&D in ICT has grown globally, total R&D expenditure in the Netherlands is low in an international respect, and R&D expenditure by the ICT sector fluctuates strongly.

Dutch companies and organisations submit a large number of patent applications, more than 37 percent of which are ICT-related. The applications include relatively many high-tech patents and patents in the field of consumer electronics. It should be mentioned that the number of patent applications submitted by a country is probably related to national traditions in this respect.

ICT education is an important factor in the diffusion and expansion of ICT knowledge. The increase in the number of computer science students was slightly smaller than the increase in the rest of higher education in the period 2000/'01 to 2008/'09. In 2007/'08 the total number of computer science graduates was just under 5 thousand. From an international perspective, the Netherlands had an above average share of computer science graduates in 2007.

As only a fraction of the population participates in ICT education, specialist ICT knowledge is quite scarce. General computer and internet skills have increased in the Dutch population, but this is probably a direct consequence of growing computer and internet use rather than ICT education. Jobs requiring a higher level of knowledge are done by people with high ICT skills. Workers in administrative, commercial and economic positions have more ICT skills than those with the same level of education working in other fields. People who use ICT for their work therefore become more skilled in this area.

As it is very clear that technological developments have made ICT skills more relevant for individuals as well as for society as a whole, ICT skills are high on national and international policy agendas. The largest potential impact of ICT is no longer being able to access the internet, but being able to benefit from the information on the internet, in both social and economic terms. And as cognitive skills play a prominent role in this respect, it is no surprise that the key determinant in studies of ICT skills is 'level of education'.

Key indicators of the digital economy, the Netherlands, 2004–2009

	2004	2005	2006	2007*	2008*	2009*
	% volume change on previous year					
ICT and the economy						
ICT investments	6.0	9.2	12.4	5.4	.	.
ICT sector: production value	1.7	3.6	4.6	3.0	0.8	.
ICT sector: labour volume of employed persons	–2.8	1.4	2.7	1.7	2.4	.
ICT sector: gross value added	2.9	5.1	5.0	3.0	2.3	.
of which:						
ICT manufacturing industry	6.9	5.9	2.6	2,0	-3.5	.
ICT services industry	2.5	5.0	5.5	4,0	2.8	.
	number					
Companies in the ICT sector[1)]						
Total	25,222	24,235	20,685	23,501	26,068	.
New companies	2,730	3,450	3,686	3,781	3,487	.
Bankruptcies	289	270	201	173	149	.
	x million euro					
R&D expenditure in the ICT sector[2)]	1,574	1,610	1,801	1,640	.	.
	number (x 1,000)					
ICT and employment						
Employed labour force working in an ICT profession	261	262	251	256	272	.
Vacancies in the ICT sector	6.0	8.9	12.5	12.7	13.4	.
Computer science graduates from higher education[3)]	4.1	4.7	5.3	5.2	5.0	.
	number (x million)					
Telecommunication infrastructure						
Fixed telephone lines: PSTN	5.9	5.5	4.5	3.4	2.9	.
Fixed telephone lines: ISDN[4)]	1.5	1.4	1.3	1.2	1.0	.
Fixed telephone lines: VoIP	.	0.5	1.6	2.4	2.9	.
Mobile telephone connections	16.0	16.3	17.1	18.5	19.7	.
Broadband connections: cable	1.3	1.6	1.9	2.1	2.2	.
Broadband connections: ADSL	1.8	2.5	3.0	3.4	3.6	.
	% of total number of companies					
ICT use by companies[5)6)]						
Companies with an internal network	80	86	83	86	86	.
Companies with internet access	90	97	99	99	96	.
Companies with broadband internet	70	81	87	86	86	.
Companies with a website	68	79	80	86	84	.
Companies ordering goods/services electronically[7)]	36	45	42	44	41	.
Companies receiving orders electronically[7)]	23	27	28	31	25	.
	% of total					
ICT use by households and individuals						
PC ownership, households[8)]	80	83	84	86	88	91
Internet access, households[8)]	71	78	80	83	86	90
Broadband access, households[8)]	34	54	66	74	74	77
Shopping online, individuals[9)]	52	55	61	66	67	74

Source: Statistics Netherlands; TNO (telecommunication infrastructure).

1) Because of changes in the Business Register, figures on companies from 2006 are not completely comparable with earlier years.
2) R&D carried out by own staff. For 2004 and 2005, revised figures are shown.
3) Higher professional education *(hbo)* diplomas and university bachelor's and master's degrees. 2006 = study year 2005/2006 etc.
4) The number of ISDN connections. One ISDN connection may consist of 2 or more lines.
5) Companies with 10 and more employed persons.
6) Because of a change in method, figures for 2008 are not completely comparable with earlier years.
7) Because of changes in questions, figures are not completely comparable over the years.
8) Private households with at least one person aged 12–74 years.
9) Percentage of people with an internet connection.

Key indicators of the digital economy, international, 2005–2008

	EU-15	EU-27	Belgium	Denmark	Germany	Finland	France	Ireland	Nether-lands	United Kingdom	Sweden	United States
	%											
ICT and the economy												
ICT expenditure as a % of GDP, 2006	5.6	5.7	5.9	6.0	5.7	6.0	5.4	3.8	6.3	6.5	7.3	5.4
Contribution of ICT capital to GDP growth, 2001–2006[1)]	.	.	0.4	0.5	0.2	0.4	0.3	0.2	0.3	0.5	0.3	0.3
Share of ICT employees (broad definition), 2007[2)]	22.0	.	22.0	27.0	22.0	25.0	20.0	21.0	23.0	28.0	25.0	20.0
Share of ICT sector in private sector R&D expenditure, 2006[3)]	.	.	26.7	37.7	24.5	65.5	30.8	60.7	31.1	27.6	34.9	35.5
	number per 100 inhabitants											
Telecommunication infrastructure												
Fixed telephone connections, 2008[4)]	.	.	.	46	63	31	52	.	41	53	.	51
Mobile telephone connections, 2008	.	.	.	120	130	129	93	.	121	123	.	87
Broadband connections, 2008[5)]	.	.	.	37	28	30	27	.	35	29	.	26
	%											
Household use of multiplay, 2007[6)]	.	29	.	47	36	7	35	15	42	30	32	.
	% of total											
ICT use by companies, 2007[7)]												
Companies with a broadband internet connection	85.9	81.1	91.0	79.7	84.0	92.1	92.3	83.0	85.8	87.1	89.4	.
Companies with electronic sales[8)]	18	16	16	20	.	13	13	25	27	32	19	.
Companies with electronic purchases[9)]	32	28	34	38	.	.	18	54	40	47	50	.
Percentage of turnover generated by orders received electronically	12	12	.	.	.	16	12	18	13	21	13	.
	% of total											
ICT use of households and individuals, 2008												
Households with an internet connection	64	60	64	82	75	72	62	63	86	71	84	.
Households with a broadband internet connection	52	49	60	74	55	66	57	43	74	62	71	.
Persons with advanced internet skills[10)]	13	13	7	13	8	13	17	5	14	10	9	.
Persons shopping online[11)]	29	24	14	47	42	33	28	30	43	49	38	.
	%											
ICT in the public sector												
Use of online public services by businesses, 2008[12)]	70	68	69	90	56	95	73	91	85	64	78	.
Use of online public services by citizens, 2008[13)]	32	28	16	44	33	53	43	27	54	32	52	.
	1 = very limited, 7 = extensive											
Internet access in schools, 2009[14)]	.	.	5.4	6.1	4.6	6.1	4.9	4.3	6.0	5.7	6.4	5.9
	%											
ICT knowledge												
Share of ICT diplomas in higher education diplomas and degrees, 2007[15)]	.	3.7	2.8	3.0	4.1	4.2	3.9	.	4.1	4.8	3.0	3.2
	number per million inhabitants											
European ICT patent applications, 2005	35	28	34	37	62	133	38	18	70	28	84	40

Source: Eurostat; OECD for ICT capital contribution to growth, ICT employees, R&D and companies with broadband connections; TNO for telephone and broadband connections; European Commission for multiplay; World Economic Forum, Global Competitiveness Report 2009–2010.

1) Average annual contribution in percentage points.
2) Share of the employed labour force.
3) Belgium, Germany, Ireland, Netherlands and Sweden: 2005. United States and France: 2004.
4) Including ISDN and VoIP connections.
5) Excluding mobile connections.
6) Percentage of households with a package of at least two services from one provider, November/December.
7) Companies with 10 and more employed persons.
8) Electronic sales account for at least 1 percent of company's total turnover.
9) Electronic purchases account for at least 1 percent of the company's total purchase value.
10) Persons aged 16–74 years using 5 or 6 internet activities in the three months preceding the survey, 2007.
11) Persons aged 16–74 years purchasing goods/services online in the three months preceding the survey.
12) Use of eight public services.
13) Use of twelve public services.
14) Weighted average 2008–2009.
15) Eurostat estimates.

1. Introduction

Information and communication technology (ICT) is a prominent factor in many different areas of today's society. Production, consumption, communication and entertainment, for example, increasingly make use of the possibilities offered by ICT. In the context of innovations with a historic impact on society and economy, the role of ICT – and the internet in particular – is still hard to assess in 2010. The distribution and the use of ICT are still very much in development. But ICT has unmistakably acquired a place in the life of almost every Dutch individual within the space of a few decades. New ICT applications continue to appear, and to become widely adopted, very rapidly. Moreover, many existing goods and services are continually changing because of ICT applications.

The social relevance of ICT is still growing, not only because the number of users keeps growing, but also because new or better ICT applications continue to be developed. This is one of the reasons that the intensity of ICT use is increasing; and thus also the technical and organisational complexity surrounding ICT. This growing complexity in turn affects the administrative and organisational side of ICT and the internet.

1.1 Policy framework

Dutch government policy aims to maximise the contribution of ICT in society. The Netherlands has been in the top 10 of all kinds of international ICT rankings for a number of years now; it is one of the front runners in terms of ICT infrastructure in particular. It is not surprising, therefore, that one of the world's largest internet exchanges is located in the Netherlands: the Amsterdam Internet Exchange (AMS-IX).
In its ICT agenda 2008–2011, the Dutch government has laid down its ambition to still be in this leading position in 2015 in terms of the availability and use of new and existing ICT applications. The main ambitions of the ICT agenda are outlined in this section.

National ICT policy

The aim of the Balkenende IV government is to focus on the users of ICT. The appreciation of a good or service, and thus its success and survival, depends mostly on how it is judged by buyers, customers, consumers, and citizens. To improve the appreciation, all links in the chain must be examined: from producer to consumer, and everything in between. In this way, the contribution of each link can be evaluated. In the government's view, this approach is the key to good services provision.

The Dutch government has specified several priorities:

- *e-skills.* To be able to make the best possible use of digital services and applications, people must be able to work with ICT. As citizens, consumers, employees or producers, they must have enough skills to use the available digital services and applications. In this context, the government launched its *Digivaardig & Digibewust* (Digital Skills and Digital Awareness) programme in 2009. Two of the aims of this programme are to reduce the number of digital illiterates, and to promote a safe internet.
- *e-government.* Making government information and services available to individuals and companies online has been on the agenda for a number of years now; so has reducing the administrative burden. However, the actual implementation and use of the services is still in progress. The provision of basic electronic services is expected to become increasingly available to all individuals and companies over the next few years.
- *interoperability and standards.* As users expect to have access to more and more services and applications via various networks, it is important to make the underlying services and information accessible. This requires the interoperability of applications and services, as well as standards. To set an example, the government will stimulate the application of standards in government services.
- *social domains and ICT.* Innovation in social domains, such as care, education and security is essential. ICT can play a key role in removing bottlenecks.
- *service innovation and ICT.* As a result of global liberalisation, the Dutch services sector has plenty of growth opportunities in terms of exports. To realise these, the international front runners in the Dutch services sector must continue to innovate.

Alongside these priorities, the government will also pay more attention to a number of preconditions in the next few years. These preconditions constitute the ICT basis, which in turn rests on three pillars: (1) the basis of infrastructure and ICT research, (2) the services offered by and to small and medium-sized businesses and 'prosumers' (a contraction of producer and consumer), and (3) the reliability of ICT and free market processes.

European ICT policy

Unsurprisingly, the Dutch government is not alone in focusing on the important role of ICT in society and the economy. The Lisbon Agenda also underlines the significance of ICT.

It focuses on how ICT can contribute to the knowledge economy and information society. The i2010 programme, in which the i refers to information space, innovation in ICT and inclusion, is the EU policy framework for the information society and media. This integrated policy sets out to gain knowledge, promote innovation, support economic growth, and create more high-quality jobs. The European Commission is currently working on the policy for the period 2010–2015 (post-i2010).

1.2 The aim of this publication

Just keeping abreast of all the developments in ICT – let alone understanding them all – presents quite a challenge. Nevertheless, by publishing *The Digital Economy* annually, Statistics Netherlands wants to contribute to this by quantifying the role of ICT in the economy and in society.
Several additional documents about the relationship between ICT and society are available on Statistics Netherlands' website (www.cbs.nl/digital-economy). They include a statistical annex with more detailed information per chapter. Some of the methodology is also explained on the website.

Most of the concepts and statistical data used in this publication are based on international agreements with other national statistical offices in the European Union (EU), which makes European comparisons possible. These comparisons are made quite frequently in the book. Eurostat, the statistical office of the EU, plays a harmonising role in concept definitions.
The definitions and classifications used in the book also conform to those used by the Organisation for Economic Co-operation and Development (OECD) and the United Nations (UN). This makes it possible to compare Dutch figures with those for non-European countries.

1.3 Layout of the publication

As ICT is rapidly penetrating the world economy, it is important to have an up-to-date picture of the digital economy in the Netherlands. However, as so much relevant information is available, we have had to make choices. The structure of this book is similar to that of the previous edition. The chapters focus successively on the relationship between ICT and the economy, the ICT sector, and ICT use in society. The role of ICT knowledge is also discussed. The last chapter consists of capita selecta, which provide a deeper insight into a number of aspects described in previous chapters. Just as in previous editions, each chapter can also be read separately. The contents of the chapters are described briefly below.

Chapter 2 gives a brief explanation of recent economic developments, addressing the current economic situation where possible. The Dutch economy is the context in which ICT is developed. The chapter also examines the role of the ICT sector in the economy. Section 2.3 looks at ICT and employment. The chapter ends with a description of expenditure on ICT and the international trade in ICT goods and services.

Chapter 3 of the book examines the telecom sector. Sections 3.1 to 3.3 highlight the main services of the telecom sector: internet, telephone, radio and television. The

end of the chapter discusses the convergence of the various services and the consequences of this for telecom companies and consumers.

Chapters 4 to 6 follow with a description of the main ICT users. Chapter 4 focuses on ICT use by companies. After a brief review of the ICT infrastructure and ICT use by companies in section 4.1, data communication within the company is examined in section 4.2. The next section focuses on external data communication, for example linking order processing systems to ICT systems of customers or suppliers. The chapter goes on to look at e-commerce and finishes with a description of the extent to which businesses use Radio Frequency Identification (RFID).

Chapter 5 describes ICT use by households and individuals, starting with an account of the ICT provisions in section 5.1, and turning to use of ICT: section 5.2 describes the main internet activities of Dutch internet users, showing the diversity of the activities they engage in. The last section looks at online shopping.

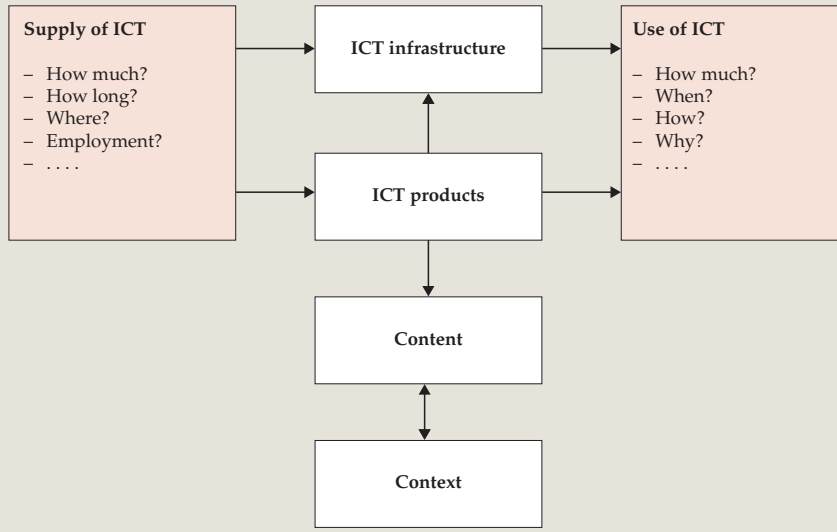
Chapter 6 examines ICT use in the public sector. The Dutch government sets great store by high quality ICT use across the public sector. Section 6.1 looks at the performance of e-government. The second section describes ICT use in education, and the chapter concludes with ICT use in health care and welfare. In all these public sectors, ICT could play a major role in solving social problems.

Chapter 7 looks at ICT-related knowledge development in the Netherlands. Section 7.1 discusses R&D expenditure by the ICT sector. This level of spending is an indication of the national R&D endeavours by companies in the Netherlands. Some of these projects result in applications for patents, the topic discussed in section 7.2. The third section describes ICT education, and the last section gives an overview of the ICT skills of the Dutch population. The subject e-skills is also addressed in Chapter 8.
Statistics Netherlands' book *Kennis en economie* (Knowledge and the economy) looks into the knowledge economy in more detail. Chapter 7 of this book addresses the specific relationship between knowledge and ICT.
The final chapter of this book contains contributions on four selected themes. These are more detailed examinations of topics discussed in previous chapters. The first contribution, a co-production of Statistics Netherlands and *De Nederlandsche Bank* (the Dutch central bank), describes the development of electronic payment in the Netherlands. The second contribution reflects on e-skills and explores the state of affairs in science and policy in this area. The third contribution to the capita selecta, written by Harry Bouwman (Delft University of Technology), covers the use of mobile services and compares the situation in the Netherlands with that in Finland. The fourth and final contribution is written by Mathieu Andriessen of NLkabel. It looks at next generation internet at present and in the future, and the new possibilities it offers.

Model for the digitisation of society

This publication is based on a model that focuses on the supply and use of ICT, and in which the ICT sector and ICT infrastructure also play a major role (see box). This simplified model is derived from an OECD report (OECD, 2008b) measuring the impact of ICT on society.

***Model of an information society*[1)]**



[1)] Simplified reproduction.

This model depicts the interface between supply and demand; the supply of ICT, for example, includes the ICT sector of the economy, while demand consists of ICT use in companies, the public sector and households. The models is used as a framework for various ICT studies. It can be used to answer the following questions:

– What kind of ICT products or internet activities are relevant in the Netherlands?
– Which technologies do users use?
– How often and how intensively do the various groups use ICT?
– How much employment does the supply of ICT generate?

The model is a broad one. The top level represents ICT infrastructure: investment and services on which the information society relies. The next level is ICT products. These include, for example, imports and exports, price and quality. The content level refers to the actual information which is transferred via the electronic networks. Lastly, the bottom level – context – shows that every ICT

study must take into account general national, social and economic developments, political factors and other relevant developments, such as globalisation.

The arrows in the model show not only that ICT has an effect, but that it, too, can be affected. It also illustrates that the impact of ICT consists of two parts: the impact as a result of ICT use and the impact of the ICT sector itself.

Source: OECD, 2008b.

International benchmarking

Partly at the request of the Ministry of Economic Affairs, for a number of years now this series has included a wide range of statistics on ICT developments in other countries. The aim of this benchmarking is to compare the Dutch situation with that in other countries and so put the Netherlands in an international perspective; to this end the book looks at the most recent and most relevant situations, rather than presenting time series.

The reference countries are not chosen at random, and are not the same for each indicator. Depending on availability and relevance, the benchmark countries are:

1. Scandinavian countries, because they are very advanced in ICT.
2. Other leading countries: Germany, France, United Kingdom, United States, Japan, South Korea and Canada.
3. EU-25 or EU-27 average, making an overall comparison possible, in which figures from non-included EU countries are taken into account.
4. Emerging economies, like China and India.

Most of the data used for the international comparisons are not as recent as the Dutch data, as it takes the international agencies some time to collect and process the data from the various countries.

The main sources for the compared indicators are Eurostat and the OECD. Eurostat presents results from the harmonised surveys on ICT use by companies and households (and individuals) in Europe. The OECD produces many regular and one-off publications on ICT use in OECD countries.

The added value of the OECD indicators lies partly in their diversity, but mainly in the fact that data are collected from other major countries that the Netherlands wants to emulate.

2. ICT and the economy

The growth of the Dutch economy in the last few years continued more modestly in 2008. The gross domestic product (GDP) grew by 2 percent in that year. However, in the first three quarters of 2009 a sharp decline set in. The downturn in world trade resulted in lower export growth in the Netherlands in 2008, and even in a decrease in exports in the second quarter of 2009. Government consumption was the only category of expenditure that was higher in the first half of 2009 than one year previously.

The ICT sector has grown significantly in the last two decades, but has also proved to be sensitive to the economic cycle. The sector has become less sensitive to economic fluctuations in recent years, partly because ICT has increasingly become part of basic business processes. Production and value added in the ICT manufacturing sector were lower in 2008. But the ICT services sector grew, particularly the computer service bureaus. The gross value added of the post and telecommunication sector has been declining since the third quarter of 2008. From an international perspective, the share of the Dutch ICT sector in total value added of the Dutch business sector is only limited.

The share of ICT companies in the total number of companies in the Netherlands increased from 3.9 to 4.5 percent in the period 2006–2008. The ICT services sector is mainly located in the Randstad region, around Eindhoven and around Arnhem/Nijmegen; ICT manufacturing companies are distributed more evenly across the country.

The employment rate in ICT increased significantly in 2008. The impact of the economic crisis on employment in this sector is still unclear. In terms of employment, too, computer service bureaus showed the fastest growth. The share of ICT specialists is relatively high in the Dutch labour force compared with the benchmark countries.

Investment in ICT increased by 21.4 percent in the period 2004–2007. The public and private sector spent substantially more on software, in particular, but investment in hardware also rose annually in this period. This considerably weakened the dominant role of investment in electronic networks observed around the turn of the century. The communication industry was one of the main investors in ICT. In terms of the share of ICT investment in total investment, the Netherlands is among the international leaders.

The value of Dutch ICT exports nearly doubled between 1998 and 2008. This was favourably affected by a significant increase in world trade on the ICT market. International trade in software is growing significantly in the Netherlands compared with other countries. Germany is one of the Netherlands' main ICT trading partners, in terms of both exports and imports. In the last ten years, the Netherlands has been doing more and more ICT trade with east European countries.

2.1 *The Dutch economy*

In the period 2002–2008, gross domestic product (GDP) growth peaked at 3.6 percent in 2007 (table 2.1.1). In 2008 the Dutch economy grew by 2 percent. As a result of the credit crisis, economic growth came under heavy pressure in 2009. In the third quarter of 2009, GDP was 3.7 percent lower than in the same quarter one year previously.

The downturn in the economy has had a negative impact on many sectors. The sectors manufacturing, transport, trade and hotels and restaurants have been hit particularly hard by the crisis and the construction sector also showed a significantly lower production in mid-2009 than the previous year.

These developments put the Dutch economy in even further decline than in the lean years 2002 and 2003, when the financial internet hype resulted in almost zero growth. The downward trend is in line with developments in Europe. Economic growth in the European Union fell from just under 3 percent in 2007 to less than 1 percent in 2008 (European Commission, 2009a).

Slower growth for expenditure

Dutch economic growth has largely been tempered by the decline in world trade. Because of the openness of the Dutch economy, its trade relations with foreign countries are essential. After the downturn in 2002 and 2003, the growth in exports of goods and services contributed importantly to economic recovery. In 2008, however, exports could not repeat this role, as the volume was more than 5 percent points lower than the peak of four years earlier.

Table 2.1.1
Developments in (final) spending categories of GDP, 2002–2008[1)]

	2002	2003	2004	2005	2006	2007*	2008*
	year-on-year volume changes in %						
Consumer spending	1.7	0.8	0.6	0.8	2.9	2.4	1.5
households[2)]	0.9	–0.2	1.0	1.0	–0.3	1.7	1.3
government	3.3	2.9	–0.1	0.5	9.5	3.7	2.0
Fixed capital formation (gross)	–4.5	–1.5	–1.6	3.7	7.5	4.8	4.9
Exports of goods and services	0.9	1.5	7.9	6.0	7.3	6.7	2.7
Imports of goods and services (–)	0.3	1.8	5.7	5.4	8.8	5.1	3.7
Gross domestic product (market prices)	0.1	0.3	2.2	2.0	3.4	3.6	2.0

Source: Statistics Netherlands, National accounts.

1) The figures for the two most recent years are provisional or revised provisional figures.
2) Consumption by households and NPI households.

In 2008 the volume growth of Dutch exports dropped below that of imports. In the second quarter of 2009, the volume of exports of goods and services was even nearly 11 percent lower than twelve months previously. Imports of goods and services also decreased in the first half of 2009, particularly imports of durable consumer goods and capital goods. In absolute terms, too, exports decreased by more than imports in the second quarter of 2009 compared with the same quarter in 2008; just over 12.5 billion versus just over 11 billion euro.

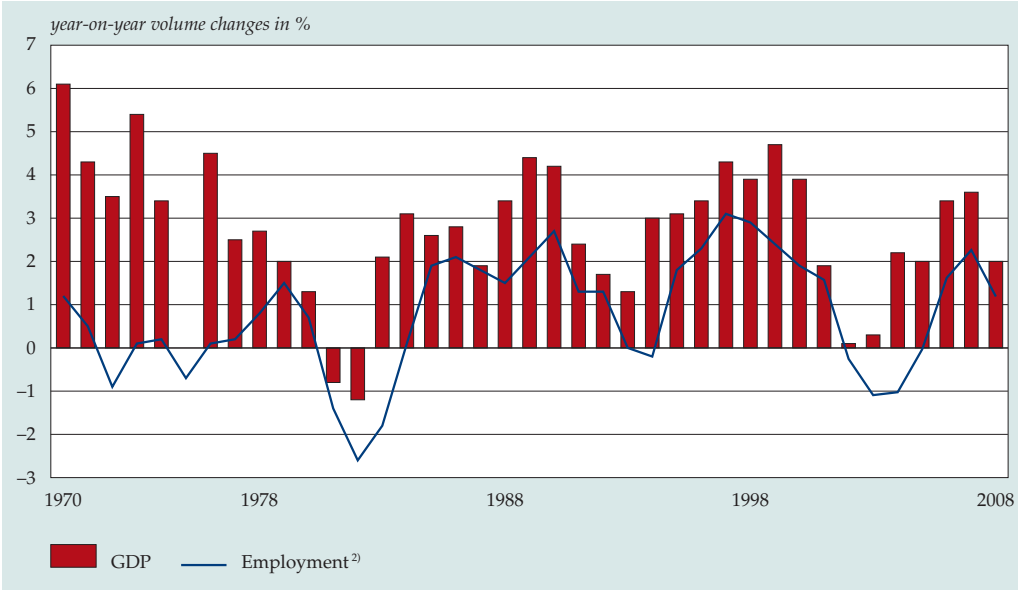
In spite of the decrease in both imports and exports, 2008 was characterised by a stable growth of investment in fixed assets. However, this picture did change in the first half of 2009, when investments also dropped significantly.
In 2008 the increase in consumer spending was lower than GDP growth for the fifth consecutive year. Lower spending on durable consumer goods was a main factor in the further decline of total consumer spending in 2008. In addition to buying fewer new cars and home furnishings, households also spent significantly less on consumer electronics.
The growth rate of government consumption slowed down for the second year in a row, after a noticeable peak in 2006. In the second quarter of 2009, the volume of government consumption was 2.8 percent higher than one year earlier. This was the only expenditure category that increased in the first half of 2009. Spending on care in particular, but also on public administration, increased.

GDP is determined by the above-mentioned national spending categories (consumer spending and investment), plus exports of goods and services, minus imports, and plus stock changes. Table 2.1.1 shows the development of these categories in 2002–2008.

Clear economic cycle

Since 1970 the Dutch economy has been characterised by periods of substantial economic growth, followed by years of decline. Figure 2.1.1 shows the developments in GDP and employment in this period. The highest economic peak was at the end of the 1990s: from 1996 to 2000 average annual economic growth was 4 percent. In this period, the ICT sector was an important driving force behind these high growth rates. Economic growth stagnated in the next few years. Partly as a result of the disappointing performance of internet companies after the turn of the century, investment in the ICT sector decreased and telecom companies faced huge debts as they had purchased UMTS licenses and invested in company takeovers. The sector using ICT (commercial and business services) benefited particularly from – and thus contributed to – the recovery of the Dutch economy after 2004. However, in 2008 the start of the credit crisis weakened GDP growth. Employment growth also slowed down in 2008, following a five year period of increase after its initial fall. In the second quarter of 2009, the number of jobs was even 1.2 percent lower than in the same quarter in 2008. Employers cut back on temporary jobs in particular.

2.1.1 GDP and employment, 1970–2008 [1]



Source: Statistics Netherlands, National accounts.

[1] 2007 and 2008: provisional figures.
[2] Labour volume of employed persons (in full-time equivalents).

Efficient use of production factors pushes up productivity

In the current economic and financial crisis, the production and application of ICT continue to be a driving force behind innovation, productivity and ultimately economic growth. First, ICT-producing industries contribute directly to productivity and economic growth as a result of their own rapid technological advances. In addition, use of ICT increases the productivity of other production factors. Lastly, there are the spillover effects on the rest of the economy, as ICT diffusion leads to innovation and productivity gains in industries applying ICT (European Commission, 2009a).

One strategy to improve the international competitiveness of the Netherlands comprises redesigning the production processes and thus increasing labour productivity (value added per hour worked). Effective investment in ICT applications plays an important role in this respect. Increasing investment in ICT will also strengthen the innovation potential of the Netherlands.

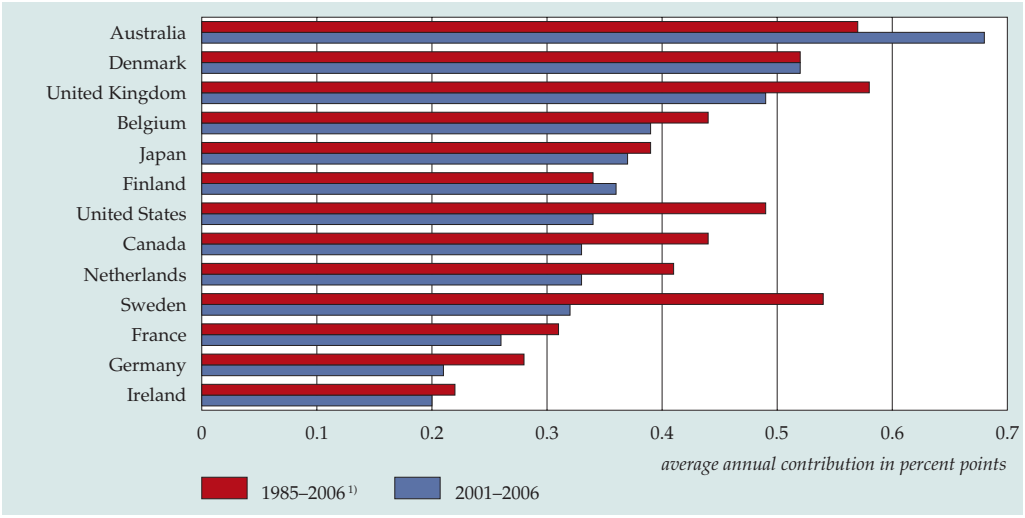
Developments in employment and labour productivity determine real GDP growth (in purchasing power parities). Effective use of new technology provides a major impetus to the increase in labour productivity. From an international perspective, the average annual increase in labour productivity in the Netherlands was relatively low (1.1 percent) in 2003–2008 (CBS, 2009b). If GDP growth is higher than the increase in the active labour force (in fte's), labour productivity is higher, (if the

volume of fte's is unchanged). In figure 2.1.1, labour productivity is implicitly shown as the distance between GDP (tops of the bars) and the employment line. Analysts generally look at labour productivity of the business sector. Labour productivity growth may fluctuate significantly, partly because the job market is usually slow to respond to economic developments, and partly because capital, ICT and other investments (e.g. R&D) also contribute to GDP growth. We shall discuss the latter aspect at the end of this section.

ICT capital contribution to economic growth decreasing

Investments in ICT have clearly contributed to GDP growth internationally. In most countries the average annual contribution of ICT capital in the period 2001–2006 was lower than the average in the period 1985–2006 (figure 2.1.2). The end of the financial internet hype (see section 2.2) in 2001 was a major factor in this decrease in Europe, the United States and Japan as well as many other countries. Since then European companies have invested relatively little in expanding or replacing ICT capital. Two frequently mentioned causes for this are that investors and companies expect low returns on this investment, and European companies have been slower to adopt new technologies than those in the United States. The latter country has a first mover advantage, as businesses there invest more in research and development (R&D) and are quick to adapt to new ICT technologies (European Commission, 2008).

2.1.2 Contribution of ICT capital to GDP growth, international, 1985–2006



Source: OECD, Productivity Database 2008.

1) Belgium and Japan: 1985–2004. Denmark, Finland, Ireland, the Netherlands and the United Kingdom: 1985–2005. Germany: 1995–2006.

Productivity differences between Europe and the United States

Labour productivity growth in the United States increased from an annual average of 1.2 percent in the period 1973–1995 to 2.3 percent in 1995–2006 (EUKLEMS database). Conversely, annual productivity growth in the EU-15 (the European Union until 2004) slowed down between these two periods: from 2.4 percent in 1973–1995 to 1.5 percent in 1995–2006 (European Commission, 2009). In the economic literature this difference is often attributed to the late emergence of the knowledge economy in Europe (Van Ark et al., 2008). The stagnation of productivity growth in the EU is largely caused by a less flexible production structure, with a focus on low and medium-tech products. Companies producing these products are usually slower to respond to international competition and rapid technological change than high-tech companies.

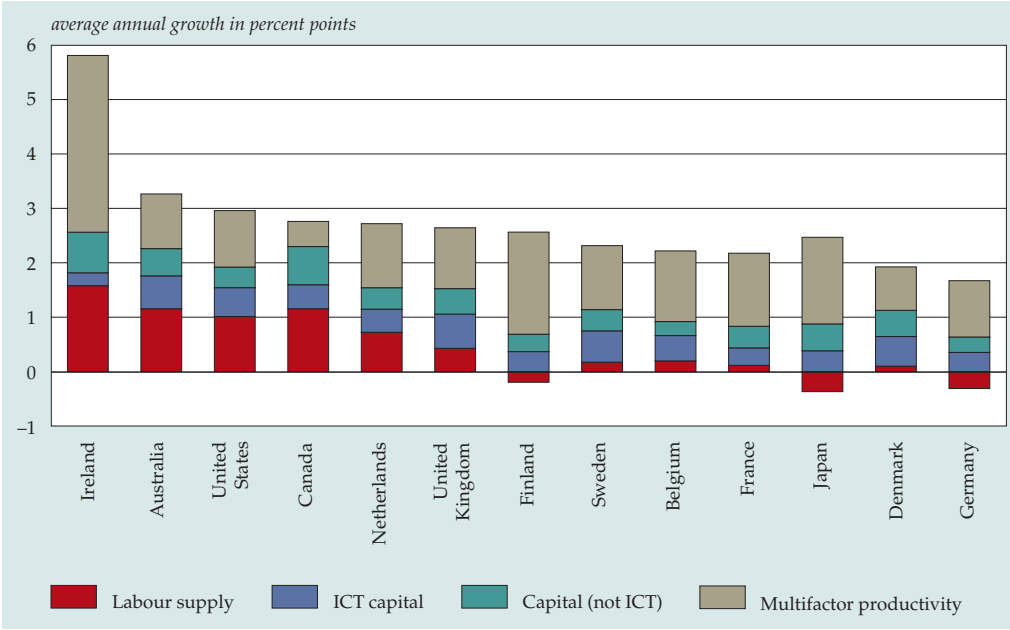
In the mid-1990s, higher productivity levels of ICT-producing industries and investments in ICT capital resulted in a sharp rise in economic growth in the United States. The largest differences between the EU and the United States, and between the EU countries, were based on the efficiency of the entire production process. In the United States this multifactor productivity (production growth that cannot be explained by increased input) rose from 0.5 percent to 1.4 percent between 1995 and 2006. [1)] In the EU, however, it fell from 0.9 to 0.3 percent. American multifactor productivity growth was particularly high in services, such as trade, finance and business services.

ICT capital important production factor

GDP growth in Ireland was clearly higher than in other countries for a long period (1985–2006) (figure 2.1.3). Multifactor productivity contributed significantly to Irish GDP growth. Finland, Japan, Belgium and France, too, realise a larger part of economic growth than the Netherlands from productivity gains by effectively combining various inputs. These efficiencies are often accompanied by increased capital and reduced labour input. Important exceptions in this respect are Australia, the United States and Canada, where labour is still an important pillar for GDP growth.

The importance of ICT for economic development has been considerable in the Netherlands in the last twenty to twenty-five years. In the period 1985–2006, an average 16 percent of GDP growth was based on the input of ICT capital (figure 2.1.3). In relative terms, ICT capital contributes more to economic growth in for example Denmark (28 percent), Sweden (25 percent) and the United Kingdom (24 percent). Since the turn of the century, the impact of ICT has become even more visible. Investment in ICT capital accounted for almost one third of average annual GDP growth in the Netherlands between 2001 and 2006.

2.1.3 Contribution of production factors to the growth of GDP, international, 1985–2006 [1)]



Source: OECD, Factbook 2009.

[1)] Belgium: 1985–2004. Australia, Denmark, Finland, Netherlands and the United Kingdom: 1985–2005. Germany: 1991–2006.

In 2007 the contribution of the ICT sector to productivity growth was lower in the EU than in the United States (European Commission, 2008). The reasons for this are that the ICT sector is smaller in the EU than in the United States (5.3 and 6.6 percent of GDP respectively) and efficiency advantages, of among other things technological progress, were smaller in the EU (5 percent) than in the United States (6.2 percent).

2.2 *The ICT sector*

This section presents an overview of the Dutch ICT sector. It starts with a macro-economic description, discussing value added, investment and spatial concentration of ICT companies. After this, the telecom sector is examined.

Definition of the ICT sector

The domain of ICT focuses on information systems, telecommunication and computers. The ICT sector consists of ICT manufacturing and ICT services, including the telecom sector. The ICT manufacturing industry makes products to store, process and exchange electronic information. The main activities of this industry are the design and production of information and communication equipment. ICT services support the process of electronic data processing and communication. The

exact distinction between the two branches is internationally agreed, and is summed up in table 2.2.1. Within the distinguished activities, the development and use of ICT is the core business. Below we discuss recent economic developments in the ICT sector.

Table 2.2.1
Definition of ICT-sector (SIC 1993)

SIC 1993	Activity
ICT manufacturing	
3000	Manufacture of office machines and computers
3130	Manufacture of isolated wire and cable
3210	Manufacture of electronic components
3220	Manufacture of television and radio transmitters and apparatus for line telephony en 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	
6400	Post and telecommunication
7200	Computer service and ICT bureaus, etc.

Source: OECD, Statistics Netherlands.

ICT sector and SIC 2008

The Standard Industrial Classification (SIC) is a classification of industries that Statistics Netherlands uses to classify companies by their main activity. The SIC is similar to the current European statistical classification of economic activities NACE. The NACE classification is based on the ISIC (International Standard Industrial Classification of all economic activities) of the United Nations, which is used around the world.
NACE has been revised several times, and in 2008 a new version came into effect. The purpose of this revision is to keep up with technological developments and structural changes in the economy (EU Regulation 1893/2006). The new classification reflects changes in business activity and in types of activity. For example: new emerging activities in the ICT sector. In line with the NACE revision, Statistics Netherlands has replaced its SIC 1993 by SIC 2008. This has certain implications for statistics and registrations, however.

Because of the transition to the new SIC, the branches within the ICT sector have been adjusted. In the overview below, the internationally agreed classification for the ICT sector is shown in terms of SIC 2008 classes. Where figures are available according to SIC 2008, they are included in this book. However, as no comparable figures for time series are yet available according to the new classification, the SIC 1993 classification is still used in this section.

Definition of ICT sector (SIC 2008)

SIC 2008	Activity
ICT manufacturing	
261	Manufacture of electronic components and circuit boards
262	Manufacture of computers and peripherals
263	Manufacture of communication equipment
264	Manufacture of consumer electronics
268	Manufacture of information media
ICT services	
465	Wholesale of ICT equipment
582	Publishing of software
61	Telecommunications
6201	Development, production and publishing of software
6202	Advice on information technology
6209	Other service activities in the field of information technology
631	Data processing, hosting and related activities; webportals
951	Repair of computers and communication equipment

Source: OECD, Statistics Netherlands.

ICT sector: dynamic but sensitive to economic change

The ICT market has grown significantly in the past twenty years, but it has also been sensitive to economic fluctuations. Initially the market was more sensitive to macro-economic trends than most other industries, the peaks were higher, the downfalls deeper. Examples are the first wave of automation in 1990 and the turn of the millennium when the ICT market grew by more than GDP. Since then, the ICT sector has become less sensitive to economic change, as information technology has increasingly evolved to become a part of primary business processes in all sectors of industry.

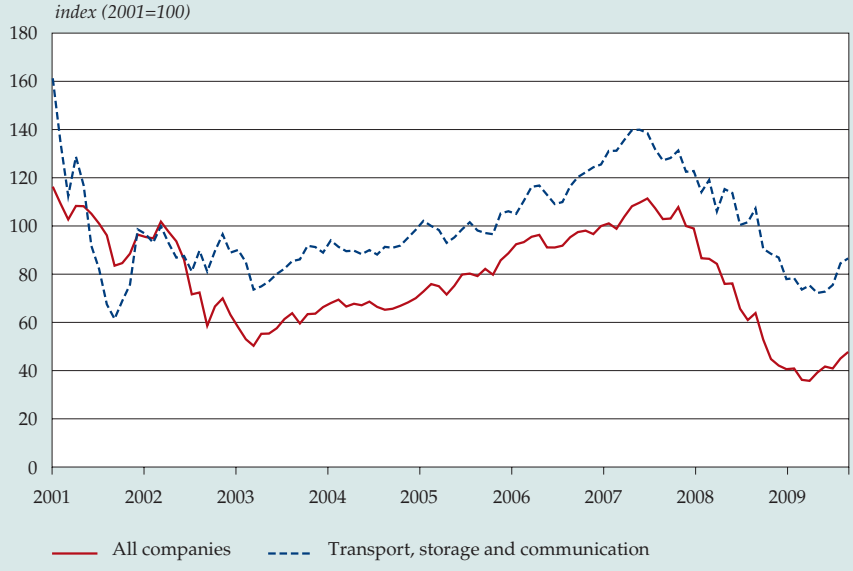
Until 2000 the Dutch ICT sector grew steadily; ICT services and investments in electronic networks grew particularly strongly. Partly because of this, the ICT sector contributed more than average to economic growth and innovation in this period. The Dutch economy benefited indirectly from the performance of ICT applications in other production processes as well. Companies in various sectors (including manufacturing, services and transport) increased their productivity by investing in computers, broadband and software.

Share prices ICT sector in line with the economic trend after the internet hype

In the last five years of the previous century, the ICT sector experienced a period of high growth. ICT services in particular expanded very quickly. The telecom sector invested a lot of money in electronic networks and UMTS licences in this period, and takeovers of other companies – often also telecom companies – were also common. However, revenues did not keep pace with this spending. From 2001 there was a sharp decline. Share prices dropped significantly, hitting ICT and telecom companies hardest. Looking back, it was only a financial hype, accompanied by overinflated expectations about how fast new technologies could be brought to market.

In the period 2001–2003, investment by the ICT sector fell, while employment also decreased. Other industries, the ICT users, were more cautious with respect to investing in computers and software. Across industry, companies marked time. The figure below shows clearly how the development of telecom share prices on the Amsterdam Stock Exchange runs approximately parallel to that of the total stock market. Although the line in the graph includes transport and storage alongside the telecom sector, this hardly obscures the picture. The ICT sector is increasingly seen as a normal economic sector.

Share prices on the Amsterdam Stock Exchange, 2001–2009



Source: Statistics Netherlands, StatLine.

In 2004, the ICT sector started to pick up again. The financial situation of various telecom companies improved and the application and use of ICT was increasingly expanding. This is also reflected in the shares prices. From the second half of 2008, the financial crisis caused a sharp drop in lending and a marked reduction in producer and consumer confidence.

Global economic activity went into serious decline and there were historical decreases in trade and production. The downturn of share prices in the transport, storage and communication sector is a little less sharp than that of the total stock market. The ICT services sector (telecom and software) tempered the crisis in the ICT sector, as demand continued for services such as internet and telephony. The internet industry is defying the crisis better than other parts of the ICT sector.

After the hype: short ICT revival

Following a number of years of growth, ICT manufacturing seems to have entered a period of decline. In 2008 both production value (–2.5 percent) and value added (–3.5 percent) fell, while the labour volume remained stable. There had already been signs of the downturn in the previous year, in particular a sharp fall in investment (table 2.2.2). As a result of this, the share of ICT manufacturing within the ICT sector decreased. In 1995, ICT manufacturing accounted for 44 percent of the production value of the ICT sector. By 2008 this had dropped to 24 percent. This downward trend is also visible in the value added of the ICT manufacturing. For many years the contribution of ICT manufacturing has been small compared with that of ICT services. ICT manufacturing accounted for nearly 10 percent of value added in the ICT sector in 2005; in 2008 this had dropped to 7.5 percent. Even during the boom in ICT goods trade in the late 1990s, growth rates for Dutch ICT manufacturers were never more than average.

The situation in the Dutch ICT manufacturing industry – more than that in the ICT services sector – is influenced by a number of large multinational companies. Although these companies are part of the Dutch ICT manufacturing industry, some parts of them do not contribute to the national economy as they are located abroad. Production, investment and employment are only included in the domestic ICT sector if they relate to companies or company branches located in the Netherlands. Therefore, not all costs and revenues are reflected in the performance of the Dutch ICT manufacturing industry. This may present a distorted picture if costs, for example for R&D, are paid for in the Netherlands, while the revenues from actual production of new or improved ICT goods are received elsewhere.

ICT services sector: computer service bureaus as the driving force

After the substantial growth in the period 1996–2000, the economic decline also led to less favourable market conditions for the ICT services sector. Following a period of modest growth, and even decrease, between 2001 and 2004, production, value added and investment started to pick up again in 2005. The ICT services sector then continued to grow to 2008, although the increase was more moderate from 2007, particularly for production value and investment. Employment (labour volume) in ICT services was also slow to respond to changes in the economic climate. In spite of the nearly zero growth in total investment in ICT services in 2007, this figure increased significantly in the computer services sector.

Computer service bureaus are the driving force behind growth in the ICT services sector. This branch expanded substantially between 2004 and 2008 (table 2.2.2). In 2004, investment started to grow again after a period of low producers' confidence. The turnover of companies providing computer and IT services is generated mainly from activities in the field of consultancy, developing and implementing information systems, management and operation. In 2008 turnover grew for the fifth consecutive year. Moreover, the growth rate of value added increased from 2004 to 2006, indicating that the profitability of computer service bureaus improved in that period. Growth of value added slowed down in 2007 and 2008. The initial increase in growth of value added was also fuelled by a reduction in the workforce, the main cost component.

Table 2.2.2
ICT sector compared with the Dutch economy, 2004–2008

	2004	2005	2006	2007*	2008*
	year-on-year volume changes in %				
Production value					
ICT manufacturing	3.1	1.9	3.6	1.4	–2.5
ICT services	1.2	4.2	1.1	4.3	2.0
of which:					
post and telecommunication	0.6	2.5	2.6	2.0	0.1
computer service bureaus	2.2	7.2	8.9	7.5	4.4
Total ICT sector	1.7	3.6	4.6	3.0	0.8
Netherlands	1.9	2.1	3.6	3.9	2.0
Gross value added					
ICT manufacturing	6.9	5.9	2.6	2.0	–3.5
ICT services	2.5	5.0	5.5	4.0	2.8
of which:					
post and telecommunication	2.5	3.7	3.1	1.4	1.1
computer service bureaus	2.4	7.1	8.9	7.3	4.6
Total ICT sector	2.9	5.1	5.0	3.0	2.3
Netherlands	2.3	2.1	3.3	3.7	2.2
Investment					
ICT manufacturing[1)]	–7.3	9.0	4.9	–12.3	.
ICT services	7.8	16.2	8.4	0.1	.
of which:					
post and telecommunication	5.5	16.3	7.5	–9.1	.
computer service bureaus	17.6	15.7	12.0	35.2	.
Total ICT sector	3.8	14.5	7.6	–2.7	.
Netherlands	–1.6	3.7	7.5	4.8	.
Labour volume of employed persons					
ICT manufacturing	–3.8	–3.5	0.2	–0.4	0.0
ICT services	–2.6	2.3	3.6	2.4	3.3
of which:					
post and telecommunication	–3.4	–3.7	–1.0	–4.9	–2.6
computer service bureaus	–2.0	7.3	7.0	7.4	6.8
Total ICT sector	–2.8	1.4	2.7	1.7	2.4
Netherlands	–1.0	0.0	1.6	2.3	1.2

Source: Statistics Netherlands, National accounts.

[1)] For investment, ICT manufacturing is defined as SIC (Standard Industrial Classification) 30–33. Investment data are not 'sufficiently detailed to be presented according to the internationally agreed definition of the ICT manufacturing sector.

Post and telecom near to zero growth

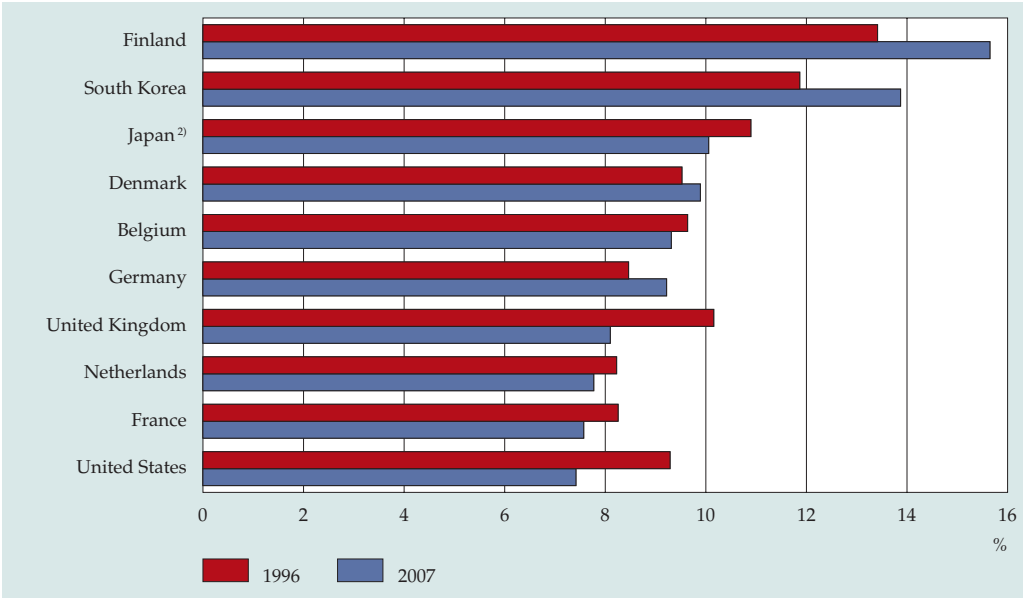
Production value (turnover) and value added in the post and telecommunications sector continued to grow for a long time, in spite of the economic downturn after the turn of the century. However, more recently a clear stagnation has set in. In 2008, turnover and value added increased only marginally, while the employment rate fell for the fifth year in a row. Investment in this sector had already dropped sharply in 2007. The high levels of turnover and value added in post and telecommunications were realised by continually reducing the workforce. This is a capital intensive sector, as investment spending on fixed assets is very substantial: buildings, machinery, equipment and computers.

Value added in Dutch ICT limited in international terms

In 2007, the Dutch ICT sector accounted for 7.8 percent of total value added in the business sector (figure 2.2.1). The Netherlands was well behind leader Finland (15.6 percent) and neighbouring countries like Belgium, Denmark and Germany. While the economic significance of the ICT sector grew steadily in the latter two countries, the share of this sector in the Netherlands (after the financial internet hype) slumped in 2007 to below that of 1996. Leaders Finland and South Korea also showed the largest growth in 1996–2007. Production of hardware has already been a major source of income for these countries for a number of years now. The contribution of the ICT sector to total value added fell by most in the United Kingdom and the United States.

The decrease in the United Kingdom, the United States and Japan corresponds with the worldwide shift in the ICT market. In 2007 non-OECD countries accounted for more than 20 percent of the ICT market. ICT expenditure in Brazil, China, India, Indonesia and Russia grew by more than 20 percent annually in the period 2003–2007. About half the global production of ICT goods takes place in countries outside the OECD; China and India, in particular, now have several prominent companies (OECD, 2008).

2.2.1 Share of the ICT sector in the value added of the business sector, international, 1996 and 2007 [1)]



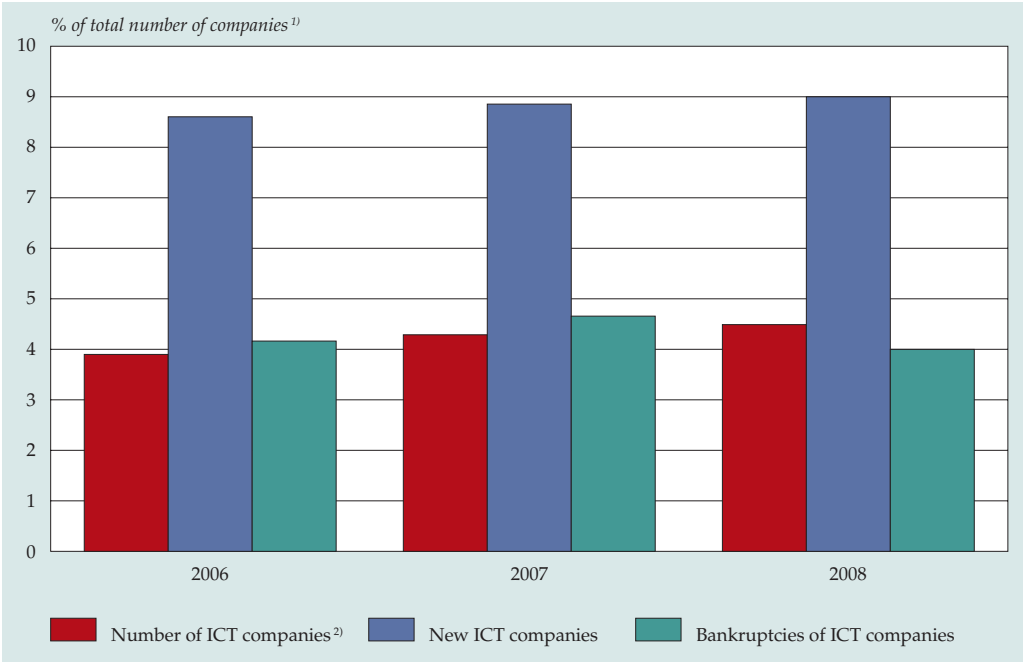
Source: OECD, STAN database 2008.

1) ICT manufacturing is defined as SIC (Standard Industrial Classification) groups 30–33 (D). ICT services in this table include transport, storage and communication (I).
2) Japan: 2006 instead of 2007.

ICT accounts for more and more of Dutch business

The development of the number of ICT companies in relation to the total number of companies is a good indicator of the success of the ICT sector. In 2008, 4.5 percent of Dutch companies were active in the ICT sector. This is just over half a percent point more than in 2006 (figure 2.2.2). The growth was the result of a slight increase in the percentage of new companies in 2006–2008 (from 8.6 to 9.0 percent), and a slight decrease in the share of bankruptcies (from 4.2 to 4.0 percent).

2.2.2 Share of ICT companies in total companies, new companies and bankruptcies, 2006–2008



Source: Statistics Netherlands.

1) Sectors Mineral exctraction (C), Manufacturing (D), Construction (F), Repair of household goods and trade (G), Hotels and restaurants (H), Transport, storage and communication (I), Rent of transport, machinery and equipment (K71), Computer and information technology (K72), Other business activities (K74), Environmental services (O90), Other services (O93).

2) From 1 July 2006 Statistics Netherlands' General Business Register has been substantially revised. Therefore data on the number of companies and institutions after 1 January 2007 are not comparable with data for previous years.

In absolute terms, the number of new companies in the ICT sector is much larger than the number of bankruptcies. In the period 2006–2008, the number of new ICT companies was twenty times the number of bankruptcies in the sector. As a result of the economic decline, the number of new companies in the ICT sector has decreased. In 2008, nearly 3.5 thousand ICT companies started up, some 300 fewer than in the previous year. Computer service bureaus accounted for no less than 82 percent of these new companies. The high number of business starts in the ICT

sector can partly be explained by the low threshold of the ICT services sector. The start-up costs for a service company are generally lower than for a manufacturing company. Whether these start-ups result in economic growth is unclear. New ICT companies often have few staff and the jobs created do not always compensate for the loss of ICT jobs in larger companies.

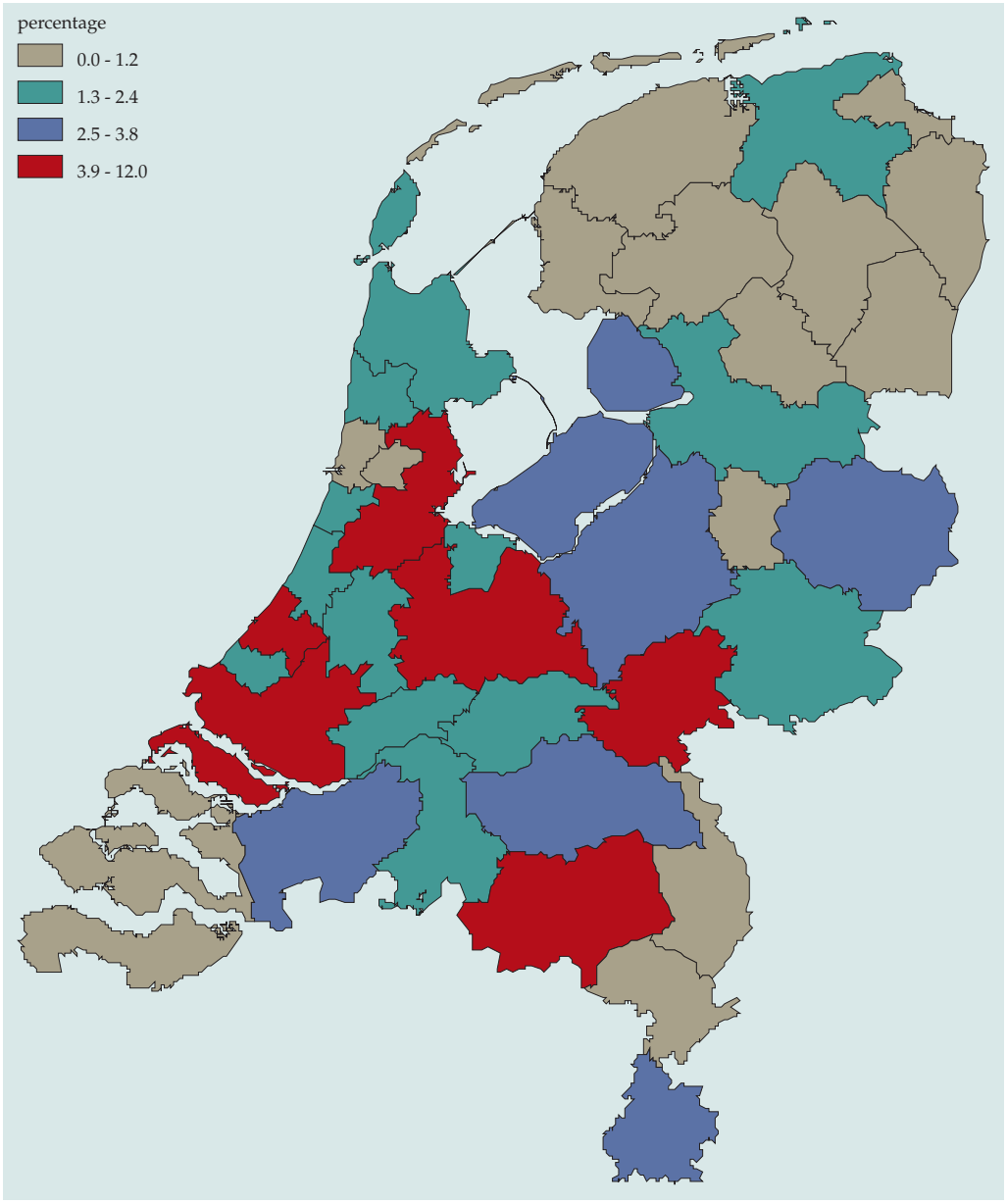
ICT sector located mainly in Randstad and North Brabant

ICT companies are more concentrated in some provinces and regions than in others. On 1 January 2008, there were just over 31 thousand branches of ICT companies in the Netherlands.[2)] This is about three times the number in 1995. The ICT services sector – which accounted for about 96 percent of the ICT branches in 2008 – realised almost all of this growth.

The ICT services sector is located mainly in the Randstad area and in the regions Eindhoven and Arnhem/Nijmegen (map 2.2.1). Most of these are office locations in urban areas. ICT services are sensitive to 'soft' location factors, such as a vibrant cultural climate and attractive meeting venues. Key location factors like local rates, accessibility and availability of premises also play a role, but are apparently less important than in other sectors (AIM, 2009).

At a provincial level, ICT services were mainly concentrated in South Holland (22.6 percent) in 2008, closely followed by North Holland. Although the urban agglomeration Groot-Rijnmond (around Rotterdam) attracts many business services, including ICT, the Amsterdam agglomeration is the prime location for ICT services: on 1 January 2008 nearly 12 percent of all branch offices of ICT services companies in the Netherlands were located in this region. These include many software consultancy and development companies, in particular, activities that are also popular in Utrecht. Further concentrations of ICT services branches were also present in the agglomeration around The Hague and in the south of North Brabant.

Map 2.2.1 Share of ICT services company locations per COROP area (NUTS III), 1 January 2008

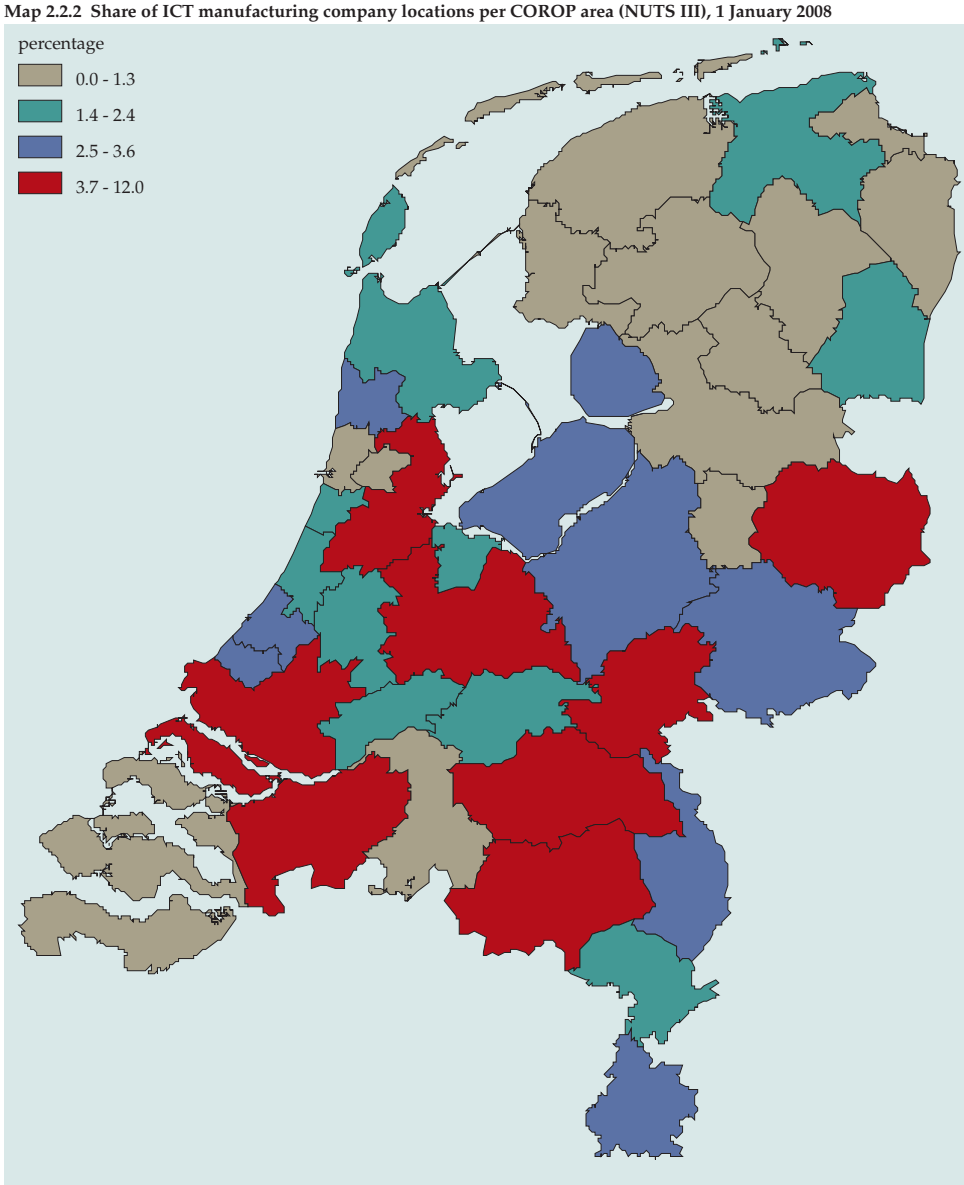


Source: Statistics Netherlands, StatLine.

ICT manufacturing locations are spread more evenly across the country than ICT services locations (see map 2.2.2). The Randstad is less dominant in this branch; many of these companies are also located in the south (Eindhoven, 's-Hertogenbosch) and east (Twente, Arnhem/Nijmegen) of the country. Regions in North

Brabant acounted for the largest share of ICT manufacturers on 1 January 2008: 21.4 percent of all ICT manufacturing locations. Another one in five were located in South Holland, followed at a distance by North Holland, with 13.8 percent. Within North Brabant, the centre of ICT manufacturing is located around Eindhoven, mostly businesses manufacturing electronic components. Just as in 2007, Utrecht and the Rotterdam agglomeration Groot-Rijnmond followed; many of the ICT companies in these cities manufacture measuring, regulating and control equipment.

Map 2.2.2 Share of ICT manufacturing company locations per COROP area (NUTS III), 1 January 2008



Source: Statistics Netherlands, StatLine.

Both maps indicate a degree of regional concentration of ICT manufacturing and services. It is difficult to explain the reasons for this. General location factors (e.g. space, price, accessibility and distance to customers) and more specific considerations (e.g. clustering) play a role in this respect.

Recession affects telecom sector

The remaining part of this section looks specifically at the telecom sector. In addition to a description of the main telecom activities, the performance of this sector is compared with that of the total Dutch economy.

Telecommunication includes the physical infrastructure (e.g. telephone cables and antenna masts) and services in the field of mobile and fixed-line telephony, internet, radio and television. The telecom sector includes phone companies, ISPs and cable companies which transport radio and television signals.

In 2008 the Dutch telecom sector contributed approximately 2.2 percent to the gross domestic product.[3)] This share has decreased gradually since 2003. In spite of ostensibly more efficient business processes, as reflected in increased net sales and investment and reduced labour volume, the gross value added of this sector decreased slightly in the period 2003–2008 (table 2.2.3).[4)] The result before tax also fell: by as much as 40 percent from 2006 to 2007.

Mobile telephony accounts for a large proportion of telecom company revenues. 'Non-voice services' such as SMS and mobile internet account for an increasing share of total revenues generated by mobile services. The capita selecta of this publication (section 8.3) examines mobile services in more depth.

In 2008, employment (labour volume) in the post and telecom sector amounted to just under 83 thousand full-time equivalents (fte's). The annual decrease in employment which started in 2003 accelerated in 2007 and 2008. Employment in this sector fell by nearly 15 percent in the space of six years.

Investment in the post and telecom sector in 1999 and 2000 were three times as high as in 1995. In 2001 investment fell, as the internet hype came to an end. From 2004 it started to rise again, but this levelled off in 2007.

Table 2.2.3
Post and telecommunication sector; key figures 2003–2008 [1)]

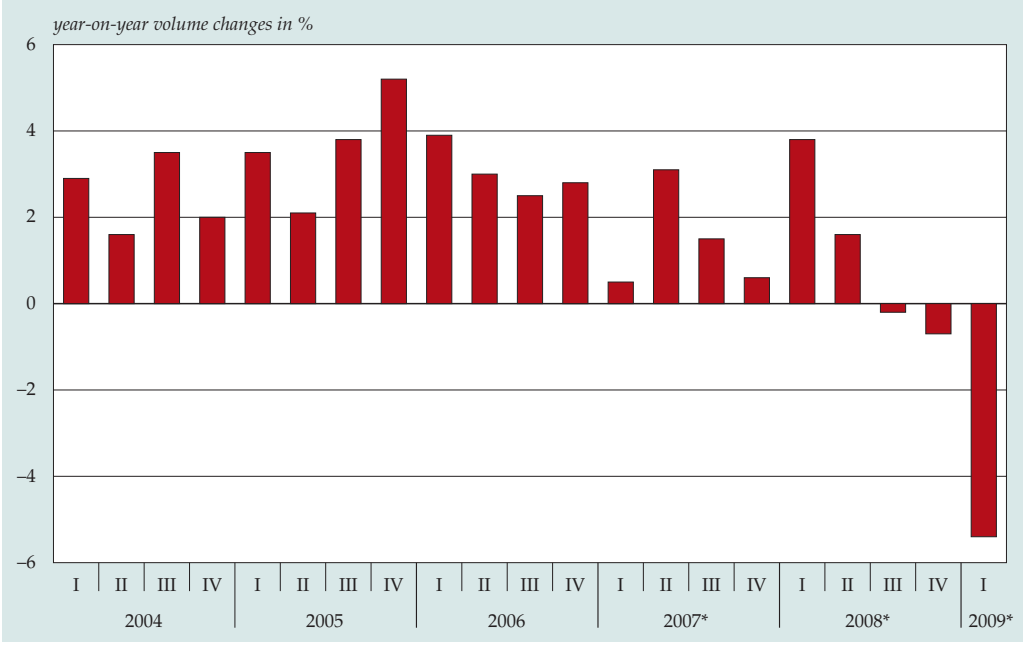
	2003	2004	2005	2006	2007*	2008*
	million euro					
Sector Post and Telecommunication						
Net turnover	23,000	22,703	22,919	23,662	24,294	.
Gross value added (basic prices)	12,101	12,244	12,419	12,346	12,304	11,712
Pre-tax results	2,859	4,419	4,236	4,046	2,440	.
Fixed capital formation	2,098	2,218	2,542	2,743	2,535	.
	full-time equivalents (x 1,000)					
Labour volume of employed persons	96.9	93.7	90.2	89.3	85.0	82.8
	%					
Share in the total economy						
Gross value added (basic prices)	2.85	2.80	2.72	2.58	2.44	2.21
Fixed capital formation	2.21	2.35	2.56	2.53	2.19	.
Labour volume of employed persons	1.48	1.45	1.39	1.36	1.26	1.22

Source: Statistics Netherlands, National accounts.

[1)] SIC 1993 code 64 (post and telecommunication).

In the run-up to 2000, consumers adopted new technologies such as mobile telephony and the internet on a massive scale, thus boosting the telecom industry. For a number of years the growth rates were around 20 percent. This growth continued for some time after the end of the hype. Figure 2.2.3 shows how gross added value developed in the post and telecom sector from 2004. The last year of substantial growth was 2006. The decline set in in the third quarter of 2008, and in the first quarter of 2009 value added was even more than 5 percent down on the same quarter in 2008. In the second quarter of 2009, too, the drop compared with twelve months previously was significant (–3.7 percent). On the one hand, the telecom sector is confronted by market saturation and the consequent competition, including price competition. The credit crisis, too, has tempered profits. On the other hand, telecom services in particular (fixed and mobile telephony, broadband access) have now become a basic consumer need, and have thus made the market more stable.

2.2.3 Gross value added of post and telecommunication, 2004–2009



Source: Statistics Netherlands, Quarterly accounts.

Number of registered telecom providers continues to grow

Companies that want to enter the field of electronic communications in the Netherlands are required to register with OPTA, the independent post and telecommunications authority in the Netherlands. The number of OPTA registrations increased annually in the period 2005–2009. In 2009 it grew by more than the year before, but not by as much as the leap in 2006 (table 2.2.4). Providers of communication services still account for most companies in the OPTA registration.[5)]

Table 2.2.4
OPTA–registered telecom providers, by activity, 2005–2009[1)]

	2005	2006	2007	2008	2009[2)]
Provision of public electronic communication network	253	302	380	385	378
Provision of electronic communication service	281	362	399	407	474
Provision of related facilities	9	11	12	10	8
Provisions of qualified certificates	3	4	4	6	6

Source: OPTA.

1) Reference date 31 December.
2) Reference date 31 August.

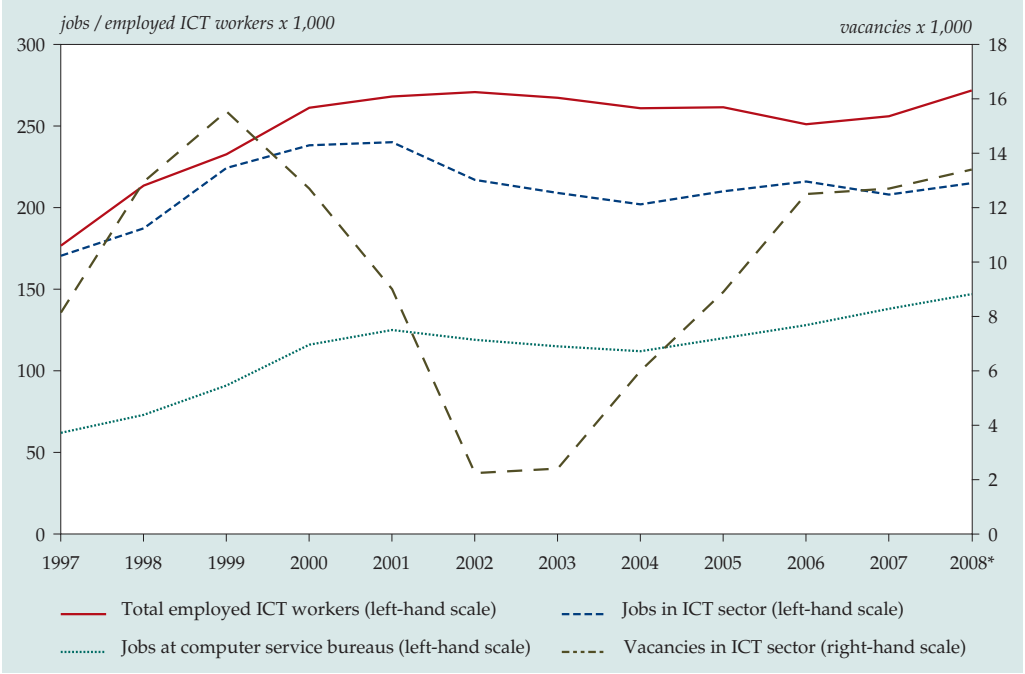
2.3 *ICT and employment*

While in most industries the number of job vacancies stabilised in 2008, in the ICT sector the number of vacancies continued to increase. Especially for computer service bureaus, employment showed an upward trend between 2004 and 2008.

ICT vacancies still growing

In spite of a slight slowdown in growth in 2007, the number of vacancies in the ICT sector rose substantially to 2008 (figure 2.3.1). At the time of writing, it was not yet clear how the economic crisis that started at the end of 2008 would affect the number of ICT vacancies. What is clear is that in 2008, the number of jobs in computer service bureaus was higher than it had ever been in the previous ten years. It increased for the fifth consecutive year.

2.3.1 Employed ICT workers, jobs and vacancies in ICT, 1997–2008



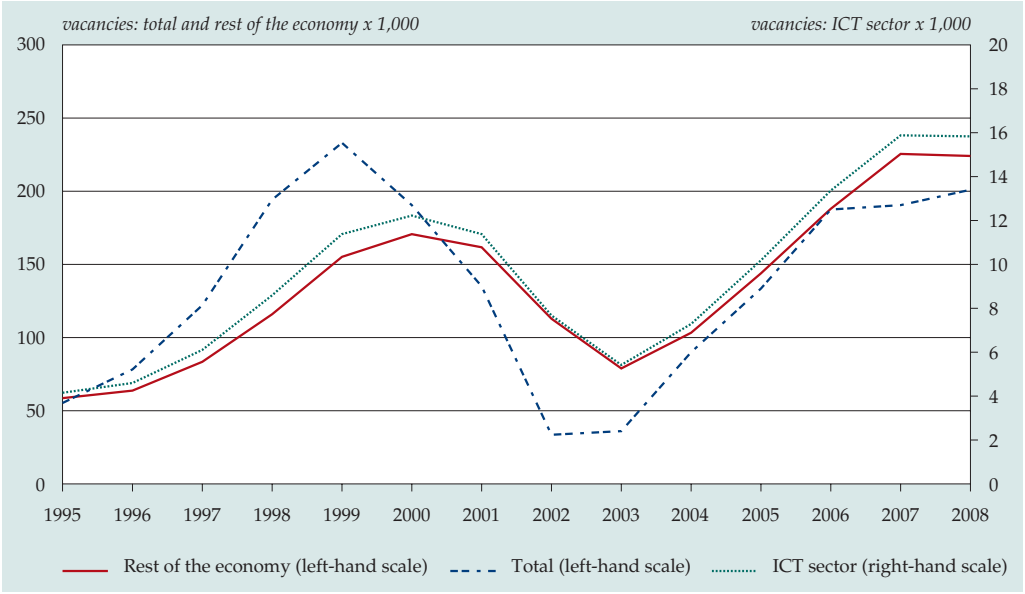
Source: Statistics Netherlands, Labour Force Survey (employed ICT workers), Employment and earnings Survey (to 2005) (jobs in ICT sector), Employment and earnings statistics (from 2006) (jobs in the ICT sector), Labour Accounts (jobs at computer service bureaus), Vacancy survey third quarter (vacancies).

In 2008, the overall number of jobs in the ICT sector recovered from a slight decline in 2007 and nearly returned to the level of 2006. However, in this respect it should be noted that the switch from own surveys conducted by Statistics Netherlands to the use of income tax data to compile statistics on jobs and employment did result

in a break in the time series concerned. Therefore, figures on employed ICT workers in 2007 and 2008 are not fully comparable with those for 2006 and earlier. The total number of employed ICT workers fell to 251 thousand between 2002 and 2006, the lowest number since 1999. In 2007 it rose to 256 thousand, but it is not clear whether this increase was partly caused by the new survey method. In 2008 employment in the ICT sector showed a clear rise. It is still unclear what the impact of the economic crisis has been on ICT employment in 2009.

The number of job vacancies in the ICT sector was higher in 2008 than in 2007, while across the whole economy the number of vacancies fell slightly in the same year. Up to 2007, the development in the number of ICT vacancies was similar to that in the whole economy (figure 2.3.2). In 2007, however, the number of vacancies in the rest of the economy grew by much more than in the ICT sector. In 2008, this was exactly the other way round.
The vacancy rate in the ICT sector in 2008 was 62 per thousand jobs, while the rate for the overall economy was only 30 (see table 2.3.1 in the online statistical annex).

2.3.2 Vacancies in the ICT sector and the rest of the economy, 1995–2008 [1)]



Source: Statistics Netherlands, Vacancy survey.

[1)] The ICT-sector is defined here as SIC groups: 30, 3130, 3210, 3220, 3230, 3320, 3330 (ICT manufacturing) and 6420, 72 (ICT services).

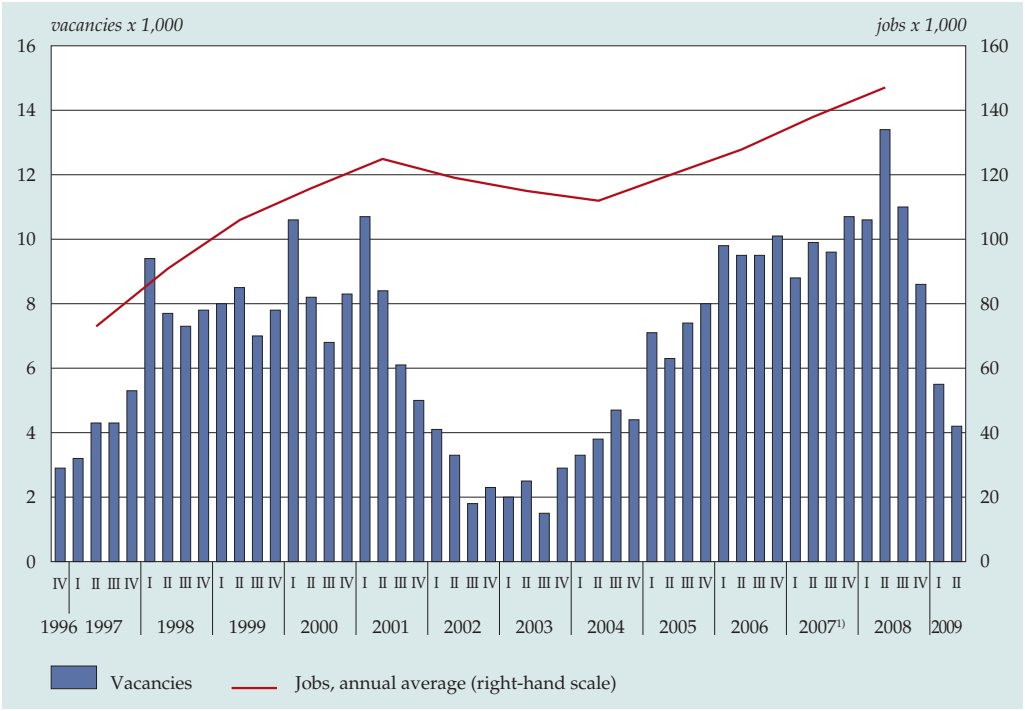
Explosive growth computer service bureaus in last twenty years

As Statistics Netherlands has changed its industry classification, from 2007 onwards the category computer service bureaus is different than in 2006 and previous years.

This makes it difficult to establish whether the number of vacancies in this branch increased in 2007 and 2008 compared with previous years. However, according to the new classification there were 9.8 thousand vacancies in the fourth quarter of 2006, and 13.4 thousand in the second quarter of 2008. From the third quarter of 2008, the number of vacancies decreased, however. This was probably caused by the economic crisis, which set in at the end of 2008. The figure is expected to have decreased further in the second half of 2009.

The annual average number of jobs at computer service bureaus has been increasing since 2004, from 112 thousand in 2004 to 147 thousand in 2008. The vacancy rate in this branch, on the other hand, fell from 76 vacancies per thousand jobs in 2006 to 71 in 2007. In 2008, it rose again, to 74. This is substantially higher than the rate in the total ICT sector (62 in 2008, see table 2.3.1 in the online statistical annex). The number of jobs in computer service bureaus more than doubled between 1997 and 2008, a massive increase in an eleven-year period.

2.3.3 Jobs and vacancies at computer service bureaus, 1996–2009



Source: Statistics Netherlands, Quarterly vacancy survey private sector, Labour accounts.

[1)] The transition to a renewed business register at Statistics Netherlands' has resulted in a break in series. Figures up to and including the fourth quarter of 2006 are before the break, figures for 2007 and after are after the break. The figures for the fourth quarter of 2006 were calculated twice: according to the old method the result was 10,100 vacancies, according to the new method it was 9,800.

ICT sector male-dominated

For years now, most employees in the ICT sector have been men. The proportion of women has fluctuated around 20 percent. In 2008 women accounted for 45 percent of employees in the whole economy, 4 percent points more than 13 years previously. In the ICT sector, the percentage of women remained almost constant in the same period.

The share of part-time labour in total labour has grown in recent years, including in the ICT sector. The share of part-time jobs in total ICT employment rose from 11 percent in 1995 to 26 percent in 2008. In the total economy, the share of part-time jobs is considerably higher: 40 percent in 1995 and 51 percent in 2008.

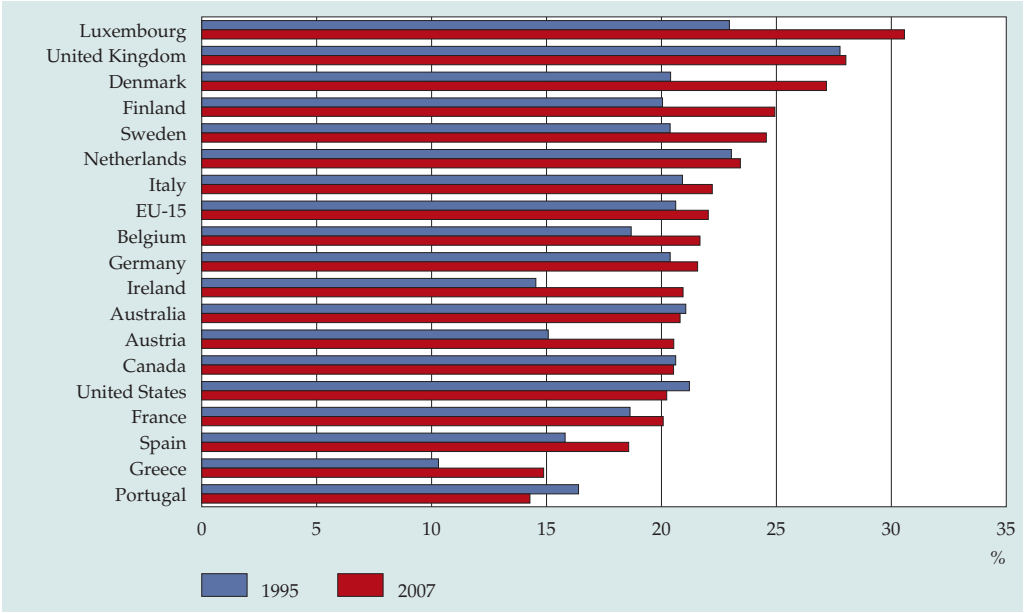
Table 2.3.2 of the statistical annex (available online at www.cbs.nl/digital-economy) shows a breakdown of employed ICT workers by various characteristics for a number of years. Only minor changes have occurred through the years; a typical ICT worker is still male, is 25–44 years old, works full-time and has a high level of education.

Relatively many ICT workers in the Netherlands

Various different international panels have drafted various definitions for ICT workers. The narrow definition of ICT workers is: specialists developing, operating and maintaining ICT systems. ICT is the core of their work. The wider definition of ICT workers includes advanced and basic users of ICT and software tools.

Figure 2.3.4 shows employed ICT workers in the broad sense (ICT users) as a percentage of the labour force. In 2007, Luxembourg had the highest percentage of ICT users, just over 30 percent, in its the labour force. Other leading countries were the United Kingdom, Denmark, Finland and Sweden. The Netherlands is in sixth place in this list. Compared with 1995, in most countries the percentage of ICT users had increased. Exceptions are Australia, Canada, the United States and Portugal. In Greece and Portugal, the share of ICT users in the labour force is the lowest of the countries included in the overview, at less than 15 percent.

2.3.4 Employed ICT workers, broad definition, as a percentage of the employed labour force, 1995 and 2007 [1) 2)]



Source: OECD, IT Outlook 2008.

[1)] The broad definition of ICT professionals is based on the definition of the OECD (2004, Information Technology Outlook, chapter 6; 2006). The percentages for non-European countries cannot be compared directly with the percentages for European countries as the classifications are not harmonised. For the EU-15 countries the figures for the missing years were estimated.

[2)] Australia, Finland and Sweden: 1997 instead of 1995.

2.4 *ICT expenditure*

Section 2.2 discussed the economic significance of the ICT sector from the supply side. In this section the perspective shifts to the customers of the ICT sector. Domestic spending on ICT goods and services can be divided into three categories:

- business and government investment in ICT capital;
- intermediate consumption by companies and government;
- consumption by households.

Domestic spending on ICT goods and services (the sum of expenditure and investment) partly benefits the national ICT sector. ICT services predominantly serve the domestic market. This means that companies, households and the government normally buy ICT services from companies based in the Netherlands. The situation is completely different for ICT goods. Since 1995, the domestic ICT manufacturing industry has lost more and more of its market share to foreign imports.

Overall picture: financial crisis also affects spending

In 2008, investment was the only spending category to show stable growth. This is because investment responds only with a delay to ups and downs in the economic cycle. Investment in fixed assets grew by 4.9 percent in 2008 (see table 2.1.1 in Section 2.1). This was almost equal to the growth in 2007. Just as in recent years, investment in computers increased by more than all other categories of investment in 2008 (CBS, 2009a).

But there were two sides to 2008. In the first half of the year, all categories of expenditure (household and government consumption and investment) grew as a result of the high economic growth in 2007. However, the financial crisis set in in the autumn and growth in household consumption only just remained positive.

Figures for the second quarter of 2009 indicate that the deterioration will continue: investment in fixed assets was 13.4 percent down on the same period in 2008. This decrease was caused by the sharp fall in private sector investment (–16.8 percent). Consumption also fell in this period (–0.6 percent), although by less than investment. Household consumption was 2.7 percent lower in the second quarter of 2009 than in the same period last year. Government consumption increased by 3.1 percent, on the other hand.

At international level, production and investment in ICT services continued to grow. In most OECD countries, these activities performed better than the ICT goods sector. Moreover, ICT services scored better than the services sector as a whole, although the growth levelled off as a result of the financial crisis. In the last period of economic decline (2001–2003), ICT services were generally weaker than the total service sector. In 2008, the production of goods by the ICT manufacturing industry continued to develop better than the output of the total manufacturing sector, excluding Japan and Korea (OECD, 2009b).

Investment in ICT capital

Investment in ICT capital increased significantly between 1995 and 2000, from 6.7 to 15.1 billion euro (CBS, 2006). This growth was based mainly on large investments by telecom companies in the construction, expansion and modernisation of electronic networks for among other things broadband internet and mobile telephony. After a brief but deep dip, partly caused by the decrease of investment in electronic networks, investment in ICT rose by 21.6 percent to over 15 billion euro between 2004 and 2007. This put investment back at its level of before the downturn. The substantial increase in investment in software is at the basis of the rapid growth of ICT investment (table 2.4.1). The growth rate of ICT investment remained slightly behind that of total investment (nearly 23 percent between 2004 and 2007) in the Dutch economy.

The volume changes in ICT investment and in overall investment in the Dutch economy show two noticeable aspects. First, the fluctuations in investment in ICT capital are more extreme than those in the overall economy. Secondly, developments in ICT investment occur earlier than in overall investment. In 2004 total

investment was still decreasing (negative volume change), while investment in ICT capital increased significantly. Although the growth of ICT investments in 2007 was smaller than the peak in 2006, the increase was still 5.4 percent above the Dutch average for all industries (4.8 percent).

Table 2.4.1
Investment in ICT capital, 2004–2007

	2004	2005	2006	2007*
	million euro			
Computer hardware	4,292	4,334	4,545	4,874
Software	6,444	7,004	7,710	8,338
Electronic networks	1,877	1,941	2,334	2,135
Total ICT	12,613	13,279	14,589	15,347
Total investment in the Netherlands	92,426	97,016	106,373	113,615
	%			
Computer hardware	34	33	31	32
Software	51	53	53	54
Electronic networks	15	15	16	14
Total ICT	100	100	100	100
% of total investment in the Netherlands	14.0	13.7	13.7	13.5
	year-on-year volume changes in %			
Computer hardware	8.2	13.2	16.4	14.4
Software	3.7	6.7	7.5	4.3
Electronic networks	8.8	9.0	21.4	–8.6
Total ICT	6.0	9.2	12.4	5.4
Total investment in the Netherlands	–1.6	3.7	7.5	4.8

Source: CBS, National accounts.

Growing market share for software

The software industry accounts for just over half the Dutch ICT market. In 1995, for every 100 euro spent on hardware, 86 euro was spent on software; by 2007 this had risen to 171 euro. The software market (which includes ICT services) recovered from 2004 to 2007. In 2004, the results of all ICT market segments were positive for the first time since 2000. Since this turning point, this sector has shown a continued steady growth. New software enhances the development of new or improved ICT applications, and is an important investment opportunity for companies.

Investment in hardware, largely by the private sector, increased annually between 2004–2007. In 2007 the hardware market grew by 7.2 percent compared with the previous year. This was a larger investment growth, particularly in computers,

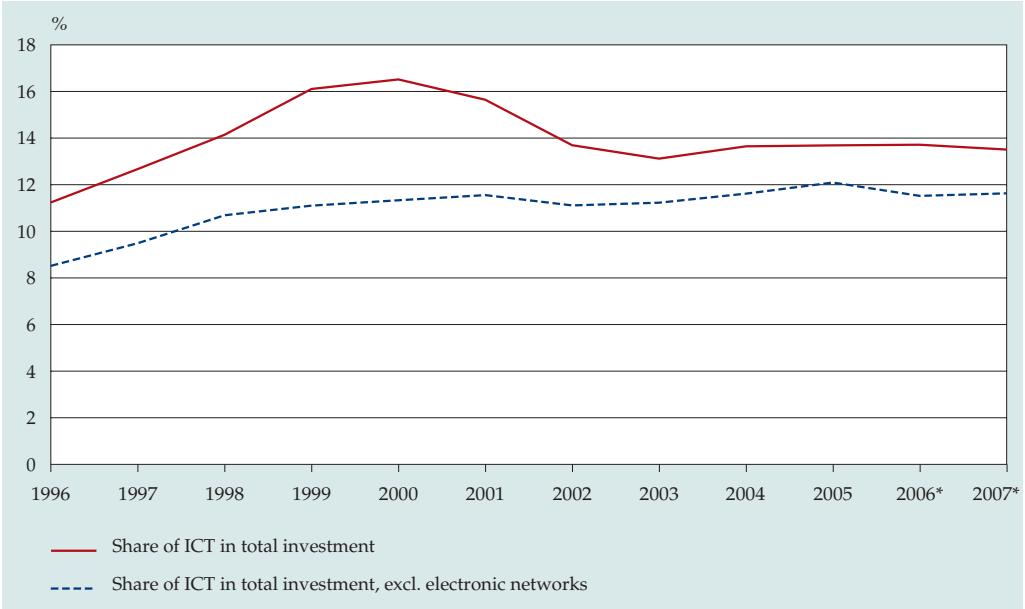
than in 2006. However, the share of hardware in total ICT investment decreased slightly, to 32 percent in 2007. This decrease was partly caused by the rapid fall in the prices of computers in recent years. Hardware remains an important market, though, because of a further increase in the demand for servers (especially by small and medium sized enterprises) and the continued investment in desktops and laptops, which enable people to work on the move (ICT~Office, 2008).

The expansion of the hardware and software markets is at the expense of investment in electronic networks, which dropped to 14 percent of total ICT investment in 2007. In 2000 this was still 29 percent.

ICT investment stimulates economic development

Following the peak of the financial internet hype around 2000 and the subsequent downturn, investors have been placing a stable share of their capital in ICT since 2004 (figure 2.4.1). This figure also shows that the expansion of the ICT infrastructure during the boom around the turn of the century was clearly stimulated by the high investment in electronic networks. The share of ICT investment (excluding networks) in total investment has been quite stable since 2001 (11 to 12 percent) and did not peak significantly during the boom. Lastly, during and after the economic downturn of 2001–2003 investors did not cut back on ICT capital as much as on other capital goods, such as buildings, machinery and vehicles.

2.4.1 Share of ICT investment in total investment, 1996–2007 [1)]



Source: Statistics Netherlands, National accounts.

[1)] Figures for 2001 and later are not completely comparable with previous years because of a revision of the national accounts.

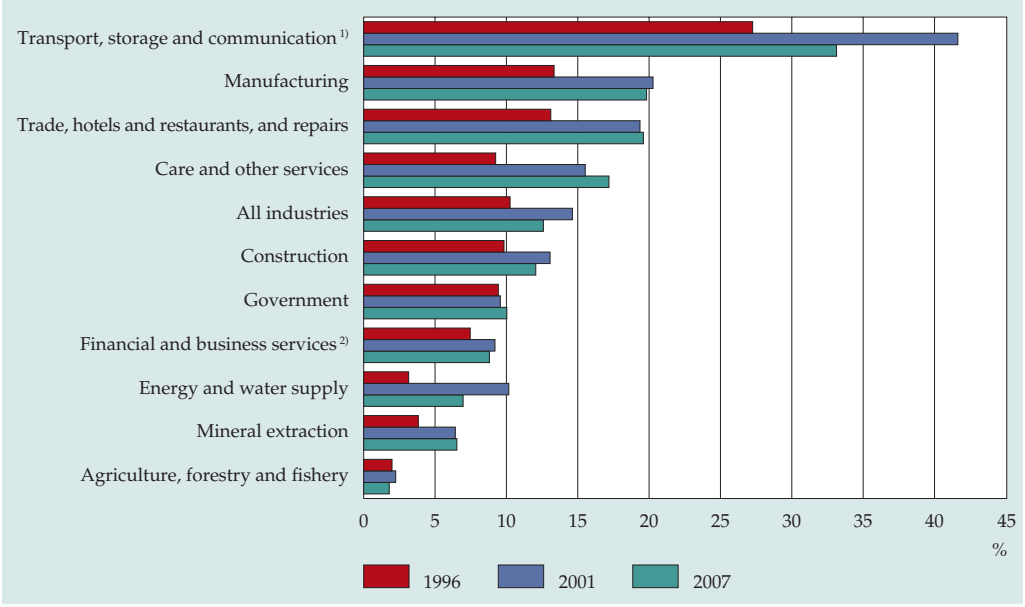
ICT investment mainly in communication industry

The share of ICT investment varies between sectors of industry. Transport, storage and communication invested most in ICT in the period 1996–2007. Agriculture and mineral extraction lagged well behind. With the exception of agriculture, ICT investment grew in all sectors in this period.

The fact that transport, storage and communication in particular put a lot of money in ICT was partly because part of the expanded ICT services sector falls within this sector of industry. In 2007, still as much as one third of investment in transport, storage and communication was investment in ICT, in spite of a sharp drop (by 8.5 percent points) compared with six years earlier (figure 2.4.2).

The peak in ICT investment occurred around the turn of the century. The sector care and other services, which is not very sensitive to economic trends, was the fastest growing sector between 1996 and 2007, with an increase of 8 percent points, followed at some distance by manufacturing and trade. Transport, storage and communication lagged slightly, with a growth of 5.8 percent points. Care and other services is the only sector where the significance of ICT investment increased substantially after the peak.

2.4.2 Share of ICT investment in total investment, by sector of industry, 1996, 2001 and 2007



Source: Statistics Netherlands, National accounts.

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

The overall shift away from manufacturing and towards a more services based economy is also reflected in the ICT sector. In addition to developments in, for

example, employment and value added, investment behaviour also indicates the growing significance of services, including ICT services. In spite of this, the share of investment in financial and business services, which includes computer service bureaus, in total ICT investment was slightly lower than in 2001. The decrease in recent years was partly caused by customer cutbacks in ICT budgets. And this effect has become even stronger as a result of the financial crisis which started in 2008. Customers are postponing projects, bargaining hard for lower prices for contract renewals and sometimes even annulling existing contracts. Computer service bureaus are spending less on exclusive company cars and other luxuries. They are also paying sub-contractors and the self-employed, to which they often delegate work, lower rates (CBS, 2009a).

Dutch among the international leaders

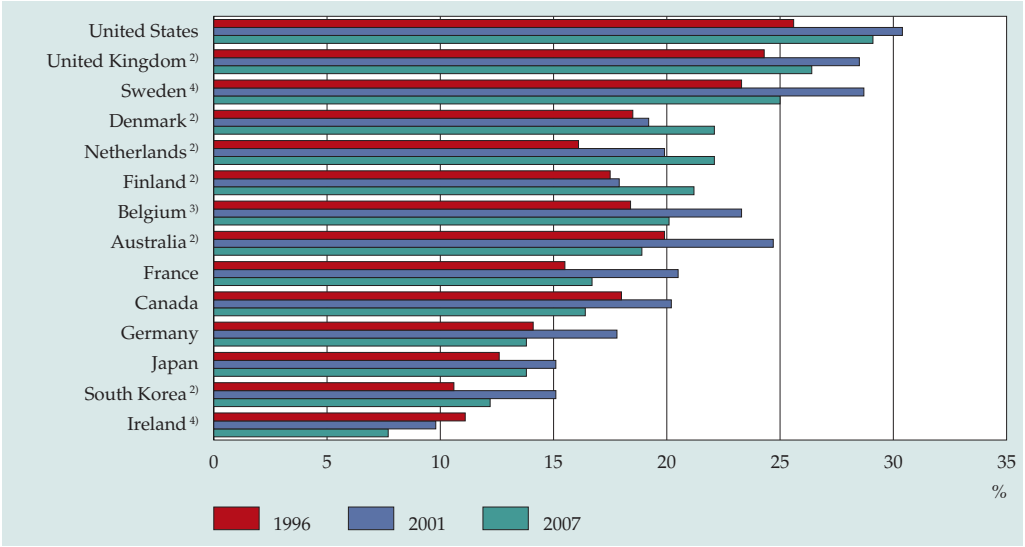
The share of ICT investment decreased in most of the benchmark countries when the internet bubble burst. From 2001 to 2007, the Netherlands, Denmark and Finland were an exception (figure 2.4.3). In terms of the share of ICT investment in total investment, the Netherlands has become a more important player in the international ICT market. The gap between the Netherlands and the leading countries (United States, United Kingdom and Sweden) has narrowed. ICT investment is relatively high in Sweden, Denmark and the Netherlands, but the impact of these small economies on the average investment level of the EU is limited. Moreover, investment is not an adequate indicator for profits.

ICT investment explains about one third of the difference in GDP growth between the United States and the EU, at least at the level of the EU-15, and in the mid 1990s (Barrios and Burgelman, 2008). Differences in manufacturing specialisations are an important factor in the gap in ICT investment between the two economic powers. ICT-intensive sectors, such as electrical engineering, are more dominant in the US economy.

The life cycle of ICT capital is short compared with other capital goods. So a sector of industry cannot work with ICT capital purchased in the 1980s and 1990s. In today's competitive global economy, companies need to continually invest in ICT, and so have access to the latest available hardware and software.

Differences in economic performance between industrialised countries can largely be explained by the level of ICT investment and the competitiveness of the ICT sector. However, the use of ICT alone is not enough to increase productivity (European Commission, 2008b). ICT investment must be accompanied by additional measures, such as business restructuring and upgrading worker skills. Therefore, organisations need both ICT skills and communication and organisational expertise to survive.

2.4.3 Share of ICT investment in total investment, international, 1996, 2001 and 2007 [1)]



Source: OECD, Factbook 2009.

[1)] International gross fixed capital formation, excluding dwellings.
[2)] Australia, Denmark, Finland, the Nederlands, United Kingdom and South Korea: 2005 instead of 2007.
[3)] Belgium: 2004 instead of 2007.
[4)] Ireland and Sweden: 2006 instead of 2007.

Intermediate consumption and consumption relatively stable

ICT spending by businesses and the government which cannot be categorised as investment is not included in ICT capital. ICT spending also includes ICT services provided by companies and government departments, maintenance of hardware and household consumption. The share of intermediate consumption in total ICT spending decreased slightly between 2004 and 2008 (by 0.8 of a percent point to 69.3 percent). Table 2.4.2 shows that total ICT spending has been relatively stable in recent years, at between 41.3 and 42.2 billion euro, except in 2006, when the total was a little lower (40.5 billion euro). This dip was caused by spending on ICT services, which was 2.2 billion lower than in 2005. Spending on intermediate consumption of ICT services in particular dropped sharply, by 2 billion, a decrease of 9 percent on 2005. Spending on ICT goods offset this somewhat, with an increase of 477 million. However, in recent years intermediate consumption of ICT services has recovered again.

It is further noticeable that spending on IT services rose slightly in 2008, while less was spent on ICT goods than in 2007. The ratio of goods (26 percent) to services (74 percent) in total ICT expenditure was exactly the same in 2008 as in 2004. Consumer spending on ICT goods and services consists of purchases of goods like computers, printers, mobile phones and digital cameras, but also the costs of mobile and fixed-line telephones and internet traffic.

Table 2.4.2
Intermediate consumption and consumption of ICT goods and services, 2004–2008

	2004	2005	2006	2007*	2008*
	million euro (current prices)				
Total ICT expenditure	41,286	42,189	40,473	41,974	41,546
Intermediate consumption	28,922	29,520	27,726	28,885	28,786
Consumption	12,364	12,669	12,747	13,088	12,760
Total ICT goods	10,633	10,489	10,966	11,141	10,710
Intermediate consumption	7,561	7,428	7,638	7,568	7,161
Consumption	3,072	3,061	3,328	3,572	3,549
Total ICT services	30,653	31,700	29,507	30,833	30,836
Intermediate consumption	21,361	22,092	20,088	21,317	21,625
Consumption	9,292	9,608	9,419	9,516	9,211

Source: Statistics Netherlands, National accounts.

2.5 *International trade in ICT*

The volume of international trade in ICT products gives an indication of the international competition on this market. ICT goods have been part of the large-scale international trade for much longer than ICT services.

Shift from OECD countries to new, fast-growing markets

At the global level, ICT production activities have increased fast in the emerging economies of China and India and – within Europe – in eastern Europe (OECD, 2008a). This is also reflected in the figures on ICT trade. In 1996, OECD countries accounted for 88 percent of total ICT trade. In 2006 this had fallen to 56 percent. Asian and east European countries have increasingly become producers and markets for ICT goods and services. This globalisation is mainly fuelled by price competition in production and the rapidly increasing diversification of goods and services. Emerging countries can produce ICT goods and provide ICT services relatively cheaply and are attractive markets for western companies.

Dutch ICT exports nearly doubled between 1998 and 2008

International trade in ICT goods and services has recovered after a dip at the beginning of the millennium. The value of Dutch ICT exports almost doubled between 1998 and 2008, from around 34 to 65 billion euros (table 2.5.1). This includes re-exports. The import value of ICT goods and services also almost doubled in this period. The ICT trade gap widened from just over 1.6 billion euro in 1998, to 4.2 billion euros in 2008.

Although international trade in ICT services has risen sharply in the last ten years, volumes of imports and exports of ICT services are still much smaller than those of ICT goods. Until 2004, the increasing importance of services was also reflected in their growing share in the Dutch exports package. After 2004, the ratio between exports of ICT goods and exports of ICT services remained quite stable.
The trade deficit for ICT goods (including re-exports) rose fast from 1998 (2.1 billion euro) to 2008 (5.7 billion euro). The trade surplus for ICT services, on the other hand, increased steadily during this period to reach 1.5 billion euro in 2008.

Table 2.5.1
Imports and exports of ICT goods and services, 1998, 2004–2008

	1998	2004	2005	2006	2007*	2008*
	million euro (current prices)					
Imports						
ICT goods	31,765	47,813	51,067	61,895	64,552	63,708
ICT services	3,422	5,397	5,345	9,029	5,766	5,815
Total ICT imports NL	35,187	53,210	56,412	70,924	70,318	69,523
Total imports NL	209,802	289,894	313,688	351,669	376,170	407,598
Exports						
ICT goods	4,027	3,536	3,768	4,098	4,253	4,104
ICT services	3,635	6,383	5,871	10,191	6,665	6,932
Total ICT exports NL	7,662	9,919	9,639	14,289	10,918	11,036
Total exports NL	226,766	326,111	357,453	393,475	425,319	457,350
Re-exports						
ICT goods	25,635	44,731	49,350	52,588	55,273	53,874
ICT services	252	566	592	557	490	413
Total ICT re-exports NL	25,887	45,297	49,942	53,145	55,763	54,287
Total re-exports NL	70,429	118,509	132,849	151,881	167,654	177,995
Total ICT exports (goods, services and re-exports)	33,549	55,216	59,581	67,434	66,681	65,324
	%					
Composition of exports of ICT goods and services						
ICT goods	12	6	6	6	6	6
ICT services	11	12	10	15	10	11
Re-exports	77	82	84	79	84	83
Total	100	100	100	100	100	100
Share of ICT goods and services in						
Total imports	16.8	18.4	18.0	20.2	18.7	17.1
Total exports	3.4	3.0	2.7	3.6	2.6	2.4
Total re-exports	36.8	38.2	37.6	35.0	33.3	30.5

Source: Statistics Netherlands, National accounts.

Most ICT goods imported by the Netherlands are intended for re-export. These are usually standard goods that undergo minimal processing in the Netherlands and are subsequently re-exported to the final country of destination. The Netherlands

plays the role of distributor of these goods to the rest of Europe. Re-exports accounted for 93 percent of total exports of ICT goods in 2008. The value added for re-exports is often significantly lower than for exports, but re-exports are crucial for the Dutch economy (CPB, 2007).

The opposite is true for services, where re-export hardly occurs at all. Personal services, in particular, cannot be sold on after a slight adjustment.

Substantial rise in trade on ICT markets worldwide

Developments in international trade in ICT goods, software and ICT services are set out below for the period 1998–2008. The division into ICT goods, software and ICT services is derived from the OECD, which uses it for its trade figures. Worldwide trade in these products grew substantially in the period mentioned above. For each country in our comparison, we show which market realised the highest growth: were they successful in ICT goods trade, for example, or on the ICT services market? It should be noted in this respect that the international market for ICT goods is many times larger than that for software and ICT services.

To place the Dutch growth rates in some sort of perspective, the sizes of the three ICT markets are examined below. Some shifts have been noticeable in the relative shares of hardware, software and services in the total ICT volume in the Netherlands. First, software has been becoming more important for a number of years now. This has had a knock-on effect on ICT services, but this branch is more vulnerable with respect to economic fluctuations. It grew strongly in the second half of the 1990s, as the supposed millennium bug problems had to be tackled, and the introduction to the euro came nearer. After that it dropped back to its former level, partly as a result of the end of the internet hype at the beginning of the new millennium. From 2005, it has been growing slightly again.

European ICT goods sector less competitive

Global trade in ICT goods grew substantially in the period 1997–2007: ICT goods production rose rapidly in Asia and eastern Europe, and manufacturing processes were streamlined. ICT goods make up a substantial part of total trade between the European Union and its trade partners: 10.2 percent of all goods exports from the EU, and 14.4 percent of all imports in 2006 (European Commission, 2008b). In that year, there was a trade deficit in computers, audio and video equipment and electronic components. The limited competitive power of the ICT sector in the EU is connected with the relatively low innovative capacity compared with other parts of the world. Europe also had to pay more for raw materials, while ICT product prices fell by more and more.

At the global level, exports from eastern Europe in particular (especially Hungary, the Czech Republic and Slovakia) grew fast in 2007. And ICT exports from Asia – China, Hong Kong and South Korea – also increased. The growth in exports did start to slow down in 2008, as the economic downturn set in with the crisis in the financial world (OECD, 2008a).

Telecommunication is a growth market

In terms of ICT goods, telecommunication equipment and electronic components are the main items exported by the European Union; computers are the most imported ICT goods (European Commission, 2008b). The internet hype on the financial markets in the late 1990s boosted exports of all kinds of new communication equipment. The internet and the rapid expansion of mobile communications made telecommunication the fastest growing segment in ICT trade (see table 2.5.1 in the online statistical annex). The fastest growth rate between 1996 and 2006 of the countries included in our comparison was in South Korea, where exports rose by about 25 percent per year. The United Kingdom and the Netherlands followed at a distance. South Korea, Germany and the United States were the largest exporters of telecommunication equipment in terms of volume.

Computer equipment accounted for the largest category within international trade of ICT goods in 2006: about one third of total trade. In the Netherlands, both imports and exports rose by 10 percent on average per year in the period 1996–2006. In the countries we compared, trade in computer equipment grew by less than trade in telecommunication equipment. One reason for this is that consumers wait longer than they used to before buying a new computer. Current generation computers perform so well that new technological developments do not render them obsolete quite so fast.

About 30 percent of trade in ICT goods consists of electronic components, but this is one of the slowest growing categories. International trade in audio and video equipment has also risen substantially in the Netherlands and South Korea, but the United States still accounts for the largest trade volumes in this segment.

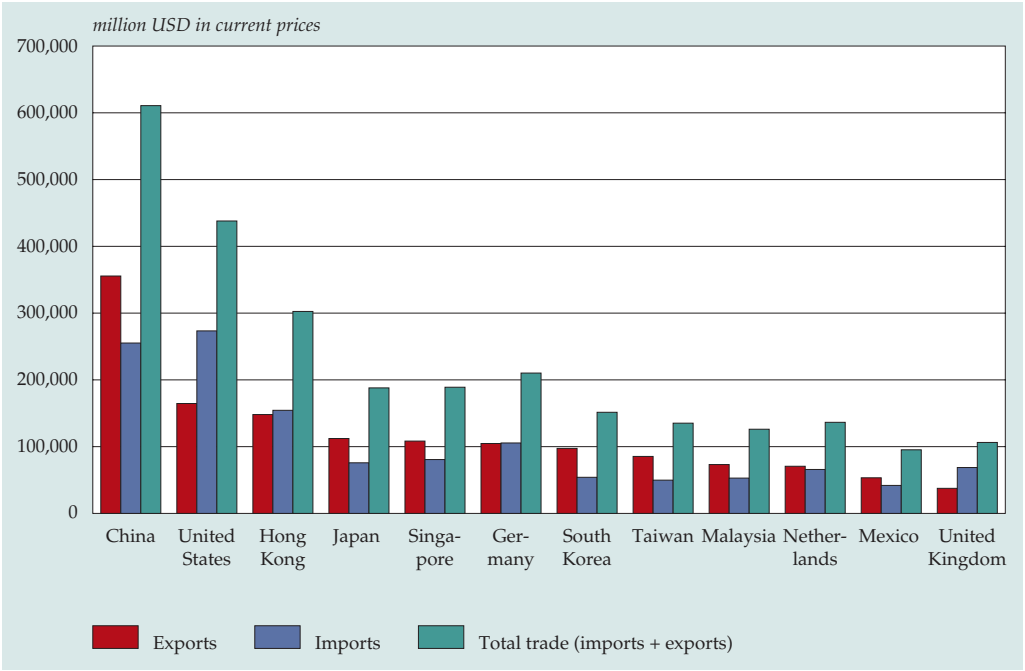
The international trade figures discussed above were compiled by the OECD and refer to the period 1996–2006. As the OECD introduced significant changes in its classifications and methods for 2007 onwards, figures for 2007 and later in this edition are not directly comparable with previous years. Figures for 2007 are therefore discussed separately below.

China was by far the largest exporter of ICT goods in 2007, with an export value of 356 billion U.S. dollars (figure 2.5.1). The value of China's exports was more than twice that of the second largest exporter, the United States. China has become an increasingly important economic power in recent years, as a result of the economic globalisation and the associated outsourcing of operations to this country. Hong Kong was a third major exporter of ICT goods in 2007. The Netherlands was in tenth place, with an export value of 71 billion U.S. dollars.

The biggest importer of ICT goods was the United States (273 billion U.S. dollars). China came second (255 billion U.S. dollars), followed by Hong Kong (154 billion US dollars). The Netherlands was eighth largest, with imports worth 66 billion US dollars. Many countries with high exports also have high imports. These are usually

countries with a highly developed ICT manufacturing industry, which import semi-manufactured products such as semiconductors, and export finished products.

2.5.1 Trade in ICT goods, international, 2007

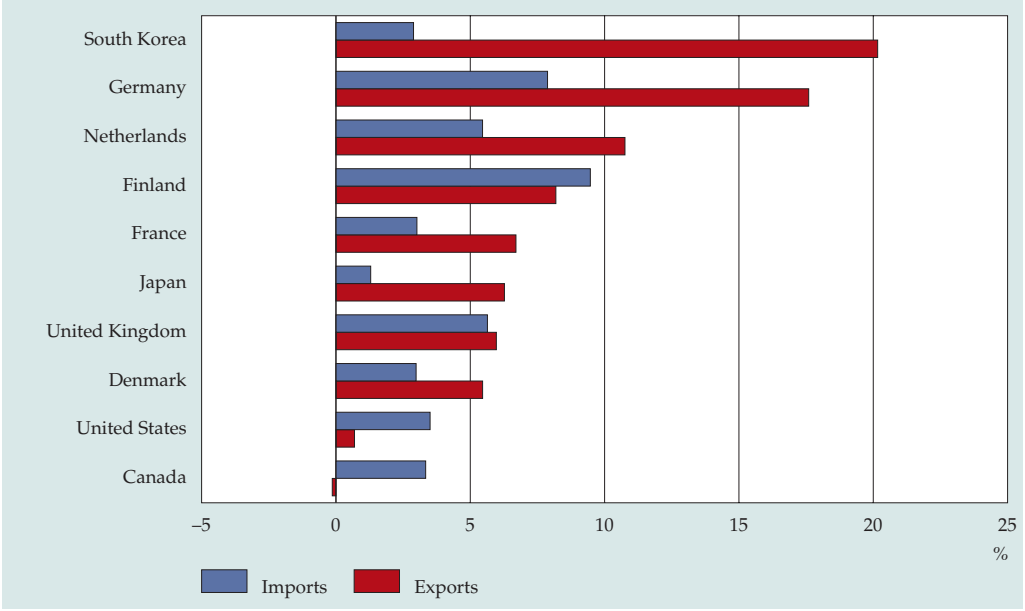


Source: Joint OECD-UNSD ITCS and UN COMTRADE database.

Above average growth in Dutch software trade

The global software market is small compared with trade in ICT goods. The average annual growth of software exports is high in South Korea, Germany and the Netherlands (figure 2.5.2). The fastest growth was in South Korea, where software exports rose from 27 million US dollars in 1996 to 169 million in 2006, an average growth of 20 percent per year. However, South Korean exports did fall after a peak of 231 million US dollars in 2004 (OECD, 2006). Germany is also a major exporter, with an average annual growth rate of just under 18 percent. The Netherlands, too, scored above average in this respect (10.8 percent). As re-exports of software are rare, Dutch exports were products of the domestic ICT sector. In terms of software, too, American imports are growing faster than exports. In the United States both the increase in exports and – to a lesser extent – in imports of ICT goods and software lagged behind those in most European countries.

2.5.2 Average annual growth of software imports and exports, international, 1996–2006



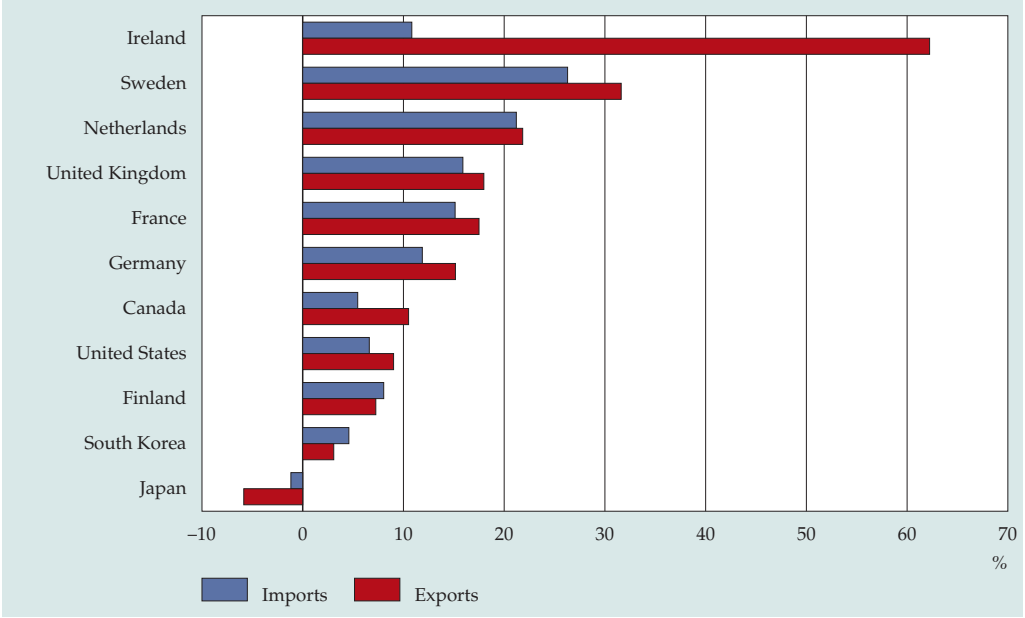
Source: OECD, ITCS database.

Fast growing trade in ICT services

Rapid technological developments have made it easier to trade ICT services. It is now possible to provide ICT services which do not require direct personal contact from remote locations. International trade in ICT services includes hiring foreign computer service bureaus and using networks of foreign (mobile) telephone providers.

Like the software market, the ICT services market is much smaller than the market for ICT goods. In 2006, total trade in ICT services (to and from OECD countries) was about 235 billion US dollars, while trade in ICT goods to and from OECD countries in that year amounted to over 1,980 billion US dollars. The market for ICT services is growing rapidly, but the volume of international trade on this market is limited compared with the market for ICT goods. Ireland, Sweden and the Netherlands participated intensively in international ICT services trade between 1997 and 2007 (figure 2.5.3). Finland, which specialises in the production of hardware, lagged behind, as did Japan, where international trade in ICT services even decreased between 1997 and 2007. Irish exports of ICT services grew notably. This may be because many American ICT companies have chosen Ireland – with its favourable business climate – as their European operations base in the past decade. Exports from Ireland are therefore largely accounted for by subsidiaries of US parent companies; and a large part of these services are probably services for the American parent company.

2.5.3 Average annual growth of imports and exports of ICT services, international, 1997–2007



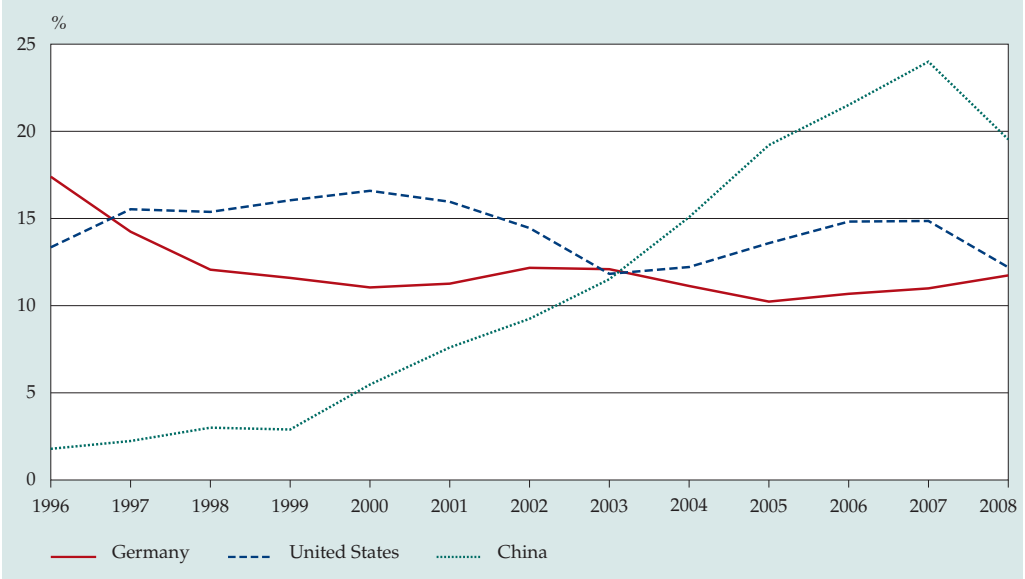
Source: OECD, Trade in Services database.

Germany important for both ICT imports and exports

The main trade partners of the Netherlands in terms of ICT imports are China, the United States and Germany. In 2008, these countries each accounted for more than 10 percent of the total value of Dutch ICT imports. The rapid rise of China as a trade partner, as shown in figure 2.5.4, is particularly striking. In 1996 this country accounted for less than 2 percent of Dutch ICT imports. In 2007, nearly one quarter of ICT imports came from China (24 percent). Another emerging region in international ICT trade is eastern Europe. For western Europe, the east European countries which joined the European Union a few years ago act as low-wage countries close to home. As cultural differences with these countries are not very large, it is easier to do business with them. After 2000 in particular, the Netherlands imported relatively less ICT from western Europe than in the years before the turn of the century. Imports from eastern Europe increased in this period, however.

The value of Dutch imports from the United States has been more or less constant over the years. ICT imports from Asia have increased by more and more in the last ten years, however, mainly pushed up by the substantial increases in imports from China. Shifts also took place between countries within Asia, as manufacturers continue to look for the cheapest places to produce their goods.

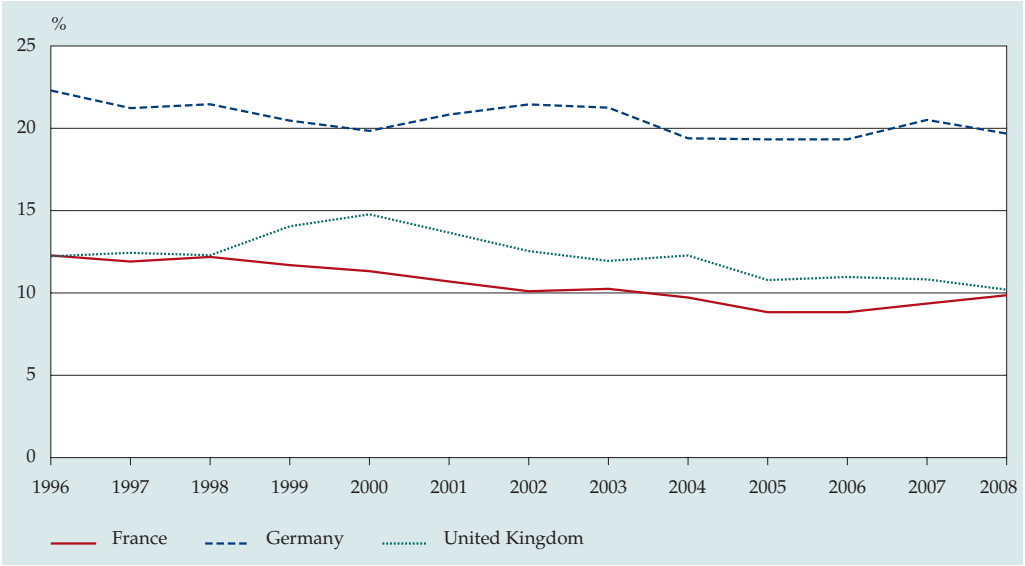
2.5.4 Main countries of origin of Dutch ICT goods imports, 1996–2008



Source: Statistics Netherlands, International trade.

The main destinations of Dutch ICT exports in 2008 were Germany, France and the United Kingdom. Germany has been the Netherlands' main export destination for years, accounting for approximately one fifth of Dutch ICT-related export value.

2.5.5 Main countries of destination of Dutch ICT goods exports, 1996–2008



Source: Statistics Netherlands, International trade.

Dutch ICT exports have shifted from western to eastern Europe in the last ten years. The shares of exports going to Poland, the Czech Republic and Hungary in particular have grown. The percentage of Dutch ICT exports going to the United States has decreased slightly over the years. India and China have accounted for increasing shares in the last ten years, but compared with other countries the percentages are still low. Just as for imports, shares of exports have shifted between countries in the Far East.

International ICT trade more dynamic

The world economy has gone through a clear globalisation process. The ICT sector has played a key role in this since the 1990s, as the sector itself has rapidly become international and it has supported the globalisation of other sectors. ICT developments have cut communication and coordination costs by so much that international outsourcing of business activities has become more and more common. Trade flows have changed direction as ICT manufacturing activities, and to a lesser extent services, are moving mainly to Asian countries. The focus in the emerging countries is on routine processing and assembly activities for the export market. International investment patterns, however, seem to indicate a shift towards offshoring high-quality manufacturing and service functions (CPB, 2007).

International trade in ICT goods and services has become more dynamic in the countries we have looked at in the period 1996–2007. Trade in ICT goods and services started its strong recovery in 2003, after the collapse in growth rates following the end of the internet hype on the financial markets. This is shown by international developments in imports and exports of ICT goods, software and ICT services. For software and ICT services, in particular, some countries had average annual growth rates of more than 10 percent. The Netherlands and Germany performed well on these three submarkets. For the Netherlands, there are various reasons for this. On the ICT goods market, the above average performance is mainly explained by re-exports. But for software and ICT services it was the domestic ICT sector that accounted for the growth. South Korea and Finland performed well on two of the three submarkets. In 1996–2006 South Korea had the highest export growth rate for ICT goods and software of all the countries in our comparison. This explosive increase was in stark contrast to the minimal growth of exports of ICT services by that country.

Lastly, the average annual growth of imports and exports of ICT products was slightly higher in European countries than in the United States, Canada and Japan. The single European market may be a factor in this respect, as it has resulted in a further increase in trade between European countries.

Notes in the text

1) The term 'multi-factor productivity' and its contribution to production development are described in *De Nederlandse Groeirekeningen 2007* of Statistics Netherlands (Voorburg / Heerlen, 2008).
2) Each company consists of at least one branch location. All branch locations of one company within one postcode area are counted as one branch location.
3) The part of section 2.2 on telecom presents data on post and telecommunications. Statistics Netherlands cannot publish figures on the telecom sector alone because of confidentiality regulations. As the telecom sector accounts for by far the largest part of post and telecommunications, the data do give a picture of the situation in the telecom sector.
4) This concerns the labour volume: the number of jobs in one year converted to full-time equivalents.
5) This is only an indication: a small number of companies who are registered are not active, and other companies have more than one registration (e.g. for separate business units or activities).

3 Telecom

The Netherlands already belongs to the European top in terms of internet use, and Dutch use of the internet is still increasing. From an international perspective, the Netherlands has relatively many broadband connections: 90 percent of Dutch households has access to the next-generation broadband internet with speeds of over 50 Mbps. In no other country is the coverage so high. On the other hand, there are relatively few glass fibre connections for high-speed internet compared with the top countries. However, also in the Netherlands a large number of glass fibre networks are now being constructed.
The number of traditional fixed landlines in the Netherlands has been decreasing steadily for several years now. It is now lower than the number of fixed connections via the internet (VoIP).
In the last few years, digital television has become increasingly popular. The number of digital television connections passed the 4 million mark in the first quarter of 2009. People can receive digital television in a variety of ways: via the ether, satellite, cable and the internet. Digital radio is also gaining popularity, although most people still listen to analogue radio.
One significant recent development in telecom has been the convergence of services. Whereas telephone, television and the internet used to be supplied by different providers and networks, now these services are increasingly supplied by a single provider through a single network. More and more consumers are opting for such all-in-one packages.

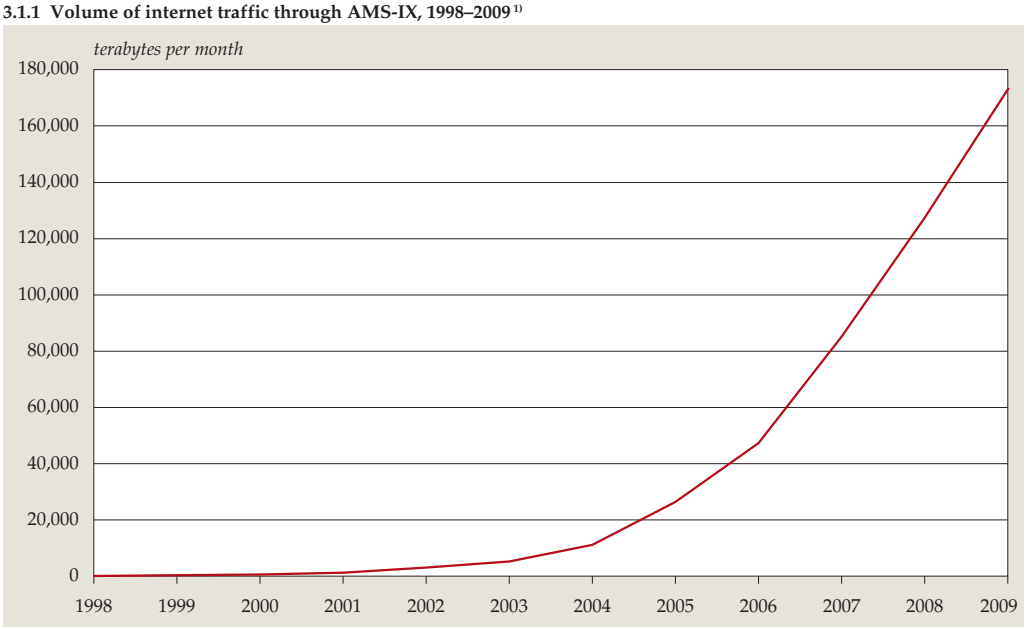
3.1 Internet

This section examines the internet services of the telecom sector, and subsequently services in the areas of telephony, radio and television. It is sometimes difficult to distinguish clearly between various services, for instance in the case of internet telephony. Although this could be seen as an internet application, in this chapter we have opted to classify the services by end product rather than by underlying method or technology. So internet telephony is discussed in the section on telephone services, even though the underlying technology is the internet.

The volume of internet traffic has increased rapidly. This is an important indication of the increase in both the number of internet users and the amount of data generated by 'heavy applications'. Figure 3.1.1 shows the monthly internet flow via the Amsterdam Internet Exchange (AMS-IX). An Internet Exchange is a kind of national interchange where the lines of the various domestic internet service providers and the lines to other countries meet. The AMS-IX is one of the largest internet exchanges in the world. The volume of data passing through the AMS-IX is an indication of the total data volume sent via the internet in the Netherlands. In November 2009, over 173 thousand Terabyte was registered at the AMS-IX. On

average that is the equivalent of more than 14 times the contents of a normal DVD per second. In December 2008 the volume was already more than 127 thousand Terabyte, which in turn was 54 percent more than at the end of December 2007. This increase is in line with the growth of internet traffic across the world. The AMS-IX used to be the biggest internet exchange in the world, but recently the DE-CIX – the fast-growing internet exchange in Frankfurt – took over this position. In December 2008, about 38 percent more traffic was recorded in Frankfurt than in the AMS-IX (University of Minnesota, 2009).

3.1.1 Volume of internet traffic through AMS-IX, 1998–2009 [1)]



Source: AMS-IX.

[1)] Flow in December of the year concerned. 2009: volume measured in November.

Types of internet connections

This overview is not exhaustive; it explains the terminology and abbreviations used in the text.

Fixed lines

Dial-up connection (max. 128 Kbps). Here an analogue or ISDN modem is used to contact an internet provider through a telephone connection.

Asymmetric digital subscriber line, ADSL (max. 8 Mbps download, 1 Mbps upload). Internet through 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 speed. One problem with this use of the telephone line is that the maximum speed attainable deteriorates as the copper wire becomes longer. So the internet speed depends on how near the user is to the neighbourhood switchboard.

ADSL2, ADSL2+ (max. 24 Mbps download, 1.3 Mbps upload). This is a new type of ADSL with mainly faster download speeds.

Very high bit rate digital subscriber line, VDSL, VDSL2 (max. 52 tot 200 Mbps download, 13 Mbps upload). This is the next generation DSL connection. VDSL2 has been available in 40 Dutch towns and cities since September 2009, with maximums of 60 Mbps download and 6 Mbps upload. This high speed is obtained by using copper only from the home to the street; from there on the signal is transported through glass fibre cable.

Cable internet (max. 200 Mbps download, 108 Mbps upload). Internet traffic is transported alongside radio and television signals through the rtv cable to the neighbourhood switchboard after which the signal is transported through glass fibre cable. Subscriptions with download speeds from 50 to 120 Mbps are already being offered on a wide scale.

Satellite internet (max. 4 Mbps). Internet signals are received through a satellite dish from a satellite in orbit. This technology is more expensive than the other types of internet connection, but it is sometimes the only option in sparsely populated areas.

Glass fibre (usually up to 100 Mbps download and sometimes for upload as well). Here glass fibre cables run to or even inside the home or office. The telephone or rtv cable can still be used inside the home or office. There are two popular methods: glass fibre cables to individual homes (Fibre to the Home or FTTH); a lot of work is involved in laying the cables in the home or office, so this method is mainly used in newly constructed homes. An alternative is Fibre to the Building (FTTB), where glass fibre is laid to reach the outside of the building. Internet traffic is then transported into the home through a local area network (LAN) or classic telephone cable.

Mobile connections

WiFi (max. 540 Mbps). These connections are used as wireless internet at home or near hotspots (antennas in busy places like stations). The range is limited: signals can be received within 30 metres with a regular antenna.

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

Universal Mobile Telecommunications System, UMTS (max. 2 Mbps). Also known as 3G (3rd generation mobile network). Internet flows are transmitted and received through the network of UMTS antennas. See section 3.2 and the capita selecta.

High-Speed Downlink Packet Access, HSDPA (max. 7.2 Mbps). Also known as 3.5G. Internet flows are transmitted and received through the network of UMTS antennas. The use of new technology makes a higher speed possible.

Worldwide Interoperability for Microwave Access, WIMAX. WIMAX comes in two forms.
The first is known under the slightly misleading term Fixed WIMAX (max 70 Mbps), where the user can move freely within the area covered by the antenna (in theory 50 kilometres at the most although the speed will be reduced in the whole area). No connection is possible outside the area. This technology makes it possible to connect outlying UMTS masts and WiFi hotspots to a physical network. This option competes with broadband internet via xDSL and cable.
Mobile WIMAX (max 15 Mbps) competes with UMTS and HSDPA. The user can move around freely without losing the connection. This method makes it perfectly possible to receive services like TV and VoIP through the mobile network.

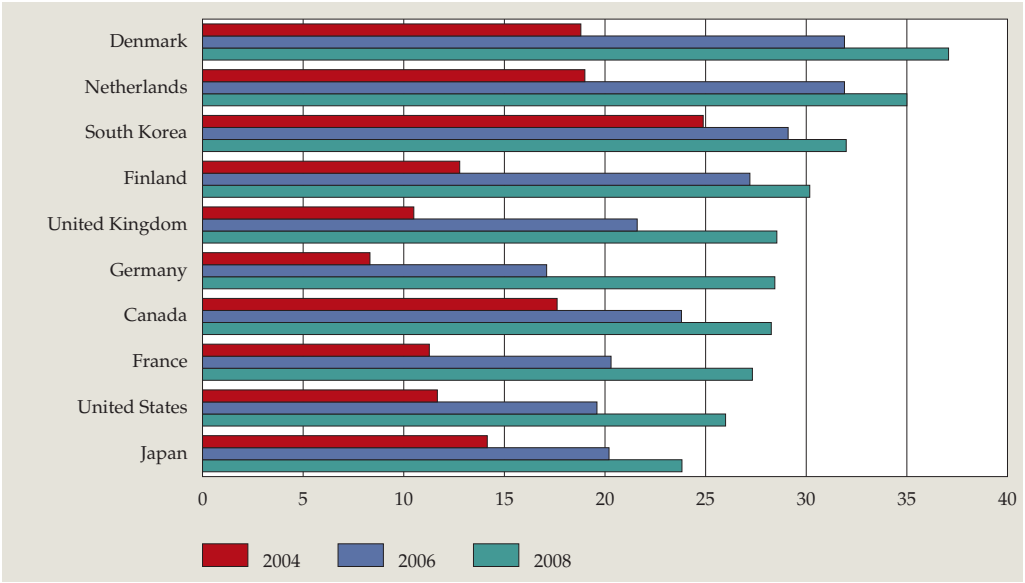
Long Term Evolution, LTE (max 100 Mbps). Also known as 4G. This very fast successor of UMTS/HSDPA is still in development and will be put into use in the next few years. LTE can largely use existing GSM and UMTS networks.

There are various reasons for the continuing surge in internet traffic. More and more companies and consumers have broadband connections (see also next section), and added to this the maximum speeds of these connections keeps increasing. Users are also increasingly using applications that require a great deal of bandwidth, such as streaming video.

Netherlands has the highest 50+ Mbps broadband coverage

The Ministry of Economic Affairs defines broadband as 'a connection allowing high-quality video and audio applications 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 upload and download speed) of at least 256 Kbps'.

3.1.2 Broadband connections per 100 inhabitants, international, 2004, 2006 and 2008 [1) 2)]



Source: OECD, Broadband statistics.

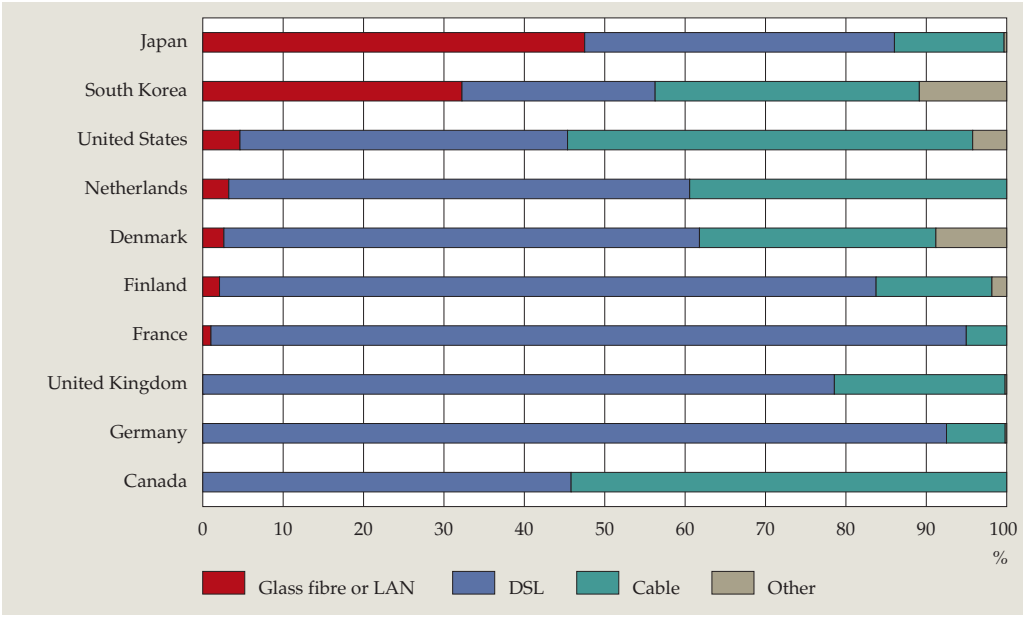
[1)] December of the year concerned.
[2)] Excluding mobile connections.

These broadband definitions cover most modern fixed internet connections, such as ADSL and cable internet, but not dial-up connections through landlines. Although mobile internet using, for example, UMTS is covered by these definitions, the figures in the remainder of this section do not include mobile connections.

Households and companies now make less use of traditional dial-up connections, as broadband connections have now become the norm. Within the OECD, the Netherlands had the second highest number of broadband connections per 100 inhabitants (35) in December 2008, as Figure 3.1.2 shows. This is only slightly up on the 34.8 of December 2007. The slower growth indicates market saturation. Denmark led the OECD countries, with 37.1 connections per 100 inhabitants.

Almost all households who wanted a broadband connection in 2008 could get one. ADSL coverage is above 99 percent and cable coverage is above 98 percent.[1)] The largest cable operators are applying the new standard EuroDOCSIS 3.0 which makes very fast connections possible using the coaxial network. Consequently, fast cable internet with download speeds of between 50 and 120 Mbps already has a coverage of over 90 percent (NLkabel, 2009). As a result the Netherlands is now the world leader in terms of coverage of 50+ Mbps broadband connections, followed by Japan and South Korea (Telecompaper, 2009). A minimum speed of 50 Mbps is required for new online applications and online services to be introduced in the coming years (see also section 8.4). Companies are also investing in other infrastructures to make fast internet possible, such as VDSL and fibre infrastructure (FTTH). Households in some municipalities already have a fibre connection at home, together they account for about 3 percent of all Dutch households (Stratix, 2009). Compared with 2007, the overall shares of fibre, DSL and cable internet in the total number of broadband connections remained more or less unchanged in 2008.

3.1.3 Access technology used for broadband internet, international, December 2008 [1)]



Source: TNO / Point-Topic.

[1)] Excluding mobile connections.

Figure 3.1.3 shows an international comparison of the technologies used to access broadband in December 2008. The figures refer only to fixed, not mobile broadband connections. In 2008 people in the Netherlands mainly used ADSL (57 percent) and rtv cable (39 percent) to access the internet. The international differences

are large. As most households in the Netherlands already had cable television and radio, a relatively high percentage of them now also receive broadband via cable. In less densely cabled countries, like France and Germany, this type of broadband access is much less common. In Japan and South Korea people use more high-speed glass fibre connections. Over 40 percent of broadband internet connections in Japanese homes are glass fibre connections. In the Netherlands this is about 3 percent, just as at the end of 2007.

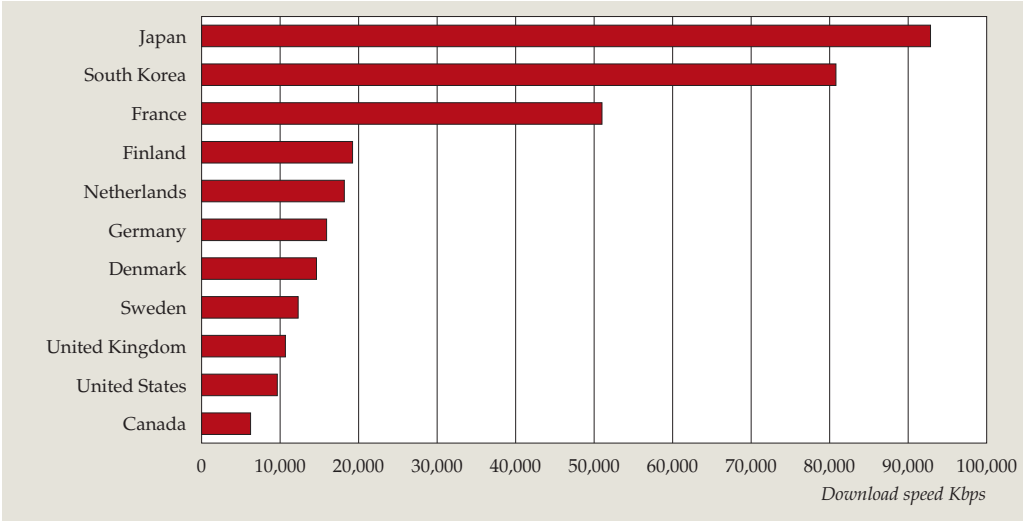
Fibre network expanding rapidly

A team of experts examined the Dutch Fibre-to-the-Home (FTTH) market in March 2008 and March 2009. In the intervening year, the FTTH network had expanded increased.
The FTTH council has a defined terminology for different stages in the development of this network: homes passed, homes connected and homes subscribed.
Homes passed are the homes which an operator can potentially connect in a service area, although they may not be actually connected to the network. These are homes in streets where the fibre ends in the street cabinet. The last part of the cable, into the house and to the meter cupboard, may not have been laid yet.
The number of homes passed grew from 188 thousand in 2008 to 349 thousand in 2009, an increase of 85 percent.
Homes that are connected to an FTTH network are the homes connected. In these homes, the fibre cable is actually present in the meter cupboard. In 2008 this was the case for 142 thousand homes; a year later this had risen to 216 thousand, an increase of 52 percent.
The number of homes connected which use at least one service on this connection under a commercial contract (homes subscribed) grew by 65 percent, from 84 thousand in 2008 to 139 thousand in 2009.
Unlike the FTTH roll-out in 2008, which consisted mainly of projects initiated by housing corporations, the roll-out in early 2009 was implemented on a large scale using a standardised approach.
There are large differences in the implementation of FTTH projects between the provinces in the Netherlands. The largest FTTH projects are being undertaken in Noord-Brabant, Noord-Holland, Flevoland, Gelderland and Overijssel. There is very little FTTH activity in the north (Drenthe and Friesland), the southwest (Zeeland) and the south (Limburg) of the country.
Some FTTH projects are ongoing in Amsterdam, but projects in Rotterdam, The Hague and Utrecht have been halted completely.
If present project plans are realised as anticipated, the number of homes passed will reach approximately 1 million by December 2011.

Source: Stratix, 2009

Compared with a number of benchmark countries, the average broadband speed advertised by providers in the Netherlands is average: 18,177 Kbits per second. In reality users usually receive lower speeds. The actually supplied speed depends on internet use by households during peak hours (cable) and the distance to the neighbourhood switchboard (DSL). The average advertised speed was highest in Japan, at about 92,000 Kbps (see Figure 3.1.4). As high-speed internet of over 50,000 Kbps has become available across most of the Netherlands in 2009, the average speed will probably increase.

3.1.4 Average broadband download speed advertised, September 2008



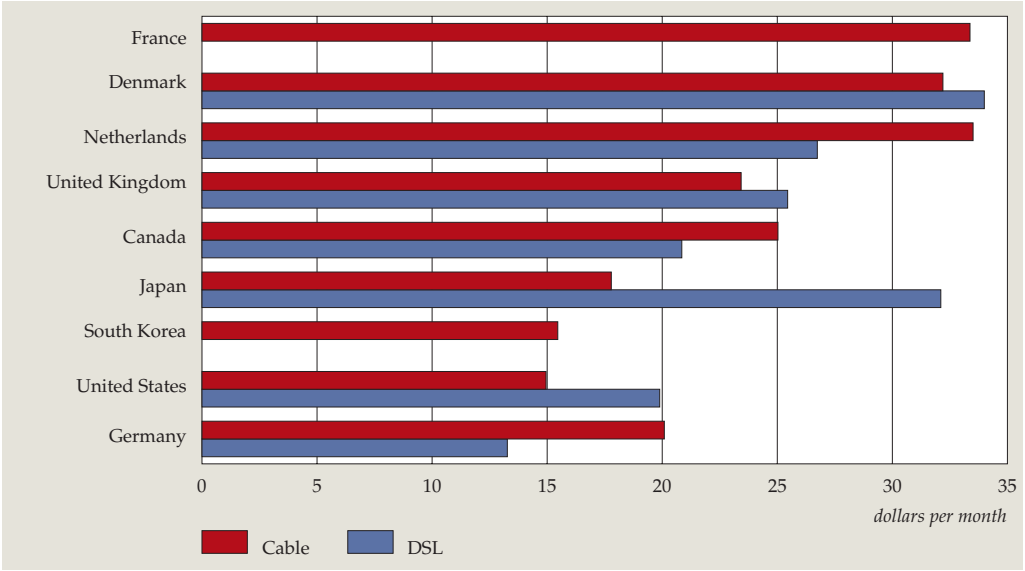
Source: OECD.

Average costs of broadband

Figure 3.1.5 shows how much a starter package costs for DSL broadband and broadband internet via cable in the Netherlands and several benchmark countries. These monthly rates are converted into US dollars to allow for comparison. Starter packages differ between countries in terms of speed, download limit, and extra services. Broadband subscriptions in the Netherlands have been upgraded several times in recent years, so consumers get a higher speed for the same price. They can also opt to downgrade their subscription and pay less for the same speed.

Dutch cable rates were average compared with the benchmark countries, but Dutch DSL rates were quite high. Compared with the end of 2007, Dutch cable rates were slightly lower while DSL rates were slightly higher.

3.1.5 Prices of broadband DSL and cable starter packages, international, fourth quarter 2008 [1)]



Source: Point-topic.

[1)] Countries are sorted by the lowest national rate for DSL or cable.

3.2 *Telephone*

The telephone market has changed. The number of traditional analogue telephone connections or landlines has decreased in favour of alternatives such as mobile phones and internet telephony. The first figures presented in this section are about landlines including up-and-coming telecom technology such as internet telephony. Subsequently, we address mobile telecommunication.

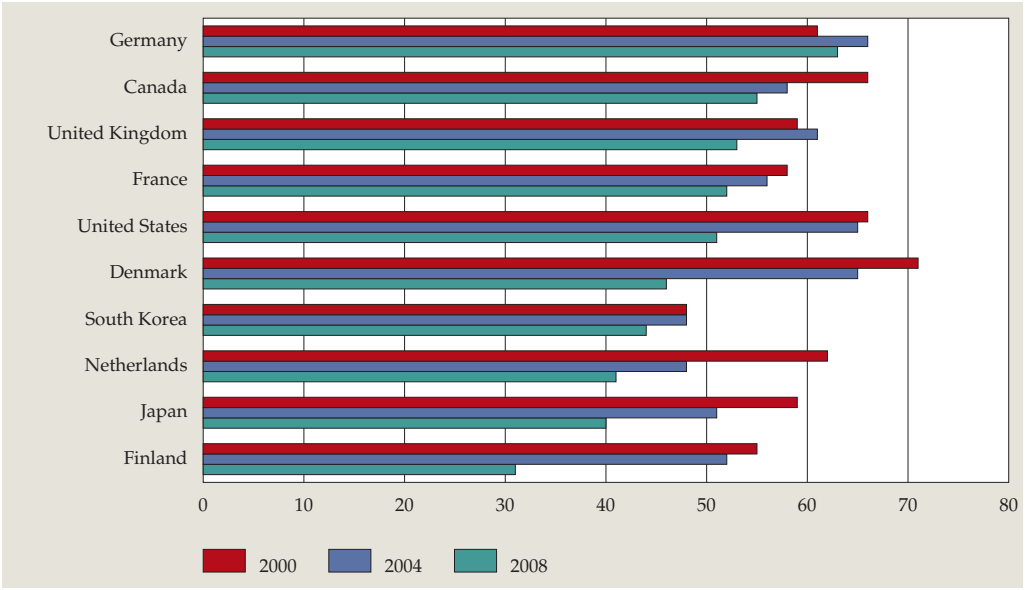
Fewer fixed landlines

Almost all households in the Netherlands can be connected to the fixed telephone network. This network has national coverage and is widely used. It used to have close to 10 million telephone connections (including ISDN). After a long period of steady growth, the number of fixed landlines started to decrease after 2000. Compared with 2007, the fall continued in 2008, this time by 1 percent.

Figure 3.2.1 shows the number of connections per 100 inhabitants in the Netherlands and some benchmark countries. The Netherlands had 41 fixed connections per 100 inhabitants in 2008, of which 18 are VoIP connections and the rest regular analogue connections. The number of fixed landlines in the Netherlands has fallen well below the EU-27 average of 65 in 2007. In 2000 there were still 62 fixed connections in the Netherlands for every 100 inhabitants. The decrease that has occurred

since then, has also occurred in most of the benchmark countries. It is the result of more and more households only using mobile telephony.

3.2.1 Fixed telephone connections per 100 inhabitants, international, 2000, 2004 and 2008 [1)]



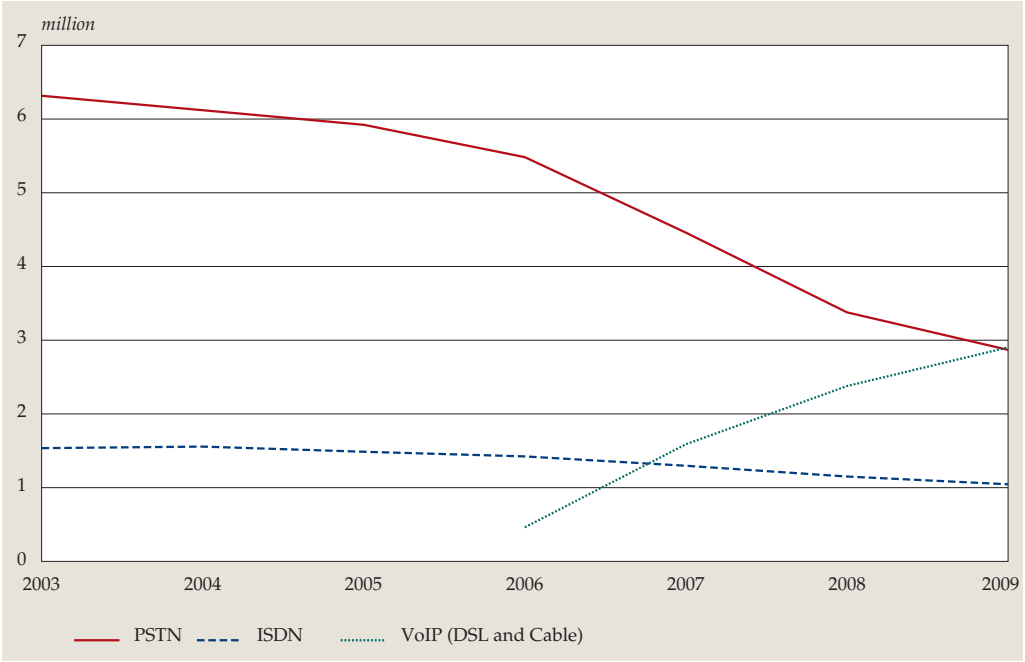
Source: TNO based on ITU and OECD.

[1)] Including ISDN and VoIP connections.

Internet telephony continues to rise sharply

Figure 3.2.2 shows the rise of internet telephony. VoIP increased rapidly again in 2008, to 2.9 million connections. Since the end of 2008 there are more VoIP connections than regular analogue (PSTN) telephone connections. At the end of 2008 there were fewer than 2.9 million PSTN connections; in December 2001 there were still over 6.5 million.

3.2.2 Fixed telephone connections, by technology used, 2003–2008 [1)]



Source: TNO, KPN.

[1)] 2009 = end of fourth quarter 2008.

Internet telephony

Phoning through the internet – Voice over IP or VoIP – has been popular for years. The telephone call is turned into digital packages and sent via Internet Protocol. There are two VoIP options:

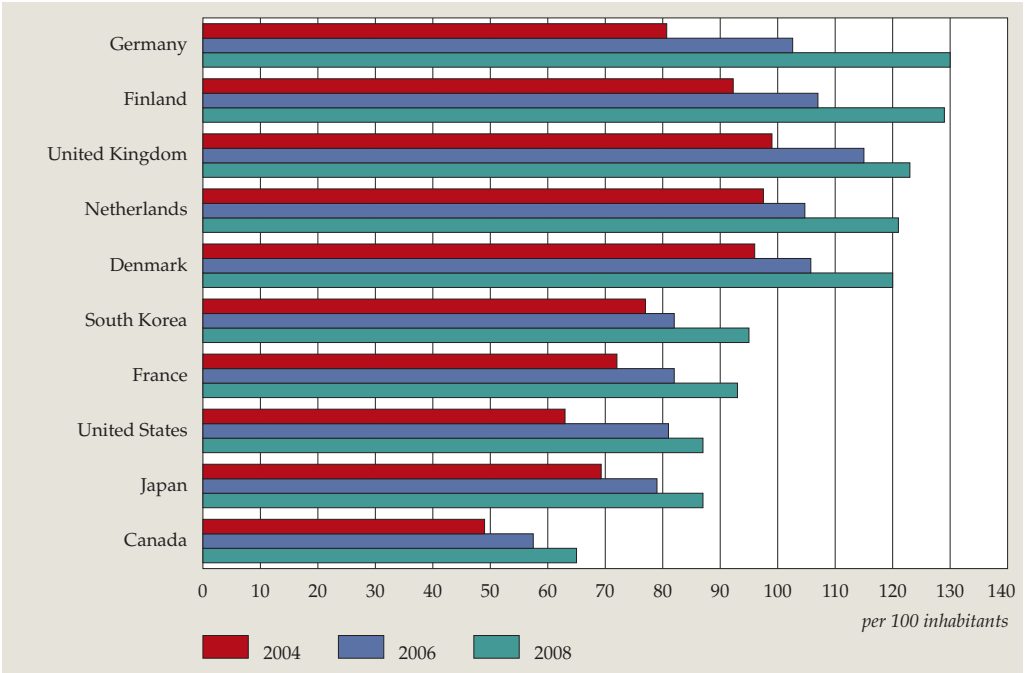
1. VoIP via a broadband internet connection as a separate service alongside the internet access. People use a regular telephone connected to a modem or internet router. No computer is necessary to make the call.
2. The other option is VoIP over a broadband internet connection, where a headset or microphone is connected to a computer. The computer digitises and sends the call via its internet connection. This requires special software on the computer (for example 'softphone'), and sometimes a special telephone provider to link the internet and the regular telephone network. A distinction is made between PC-to-PC calls and PSTN-terminating-calls. In the former, both callers call through their computers, often free of charge. In the latter the caller uses a computer to call a regular phone; this usually costs money.

Many mobile telephone connections

At the end of 2008, there were 18.7 million mobile phone connections (prepaid and subscriptions) in the Netherlands, 7 percent more than in December 2007. Apparently the market is not yet saturated, despite the fact that since 2005 the total number of mobile connections exceeds the number of inhabitants in the Netherlands. Some people have two or more mobile telephones, for instance one for work and one private phone. Mobile phone connections also include other devices with a SIM card, such as laptops with UMTS mobile broadband internet. As the use of this form of mobile internet increases, the number of mobile connections may also increase further. In the future this may lead not only substitution of fixed telephony, but also to substitution of internet access via the fixed network.

Placed in an international perspective, the Netherlands has relatively many mobile telephone connections. Figure 3.2.3 shows the number of connections per 100 inhabitants for the Netherlands and several benchmark countries. The Netherlands had 121 mobile connections per 100 inhabitants in 2008. Germany had the highest rate: 130 connections. The number of mobile connections is still increasing in all the benchmark countries. Remarkably, in several large economies, such as the USA and Japan, there are fewer than 90 mobile telephone connections per 100 inhabitants.

3.2.3 Mobile telephone connections per 100 inhabitants, international, 2004, 2006 and 2008



Source: TNO.

The mobile telephone network in the Netherlands has almost complete national coverage. As a result of the merger of two telecom providers and the subsequent combination of their networks, the number of antennas in mid-2009 was smaller than twelve months previously. GSM is the most commonly used mobile telephone standard. In June 2009 there were 12,428 GSM antennas across the country, over 2,500 fewer than in June 2008 (Antennebureau, 2009). The number of antennas for UMTS, GSM's successor, fell by 900 to 8,416. Since the merger at the end of 2008, the numbers of both GSM and UMTS antennas have increased slightly.

3.3 *Television and radio*

1951 saw the first, analogue, television broadcast in the Netherlands. To receive television people had to place a huge antenna on their roof and to pick up signals from the air. The first household rtv cable connections were established in the 1960s. Cable gave a better sound and picture quality than the ether, and more channels. Cable is indeed still the most common way to receive television. In 2008, about 98 percent of Dutch households had an rtv connection, making the Netherlands one of the most densely cabled countries in Europe.

Frequency shortage for analogue radio and television

Although terrestrial analogue television is a thing of the past (it ended on 11 December 2006), analogue radio via the ether is still very popular: think of the many car radios and mobile radio receivers (traditional transistor radios and modern mobile phones with radio). The shortage of frequencies for current terrestrial FM stations is a major problem in the Netherlands. The number of stations that want to broadcast exceeds the number of frequencies available for them to do so. Therefore the government auctions off frequencies. One of the solutions to this problem is the introduction of digital terrestrial radio (T-DAB).

Analogue television signals are transmitted via rtv cable, often together with analogue radio. Although cable offers more room for radio channels than the airwaves, there is a shortage here, too. The use of analogue signals has its disadvantages. Disturbances in the signal are quite clear, occurring as noise, 'snow' or ghosting effects. This problem occurs mainly in analogue terrestrial signals, although loss of quality also occurs with analogue cable television.

Another problem is the limited amount of space available for channels. Only a few ether frequencies (or rather frequency bands) can be used to transmit radio or television. Likewise, rtv cable can only accommodate a limited number of channels. Partly because of this, at the end of 2008 nearly 35 percent of cable subscribers watched digital television on their primary television. In the remainder of this section digital television and radio will be discussed more in depth, including the various options for receiving them.

Digital television requires less bandwidth

The picture information – the various television channels – in digital television is not transmitted as a continuous, analogue signal, but as discrete data packages. The channels require less bandwidth because digital data can be compressed, which means the same transport medium can provide more digital than analogue television channels. Six to eight digital channels can be transmitted in the same bandwidth used by one analogue channel, while the quality stays the same. Another option is to transmit high-resolution signals, such as HDTV, instead of more channels.

The standard for digital television signals in Europe is Digital Video Broadcasting (DVB). Other standards are used alongside this internationally agreed standard. In the USA ATSC is the standard and Japan uses ISDB as its standard for digital television via the ether.

Digital subscriptions usually cost the same as analogue television. People often have to pay more for extra channels or HDTV. They also need a special digital receiver and a smartcard for each television set. These are often made available by the digital television provider to convert the digital signal into a format that regular TV sets can handle.

Households can receive digital television in various ways: via rtv cable, terrestrial, via satellite or through the internet. Below we sketch the possibilities and differences between the various methods and where possible show figures about their use.

Digital terrestrial television

Digital terrestrial television, also known as DVB-T (Digital Video Broadcasting – Terrestrial), is the modern version of television received with the classical analogue TV antenna. This form of reception is available almost everywhere in the Netherlands. The old analogue television broadcasts were terminated on 11 December 2006. While a huge roof antenna used to be required for a decent reception, digital television requires only a small 20 centimetre antenna inside the home. Reception is better than an analogue antenna could hope to offer, but the picture is more compressed than with other forms of digital television and therefore of lower quality. In 2009, terrestrial digital television could accommodate 23 television channels. The bandwidth is not large enough to broadcast in HD, and interactive television is not possible.

The digital versions of Nederland 1, 2 and 3 and the regional channels have been available free of change since the analogue terrestrial signal stopped. However, consumers have to buy a digital decoder and a suitable antenna.

At the end of 2008, there were 743 thousand subscribers to digital terrestrial television in the Netherlands, compared with just 482 thousand one year previously. It is therefore the fastest growing form of digital television in relative terms, probably because of the relatively low costs.

Mobile television

Watching television in the train or while stuck in traffic is becoming more and more common. Regular television broadcasts can be watched on a mobile telephone or PDA. Most people use the UMTS network for this. The image is sent to the handheld devices through an internet connection set up via the UMTS antennas. The images are sent to each individual user through UMTS, generating a large flow of data traffic. The picture quality is therefore not as high as with the other option, which is to send a single TV signal that is simply picked up by the mobile telephone. This signal is similar to digital terrestrial television, but specially adapted for small handhelds. New standards have been developed for this purpose, such as DVB-H (Digital Video Broadcasting-Handheld) and DMB (Digital Multimedia Broadcasting). At the end of 2008 there were about 30 thousand subscribers to DVB-H in the Netherlands (Telecompaper, 2009).

Digital satellite television

Besides digital terrestrial television, households can also receive digital television via satellite. This technology makes over 400 television channels available and also offers the widest choice in HDTV. Picture quality is also better than digital terrestrial television. There is one disadvantage, however: a satellite dish has to be placed outside the home, which is not always possible or even allowed. In addition, the dish must have a direct line-of-sight with the satellite. Interactive television is not possible with satellite television.

Since 11 December 2006, satellite broadcasts by Dutch stations can only be received digitally. Nearly all foreign satellite stations have switched to digital technology in recent years. In terms of the infrastructure required, there is little difference between analogue and digital television reception with a satellite dish and receiver. Consumers with a satellite dish can simply switch to digital television, usually just by placing another receiver. Digital television via satellite is broadcast with the DVB-S standard (Digital Video Broadcasting – Satellite). These satellites cover an enormous area: one satellite can broadcast to an entire continent. In principle the coverage of satellite reception is 100 percent if there is line-of-sight with the satellite. In 2008, some 870 thousand households watched digital satellite television in the Netherlands, compared with 800 thousand in 2007. In 2005 it was the most popular way to receive digital television; after that digital television via cable started to grow rapidly.

Digital cable television

As the name suggests, in this form of television reception the digital television signals enter the home via rtv cable. No extra aerials or dishes are required. The standard for digital television via rtv cable is DVB-C (Digital Video Broadcasting – Cable). It is possible to broadcast more channels and/or a higher definition than

with analogue cable television. People can still receive the regular analogue cable signal on their sets without an extra digital receiver, because the analogue signal is still transmitted alongside the digital signal. The picture quality is about the same as with digital satellite television. Dozens of channels are offered, including some in HD quality. Interactive services such as VOD (Video-on-demand) and voting in a quiz or show are possible using the remote control.

The number of households with digital television via cable increased by 416 thousand from 2007 to 2008, again making it the fastest growing form of digital television in Dutch households. By the end of 2008, there were just under 2 million digital cable television connections (1.99 million). The 2 million mark was passed in the first quarter of 2009.

Digital television via internet (IPTV)

A fourth option is to receive digital television via the internet, also known as IPTV (Internet Protocol Television). Using a DSL line with sufficient capacity or a fibre connection, it is possible to transmit an entire high-quality television channel. The advantage of this form of digital television is that it transmits only the channel to which the user has selected. Most other forms broadcast all channels simultaneously, leaving the television set to filter out a single channel. The frequency shortage does not affect this technology, therefore, and in theory the number of stations is unlimited.

One restriction for this form of television is that the internet connection must be fast enough to accommodate it. ADSL2 is usually recommended, but this is not available for all households in the Netherlands (see also section 3.1). At present HDTV is only possible with a fibre connection. Just as digital cable television, IPTV also offers the possibility of interactive television.

At the end of 2008, there were 282 thousand subscriptions to IPTV, up from 211 thousand one year earlier. It is the least used method to watch TV so far. This type of digital television should not be confused with watching television on a computer with a special TV card, where the signal still enters the home via rtv cable, or with downloading films or programmes from the internet.

HDTV

The term High Definition Television (HDTV) refers to television with 720 or more horizontal lines of resolution, wide screen format (16:9) and multi-channel sound. The image is much more detailed than that generated by analogue systems such as PAL and NTSC. There are a number of frequently used standards, which can be divided into two main groups: progressive scanning and interlaced scanning. TV images are refreshed several times a second. With progressive scanning the entire image is restructured with each refreshment. With inter-

laced scanning, the image is always refreshed in two parts: first the uneven lines and then, with the next refreshment, the even lines. Interlacing is mainly noticeable when objects on the screen move horizontally, and the pixels no longer connect perfectly. The advantage of interlaced scanning is that it requires only half the data flow needed for progressive scanning.

There are many kinds of HDTV format resolutions. The main ones are:

720p – This format indicates that there are 720 lines with 1280 pixels each, using progressive scanning. A television set with an HD-ready logo can show at least these 720 lines.

1080i – This format indicates that there are 1080 lines with 1920 pixels each, using interlaced scanning. Even though this standard has more lines in total than 720p, it only shows half per frame – 540 lines. This standard is known as Full-HD.

1080p – This format has the same number of lines and pixels as 1080i, but these use progressive scanning. Therefore this format requires twice the bandwidth. This standard is also known as Full-HD.

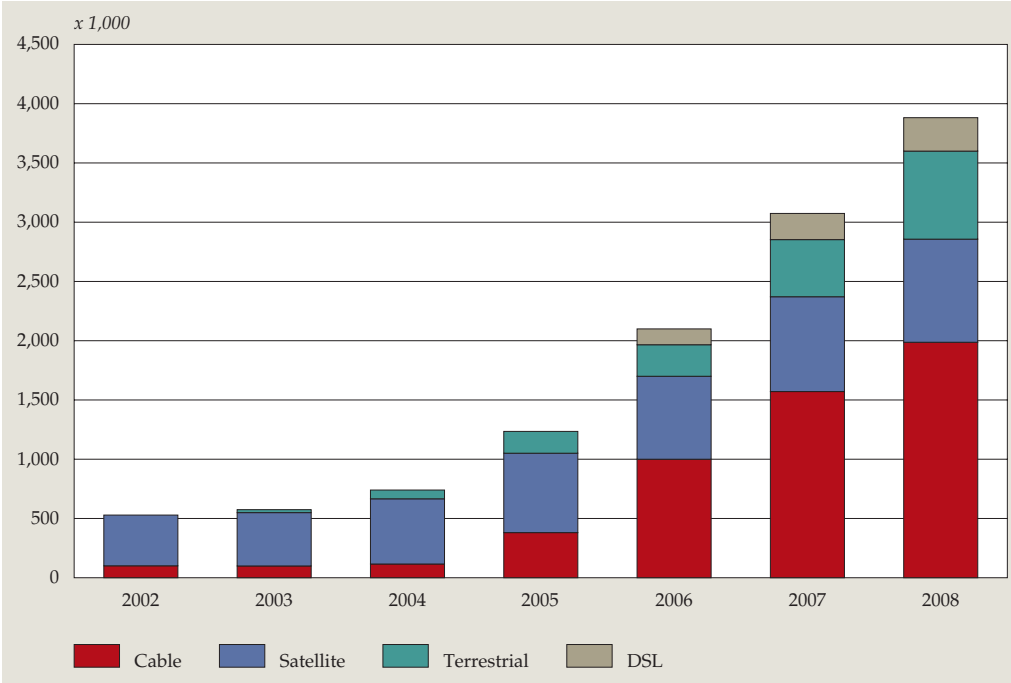
Viewers need an HD-ready television set to watch the 720p format. For the 1080i and 1080p screen sizes, they need a Full-HD television. In 2008, 88 percent of televisions sold in the Netherlands were suitable for HDTV: one quarter were even capable of showing Full-HD (GfK, 2009).
Both in Europe and the USA there are broadcasters who transmit in 720p and 1080i. The frames are usually changed with a frequency of 50 or 60 per second. For fast-moving images, such as sports programmes, 720p gives a better quality, while for less dynamic programmes, such as documentaries, 1080i is better. Since July 4, 2009, the Dutch public television broadcasters Nederland 1, Nederland 2 and Nederland 3 have been broadcasting in HD (1080i). This is partly native HD (actually recorded in HD) and partly non-HD images which are scaled up to 1080i. Some commercial broadcasters followed suit later in 2009.
For the time being, 1080p will not be used for television broadcasts because of the bandwidth it requires. In the next few years this standard will probably only be used in Blu-Ray films.

Digital television via cable and the ether most popular

Figure 3.3.1 shows the development in the use of digital television broken down by type of reception: terrestrial, satellite, cable or DSL/fibre connection. Satellite had the highest number of digital connections in 2005, but this changed in 2006 when rtv cable became most popular. Terrestrial digital television is also becoming more

popular. In 2008 this category even grew faster than the rest (54 percent), probably because the subscriptions are cheaper than digital television via rtv cable, on average by about half. However, the number of channels and additional services is more limited. Overall there were 3.9 million digital television connections at the end of 2008, 26 percent more than at the end of 2007.

3.3.1 Digital television connections, by method of reception, 2002–2008



Source: TNO.

Extra options with digital television

Apart from advantages such as better picture quality and more channels, digital television also has several other options than analogue television, for example:

Pay per view/per channel
It is easy to send a coded signal with digital television, enabling pay TV. Viewers select the channels or packages they want to buy and receive a smartcard from the provider that they place in the digital receiver. The receiver then decodes the channels for which the viewer pays.

Video-on-demand
Digital television provides many interactive options, for instance services that make it possible to watch programmes after the transmission, (Uitzendinggemist in the Netherlands). Such services place the programmes entirely or partially in an archive. With digital cable television and IPTV it is also possible to order films or series, and pay for specific programmes.

HDTV
High Definition Television (HDTV) is a standard for television broadcasts with a higher resolution than the regular broadcasts. The increased popularity of large plasma, LCD and LED television screens has pushed up the demand for HDTV, as regular broadcasts give a blurred or 'blocked' picture. Because HDTV requires a greater bandwidth, it is only available for digital television through cable, fibre and satellite.

Other extra features
Digital television always provides an on-screen up-to-date electronic programme guide. Viewers can also interact with some live broadcasts, for example by voting in a contest or a show, but also by directly purchasing items that appear on the screen. It is also possible to playing games with digital television.

Digital terrestrial radio stimulated

Many countries use DAB (Digital Audio Broadcast) as the digital radio standard. Public broadcasting in the Netherlands has used terrestrial DAB (T-DAB) alongside the analogue signal since 2007. Commercial radio stations with an FM licence will be obliged by the government also to broadcast in T-DAB, which can be seen as the successor to the FM technology. In the Netherlands, T-DAB reached about 70 percent of the population in 2007, primarily in the Randstad region in the west of the country and in the province of North Brabant. There are no figures on the number of people who actually listen to the radio via T-DAB.
Apart from DAB it is also possible to receive radio transmissions via DVB-T, DVB-S and DVB-C. These technologies transmit radio signals together with the television signals. Listeners can already receive commercial radio stations in this way. Figures on coverage and use of these methods are shown in the section on digital television.

Digital radio signals are transmitted in small digital data packages, just like digital television signals. The advantages are the same as those of digital television: better signal quality (especially compared with analogue terrestrial radio) and the possibility of accommodating more channels in a limited frequency range. It is also possible to send extra information with the signal, which can be used to update car navigation systems with traffic warnings, or to send images. The radio receiver can

show these images on a display or screen. Listeners to digital radio need a digital radio receiver to do so.

DRM (Digital Radio Mondiale) is an altogether different standard.[2)] This can be seen as the digital equivalent of shortwave. The advantage of shortwave is that the transmitter covers a much wider area than an FM transmitter. The drawbacks are more interference and a lower sound quality. Digital signals can reduce the interference, so that a transmission of reasonable quality over more than a thousand kilometres can be achieved. The only radio station in the Netherlands using DRM in 2009 was Radio Netherlands Worldwide.

Digital radio via the internet

Users can listen to streams on the internet. These may be live streams (direct copies of transmissions of terrestrial or cable broadcasts), as well as a great many internet only broadcasts. The worldwide character of the internet makes it possible to listen to radio stations from all over the world. Frequency shortage is not a factor here, as only the selected channel is sent.

The internet also provides the option of listening to programmes at any time. While high-quality television through the internet requires a high-speed internet connection, this is not the case for digital radio via the internet. A starter broadband subscription is usually enough.

3.4 Convergence

In the past, each telecom service had its own unique transmission method. One institution or company had the monopoly in this service. Speech and fax messages went through a telephone line, and television though the cable of the local cable company. There have been two major changes in this system. First, telephone services are no longer in the hands of one state company, as other companies can also use the telephone cable infrastructure. And second, major new technologies such as mobile telephones and the internet have come on the market. The emergence of the internet introduced new ways of providing services. Services that used to be separate can now be sent jointly via Internet Protocol (IP) and one single infrastructure. This has led to a convergence of services.

Today many telecom companies offer service bundles via one single distribution method. This is also known as ‘multiplay’. For instance, a company can now use the rtv cable to supply television, internet and telephone services. Sometimes these services are offered in a single package through different distribution methods.

Convergence of services: All-IP

Technically speaking the differences between the various services are 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 used to send IP packages is no longer relevant. All services can be sent through twisted-pair copper cable (which were previously only used for telephone calls), coax cable (previously used for television signals) or new glass fibre cables. The IP packages can also be sent through mobile infrastructures such as UMTS, even DVB-T and T-DAB. Although the technology used to transmit information may be different, consumers will experience little difference.

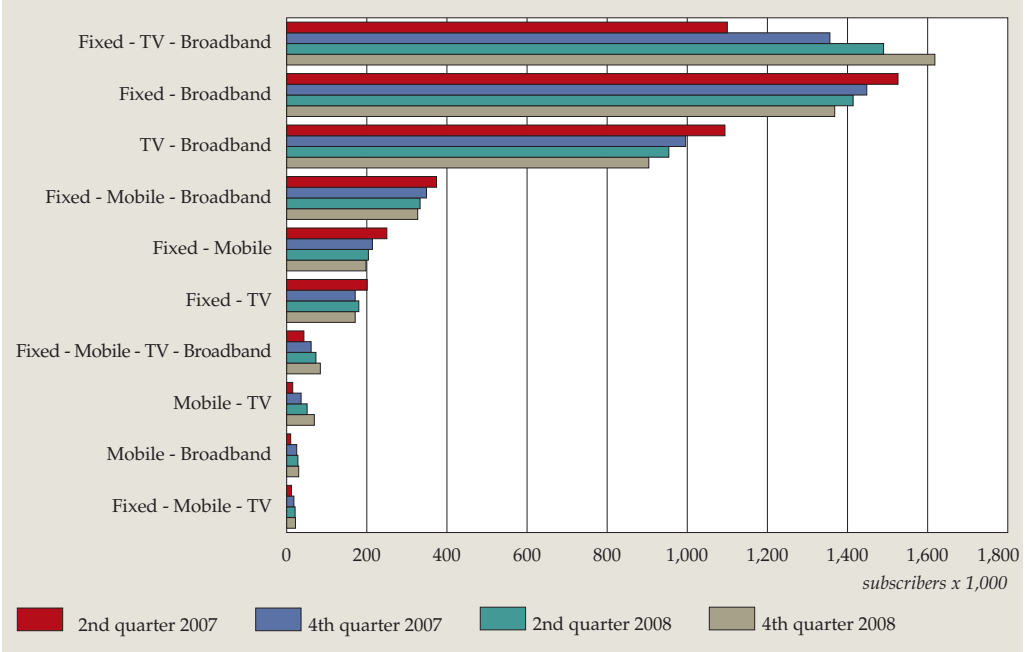
The main reasons households give for choosing a combined package are convenience and the lower costs (EIM, 2006). Additional advantages are one infrastructure (one small box instead of a separate modem and telephone connection box), and one helpdesk. The disadvantage is that when the line goes down all services go down with it. This can be a problem, especially for companies. While it may not be too disastrous if the email system is temporarily unavailable, if a company has no telephone or internet access at all, this may well cause severe disruption.

The advantage for telecom companies is that they can offer a wider product range, possibly lower costs because of the advantages of scale. Traditional cable companies, which used to provide television and radio, can now add telephone services. To counter the loss of customers, telephone companies now also offer television services.

It is relatively simple these days to change from one provider to another. OPTA – the Dutch telecom watchdog – had already introduced regulations that make it easier to change (mobile) telephone provider: people can keep their existing number, for instance. It has also become more common and is gradually becoming simpler to change internet or radio and television providers. It used to take weeks to switch from one internet provider to another, leaving customers without internet at all. Today providers are required to realise this within one day.

Figure 3.4.1 shows the purchase of different services from one provider. Various market parties are specialising in this area. In 2007, use of multiplay rose sharply: 55 percent more subscribers compared with 2006. However, this growth stabilised in 2008, at only 3 percent. The most frequent combination of services in 2008 was landline, broadband and TV (1.6 million subscribers). This number has increased continuously in the last two years.

3.4.1 Use of multiplay, 2007–2008 [1)]

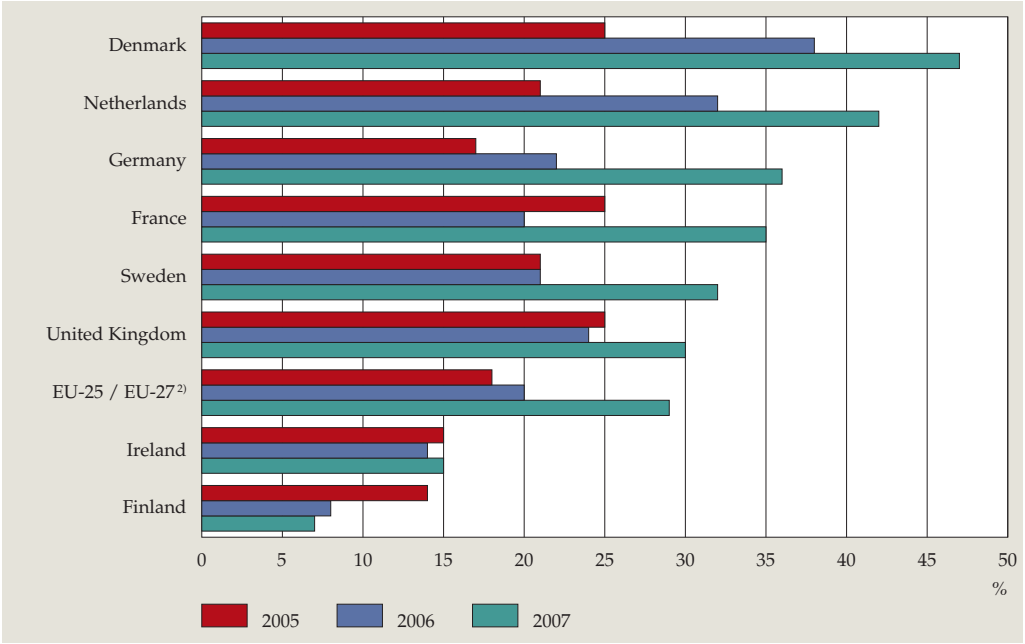


Source: OPTA.

[1)] The term 'fixed' means telephone via a fixed line (including VoIP), 'mobile' stands for a mobile telephone connection. 'Broadband' stands for a fixed or wireless broadband internet connection.

A study by the European Commission (EC, 2006, 2007 and 2008) shows major differences within the European Union (EU) in the use of multiplay, see Figure 3.4.2. In 2007 the share of households within the EU-27 that purchased at least two services in a single package averaged 29 percent. In the same year this was 42 percent in the Netherlands; only in Denmark was multiplay use higher within the EU-27.

3.4.2 Use of multiplay, international, 2005–2007 [1)]



Source: European Commission, 2006, 2007, 2008a.

[1)] Share of households purchasing at least two services in one package from one provider.
[2)] 2005: EU-25; 2006 and 2007: EU-27.

Notes in the text

1) Some households may not be connected because of technical reasons such as the distance to the neighbourhood switchboard.
2) DRM is also the abbreviation for Digital Rights Management, technology to protect digital rights such as copyrights on digital music files.

4. ICT use by companies

As most companies in the Netherlands now have broadband internet and their own website, there is a considerable basis for advanced and large scale ICT applications. There are differences between companies in the use of advanced applications, and these differences will probably remain in the near future. Selling products online, for example, is typically an activity that not all companies are expected to adopt. This chapter describes a number of ICT applications used by companies in the Netherlands. The use of these applications differs, sometimes significantly, between large and small businesses, but also between sectors of industry. The decision on whether or not to invest in technology or an ICT application will always be based on business considerations, and the cost-benefit analysis will not work out the same for all companies.

In the manufacturing industry, the use of ICT to support business processes has focused more on the production and distribution chain, while in the services sector it has been used more for marketing and customer services. At the end of 2008, order processing systems were more likely to be linked to automated systems for stock management in manufacturing and trade companies than in companies providing services, as it is very important that companies in the former sector receive goods on time. A similar difference has been established in the use of ERP and CRM software. ERP software is used more in manufacturing and in trade, while CRM software is more common in business services. These differences can be explained quite easily, as they show a rational use of ICT in different companies.

One in five companies were using open source operating software in December 2008, mainly large companies and ICT companies. In this case, differences in use seem to be based on differences in relevant knowledge and skill levels.
Automated data exchange (ADE) offers advantages in terms of efficiency and of the standardisation of services and products. Large companies, in particular use ADE: 47 percent of companies with more than 500 employed persons used ADE in 2008 to send purchasing orders to suppliers. Supply chain management is mainly the domain of large trade and manufacturing companies. At the end of 2008, 41 percent of the largest companies had implemented some form of supply chain management.

As electronic sales are very industry related, there are large differences in the extent of these transactions between sectors of industry. Two-thirds of accommodation and travel agents use electronic sales, as their products are prime examples of products consumers have increasingly been buying online in recent years. Within companies, electronic purchasing is more common than electronic sales, possibly it entails lower investment costs.
While e-commerce accounted for just over 3 percent of total turnover of Dutch companies in 1999, this had risen to almost 12 percent in 2008. Large companies and companies in the transport and storage sector generate a large proportion of their turnover through e-commerce.

Radio Frequency Identification (RFID) is not used very widely yet: 9 percent of companies used this technology in 2008. Again, large companies, in particular, have discovered RFID, and use it mostly for person identification and access control. About one sixth of companies in the information and communication sector use RFID technology. Transport and storage companies also use RFID relatively frequently to monitor goods and pay road tolls.

From an international perspective, the Netherlands is not among the leaders in terms of ICT use by companies. Companies in north European countries, in particular, used ICT more intensively. Nor were Dutch companies among the early adopters of various ICT applications. A number of years ago, use of broadband internet and electronic purchases and sales were quite average compared with the rest of the EU, but in 2008, these were well above average in the Netherlands.

4.1 ICT infrastructure and use

ICT has been widespread in the business sector for many years, and almost all companies in the Netherlands now use basic ICT at least. This process has taken about 25 years, with a leap in progress between 1995 and 2005. Companies no longer differ in whether they use ICT, but in how they use it; and not all companies have to be equally advanced in this respect. The decision to invest in ICT is ultimately a matter of business economics. For a small company it may be more rational not to spend a lot of time and money on developing and operating an intranet. It may be more profitable for a large company with numerous suppliers to invest in advanced computer systems that communicate with systems of their suppliers than for a smaller company with only a few regular suppliers. In brief: the requirements differ for different companies.

The process of increasingly advanced use of ICT starts with the widespread adoption of the necessary ICT, and the construction of the necessary infrastructure within and outside the business sector. This sounds so logical that it is often considered self-evident, and people sometimes underestimate the correlation between the adoption of ICT and developing and using advanced ICT applications. It is important for developers of ICT applications to have a large number of potential users. This defines the size of the market and determines whether it is profitable to invest in the development of a system. The number of other people using an ICT application often determines its usefulness for users. Phoning through the internet is a prime example of this. The more people who do this, the more useful it will be for an individual user to join in. The same principle of network effects holds for countless other ICT applications and illustrates the importance of the use of standards in electronic data communication.

Survey on ICT use by enterprises

The survey on ICT use by enterprises – which was held under the name IT Survey until 2002 – covers a sample of companies employing 10–249 persons, and all companies employing 250 persons and more. The survey has been conducted by Statistics Netherlands since 1983.
In accordance with the rapid developments in ICT in the past 25 years, the content of the survey was continually adapted. Initially the questions focused on the presence of computers, computer staff and automation costs. In recent years the focus has shifted to the use of external networks, such as the internet, e-commerce and software applications.
The results for a given year refer to the situation at the end of the year; figures on 2008 refer to the situation in December 2008.
Since 2001 the survey on ICT use by enterprises has been comparable to that of other EU countries. It is difficult to make longer time series of comparable data because of the rapid changes in the penetration and use of ICT. International comparison has therefore become a key benchmark for the situation in the Netherlands.

All companies use the internet

At the end of 2008, almost all companies in the Netherlands were connected to the internet; nearly 86 percent of them had a broadband connection. In 1995 less than ten percent of the companies had internet, and broadband connections were a rarity. Broadband internet connections are fixed high-quality connections, such as xDSL (ADSL, DSL etc.), radio and television cable and leased and rented lines.
There is no longer any real difference in internet access between large and small companies. Large companies always used to be slightly ahead of smaller companies in this respect. But although small companies were slower to embrace the internet, they have now attained the same level as large companies. In December 2008, use of broadband internet varied from 82 percent for companies employing 10–20 persons to 99 percent of companies employing more than 500 persons.
There is also very little difference in internet access between the various sectors of industry. Broadband internet is now standard in almost all sectors. Its use varies from 72 percent of businesses in the 'accommodation and food services activities' sector to almost all companies in information and communication. As most companies in all sectors now have broadband internet, it is possible to implement large-scale advanced internet applications.

More than eight in ten companies have their own website

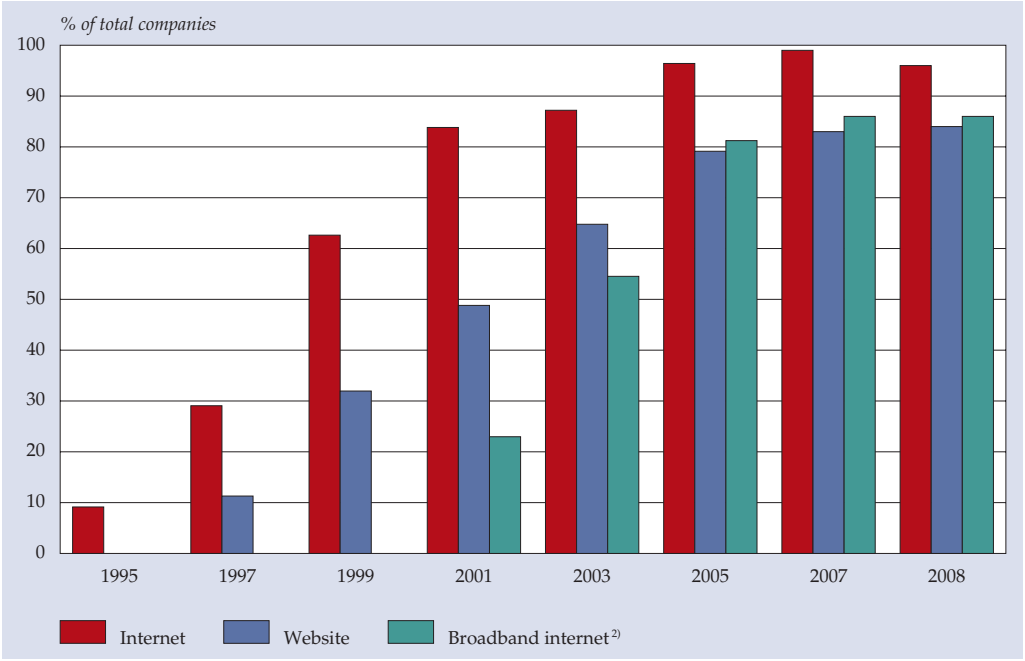
About 84 percent of Dutch companies were active on the internet with a website of their own in December 2008. Their presence on the internet varied from 80 percent for the smallest companies (employing 10–19 persons) to 98 percent for the largest

companies (employing 500 persons and more). Here, too, the 'accommodation and food services activities' sector is the lowest scoring industry (78 percent), while information and communication companies lead the way with 94 percent. The decision to create a company website is based on different considerations than the decision to implement broadband internet. Not only does it cost more time and money to design a website, it takes a lot more resources to operate and maintain a website than to maintain an internet connection. This is probably why relatively many small companies do not yet have their own website. One fifth of companies with 10–19 employed persons did not have a website, while for companies employing 20–49 persons this was still 15 percent. The cost-benefit analysis for constructing and maintaining a website must have produced a negative result for these companies, in spite of the fact that more and more internet users look for information about companies online. [1)] Potential customers may therefore overlook companies that do not have a website.

If we break down the sectors of industry further, the share of companies with a website varies slightly more, from about 7 out of 10 companies in the group 'food and beverage outlets' (restaurants, pubs, cafés, snack bars, etc.) and 'retail (excl. cars)' to complete and almost complete coverage in the 'accommodation' and 'advertising and market research'. A company's decision about whether or not to set up a website is influenced by among other things its nature, and its position in the production and distribution chain. In this regard the sector 'accommodation and food services activities' is an illustration of how differences between groups of companies influence their ICT behaviour. Relatively few 'food and beverage outlets' (restaurants etc.) have their own website. They seem to have other channels to attract customers, or they may have large numbers of regular customers, making a website (with advertising potential) less necessary. For bars, cafés and restaurants, the costs of designing and maintaining a website are apparently not always compensated by the benefits. In the same accommodation and food services activities sector, on the other hand, relatively many accommodation providers do have a website. The potentially lucrative possibility of receiving online bookings probably plays a major role in this; it will be easier for many accommodation providers to earn back the investment in a website.

At the end of 2008, Dutch companies were massively connected to the internet, many of them through broadband. Most companies also had their own website, offering facilities ranging from only an electronic signpost, to full online commercial services. The overwhelming majority of companies now recognise how important it is to be active on the internet. So a critical mass seems to have been reached for large-scale advanced use of the internet in the Netherlands. Detailed figures on the use of internet and on website coverage can be found in the statistical annex at www.cbs.nl/digital-economy.

4.1.1 ICT use by companies, 1995–2008 [1)]



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

[1)] Companies employing ten and more persons. For 1995–2001, only people on the payroll are included.
[2)] Broadband internet is defined here as ADSL, cable and other fixed internet connections with a large bandwidth.

ICT diffusion average in international terms

In an international perspective, the widespread diffusion of ICT in the Netherlands did not take place very smoothly. In north European countries such as Sweden, Denmark and Finland, this process was faster. The rate at which ICT spread in the Dutch business world was average for Europe, considering the size of the market of ICT users and the development and actual use of ICT applications. The number of potential users is now so substantial that it is no longer an impediment for the development and use of a great many large-scale ICT applications, and it is now possible to make use of the advantages such applications offer. This chapter further examines whether this is reflected in the use of advanced ICT by companies in the Netherlands.

Although rapid technological development has advantages for the rapid spread of ICT across society or throughout the business private sector, there may also be some drawbacks. Pioneers may be affected by the dialectics of progress: a company that is one of the first to use a new technology may well be overtaken by companies that become involved at a later stage, for instance, if new and improved versions of the technology quickly become available. It may not always be feasible financially or in terms of organisation to keep up by purchasing latest versions of technology.

The 2009 e-readiness rankings

The Economist Intelligence Unit (EIU), the research unit of The Economist, in collaboration with the IBM Institute for Business Value, produces an annual ranking of e-readiness. More than 100 indicators are divided into six categories to derive the e-readiness score for all countries included in the survey. These are not just purely technical indicators, such as the number of computer users or broadband connections, but also figures on the general, economic and political climate.

The six categories are:
1. connectivity and technology infrastructure (weight: 20 percent);
2. investment climate (weight: 15 percent);
3. social and cultural environment (weight: 15 percent);
4. legal and policy environment (weight: 10 percent);
5. government policy and vision (weight: 15 percent);
6. use of ICT by citizens, companies and government (weight: 25 percent).

Top 15 countries in e-readiness rankings, 2009

Ranking 2009 (70 countries)	Ranking 2008 (70 countries)	Country	E–readiness score 2009 (scale 1–10)	E–readiness score 2008 (scale 1–10)
1	5	Denmark	8.87	8.83
2	3	Sweden	8.67	8.85
3	7	Netherlands	8.64	8.74
4	11	Norway	8.62	8.60
5	1	United States	8.60	8.95
6	4	Australia	8.45	8.83
7	6	Singapore	8.35	8.74
8	2	Hong Kong	8.33	8.91
8	12	Canada	8.33	8.49
10	13	Finland	8.30	8.42
11	16	New Zealand	8.21	8.28
12	9	Switzerland	8.15	8.67
13	8	United Kingdom	8.14	8.68
14	10	Austria	8.02	8.63
15	22	France	7.89	7.92

In 2009, the Netherlands came third in this ranking, out of a total 70 countries; up four places from 2008. Denmark led worldwide, just as in the period 2005–2007. Outside Europe, the United States and Australia were the most e-ready countries.
The EIU survey shows that the level of e-readiness has fallen across the world. On a scale of 1–10 the average score of the countries included in the survey decreased from 6.39 in 2008 to 6.13 in 2009. This is understandable given that the

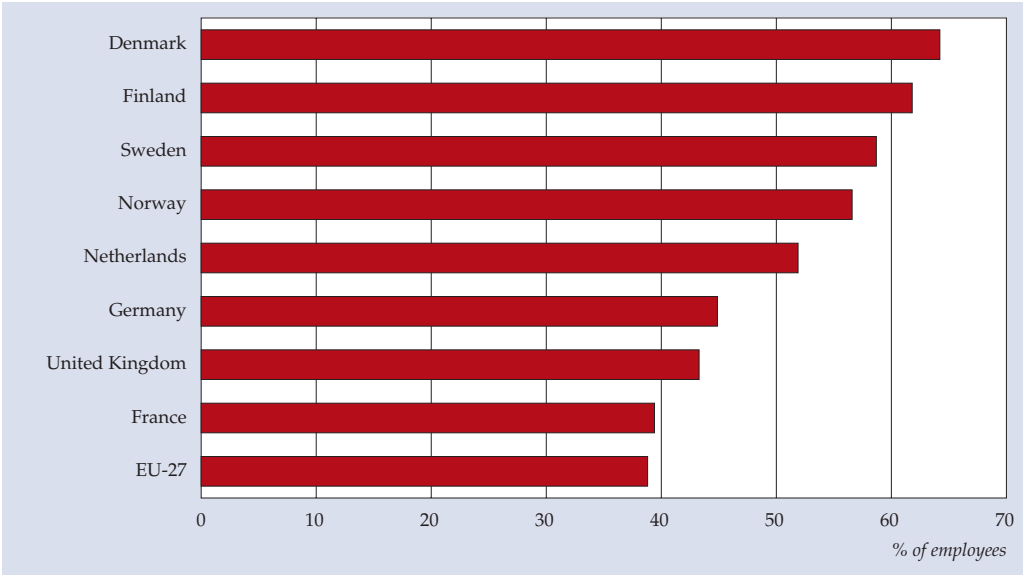
score is partly determined by the development in the investment climate. The economic crisis has left its mark here too.

Source: Economist Intelligence Unit and IBM Institute for Business Value, 2009.

Internet at work widely accepted by companies

The number of employed persons who regularly use a computer with direct internet access at work – 57 percent in the Netherlands in 2008 – is another illustration of large-scale internet use. In 2002, only one third of employed persons had access to the internet at work. So there is a growing recognition that the internet is a useful source of information or tool for workers. More and more companies recognise the importance of internet access for some or all of their employees. Workers in the sectors 'information and communication' and 'financial institutions' are most likely to use the internet regularly for work, while workers in 'transport and storage' and 'accommodation and food service activities' are least likely to do so. Naturally, the number of workers who use the internet depends on the kind of work they do; indeed internet use at work is in line with the findings for other indicators discussed in this section, namely that ´accommodation and food service activities' scores relatively low, and 'information and communication' leads in the comparison between sectors.

4.1.2 Employees using the internet at least once a week at work, international, 2007 [1)]



Source: Eurostat.

[1)] Companies employing ten and more persons, excluding the financial sector.

There are no significant differences between large and small companies in this respect, so internet access at work is not the exclusive privilege of the employees of large companies. Compared with the rest of Europe, the number of employed persons who regularly use the internet at work in the Netherlands is above average. After the Scandinavian countries, the Netherlands shares fourth place and is well above the average of the EU-27. The fact that the Netherlands has developed into a services economy probably plays an important role in this respect. Workers in the manufacturing industry less often need an internet connection for their work than office workers.

4.2 *Internal data communication*

In the business sector, ICT is widely used for internal communication. While an internal computer network is apparently a basic provision for nearly all large companies, fewer small businesses (10 to 20 employed persons) have an internal computer network, namely 81 percent.

Wireless applications have become increasingly popular in recent years, particularly among major companies (employing over 500 persons). In this group, 55 percent had a wireless internal network at the end of 2008. These wireless networks are often used alongside with fixed internal networks. The main advantages of wireless networks are their flexibility and mobility. An employee no longer has to be connected to a cable to work on the computer and have access to the company network.

Intranets more frequently used in services

An intranet is a facility to communicate and provide information within a company. It is based on internet technology, but it is only accessible to company employees. Intranets are more advanced than internal networks and they require more maintenance; the content must be updated regularly if it is to remain useful as an application. This means of communication is mainly used in large companies: the use varies from 22 percent among companies with 10 to 20 employed persons to 89 percent among companies employing more than 500 persons. This is not surprising, as it is easier to communicate and share information in a small company than in a large one. So large companies have a greater need for an intranet, and the benefits for them are greater. They also have more resources to invest in setting up and maintaining an intranet.

More companies in the services sector use an intranet than companies in manufacturing, construction, and accommodation and food service activities. The difference is caused by the differences in the nature of their production processes. As the production process and products in the services sector are usually digital, and more employees in this sector work at a computer every day, an intranet gives more benefits. This again illustrates that levels of sophistication do not have to be

the same for all companies and sectors. One in three companies overall in the Netherlands had an intranet at the end of 2008; so still by no means a majority.

Extranets still quite rare

An extranet is a part of an intranet made accessible to people outside the company, such as regular clients or suppliers. The use of extranets is far from common among companies: 18 percent of companies overall had an extranet at the end of 2008, varying from 15 percent of small companies to 50 percent of large ones. Detailed figures on the use of internal networks, intranets and extranets can be found in the statistical annex on www.cbs.nl/digital-economy.

Invoicing and payment systems nearly always linked

Alongside relatively basic provisions such as local networks, intranets and extranets, it is also possible to implement more complex applications, such as linking different computer systems within a company. In 2008, most enterprises with a system to process sales orders had linked this with one or more other internal computer systems. Links with invoicing and payment systems are common in this respect: 80 percent of companies with a sales order processing system had linked it to an invoicing system.

Purchase order processing systems were also often linked to other internal software systems at the end of 2008, particularly payment and accounting systems; 77 percent of companies with a purchase order processing system had linked it to a payment and/or accounting system, while 51 percent had linked it to a stock management system.

The overall picture in 2008 is that large companies have advanced more in terms of integrating internal computer applications than small companies, although the differences are limited. The percentage of companies with sales order processing systems linked to invoicing and accounting systems varied in 2008 from 79 percent among the smallest companies to about 90 percent among companies employing more than a hundred people. The differences between large and small enterprises are significantly larger for links of sales order processing systems with systems for stock management, production and logistics. For linked purchase order systems, the difference between the smallest and the largest companies is also significant.

Table 4.2.1
Companies with other in-house ICT systems linked to their order processing system, 2008[1)]

	Sales order processing system linked to invoicing and accounting system	Sales order processing system linked to stock management system	Sales order processing system linked to production systems	Sales order processing system linked to logistics systems	Purchasing order processing system linked to payment and accounting system	Purchasing order processing system linked to stock management system
	% of companies with a sales order processing system				*% of companies with a purchasing processing system*	
Total	80	46	29	38	77	51
Sector of industry (SIC 2008)						
Manufacturing	79	56	52	49	74	63
Electricity and gas supply; water supply; waste management	83	47	33	53	76	49
Construction	82	24	20	16	83	27
Wholesale and retail trade; repair of motor vehicles and motorcycles	81	74	29	49	73	76
Transport and storage	84	33	12	63	89	31
Accommodation and food service activities	73	15	10	15	74	22
Information and communication	75	26	24	29	73	29
Financial institutions	72	14	36	18	83	26
Renting, buying and selling of real estate	78	18	12	17	80	21
Consultancy, research and other specialised business services	81	23	23	21	82	25
Renting and leasing of tangible goods and other business support services	79	20	15	19	80	22
Human health and social work activities	83	19	21	23	82	28
Company size						
10–19 employed persons	79	40	23	28	76	45
20–49 employed persons	78	44	29	37	76	51
50–99 employed persons	82	54	38	54	77	58
100–249 employed persons	88	64	45	64	82	63
250–499 employed persons	88	68	51	66	85	69
500 and more employed persons	87	66	58	69	87	67

Source: Statistics Netherlands, ICT use by enterprises 2008.

[1)] Companies employing ten and more persons.

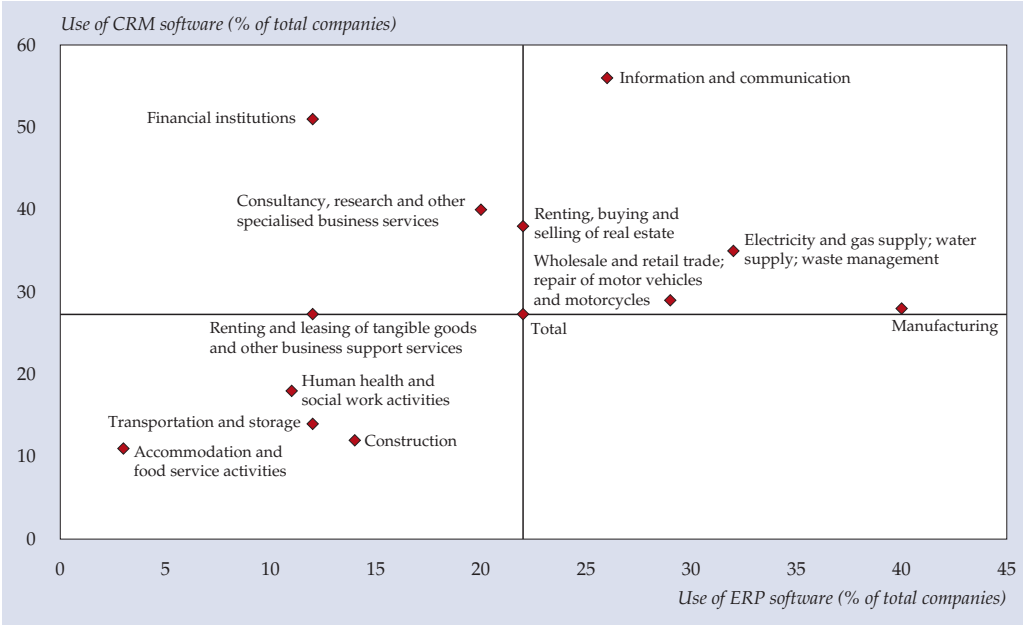
Link-ups between order processing systems and invoicing systems are the most common in all sectors of industry: when an order is placed, an invoice is generated. Differences between sectors are larger for linked stock management systems. These are most common in 'wholesale and retail trade, repair of motor vehicles and motorcycles', 'manufacturing' and 'electricity and gas supply; water supply; waste management'; remarkably more common than, for example in 'financial institutions'. It is crucial for manufacturing companies to replenish stocks of raw materials and semi-manufactured goods on time. This is reflected in the fact that it is

quite common in manufacturing to connect order processing systems with computerised stock replenishment systems. Such connections are also common in 'wholesale and retail trade, repair of motor vehicles and motorcycles'. As punctual supply and the availability of goods is vital for this sector, companies have apparently invested in computer systems to support this.

Use of ERP and CRM software

Although software for enterprise resource planning (ERP) and customer relationship management (CRM) is used fairly regularly, most companies in the Netherlands do not use either. ERP software systematically integrates data of various units within the company, such as planning, purchasing, logistics and production; it thus focuses more on the input process. CRM concerns mainly sales and marketing, the output side of the production chain. This software supports company-wide collection, storage and distribution of customer data; it aims to widen a company's market, for example, by basing marketing strategies on analysis of customer data. From the company's perspective, the information gathered and processed is different in the two systems, and as a result, there are substantial differences between the various sectors in the use of ERP and CRM software.

4.2.1 Use of ERP and CRM software, by sector of industry (SIC 2008), 2008 [1)]



Source: Statistics Netherlands, ICT use by enterprises 2008.

[1)] Companies employing ten and more persons.

In December 2008, ERP software was used by 22 percent of all companies and CRM software by 27 percent. Manufacturing companies used ERP more often (40 percent) and CRM software less often (28 percent). The construction sector shows a similar picture. Just as described above, these sectors use ICT more to support production and distribution processes.

CRM software was more dominant in the sectors 'information and communication' and 'financial institutions' in December 2008; these sectors invested more in structuring customer data for direct marketing strategies. Marketing is very important in these sectors as there is a large, but unidentified, number of potential customers. Nine out of ten companies with CRM software at the end of 2008 used it to store and distribute customer data. Two-thirds of companies using CRM software actually analysed the data, and thus actively used the system.

Open source software mainly used by large companies

The Dutch government encourages the use of open source software. There are two reasons for this. One is that open source software helps to reduce the dominance of a limited number of main software producers. It makes consumers less dependent on the products of a small number of companies. The second is the idea that open source software will eventually contribute to the creation of standards and applications developed through the cooperation of a large number of people together, which will be able to hold its own compared with software developed by major commercial suppliers.

But what is open source software exactly? Definitions differ, but all contain the following three aspects: (1) the source code of the software is freely available, at least in part; (2) everyone can add to it or improve it; and (3) everyone can distribute it. Open source software is not necessarily free of charge; providers can charge for their products. Well-known open source software products are the Linux operating system, Firefox web browser, Star Office and Open Office word processing packages, MySQL database and Apache web server software.

Everyone can access and improve the source code of open source software. Often communities of online developers work on the set-up, extension and improvement of the software. As large groups of people can develop the product, developments and improvement may take place in very short spaces of time. Users do not have to depend on the original supplier for adjustments, as they do for commercial software. Although companies using open source software do not have to pay a licence fee, they are bound by other licence agreements, but these are usually free of charge. There will be a charge for tailoring the software to the needs of the user, and for maintenance and management, but this is also the case with regular software.

One strategic consideration underlying the use of open source software is to increase the options for the various applications. Users are less bound by the limitations which regular software has. Another advantage is that costs are lower, which is important for small and medium-sized companies. However, working

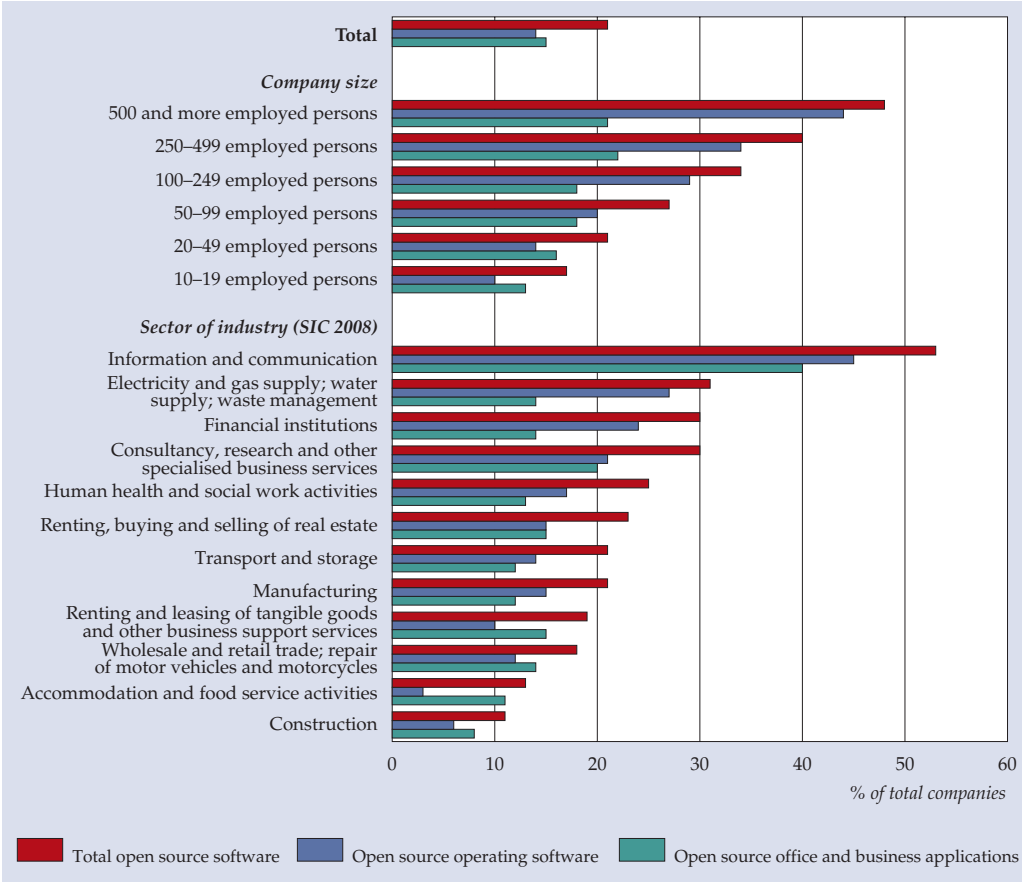
with open source software requires different skills and knowledge, which are not always present in small companies. The figures show that more large companies than small companies used open source software in 2008.
Of course, open source software also has disadvantages. One main drawback is that – unlike standard software packages – any damage caused by the use of the software cannot be recouped from the developer.

One in five companies use open source software

Just over 20 percent of companies in the Netherlands used open source software for operating systems or office and business applications in 2008. These companies do not necessarily operate entirely with open source software. The use of open source software may also be quite limited, for instance to the servers or routers of a company.

As mentioned earlier, small companies use open source software less than large companies, particularly open source operating software. Also, open source software is mainly used in the services sector, for example in 'information and communication' and 'financial institutions', and less in the sectors 'construction' and 'accommodation and food service activities'. This is true for both operating software and office and business applications. The prominent role of the sector 'information and communication' in the adoption of open source software is striking. It suggests that general knowledge and ICT knowledge play a role in the decision to use open source software, although the argument of gaining knowledge and experience for themselves by using this software may also have had an effect. Open source software is also used by relatively many companies in 'electricity and gas supply; water supply; waste management', but this is because this sector has relatively many large companies, and they simply use more open source software than smaller companies. Within the sector 'electricity and gas supply; water supply; waste management' there is a relatively large difference between the use of open source software for operating systems on the one hand, and for office applications on the other. Fourteen percent of companies in this sector use open source software for office and business applications, 27 percent for operating systems. This, too, is typical of large companies; for small enterprises there is little difference in this respect.

4.2.2 Use of open source software, by sector of industry (SIC 2008) and company size, 2008 [1)]



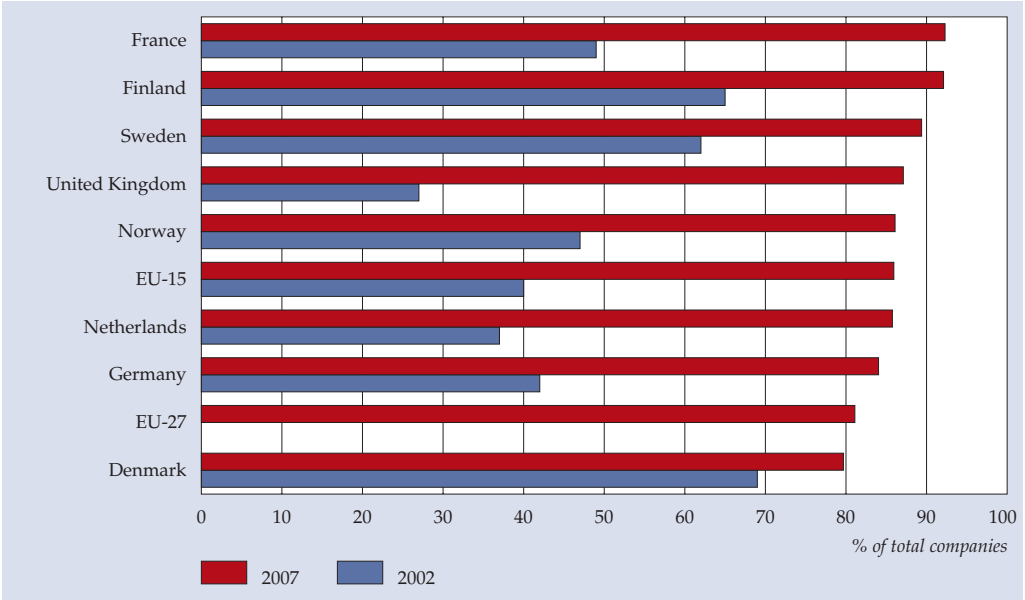
Source: Statistics Netherlands, ICT use by enterprises 2008.

[1)] Companies employing ten and more persons.

4.3 *External data communication*

One step further than the use of ICT within a company is the use of ICT for communication with others (external data communication). As mentioned earlier, virtually all companies in the Netherlands have internet access, making the internet the dominant electronic network for companies – and the rest of society – for all kinds of applications. The vast majority of companies have broadband internet, which facilitates the use of advanced applications requiring a minimum bandwidth. Broadband allows users to download and upload information in large quantities. The internet is also used for electronic purchasing and sales (e-commerce), with or without e-payment. The broader the available bandwidth, the easier and more efficient it is to provide and use such facilities.

4.3.1 Companies with broadband internet, international, 2002 and 2007 [1)]



Source: Eurostat.

[1)] Companies employing ten and more persons, excluding the financial sector.

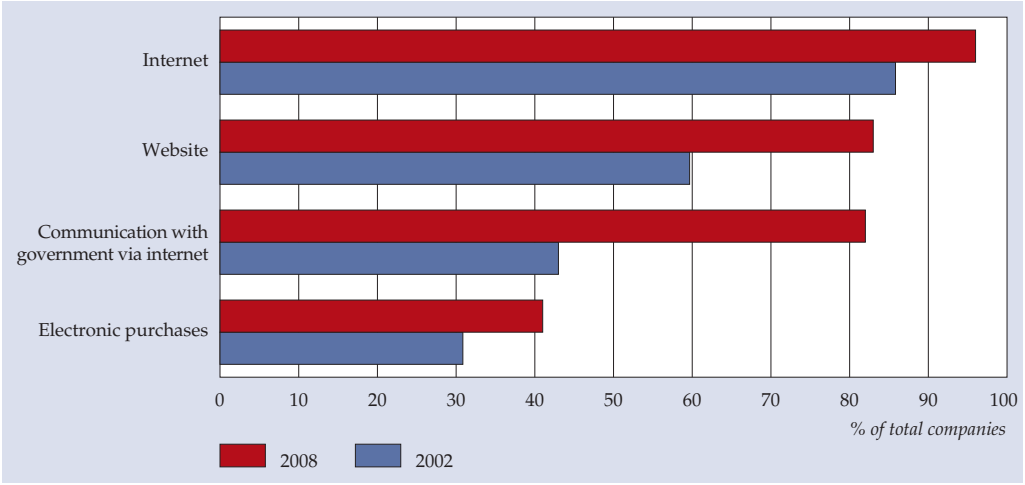
Figure 4.3.1 illustrates that broadband internet was widespread among companies in the Netherlands at the end of 2007, but also that in 2002 the Netherlands was not one of the leading countries in this respect. In 2002 Denmark, Finland and Sweden were more advanced in this area. For this reason the Netherlands has had a slightly shorter experience with large-scale broadband applications than those countries.
By 2007 the Netherlands had shown a significant growth, like most benchmark countries, and had reached a level similar to that of Norway. However, the Netherlands is still not among the frontrunners. France and Finland lead the way and the Netherlands is only around average in the EU-15. In Denmark, which had the highest percentage of companies with broadband in 2002, the growth to 2007 was surprisingly small.

ICT use more intensive

Figure 4.3.2 uses four indicators to illustrate the development of ICT use in the Dutch business sector. Dutch companies were already using electronic data communication in the 1990s. This took place mainly through 1-to-1 or 1-to-n networks, where one company could communicate electronically with one or more other companies. The latter could not necessarily communicate with each other.
The arrival of internet technology provided the breakthrough for n-to-n networks. An individual user with access to the internet can communicate with all other internet users, and vice versa. As a result, in the space of ten years almost all com-

panies in the Netherlands had linked up to the internet. Initially they were passive users, mainly using the facilities provided by others rather than creating facilities of their own. But since a few years ago, the vast majority of companies actively provide their own facilities on the internet (website), which has made the network a great deal more useful.

4.3.2 Use of some ICT applications by companies, 2002 and 2008 [1) 2)]



Source: Statistics Netherlands, ICT use by enterprises.

1) Companies employing ten and more persons.
2) Figures are not fully comparable as a result of the introduction of a new method.

The nature of the facilities on offer varies widely. For example, at the end of 2008, people could order products online from just under a quarter of companies (23 percent), and pay for these products online at 14 percent. In general terms, both the advanced use of the internet and the number of users are increasing. However, not all applications necessarily have to be adopted by all companies.

Automated data exchange

Automated data exchange (ADE) between companies can significantly reduce written communication, for instance in the case of trade transactions. The advantages in terms of efficiency are evident: electronic data exchange is faster and often cheaper than written procedures, even more so if it is automated. In addition, ADE prevents differences in interpretation and promotes standardisation of products and services. For these reasons ADE is usually attractive for enterprises with a sophisticated ICT infrastructure.

Automated data exchange can take place in many different ways, on or off the internet. International standards prescribing the layout of the messages are often used for ADE between companies. Well-known standards are for example XML and EDIFACT. Automated data communication has countless applications. It may

be used for sending and receiving orders, invoices, product information and documents. ADE is also suitable for sending payment instructions to the bank and data to the tax authorities.

ADE not yet common

Not many companies in the Netherlands use ADE to send and receive invoices and orders. Only 14 percent of companies send electronic invoices via ADE. More companies use ADE to send and receive orders, and to receive electronic invoices: more than a quarter of companies at the end of 2008. ADE is used mainly by large companies. The differences in the use of ADE between large and small companies are substantial for the various purposes, with the exception of receiving orders from customers. In this regard small companies manage to keep up with larger ones. Investing in this ADE option is apparently profitable for small businesses as well. One reason may be that it lowers the threshold for customers and potential customers to place an order. This almost directly means more orders, and thus a higher profit.

Table 4.3.1
Automated data exchange by companies, by purpose, 2008 [1)]

	Sending purchasing orders to suppliers	Receiving invoices electronically	Receiving orders from customers	Sending invoices electronically
	% of total companies			
Total	25	28	29	14
Sector of industry (SIC 2008)				
Manufacturing	27	25	36	14
Electricity and gas supply; water supply; waste management	17	26	26	9
Construction	27	23	23	3
Wholesale and retail trade; repair of motor vehicles and motorcycles	35	35	36	23
Transport and storage	17	32	47	11
Accommodation and food service activities	24	23	22	9
Information and communication	24	35	30	19
Financial institutions	22	30	27	16
Renting, buying and selling of real estate	13	22	15	8
Consultancy, research and other specialised business services	19	32	23	12
Renting and leasing of tangible goods and other business support services	14	23	25	11
Human health and social work activities	12	21	10	22
Company size				
10–19 employed persons	22	27	27	12
20–49 employed persons	27	30	31	14
50–99 employed persons	26	25	33	17
100–249 employed persons	29	29	35	23
250–499 employed persons	34	34	35	26
500 and more employed persons	47	43	35	35

Source: Statistics Netherlands, ICT use by enterprises 2008.

[1)] Companies employing ten and more persons.

Relatively many companies in the industries 'wholesale and retail trade, repair of motor vehicles and motorcycles', 'information and communication' and 'transport and storage' use ADE for the various purposes distinguished. Purchase and sale of products obviously plays a very prominent role for 'wholesale and retail trade, repair of motor vehicles and motorcycles' in particular. This makes the automation of these core elements of the business process easily cost effective. Reducing human errors by applying ADE may also play a role in this. Moreover, ADE concerns only the fully automated exchange of information. It does not include online banking.

Supply chain management

Many production chains are made up of links consisting of companies that together form a supply chain by purchasing, processing and selling. A classic example of a production chain is the process of extracting minerals, which go on via suppliers and manufacturers to the wholesale trade, retail trade and then ultimately to the end user. A similar process takes place in numerous chains, where the output of one link in the production chain forms the input for the next link. Supply chain management coordinates the activities involved in the supply chain. The aim is to improve the results of the individual companies, and of the supply chain as a whole in the long term.

ICT systems are an important application tool in supply chain management, as they can help integrate the business processes of the business partners, making both parties, and thus the whole supply chain, more efficient: companies that link information processes with suppliers and/or customers can cut costs in various areas. The efficiency gain in the purchasing process consists first of all in setting up a long-term partnership between the parties. Thus suppliers have more security about future orders, which could translate into favourable prices for the customer. Furthermore, overheads are reduced by chain integration because of more efficient and better communication. Lastly, inventory management can be partially automated by way of integrated systems, which can prevent errors in orders and the costs these involve.

On the sales side, too, integrated business processes can reduce costs substantially: invoicing becomes much more efficient when the financial information of supplier and buyer are collected, exchanged and stored electronically. The implementation of supply chain management is not a logical choice for every company, but in many chains an increase of supply chain management may well lead to a far more efficient production chain.

Supply chain management most common among large trade companies

At the end of 2008, 13 percent of companies in the Netherlands were using some form of supply chain management. There is a fair difference between the smallest and the largest companies in this respect: 10 versus 41 percent. The difference in the sophistication of ICT systems is obviously a factor in this respect. Relatively many companies in 'wholesale and retail trade, repair of motor vehicles and motorcycles'

use supply chain management. Also, relatively more companies in 'manufacturing' use supply chain management than in other sectors, although the share for this industry is close to average. So supply chain management is commonly applied in chains trading physical end products or semi-manufactured goods between the different links. It is less common in chains that mainly exchange services. One exception is the sector 'information and communication' which is also above average in this regard. The presence of an extraordinary amount of knowledge about ICT in such companies might be an explanation of their relatively high use of supply chain management.

Table 4.3.2
Supply Chain Management (SCM), 2008 [1)]

	Applies some kind of SCM	Method used	
		SCM via websites	SCM via Automated data exchange
	% of total companies		
Total	13	8	5
Sector of industry (SIC 2008)			
Manufacturing	15	9	6
Electricity and gas supply; water supply; waste management	11	7	7
Construction	8	5	1
Wholesale and retail trade; repair of motor vehicles and motorcycles	21	12	11
Transport and storage	13	10	9
Accommodation and food service activities	7	6	1
Information and communication	15	13	7
Financial institutions	9	8	7
Renting, buying and selling of real estate	6	4	2
Consultancy, research and other specialised business services	8	6	3
Renting and leasing of tangible goods and other business support services	7	5	2
Human health and social work activities	5	3	3
Company size			
10–19 employed persons	10	7	2
20–49 employed persons	12	7	6
50–99 employed persons	14	9	8
100–249 employed persons	24	15	14
250–499 employed persons	34	22	22
500 and more employed persons	41	31	29

Source: Statistics Netherlands, ICT use by enterprises 2008.

[1)] Companies employing ten and more persons.

Looking at a more detailed level of industries, it appears that companies in the trade and repairs of cars and motorcycles use supply chain management more often than companies in other branches: 37 percent of these companies have inte-

grated their systems with business partners. The costs of a product unit are high in this sector of industry, and mistakes in orders quite costly. An automated system coordinating product supply can be an important tool, and will quickly earn back the investment concerned.
Supply chain management is mostly used through websites. In 2008, 8 percent of companies in the Netherlands worked with supply chain management in this way. Automated data exchange (via XML or EDIFACT) is less common in supply chain management, only 5 percent of companies used it. A fully automated system requires a much larger investment by the business partners than communication via websites. This may play a part in considerations on how to integrate business processes and ICT systems.

4.4 E-commerce

One very specific use of electronic networks is ordering goods and services online: the actual transaction. Companies were already doing this before the internet came into our lives, but they used networks in which the companies involved had specially invested and which only they could use. Internet technology has lowered the technological threshold for ordering goods and services online. This is certainly the case for consumers, who did not have access to these services before.
Many business processes can be made more efficient by using ICT within and between companies. These efficiency gains can be realised without the final transaction being automated. The transaction is just at the end of a process that primarily involves the exchange of information. But the number of companies concluding electronic transactions and the value of these transactions are good indications of how e-commerce is developing in a sector or country.

Electronic sales industry-related

One quarter of Dutch companies used the internet or other electronic networks to receive orders in 2008. For enterprises with 10 to 20 employed persons this was just under 25 percent, but for companies employing at least one hundred persons the share was more than one third. By far the most of the turnover generated in this way was realised through websites. In 17 percent of companies more than 5 percent of the total turnover was generated through sales via the website.

The share of companies with provisions to receive electronic orders depends largely on the sector of industry, and the position of this sector in the economy. The intensity of this application therefore varies considerably between the different sectors of industry. Electronic sales are particularly common in 'accommodation' and 'travel reservation services and organisers'. Two-thirds of all businesses in these industries received bookings via the internet or other electronic networks in 2008. Travel tickets and accommodation are prime examples of products that con-

sumers have been buying online more and more in the last few years (see also section 5.3). The share of companies selling products electronically was also relatively high in 'wholesale': 45 percent. However, this sector of industry does not sell to consumers via the internet. The great advantage of electronic sales for 'wholesale' lies mainly in the application of automated data exchange with customers. The sectors with fewest companies using electronic sales are mainly those that also use other aspects of ICT less. Investing in ICT development is less profitable for companies in 'construction' for example, and this is also reflected in a low share of construction companies selling their products electronically.

Table 4.4.1
Sectors of industry using electronic sales most intensively, by company size, 2008 [1)]

	% of total companies
Total	25
Sector of industry (SIC 2008) [2)3)]	
Accommodation	66
Travel agencies, reservation services and tour operators	65
Insurance	57
Wholesale	46
Information and communication	45
Renting of real estate	40
Company size	
10–19 employed persons	23
20–49 employed persons	27
50–99 employed persons	30
100–249 employed persons	32
250–499 employed persons	33
500 and more employed persons	36

Source: Statistics Netherlands, ICT use by enterprises 2008.

1) Companies employing ten and more persons.
2) Only sectors of industry with a high share of companies using electronic sales.
3) In this table, the sectors of industry are listed at a lower level of detail than in the other tables and figures in this chapter.

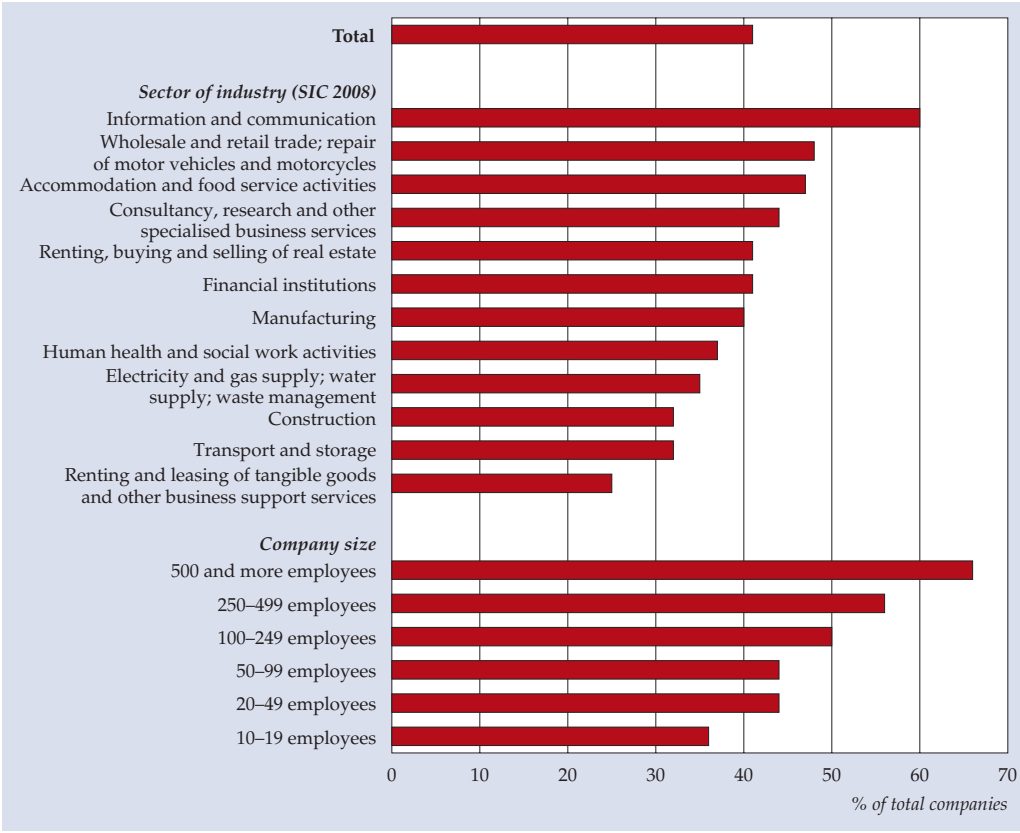
Electronic purchasing more common than electronic sales

More companies purchase products than sell products electronically. In 2008, 41 percent of companies purchased at least some products electronically. If they use the internet, this requires less significant investment than facilitating electronic sales. So the threshold is lower for electronic purchasing.

Here again, large companies (100 or more employed persons) have advanced further than small businesses. Half of all companies employing 100 to 250 persons purchased electronically in 2008. For companies with more than 500 employed persons this was even two-thirds. The share did not exceed 40 percent for companies employing 10 to 100 persons. In this case, too, it is more rational for large compa-

nies to invest in systems for electronic purchasing: they often buy in products in large volumes, they have relatively well developed ICT systems, and they have more resources to invest than small companies.

4.4.1 Electronic purchases, by sector of industry (SIC 2008) and company size, 2008 [1)]



Bron: Statistics Netherlands, ICT use by enterprises 2008.

[1)] Companies employing ten and more employees.

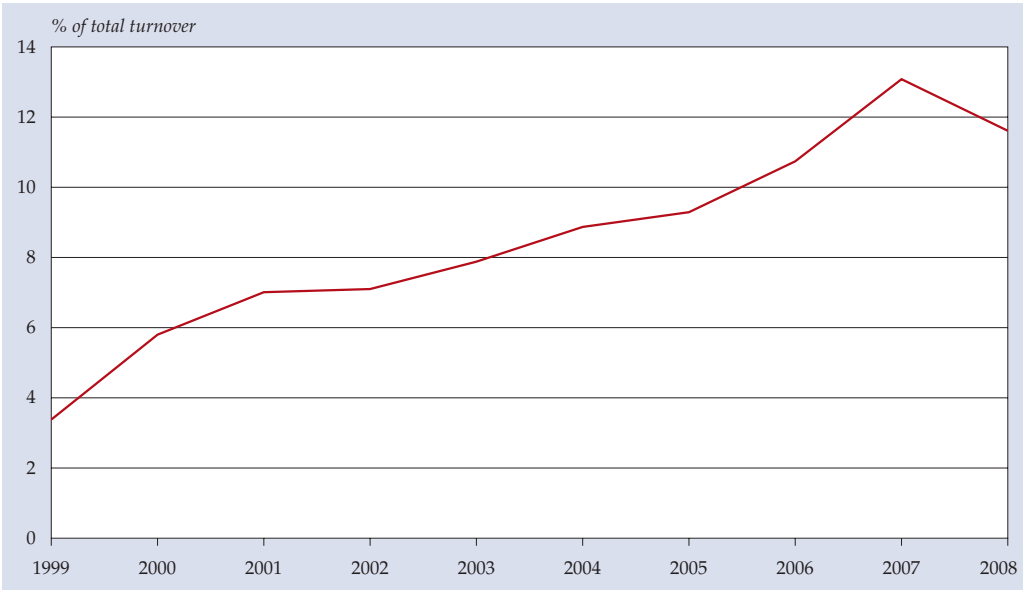
Figure 4.4.1 clearly shows that 'information and communication' is well above the other sectors of industry in terms of electronic purchasing. This industry is strongly focused on ICT, and this is reflected in its purchasing channels. The figure further shows that in almost all industries, one third to half of companies purchase electronically. The industry 'renting and leasing of tangible goods and other business support services' lags behind slightly, with 25 percent.

E-commerce turnover up

Turnover generated by electronic sales rose from just over 3 percent of total turnover in 1999 to almost 12 percent in 2008, with a clear peak in 2007.[2)] The number

of transactions completed electronically almost certainly increased as well. This is in line with one of the advantages of the use of electronic networks: lower transaction costs. Although the turnover increase indicates the growth of e-commerce, it is the increase in the number of transactions that determines the efficiency gain.

4.4.2 Turnover from e-commerce, 1999–2008 [1)]



Source: Statistics Netherlands, ICT use by enterprises 2008.

[1)] Companies employing ten and more persons.

High e-turnover in transport, manufacturing and trade

The highest percentage of turnover generated through electronic networks is in 'transport and storage'. Nearly a quarter of turnover of companies in this sector of industry was generated through e-sales. This industry includes airlines, which receive a large part of their bookings online.

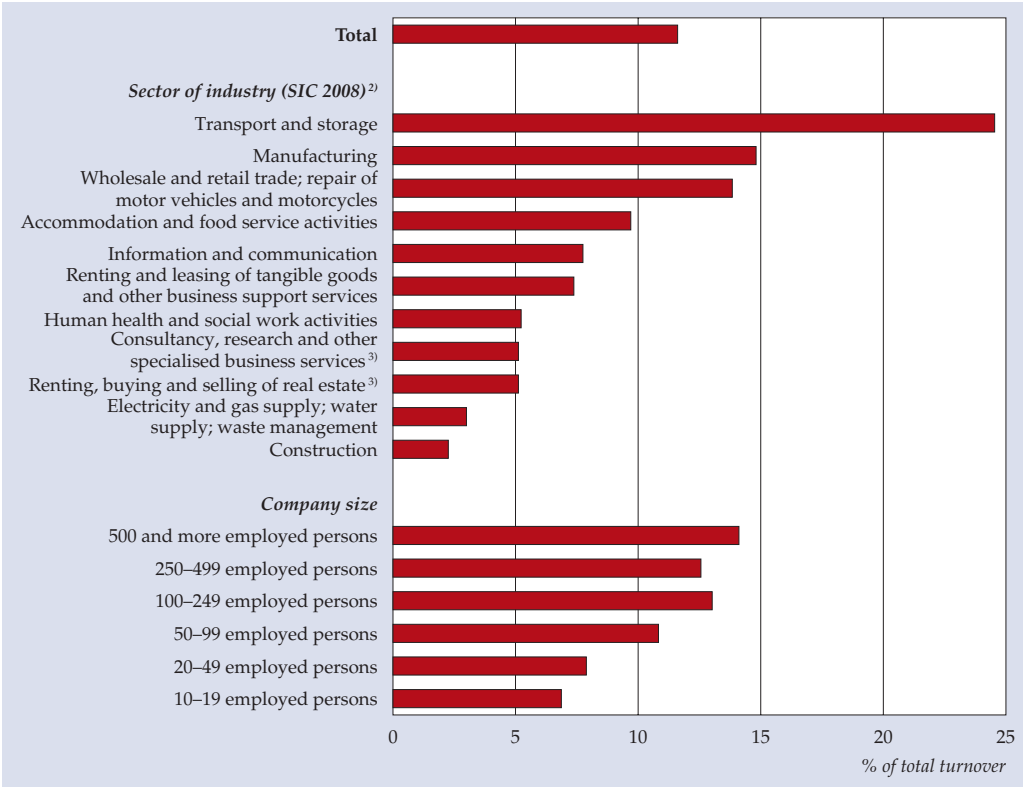
The sector 'accommodation and food service activities' is not one of the highest scoring sectors in this respect. This is because it comprises not only accommodation providers, but also bars, cafes and restaurants. As explained above the sector consists of two types of companies that differ greatly in terms of ICT use. Accommodation providers have widely adopted electronic sales, but bars, cafes and restaurants, etc. are much less active in this respect. As a result, the sector is in the mid section of figure 4.4.3.

E-sales account for a relatively large share of turnover in the sectors 'manufacturing' and 'wholesale and retail trade, repair of motor vehicles and motorcycles'. In business services the share of turnover based on e-trade is lagging somewhat. As electronic order receipt has the longest tradition in manufacturing and trade, these

sectors relatively often use older electronic networks. These networks still contribute significantly to total turnover, partly because larger transactions are involved. Within business services, e-commerce only started to develop significantly with the arrival of internet technology.

Large companies realise significantly more of their turnover through e-sales than small businesses. Companies with fewer than 50 employed persons are far below average. This is in line with previously discussed differences between the ICT use of large and small companies.

4.4.3 Turnover from e-commerce, by sector of industry (SIC 2008) and company size, 2008 [1]



Source: Statistics Netherlands, ICT use by enterprises 2008.

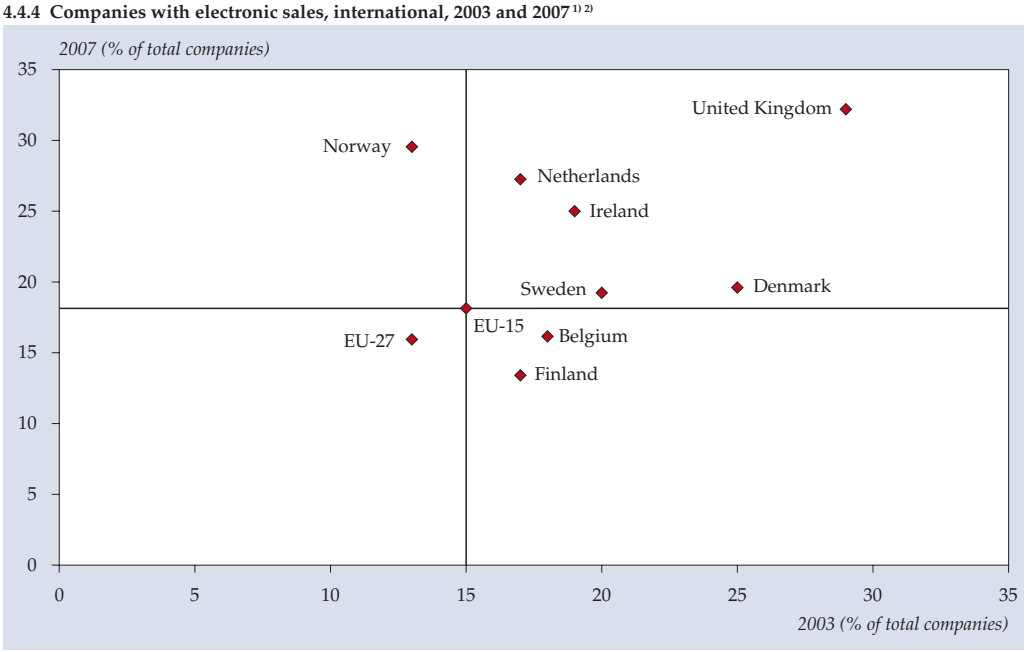
[1] Companies employing ten and more persons.
[2] Excluding financial institutions.
[3] 'Renting, buying and selling of real estate' and 'Consultancy, research and other specialised business services' are taken together.

Dutch companies catching up

Compared with companies in other EU countries, Dutch companies performed above average in terms of electronic purchases and sales. This was even more true

in 2007 than in 2003. As far as the share of electronic selling is concerned, the Netherlands performed slightly above average in 2003. But companies in the Netherlands were significantly behind companies in the leading countries (United Kingdom and Denmark). In 2007, however, the Netherlands performed much better than the EU-15 average. The strong growth in the Netherlands had put it at the level of the best performing countries. Growth was only higher in this respect in Norway. In 2007, the Netherlands was among the leading countries in terms of the share of companies that sell products electronically.

4.4.4 Companies with electronic sales, international, 2003 and 2007 [1) 2)]

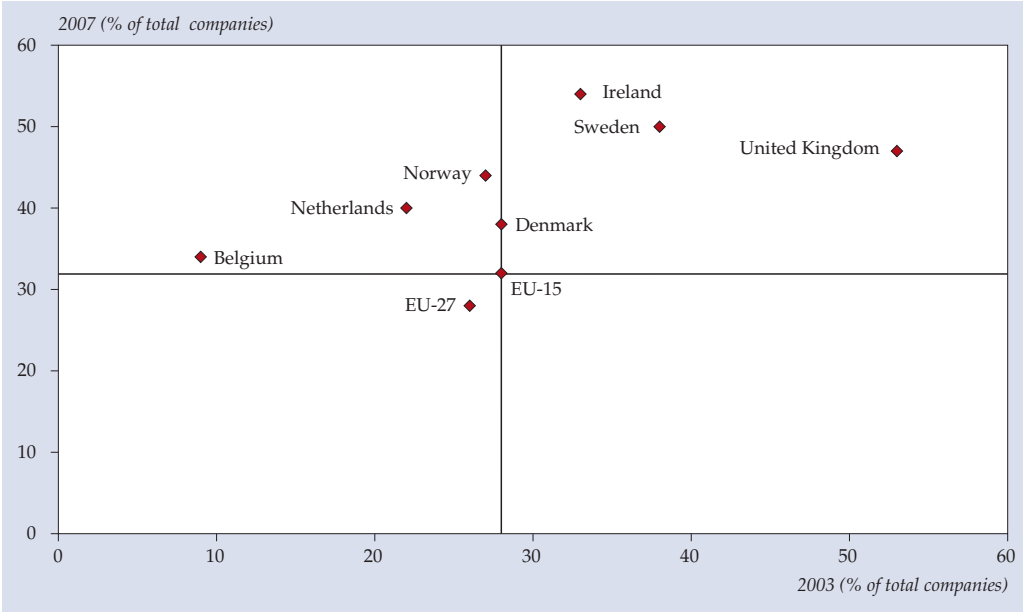


Source: Eurostat.

[1)] Companies employing ten and more persons.
[2)] Electronic sales account for at least 1 percent of total company turnover.

The percentage of companies in the Netherlands purchasing electronically was below the average of the EU-15 in 2003. In 2007 it was significantly above this average. However, companies in the Netherlands remained behind the companies in the countries in the top right-hand quadrant of figure 4.4.5: Sweden, Ireland and the United Kingdom. These countries were the top performers in 2003 and 2007, while Norway also closed the gap with the leading countries in terms of electronic purchasing in 2007.

4.4.5 Companies with electronic purchasing, international, 2003 and 2007 [1) 2)]

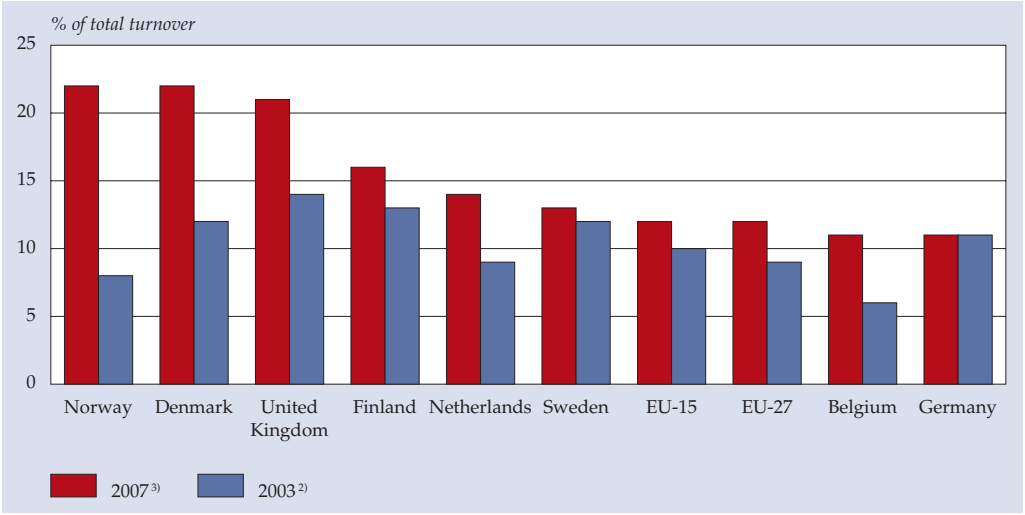


Source: Eurostat.

[1)] Companies employing ten and more persons.
[2)] Electronic sales account for at least 1 percent of total company turnover.

The Netherlands is behind the best countries in Europe in terms of turnover from e-commerce, namely Norway, Denmark and the United Kingdom. The Netherlands was slightly above the EU average in 2007, leaving Sweden, Belgium and Germany behind. All figures on turnover from e-commerce should be interpreted with some caution. Companies often find it very difficult to indicate the percentage of their turnover derived from electronic sales.

4.4.6 Share of electronic sales in turnover, international, 2003 and 2007 [1]



Source: Eurostat.

[1] Companies employing ten and more persons.
[2] Sweden: 2002 instead of 2003. EU-15: 2004 instead of 2003.
[3] Germany, Denmark, Belgium: 2006 instead of 2007.

4.5 *Radio Frequency Identification*

Radio Frequency Identification (RFID) technology uses radio waves to transfer data from a distance with the aim of identifying or tracking objects, animals or persons. It uses a transmitter – an RFID tag, often a chip – which is very easy to transport because of its small size. The tag is attached to or incorporated in the object to be tracked. In the vicinity of a suitable receiving device the tag transmits a unique identification number via radio waves which identifies the object.

RFID can be used instead of a bar code, for example. By using radio waves, identification by an RFID tag is possible over a much greater distance than by a bar code. In addition, an RFID tag is more difficult to forge than a bar code. Some common applications of RFID technology are access cards, the chip identification affixed to animals, and chips in car keys that allow remote control.

RFID offers many opportunities for companies to improve the production and distribution chain. This technology makes it easier to track and trace products, for example, allowing early detection of distribution errors, such as a wrong delivery address, and earlier rectification. This will result in fewer delays and lower costs. RFID can also identify irregularities in production processes, which will lead to efficiency gains. For these reasons RFID technology has a significant potential economic impact.

RFID in official statistics

As national and European policy-makers increasingly recognise the potential economic importance of RFID, official statistics are set to focus on this topic in the coming years. The use of RFID by companies was measured for the first time in a European context for 2008. The results for the Netherlands are discussed in this section. When this book was published, the results for other European countries and the European average were not known.

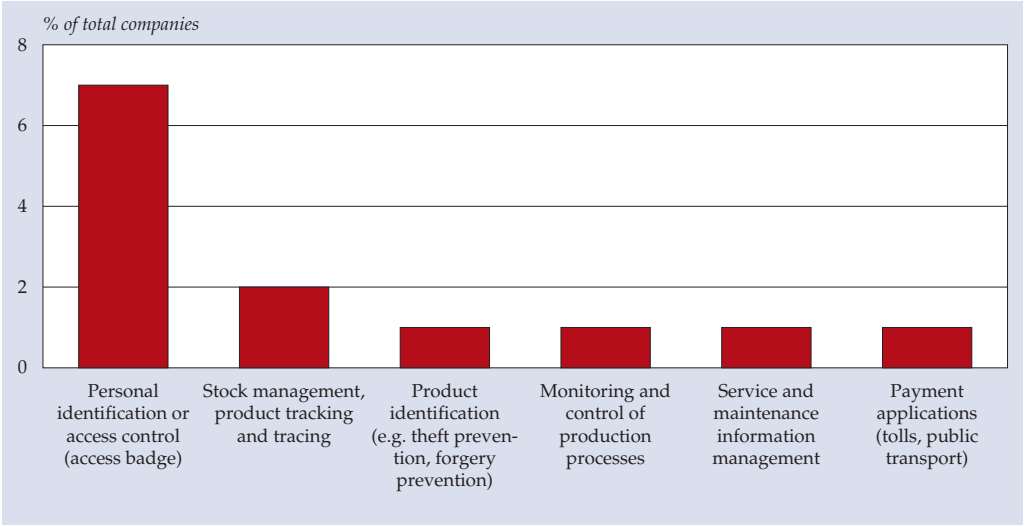
The survey 'ICT use by companies' asked companies whether they used RFID for the following applications:
- person identification or access control (access badge);
- product identification (e.g. theft prevention, forgery prevention);
- monitoring and control of production processes;
- inventory and tracking and tracing;
- service and maintenance information management; and
- payment applications (tolls, public transport).

In the near future, the European harmonised questionnaire on ICT use by enterprises will continue to cover RFID, probably by including a question every other year. This will provide a picture of the adoption of this technology by companies.

RFID not widely applied

Nine percent of companies in the Netherlands used some form of RFID in 2008. This includes only the forms of RFID described in the box. Person identification and access control is the most used application (figure 4.5.1). This is a fairly common application of RFID in large companies in particular: one in five companies employing more than 100 persons uses it, and this rises to nearly one in three companies with more than 500 employed persons. For more detailed statistical information, see the online statistical annex to this publication (www.cbs.nl/digital-economy).

4.5.1 Radio Frequency Identification (RFID) applications, 2008 [1)]



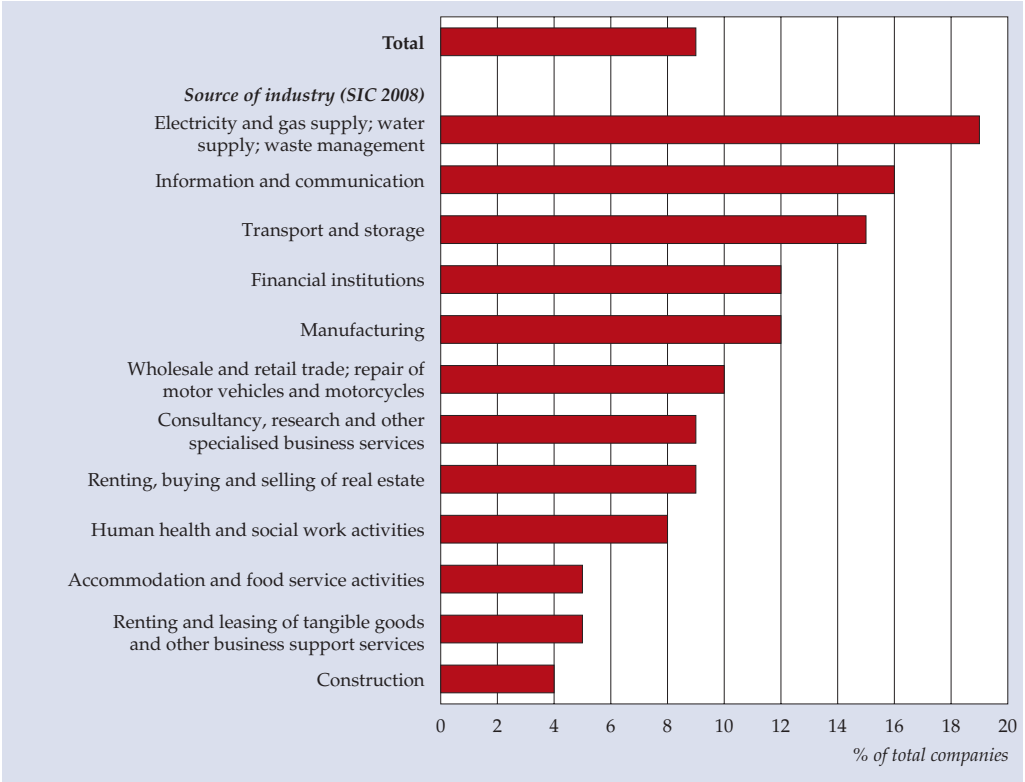
Source: Statistics Netherlands, ICT use by enterprises 2008.

[1)] Companies employing ten and more persons.

RFID especially popular in energy, ICT and transport companies

Nearly one in five companies in the sector 'electricity and gas supply; water supply; waste management' used some form of RFID in 2008 (figure 4.5.2). This industry has many relatively large companies, which explains the high proportion. In 'information and communication', too, relatively many companies use RFID. Again this fits in with the image that consistently emerges for this sector: advanced levels of ICT as a result of high levels of ICT knowledge. In the sector 'transport and storage' relatively many companies use RFID for stock management and tracking and tracing, and for payment applications. Over 10 percent of transport and storage companies employing more than 50 persons use these applications. Obviously, this industry has a vested interest in investing in technologies that make it easier to track goods. For these companies the use of RFID is also very convenient for payments at toll gates.

4.5.2 Companies using Radio Frequency Identification, by sector of industry (SIC 2008), 2008 [1)]



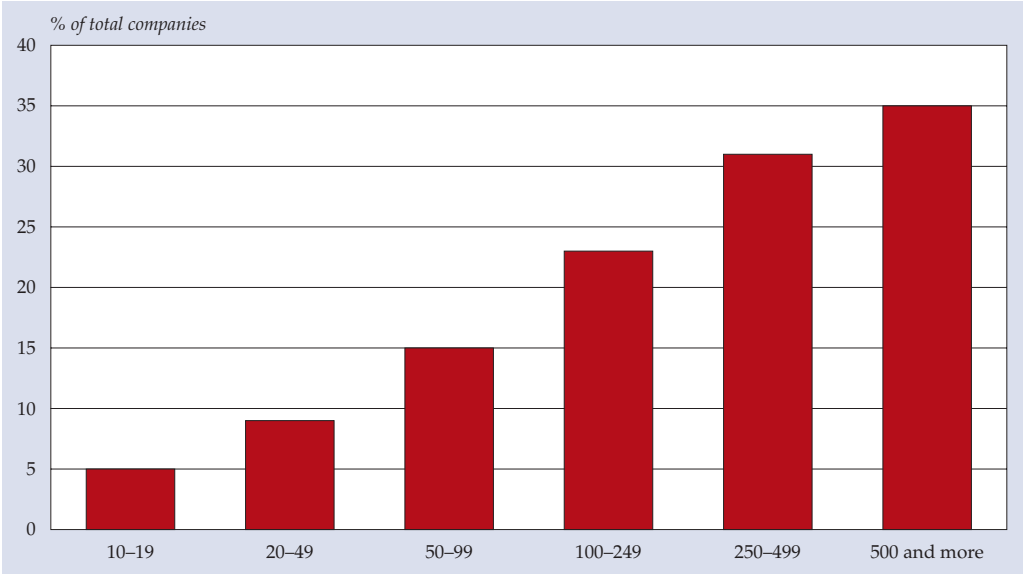
Source: Statistics Netherlands, ICT use by enterprises 2008.

[1)] Companies employing ten and more persons.

One third of large companies uses RFID

Just as with many ICT applications, RFID use also correlates clearly with company size. While only few small companies use RFID, a quarter to even more than a third of larger companies use this technology (figure 4.5.3). The turning point is around one hundred employed persons.

4.5.3 Companies using Radio Frequency Identification, by company size, 2008 [1)]



Source: Statistics Netherlands, ICT use by enterprises 2008.

[1)] Companies employing ten and more persons.

Differences between large and small companies in the application of RFID are especially large for person identification and access control. For example, companies employing more than one hundred persons use access cards with RFID technology much more frequently than smaller companies. As other RFID applications are not yet widely applied by large companies, the difference between large and small businesses is smaller for these.

Notes in the text

1) Of all Dutch internet users, 87 percent used the internet to look for information about goods and services in 2009. Source: Statistics Netherlands, ICT use by individuals and households.

2) Figures 4.4.2 and 4.4.3 use data from the annual Statistics Netherlands survey 'ICT use by companies'. This survey is primarily designed to measure the number of companies using (various types of) ICT. Financial figures on electronic sales are a secondary result and therefore have a greater margin of uncertainty than other results from this survey. In some exceptional cases the deviations in individual figures amount to some tenths of a percentage point.

5. ICT use by households and individuals

Since the introduction of the personal computer on the Dutch market in the early 1980s, the technological development of computer equipment has gone hand in hand with its adoption by consumers. ICT now occupies an important position in day-to-day life in the Netherlands. In 2009, 91 percent of households had a PC, and 77 percent had a broadband internet connection. More and more internet connections are wireless. At home, laptops are increasingly replacing desktop computers. Mobile connections, via laptop, mobile telephone and palmtop, are also increasingly used. More than nine in ten Dutch people have ever used a mobile telephone. The Netherlands is still an international leader with respect to the widespread distribution of various ICT provisions.

People are using the internet for an increasing number of different purposes. Just as in previous years, in 2009 communicating with other people headed the list of activities of internet users. The use of email in particular has become commonplace. Listening to the radio and watching television via the internet continued to increase, and online banking was also popular in 2009: nearly eight out of ten internet users did bank business online.

Visits to government websites have been quite stable since 2006. At the beginning of 2009, 53 percent of internet users visited a government website, relatively more people with a high education level than with a low education level. In 2009, 61 percent of government website visitors downloaded electronic forms, while 56 percent completed and returned them electronically. These figures demonstrate that the internet is an important medium for the exchange of information between the government and its citizens.

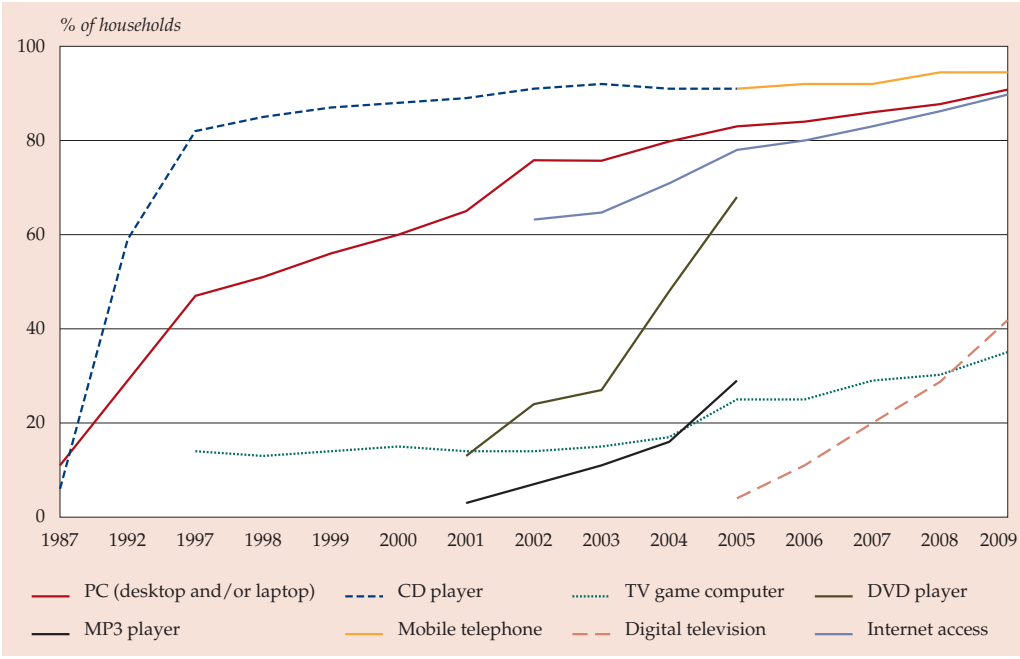
More and more consumers order, buy or book products online. The number of e-shoppers grew strongly in 2009, to 8.8 million. Consumers report convenience, the availability of products and favourable prices as the main reasons for shopping online. The Netherlands is among Europe's leaders with respect to the extent to which online shopping has become an established custom.

The average Dutch e-shopper is a man aged between 25 and 45 years with a degree in higher education. Almost six out of ten internet users book holidays and accommodation online, but books, tickets for events, and clothing and sportswear are also popular online purchases. The largest group of e-shoppers had spent between 100 and 500 euro online in the three months preceding Statistics Netherlands' 2009 survey, while just over three-quarters of frequent e-shoppers shopped online one to six times in this period. The annual B2C (business to consumer) turnover is estimated to be about 6 billion euro in 2009. Most online purchases were paid for via online banking, including iDEAL.

5.1 *ICT provisions in households*

The increasing digitalisation of society has also left its mark inside Dutch homes. Households own more and more information and communication media and are using them to an increasing extent (figure 5.1.1.).
This section examines ICT ownership and the use of devices providing internet access. It looks at why certain individuals and households do not use these modern provisions; places ICT use by Dutch households in an international perspective; and describes the use of mobile phones.

5.1.1 Electronic equipment in households, 1987–2009 [1)]



Source: Statistics Netherlands, Socio-economic panel survey 1987–2002, Integrated System of Social Surveys (POLS) 2002–2004, Budget survey 2003–2004, ICT use by households and individuals, 2005–2009.

[1)] Private households with at least one person aged 12 to 74 years.

The data on Dutch households and individuals are taken from Statistics Netherlands' annual survey of ICT use by households and individuals, in which over four thousand people aged 12–75 years are interviewed.[1)]

PC and the internet commonplace

Today, it is hard to imagine a household in the Netherlands without a PC, either a desktop or a laptop. PC ownership rose substantially around the turn of the century and this trend has continued since then. In 2002, over three-quarters of Dutch households owned a PC, by 2009 this had risen to 91 percent (table 5.1.1). This

means that 12.1 million people in six million households in the Netherlands, or 93 percent of the population had access to a desktop and/or laptop at home in 2009. In 2002, this was slightly over 80 percent of the population.

Internet access, among both households and individuals, was at about the same level as PC ownership, as almost all PC owners have an internet connection. Some 63 percent of households had access to the internet in 2002. This had increased to 90 percent by 2009. This means that 5.9 million households, or 12 million people, had access to the internet at home.

Table 5.1.1
ICT provisions of households and individuals, 2002–2009

	2002	2003	2004	2005	2006	2007	2008	2009	2007	2008	2009
	% of households								*absolute (x 1 mln)*		
Households[1)]									6.6	6.5	6.6
PC (desktop/laptop)	76	76	80	83	84	86	88	91	5.7	5.7	6.0
Internet access	63	65	71	78	80	83	86	90	5.4	5.6	5.9
Broadband internet connection	15	22	34	54	66	74	74	77	4.8	4.8	5.1
	% of individuals								*absolute (x 1 mln)*		
Individuals[2)]									12.8	12.9	12.9
PC (desktop/laptop)	81	82	85	87	88	90	92	93	11.6	11.8	12.1
Internet access	69	72	77	83	85	88	91	93	11.3	11.7	12.0
Broadband internet connection	17	26	39	59	71	79	78	79	10.1	10.0	10.3

Source: Statistics Netherlands, Integrated System of Social Surveys (POLS) 2002–2004, ICT use by households and individuals, 2005–2009.

1) Private households with at least one person aged 12 to 74 years.
2) Individuals aged 12 to 74 years in private households.

Limited growth in broadband, ADSL most popular for high-speed internet

Almost eight in ten Dutch households have broadband internet. Broadband internet has expanded substantially since the turn of the century. In 2002, only 15 percent of households had a broadband connection; in 2007 this had increased to 74 percent, but since then the increase has slowed down. The increase in broadband internet connections has been at the expense of slower types of internet access, such as ISDN and analogue modems.

Half of internet users without high-speed internet say they do not have it because they do not need it. Over 7 percent of them thought it cost too much, while 9 percent thought it could not be installed at their home address.[2)]

Table 5.1.2 shows the distribution of broadband internet in the Netherlands. It illustrates that the penetration of internet was not equally strong in all provinces. In Limburg, two out of three households had a broadband internet connection. This is significantly lower than the national average of 77 percent. In the provinces Utrecht and North Holland, on the other hand, broadband internet coverage was higher than the nationwide average: 84 percent of households in these provinces had a high-speed internet connection.

Most households with a broadband connection had an ADSL connection: two-thirds of households had ADSL. Other high-speed internet connections, such as cable and UMTS, were significantly less common (35 percent). In most provinces, the share of ADSL is between 60 and 70 percent of households, although there are noticeable differences. In the province of Gelderland, three-quarters of households with broadband internet had ADSL, whereas in North Brabant other broadband connections are more common.

Table 5.1.2
Share of households with broadband internet, by province, 2009[1)]

	Total	Of which[2)]	
		ADSL	Other broadband (cable, UMTS)
	% of households	*% of households with broadband*	
Netherlands	77	66	35
North Holland	84	68	34
Utrecht	84	72	29
Drenthe	80	66	35
South Holland	78	69	33
Gelderland	77	75	26
North Brabant	76	56	45
Overijssel	74	62	41
Groningen	71	65	37
Friesland	70	70	31
Zeeland[3)]	69	.	.
Limburg	67	63	39
Flevoland[4)]	.	.	.

Source: Statistics Netherlands, ICT use by households and individuals, 2009.

1) Private households with at least one person aged 12 to 74 years.
2) More than one answer possible.
3) Because of small number of observations, no breakdown by type of broadband connection can be made.
4) Number of observations too small in Flevoland.

Global emergence of broadband internet

The number of households with broadband internet will continue to grow substantially. Gartner, a research and consultancy company, expects one in five households worldwide to have a fixed broadband connection at the end of 2009. In many developed countries, broadband internet is approaching the saturation level. But the new, emerging economies are often still in the early stages of broadband internet acceptance and substantial growth is still possible there. Gartner therefore predicts that, together, these emerging economies (e.g. China, India, Indonesia, South America and the Middle East) will have twice as many new broadband connections as developed economies in the next five years.

Source: Gartner.com, 2009.

Laptop displacing desktop for internet access

Fewer households are using a desktop computer to go online. In 2009, 83 percent of households had a desktop with internet access, ten percent points down on 2005. The decrease is the result of the growing popularity of laptop computers. In 2009, just over six in ten households had a laptop with internet access, up from only a quarter of households in 2005. Alongside laptop computers, other equipment is also increasingly used for internet access: mobile phones, game consoles, palmtops and televisions. In 2009, just over 37 percent of households were able to access the internet with these devices; in 2005 this was only 15 percent of households.

Table 5.1.3
Devices in households with internet access, 2005–2009 [1)]

	2005	2006	2007	2008	2009
	% of households with internet				
Desktop computer	93	91	89	84	83
Laptop computer	27	32	42	54	62
Mobile telephone	12	13	19	22	28
Palmtop computer	3	4	5	5	7
Game computer	1	1	4	7	12
Television with set-top box	0	1	3	4	8

Source: Statistics Netherlands, ICT use by households and individuals, 2005–2009.

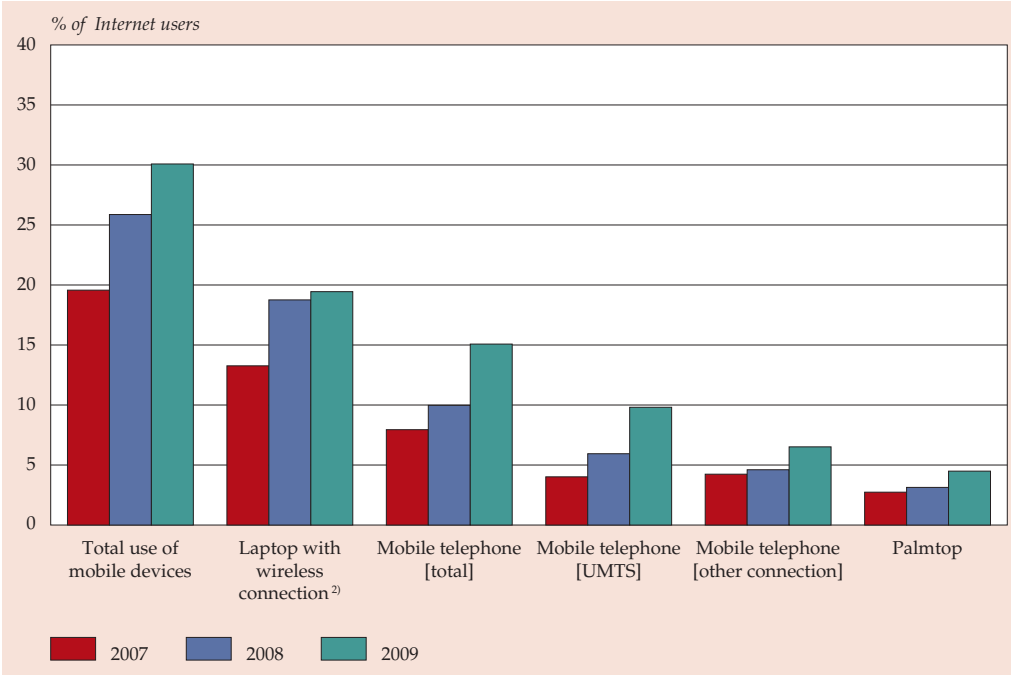
[1)] Private households with at least one person aged 12 to 74 years; more than one answer possible.

Mobile internet access up

Thirty percent of internet users in 2009 sometimes used a mobile device to go online. This is just over five percent points more than in 2008 and just over 10 percent points more than in 2007. The most popular mobile device was a laptop with wireless access: 20 percent of internet users regularly used a laptop to go online away from home or workplace (figure 5.1.2). This was about the same proportion as in 2008. The use of mobile phones to access the internet did increase, on the other hand. In 2009, 15 percent of internet users went online via their mobile phone. Less than 5 percent used a palmtop.

More men than women use the mobile devices described above to go online: almost 40 percent of male compared with 22 percent of female internet users. Mobile internet access is clearly less popular among internet users aged 45 years and older. One in five internet users aged 45 to 64 years had ever used a mobile device to access the internet, and for users aged 65 to 74 this was only 13 percent. In comparison, 38 percent of the 12–24 year-olds and 36 percent of the 25–44 years-olds use mobile internet devices.

5.1.2 Use of mobile devices to access the internet, 2007–2009 [1)]



Source: Statistics Netherlands, ICT use by households and individuals, 2007–2009.

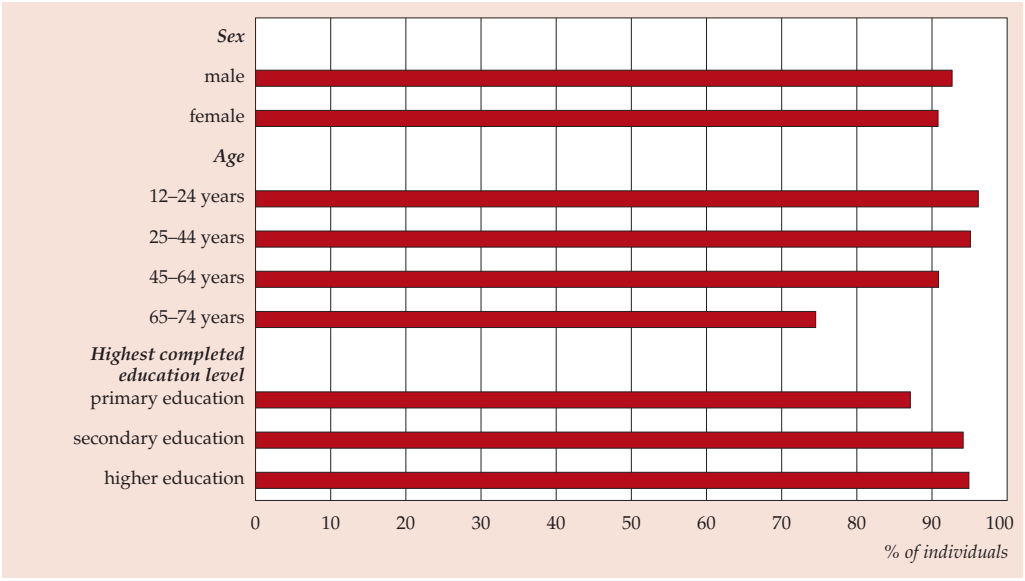
[1)] Individuals aged 12 to 74 years who used the internet in the three months before the survey; more than one answer possible.
[2)] Use outside home or work.

There is also a difference between working and non-working people in use of mobile internet. About 34 percent of internet users with paid work used mobile devices to go online in 2009, considerably more than the 20 percent of people without a paid job.

Nearly everyone now has a mobile phone

The vast majority of Dutch people have ever used a mobile phone: 92 percent. Mobile phones are least popular among people aged 65–74 years: 'only' three out of four people in this age group use a mobile phone. Although mobile phone use is about equal for the sexes, more men than women use their mobile phone to access the internet. Younger people also more often use their phone to go online than older people. People who never use a mobile phone are also less likely to use other ICT. In this group, about 70 percent had access to the internet and only 53 percent had broadband internet at home. For the Netherlands as a whole these shares are 93 and 79 percent respectively.

5.1.3 Use of mobile telephones, by personal characteristics, 2009 [1)]



Source: Statistics Netherlands, ICT use by households and individuals, 2009.

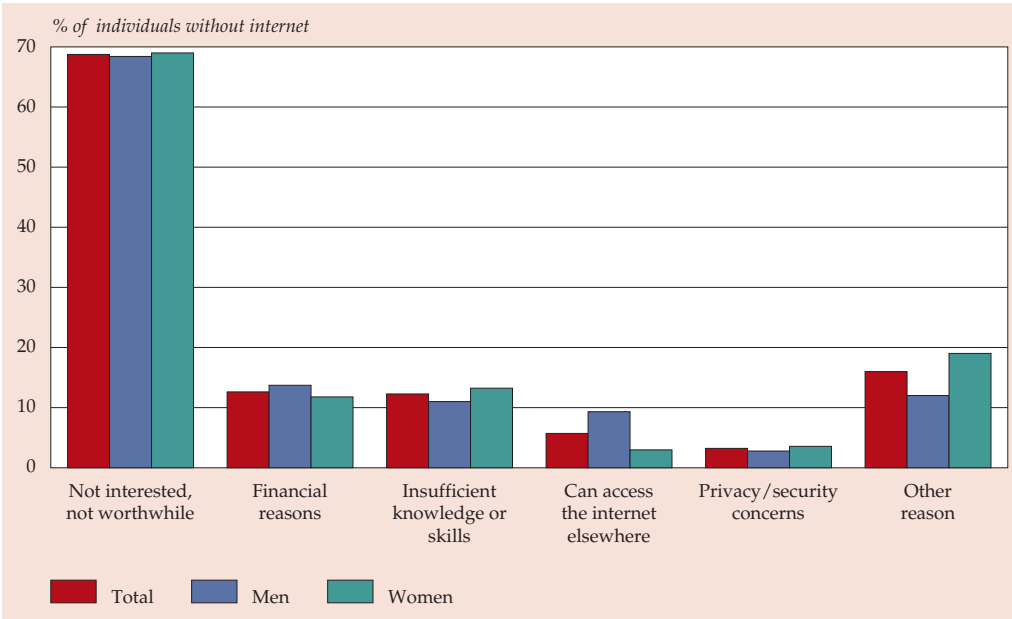
[1)] Individuals aged 12 to 74 years.

Almost a million people do not have internet

The share of the Dutch population without access to the internet access continues to shrink. In 2009, about 900 thousand people aged 12–74 years had no internet access at home; half of these were over 65. Figure 5.1.4 shows that most of these people do not think internet access is useful, are not interested in the internet, or

simply do not want it. This applies to men and women equally. One in eight people said they did not have internet for financial reasons. Relatively few people said they did not have internet because they were worried about privacy and/or security aspects (3 percent).

5.1.4 Reasons for not using internet at home, by sex, 2009 [1)]



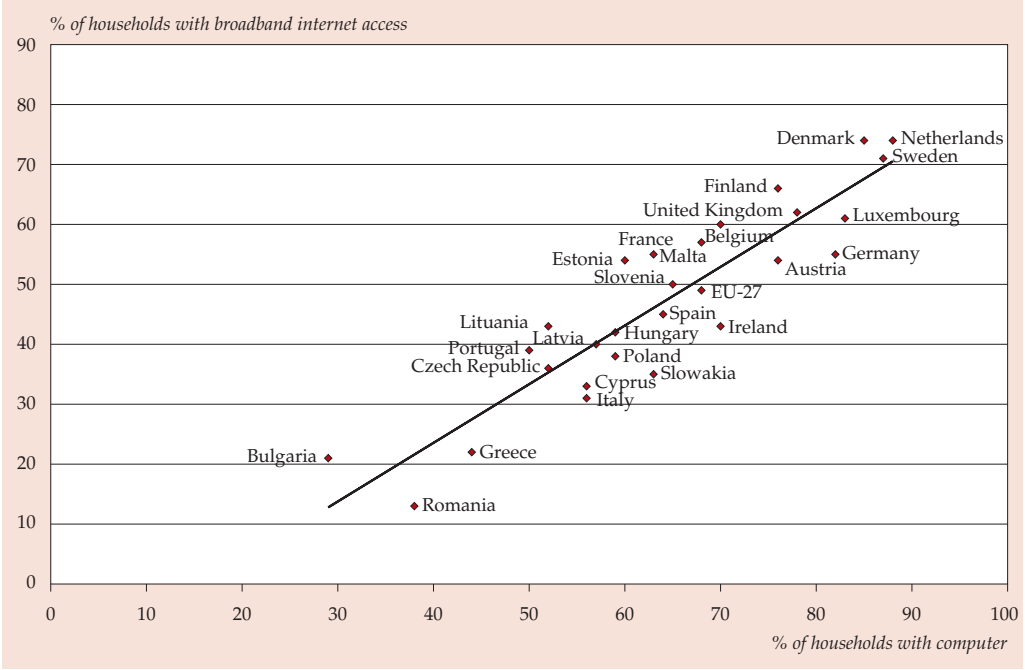
Source: Statistics Netherlands, ICT use by households and individuals, 2009.

[1)] Individuals aged 12 to 74 years in private households; more than one answer possible.

Dutch lead the way in computer ownership and internet access

In terms of computer ownership and internet access, the Netherlands is the leader in the European Union. In 2008, 88 percent of households in the Netherlands owned a computer. In Sweden, Denmark, Luxembourg and Germany, too, over 80 percent of households had one or more personal computers, whereas the EU average was 68 percent. Ownership is much lower in eastern and southern Europe: only 44 percent of households in Greece own a computer, and this is even lower in Romania and Bulgaria with 38 and 29 percent respectively. There is a strong correlation between computer ownership and broadband internet connections. With respect to fast internet connections, too, the Netherlands heads the EU list, again in the company of north European countries like Denmark and Sweden. In these countries, just under three-quarters of all households had broadband internet. Again, Bulgaria and Romania are at the tail end of the list. In Bulgaria, approximately one in five households (21 percent) had broadband internet. In Romania this proportion is even lower: 13 percent.

5.1.5 Computer ownership and broadband internet access in the EU, 2008



Source: Eurostat.

5.2 *Activities and services on the internet*

This section looks at how people use the internet. Statistics Netherlands annual survey includes questions on various internet activities such as communication and entertainment. In view of its economic significance, online shopping is described in the following section. In Chapter 7 we shall see that Dutch people have become more skilled in the use of computers and the internet. These skills are of course not unrelated to the use of PC and the internet themselves: skills and use go hand in hand.

Communication most popular use of internet

Communication was the most important internet activity, and remained so in 2009. Almost all internet users use the medium to communicate in one way or another (see table 5.2.1). Communication mainly takes place by email (95 percent of internet users). Almost one in three communicates through online chat (29 percent). Phoning via the internet (VoIP, see Chapter 3 for definition) rose by 4 percent points; after a sharp increase in 2007, it fell in 2008. However, as the survey questions about phoning via the internet in 2007 did not take into account the rapid rise of VoIP, where people do not have to sit behind a PC to make a phone call, the

figures for 2007 and 2008 are not comparable. The figures for 2008 and 2009 are comparable.

Just as many men as women communicate online, whether via email, chat or telephone. The age of internet users correlates with how they communicate online. Relatively more young than older people chat online. The number of chatters appeared to stabilise in 2009. Chat also includes participation in online newsgroups and discussion forums. Age differences are less pronounced for email and internet telephony.

Information, services and entertainment

Nine out of ten internet users used the internet to look up information in 2009 (see table 5.2.1). Over half played or downloaded games (57 percent) and used the internet for travel services (51 percent). Both shares fell slightly compared with 2008; these services are mainly used by people aged 25–64 years.

Downloading and reading newspapers and magazines continued to rise: almost half of internet users read newspapers or magazines online in 2009; in 2005, this was only one third (35 percent). The increase occurred in all age groups but particularly in the 25–44 age bracket. As the increased supply of online news has resulted in a fall in the number newspaper subscriptions, publishers have started offering 'digital subscriptions', where subscribers receive the paper at home (usually only in the weekend) and also have access to the digital version of the newspaper or magazine.

Table 5.2.1
Activities of internet users, 2005–2009 [1)]

	2005	2006	2007	2008	2009
	%				
Communication					
E-mailing	92	93	94	94	95
Phoning via the internet [2)]	6	12	26	21	25
Other, e.g. chatrooms	40	40	35	27	29
Information and entertainment					
Looking for information on goods and services	87	88	89	86	87
Playing and/or downloading games, images or music	50	55	56	65	57
Using travel services	49	50	54	55	51
Downloading or reading newspapers	35	43	45	47	49
Downloading software	27	31	34	37	34
Listening to the radio or watching television	26	35	42	52	57
Applying or looking for a job	19	22	21	18	19

Source: Statistics Netherlands, ICT use by households and individuals, 2005–2009.

1) Individuals aged 12 to 74 years who used the internet in the three months before the survey; more than one answer possible.
2) Questions changed in 2008. Results for 2008 and 2009 are comparable with each other, but not completely with earlier results.

Internet is also used more and more for listening to the radio and watching television: 57 percent of internet users in 2009. Young people, in particular use these services.

The share of internet users looking for or applying for a job online stabilised in 2009. Women used the internet slightly less often for job searches and applications than men. Obviously, this correlates with the extent to which men and women are looking for work, a factor that was not measured in this survey.

Online banking widely accepted

With the rise of the internet, people have to leave their home less and less for services. Financial transactions, for example, with banks or other financial institutions can easily be done online. Online banking is a service that has rapidly become widely accepted as a result of the internet. Table 5.2.2 shows that in 2009 almost eight in ten internet users did their bank affairs online. This is 4 percent points higher than in 2008, and 20 percent points higher than in 2005. Nine out of ten internet users aged 25–44 years used online banking; for the over-65s this was 64 percent.

Apart from banking, internet users also conduct other financial transactions online, for example buying shares or selling goods and services. Six percent of internet users bought shares online in 2009, less than in the three previous years. Share buyers are more likely to be men than women, have a high education level, and be in the age group 45–64 years. These groups are better off financially.

Table 5.2.2
Use of the internet for online banking and other financial services by age, 2005–2009[1)]

	Online banking					Financial services				
	2005	2006	2007	2008	2009	2005	2006	2007	2008	2009
	%									
Total	58	67	72	74	78	5	8	7	8	6
12 to 24 years	40	49	54	56	59	2	3	4	5	5
25 to 44 years	69	78	83	85	89	5	9	8	8	7
45 to 64 years	59	70	75	76	79	7	11	10	11	7
65 to 74 years	47	55	53	63	64	4	7	7	9	2

Source: Statistics Netherlands, ICT use by households and individuals, 2005–2009.

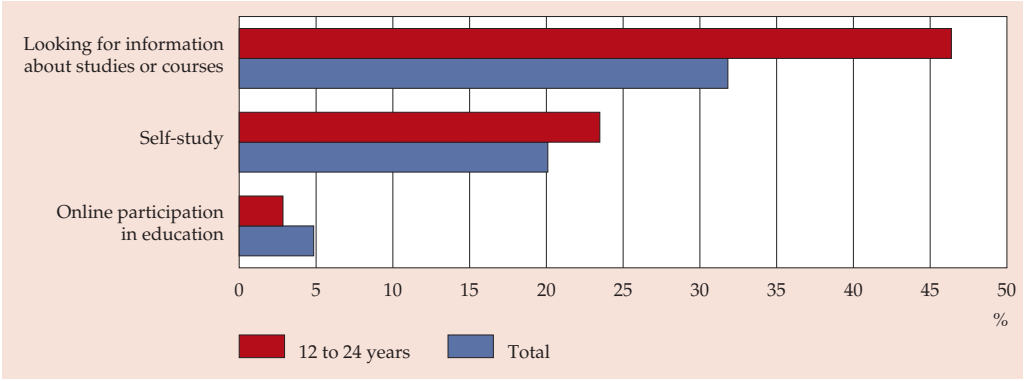
[1)] Individuals aged 12 to 74 years who used the internet in the three months before the survey.

Nearly half of young people search for education information online

More and more education institutions provide information about their courses online. In some cases, students can even do the courses online. The internet has become a important factor in education, in terms of both information and actual

participation (see also section 6.2). This is illustrated by the fact that four out of ten users in 2009 used the internet for education-related activities, mainly to look for information and self-study; one in five used the internet for self-study (figure 5.2.1). It is mainly the younger generation (12–24 years) who search for information about education online. Online participation is less popular: only 5 percent of internet users said they had done or were doing a course online; among young users this share was only 3 percent.

5.2.1 Internet activities for education and study, 2009 [1)]



Source: Statistics Netherlands, ICT use by households and individuals, 2009.

[1)] Individuals aged 12 to 74 years who used the internet in the three months before the survey; more than one answer possible.

Internet activities more diverse

Almost twelve million people in the Netherlands use the internet regularly. There are large differences in what they use it for. The share of internet users who only do a few things online is slowly decreasing. Statistics Netherlands distinguishes ten common types of internet activities:

- communication, including email, chat and phoning;
- looking up product information and travel services;
- news, including listening to the radio, watching television, reading or downloading newspapers;
- entertainment, including games, listening to music or downloading other software; uploading files or sharing photos and videos;
- looking for or applying for a job;
- financial transactions, including online banking;
- online buying and selling;
- government services, including looking for information on government websites, downloading and emailing official documents;
- education, including course-related activities, such as looking for information about courses, online participation or self-study;
- looking up information on health.

An increase in the diversity of internet use is defined as an increase in the number of different internet activities undertaken by individuals. According to this definition, the diversity in the Netherlands is still increasing. In 2009, 4.6 million internet users undertook at least eight different internet activities (table 5.2.3), up from 2.6 million in 2006. The number of internet users with only a few internet activities decreased between 2006–2009. Therefore more and more people are doing more and more different things on the internet.

Table 5.2.3 also shows the cumulative percentages. The figures show a negative correlation between age and diversity: the more activities, the lower the average age. More information about this topic is included in the statistical annex at www.cbs.nl/digital-economy.

Table 5.2.3
Diversity of internet activities, 2005–2009[1)]

Number of internet activities	Number of internet users				Share of internet users				Average age of internet users
	2006	2007	2008	2009	2006	2007	2008	2009	2009
	absolute (mln)				*% cumulative*				*years*
1	0.3	0.2	0.2	0.2	3	2	2	1	49
2	0.5	0.5	0.4	0.3	7	6	5	4	45
3	0.7	0.7	0.8	0.7	14	13	13	10	39
4	1.1	1.1	1.1	0.9	24	23	22	18	38
5	1.7	1.5	1.4	1.3	41	36	35	29	40
6	1.7	1.8	1.8	1.6	57	53	51	43	41
7	1.8	1.8	2.0	2.0	75	70	69	61	40
8	1.5	1.6	1.8	2.4	90	85	85	81	39
9	0.8	1.2	1.3	1.6	97	96	96	95	37
10	0.3	0.4	0.4	0.6	100	100	100	100	34
Total	10.4	10.9	11.2	11.5					39

Source: Statistics Netherlands, ICT use by households and individuals, 2005–2009.

[1)] Individuals aged 12 to 74 years who used the internet in the three months before the survey.

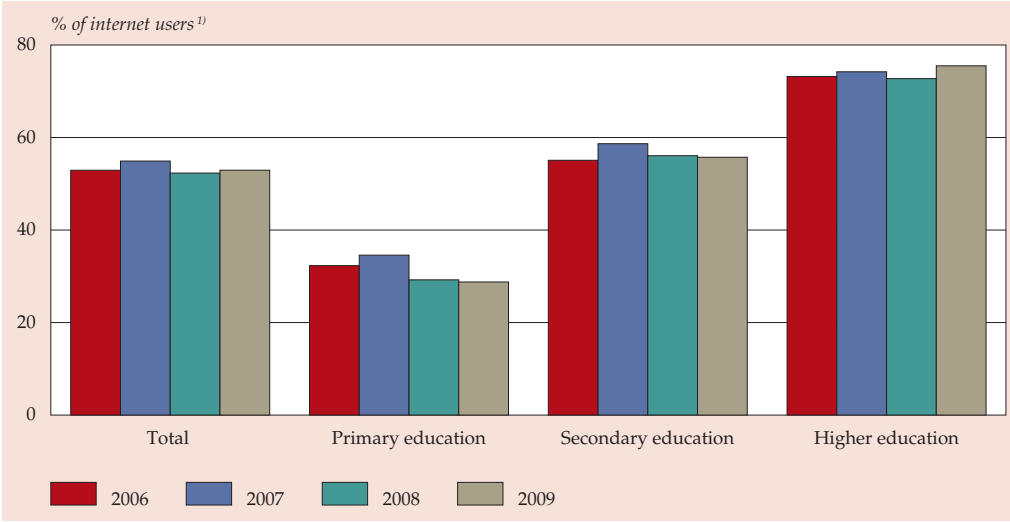
Visits to government websites stable

Dutch citizens have access to more and more government services online (see also section 6.1 on e-government). Citizens can obtain information, download documents and forms, and return completed forms in this way. These forms of e-government are relatively cheap and flexible. Furthermore, people can use these services when it suits them, and are no longer bound by the opening hours of the department concerned.

Half of internet users looked up information on government websites in the three months preceding Statistics Netherlands survey in 2009 (figure 5.2.2). This share has hardly changed since 2006. About eight percent of internet users visited

government websites in the twelve months preceding the survey. Overall 61 percent of internet users visited these sites for information.
Individual and household characteristics seem to correlate with visits to government websites. Relatively more men than women visited these sites (59 and 46 percent respectively), for example, and people with a higher education level also use them more: three-quarters of people with higher education levels compared with 29 percent of people with low education levels.

5.2.2 Looking up information on government websites, 2006–2009 [1)]

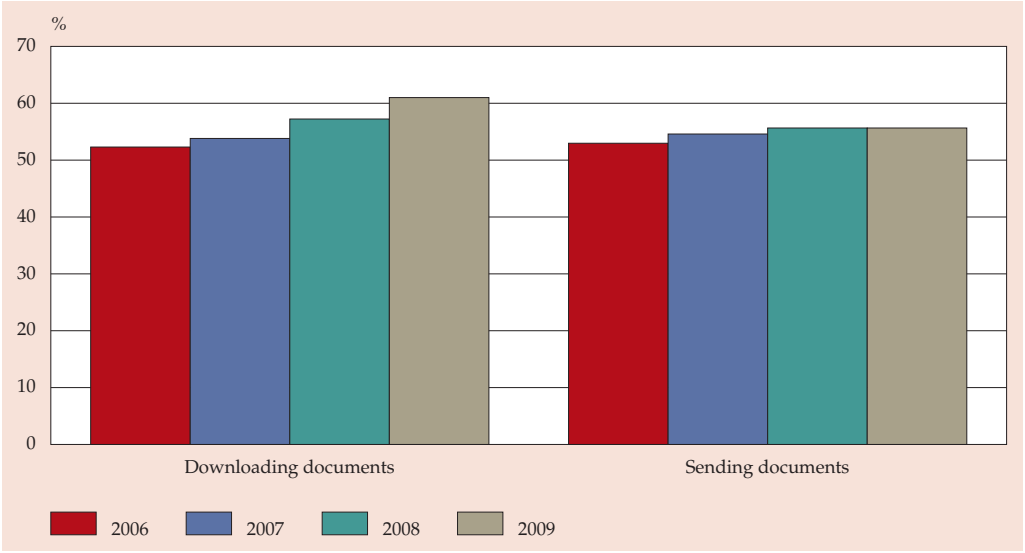


Source: Statistics Netherlands, ICT use by households and individuals, 2006–2009.

[1)] Individuals aged 12 to 74 years who used the internet to visit a government website in the three months before the survey.

Most users of government websites not only looked for information. Just over six out of ten also downloaded documents (figure 5.2.3) in 2009, continuing the increase of 2008. Online completion of forms and emailing them back is more stable: 56 percent of visitors to government websites did this in 2009. These figures prove that the internet has become an important medium for the exchange of information between citizens and government. In this case, too, this applies more to men than to women.

5.2.3 Use of e-documents by visitors to government websites, 2006–2009 [1)]



Source: Statistics Netherlands, ICT use by households and individuals, 2006–2009.

[1)] Individuals aged 12 to 74 years who used the internet in the three months before the survey; more than one answer possible.

5.3 *Online shopping*

Online shopping is still increasing in popularity. The convenience of the internet, the possibility to compare products, the availability of information and the costs are probably main reasons for this increasing popularity. This section reviews various aspects of online shopping behaviour of individuals, for example the development of online shopping, types of goods and services purchased, frequency of online shopping and how much e-shoppers spend. Dutch online shopping is also placed in a European perspective. The section also looks at the reasons people give for shopping – or not shopping – online.

Number of online shoppers up substantially in 2009

Anyone who orders or buys goods or services online is defined as an online shopper. They need not pay for these goods or services online, and how often they buy a product online is not relevant. The number of online shoppers rose substantially, to 8.8 million people, in 2009 (table 5.3.1). This number had already risen sharply in the period 2002–2005, but the growth had slowed down since then.

Table 5.3.1
Online shopping, 2002–2009[1)]

	2002	2003	2004	2005	2006	2007	2008	2009
	absolute (mln)							
Online shoppers	3.6	4.2	5.1	5.9	6.6	7.5	7.7	8.8
Frequent online shoppers	1.9	2.2	2.9	3.9	4.5	5.3	5.4	6.0
Infrequent online shoppers	1.7	2.0	2.2	2.0	2.1	2.2	2.4	2.7
Not online shoppers	5.3	5.1	4.7	4.8	4.2	3.8	3.7	3.0
Total	8.9	9.2	9.8	10.7	10.9	11.3	11.5	11.8
	%							
Online shoppers	40	45	52	55	61	66	67	74
Frequent online shoppers	21	24	30	36	41	47	47	51
Infrequent online shoppers	19	22	23	19	20	19	21	23
Not online shoppers	60	55	48	45	39	34	33	25
Total	100	100	100	100	100	100	100	100

Source: Statistics Netherlands, Integrated System of Social Surveys (POLS) 2002–2004 and ICT use by households and individuals, 2005–2009.

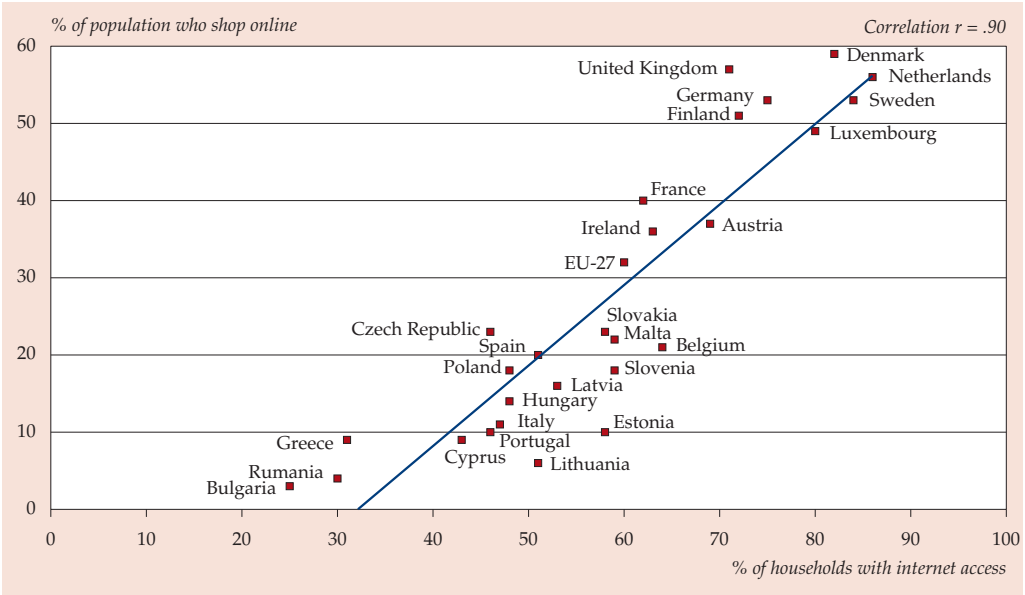
[1)] Individuals aged 12 to 74 years who use the internet. Frequent online shoppers shopped online in the three months before the survey. Infrequent online shoppers did so longer than three months before the survey.

Online shoppers can be divided into frequent and infrequent online shoppers. Frequent online shoppers are defined as internet users who purchased a product on the internet in the three months preceding Statistics Netherlands' survey. In 2009, 6 million people had done this. Infrequent online shoppers had purchased a product online longer ago than three months preceding the survey. Overall, three-quarters of internet users in 2009 were online shoppers. The increase in the total group of online shoppers can be attributed to the group of frequent online shoppers. The number of people who do not shop online fell from 5.3 million in 2002 to 3 million in 2009. The table shows that online shopping has become a well-established internet activity among the Dutch the population.

Dutch among EU's top online shoppers

Online shopping seems most widely accepted in the Netherlands, Denmark and the United Kingdom. In Bulgaria, Romania and Greece, online shopping is relatively rare. Figure 5.3.1 illustrates this, and also shows the extent of household internet access. It shows a strong correlation between these factors (correlation coefficient r = .90). The larger the share of households with internet access in a country, the greater the share of online shoppers in the population.

5.3.1 Online shopping in the EU, 2008 [1)]



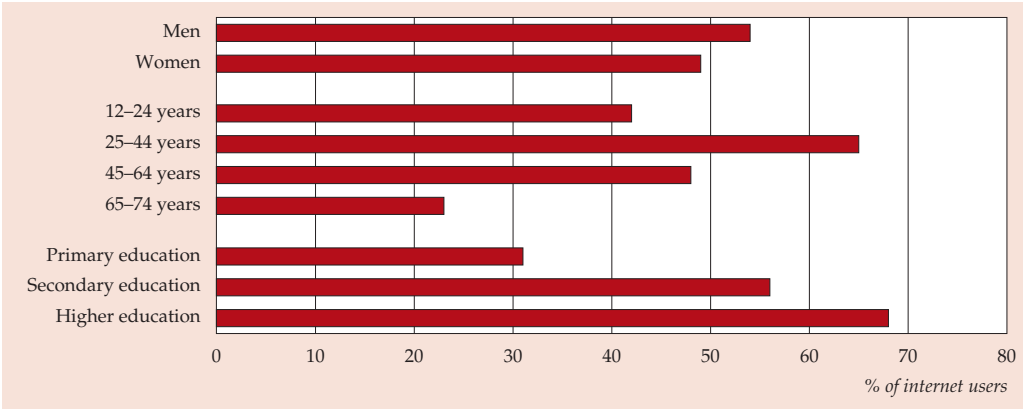
Source: Eurostat.

[1)] Individuals aged 16 to 74 years who shopped online in the twelve months before the survey.

Typical online shopper: male, 25–44 years, higher education

In the Netherlands, the profile of the typical online shopper is quite stable. In 2009, 54 percent of male internet users were frequent online shoppers, versus 49 percent of women. These gender differences diminished in 2009. Online shopping also correlates with age and education level (figure 5.3.2).[3)]

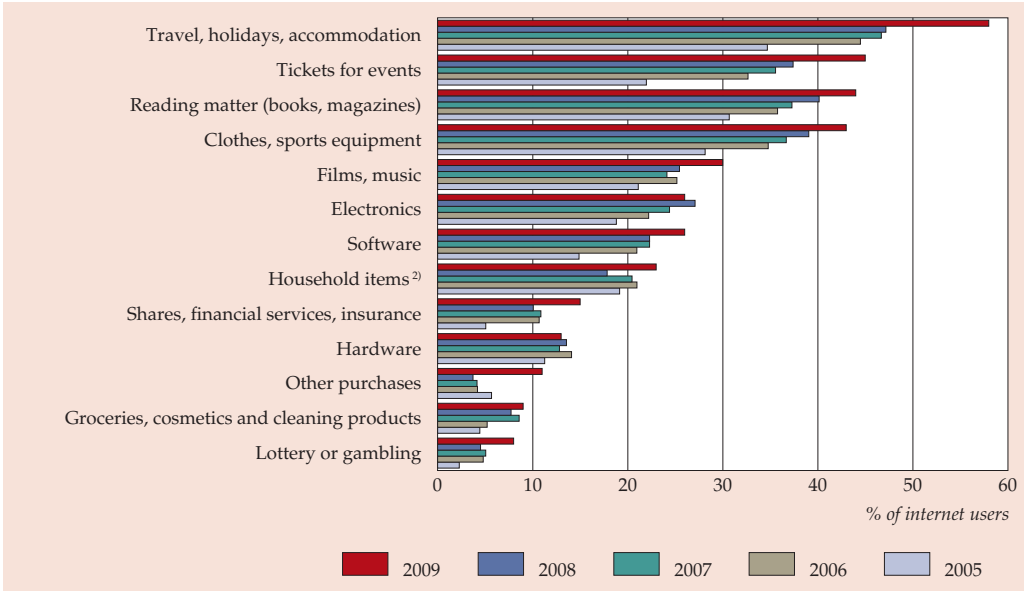
5.3.2 Frequent online shoppers by personal characteristics, 2009 [1)]



Source: Statistics Netherlands, ICT use by households and individuals, 2009.

[1)] Individuals who bought at least one product online in the three months before the survey.

5.3.3 Online purchases by type, 2005–2009 [1]



Source: Statistics Netherlands, ICT use by households and individuals, 2005–2009.

[1] Internet users who bought at least one product online in the three months before the survey.
[2] E.g. furniture, washing machines, toys.

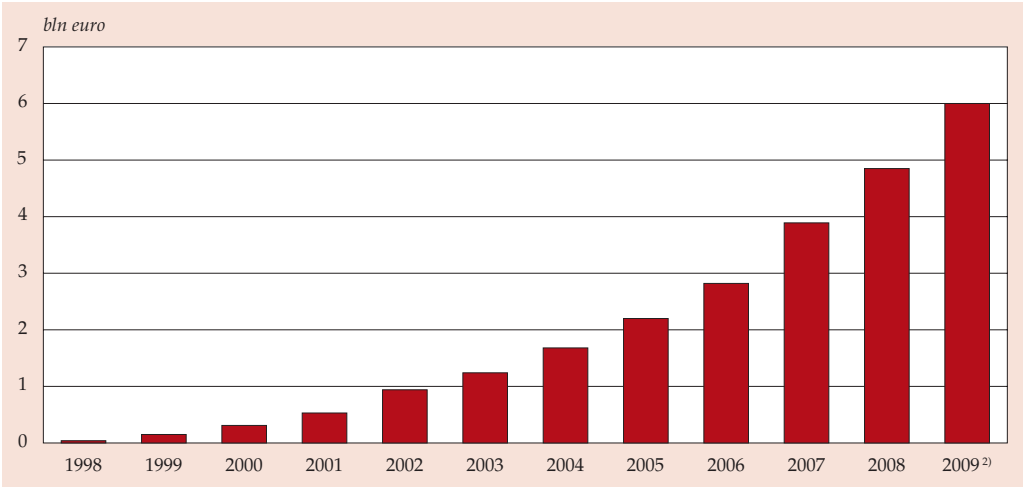
Travel, holidays and accommodation most popular online purchases

Online purchases of travel tickets, holidays and accommodation by internet users were 11 percent points higher in 2009 than in 2008. It should be noted that from 2009 this category also includes holiday-related transport facilities, car rentals and air tickets. Nearly six in ten internet users purchased travel tickets and holidays online. This category is followed by 'tickets for events', 'books and magazines' and 'clothing and sports equipment'. 'Tickets for events' also rose substantially in 2009: by 8 percent. Online purchases increased across all categories in 2009 (figure 5.3.3). Although all goods and services listed in figure 5.3.3 were bought both by men and women, some differences between the sexes have been visible for a number of years now. More men than women bought electronics online (11 percent points difference); four times as many men bought hardware, and twice as many men purchased software. More women than men bought sports equipment and clothes on internet.

Online spending continues to rise

In Statistics Netherlands' 2009 survey, the largest group of online shoppers reported having spent between 100 and 500 euro. People who spent more than one thousand euro online may have booked a holiday. More than three-quarters of frequent online shoppers made between one and six times purchases in the period examined. The remainder purchased goods online more than six times.

5.3.4 Annual turnover from B2C e-commerce, 1998–2009 [1)]



Source: Thuiswinkelmarktmonitor, 2009.

[1)] Turnover on the Dutch home shopping market.
[2)] Estimated figure.

The annual B2C (business to consumer) turnover in the Netherlands was an estimated 6 billion euro in 2009 (Thuiswinkelmarktmonitor, 2009). This turnover increased significantly in spite of the financial and economic crisis in 2009. It includes spending of consumers on the Dutch home shopping market. Figure 5.3.4 shows the annual turnover from e-commerce for 1998–2009. More information on these figures can be found in Thuiswinkelmarktmonitor. [4)]

Why do online shoppers buy outside the Netherlands?

What is the advantage of buying online via foreign websites? Often it is an economic consideration: clothes, software and electronics are cheaper. Goods manufactured in the United States or Asia are available on local markets at lower prices than in other countries. Some products are not exported at all, as they do not meet specific export standards; only similar, more expensive, products are then exported. Price differences can also be caused by differences in tax rates, which are usually higher in the Netherlands. Some products may be purchased tax free by foreign consumers. Another reason for lower prices abroad may be currency exchange rates. The US dollar and the British pound, in particular, have low exchange rates against the euro, thus tempering prices. In addition, manufacturers often use higher prices in the EU than elsewhere in the world (e.g. because of regulations and complex distribution channels). Lastly, sometimes foreign products for sale abroad are not, or not yet, available in the Netherlands. For example, when first launched in the US, iPhones and Microsoft Zune were not available in the Netherlands.

Convenience main factor

Consumers report different reasons to shop online. Convenience is the most cited reason; nearly three-quarters of frequent online shoppers said convenience and time-saving were very important. In addition, half of them mentioned product availability and lower prices as very important reasons to shop online.

Besides these general reasons for online shopping, the features of the websites offering the products were important. Nearly two-thirds of frequent online shoppers said the usability of the website itself was very important. Other website features examined by Statistics Netherlands are: 'assurance with respect to legal rights and guarantees' (64 percent), 'quality certificate issued by a recognised authority' (46 percent) and 'reviews and feedback from other users of the website' (36 percent). The statistical annex contains detailed information on reasons for shopping online.

Most payments via online banking

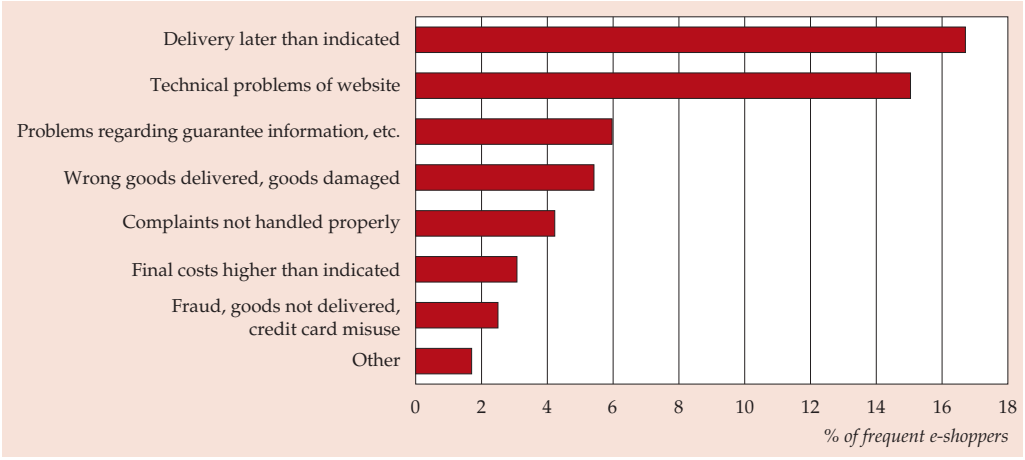
Online consumers have several options to pay for their purchases via the internet. Internet banking, including iDEAL, was by far the most common method of payment in 2009. More than three-quarters of e-shoppers paid for their purchases via internet banking; one third used a credit or debit card. Just over a quarter used a non-internet money transfer, or sent money through the post. The latter option was mainly used by people over 65.

Methods of payment hardly differ between education levels, with the exception of payment by credit card: nearly half of buyers with a high education level used a credit card. Other methods of payment – prepaid cards, electronic vouchers and providing prepaid account data – were only rarely used.

Delivery times biggest problem

Online consumers may encounter a number of problems. According to Statistics Netherlands' survey, over 17 percent of online shoppers reported that their purchases were delivered later than promised; just over 15 percent experienced technical problems with the website. Two percent of online shoppers reported misuse of credit card information (figure 5.3.5).

5.3.5 Problems experienced by online shoppers, 2009 [1)]



Source: Statistics Netherlands, ICT use by households and individuals, 2009.

[1)] Internet users who bought at least one product online in the three months before the survey.

Reasons for not shopping online

Respondents in Statistics Netherlands' survey reported a number of reasons for not shopping online. The most cited reason (nearly 60 percent) was the preference to shop traditionally, for example to be able to try on clothes. Many people also think online shopping is unnecessary (44 percent). In addition to motives, some – subjective – barriers were also reported. One third of people who do not shop online, for example, were concerned about security, and a quarter about privacy. In a few cases these concerns are justified, as illustrated by the problems online shoppers experience: 2 percent of the 8.8 million online shoppers reported misuse of their credit card. This means that more than 150 thousand people may decide to stop shopping online or to use a different method of payment.

Few online buyers (less than 2 percent) think the speed of their internet connection is a reason not to shop online. Not being able to find relevant information quickly, and not being able to receive goods at home are also rarely reported reasons not to shop online.

Compared with younger people, relatively fewer people aged 45 years or older shop online; the difference is 8 percent points. People aged over 65 express most concerns about security and privacy. The statistical annex contains detailed information on the reasons for not shopping online.

Notes in the text

1) For the survey of ICT use by households and individuals, carried out by Statistics Netherlands since 2005, only people aged 12–74 are interviewed. ICT outcomes for 2002–2004 are taken from the Integrated System of Social Surveys (POLS), for which people over the age of 12 were interviewed. The new ICT survey was designed differently. People are interviewed by phone rather than face-to-face, as they were in the POLS survey. The sample size of the new ICT survey is more than 4,000 individuals, which is smaller than the sample in earlier POLS surveys. For this book, data for 2002–2004 were made comparable at the individual level by recalculating them for the population aged 12–74 years. No full correction took place for comparability at household level. The survey on ICT use by households and individuals is carried out within a European framework, in which all EU member states ask comparable questions. Dutch results can therefore be compared with those of the other member states. The international results refer to individuals aged 16–74 years.
2) The coverage of broadband internet in the Netherlands is around 99 percent. See also sections 3.1 and 8.4.
3) Education level also correlates with other background characteristics of persons and households, such as income. Only a so-called determinants study can demonstrate which background feature statistically explains online buying behaviour the best. Statistical Netherlands published such a study in 2003 (http://www.cbs.nl/NR/rdonlyres/5C173CFC-7CF0-4E5F-8D0E-6D58D-1823F8E/0/determinantenonderzoekpcbezit.pdf).
4) http://www.thuiswinkel.org/bedrijven/nieuws_publicaties.aspx?subnavid=1&id=13622.

6. ICT use in the public sector

Just as companies and households, the public sector – government, education and care – is also subject to the continuing process of digitalisation. The terms used in this respect are e-government, e-learning and e-health, which emphasise the role of ICT. In these domains ICT is used to improve services; for example the quality of service, customer focus and efficiency.

A well-known development in the public sector is the introduction of the DigiD. On 1 January 2009 half of the Dutch population aged 18 and older held an active DigiD. There are regional differences in the proportion of the population with an active DigiD. Age-related legal provisions, such as the general pensions act and the 2000 act on study grants, as well as the option of online income tax declaration have had a substantial effect on the number of people applying for a DigiD.

In education, the number of pupils and students per computer has fallen further, and more teachers are using computers in the classroom. Almost all computers in education have access to the internet. Schools report that ICT contributes to various educational goals.

In the care sector, ICT is just as widespread as in the rest of the economy. In 2008 relatively more health care workers regularly used a computer and the internet than welfare workers. E-health is an up-and-coming area, in which medical informatics, health care and business practices interact with each other. The best known application of this is the electronic patient dossier. The share of Dutch GPs who use ICT for purposes of diagnosis is well above the EU average and comparable with the Scandinavian countries.

6.1 Dutch e-government

The Dutch government has set itself the objective to improve its services to citizens and businesses, among other things by using ICT. It also aims to make government processes more transparent and efficient, again by using ICT. Many government services include or consist of collecting, processing, storing and supplying information to citizens and companies. As a lot of information can now be stored, processed and disseminated digitally, authorities can re-use information supplied to other government bodies without having to approach citizens and companies again. Additionally, information and services can be offered to citizens and businesses online, from publishing legislation and regulations on the internet to practical applications, such as online application for population register records.

Dutch government authorities are trying to become more 'customer' oriented. Whether they show up in person, apply online, telephone or send an e-mail, citizens and companies should receive the same information from a local authority. Government organisations should not ask people or companies for the same information over and over again, or send citizens and companies from pillar to post. To

this end, they must have access to reliable information and must share it in a reliable way among themselves and with citizens and companies. To achieve this, Dutch government organisations are building an e-government.

Increasing digitalisation may lead to productivity gains: government organisations may be able to provide better services for the same price, or the same services for a lower price. The box below shows that 'public administration and social security' sector accounts for nearly 6 percent of Dutch gross domestic product (GDP). This is more than many other sectors of industry.

Key figures on the government

In 2008, the 'sector of industry' public administration and social security accounted for 6 percent of the gross domestic product and employment in the Netherlands. This is similar to the share of the construction sector, and the sector transport, storage and communication, but considerably higher than the contribution to the economy by the chemical industry and the gas, water and electricity sector. Public administration and social security consists of several levels of government, from central government to municipal government, and of several departments, ranging from general public administration to fire departments.
Compared with 1998, the share of public administration and social security in GDP and employment was slightly smaller in 2008. However, its share in intermediate consumption and particularly in investment has grown over the years. The government is an important investor; it accounted for nearly 13 percent of all investment in the Netherlands in 2008. Nearly 7.5 percent of total remuneration of employees consists of remuneration for government employees. This is quite high compared with other economic variables. Labour is the government's main production factor: almost 70 percent of value added of the government consists of remuneration of employees. This share was a lot lower for the economy as a whole: 50 percent.

Key figures for the government sector

	1998	2003	2007**	2008*
	million euro			
Government [1)]				
Production value	32,680	47,962	54,870	58,458
Intermediate consumption	12,798	20,786	24,544	26,670
Gross value added	19,882	27,176	30,326	31,788
Remuneration of employees	14,282	19,445	20,838	21,727
Investment	7,638	12,907	14,011	15,552
	full-time equivalents (x 1,000)			
Employed persons	375	414	386	384
	%			
Share in the total economy				
Production value	4.8	5.4	5.1	5.1
Intermediate consumption	3.5	4.5	4.3	4.3
Gross value added	6.1	6.4	6.0	6.0
Remuneration of employees	7.8	7.9	7.4	7.4
Investment	9.5	13.9	12.3	12.8
Employed persons	6.0	6.3	5.7	5.6

Source: Statistics Netherlands, National accounts.

[1)] The government sector is defined here as Public administration and social security.

Dutch government constructing e-government.

If they are to share information reliably, all levels of government must know exactly which information is reliable. They must also know who or what this information is about, and make sure that sensitive information is not readily accessible to everyone. Therefore, the Dutch government is working on a number of basic provisions, or 'building blocks', for e-government. These basic provisions, often developed at the national level, are intended to prevent the proliferation of the number of provisions, and tackle the following themes.

1. accessibility: how can government information be made accessible electronically?
2. authentication: how can authorities verify with whom they communicate electronically?
3. basic registrations: which information is reliable?
4. information exchange: how are data exchanged?

The building blocks for e-government are in various stages of development. Some have long been in use, while others are still in their infancy.

The customer contact centre and the mid office

Municipalities are increasingly offering citizens the option to conduct their business through internet, by e-mail, phone or at the counter through a single organisational point of contact. To streamline this service, several municipalities are setting up customer contact centres to answer as many questions as possible directly, in the first place about their own organisation, but in the long run also about Dutch government as a whole.

To be able to answer questions directly, the front-office, i.e. the people who are in contact with the customers, must have access to specific information. This information is generally supplied by the specialised departments in the back-office. To connect the business processes and data systems of the process and product-oriented back-office with the customer-oriented front-office, the concept of a 'mid-office' has been introduced: an information architecture and software suite to facilitate this connection.

Two types of mid-office software suites are being implemented in municipal government: the thin mid-office, which only brokers the messaging between the front and back-office, and the fat mid-office, which – in addition to brokering messages – also carries out operations traditionally performed by the back-office (W. Keller, 2007).

Building blocks per theme

Government information can be made accessible in several ways. Government websites can be designed in such a way that people with visual impairments can use them, for example, or to show citizens what information is registered about them personally. The building blocks in this theme therefore focus on these aspects. The building block *Webrichtlijnen* (web guidelines) lays down quality demands for accessibility and searchability of government websites. The building block *Samenwerkende Catalogi* (cooperating catalogues) ensures that citizens and businesses are not sent from pillar to post. Government products and services are made findable in a standard way. The building block *MijnOverheid.nl* (my government) shows citizens how they are registered with various government authorities and allows them to apply for services online. The building block *Antwoord voor bedrijven* (answers for businesses) clusters all government information for businesses and allows companies to apply for services online.

It is important for organisations to know who wants to use their products, or looks up information on a website. They can use this knowledge to tailor their services to an individual person or a specific company. Citizens and companies must therefore have a digital form of identification so that government agencies can check their identity. The building blocks *DigiD burger* (DigiD for citizens) and *DigiD bedrijven* (DigiD for companies) were made for this purpose. With the aid of the *Gemeenschappelijke Machtigings- en Vertegenwoordigingsvoorziening* (common authorisation and representation provision), users can also authorise someone else to apply for services and products online.

The government has a vast amount of information on Dutch society. These data are stored by over 1,500 institutions in about thirty thousand national, provincial and municipal systems. Many of these systems were developed more or less independently and they have hardly been harmonised with each other (VROM, 2007). As this makes it more difficult to reuse information, the government is setting up a system of basic registrations to make this easier.

Key information about Dutch society is stored in a limited number of registers. Citizens and businesses thus only have to supply information once, after which all levels of government have access to reliable information from the system of basic registers. Public institutions are obliged to use these basic registers to reduce the number of surveys among the public and among companies. Authorities are required to suspected errors in the basic registers to the owner of the information. This serves as a quality check of the data in the basic registers.
In 2009 ten registers were designated as basic registers. These include:
- *Basisregistraties Adressen en Gebouwen:* buildings, dwellings and addresses.
- *Basisregistratie Kadaster:* land register
- *Basisregistratie Waarde Onroerende Zaken:* values of real estate.
- *Basisregistratie Inkomen:* developed and operated by the Dutch tax authorities. This will make it unnecessary to provide income information to other government authorities.
- *Basisregistratie Personen:* the existing municipal population registration.
- *Nieuw Handelsregister:* companies and legal persons (operated by the Chambers of Commerce).

Exchanging data is not as easy as it seems: problems that had previously been solved come to the fore again. Information has to be transmitted to the rightful receiver, arrive without being intercepted, and be able to be read. To achieve this, technical agreements and provisions are required. Existing traditional agreements and provisions include postal addresses, and postmen, confidentiality of the mail, as well as the alphabet. New agreements and provisions are provided by, among other things, the building block *Overheidsservicebus* (government service bus).

In addition to communicating with each other, government authorities also communicate with citizens and businesses. The building block *Overheidstransactiepoort* (government transaction portal) was developed for companies that often exchange large volumes of information with government authorities; it works as a sort of post office for e-government.

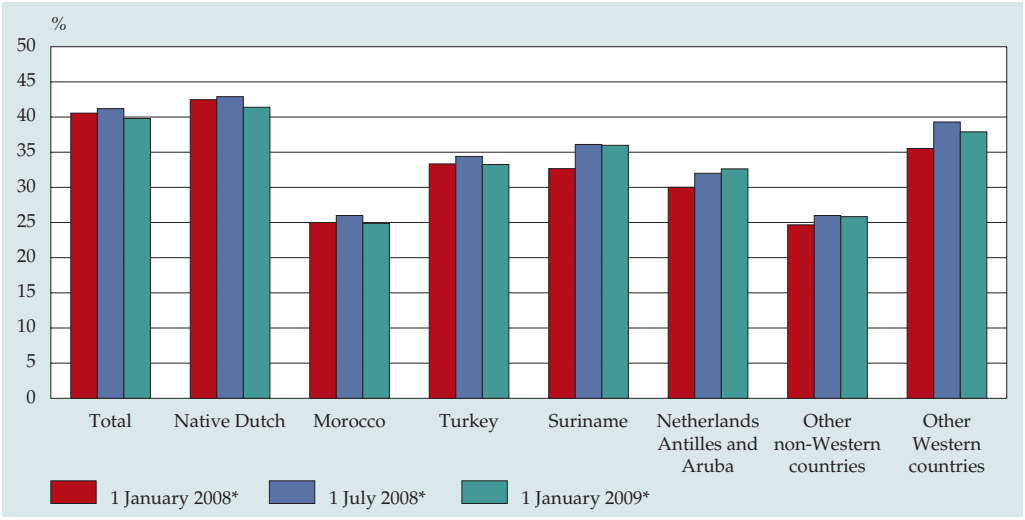
DigiD contributes to customer orientation

The traditional technical solution for identification (a passport) is not suitable for electronic use. To solve this problem, the Dutch government started to develop the building block *DigiD burger* (DigiD citizen) in 2003. DigiD stands for digital identity and in its most basic form consists of a user name and password. Citizens can use their unique DigiD to communicate, and to complete transactions with a variety of public authorities online. With the introduction of DigiD government authorities do not need to develop their own authentication system, and citizens do not have to memorise numerous log-in names and passwords. In this way, DigiD contributes to government efficiency and customer orientation.

Slight fall in DigiD holders in second half 2008

On 1 January 2009, half the Dutch population aged 18 years and older had an active DigiD. This is roughly the same as the year before, but slightly less than in July 2008. The percentage of native Dutch men with an active DigiD is higher than the percentage of native Dutch women. For people with an immigrant background this was the other way around.

6.1.1 Share of the population by origin with an activated DigiD on reference date, 2008–2009 [1)]

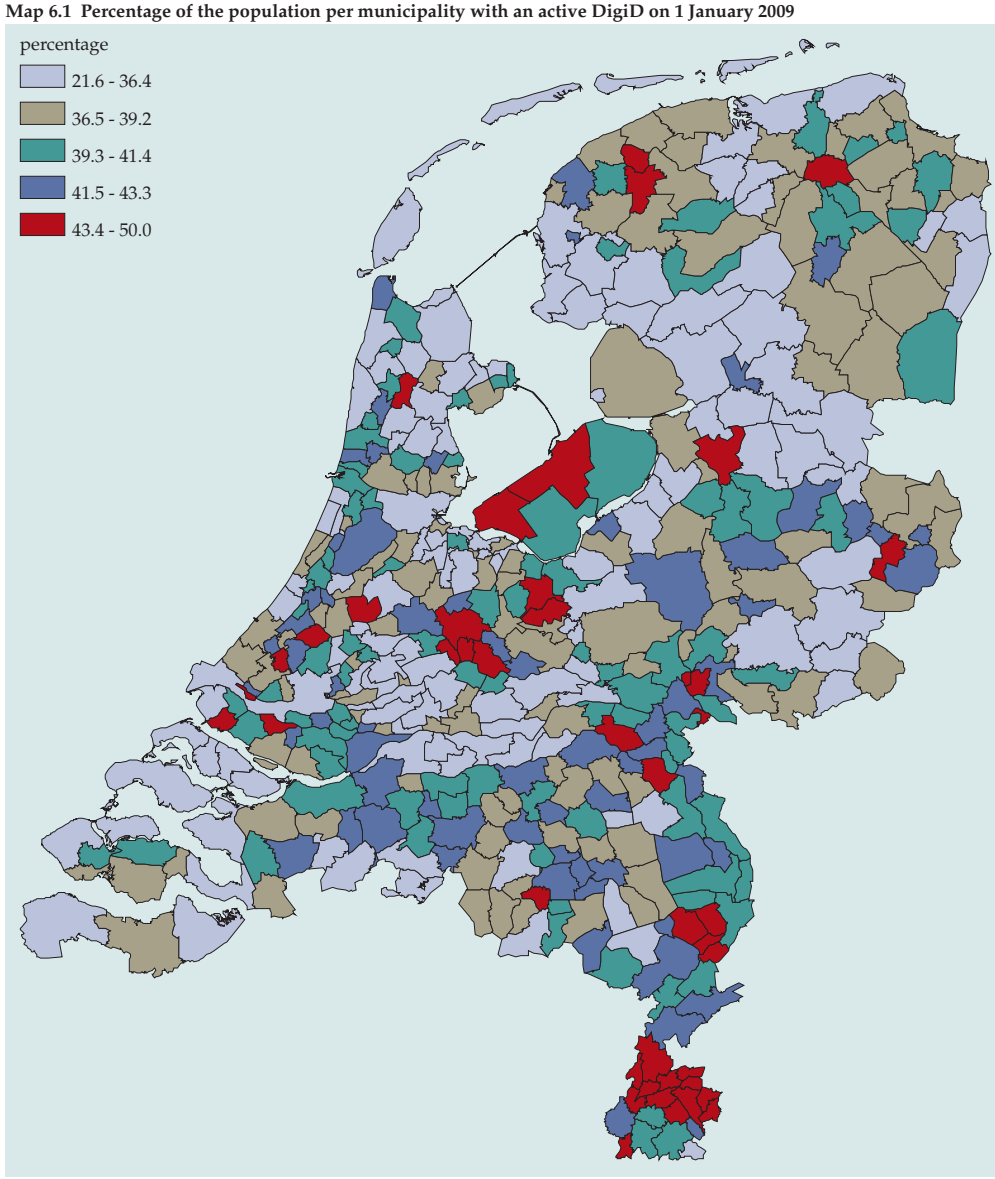


Source: Statistics Netherlands/Ministry of the Interior and Kingdom Relations - GBO.Overheid.

[1)] Figures are provisional. Figures for 1 January 2008 include only DigiDs active on 1 July. DigiDs that had expired at an earlier moment are not included.

Although the share of DigiD holders fell slightly overall in the Netherlands in the second half of 2008, among people with an Antillean and Aruban background and people under the age of 26 years it rose. (see also Figure 6.1.1).

Map 6.1 Percentage of the population per municipality with an active DigiD on 1 January 2009



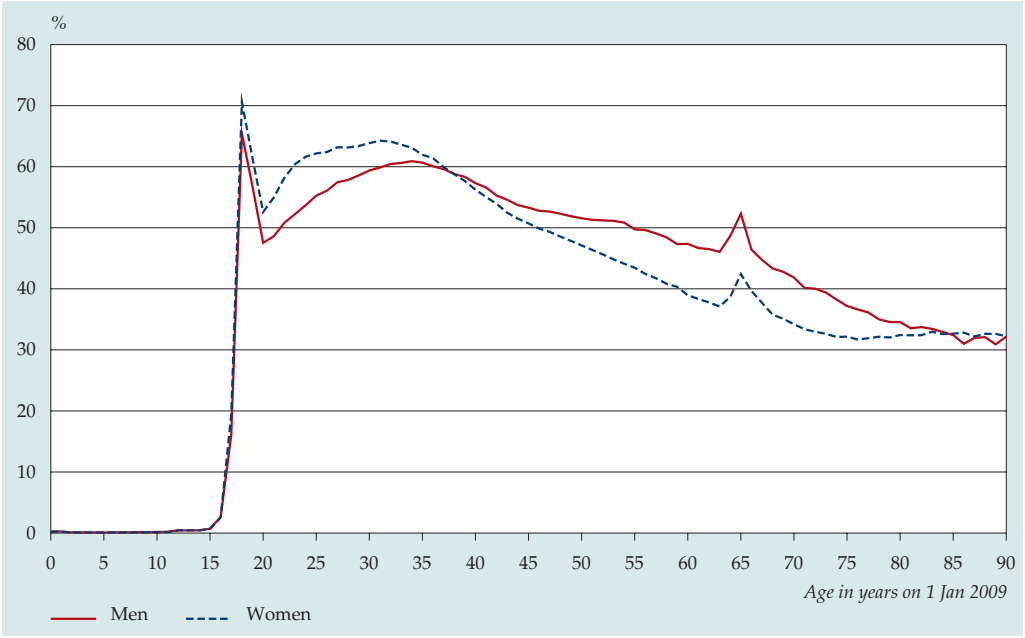
Source: Statistics Netherlands/Ministry of the Interior and Kingdom Relations - GBO.Overheid.

There are also regional differences in the share of the population with an active DigiD (map 6.1). The share of DigiD holders is lower on the Wadden Islands and along the coast than in large parts of provinces Limburg and Flevoland.

DigiD activation age-related

In addition to the regional distribution of DigiD holders, there are also differences based on age. Figure 6.1.2 shows the proportion of the population holding an active DigiD on 1 January 2009. It illustrates that the proportion of women under 38 with a DigiD is larger than the share of men of the same age. Two other peaks are noticeable; one around age 18 and one around age 65. These are presumably related to the use of DigiD for age-related legal provisions, such as study grants and state old age pension.

6.1.2 Percentage of the population with an activated DigiD by age, 1 January 2009*



Source: Statistics Netherlands/Ministry of the Interior and Kingdom Relations

Income tax declaration has a large effect on overall DigiD use

Every year, the number of applications for a DigiD rises substantially in the months leading up to the deadline for income tax declaration (1 April). Furthermore, applicants show a preference for certain days of the week: fewer applications for a DigiD are submitted just before and during weekends than on other days. The previous edition of this publication contains more information on this.

Number of people using MijnOverheid.nl growing steadily

Since its launch in April 2008, MijnOverheid.nl has had a steadily growing number of users. Because MijnOverheid.nl is a relatively new and fairly unknown building block, its number of users is still small. In September 2009 only 1.2 per thousand of

the Dutch population had logged in to this site at least once. This proportion was slightly higher in South Holland, Utrecht and Groningen than in other provinces, probably because there were more pilot users in these provinces.

Table 6.1.1
Use of MijnOverheid.nl, by province, April 2008-mid-September 2009

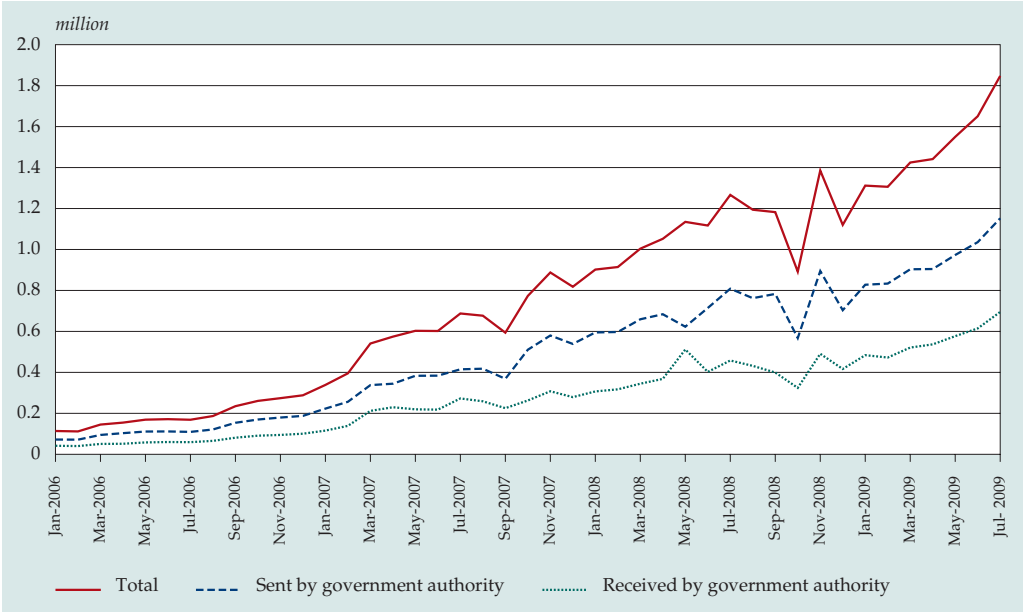
	Number of persons who logged in to MijnOverheid.nl at least once	Population on 31 August 2009*	Percentage of population who logged in to MijnOverheid.nl at least once
Netherlands	20,646	16,539,449	0.12%
Groningen	873	575,063	0.15%
Friesland	634	645,676	0.10%
Drenthe	574	490,701	0.12%
Overijssel	1,335	1,128,997	0.12%
Flevoland	549	386,792	0.14%
Gelderland	2,331	1,996,131	0.12%
Utrecht	1,774	1,215,850	0.15%
North Holland	3,393	2,660,577	0.13%
South Holland	5,151	3,494,168	0.15%
Zeeland	385	381,565	0.10%
North Brabant	2,477	2,440,976	0.10%
Limburg	1,170	1,122,953	0.10%
Percentage of male MijnOverheid.nl users			73%
Percentage of female MijnOverheid.nl users			27%

Source: Statistics Netherlands/Ministry of the Interior and Kingdom Relations.

Portals for businesses

In 2009, the number of sectors and branches of industry for which the special government website for businesses *www.antwoordvoorbedrijven.nl* (answers for companies) provides sector-specific answers to questions increased to 62. From October 2008 to October 2009 the site received nearly 150 thousand visits per month. The building block *Overheidstransactiepoort* (OTP), which translates as 'government transaction portal', can be seen as a digital government post office for businesses. Companies connected to OTP can send small messages to OTP, which then sees to it that the message is forwarded to the right government body. This government body then sends confirmation of receipt, and if necessary a response. This is why government bodies send more messages than they receive through OTP. OTP was designed especially for small messages, but in mid-May 2009 a facility for large messages was introduced. Between January 2006 and July 2009 over 39 percent of messages sent were less than 1 kilobyte, and only 0.5 percent exceeded 10 kilobytes. The number of messages exchanged between government authorities and the private sector through OTP has risen substantially since January 2006.

6.1.3 Number of messages per month to and from government via OTP, January 2006 - July 2009



Source: Statistics Netherlands/Ministry of the Interior and Kingdom Relations.

6.2 *ICT and education*

This section examines the use of ICT in education and the available ICT tools. The data on the Netherlands in this section are based on the report *Four in Balance Monitor 2009: ICT at Dutch schools* compiled and published by *Kennisnet*. The aim of this report is primarily to inform schools about the balanced and sustainable integration of ICT. It focuses on four key elements: vision and leadership, expertise, digital education materials, and ICT infrastructure. These four building blocks should be in balance when ICT is used for education purposes. The monitor mainly addresses ICT use in primary and general secondary education. For a number of subjects data are also available for secondary vocational education. The monitor is very useful because many of its indicators have been measured in almost the same way for a number of years.

Key figures on education

In 2008, subsidised education in the Netherlands accounted for a gross value added of 22.5 billion euro. This is 4.3 percent of total Dutch GDP, the same as in 2007, and 0.2 of a percent point more than in 1998. Personnel is the largest cost category in education. In 2008, 5.0 percent of all employees in the Netherlands worked in education. In spite of the shortage of teachers, this is relatively more than in 1998 when 4.7 percent worked in education.

Total expenditure on education in 2008 was almost 37.6 billion euro, or 6.3 percent of GDP. This is 0.6 of a percent point more than in 1998, which means that education spending kept pace with the rest of the economy. Per capita spending on education in current prices increased from 1,318 euro in 1998 to 2,290 euro in 2008.

Key figures for education, 1998–2008

	1998	2003	2007**	2008*
	million euro			
Subsidised education				
Production value	16,629	23,750	27,919	29,213
Intermediate consumption	3,494	5,002	6,369	6,711
Gross value added	13,135	18,748	21,550	22,502
Remuneration of employees	11,498	16,637	18,953	19,741
Investment	1,119	1,945	2,627	2,676
	full-time equivalents (x 1,000)			
Employed persons	295	334	333	339
	%			
Share in the total economy				
Production value	2.4	2.7	2.6	2.5
Intermediate consumption	1.0	1.1	1.1	1.1
Gross value added	4.1	4.4	4.3	4.3
Remuneration of employees	6.2	6.8	6.8	6.7
Investment	1.4	2.1	2.3	2.2
Employed persons	4.7	5.1	5.0	5.0
Expenditure on education [1)]				
Total (billion euro)	20.6	29.9	35.2	37.6
Per capita (euro)	1,318	1,849	2,149	2,290
As a % of GDP	5.7	6.3	6.2	6.3

Source: Statistics Netherlands, National accounts/Education accounts.

[1)] Expenditure on education is defined as total public and private spending on households and institutions. Education-related private spending on non-educational institutions is not included in the total. Public expenditure on households excludes subsidies for tuition fees, as this part flows back via households to the institutions and is therefore part of private spending on institutions.

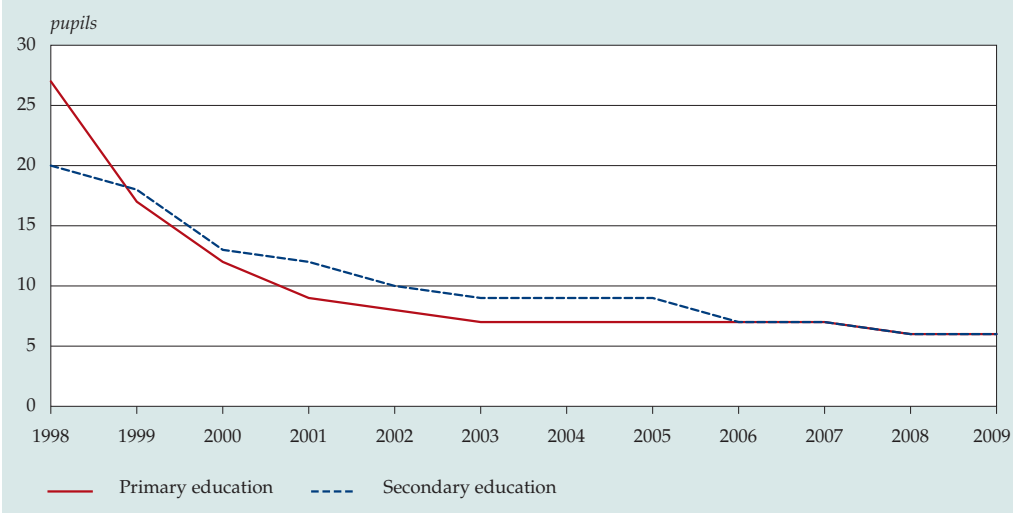
Kennisnet is a public knowledge centre for ICT and education in the Netherlands. Its mission is to support schools and education facilities with independent services with regard to the safe and effective use of ICT. It represents the interests of the Dutch education sector in ICT, offers help in selecting ICT products and services and provides innovative educational services and products. Until the second half of 2005, the Ministry of Education, Culture and Science had its own ICT directorate, and conducted its large-scale project 'ICT in education'. Both have now been discontinued. *Kennisnet* has taken on many of the directorate's tasks. This was made easier as ICT had clearly found a place in education and had scored its first successes.

In addition to data on the Netherlands from the *Kennisnet* report, this section also includes international data from the *Global Competitiveness Report* of the Global Economic Forum. This annual publication provides an international ranking of pupil internet access in schools. This topic is discussed at the end of this chapter.

One computer per six pupils

On average, Dutch primary and secondary schools had one computer per 6 pupils in 2009, the same rate as in 2008. Managers in 80 percent of the schools say they are satisfied or very satisfied with the available provisions. Teachers, on the other hand, do not always agree. More teaching staff than managers express a need for more computers, wireless networks, professional ICT support and more stable internet connections.

6.2.1 Number of pupils per computer, 1998–2009



Source: Kennisnet, Four in Balance Monitor 2009.

In 2009 almost all computers in primary and secondary schools had internet access: 93 percent in primary and 98 percent in secondary schools. In secondary schools in particular, glass fibre internet connections have become standard. In 2007, 41 percent

of secondary schools had a glass fibre connection to the internet. Two years later this had risen to 78 percent, and this is expected to rise further. School managers expect that 94 percent of secondary schools will have fibre internet in two years' time.

Numbers of pupils and students

In school year 2007/'08, some 3,7 million people in the Netherlands were in some form of education; this was 22.2 percent of the population on 1 January 2008. In the space of five years, the number of pupils and students grew faster than the population as a whole; in 2002/'03, 21.7 percent of the population were in education. Higher education accounted for almost all of this increase. In other levels of education, the growth rate was equal to that of the population as a whole.

Primary schools accounted for the largest group of pupils: 1.6 million. Some 941 thousand pupils attended secondary education, which includes preparatory vocational education *(vbo)*, preparatory secondary vocational education *(vmbo)*, junior general secondary education *(mavo)*, senior general secondary education *(havo)*, pre-university education *(vwo)* and practice-based secondary education. About 585 thousand students were in higher professional education *(hbo)* or university in 2007/'08. The smallest group, some 526 thousand, attended senior secondary vocational education *(mbo)* and adult education.

Pupils and students in education, 2002–'03-2007–'08

	2002–'03	2003–'04	2004–'05	2005–'06	2006–'07	2007–'08*
	number (x 1,000)					
Total pupils and students	3,505	3,540	3,565	3,596	3,619	3,650
Primary education	1,602	1,599	1,599	1,598	1,595	1,597
Primary education	1,550	1,548	1,549	1,550	1,549	1,553
Special primary education	52	52	50	48	46	45
Secondary education	913	925	935	940	943	941
Years 1 and 2	405	407	407	400	394	390
Vwo and havo, year 3 and higher[1)]	256	265	275	287	298	307
Vmbo, vbo, mavo, lwoo and ivbo, years 3 and 4[2)]	229	228	226	226	223	217
Special secondary education and practice-based education	23	25	26	27	28	27
Vocational and adult education	489	493	487	499	508	526
Senior secondary vocational education (mbo)	473	479	474	484	496	513
General secondary adult education (vavo)	16	14	13	15	12	13
Higher education[3)]	501	523	544	560	573	585
Higher professional education (hbo)	323	336	347	357	367	374
University	180	190	200	206	209	213

Source: Statistics Netherlands, Education statistics.

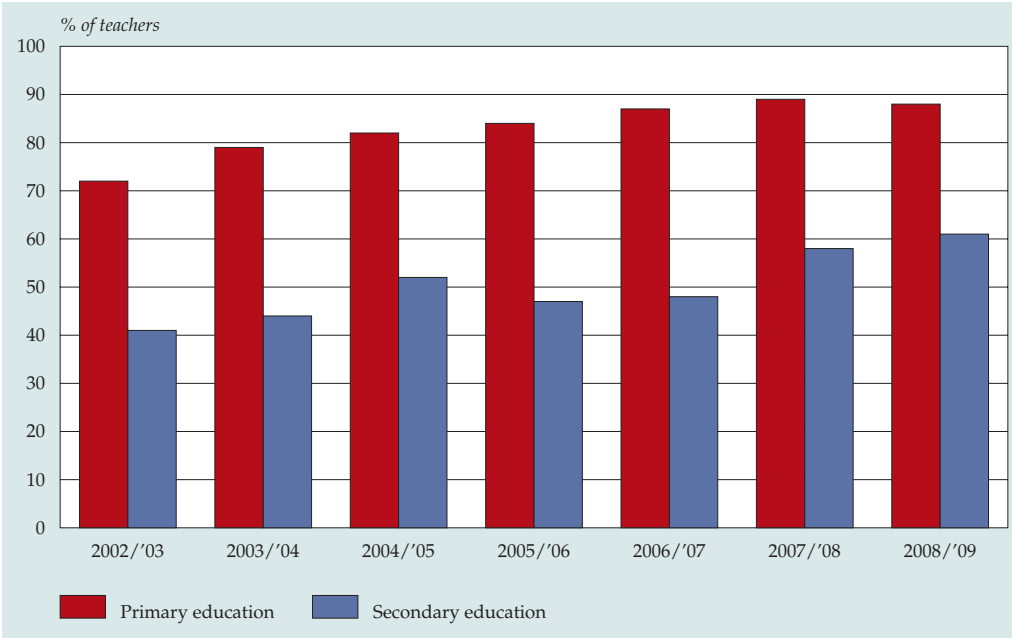
1) Incl. combined year 3 classes.
2) Lwoo and ivbo are forms of education for children with learning and behavioural difficulties.
3) Students who attend both higher professional education and university only count once.

Not all teachers use ICT in the classroom

According to school managers, almost nine out of ten primary school teachers used a computer in the classroom in school year 2008/'09. In general secondary and secondary vocational education this share was much lower: six out of ten.

The number of teachers who use a computer as a teaching aid is growing steadily, and school managers foresee that it will continue to do so. They expect that in three years' time, almost nine out of every ten teachers will be using computers in their lessons (figure 3.2). It will not be long, therefore, before every teacher will be making use of ICT. Indeed this is already almost the case in primary schools.

6.2.2 Percentage of teachers using ICT in primary and secondary education, 2002/'03–2008/'09



Source: Kennisnet, Four in Balance Monitor 2009.

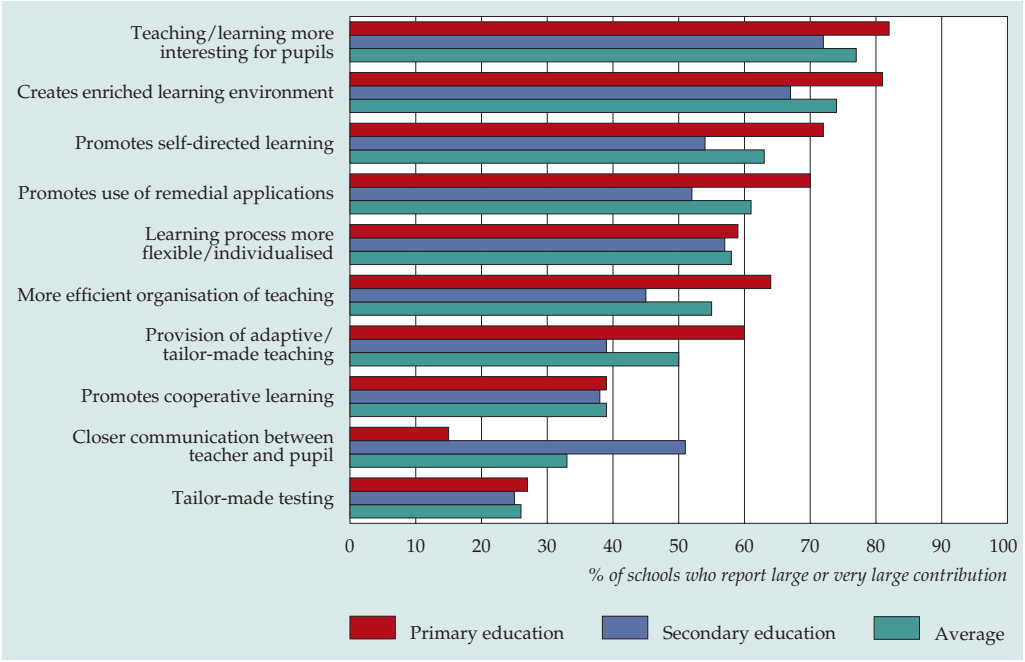
ICT makes education more attractive

Management – including ICT management – of primary and secondary schools say that ICT is an important factor in making education more attractive (82 and 72 percent respectively in 2008/'09). But it also contributes to other goals in education. Most school managers say that ICT can contribute to enriching the learning environment, promote independent learning, and help disadvantaged pupils to catch up (remedial applications). Figure 6.2.3 gives an overview of schools' opinions in this respect.

Overall, primary school managers are slightly more positive about the educational contribution of ICT than managers in secondary schools. For communication

between teachers and pupils, however, this is the other way around. The top ten educational goals to which ICT can contribute has been stable for years now.

6.2.3 Contribution of ICT to goals in primary and secondary education, 2008/'09



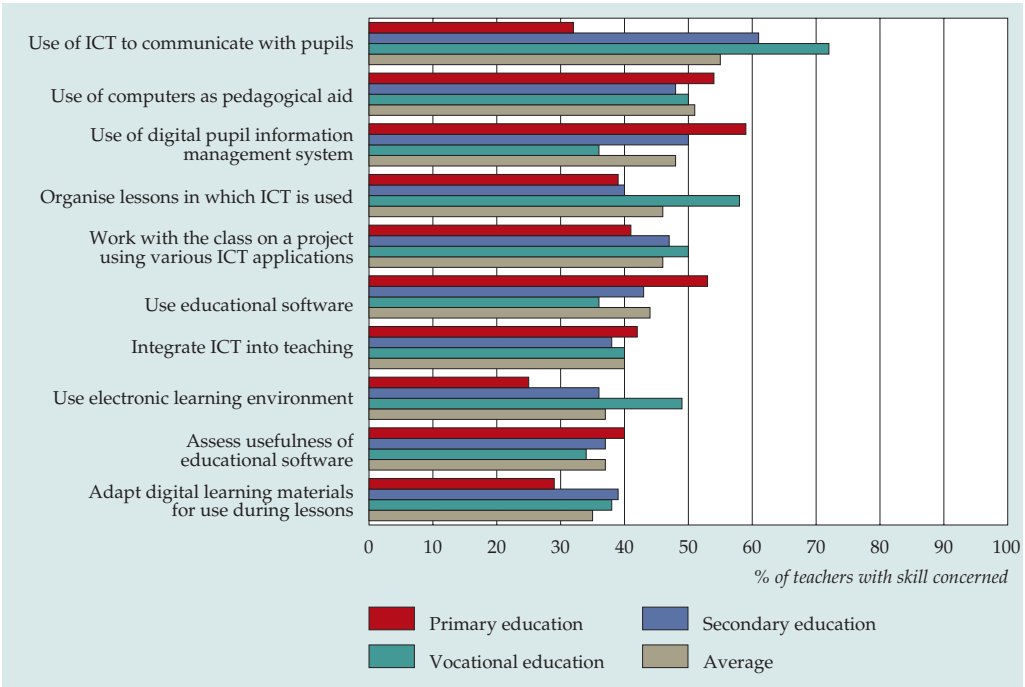
Source: Kennisnet, Four in Balance Monitor 2009.

Pedagogical ICT skills of teachers

Knowledge of the possibilities opened up by ICT is one thing, but to use ICT effectively in the classroom teachers must be able to use these possibilities in a pedagogical context. Pedagogical ICT skills are defined as the specific skills required to use ICT as an aid in learning situations; more specifically the skill to use the right combination of ICT, content and teaching methods. Section 7.4 (chapter 7) of this book gives more information about the ICT skills of the Dutch population in general. One of the capita selecta (section 8.2) also looks at this in more depth.

About half of teachers in the Netherlands say their personal skill level with respect to using computers as a teaching aid are advanced or very advanced. Surprisingly, school managers are consistently more optimistic about their teachers' skills than the teachers themselves. Also, teachers become significantly less self-confident when asked about specific ICT skills (see figure 6.2.4). There are no specific skills for which a majority of teachers consider their level to be advanced. Teachers are particularly uncertain about their ability to assess how useful educational software is, to adapt digital learning materials to suit their own needs, and to use an electronic learning environment.

6.2.4 Pedagogical ICT skills of teachers, 2008/'09



Source: Kennisnet, Four in Balance Monitor 2009.

Computer games in school

It is difficult today to imagine a world without computer games. Many parents have mixed feelings about the amount of time their children spend on computer games, fearing that their schoolwork might suffer. Surprisingly, then, a study has revealed that playing computer games may have a positive effect on school performance. Researchers from the University of Utrecht have studied the influence on some aspects of school performance of playing the computer game Oblivion in the classroom, and of playing computer games at home. Two groups of pupils were compared: a test group, who had to play Oblivion for several hours at school, and a control group who were asked to organise a – physical – treasure hunt in the same period of time. A number of aspects of school performance were measured before (pre-test) and after (post-test) the experiment. The study showed that after the experiment, the gaming pupils showed higher scores for English, collaborating, and assessing their own actions than the pupils who had prepared the treasure hunt. The gamers also scored higher on the post-test than on the pre-test on school performance. Furthermore, the pupils who were used to playing games at home learned more from playing a game at

school than pupils who did not play computer games at home. Their performance on the measured aspects increased by more than the performance of pupils who never played games at home. This was also the case in the control group: pupils used to playing computer games at home who organised the treasure hunt increased their score in the post-test compared with the pre-test by more than the pupils who did not play games at home.

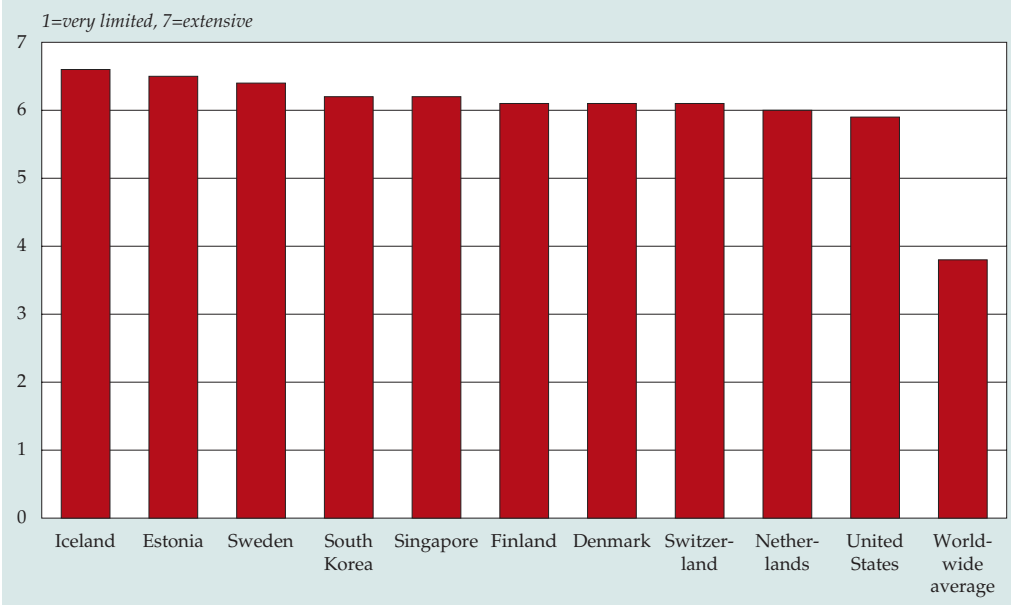
The researchers assume that playing games at home gives pupils a kind of mind-set that ensures that they benefit from the activities they perform, whether this is playing a computer game or organising a treasure hunt. Overall, gaming seems to be beneficial, but only for activities aimed at training problem-solving skills.

Source: Verheul and Van Dijk, 2009.

Dutch schools in international internet access top ten

Schools for secondary and higher education in the Netherlands have high levels of internet access compared with other developed countries. The World Economic Forum has compiled a list ranking among other things 'readiness', of which internet access is a component.

6.2.5 Internet access in schools, secondary and higher education, international, 2008–2009 [1)]



Source: World Economic Forum.

[1)] Weighted average 2008–2009.

Iceland has the highest proportion of pupils and students with regular access to the internet at school, followed by Estonia and Sweden. The Netherlands ranked ninth in 2009, just above the United States, and up from twelfth place in 2008. Compared with other countries taken into consideration in this book, school internet access is high in the Netherlands

6.3 ICT and care

The health care and welfare sector is changing rapidly. The ageing population is pushing up the demand for care, care providers have to work together more, and the privatisation has resulted in market forces coming into play. Patients have developed into well-informed consumers, and are less afraid of expressing their opinions and asking questions. Internet is contributing to these developments by providing easy access to all sorts of medical information.
A lot of information is recorded, processed and exchanged within and between care institutions. And not only operational management information, but also information about patients. ICT is playing an increasingly prominent role in this respect. In addition to the public interest of national public health, the care sector is also of great economic significance for the Dutch labour market and the economy. Care expenditure accounted for 13.3 percent of GDP amounted in 2008. This section looks at recent ICT-related developments in the care sector.

Key figures on care

Nearly 1.3 million people worked in Dutch health care and welfare in 2008. They represented a total labour volume of 866 thousand fte's. The difference between these two figures is accounted for by the large number of part-time jobs. The share of health care and welfare in gross value added of the economy as a whole was 8.8 percent in 2008, almost the same as in 2007 (8.7 percent). This share has grown by 1.5 percent points in the last ten years, confirming that health care and welfare is an increasingly important sector of the economy.

Health care and welfare is a very labour-intensive sector, with labour costs accounting for over 76 percent of value added in this sector. Total spending on care was 6.2 percent higher in 2008 than in 2007. Although spending almost doubled in the space of ten years, as a percentage of GDP it rose from 11.3 percent in 1998 to 13.3 percent in 2008. Per capita spending on care rose by 85 percent in this period, from 2,599 euro in 1998 to 4,809 euro in 2008.

Key figures for health and welfare, 1998–2008

	1998	2003	2007**	2008*
	million euro			
Health and welfare				
Production value	32,800	50,668	59,710	63,503
Intermediate consumption	9,076	13,338	15,744	16,884
Gross value added	23,724	37,330	43,966	46,619
Remuneration of employees	18,239	27,911	33,098	35,487
Investment	2,201	3,761	4,615	4,845
	full-time equivalents (x 1,000)			
Employed persons	647	794	850	866
	%			
Intermediate consumption				
Production value	4.8	5.7	5.5	5.5
Intermediate consumption	2.5	2.9	2.7	2.7
Gross value added	7.3	8.8	8.7	8.8
Remuneration of employees	9.9	11.4	11.8	12.0
Investment	2.7	4.1	4.1	4.0
Employed persons	10.3	12.1	12.6	12.7
Expenditure on care 1)				
Total (billion euro)	40.8	63.4	74.4	79.1
Per capita (euro)	2,599	3,910	4,545	4,809
As a % of GDP	11.3	13.3	13.1	13.3

Source: Statistics Netherlands, National accounts/Care accounts.

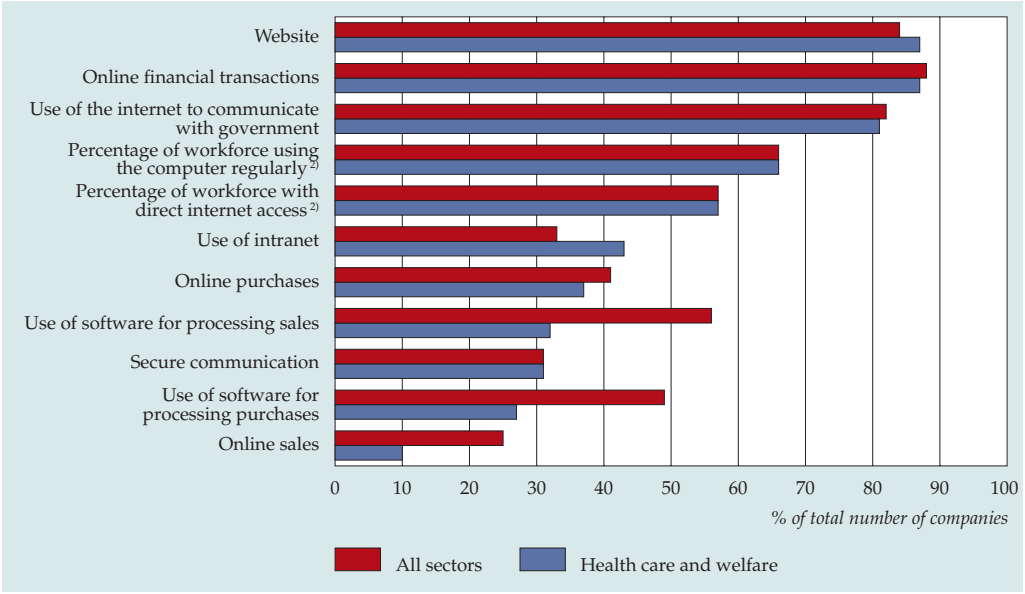
1) Spending on care is defined as the total income these companies and institutions generate with their activities. The expenditure on care is higher than the production value of the sector health care and welfare as some companies and institutions outside the sector provide care (e.g. pharmacists).

ICT common in care

Statistics Netherlands' survey on ICT use by companies includes questions on several aspects of automation and the application of ICT. The survey will be held among a sample of companies with ten or more employees, including companies in the health care and welfare sector[1]. Although the survey does not address some specific ICT applications that are used in care, the results do give an idea of ICT use in care, and allow a comparison with other sectors.

Figure 6.3.1 shows that most care institutions have computers which can be used for external data communication, so in this respect care is comparable with the rest of the economy. The care sector makes far less use of software for processing purchasing or sales orders than the private sector as a whole. Only 10 percent of companies in health care and welfare in 2008 bought products or services through electronic networks, compared with 25 percent for the whole economy. Purchasing through electronic networks is about as common in care as in other sectors.

6.3.1 Use of ICT in health care and welfare and in other sectors, 2008 [1]



Source: Statistics Netherlands, ICT use by enterprises 2008.

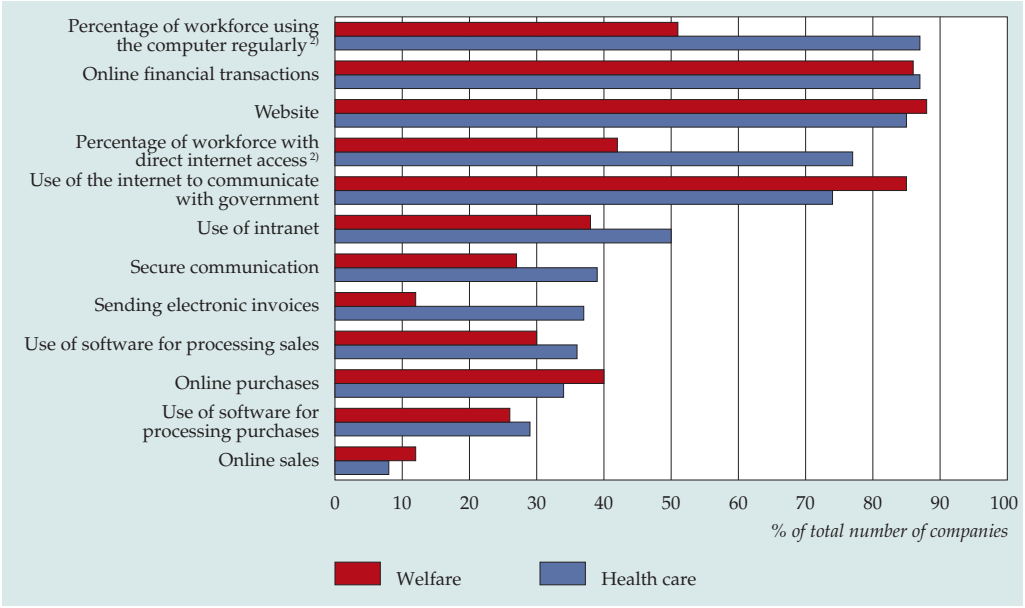
[1] Companies with 10 or more employed persons.
[2] Percentage of workers, not percentage of companies.

In 2008, 66 percent of care workers regularly used a computer at work. They can therefore be reached via ICT, or in other words: they are – or can be – connected to an ICT network. This gives an indication of the volume of ICT work. The share of workers using a computer is similar in other sectors of the economy. More care institutions have an intranet than companies in other sectors: 43 versus 33 percent. For further analysis of the use of ICT applications in care, the figures are broken down by health care and welfare (figure 6.3.2) and by three size classes (table 6.3.1).

More computer users in health care than in welfare

In relative terms, many more health care employees (87 percent) regularly used a computer at work in 2008 than welfare workers (51 percent). Also the percentage of employees who had direct access to the internet was considerably higher in health care (77 percent) than in welfare (43 percent) in 2008 (see figure 6.3.2). Although use of software for order processing did rise in both health care and welfare, both still lag behind other sectors of industry. Online financial transactions were similar for health care and welfare. Online communication with government organisations was more common in welfare than in health care, while online invoicing was three times as common in health care. Welfare institutions purchased and sold products via e-networks slightly more than heath care institutions.

6.3.2 Use of ICT in health care and welfare, 2008 [1)]



Source: Statistics Netherlands, ICT use by companies 2008.

[1)] Companies with 10 or more employed persons.
[2)] Percentage of workers, not percentage of companies.

Table 6.3.1 shows how company size influences the use of ICT in health care and welfare. Small institutions (fewer than 50 employees) are less advanced in ICT use than larger ones (50 or more employees), but this pattern does vary somewhat. Larger institutions make more use of intranets, software to process purchases, and networks to purchase products. Company size has a much weaker correlation with the use of computers and internet access,

Health care and welfare are still lagging well behind with respect to automated order processing, and electronic purchasing and sales. The external orientation required to increase these applications will also be useful for specific care-related ICT developments, such as e-health and electronic patient dossiers.

Table 6.3.1
ICT in health care and welfare by company size, 2008

	Company size (number of employed persons)		
	10–49	50–249	250 and more
	% of companies		
Website	82	94	99
Online financial transactions	85	90	90
Use of the internet to communicate with government	74	90	93
Percentage of workforce using the computer regularly [1)]	67	67	66
Percentage of workforce with direct internet access [1)]	54	57	57
Use of software for processing sales	33	28	34
Use of software for processing purchases	21	26	52
Online purchases	30	42	60
Online sales	10	10	14
Use of intranet	25	65	84
Use of extranet (with access for third parties)	13	18	32
Secure communication	29	25	49
Open source operating system	18	33	41
Use of CRM software	15	22	23
Use of ERP software	9	10	16
Sending electronic invoices	23	17	27
Receiving electronic invoices	22	16	28

Source: Statistics Netherlands, ICT use by companies 2009.

[1)] Percentage of workers.

E-health

The application of ICT in health care and welfare has expanded rapidly in the last fifteen years. Governments worldwide recognise the possibilities ICT provides to raise effectiveness and efficiency in care. Many countries have adopted special policies to develop information systems for health care. One common element is the aim to improve safety, quality and efficiency of care. This is done by making medical dossiers more accessible and by supporting clinical practice, but also by making patients more aware of their own responsibility. The emphasis is on setting standards for data exchange and security.

E-health is the product of the development of international ICT networks, the improvement of security and efficiency in health care. E-health refers to health services – and related information – that can be provided using the internet and ICT. E-health also aims to provide patients with self-care options, by giving them adequate medical information. E-health is and up-and-coming area, and is characterised by the interaction between medical informatics, health care and business practices.

The focus of medical ICT itself is also shifting. Initially, medical ICT was mainly concerned with hardware, system architecture and databases; now more attention is paid to the innovative use of technology for efficient communication and deci-

sion-making. This shift is evidence of the increasing recognition of the importance of human and organisational aspects.

New ICT applications have made it possible to advise and monitor patients from a distance. This means fewer consultations and hospital stays. These developments have prompted institutions to assess and improve their processes. The patient plays a key role in most applications, as he or she has to respond to certain signals or answer certain questions. But applications are conceivable in which the conscious role of the patient is reduced to a minimum.[2)] In some uses the GP plays a key role.[3)]

Introduction of the electronic patient dossier

The electronic patient dossier (EPD) and its related systems are central to e-health. The EPD can improve safety in care. Mistakes in medication can be prevented by constructing an electronic dossier based on specific software. The EPD was introduced nationally in 2008. The system stores patient data digitally on a national network.

The advantages of the national EPD are:

- a patient's medical data are always available;
- the data have to be entered only once;
- hospitals, GPs and other health care providers have access to up-to-date patient information wherever they are.

A lot of medical information was already stored digitally before the introduction of the EPD. However, this information was often only available within a single hospital or GP practice. With the national EPD, the information is available to all care providers. The computer systems of care providers are linked nationwide. Dutch GPs are expected to be the first to have access to the national EDP, at the beginning of 2010.

E-health in a European perspective

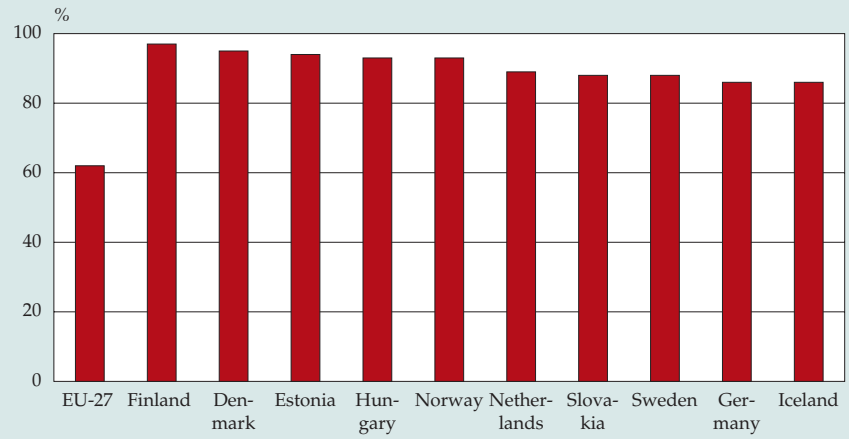
In a report commissioned by the European Commission, international research and consulting firm Empirica presents an international comparison of the use of ICT in the health care sector (e-health). The report describes the results of a pilot study among general practitioners. For 2007, the main results of the study are:
- A foundation has been laid for the ICT infrastructure in health care;
- The use of ICT by GPs differs greatly across Europe;
- There is still a wide gap between actual and potential use of ICT.

European GPs report the following views on the use of ICT:
- They are positive about the role of ICT in health care;
- They clearly see the possibilities of ICT;
- Once they start using ICT, they experience fewer obstacles. Non-users are more negative about ICT applications;
- The impact of ICT applications is generally seen as positive.

Patient administrations are stored electronically in 80 percent of GP practices in the EU-27 countries. In twelve countries, over 90 percent of GP practices use EPDs, and 55 percent of European GPs used the internet or other electronic networks to communicate with other actors in the health services such as laboratories, other GPs and care authorities in 2007.

Just over 62 percent of European GPs use a Decision Support System (DSS) as an aid to diagnosis. The Netherlands (89 percent) is in sixth place in Europe in this respect. Finland and Denmark lead the way: 97 and 95 percent respectively of GPs there use DSS. All the Scandinavian countries are in the top ten DSS users. Latvia is bottom of the list: only 2 percent of Latvian GPs use DSS.

Use of a Decision Support System, international, 2007



Source: Empirica, 2008.

Notes in the text

1) For more detailed information on this survey see the text box in section 4.1.
2) The VU medical centre has placed the first pacemaker for heart failure with SMS technology. This pacemaker sends text messages to the cardiologist, who then checks the status on the internet and takes action when needed. As a result less frequent check-ups are necessary.
3) Thousands of GPs already make use of tele-dermatological consultations, for example, by sending digital photos of skin to a dermatologist (*Public Health Newsletter 225*, 10 September 2006 on www.integratedcare.nl).

7. ICT knowledge

This chapter addresses the relationship between ICT and knowledge. The relationship between knowledge and the economy in general is described in detail in Statistics Netherlands' 'Kennis en economie' series. ICT is a domain of knowledge in itself, but it also has a role in the dissemination of knowledge. We refer to the information society in this respect, although this term is somewhat outdated and no longer fully adequate. At the end of the previous century, surfing the internet to look for information was a relevant policy indicator. In 2009 almost everyone surfs the internet (see also chapter 5) and it is evident that ICT can be used for knowledge purposes. This makes it more difficult to separate the concepts information society, digital economy and knowledge economy. Information, communication and knowledge – including skills – have converged as a result of ICT.
This chapter consists of four sections. The first examines R&D expenditure by the ICT sector. What does research and development at Dutch ICT companies entail? The answer to this question provides insight into the development of new ICT knowledge. Sometimes this leads to patents, the subject of the second section. ICT education is the third issue discussed in this chapter, while the fourth section describes the ICT skills of the population. These skills can be seen as one of the many expressions of ICT knowledge.

7.1 R&D expenditure by the ICT sector

Research and development (R&D) is an important driving force behind innovation and a basis for the increase of productivity and prosperity. R&D expenditure is a direct form of investment in knowledge development.
Traditionally R&D is concerned with fundamental and applied research on new knowledge and technology, possibly resulting in concrete development routes for new products or processes. Extending scientific knowledge is at the core of fundamental research, and it is this type of research that institutions such as universities and research institutes particularly aim at. Applied research is more concerned about developing ideas into new or strongly improved processes and products. This type of research is relatively frequently performed by enterprises. It may result in innovative production or logistical methods (process innovations) or to new product innovations (CBS, 2009b).

In-house research on among other things electronic components, software and IT services is important for the expansion of knowledge within the company or the research institute. If this effectively leads to the introduction of products on the market, this reinforces the competitive and innovative power of a company, sector or country. Alternatively, an organisation may not perform R&D itself, but outsource these research activities. If an organisation has an accessible knowledge infrastructure, this may reduce costs (for example investment in research facilities).

However, outsourcing R&D may result in a deterioration of own R&D knowledge and infrastructure.

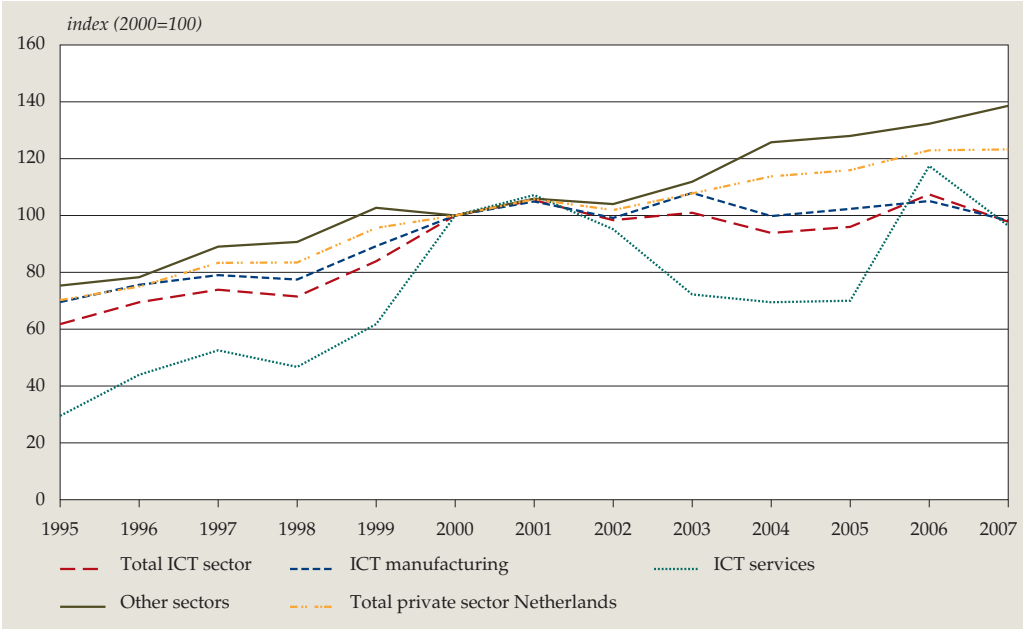
Innovation is more likely to be successful within a well functioning network of companies, universities and public research institutes investing in R&D. Such a network, with a positive reputation, will also attract new and foreign companies.

Rise in ICT spending on R&D stagnating since 2000

R&D expenditure in the Dutch ICT sector rose in the second half of the 1990s (figure 7.1.1). Following the financial internet hype, the increase in R&D spending by the ICT sector faltered from 2001 to 2005 (see also chapter 2). Growth in this sector clearly lagged behind that in other sectors. Surprisingly R&D expenditure in the ICT sector decreased in 2007, while it continued to rise in other sectors.

In the telecom sector within ICT services, in particular, it was noticeable that companies invested less in R&D in the first years after the internet hype. Increases in spending on research by computer service bureaus in particular seems to have pulled ICT services out of the mire from 2006 onwards.

7.1.1 R&D expenditure (own staff) by companies in the ICT sector and in other sectors, 1995–2007 [1)]



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

[1)] Companies with 10 or more employed persons (from 2002 onwards).

Larger share of ICT services in R&D expenditure

The share of ICT activities in private sector R&D expenditure fell from 33 in 1995 to 30 percent in 2007. In spite of this, companies and institutes in the ICT sector are very active in research and development compared with other industries in the Netherlands. Their contribution peaked in 2000, when 38 percent of R&D expenditure originated from the ICT sector.

Because of the usually technological nature of R&D, the ICT manufacturing sector invests systematically more in it than the ICT services sector. In 1995 ICT manufacturing accounted for 90 percent of R&D expenditure in the ICT sector. By 2007 this share had dropped to 81 percent. ICT services not only spend less on R&D, this sector seems to be more easily affected by economic developments than ICT manufacturing. So the increase of R&D expenditure in services is relatively unpredictable. Nevertheless, the share of ICT services in R&D expenditure has grown, from 3 percent in 1995 to almost 6 percent of total private sector R&D expenditure in 2007. Manufacturing companies still perform most R&D activities within the ICT sector, although their share decreased from 30 to 24 percent of total R&D expenditure in the same twelve-year period.

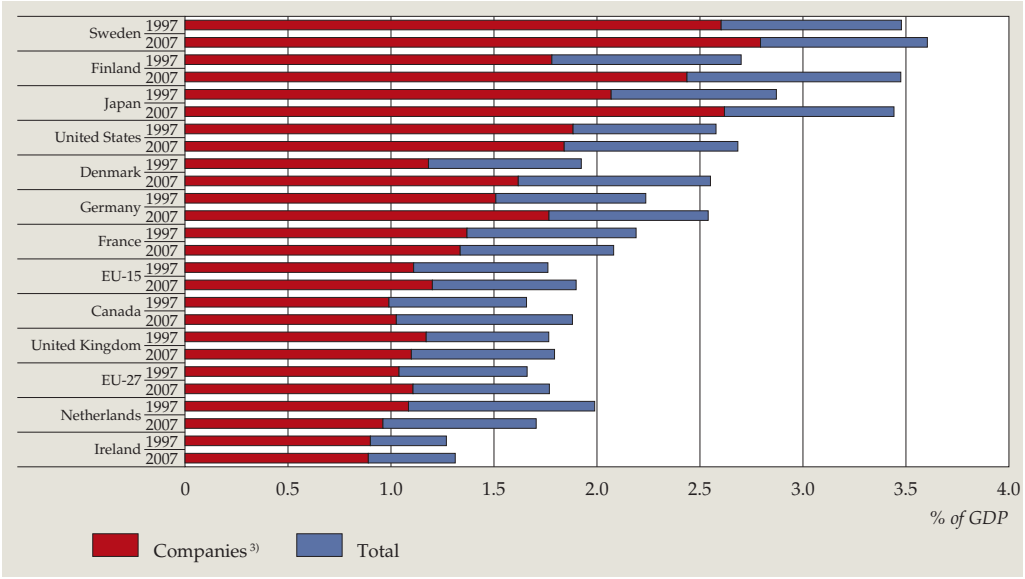
Dutch R&D expenditure low in international terms

In an international perspective, Dutch R&D intensity is relatively low. Like France, the Netherlands is one of few countries where R&D intensity decreased in the period 1997–2007 (figure 7.1.2). R&D expenditure in the Netherlands was also below the EU-15 average and even below the average level of EU-27 countries in 2007.

In 1997, R&D accounted for almost 2 percent of Dutch GDP. This percentage fell slowly in subsequent years, to reach 1.7 percent of GDP in 2007. In line with this overall trend, the Dutch private sector invested less in R&D (in terms of a percentage of GDP) compared with ten years earlier. Although the trend is similar in France, the share paid for the private sector in that country is still clearly above the Netherlands. In most countries, on the other hand, the private sector was precisely the driving force behind the increase of R&D intensity in the period 1997–2007.

Among the European reference countries, Sweden and Finland – both with substantial increases in R&D expenditure in recent years – lead the way in terms of R&D expenditure. Both countries invested more than twice as much in R&D – in terms of a percentage of GDP – than the Netherlands in 2007; they were also well ahead of larger economies like Japan, the United States and Germany.

7.1.2 R&D expenditure: total and private sector, international, 1997 and 2007 [1) 2)]



Source: OECD, Main Science and Technology Indicators.

1) Total R&D consists of gross national R&D expenditure. R&D of companies consists of gross R&D expenditure by the private sector.
2) Breaks in series for France (2001 and 2004), United Kingdom (2001) and Sweden (2005).
3) For United Kingdom, the Netherlands, France, Denmark, United States, Japan, Sweden, EU-15 and EU-27: 2006 instead of 2007.

In 2007, total R&D expenditure amounted to almost 10 billion euro in the Netherlands, of which the private sector accounted for 60 percent. Traditionally, the chemical and electrical engineering industries are the most R&D intensive in the Netherlands (CBS, 2009b). Universities generated approximately one quarter of R&D expenditure in 2007. Research institutes (such as TNO) and PNPs (private non-profit institutes carrying out R&D activities, mostly non-profit organisations) accounted for the remainder (CBS, 2009b).

R&D not crucial for innovative power

This trailing Dutch R&D expenditure may result in a declining knowledge base and, in turn, in weaker competitiveness. Moreover, a weaker international position may discourage top scientists from coming to work in the Netherlands, or cause them to leave, which may have a negative impact on attracting new business. However, low R&D expenditure should be put in perspective. The sector structure of an economy also influences R&D intensity. The significance of the manufacturing industry is decreasing within the Dutch economy. Less R&D intensive sectors (among others financial and commercial services, care and trade, hotels and restaurants, repairs) increasingly contribute to GDP in the Dutch services economy. A logical consequence of this development is a decreasing R&D intensity.

A solid research base and effective knowledge transfer are essential conditions to maintain and to attract more R&D. This is important in a globalising economy, where R&D activities seem to be transferring to countries in Asia and South America which have well-functioning innovation systems and close links between the private sector and knowledge institutions (European Commission, 2008).

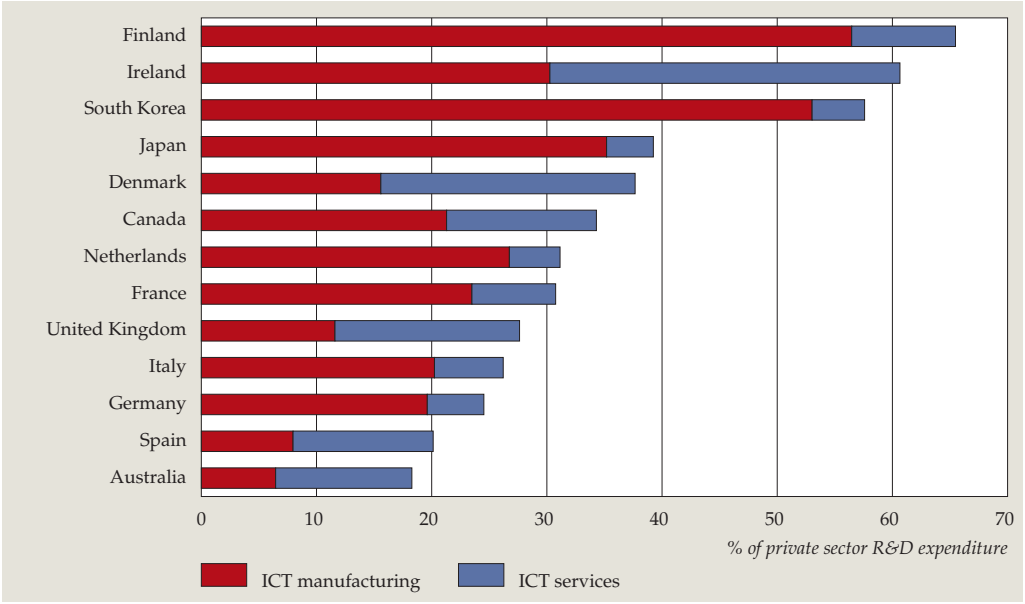
The advantage of comparing countries based on R&D data is their international harmonisation: R&D is measured according to the same definition in each country. R&D intensity is an important factor, but not the only one to explain the differences in innovation between countries. This requires a deeper insight into the specific characteristics of innovation systems in several countries. These systems vary strongly, which explains the consistently large differences between research and innovation performances within Europe. Although an international comparison based on R&D expenditure is an indication of the volume of R&D activities in a country, it is not a good indication of the quality of the research infrastructure. Each country has a different research infrastructure, and the size and composition of the ICT sector may strongly determine for the volume and direction of ICT research (Dialogic and Technopolis, 2008). Effective interaction between companies and institutions, and between consumers and suppliers is an important condition to convert R&D activities into new products or services for the market.

Most R&D expenditure in ICT manufacturing

The ICT sector is an important R&D player in the Dutch private sector. In 2006, 31 percent of total private sector R&D expenditure was generated by this sector (figure 7.1.3). In an international perspective, the Netherlands is in a middle position. Within the ICT sector, ICT manufacturing clearly spent most on research and development in 2006. Electrical and control engineering, computer technology, and communication are the most R&D intensive branches within ICT manufacturing (Dialogic and Technopolis, 2008). Compared with the reference countries in figure 7.1.3, Dutch ICT manufacturing was just under the leaders in terms of the share of R&D expenditure in business.

In several countries ICT services account for a larger part of R&D expenditure than ICT manufacturing. This is particularly the case in Denmark and Australia, and to a lesser extent in the United Kingdom and Spain. Alongside Germany, Japan and South Korea, the Netherlands lagged behind in 2006 with regard to R&D expenditure in the services sector.

7.1.3 R&D expenditure by companies in the ICT sector, international, 2006 [1)]



Source: OECD, R&D-survey.

[1)] Germany, Italy, the Netherlands and Ireland: 2005. France: 2004.

R&D expenditure: mainly telecom in EU, manufacturing and internet in the US

Of all the countries in the OECD, ICT sector investment in R&D was relatively largest in the United States in 2007 (40 percent). Within the EU-15 it amounted to approximately a quarter, and in Japan it was slightly lower (22 percent) (OECD, 2008). Although the EU and the United States have similar GDP levels, total R&D expenditure in the ICT sector is twice as high in the United States. Both the public and the private sector invest more in research and development in the United States, although it should be mentioned in this respect that private sector ICT is smaller in the EU.

More and more R&D is directed to improving user freedom: the end user is more often the focus of R&D activities. Many ICT service providers compete on this aspect.

In Europe, telecom, semiconductors and software are the most R&D intensive ICT branches. Together, they accounted for more than 90 percent of R&D expenditure in the ICT sector in 2007. European R&D investment in computer services, internet and hardware was considerably lower.

This picture reflects the strengths and weaknesses of European ICT activities. In global terms, the European hardware industry is small. Moreover, European companies do not play a prominent role in the internet sector: companies like Google, Yahoo and Microsoft are dominant here, with respect to both R&D and market

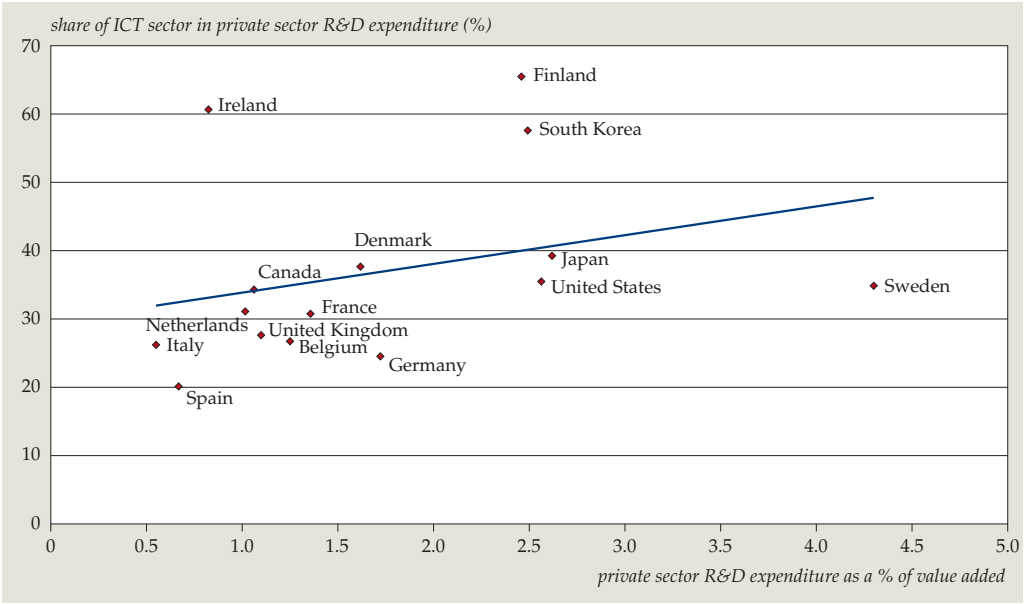
share. Traditionally, Europe has a well developed telecom sector and market leaders in software. Total R&D expenditure in software increased by 14 percent in the EU-27 in 2007. This increase is slightly larger than outside the EU, where it was 12.6 percent on average. In 2007 the R&D intensity for software in the EU-27 was approximately the same as outside the Union (European Commission, 2009).

Dutch ICT spending on R&D below international average

In figure 7.1.4, the share of the ICT sector in private sector R&D expenditure is compared with the R&D intensity of the private sector as a whole. Although the Netherlands is very close to the international trend line, compared with the reference countries the score on both axes is quite low.

Four countries stand out in this figure, because of their large distance from the trend line: Finland, Ireland, South Korea and Sweden. In Finland and South Korea the major share of the ICT sector in total R&D expenditure is accompanied by above average private sector R&D intensity. The figure confirms that in countries with an R&D-intensive ICT sector, the same is true for the whole private sector. However, this relationship does not apply for all countries.

7.1.4 Private sector R&D intensity versus R&D expenditure by the ICT sector, international, 2006 [1)]



Source: OECD, MSTI database, R&D-survey.

[1)] Belgium, Germany, Ireland, Italy, the Netherlands and Sweden: 2005. France and United States: 2004.

Although the ICT sector in Ireland contributes heavily to total private sector R&D, the share of R&D in the private sector is relatively small. In this case the R&D

intensity of the ICT sector itself is not that high, as a relatively large amount of assembly work is performed in daughters of mainly US parent companies. On the other hand, in Sweden R&D is a vital source of value added in the private sector. Nevertheless, the contribution of the Swedish ICT sector to total private sector R&D was slightly lagging in international terms.
As the share of the ICT sector was over twenty percent of total private sector R&D expenditure in all selected countries, the ICT sector is apparently important for national R&D intensity.

The figure requires some explanation. First, multinational corporations often concentrate their R&D activities in one place and their production somewhere else. Moreover they are increasingly outsourcing R&D to foreign 'research companies'. This affects the statistical description of the ICT sector.
Since the beginning of the 1990s, globalisation has become an important aspect of R&D. Companies often base the location for their R&D activities on production advantages, the proximity to large potential markets and possibilities for cooperation with local companies or institutions (OECD, 2008b). Rapidly developing markets become increasingly attractive for business activities, and companies will tend to set up production and development facilities there. Examples are Japan and South Korea for micro-electronics and the United States for software (CBS, 2009b). Many European and Asian software companies have settled in the United States and perform, among other things, R&D activities. Nevertheless, the R&D intensity of the United States may be lower than expected based on the scope of R&D activities actually performed. One explanation for this is that, for accounting purposes, R&D expenditure is generally attributed to the head office (outside the United States).
A second explanatory comment is that R&D by the ICT sector describes only part of the expansion of ICT knowledge. This knowledge is also developed by other actors in the economy, like universities and research institutes where ICT research is done. Moreover an unknown share of R&D activities are performed by companies in the Netherlands whose core business is not ICT. These companies may be active in this field, but are not classified as such. This means that in the Netherlands, more money than described above is spent on ICT-related R&D. However, from a statistical point of view, this part is particularly difficult to quantify. Therefore, output indicators are supplementary. Not all R&D results in satisfactory output; one indicator of satisfactory output is the number of applications for ICT patents.

7.2 *ICT and patents*

R&D expenditure is a direct form of investment in knowledge development. Companies are eager to recover this investment, for example by selling the knowledge

in the form of a licence or by incorporating it in a new product. To this end, the knowledge should be protected in some way so that it can be used exclusively by the company that developed it. One way to protect knowledge is to apply for a patent.

A patent is a legal title protecting an invention. It grants its owner a set of exclusive rights concerning an invention as defined by the claims. The legal protection conferred by a patent gives its owner the right to exclude others from making, using, selling, offering for sale or importing the patented inventions for the term of the patent, which is usually twenty years from the application date, and in the country or countries concerned by protection (OECD, 2009a). To be patentable, an invention has to fulfil certain requirements which are reviewed by the relevant patent authority. First, the invention must be novel, i.e. before the filing date of the patent, the invention may not have been described in any publication or available to the public in any other form. Secondly, the invention must contain an inventive step, and thirdly, it must to be industrially applicable.

Patents provide an insight into a country's inventive capacity and into its ability to convert this capacity into potential economic benefit. In this context, patent-based indicators are widely used to assess the inventive performance of countries. As patent documents contain vast amounts of information, it is possible to break down the inventive performance of a country into among other things technology areas, including ICT, or to place it in a historical perspective.

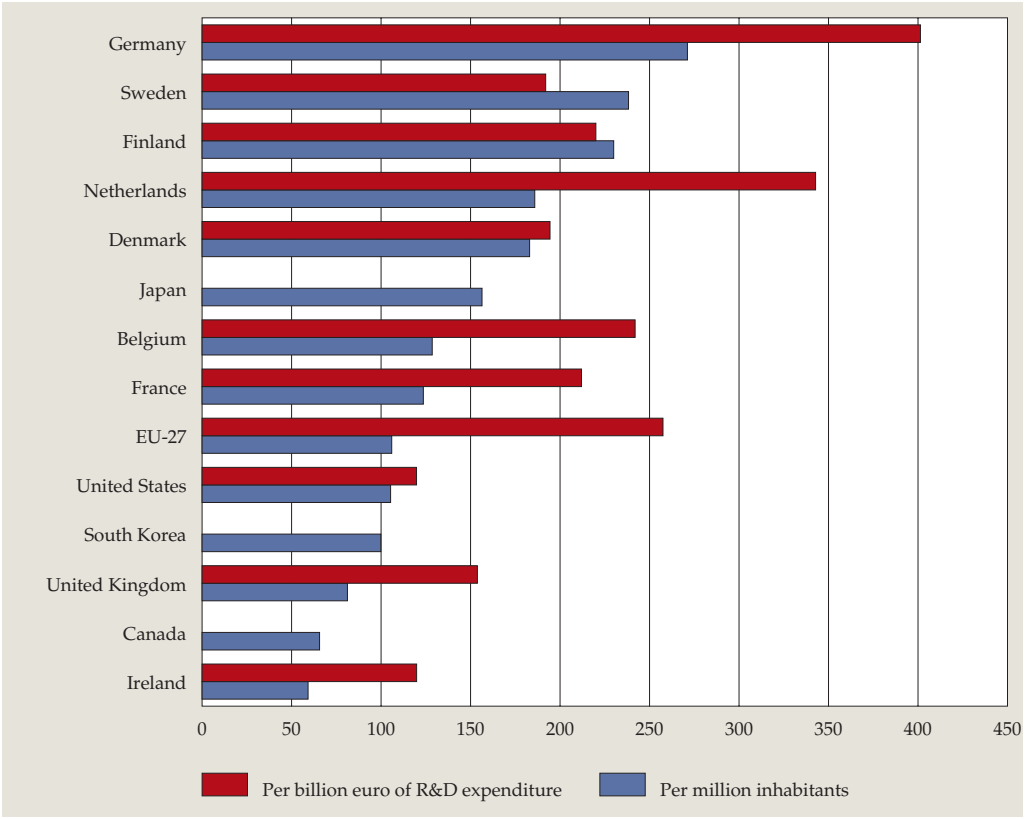
The indicators presented in this section include patent applications to the European Patent Office (EPO). If a patent application is granted by the EPO, the patent is valid in all its member countries (36 in 2009), on the condition that the applicant validates his rights in a country. Only after ratification of the patent at the national patent office does the patent become effective. To validate an EPO patent, for example in the Netherlands, the claims of the patent must be translated – into Dutch in this case – (all other information may remain in English) and the patent-related fees must be paid. For the indicators presented in this section, the patent applications are further classified by year according to the priority date. This is the first date of filing of a patent application, anywhere in the world. Accordingly this is the date closest to the date the invention was actually made. The definition of ICT patents is based on the technology codes [1)] assigned by patent examiners.

Relatively many patent applications by Dutch ICT sector

In 2005, Dutch parties filed 343 patent applications to the EPO per billion euro of R&D spending. After Germany (401 patent applications), the Netherlands has the most patent applications of the benchmark countries. The majority of Dutch patent applications originate from a small number of companies. More specifically, 10 percent of Dutch applicants account for 80 percent of all Dutch patent applications

(CBS, 2007). The Dutch number of applications far exceeds the 258 applications per billion euro of R&D spending of the EU-27 (see figure 7.2.1). Among the benchmark countries, the United States has the smallest number of patent applications per billion euro of R&D spending (120).

7.2.1 Patent applications to the European Patent Office, 2005



Source: Eurostat.

When patent applications are set off against national population sizes, again Germany filed most patent applications to the EPO, namely 271 per million inhabitants. From second place in terms of applications compared with R&D spending, the Netherlands is pushed down to fourth place by Sweden (238) and Finland (230) for applications per million inhabitants. More specifically, Dutch parties filed 186 patents applications per million inhabitants. Among the benchmark countries Ireland has the lowest number of patent applications per million inhabitants: 59. This does not necessarily mean that Irish R&D activities are less successful; there are other ways of protecting knowledge.

Dutch ICT sector makes extensive use of intellectual property rights

Over 37 percent of all Dutch patent applications to the EPO in 2005 related to ICT. Among the benchmark countries, South Korea had the largest share of ICT patent applications to the EPO: 63 percent. Finland, Canada, Japan and the United States were also above the Netherlands in this respect. The average for the EU-27 was 27 percent.

The picture is the same if only innovators are taken into account. The ICT sector is particularly active in the field of intellectual property rights, which include registered industrial designs, trademarks and copyrights alongside patents. In the period 2004–2006, 24 percent of innovators in ICT manufacturing filed a patent application, compared with 5 percent in the ICT services sector. The low percentage in ICT services is connected with the fact that services cannot be easily patented. Among innovators in other sectors of the economy, 12 percent filed a patent application. Within ICT manufacturing, large firms in particular (250 employed persons or more) patent their inventions. Nearly two-thirds of large ICT manufacturing companies applied for a patent, compared with 11 percent of small businesses (10 to 50 employed persons). Compared with the period 2002–2004, patent applications by large and small businesses in ICT manufacturing fell slightly. For medium-sized businesses, however, they rose.

Innovating companies providing ICT services relatively often register a trademark: 23 percent of innovators in 2004–2006. In other sectors of the economy (excluding ICT) this share was 16 percent, one percent point higher than in 2002–2004.

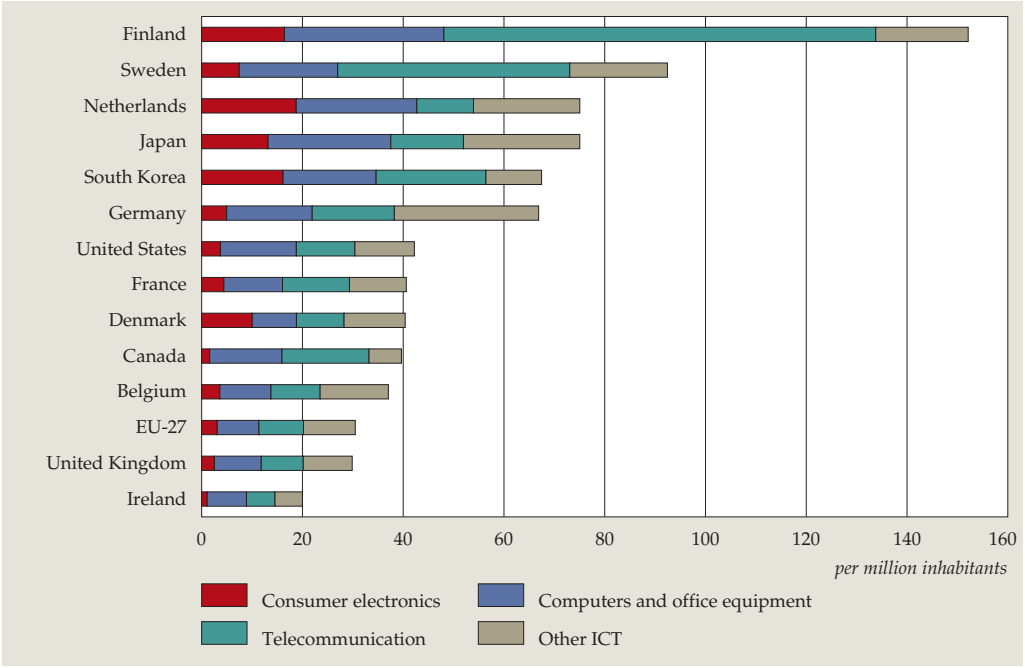
Looking at the whole range of instruments for protecting intellectual property in the period 2004–2006, 38 percent of innovators in ICT manufacturing and 33 percent in ICT services applied for an intellectual property right. Both groups make use of intellectual property protection significantly more than innovators in other industries. The percentage of innovators who applied for an intellectual property right excluding the ICT sector was in fact 24 percent in the period 2004–2006. Compared with the period 2002–2004, applications for intellectual property rights decreased slightly across the board. For innovators in ICT manufacturing and ICT services they fell by 4 and 7 percent points respectively.

Dutch relatively strong in consumer electronics

In 2005, 19 patent applications per million inhabitants were filed by Dutch companies in the field of consumer electronics. This is the highest number among the countries reviewed (see figure 7.2.2). Finland, South Korea and Japan were also strong in this area. The Netherlands was also among the leaders (third) in the areas computers and office machinery, and other ICT (including measuring instruments and semi-conductors). The Dutch applied for relatively few patents in the area of

telecommunications: 11 applications per million inhabitants. Finland scored highest in this field (86 applications).

7.2.2 ICT patent applications to the European Patent Office, 2005



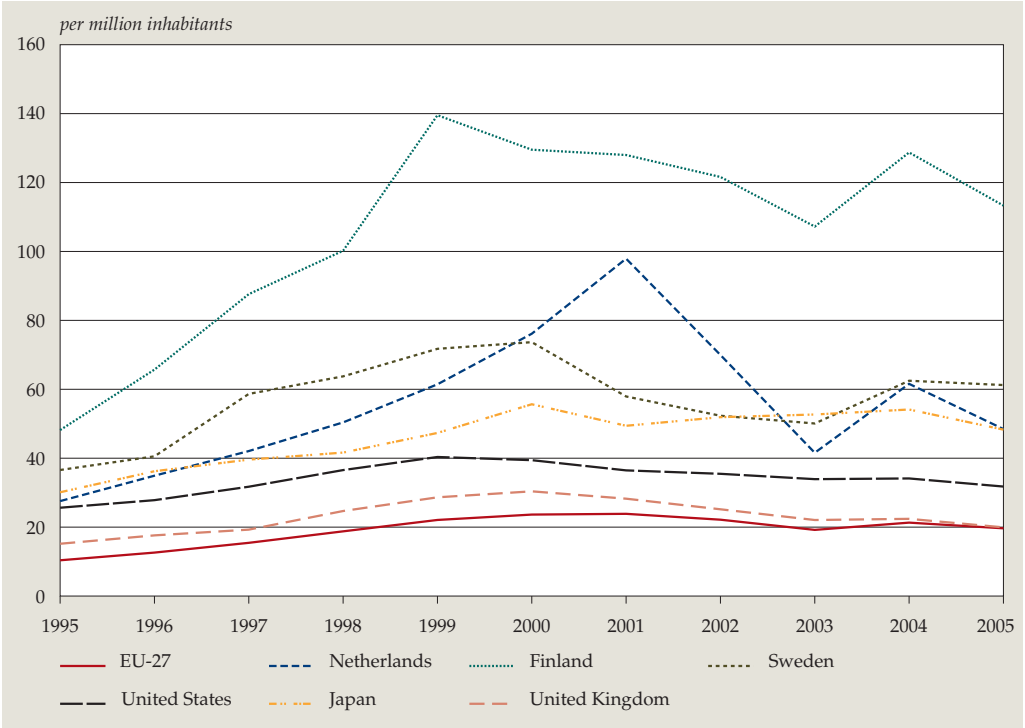
Source: Eurostat.

Almost a third of Dutch ICT patent applications in 2005 (31.8 percent) were in the category computers and office equipment; 15 percent were in the category telecommunications.

More Dutch high-tech patent applications

The number of high-tech patents filed by Dutch companies and institutions rose in the period 1995–2005[2)]. In this ten-year period, the number of Dutch high-tech patents per million inhabitants rose by 75 percent to 49 in 2005, although there were significant fluctuations (see figure 7.2.3). From 1995, the number of applications rose every year to 98 per million inhabitants in 2001. Then it dropped to 42 in 2003. After a brief revival in 2004, the number fell by 20 percent in 2005.

7.2.3 High-tech patent applications to the European Patent Office, 1995–2005



Source: Eurostat.

Among the benchmark countries, Finland was the most active in high-tech patent applications, not only in 2005 but in the entire period under review. Japan and Sweden also filed relatively many high-tech patent applications.

Just over a quarter (26 percent) of Dutch patent applications in 2005 were high-tech patent applications. This put the Netherlands in fourth place among the reviewed countries. Finland led the field in this respect, followed by Japan (31 percent) and the United States (30 percent). Nearly half of all patent applications in Finland were high-tech applications.

The figures presented in this section should be interpreted with caution. For example, R&D spending (figure 7.2.1) often does not coincide with the year the patent application is submitted, and this may give some distortion. Also there are differences in cultures between countries in the area of protecting knowledge. This need not always be in terms of applying for a patent; in some countries it is more common to keep knowledge secret. In addition, the presence or absence and the size of some industries in a country may play a role in that country's position. For example, nearly 70 percent of inventions in the field of electronics are patented, while in

certain parts of the chemical industry 'only' 25 percent of inventions are patented[3]. Lastly, countries outside Europe are not members of the EPO, and parties in these countries submit relatively more patent applications to their national authorities than to the EPO (OECD, 2009a).

7.3 ICT education

National performance in education gives an indication of the country's knowledge supply. A higher degree of education in a country means that more people in that country have attained a certain level of education. This section outlines higher education in the Netherlands, focusing on participation, the number of first-year ICT students, graduates, in particular ICT graduates, and a comparison with other countries in terms of the share of ICT graduates.

Participation in higher education rising, also in ICT disciplines

The goal of higher education is primarily to increase the number of highly qualified people on the labour market. There have been major developments in higher education in the last fifty years. In study year 2008/'09, almost 602 thousand students were enrolled in higher education, about ten times as many as in 1950, and 17 thousand more than in 2007/'08. This increase in the number of students in higher education reflects the turn from the agrarian and industrial society in the Netherlands just after the second world war to the current knowledge society (Ministry of Education, Culture and Science, 2008).

Nearly 384 thousand students were registered in higher professional education (hbo) and around 220 thousand in university in 2008/'09. Participation in higher education has increased strongly in the recent years as well: by 26.3 percent in the period 2000/'01–2008/'09 (table 7.3.1). This increase was largest for university students (32.5 percent), and smaller for hbo students (22.7 percent).

This increase is slightly less apparent for ICT-related disciplines in higher education. In 2008/'09 a total of approximately 27 thousand students had enrolled in the disciplines information science and electronics. At the beginning of this century, in 2000/'01, approximately 24 thousand students enrolled in these disciplines, so the increase is almost 13 percent. The relative increase for these disciplines was thus lower than the total increase in higher education enrolment. In the period 2000/'01–2008/'09, the increase in the number of students in ICT-related disciplines was slower at universities in particular (6 percent).

Table 7.3.1
Enrolment in higher education, total and information science, 2000/'01–2008/'09 [1) 2) 3)]

Type of education	Increase in number of enrolled students	
	absolute number	%
Higher professional education (hbo)	70,998	22.7
University	54,048	32.5
Total	125,180	26.3
Hbo/information science	2,668	14.7
University/information science	367	6.0
Total/information science	3,086	12.8

Source: Statistics Netherlands, Education statistics.

1) Students who have paid their college or exam fees and whose enrolment process has been completed. Students doing *hbo* and a university programme in one year are included in both forms of higher education. Within higher education as a whole they are counted only once. The increase in the number of students enrolled in higher education is thus slightly smaller than the sum of the increase in the numbers enrolled in hbo and university separately.
2) Figures for study year 2008/'09 are provisional.
3) Computer science students are those enrolled in disciplines classified as ISCED 481: 'information science' and 523: 'general electronics'.

Bachelor-master system introduced in 2002/'03

The bachelor-master structure was officially introduced in Dutch higher education in study year 2002/'03. In 2007/'08 some 4 thousand students in computer science received a bachelor's degree and nearly a thousand students a master's degree. The share of the latter group, which includes only university students, increased, as since the start of the new system there were five bachelor's degrees for each master's degree in computer science. Since 2002/'03 most bachelor's degrees in computer science are awarded by colleges of higher professional education *(hbo)*, although universities are catching up. Between 2002/'03 and 2007/'08 the share of university students in bachelors increased from 3 to 16 percent.

As the old-style master's *(doctoraal)* and current master's programmes lead to a similar level of education, these graduates can be added together. Most old-style master's programmes lasted four to five years. With the introduction of the bachelor-master system, university education is divided into a bachelor programme of three years, and a subsequent master's programme of one or two years.

In addition to bachelor's and master's degrees, students can also be awarded professional qualifications if they pass the final professional examination in the disciplines medicine, veterinary medicine, dentistry, pharmacy, philosophy, or one of the university teacher-training programmes. Before receiving a professional qualification from a university, graduates have received a master's degree at an earlier stage (CBS, 2007 and CBS, 2009c).

Decrease in ICT graduates

Just under 113 thousand students graduated from higher education in 2007/'08; this is slightly down on the previous study year, but nearly twice as many as the nearly 58 thousand in 1990/'91 (table 7.3.2).[4)] This increase is also visible in the annual averages. The number of graduates from higher education was approximately 70 thousand per year on average in the 1990s. In the new millennium, this has risen to approximately 92 thousand graduates per year.

The number of *hbo* graduates has been stable at just under 60 thousand since 2003/'04. The number of university graduates was down significantly in 2007/'08 from the previous study year (by 8 percent), the first decrease since 1999/'00. On the other hand, the number of university bachelor's degrees grew considerably again (by 10 percent).

Table 7.3.2
Graduates from higher education, total and ICT, 1990/'91–2007/'08 [1)]

	Bachelors						Masters				
	Higher professional education (hbo)			University			University			Population aged 23 yrs	Hbo and university graduates as a % of 23-year-olds
	Total	ICT	Share of ICT	Total	ICT	Share of ICT	Total	ICT	Share of ICT		
	number		*%*	*number*		*%*	*number*		*%*	*x 1,000*	*%*
1990/'91	38,660	1,360	3.5				19,110	620	3.2	250.3	23.1
1991/'92	42,440	1,390	3.3				20,740	650	3.1	252.5	25.0
1992/'93	43,880	1,410	3.2				22,590	740	3.3	264.9	25.1
1993/'94	46,660	1,700	3.6				24,710	780	3.2	257.8	27.7
1994/'95	48,870	1,680	3.4				25,360	710	2.8	245.7	30.2
1995/'96	51,180	1,700	3.3				28,300	720	2.5	231.9	34.3
1996/'97	50,510	1,580	3.1				25,400	660	2.6	212.3	35.7
1997/'98	50,090	1,580	3.2				22,170	510	2.3	203.8	35.5
1998/'99	50,130	1,630	3.3				20,490	440	2.1	194.8	36.2
1999/'00	52,230	1,790	3.4				20,250	440	2.2	193.0	37.5
2000/'01	53,140	2,110	4.0	110			20,430	490	2.4	191.2	38.5
2001/'02	56,060	2,550	4.5	120			21,300	510	2.4	194.7	39.8
2002/'03	57,970	2,810	4.8	2,130	80	3.8	22,140	590	2.7	194.0	42.4
2003/'04	59,630	3,110	5.2	5,720	230	4.0	23,780	720	3.0	200.3	44.5
2004/'05	59,260	3,330	5.6	12,770	510	4.0	26,210	870	3.3	197.5	49.8
2005/'06	59,490	3,500	5.9	19,080	690	3.6	29,290	1,070	3.7	191.8	56.3
2006/'07	60,036	3,338	5.6	22,327	772	3.5	30,731	1,111	3.6	189.5	59.7
2007/'08	59,878	3,353	5.6	24,597	642	2.6	28,270	955	3.4	194.4	58.0

Source: Statistics Netherlands, Education statistics; Population statistics.

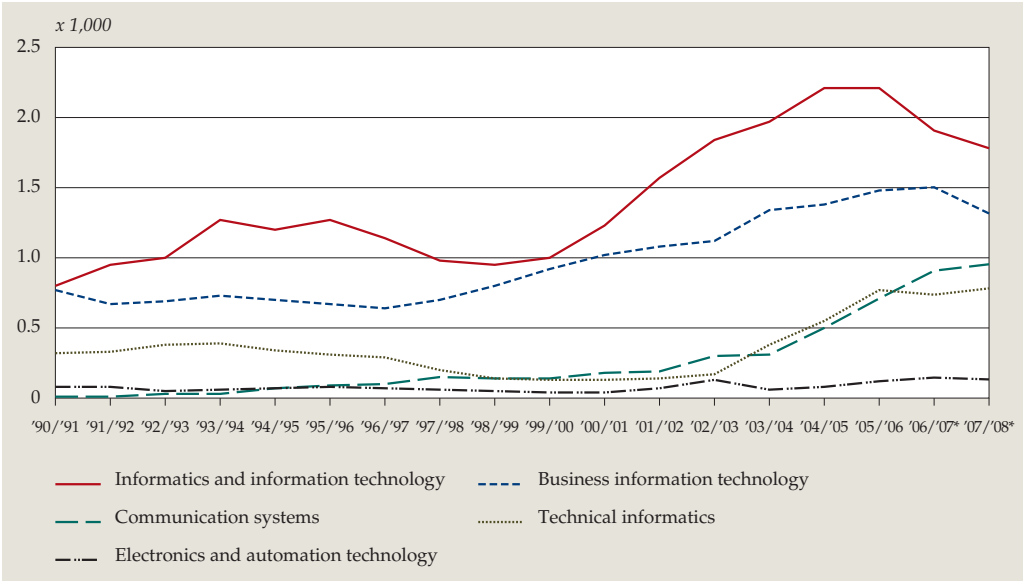
[1)] Graduates from higher professional education (hbo) and university (bachelors and masters), and studies classified as ISCED 481: informatics and 523: electronics and automation technology.

Within higher education, graduates in ICT-related disciplines accounted for 4.4 percent of graduates in 2007/'08, 0.2 of a percent point down on the previous study year. The differences are clearer when broken down by study stage. At universities, the percentage of graduates in ICT-related disciplines fell both for bachelor's (0.9 of a percent point) and master's degrees (0.2 of a percent point) in 2007/'08 compared with the previous year. There was no fall among hbo graduates; 5.6 percent graduated in ICT-related disciplines, just as in the previous study year.

To interpret these figures reliably, we need to know more about the composition of the Dutch population. As most *hbo* graduates are 22 and most university graduates 24 years old, table 7.3.2 also shows the population aged 23 years on 1 January of the year concerned. The number of 23 year-olds decreased by almost a quarter between 1990/'91 and 2007/'08. The number of graduates almost doubled in this period. As the number of graduates increased and the number of 23 year-olds decreased, nearly 60 percent of people in this age group graduated from higher education in 2007/'08.
It should be mentioned in this respect that university bachelors often move on to a master's programme, and may be counted double in this percentage. If university bachelors are not taken into account, the percentage of 23 year-olds with a degree in higher education is lower (45 percent).

Classifying education programmes is a complex matter. Statistical descriptions of study programmes in higher education distinguish five ICT-related disciplines (figure 7.3.1). New disciplines are regularly added. When universities switched to the bachelor-master system, nearly all studies at universities and colleges of higher professional education were redesigned, and were subsequently reclassified by Statistics Netherlands. The classification into five disciplines used in this section is based on the names and content descriptions of the various programmes. It is adjusted every year because of the introduction of new disciplines and shifts in programme emphasis. This may cause some distortions in the figures in this section. As a result of a new name or adjustment of the contents, a programme may belong to a different category a year later.

7.3.1 ICT graduates from higher education, 1990/'91–2007/'08



Source: Statistics Netherlands, Education statistics.

Substantial rise in communication systems graduates

The total number of graduates in information sciences rose from just under 2 thousand in 1990/'91 to nearly 5 thousand in 2007/'08. Two study years before that, it peaked at 5.3 thousand graduates. The number fell by 5.2 percent in 2007/'08 from the previous study year; from 1999/'00 to 2005/'06 it increased every year.

Within computer sciences 'informatics and information technology' has been the largest discipline for a number of years now. This discipline accounted for approximately 1.8 thousand graduates in 2007/'08, a decrease of 6.6 percent compared with the previous study year; in that year (2006/'07), too, the number of graduates had already decreased. 'Business information technology', the second most popular discipline, has shown an annually increasing number of graduates since 1997/'98. This trend ended in a 12 percent decrease in the number of graduates in 2007/'08.

There was a notable steady growth in the number of graduates in 'communication systems'; this number has increased significantly since 2003/'04. Together with 'technical informatics' this was the only computer science discipline in which the number of graduates increased in 2007/'08.

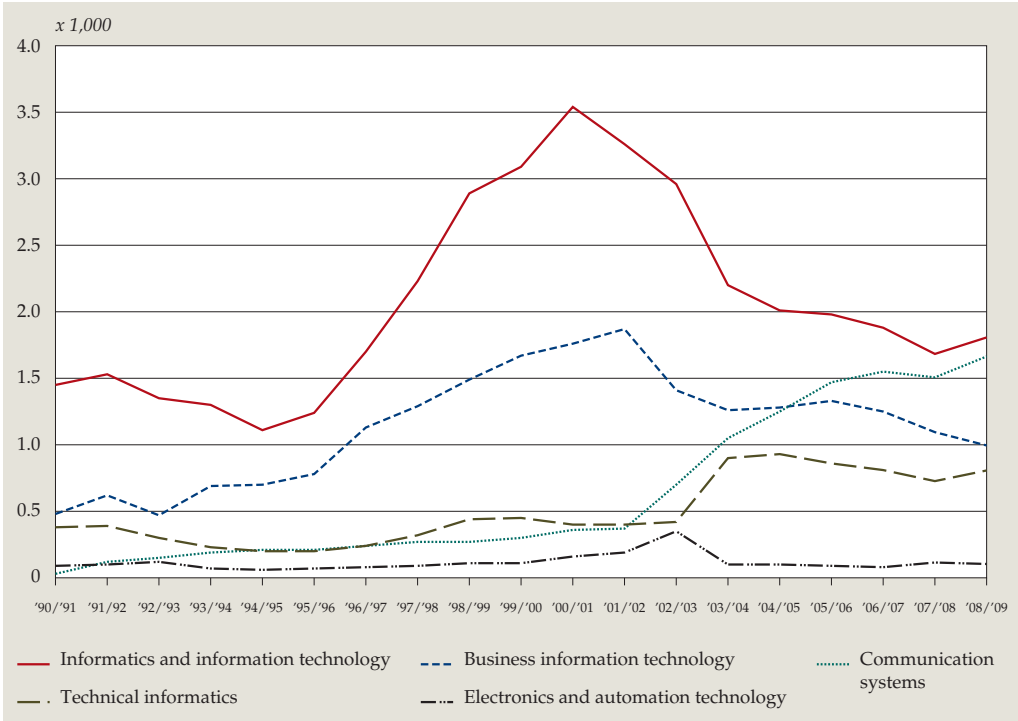
Inflow of computer science students improves

The total number of first-year students in computer science peaked at just over 6 thousand students in 2000/'01 (not indicated in graph 7.3.2). Since then, the total number of first-year students has fallen steadily to about 5.4 thousand in 2008/'09.

The low (5.1 thousand entrants in 2007/'08) seems to have been passed. The decrease was probably a visible effect of reduced confidence in employment prospects for computer scientists after the financial internet hype. In the years after the hype, the number of first-year students dropped considerably, although not for the discipline communication systems.

The number of first-year students gives an idea of the number of computer scientists who will enter the labour market in the future. For the first time since the turn of the century, the number of first-year students in 'informatics and information technology' increased slightly in 2008/'09 (figure 7.3.2). For the disciplines 'communication systems' and 'technical informatics' there was not only a slight increase in the number of graduates (figure 7.3.1), but also in the number of first-year students in 2008/'09 compared with the previous study year. For communication systems, there were one and a half times as many first-year students as graduates in 2007/'08. Therefore the number of graduates in this discipline is likely to grow. The disciplines 'technical informatics' and 'electronics and automation technology' seem to be stable in the coming years, as long as the students that move out of these disciplines are excluded. The number of first-year students just about equals the number of graduates.

7.3.2 First-year ICT students in higher education, 1990/'91–2008/'09



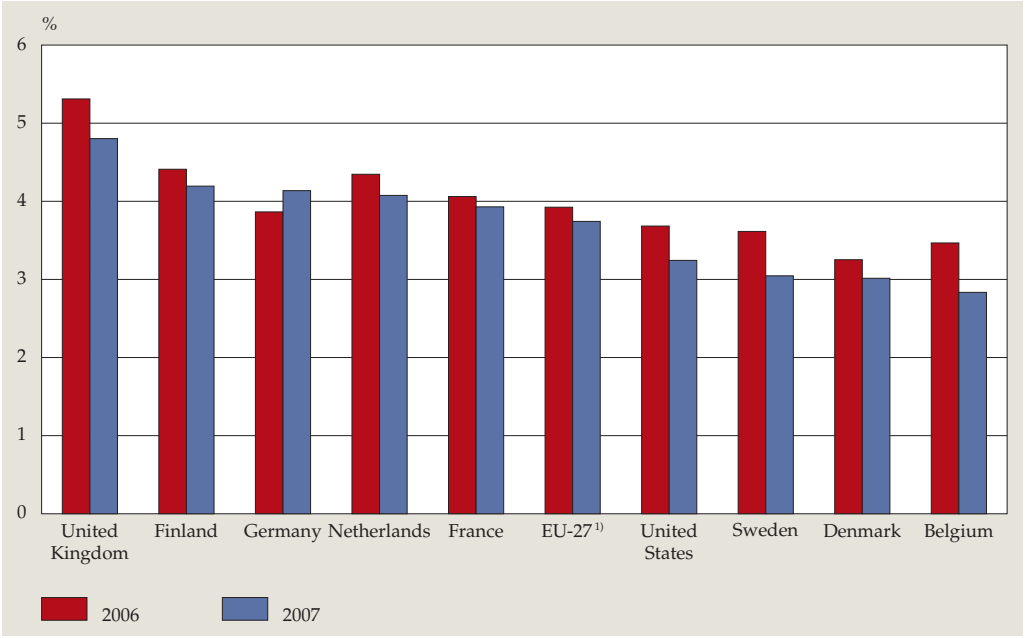
Source: Statistics Netherlands, Education statistics.

The inflow in 'business information technology' has decreased since the turn of the century, while the number of graduates has increased almost annually in the same period. This means that the number of graduates from this discipline will probably shrink in the coming years. The same applies to the discipline 'informatics and information technology'.

Many information science graduates in the Netherlands

In an international perspective, the Netherlands had an above average share of graduates in information science in 2007 (figure 7.3.3). Just as in other countries, this share was smaller than in the previous year. The Netherlands was still above the European average, however. Leader the United Kingdom, but also the United States and Belgium showed a decrease of at least 0.5 of a percent point in the space of one year. Germany was the exception in the countries under review; it showed a slight increase which put it at the level of the Netherlands (4.1 percent in 2007). In the United States the share fell from 3.7 to 3.2 percent. These figures should be interpreted with caution, as according to international agreements, the category 'electronics and automation technology' is not included as an ICT discipline.

7.3.3 Share of ICT graduates in total graduates from higher education, international



Source: Eurostat.

1) Eurostat estimate.

In a wider perspective, the science and engineering disciplines 'natural sciences, mathematics and computer science' and 'technology, manufacturing and construc-

tion engineering' (not included in figure 7.3.3) were mainly popular in Finland, Germany and the United Kingdom in 2006 but also in Sweden and France. Fewer students than the EU-27 average enrol for these disciplines in the Netherlands (Ministry of Education, Culture and Science, 2009).

To sum up, it can be concluded that with the advent of ICT in society, ICT knowledge, too, has increased in terms of completed education. The share of computer scientists is decreasing, but students are focusing more on developing knowledge of communication systems. However, only a small proportion of the population participates in ICT-related education, which means that the corresponding specialist knowledge is scarce. Given the ageing population, relatively more young people must enrol in computer science disciplines if we are to maintain a high level of highly skilled ICT workers in the Netherlands in absolute terms.

7.4 ICT skills

As computer and internet skills are important to be able to use ICT effectively, the Dutch government sets great store by the development of ICT skills in the population.

Most computer users have never taken a computer course

Computer courses are intended to enhance computer skills. However, just over half of computer users (52 percent) had never taken a computer course in 2009. The percentage is about the same for men and women. Most users who had done a course, had done it a relatively long time ago: 67 percent even more than three years before the survey. Only 16 percent had done one in the year preceding the survey.

Measurement of computer skills

Respondents were asked about their activities on the computer. Their responses were used to assess their computer skills.

The computer activities measured in this study were:
- Copying or moving a file or folder;
- Copying and pasting information in a document;
- Using simple formulas in a spreadsheet;
- Compressing folders or files, e.g. using Winzip;
- Installing new hardware such as a printer or modem;
- Writing a computer program in a programming language.

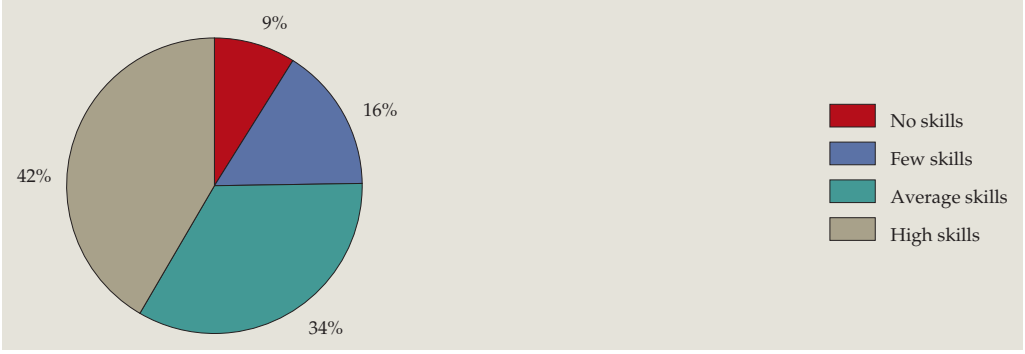
Respondents were classified into four categories:
- No skills: not done any of the listed activities;
- Few skills: done one or two of the listed activities;
- Average skills: done three or four of the listed activities;
- High skills: done five or six of the listed activities.

Three-quarters of users have average or high skills

A computer course does not appear to be a necessary condition for having an average or high level of computer skills. Notwithstanding the small share of computer users who have done a computer course, three-quarters of all computer users could be described as average or skilled users in 2009 (see box for more information on the definition of skills). Fewer than one in ten computer users who had ever taken a computer course, had no computer skills according to the classification of this study.

In 2009, most computer users were able to copy or move files and folders (87 percent), cut and paste information into a document (85 percent), use formulas in a spreadsheet (59 percent), and install new hardware, such as a printer or modem (66 percent).
Computer skills correlate with education level and employment status: 16 percent of people with a low education level had no computer skills, compared with 3 percent of people with a high education level, while there were also many more unemployed (21 percent) than employed (6 percent) people without computer skills.

7.4.1 Computer skills of all computer users, 2009 [1)]



Source: Statistics Netherlands, ICT use by households and individuals, 2009.

[1)] People aged 12 to 74 years who use a computer (see box).

Dutch internet skills rising

Statistics Netherlands' survey on ICT use by households took into account internet skills alongside computer skills. These internet skills are measured on the basis of

activities respondents undertook on the internet. The box below describes these activities.

Measurement of internet skills

In order to measure internet skills, respondents were asked about their activities on the internet. These 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 forums;
- Using the internet to make phone calls;
- Sharing files to exchange music, films etc;
- Designing a web page.

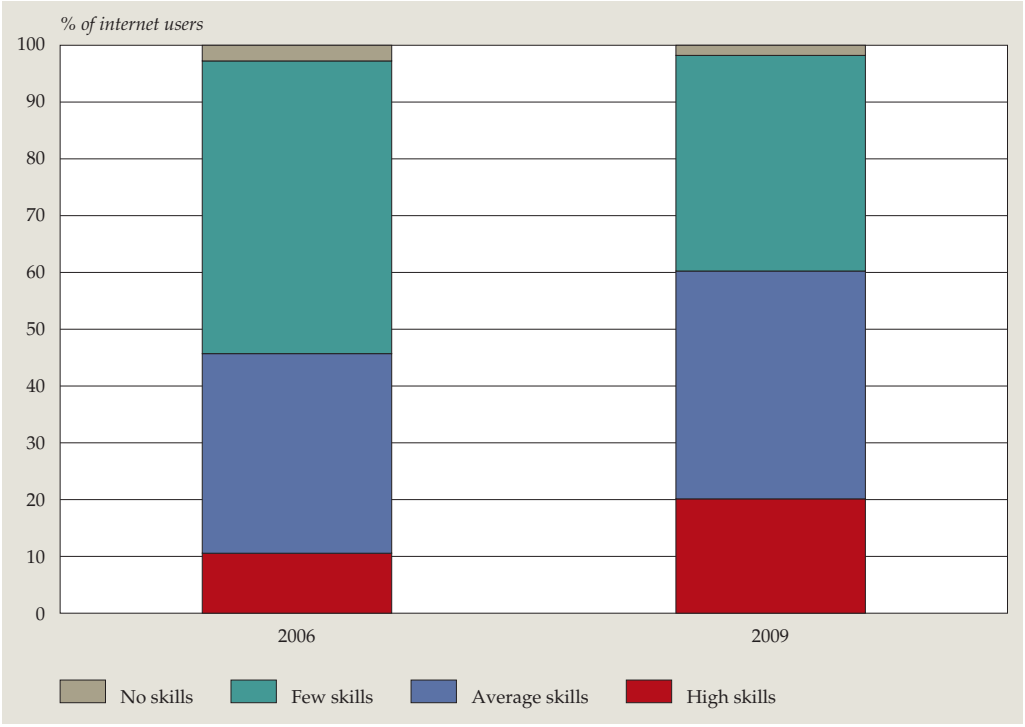
Respondents were classified into the following categories:
- No skills: not done any of the listed activities;
- Few skills: done one or two of the listed activities;
- Average skills: done three or four of the listed activities;
- High skills: done five or six of the listed activities.

In 2009, about 60 percent of internet users appeared to have an average or high level of internet skills. The remaining 40 percent of internet users had few or no skills, but this share is smaller than in previous years. For example, in 2008 just under half of internet users had few or no internet skills, and in 2006 this share was even larger.

Relatively many people younger than 25 years had a high level of internet skills: 38 percent. This compares with only 7 percent of people older than 45 years. Also, more men (23 percent) than women (17 percent) had a high level of internet skills.

In previous editions of this publication, the Dutch figures in this section were placed in a European perspective. As computer skills were not included in the mandatory European questionnaire in 2008, no figures are available for other European countries. Data for 2007 are still available, see The digital economy 2008.

7.4.2 Skills of internet users, 2006 and 2009 [1)]



Source: Statistics Netherlands, ICT use by households and individuals, 2006 and 2009.

[1)] People aged 12 to 74 years who use a computer (see box).

ICT skills mainly determined by occupation

Table 7.4.1 shows average ICT skills scores for the period 2005–2009 broken down by occupational classes. ICT skills are expressed in terms of number of activities, as listed in the two boxes in this section, performed by individual respondents. Thus, individual respondents scored between zero and six, based on their computer and internet skills. The figures are presented both before and after controlling for effects of gender, age, residence and education level.

The table reveals large differences between occupational classes, for both computer and internet skills. The figures indicate that being in a certain occupation, doing a certain kind of work with its unique properties, has a large influence on the level of ICT skills. People apparently acquire ICT knowledge mainly in specific practical contexts, including work. Therefore ICT skill levels are partly determined by occupation.

People with a high level of education have more computer and internet skills than those with a low education level. It can therefore be assumed that occupations which require a higher level of knowledge are carried out by persons with rela-

tively high ICT skill levels. Table 7.4.1 confirms this. Occupational classes at the highest knowledge levels all have a relatively high score on both computer and internet skills. On average, people in university graduate level economic and administrative occupations (such as accountants, programmers and researchers) and managers at university graduate level have high ICT skills.

However, not all non-academic occupational classes have lower average ICT skills. Examples are technicians at higher occupational levels (such as construction project managers, and architects) and business and administration at higher occupational level (for example marketing consultants and real estate agents). These occupational classes have almost the same ICT skill scores as the graduate level occupations.

Table 7.4.1
Average computer and internet skills of employed persons (>= 12 hours per week), 15 to 65 years, by occupational group, 2005–2009

	Computer skills		Internet skills	
	before control	after control[1)]	before control	after control[1)]
Business and administration at higher occupational level	4.82	4.49	3.35	3.23
Business and administration at university graduate occupational level	4.95	4.37	3.38	3.12
Technicians at higher occupational level	4.85	4.32	3.07	2.83
Managers at university graduate occupational level	4.58	4.30	3.01	3.01
Business and administration at intermediate occupational level	4.13	4.16	2.87	2.87
Pedagogical occupations at university graduate occupational level	4.21	4.01	3.05	3.08
Judicial, administrative and protective service related occupations at intermediate level	4.01	3.89	2.70	2.62
Higher level occupations in behaviour and society	4.05	3.82	2.95	2.87
Higher level pedagogical occupations	3.66	3.62	2.73	2.81
Intermediate level occupations in behaviour and society	3.37	3.60	2.81	2.86
Judicial and administrative occupations at university graduate occupational level	3.90	3.54	2.79	2.60
Business and administration at lower occupational level	3.11	3.47	2.56	2.67
Medical and paramedical occupations at higher level	3.47	3.42	2.74	2.80
Technicians at intermediate occupational level	3.57	3.36	2.48	2.35
Medical and paramedical occupations at intermediate level	2.85	3.23	2.35	2.55
Personal care occupations at lower level	2.71	3.13	2.38	2.50
Personal care occupations at intermediate level	2.90	3.08	2.39	2.42
Elementary occupations	2.82	3.05	2.40	2.42
Lower level transport-related occupations	2.63	2.84	2.02	2.20
Technicians at intermediate occupational level	2.50	2.67	2.04	2.16
Lower level agricultural occupations	2.58	2.64	1.88	1.82
Intermediate level agricultural occupations	2.45	2.43	1.84	1.90

Source: Statistics Netherlands, ICT use by households and individuals, 2005–2009.

[1)] Each background characteristic is controlled for other background characteristics (gender, age, region of residence, level of education).

The figures above are aggregated figures for the period 2005–2009.

Manual workers score low on ICT skills, especially people with lower and intermediate level agricultural occupations. They have lower levels of ICT skills than people working in business and administration at lower occupational level, such as telephone operators and checkout workers. More surprisingly, intermediate level agricultural workers, such as heads of small farms, have fewer computer and internet skills than people working in business and administration at lower occupational level.

People in business and administration occupations generally have a higher level of ICT skills than workers with the same level of education in other occupations. This applies to workers with primary, secondary, higher and university education. Again, this shows that the use of ICT at work contributes to the ICT skills of workers.

Notes in the text

1) In this case: the International Patent Classification (IPC) system. This is an internationally acknowledged classification system of patents for inventions. The IPC is currently used in more than 100 countries (OECD, 2009a). The IPC is divided into sections, subsections, classes, subclasses, main groups and subgroups (in total 70,000 categories are distinguished). The purpose of the IPC system is to group patent documents according to their technical field, whatever the language and terminology.
2) See 'Concepts and definitions used' for explanation.
3) Based on EPO applicant panel survey 2006 (OECD, 2009a).
4) This group of graduates consists of bachelors in higher professional education (hbo), and university bachelors, masters and old-style masters.

8. Capita selecta

This chapter consists of four contributions which discuss their subjects in more depth than the other chapters of this book. Two of these contributions are by authors from outside Statistics Netherlands (Delft University of Technology and NLKabel); one was co-written by an author from *De Nederlandsche Bank* (the Dutch central bank). The four contributions examine the following issues:

- Electronic payments (*De Nederlandsche Bank*/Statistics Netherlands);
- ICT skills (Statistics Netherlands);
- Mobile services (Delft University of Technology);
- Next-generation broadband internet (NLKabel).

Statistics Netherlands hopes to highlight other relevant research in the field of ICT by including these external contributions in this book. As such research may have a very narrow focus, or may be aimed at forecasting of future developments, it falls outside the core business of Statistics Netherlands.
Some figures in this chapter do correspond to those published by Statistics Netherlands. The differences are caused mainly by differences in the population described, the time of data collection, and the research method used.

8.1 From cash to electronic payments: an overview of developments

Dutch shoppers are using electronic forms of payment for more and more of their purchases. Debit cards are used particularly often in this respect. Their use will continue to grow in the future, on the one hand because more consumers are using debit cards, and on the other because more and more retailers are accepting them. The increasing use of cards is beneficial from a social point of view: it reduces the total costs of payments for society as a whole, it increases safety for retailers, and it is convenient for consumers.
This contribution addresses the following topics: the development of the use of various means of payment, the use of debit cards by consumers, the acceptance of debit cards by retailers, and future developments with respect to retail payments.

Authors: Nicole Jonker, De Nederlandsche Bank and Alex Lammertsma, Statistics Netherlands

Introduction

In the past twenty years, Dutch consumers have increasingly paid for their purchases electronically. While they used to pay mainly with coins, banknotes and cheques, now they more often use a debit card. They are also using e-purses more, mainly for specific purposes such as parking ticket machines, in work canteens and

for vending machines. In 2008, 5 billion payments were done with cash, 1.8 billion using a debit card and 176 million using an e-purse.

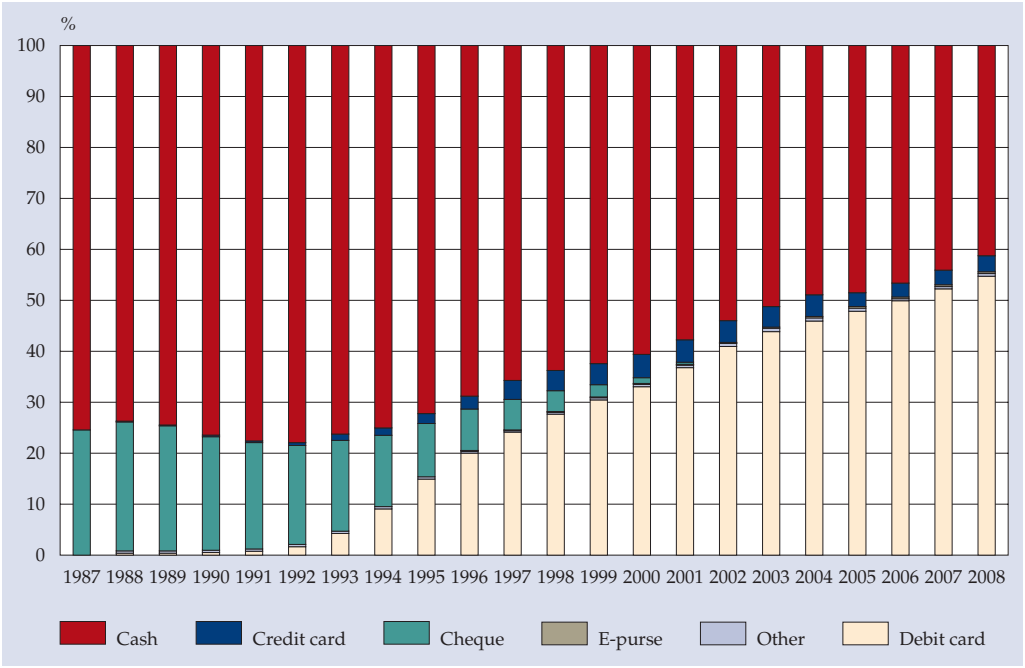
The costs for processing point-of-sale (POS) payments for banks, value carriers, retailers, telecom companies and *De Nederlandsche Bank* amounted to 2.9 billion euro in the Netherlands in 2002 (Brits and Winder, 2005). These costs could be reduced along the whole payment chain if consumers paid more with debit cards and less with cash. Studies have shown (McKinsey & Company, 2006, EIM, 2007) that even for small amounts, the debit card is a cheaper way to pay than cash. A further increase in electronic payments also contributes to safety: retailers are a less attractive target for raiders if they have less cash in the till. Furthermore, debit cards are convenient for consumers. They don't have to go to the bank or an ATM as often to withdraw cash; and they need not worry about having enough cash in the case of a – sometimes unexpected – purchase. This is also favourable for retailers: 6 percent of them reported that customers spend more money in their shops since they have the option of paying with a debit card (Bolt et al., 2008).

Development in various means of payment

Dutch banks introduced the debit card in 1988. Initially consumers mainly used these cards, which are secured by a personal identification number (PIN), to withdraw cash from ATMs. At the end of the 1980s, oil company Shell and supermarket chain Albert Heijn were the first companies in the Netherlands to enable payments with debit cards by installing POS terminals at their petrol stations and their supermarkets respectively (Out et al., 1995). The acceptance of debit cards by these two major players contributed substantially to the adoption of debit cards by the public. In the mid-1990s, banks also introduced the e-purse, which was mainly intended to replace cash for small-amount transactions. The introduction of these new debit cards resulted in significant shifts in the way consumers paid for their shop purchases.

Figure 8.1.1 shows the value shares of various forms of payment in total POS sales (shops, hotels, restaurants, petrol stations, etc.) in the Netherlands. The figure clearly shows the growing significance of debit cards as a method of payment, and also the corresponding decrease in the use of cash and the complete disappearance of cheques. With the introduction of debit cards, cheques became less popular for purchases involving large amounts. In 2002, banks stopped supplying cheques – a relatively expensive form of payment – as a means of payment on the domestic market. Consumers could also easily use debit cards to withdraw cash. They no longer had to go to the bank during business hours, but could use their debit cards to withdraw money from an ATM twenty four hours a day, seven days a week. Initially, therefore, the introduction of debit cards did not result in a decrease in the share of cash in the turnover of shops; on the contrary, it coincided with a rise, from 74 percent in 1988 to 78 percent in 1992. As debit cards facilitated the withdrawal

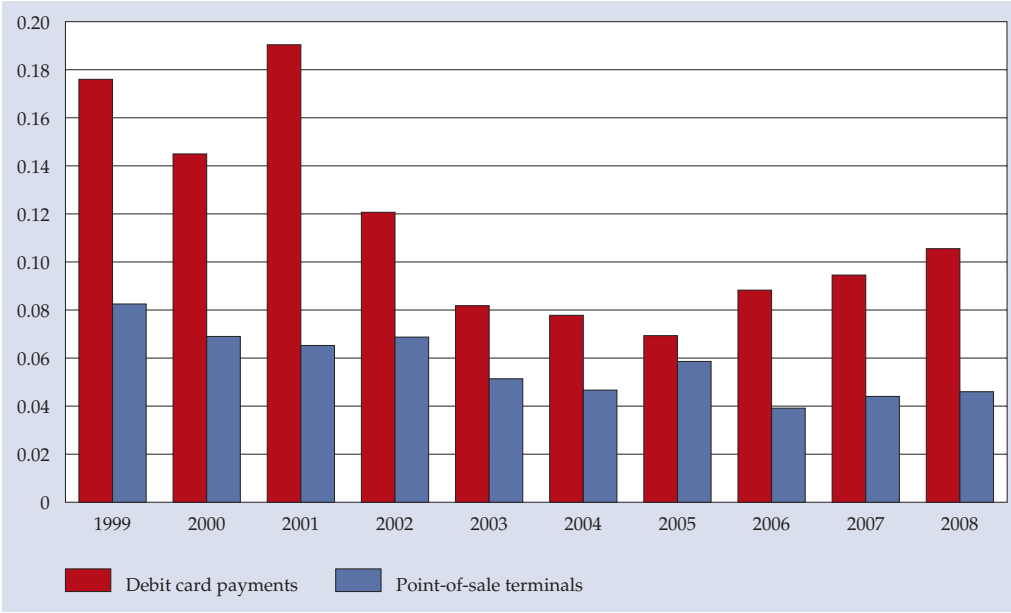
8.1.1 Value shares of methods of payment in POS sales, 1987–2008



Source: Statistics Netherlands, Currence.

of cash, cheques became less popular. From 1992 onwards, consumers could increasingly use debit cards to pay at the counter, as many retailers installed POS terminals. Turnover from debit card payments increased spectacularly between 1992 and 1995 (figure 8.1.1), although compared with total POS turnover its volume was still modest. After 1995, more and more retailers and service providers accepted debit card payments. In the space of twenty years, the share of this method of payment in total turnover at points-of-sale increased to nearly 55 percent in 2008. The rise was at the expense of payments by cash and cheques. In 2008, the share of cash was 41 percent, down from 78 percent in 1992. Fewer consumers used an e-purse, however. These cards have developed into a method of payment for specific purposes where debit cards cannot be used, or fast transactions are desirable: for example parking meters, vending machines, and in work canteens and cafeterias. E-purses have a number of disadvantages compared with debit cards: users have to charge them beforehand, the balance is not visible on the card, and there are relatively few charging points. Also, fewer shopkeepers accept e-purses, and the number continues to fall as only few consumers use them to pay (Jonker, 2007).

8.1.2 Increase in number of debit card payments and number of POS terminals, year-on-year, 1999–2008



Source: Currence.

The increase in the use of debit cards is based on the broad acceptance by businesses that accept debit card payments as well as consumers who use the card to pay for their purchases (figure 8.1.2). From 1999 the number of POS terminals increased by 4 to 8 percent yearly, but the number of debit card payments increased by much more: 7 to as much as 19 percent in 2001. The growth in the number of debit card payments was more than twice as high on average as the growth in the number of point-of-sale terminals. This not only indicates that increased acceptance at points-of-sale contributed to the increased use of debit cards, but also that more consumers pay their for purchases with a debit card, and/or consumers pay for a larger share of their purchases by debit card.

Use of debit cards by consumers

Almost all adults in the Netherlands have a debit card linked to a bank account. In 2008, some 86 percent of Dutch people aged fifteen or older used the card for both cash withdrawals and payments. The more a purchase costs, the more likely it will be paid for with a debit card (Currence/GfK, 2008, Bolt et al, 2008b). One in eight Dutch consumers do not use a debit card to withdraw cash, but do use it to pay for purchases. Only one in sixteen consumers use a debit card to withdraw cash, but not for payments. The latter group includes relatively many men, people with a low education level, young people, and elderly people. A small minority of Dutch people do not use a debit card at all. Several studies show that the younger and

more educated consumers are, and the more they earn, the more likely they are to use electronic means of payment (Stavins, 2001, Van Hove et al., 2005; Borzekowski et al., 2008). On the other hand, another study shows that age has only a limited impact on the use of debit cards in the Netherlands (Jonker, 2007).

In 2004, Dutch consumers said they wanted to pay by debit card more often, but did not do so for a number of reasons. Sometimes they paid cash because that was the only form of payment accepted, but many also opted to pay cash when a surcharge was charged for electronic payment of amounts below a certain threshold. These surcharges were still regularly being charged at the end of 2007: 20 percent of all retailers who accepted debit card payments charged customers on average 0.24 euro extra for debit card payments below a certain threshold (Bolt et al., 2008). Faced with this extra charge, two-thirds of consumers opted to pay cash in 2006. More than one in five (22 percent) used a debit card and paid the surcharge. A smaller proportion shopped elsewhere (5 percent), or paid by e-purse (4 percent).

Last year, fewer and fewer retailers charged extra for debit card payments; by mid 2009 this had fallen to only 8 percent of small and medium-sized businesses (Currence, 2009). At the end of 2007, Currence launched a public campaign encouraging consumers to use debit cards for small amounts, and as a result many shops have ceased to demand a surcharge. Furthermore, the average amount paid with a debit card had been decreasing for some time, but after the start of the campaign it fell faster, from 43.07 euro in the first half of 2008 to 39.48 euro in the first half of 2009 (Currence/DNB). In supermarkets, the sector targeted by the first series of commercials, the number of debit card payments rose by 13 percent. This is 3 percent points more than the increase in other sectors. New campaigns were launched in May and August 2009, concentrating on chemists and shops selling alcoholic beverages. Just as in supermarkets, the number of transactions below 10 euro paid by debit card has increased in these branches since the start of the campaigns.

Acceptance of the debit card

Although more and more retailers accept payments by debit card, there are large differences between the various retail branches. On average, 70 percent of shops, hotels, restaurants, cafes etc., and service providers accept payments by debit card (table 8.1.1). Acceptance of the debit card is relatively high in sectors with large purchase amounts, such as clothes and shoe shops, chemists and perfumeries, petrol stations and travel agencies. Relatively few businesses in the hotel and restaurant sector accept debit card payments. In addition to the sector, the size of the business also plays a role: consumers can use debit cards at only half of one-man businesses, while nearly all businesses with 50 and more employees accept debit cards.

Retailers who do not accept debit card payments often do not do so for financial reasons. In 2007, more than half of businesses that accepted only cash payments said the investment costs were too high; for nearly 40 percent the bank charges for debit card payments were an obstacle. Many retailers also said it was too much hassle to introduce the option of debit card payments. Other reasons for retailers not to accept debit card payments were the low transaction speed, and the fear of fraud with POS terminals.

Recent developments have shown that the acceptance of debit cards can rise significantly in a relatively short time as a result of technological developments or specific campaigns. In the late 1990s, for example, mobile POS terminals were introduced. These devices enable the seller to go the customer, instead of vice versa, and the customer can then pay by debit card on the spot. Some years after its introduction, this innovation was successful in the Dutch hotel and restaurant sector and on street markets. While the total number of fixed and mobile payment terminals increased by 6.5 percent between late 2004 and late 2005, the number of terminals in the hotel and restaurant sector rose by 14 percent. Furthermore, the growth in the number of payment terminals in this sector was more than twice as high as in other sectors in 2006.

Table 8.1.1
Acceptance of debit cards, by branch and business size, October 2007

	% of total number of businesses
Total	70
Sector	
Food	76
Garden centres, florists	73
Clothes and shoe shops	89
Builder's merchants and DIY stores	80
Hotels and restaurants	56
Department stores, shops for household items and furniture	73
Media (books, DVDs, CDs)	84
Chemists, perfumeries	85
Other shops and markets	75
Petrol stations, travel agents, etc.	81
Other services	44
Business size	
1 employed person	50
2–4 employed persons	75
5–9 employed persons	89
10–19 employed persons	93
20–49 employed persons	92
50 and more employed persons	97

Source: DNB, 2008.

2005 Payment Covenant and Additional Agreement of 2009

In order to promote the use of debit cards and thus reduce costs, banks and retailers drew up the Payment Covenant in November 2005. Under this agreement banks offer retailers a discount of at least 0.01 euro on their tariffs for debit card payments. Furthermore, in cooperation with retail organisations, banks set up a foundation for the promotion of efficient payment *(Stichting Bevorderen Efficiënt Betalen)*, which supports projects designed to improve safety and efficiency of payments. On 27 May 2009 banks and retailers agreed on the Additional Agreement, which is valid up to and including 2012.
Among other things, the foundation for the promotion of efficient payments aims to promote the acceptance of debit card payments in small and medium-sized businesses. Various studies have shown that the number of debit card payments correlates positively with the number of locations where consumers can use these cards (Bolt et al., 2008a; Jonker and Kettenis, 2007). The foundation called on banks, telecom companies and terminal suppliers to develop cheap and simple all-in-one 'debit card packages'. These consist of at least one payment terminal and a telecom contract, but also often include a bank contract. The packages are also attractive for businesses who receive small amounts by debit card: they can receive payments by debit card for a fixed monthly charge. Businesses applying for such 'smart debit card packages' were also entitled to a 100 euro grant from the foundation. This campaign persuaded many smaller businesses to accept debit card payments; not only retailers, and hotels and restaurants, but also taxi companies, traditional craft businesses and market traders. At the end of January 2009, over 16 thousand businesses had registered with the foundation for the promotion of efficient payments for a smart debit card package. The foundation is also involved in a campaign promoting the use of debit cards for small amounts developed by Currence (brand owner of PIN, the Dutch debit card system). They provided promotional material to businesses, and the first TV commercials were broadcast at the end of 2007. The first campaign, for supermarkets, was launched in September 2008, and was followed in 2009 by campaigns aimed at chemists and shops selling alcoholic beverages.

The future of electronic payment

The use of cash is expected to decrease further in the future. Both parties on the demand side of payments by debit card – consumers and retailers – are eager to increase use of debit cards further. And the supplying parties – the banks – also want to stimulate further use, for efficiency reasons. The abolition of surcharges and public campaigns have encouraged consumers to use debit cards for smaller amounts, and they are actually doing so. The acceptance of debit cards continues to increase, also among small and medium-sized businesses, which have benefited from the introduction of debit card packages specially tailored to the needs of busi-

nesses who receive few or mainly small payments. In the coming years, banks and retailers will continue to introduce plans to reduce the use of cash in favour of electronic payment. This was officially agreed on 27 May 2009, in the so-called Additional Agreement to the 2005 Payment Covenant.

Looking further ahead, cash payments, but perhaps also debit card payments, could be replaced by new electronic options, for example through mobile phones. A few years ago, financial institutions and telecom companies started to develop the technology needed for this. At the moment (2010), consumers in the Netherlands can pay for parking tickets using their mobile phone. The final payment in this method is done by a money transfer order or a credit card. Consumers can also transfer money to each other via SMS text messages. In other countries, such as Belgium and South Korea, consumers can even use their mobile phone to pay in certain shops. In the Netherlands, two supermarket chains have tested methods of payment via mobile phones.

An important development in this context is the introduction of the European payments market (Single Euro Payments Area, SEPA). SEPA could, albeit to a limited extent, contribute to an increased use of debit cards. The aim of SEPA is to transform the national payment markets in Europe, which are focused on domestic methods of payment, into a European payment market with methods of payment that allow consumers and businesses across Europe to pay in the same way, with the same charges and under the same conditions. Under SEPA, banks will offer payment services, both to consumers and businesses, which are in principle suitable for use throughout Europe. SEPA could contribute to an increase of the number of debit card payments in two ways. On the one hand because Dutch consumers will use debit cards more in other European countries, and also because other Europeans will be able to use debit cards more in the Netherlands. At the moment, Dutch consumers pay more in cash or by credit card elsewhere in Europe than in the Netherlands (Jonker and Kosse, 2008). They would like to pay more by debit card, but cannot do so because the acceptance of debit cards abroad is generally lower than in the Netherlands. SEPA will change this. European retailers will eventually accept debit card payments from networks that can be used throughout Europe and not just at a national level.

Cash payments will not disappear in the foreseeable future. In some situations, consumers or retailers will prefer cash instead of electronic payment because of security or convenience. This will certainly remain the case as long as there is no widely accepted option for electronic transfers between consumers, as cash is fast and easy to transfer. Cash also has the advantage that it can be used if the electronic payment system malfunctions. And lastly: unlike electronic payments, cash is completely anonymous.

8.2 ICT skills and functioning in a knowledge economy

Section 7.4 provides detailed information on ICT skills. This section gives a more contextual description of the theme. It includes the relevance of ICT skills and developments in the understanding of this concept.

Author: Vincent Fructuoso van der Veen, Statistics Netherlands

Relevance of ICT skills

The theme ICT skills is high on the national policy agenda. On the ICT agenda 2008–2011 of the fourth Balkenende Cabinet, for example, developing the ICT skills of the population is listed as a point of particular interest. In the international community, too, ICT skills are a central agenda item in the policy domains 'Information Society' and 'Science and Technology'. Both the European Commission (EC) and the OECD are active in these domains, as they expect ICT skills to become increasingly important in the knowledge economy. Thus, the EC states:

"The success of the Lisbon strategy, the competitiveness of European industry and social cohesion are dependent on the availability and the effective use of information and communication technology (ICT) and the knowledge, skills, competences and inventiveness of the European workforce and citizens. < ..... > As ICT is developing rapidly, e-skills are increasingly becoming important and need to be constantly updated."

New requirements

Technological changes go hand in hand with new opportunities, as well as new demands on individuals, both at work and at home. These requirements are primarily of a quantitative nature: an ability to use a browser or various software packages, is already an expression of learning or adaptation to new requirements. The qualitative nature of these requirements is secondary: although today most people possess basic ICT skills, this does not mean they can use these skills effectively.

The share of the Dutch population who have never used the internet can be used as an indication of digital illiteracy. In 2008, as many as 11 percent of 12–74 year-olds, i.e. 1.5 million people, had never been on the internet; for the entire population, this number is even higher.

Older people in the Netherlands, in particular, have not adjusted to the digital revolution: most computer illiterates in the Netherlands are over 55 years. However, as there are also many older people in the Netherlands who do have ICT skills, the stereotype of old people who cannot use ICT is unjustified.

Some drawbacks to not being able to use a computer are:

1. More and more goods and services can be only purchased online, or are cheaper on the internet;

2. More and more information is available only online, or can be found more easily or more quickly online;
3. More and more government matters can be dealt with online;
4. More and more transactions – in the broad sense of the word – are conducted on the internet;
5. More and more communication takes place online and more and more people are communicating online.

Social benefits of ICT skills

Evidently, internet skills have become more important for individuals and society because of these developments. Two major conclusions on the social benefits of ICT skills of a study conducted by economic research bureau SEO run as follows:

1. If all employed persons with no ICT skills were taught the most basic level of computer skills, the resulting productivity improvements could generate about 250 million euro in the Netherlands, of which approximately 80 percent will go to employees in the form of higher wages;
2. A rough estimate of the quantitative impact on consumer purchasing decision processes is a benefit of 87.50 euro per person per year; multiplied by the number of computer illiterates in the Netherlands, this results in a gain of 140 million euro per year.

So is it just about money? No, ICT skills play a role in many aspects of life, such as employment opportunities and integration. More fundamentally, ICT skills may play a direct or indirect role in the entire range of human needs. According to Maslow's hierarchy of needs these are: physiological needs, safety needs, social needs, esteem, and lastly self-actualisation. A few examples of ICT-related needs are: online shopping, use of antivirus software or taking out insurance online, using Facebook, instant messaging, e-mailing, writing a weblog or searching for information.

Developments in the definition of ICT skills

Different definitions of ICT skills are used, even for the concept itself. Variants include: e-skills, ICT skills, computer or digital literacy, computer and internet skills. We do not use all the current terms and definitions below, but try to outline the development of the concept.

The definition of ICT skills has developed more or less parallel to the diffusion of ICT in society itself. Just over ten years ago, the first home internet connections became available in the Netherlands. Average users – who mostly had to use an analogue telephone connection – had two basic skills: e-mailing and surfing. As ICT became more widespread, more and more other skills became relevant. The skills expanded to understanding and being able to use various internet options, such as online file sharing, online banking, and website construction. Likewise, ten

years from now new internet services will exist, and they will require ICT skills that are now still unknown. People will then have to acquire new ICT skills.

Apart from this time-related aspect, ICT skills are not just about knowing which button does what. In the course of the years, there has been more and more emphasis on the ability to benefit from processing information. For example, being able to find information online about a certain product is now less important than benefiting from that information; for example saving money with the aid of the information found online.

Relationship between ICT skills and cognitive skills

Being able to use online information effectively is not related – directly – to ICT skills, but to cognitive skills. For example, someone who makes a decision on the basis of online information has to judge whether the source is reliable and whether it provides relevant and accurate information. Then the information found has to be converted into meaningful action. However, we can assume that the introduction of ICT in society has led to a convergence of ICT and cognitive skills. The reason for this is the time interval between the supply and the use of information: this has been reduced substantially. As a result, people can almost immediately get – and use – information they need, which was out of their reach fifteen years ago. People who do not make full use of such information will fall behind people who do. For a long time, the largest impact of ICT was having access to the internet or not – the so-called digital divide and the disadvantages that this entailed. Now the ability to benefit from online information, both in social and economical terms, is the main factor.

Information and strategic skills

In 2008 the University of Twente published the results of a study of ICT skills. In this study, these – mainly internet – skills were defined as follows: operational, formal, information and strategic skills. Information and strategic skills in particular seem to reflect cognitive skills. Two examples of information and strategic skills in the study are 'defining keywords when confronted with information problems' and 'orienting oneself to a given purpose'.

Not surprisingly, the variable 'education level' turns up again and again as the main determinant of ICT skills in almost all studies. Education level is an indirect and rough measure of general cognitive skills, and these are precisely the relevant skills for processing and integrating information to knowledge.

Flexibility and reflection

In aid of research into ICT skills, VU University Amsterdam has developed a programme to teach certain ICT skills in primary schools (Kuiper et al., 2009). For these skills, it is very important to use various search strategies – and to alternate between them (flexibility) – and also to be aware of the strategy chosen, and what it results in (reflection). Being able to read the results of a search command, and the

texts themselves, critically is a skill that should not be underestimated: reading is just as important as technical skills, such as being able to navigate through a website. In addition, knowing how to interpret visual information in relation to text is also an important element of the programme.

DQ test

The Digital Quotient or DQ test was introduced in the Netherlands at the beginning of 2009. This self test enables internet users to measure their own DQ anonymously (www.dqtest.nl). The test consists of four components: buttons knowledge, navigating the internet, finding information on the internet and using the internet effectively.
The DQ test is a result of government initiatives to stimulate the public to develop their ICT skills. Thus the Ministry of Economic Affairs developed the five-year programme Digivaardig&Digibewust (digital skills and digital awareness) with the aim of teaching people basic ICT knowledge and raising the awareness of the opportunities and risks of ICT. The programme's target is a 50 percent reduction in the number of computer illiterates in the Netherlands.

In the end, the one aspect that matters in terms of ICT skills is the ability to function in a knowledge economy. This includes knowing how to cope with the new media culture. Functioning in a knowledge economy makes demands of people's ICT skills, of specific cognitive skills and particularly of personal adaptability.

8.3 The use of mobile services

In cooperation with the Institute for Advanced Management Systems Research (Åbo Akademi in Finland), Delft University of Technology is constructing a time series on the use of mobile services. The study started in Finland in 2002. Since 2007, comparable data have been collected in the Netherlands. In the meantime other countries have also joined the project, such as Greece and New Zealand. This contribution presents the results for the Netherlands and Finland.

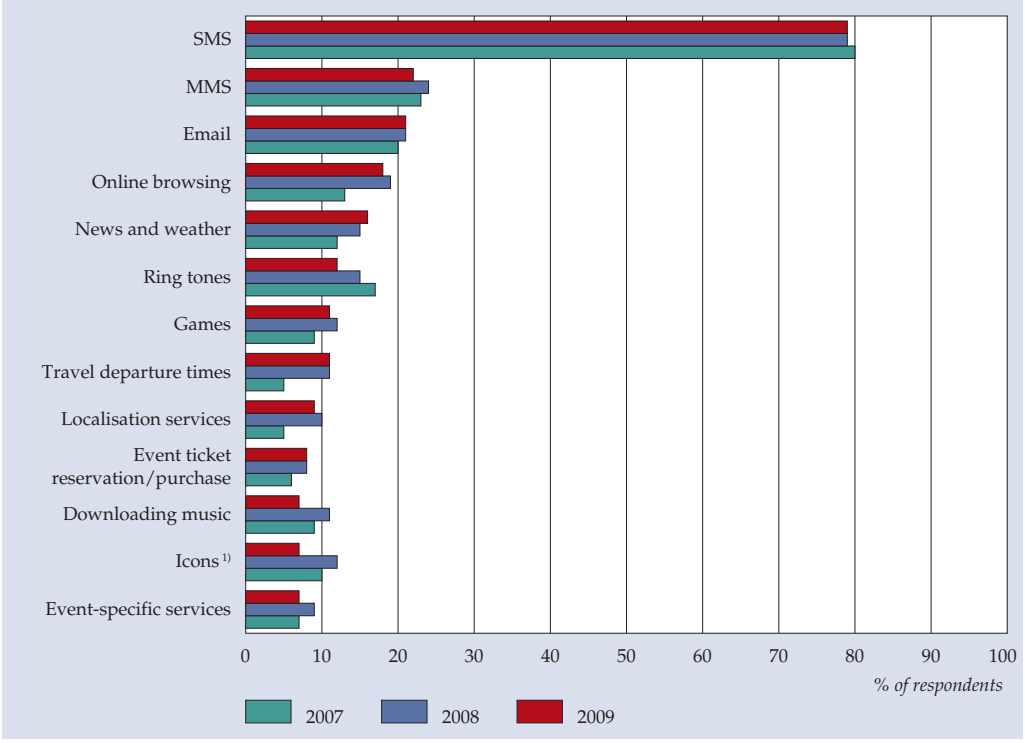
Author: Harry Bouwman, Delft University of Technology, the Netherlands and Åbo Akademi, Finland.

In 2009, nearly everyone in the Netherlands had a mobile phone; 17 percent of the population even had two or more. In that year, almost three-quarters of mobile phones in use were two years old at the most; one in eight people were considering buying a new mobile within the next twelve months. It should be mentioned in this respect that more and more of these mobile phones are smartphones instead of simple mobile phones. A smartphone has more functions than a 'normal' mobile phone. People use a wide variety of criteria to choose a phone. In 2008 about

60 percent of individuals thought Bluetooth was a key function, 59 percent wanted a camera in their phone and 37 percent wanted a full colour screen.
In 2009, three-quarters of respondents the used their mobile phone mainly for private purposes. Nearly one in ten used it primarily for business; this corresponds to the share of employer-paid subscriptions. These shares have been stable since 2007.

The statistical annex on the website of Statistics Netherlands (see www.cbs.nl/digital economy) contains a lot of additional information on the use of mobile services in the period 2007–2009. The figures included in this section are a selection from the available data.

8.3.1 Development in the use of mobile services, 2007–2009



Source: Delft University of Technology, 2009.

[1] These are pictures, logos and wallpapers.

Small growth in use of mobile services

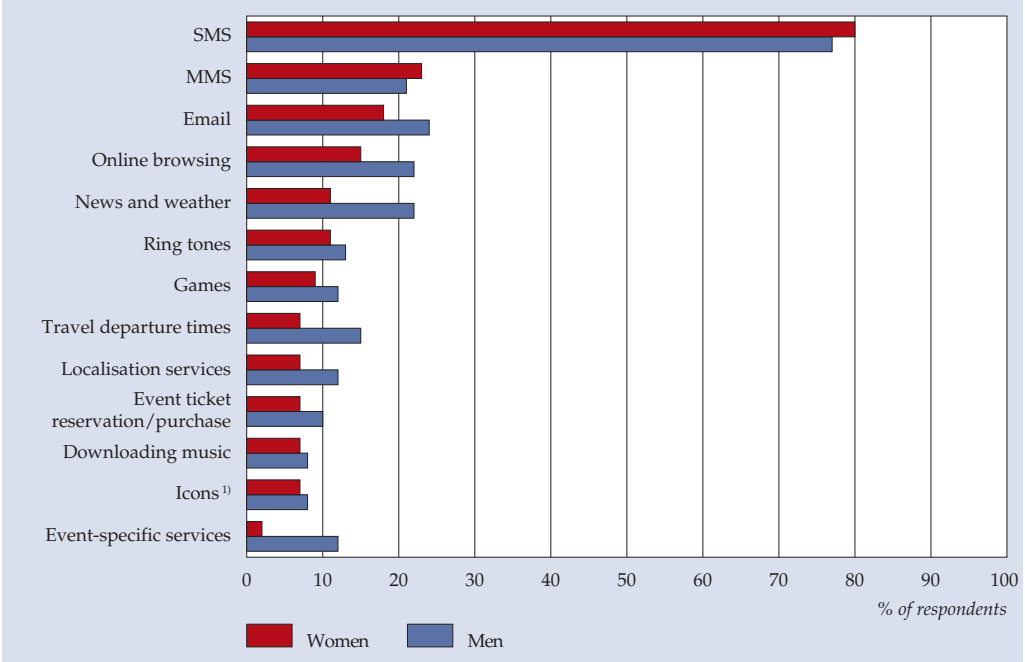
Although the use of mobile services in the Netherlands grew from 2007 to 2009, this growth stagnated in 2009 (figure 8.3.1). In 2009, mobile phones were used most for telephone calls and SMS (texting).

Eight out of ten Dutch mobile owners used SMS with varying intensity; just over a quarter used it on a daily basis. Only one in five people used MMS (multimedia messaging). Dutch mobile phones were not widely used for sending photos, e-mail, other multimedia messages and online surfing in 2009: two in ten people on average used their phones to e-mail and/or to go online. Only half of this group did so on a daily or weekly basis. Other services shown in figure 8.3.1 were used less frequently.

More men than women use mobile services

In 2009, most of the mobile services included in the study were used relatively more by men than by women (figure 8.3.2). This is also true for new services, such as mobile blogs, RSS feeds, navigation services and Google Maps (see statistical annex). Relatively more women than men used SMS and MMS in 2009.

8.3.2 Use of mobile services by gender, 2009



Source: Delft University of Technology, 2009.

1) These are pictures, logos and wallpapers.

Mainly young people use mobile services

Of all the age groups examined, 15–24 year-olds in the Netherlands were the most intensive users of mobile services. There were substantial age differences for nearly every type of mobile service. Use of mobile internet among young people increased gradually in the period 2007–2009. Relatively many young people used mobile

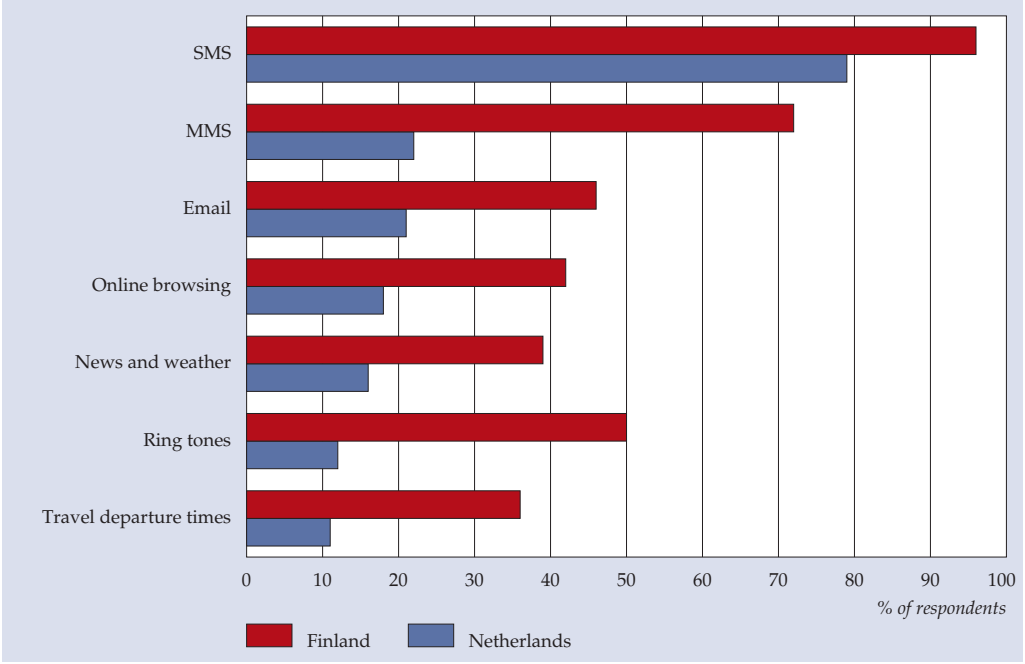
blogging (16 percent), mobile navigation (23 percent), Google Maps (30 percent), social networking (30 percent) and RSS feeds (20 percent).

The study also examined the relationship between the use of mobile services and three income groups: below average, average and above average. Differences in the use of mobile services between these groups were small in 2009. People with a low income use mobile services least, with the exception of mobile banking.

Netherlands lags behind Finland

Within Europe, Finland can serve as a good example for the Netherlands in terms of ICT performance. It is also a suitable partner for comparing the use of mobile services, not only because of Nokia's success, but also because of the active influence of the Finnish government on ICT innovations. Mobile services are a focus of attention in Finland.

8.3.3 Seven most used mobile services in the Netherlands compared with Finland, 2009



Source: Delft University of Technology, 2009.

There is a prominent gap in the use of mobile services between Finland and the Netherlands. The Netherlands lags several years behind Finland. New mobile services are accepted faster and much more willingly in Finland than in the Netherlands, especially navigation and Google Maps. Most new applications use Google Maps. Figure 8.3.3 shows seven of the most frequently used mobile services in the Netherlands compared with Finland. It shows clearly the large differences in the

services ringtones, MMS and travel departure times. The study showed that these services were used three to four times more frequently in Finland. Only in the use of SMS was difference between Finland and the Netherlands relatively small.
Just as in the Netherlands, more men than women in Finland use mobile services, with the exception of ringtones, icons and mobile blogs. Relatively more Finnish women than Dutch men use mobile services.

In summary, it can be concluded that although mobile services have been provided in the Netherlands for a number of years now, their use is still not widespread. Only 'simple' functions – phone calls and SMS – are used frequently. The use of mobile services stagnated in the Netherlands in 2009, but is expected to grow steadily in the coming years, as it also grew in the period 2007–2009. Both in Finland and the Netherlands, relatively more men than women use these services. However, the Fins use them three to four times more than the Dutch.

8.4 *The deployment of next-generation broadband internet*

Back in 1993, the first home internet connections in the Netherlands were installed: dialup connections with a speed of 14 Kbps. The possibilities were very limited. Two years later, the first cable company offered internet access. Cable connections had many advantages: users no longer had to pay per minute, there was often no data limit and higher speeds became possible. It soon became clear that broadband was the future. In 1998, broadband also became available via the telephone line with ADSL. In the course of the 1990s, Dutch telephone and cable networks were made suitable for new services based on the Internet Protocol. Fast and 'always-on' broadband (up to 20 Mbps) opened the door for a wide range of new applications. Now, next-generation broadband internet has made its appearance. Important new applications are expected with potentially far-reaching consequences for society.
This contribution first addresses the question of whether the infrastructures for telecommunications in the Netherlands are suitable for next-generation broadband internet. In the second part, a number of services are discussed that could thrive using next-generation broadband. Lastly, the adoption of next-generation broadband is addressed.

Author: Mathieu Andriessen, NLkabel

The Netherlands excels in broadband

Nearly 80 percent of Dutch households have a broadband internet connection (see also section 5.1). This high penetration is partly because of the wide deployment of the technical infrastructure used to provide broadband internet. In 2009 the DSL network of KPN covered 99.9 percent of Dutch households with speeds of 768 Kbps and higher. Over half of this DSL network (57 percent) has been made suitable for ADSL2+, a technology that makes download speeds possible of up to

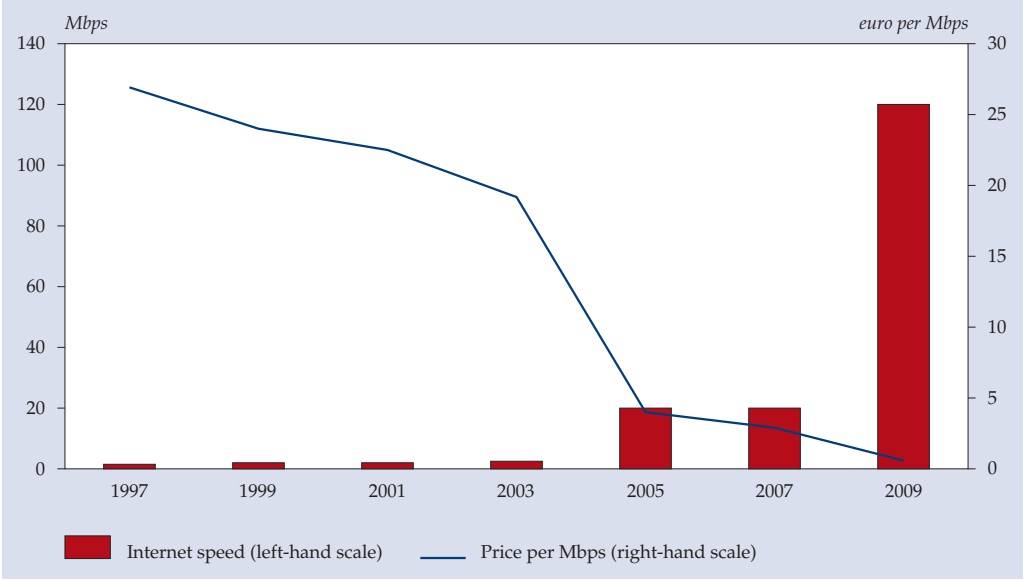
24 Mbps. The HFC network of Dutch cable companies covers 98 percent of households, with a possible connection speed of at least 20 Mbps. Mobile operators have over 90 percent coverage through HSDPA, the successor to UMTS which offers speeds up to 7 Mbps.

Compared with the rest of Europe these Dutch figures are very positive (DG Infosoc, 2008). In terms of average download speed, too, the Netherlands performs excellently. At the beginning of 2009, the Netherlands ranked sixth in the list of countries with the fastest average internet connection, with an average speed of 5.7 Mbps (Akamai, 2009). In 2009, 34 percent of broadband subscribers in Netherlands had a speed of over 5 Mbps. According to another study, the average download speed in the Netherlands is 11 Mbps. Only South Korea (20.4 Mbps), Japan (15.8 Mbps) and Sweden (12.8 Mbps) have faster speeds according to this study (Speed Matters, 2009). In any case, it is clear that the Netherlands belongs to the top countries in terms of penetration, availability and speed of broadband internet.

Competition has a positive impact

Strong competition between DSL and cable providers has played an important part in achieving the current speed level. This competitive pressure has also reduced the price of broadband significantly in recent years (figure 8.4.1), making speeds of 20 Mbps affordable for every wallet (Vermaas, 2007).

8.4.1 Price and speed of fastest cable subscription, 1997–2009

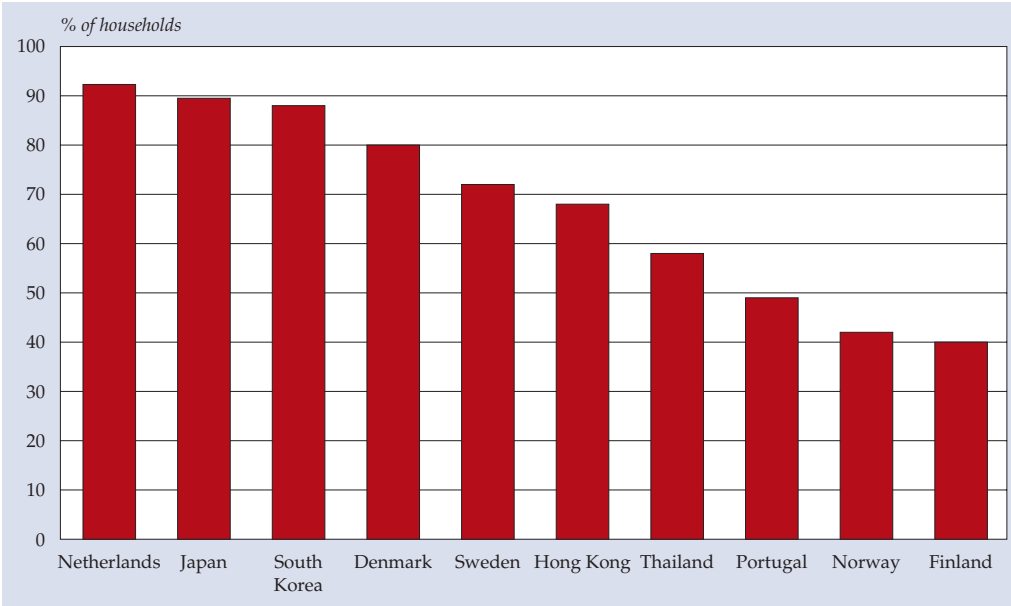


Source: NLkabel, cable company websites.

Dutch infrastructure increasingly better equipped for next-generation broadband

The question is: can the Netherlands maintain its international position, or improve it even further. Researchers from the universities of Oxford and Oviedo published reports on the quality of broadband in various countries in 2008 and 2009 (Said Business School and Universidad de Oviedo, 2008/2009) to find out which countries are ready for the future. The Netherlands scored well in these studies in terms of price and quality of broadband internet. The reports show that although Dutch providers do not achieve all the advertised speeds, they do realise more of it than other countries. According to these studies the Netherlands is also ready for future internet applications, probably because of its almost national coverage of networks suitable for broadband and the active deployment of next-generation broadband through these networks. Broadband connections with a minimum download speed of 50 Mbps and a minimum upload speed of 8 Mbps are considered to belong to the 'next generation'. There is every indication that this new generation of broadband connections is about to break through.

8.4.2 Access to next-generation broadband, international top ten, 2009



Source: Telecompaper, 2009.

The technologies providers use to deliver next-generation broadband are described below: Cable, DSL, FTTH and mobile connections.

Cable makes next-generation broadband possible for nine in ten homes

With the upgrade to the new modem technology EuroDOCSIS 3.0, the cable companies were the first providers to deploy next-generation broadband in the Netherlands on an almost national scale. Since September 2009, over 92 percent of Dutch homes have access to a cable that is suitable for download speeds of 50 Mbps and higher. With the deployment of EuroDOCSIS 3.0 the Netherlands now has the highest availability of next-generation broadband in the world, even higher than Japan and South Korea (Telecompaper, 2009).

EuroDOCSIS 3.0 increases speed by linking frequency channels

With the introduction of EuroDOCSIS 3.0, cable companies can use the bandwidth of their hybrid fiber coax (HFC) networks more effectively. The HFC network consists of fiber to a central point in the neighbourhood and a coaxial cable from the neighbourhood switchboard to the meter cupboards inside local homes. The total bandwidth is least 4.5 Gbps.

EuroDOCSIS 3.0 allows the cable companies to link multiple frequency channels of 8 MHz. This was not possible with previous EuroDOCSIS specifications, under which only one channel could be used, limiting the speed to 50 Mbps. By using four channels downstream and four channels upstream, there is enough room for at least 200 Mbps downstream and at least 100 Mbps upstream. By linking more channels even higher speeds are possible. In October 2009, the fastest available subscription for consumers was 120 Mbps down and 10 Mbps up. At the end of 2009, next-generation broadband via EuroDOCSIS 3.0 was available for more than 6.77 million homes in the Netherlands.

VDSL2 makes next-generation broadband via DSL possible

In addition to cable companies, DSL providers can also upgrade their network to a next-generation broadband network. By replacing the current ADSL2+ equipment in the neighbourhood switchboards by VDSL2 equipment, households within a limited radius of these neighbourhood switchboards can get speeds up to 60 Mbps. DSL providers can also opt to place the VDSL2 equipment in the street cabinets. This last deployment of VDSL2 is then combined with the roll-out of glass fiber to the street cabinet: FTTC (Fiber to the Curb or Fiber to the Cabinet). By replacing the traditional twisted pair copper telephone cables – which with ADSL run from the neighbourhood switchboard to the street cabinet – by fiber, high upstream and downstream rates are possible. At full deployment, virtually all households can be reached with next-generation broadband via VDSL2. In October 2009, the fastest available VDSL2 subscription for consumers offered rates of 60 Mbps download and 6 Mbps upload. In 2009, VDSL2 services were available to approximately 450,000 households (Poulus, 2009; KPN, 2009).

FTTH and fast mobile connections still only small scale

Unlike FTTC, with fiber to the home (FTTH) the last segment of telephone cable between the street cabinet and the meter cupboard is replaced by fiber. In April 2009, FTTH was available for 361,700 households (homes passed). In October 2009, the fastest available connection for consumers using FTTH was 100 Mbps upstream and downstream (Telecompaper, 2009).

Wireless networks with more than a limited local coverage and speeds of over 50 Mbps were not available in the Netherlands in 2009. Next-generation broadband is possible, however, via (local) WiFi connections, via Wimax and via the successor of HSDPA: LTE. The latter two networks are not available nationwide in the Netherlands, but this is expected to change with upcoming frequency auctions within the spectrum of the 2.6 GHz band and other frequency bands. Terrestrial next-generation broadband is also anticipated.

Next-generation broadband offers new services

With the increasing data speeds over the various infrastructures, a growth of the internet traffic volume is expected to occur. According to the independent think tank Information Technology and Innovation Foundation (ITIF), next-generation broadband opens the door for web-based applications capable of delivering substantial benefits to consumers, academic institutions, businesses and society in general (ITIF, 2009). Use of the new possibilities of next-generation broadband can also contribute to the quality of the environment, education, social cohesion and care for the elderly (Dunnewijk, 2009). Some the consequences of the adoption of next-generation broadband are discussed below.

Next-generation broadband makes internet even more visual

The internet is rapidly developing into a full video platform, offering both video on demand and 'traditional' linear programming. The demand for online video is expected to increase more strongly in the future (see e.g. Bain & Company, 2009). Higher download speeds are ideally suited for linear and on demand transmission of video files, which by nature are relatively large. Research by Ofcom shows that the use of internet video is growing with faster subscriptions (Ofcom, 2009). Therefore next-generation broadband can make the internet a more visual medium, or facilitate the use of internet for the transmission of streaming video images that are viewed on televisions with internet access. Users who want to download films in a short time, for instance in HD quality, also need next-generation broadband.

In the space of six years, the number of television sets in Dutch households suitable for receiving HDTV has grown from zero to 1.7 million in 2009 (Expert Group Digital Television, 2009). One of the possibilities that these TVs offer is displaying HD video from the internet or transported by the internet. Next-generation broadband is an important condition for the growth of streaming HD video and for online HD content.

Multiple users online no problem

Large bandwidth allows multiple users to be online on multiple computers, TVs and other devices simultaneously, without this affecting the connection. With next-generation broadband, for example, people in the same household can watch online HDTV, play online games, download music and performing other more or less intensive internet tasks simultaneously. Researchers expect that in 2011 an average household will need an internet connection with 50 Mbps downstream and 10 Mbps upstream (ITIF, 2009 and others).

In the future, not only people but also electronic devices will use the internet. Home automation is an emerging industry. Future homes will increasingly be an environment that helps their resident by taking over his or her duties. Lighting, heating, security system, ventilation, telephone, television and cameras can work together to increase the quality of the environment. As more devices will connect with the home network and the internet, the need for a greater bandwidth will increase.

Fast upload speeds increase consumers contribution to online content

As next-generation broadband allows much higher upload speeds, it is now possible for the first time to upload heavier data files efficiently and thus share them with others. Next-generation broadband can for example be used for rapid data backups on a remote server. Also, uploading photos to a photo print service or uploading HD video to a video site is much faster. Higher upload speeds will make it easier for consumers to step in the shoes of the producer and to share their files faster with others.

Cloud computing, where a user works with web applications or services that are available via the internet, will also mature with the higher upload speeds. Thus the need to keep software and files on a hard disc at home or at work decreases when files can be distributed faster digitally.

Various services send massive volumes of music over the web on a daily basis, without users having stored the music on their own computer. Games involving complex graphics can also be supplied in this way, so an expensive PC or game console is no longer required. Programs and files no longer have to be present on local computers, but can be stored in – and run from – the network. This is all under the condition that the internet connection has sufficient bandwidth and other quality features.

Expanding communication possibilities

Next-generation broadband makes services possible using 'real-time collaboration': HD video connections that enable people to communicate online with each other as if they were physically in the same room. Such connections demand higher upload speeds to process the images of the HD camera. Advanced e-learning services such as online lectures and HD videoconferencing with other students and teachers are possible, just as care services such as online consultations with a

doctor. The need to go to the office to work will continue to decrease if for example workers can attend meetings online in HD quality.

Adoption of next-generation broadband

In the future, many new applications will be invented that go beyond what we can imagine today. The availability of next-generation broadband internet is an important condition for these new services. Despite its wide availability, the use of next-generation broadband in the Netherlands is still lagging; the share of subscribers to these broadband networks is only a few percent. The history of the adoption of broadband from 1995 onwards shows that availability alone is not enough. Consumers are primarily stimulated by pricing and convenience; the actual use of services will follow on from these. (Vermaas, 2007).

The price of broadband in the Netherlands has always been kept low in the past because of competition between cable and DSL. This will be no different with the leap to next-generation broadband. At the moment, next-generation broadband offers convenience mainly to users who download very large files, like online video. The success of other applications will require time and effort from various parties. Teleconsultation, for example, is doomed to fail if both doctor and patient prefer physical consultation. Remote education would seem to be an especially interesting option as a niche service for students who are not able to physically attend lectures and classes. There are many other relevant examples: HD-teleconferencing and telework usually require a certain company culture; home automation (domotics) requires appropriate hardware in the house, and for cloud computing, consumers must be confident that they will always have access to their programs and data within the 'internet cloud'.

The success of such services would seem to depend on the extent to which governments, social organisations and the business community collaborate to achieve their acceptance, and to formulate further conditions. But the main condition has already been met in the Netherlands: next-generation broadband internet is widely available. The Netherlands leads the world in terms of broadband infrastructure; only time will tell whether it will also be a front runner in terms of adoption of next-generation broadband internet and the services it enables.

Note in the text

1) The survey of use of mobile services in the Netherlands is based on a small sample (about 500 persons) and data are only available for three years. It is therefore impossible to show a reliable trend. The results of the sample are described here. For example, if 15 percent of the respondents in the sample used a mobile service, for the sake of convenience this is expressed as '15 percent of people have used this service'.

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Concepts and definitions

Some key concepts and definitions used in this book are explained briefly below.

Basic price

The price received by the producer, excluding trade and transport margins of third parties and net product-related taxes (e.g. VAT) and product-related subsidies.

Basic registration

An registration based on legal obligation. Government organisations and private organisations carrying out a public task are required to use the data in these registrations. This prevents these organisations from repeatedly asking respondents for the same information.

Branch

Each individual location, terrain or complex used by a company to carry out its activities. Every company consists of at least one branch.

Broadband

High-quality communication connections with the internet such as cable, ADSL and other kinds of DSL connections. Also includes rented and leased lines with high-speed transmission, and UMTS (mobile broadband). The OECD uses 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. The expression 'high-speed internet' is also used for a broadband connection.

Business-to-Business market

The market for electronic shopping where companies sell goods and services to other companies (B2B).

Business-to-Consumer market

The market for online shopping where companies sell goods and services to consumers (individuals and households) (B2C).

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. They include material assets (such as buildings and machinery) and immaterial assets (such as software).

Consumer-to-Consumer market

The market for online shopping where consumers (individuals and households) sell goods and services to other consumers (C2C).

Consumer confidence

The indicator for the confidence and expectations of consumers about developments in the economy. Together with the indicators on economic climate and willingness to purchase, these contribute to the prediction of short-term fluctuations in household consumption, particularly the demand for and purchase of durable consumer goods.

Consumption

Goods and services used for the 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.

DigiD

DigiD is the digital log-on code of the Dutch government. Dutch citizens can use this digital code to identify themselves online to a government institution (e.g. the tax authority, the institute for employment benefit schemes (UWV), the student grants agency (IB-groep), or other relevant organisations (e.g. health insurance companies). Users with a DigiD can complete their tax returns online, apply for benefits and grants online, and acquire other government information, services and products online. DigiD consists of a user name and a password, sometimes supplemented with an SMS-code for a higher security level.

Durable consumer good

A product that can normally be used more than once and over a longer period of time. During the use the quantity hardly changes, it is not 'consumed' in the same sense as food, cigars or perfume.

E-commerce

Placing or receiving orders for goods or services through electronic networks, regardless of delivery and payment method. Excludes orders by telephone, fax or email.

E-government

Electronic government. The use of ICT to improve the way government services operate and to reduce the administrative burden for private individuals and companies.

EDI

Electronic Data Interchange: exchange of electronic data in an agreed format. An EDI network (such as EDIFACT or Ainsi 12x) is a closed network, i.e. not accessible to the public, often used for trade between companies, often using a modem and telephone line.

Employed labour force

Everyone who works for at least twelve hours a week (employees, self-employed, people working in a family business). The figures usually refer to the employed labour force aged 15–64 years. The internationally used definition includes everybody who works for at least one hour a week.

EPO (European Patent Office)

The European Patent Office provides a uniform application procedure for individual inventors and companies who want to protect knowledge by means of a patent in 36 European countries. For more information, see: www.epo.org.

Exports

Goods and services sold by residents to the rest of the world (non-residents). Exported goods must supplied by the Dutch economy to the foreign country. If trade and freight margins are included to the Dutch border, this is indicated by 'free on board' (f.o.b.). Exports also include spending in the Netherlands by foreign tourists, border area inhabitants, and diplomats.

External data communication

Communication via one or more computers of one company with computers of other companies.

Globalisation

The increasing international interaction of national economies.

Government consumption

Expenditure by the government for goods and services which are used for the direct satisfaction of individual or collective needs of members of the community.

Gross value added and gross domestic product (GDP)

Gross value added at basic prices per sector is equal to the difference between production (at basic prices) and intermediate consumption (at purchase prices). The sum of the gross value added at basic prices per sector, plus some transactions not allocated to sectors, is the gross value added of the total economy, the gross domestic product (at market prices). The other transactions include net product-related taxes and subsidies and imputed minus paid VAT. Gross here means that

depreciations are not subtracted from the value added. Economic growth is the volume growth of the gross domestic product expressed as a percentage.

High-tech patent applications

Patent applications in the following technology areas: computers and other automated office equipment, micro-organisms and genetic modification, aviation, communication technology, semiconductors and lasers (IPC classification). For more information, see:
http://epp.eurostat.ec.europa.eu/cache/ITY_SDDS/Annexes/pat_esms_an8.pdf

High-tech products

High-tech products are R&D-intensive products, i.e. products for space travel and aviation, computers, office machinery, electronics, instruments, pharmaceutics, electronic machinery and weapons.

ICT

Information and communication technology. The field of information systems, telecommunication, and computers. This also includes the development and operation of systems, networks, databases and websites; computer and software maintenance and development of administrative software.

ICT capital

ICT capital includes ICT goods and services used to produce other goods which have a life of more than one year in the production process. 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 consumption 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 consumption and consumption.

ICT market

The ICT market is the total 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

See section 2.2 for the definition of the ICT sector, including the Standard Industrial Classification of All Economic Activities 2008 (SIC 2008).

ICT workers

ICT workers include the occupations Programmers (514), Technical systems analysts (666), Systems analysts (714) and Informatics experts (914) from the Standard Classification of Occupations.

Imports

Imports are goods and services sold by the rest of the world to residents of the Netherlands. Imported goods are goods coming into the economic territory of the Netherlands from abroad. to. If trade and freight margins are included to the border of the exporting country, this is indicated by 'free on board' (f.o.b.).

Imports of services refer to spending by Dutch companies abroad, such as transport costs, banking costs and business travel. Payment for software produced by foreign companies is also considered as an imported service.

In government, imports refer to spending abroad by embassies. Imports by households consist of consumer goods and direct consumer spending by Dutch tourists abroad, border area inhabitants, diplomats and military personnel serving abroad.

Informatics disciplines

In this publication, informatics disciplines in higher education are determined on the basis of the international classification of education (ISCED). They include Informatics (ISCED 481) and Electronics and automation (ISCED 523). The international data refer only to Informatics.

Innovation

The development of new or significantly improved goods (product innovation) and/or the implementation of new or significantly improved production processes (process innovation). In addition, organisational and marketing innovation belong to the concept of innovation. In general terms, innovation can be divided into technological and non-technological innovation.

Technological innovation consists of product innovation and process innovation, non-technological innovation consists of organisational innovation and marketing innovation. Innovations may be new for a company, but they need not be new for the sector of industry or market. The innovation may also have been originally developed by a company or by other companies.

Intermediate consumption

Intermediate consumption includes all products used in the production process in the period under review. These may be raw materials, semi-manufactured goods and fuels, or services such as communication services, cleaning services and services of external accountants. Intermediate consumption is valued at purchase prices, excluding deductible VAT.

International Standard Industrial Classification of All Economic Activities (ISIC)

The classification of economic activities developed by the United Nations. At the two-digit level, SBI'93 and NACE Rev. 1 are the same as ISIC Rev. 3.1. A revised version will be used for statistics for 2008 and later.

Internet users

People using the internet. Most figures on internet users refer to people who used the internet in the three months preceding the survey. In this book they refer to internet users aged 12–74 years. In international ICT data, the figures refer to people aged 16–74 years.

Job

A position occupied by an employee. An employee may have more than one job at a time. For these employees a distinction is made between main job and secondary job(s). The jobs referred to in this book are usually main jobs.

Labour productivity

Gross value added in basic prices per unit of labour volume.

Labour volume

The volume of labour used in the production process, expressed in full-time equivalents (FTEs) 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.

Multifactor productivity

The part of production which cannot be attributed to separate production factors (labour, capital, energy, materials and services).

National accounts

Statistical system providing a quantitative, systematic and complete description of the economic process in a country, and its economic relations with the rest of the world.

Online shopping

Online ordering of goods or services by consumers. Online shopping is a form of e-commerce.

Producer confidence

Mood indicator for short-term developments in manufacturing production based on the opinions and expectations of manufacturing companies.

Production

Production includes the value of all goods intended for sale (incl. unsold goods) and revenues for services rendered. Production also includes products with a market value produced for the company's own use, for example software developed within the company for the company's own use. Production is valued at basic prices.

Production factors

The means of production necessary in a production process. Traditionally these are natural resources, labour and capital.

Productivity

See labour productivity

Public electronic communication network

Dutch telecommunications law defines a public electronic communication network as a transmission system, including transmission and routing equipment and other means that make it possible to transmit signals through cables, radio waves, optical or other electromagnetic means, including satellite networks, fixed and mobile terrestrial networks, electric grids used to transmit signals, networks for radio, television broadcasts, and cable networks, regardless of the information transmitted. The network should be used mainly or entirely to provide public electronic communication services, i.e. to distribute programmes to the public. The 'provision' of such an electronic communication network includes construction, operation and management, and making it available.

Public electronic communication service

Dutch telecommunications law defines a public electronic communication service as a service, usually provided for a fee, available to the public and used mainly or entirely to provide public electronic communication services, including telecommunication and transmission services on broadcasting networks. A well-known example is the provision of mobile telephone services.

Purchasing power parity (PPP)

A conversion factor for currencies which eliminates the effects of price differences, thus allowing volume comparisons of GDP components and comparisons of prices.

Radio Frequency Identification (RFID)

Technology for the remote transfer of data through radio waves with the aim of identifying or tracking objects, animals or persons. An RFID-tag – often a chip – is used as a transmitter, which is very easy to transport because of its small size. Such a tag is attached to or incorporated in the object to be tracked and the tag transmits

a unique identification number by means of radio waves. A receiver recognises this number and thus identifies the object concerned.

Re-exports

Goods imported into the Netherlands, temporarily owned by a resident, and exported again without undergoing any further processing. For example goods cleared through customs by Dutch distribution centres and supplied to other countries in Europe. Unlike transit trade, re-exports are included in imports and exports.

Research & Development (R&D)

Activity characterised by originality and innovation consisting of creative and systematic search processes for solutions to practical problems. It also includes strategic and fundamental research aimed at gaining background information and increasing pure scientific knowledge rather than at direct economic gain or problem solving. R&D also encompasses the further development of ideas and prototypes into usable processes and producible products.

R&D expenditure

Expenditure on R&D by the staff working in a company or organisation. It includes both the operating costs and the investment for this R&D.

Self-employed

People earning an income by working on their own account or at their own risk in their own business or in an independent profession, or by working in the business of a family member. Family members working in a family business are considered self-employed, unless they have a specific employment contract.

Smartphone

This type of mobile telephone has more advanced capabilities than an 'ordinary' mobile phone. Most smartphones have options for saving addresses and appointments, using mobile internet (receiving and sending email, and browsing), listening to music and watching short video clips. They may also have a built-in gps-receiver, and be able to synchronise with Microsoft Outlook or Lotus Notes and/or connect with company networks.

Turnover

Turnover is the total revenue from the goods and services sold.

Vacancy

An unfilled employment position that a company or institution is looking to fill with someone from inside or outside the company who can start work in the very near future.

Vacancy rate

The number of vacancies per 1,000 jobs (main and secondary jobs).

Volume change

The weighted average of the change in the volume of particular goods or service transactions, of the volume of value added.

Working year

A measure for the labour volume calculated by taking all jobs (full-time and part-time) in a given year and recalculating them into full-time equivalents.

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