ICT, knowledge and the economy 2013

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Explanation of symbols

.	Data not available
*	Provisional figure
**	Revised provisional figure (but not definite)
x	Publication prohibited (confidential figure)
–	Nil
–	(Between two figures) inclusive
0 (0.0)	Less than half of unit concerned
empty cell	Not applicable
2012–2013	2012 to 2013 inclusive
2012/2013	Average for 2012 to 2013 inclusive
2012/'13	Crop year, financial year, school year, etc., beginning in 2012 and ending in 2013
2010/'11–2012/'13	Crop year, financial year, etc., 2010/'11 to 2012/'13 inclusive

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

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Foreword

The Dutch information society continues to evolve. New technologies are time and again finding their way into society, while old technologies are disappearing. Devices such as tablets and smartphones illustrate the rapid pace of renewal. In 2012, 61 percent of Dutch citizens had internet access via a mobile telephone. The corresponding figure for 2010 was a mere 36 percent.
Companies are anticipating the rapidly growing technological opportunities by optimising their production processes using ICT. The emergence of the mobile internet likewise offers key opportunities for the business community. Over half of all companies are now providing their employees with devices for accessing the mobile internet. Clearly, many companies consider it important for their employees to have access to the internet anywhere.

In the publication series *ICT, knowledge and the economy*, Statistics Netherlands describes the Dutch knowledge economy. This publication series devotes ample attention to the way in which companies and households use ICT. This edition also deals extensively with the development of knowledge on the basis of Research & Development and education. The role of the ICT sector in the Dutch economy and innovation by companies are other key themes. Several capita selecta that explore these subjects in greater depth form the concluding part of this publication.

Thanks to the cooperation with the Netherlands Organisation for Applied Scientific Research (TNO) and financial support from the Ministry of Economic Affairs this publication also provides elaborate information about the telecommunications infrastructure in the Netherlands and makes numerous comparisons with other countries. In addition to the Statistics Netherlands figures, data available from other organisations is also dealt with. In addition to that provided by this publication, a great deal of numerical data is available on the Statistics Netherlands website: www.cbs.nl/ICT-knowledge-economy.

Director-General of Statistics
G. van der Veen

The Hague/Heerlen, July 2013

Contents

Summary

This publication comprises an introductory chapter, seven statistically substantive chapters and several special contributions in a concluding chapter. This summary reviews the key facts from each chapter, item by item.

1 Introduction

This chapter reviews the government's ICT and innovation policy. It also includes a theoretical model for knowledge and innovation.

ICT, R&D and innovation policy framework (1.1)

- The European Commission's (EC) 2020 target is for 3 percent of the EU's total GDP to be invested in R&D. In 2011, the R&D intensity was only 1.94 percent (OECD, 2012a).
- The Dutch government's target is for 2.5 percent of the nation's GDP to be invested in R&D by 2020 (Ministry of Economic Affairs, Agriculture and Innovation, 2011a).
- The European Commission has laid out its ICT policy in 'A Digital Agenda for Europe' (European Commission, 2010b). The EC's aim is to create conditions that transform ICT into an enabler for economic growth. In December 2012, the Commission identified seven new priorities for the period 2013–2014 (European Commission, 2012a).
- Dutch ICT policy makers base their national ICT strategies on the European policy formulated in 'A Digital Agenda for Europe'. The 'Digitale Agenda.nl' describes the Dutch ICT policy for 2011–2015 (Ministry of Economic Affairs, Agriculture and Innovation, 2011c). The emphasis of this policy document is on how to apply ICT as an enabler for economic growth.
- The innovation-related rate of spending by Dutch companies in the period 2000–2010 stayed below the GDP growth rate. Investments in ICT declined in 2009 and 2010.

Purpose of this publication (1.2)

- This publication describes the economic and social role of knowledge and technology.

Structure of this publication (1.3)

- This year, this publication contains a brief chapter on innovation. The R&D and knowledge potential subject areas are extensively dealt with in this edition.

– This chapter concludes with a theoretical model that describes the knowledge flows between government entities, universities, research institutes and companies. This model is an adaptation of the National Innovation System used by the OECD as an overarching framework for theoretical insights into a country's innovation processes (OECD, 2005; OECD, 2009).

2 ICT and the economy

ICT plays an important role in the Dutch economy. This chapter discusses the contribution of ICT to various macroeconomic indicators.

The ICT sector and the Dutch economy (2.1)

– In 2012, 4.4 percent of Dutch companies was active in the ICT sector. The corresponding figure for 2007 was only 3.8 percent. The share of the ICT sector therefore rose significantly.
– In 2011, Dutch ICT companies achieved higher revenues than in 2010. The growth amounted to 2.3 percent. Both the ICT industry and the ICT services sector achieved growth in revenues in 2011.
– In 2009, ICT companies accounted for 8.9 percent of the business sector's value added in the Netherlands. This is not above-average in an international context.
– The value added of the Dutch telecom sector was 8.4 billion euros in 2011. This represents 1.55 percent of the gross domestic product (GDP) and a further decline in the contribution of the telecom sector to the GDP.

ICT and employment (2.2)

– In 2010, 4 percent of the Dutch workforce was ICT worker. The corresponding figure for 1995 was only 3.3 percent.
– In the fourth quarter of 2012, there were 6,900 ICT job openings in the Netherlands. This represents a drop of 300 compared to a quarter earlier. The decline in the number of job openings was less pronounced in the ICT sector compared to the economy as a whole.

ICT expenditure (2.3)

– In 2010, Dutch companies and government organisations invested 4.4 percent less in ICT capital than in 2009. In total they invested 13.7 billion euros in ICT capital in 2010. As such, ICT investments represented 13.4 percent of total investments in the Netherlands.
– The 'Information and Communication' sector especially invests a great deal in ICT. In 2010, 79 percent of investments in this sector was ICT-related. Companies in the financial sector also invest a relatively high amount in ICT.

– In 2011, ICT spending in the Netherlands amounted to 48 billion euros; 15 billion euros on ICT goods and 33 billion euros on ICT services.
– Household spending on ICT dropped significantly between 2007 and 2009: from almost 14 billion euros to 12.8 billion euros.

International trade in ICT (2.4)

– In 2010, the Netherlands imported 72.3 billion euros worth of ICT. The corresponding figure for 2011 was 68.4 billion euros; a drop of 5 percent.
– In 2011, the Netherlands exported 12.9 billion euros worth of ICT. This is 6 percent higher than in 2010. The major share of Dutch ICT export concerns re-export: 82 percent in 2011.
– The Netherlands is among a group of countries with a high export value of ICT goods.
– At the end of 2012, 30 percent of the ICT goods imported by the Netherlands came from China. China's share of Dutch ICT imports at the beginning of 2003 was still a mere 12 percent.
– The Netherlands primarily exports its ICT goods to Germany, the United Kingdom and France.

3 Telecommunications

To be able to efficiently apply information and communication resources requires a solid infrastructure. The use of this ICT infrastructure is a key theme of this chapter.

Internet (3.1)

– The volume of internet traffic once again rose sharply in 2012. The Amsterdam Internet Exchange (AMS-IX) recorded 429,000 terabytes of data traffic in December 2012.
– Mobile data traffic has increased significantly in recent years. The total mobile data traffic in the Netherlands in the first half of 2008 consisted of 342 terabytes. In the same period of 2012, this volume had increased to almost 9,500 terabytes.
– In technical terms, almost all households in the Netherlands have the option of acquiring a broadband connection. The very high-speed fixed connections are accessible to virtually all households as well. This gives the Netherlands a significant lead over other countries.
– DSL and cable are by far the most often used forms of broadband in the Netherlands. By mid-2012, 51 percent of all broadband connections ran over DSL and 44 percent via cable.

– In 2012, there were 59 mobile broadband connections per 100 inhabitants in the Netherlands.

Telephony (3.2)

– In 2012, the Netherlands had 6.8 million fixed telephone connections. This is significantly less than the peak of almost 10 million which was reached in 2000.
– At the end of 2012, the Netherlands had almost 20 million mobile connections.
– The number of text messages sent declined from 5.7 billion in 2011 to 4.3 billion in 2012. The number of calling minutes declined as well, although this was limited to 2 percent. Especially the text messages are being displaced by data traffic via internet applications such as WhatsApp, Facebook and Twitter.

Television and radio (3.3)

– The number of digital television subscriptions in the Netherlands continued to rise in 2012. In total, the Netherlands had 6.3 million digital TV subscriptions. This is 3 percent higher than in 2011.
– Many Dutch households obtain multiple telecom services from a single provider. In 2012, 5.6 million subscribers had a combined package of two or more services.
– Only 13 percent of the Dutch population had ever heard of T-DAB in 2012. This is approximately the same as the year before. In 2012, 3.9 percent of the Dutch population owned a T-DAB receiver. The corresponding figure for 2011 was 3.2 percent.

4 ICT use by households and individuals

Almost every Dutch citizen has access to the internet; at home via a fixed connection or elsewhere via a smartphone. This chapter describes the devices and internet connections used by the Dutch population, as well as the popular applications.

ICT facilities in households (4.1)

– In 2012, 93 percent of households had a desktop or laptop. This amounted to 6.2 million households comprising 12.5 million individuals.
– In 2012, 94 percent of households had access to the internet. This is higher than in many other countries.
– Progressively fewer Dutch households are using a desktop computer. In 2012, this figure was 73 percent. Households are increasingly using other devices for accessing the internet.

- In 2012, 60 percent of internet users used a smartphone or laptop for mobile internet access.
- In 2010, only 21 percent of internet users had a smartphone. Two years later this figure had more than doubled.
- In 2012, one in three internet users used a laptop with mobile internet; one in five used a tablet.
- The percentage of internet users in the Netherlands is the highest in Europe: 94 percent in 2012.
- In 2012, 87 percent of all internet users accessed the internet virtually every day.

Activities and services on the internet (4.2)

- Communicating has been the most important internet activity of individuals for many years. Virtually every internet user communicated in one form or another over the internet in 2012.
- The internet is also important as a source of information. Nine in ten internet users used the internet in 2012 to search for online information on goods and services.
- In 2012, eight in ten internet users engaged in online banking.
- Almost three quarters of internet users uses a smartphone for e-mailing. In addition, it is customary to use the smartphone for playing games, listening to music or keeping up with the news.
- Social networks are the most often used form of social media in the Netherlands. Almost two thirds of Dutch internet users were active in a social network in 2012.
- In 2012, 95 percent of young internet users had a social network account.

Online shopping (4.3)

- In 2012, 9.8 million Dutch citizens had done some online shopping at one time or another. This once again represents an increase over the previous year.
- The frequency at which the Dutch population is engaging in online shopping is also increasing.
- 79 percent of internet users aged 16 to 75 in the Netherlands engaged in online shopping in 2012. As a result, the Netherlands is among a group of countries with a relatively high number of e-shoppers.
- Trips, holidays and accommodations have been the most common type of online purchases made for some years. In 2012, six in ten frequent e-shoppers booked trips and holidays online. Many people also purchase clothing, books, magazines and tickets for events via the web.
- E-shoppers especially purchase new goods and to a much lesser extent second-hand goods via the web.
- Dutch internet users primarily purchase goods from their own country.

– In 2012, 41 percent of internet users purchased digital media, such as films, music and electronic newspapers, via mobile devices.
– In 2012, 22 percent of Dutch internet users still had never purchased anything online.

5 ICT use by companies

ICT is essential for companies. New applications that help companies improve their processes and make them more efficient are constantly emerging.

The workforce and ICT (5.1)

– In 2012, 66 percent of employees regularly used a computer to perform their work. The share of employees using the internet for their work was 60 percent.
– In the Netherlands, a significantly larger proportion of employees work with the internet than the average in the EU.
– Increasingly more companies support teleworking. In 2012, the proportion of companies supporting teleworking was 58 percent. Of all employees 22 percent can telework.
– In 2011, 8 percent of companies had job openings for ICT specialists. Aside from the ICT sector, financial institutions and research institutions also had many ICT job openings. Large companies far more often have ICT job openings than small companies.
– Almost half of companies with ICT job openings had difficulty filling them in 2011: 44 percent. In the Netherlands there was a greater shortage of ICT workers than the EU average.
– In 2011, 13 percent of companies provided their ICT workers with an opportunity of taking ICT courses. A somewhat smaller proportion of companies provided non-ICT workers with an opportunity of taking an ICT course, namely 9 percent.

Internet access and use (5.2)

– In 2012, 96 percent of companies had a fixed broadband connection and 55 percent had a mobile broadband connection.
– Dutch companies have faster internet connections than the average in the EU. In 2012, 36 percent of Dutch companies had an internet connection that was faster than 30 Mbit per second. The corresponding average in the EU was 18 percent.
– In 2012, 84 percent of Dutch companies had their own website. The Netherlands scores significantly higher than the EU average of 71 percent.

- In 2011, 20 percent of Dutch companies consulted tender documents via the internet. Twelve percent of all companies submitted a tender online in response to a request for tenders.
- In 2012, 53 percent of Dutch companies gave their employees laptops, tablets or smartphones for mobile access to the internet. This is slightly higher than the EU average.
- Companies primarily provide their employees with mobile internet for e-mailing. In addition, many companies consider it important for their employees to have access to information and to company files via mobile internet.
- In 2012, 27 percent of companies considered mobile internet too expensive. Security-related issues represented an obstacle to using mobile internet for 20 percent of companies.

Software (5.3)

- In 2012, 15 percent of companies in the Netherlands applied some form of supply chain management. The corresponding figure for 2009 was a mere 5 percent.
- In 37 percent of companies, the sales order system was linked to other systems in 2012.
- In 2012, 31 percent of companies had an automated interface between their purchase order system and other business applications.
- In 2012, 24 percent of Dutch companies used ERP software. This is roughly equal to the European average.
- In the Netherlands, the proportion of companies using CRM software is also roughly equal to the EU average. This average was 26 percent in 2012, compared to 29 percent in the Netherlands.

Social media and companies (5.4)

- In 2012, 41 percent of companies used at least one form of social media.
- Most companies that use social media do so for the purpose of developing the company's image and for marketing their products (68 percent).
- Social networks are the most popular form of social media among companies. In 2012, 35 percent of companies used a network such as Facebook or Hyves.
- The ICT sector is the most active in every form of social media. Of ICT companies, 71 percent used social networks in 2012.
- Of the large companies, 67 percent used social networks in 2012. This proportion was 31 percent for small companies.

E-commerce (5.5)

- In 2011, 18 percent of companies were involved in electronic sales. Companies more often received orders via a website than via EDI in this respect.
- E-commerce is far more common among large companies than among small companies.
- Many companies in the wholesale and retail trade sell via websites: 25 percent in 2012.
- The Netherlands has somewhat more companies that sell their products via a website than the European average.
- In 1999, 3 percent of the total revenues earned by companies in the Netherlands were derived from e-commerce. The corresponding figure for 2011 was 13 percent. In the EU, on average 15 percent of operating revenues was derived from e-commerce.
- The average company realised 47 of its web revenues in 2011 from consumer sales versus 53 percent from sales to other companies and government organisations.
- In 2011, 12 percent of Dutch companies made purchases via e-commerce.

6 An international perspective of innovation

This chapter puts the Dutch figures on innovation in an international perspective. Is the Netherlands more innovative than other countries?

Innovative companies (6.1)

- According to the broad innovation concept, 57 percent of Dutch companies were innovative during the 2008–2010 period. This places the Netherlands in the middle group in Europe.
- The Netherlands has a relatively large share of companies that exclusively devote themselves to technological innovation.

Technological innovation (6.2)

- During the period 2008–2010, 47 percent of Dutch companies were working on technological innovations. In the overall EU, 39 percent of companies were technologically innovative.
- In 2010, Dutch companies realised approximately 10 percent of their joint revenues from new products. In the overall EU, companies realised 13 percent of total revenues from new products.
- In the period 2008–2010, one in three Dutch innovators was engaged in innovative activities in collaboration with others. In the overall European Union this was an average of one in four.

Non-technological innovation (6.3)

- During the period 2008–2010, 38 percent of Dutch companies were non-technologically innovative: they introduced new organisational methods or renewed their marketing techniques. In Europe, this proportion was 41 percent.
- The Netherlands had an average share of companies with new organisational methods: 30 percent. The corresponding average in the overall EU was 31 percent.
- In the Netherlands, 23 percent of companies implemented new marketing methods in the period 2008–2010. The corresponding figure for the EU as a whole was 27 percent.

7 Research and development

Research and development (R&D) are important for an economy that primarily competes on knowledge. R&D is not exclusively a matter for the business sector; it is also important to science.

R&D in the Netherlands (7.1)

- In 2011, Dutch companies and institutions spent over 12 billion euros on R&D.
- The Dutch business sector carried out over half of all R&D in the Netherlands: 56 percent.
- In many other EU countries the business sector's share of total R&D spending is higher than it is in the Netherlands.
- In 2011, Dutch companies and institutions together devoted 116,000 FTEs labour input to R&D. Here too companies accounted for the largest share: 63 percent.
- The R&D intensity in the Netherlands was 2.0 percent. This is slightly higher than the EU-27 average of 1.9 percent.

R&D in the business sector (7.2)

- Industry accounted for the largest share of R&D spending by the business sector: 58 percent.
- The services sector's share of the total R&D spending by companies was much smaller: 37 percent.
- Almost 85 percent of companies engaged in R&D in 2011 had fewer than 50 employees. These companies accounted for 20 percent of total R&D spending and 32 percent of R&D personnel.
- In 2011, R&D spending by the business sector represented 1.1 percent of the Dutch GDP. The EU average was 1.2 percent.

R&D in the higher education sector (7.3)

- In 2011, institutes of higher education spent almost 4 billion euros on R&D. As such they generated one third of total R&D spending in the Netherlands.
- This amount has almost doubled since 2000.
- In 2011, the field of science 'health' comprised one third of the total research effort of the higher education sector.
- The R&D expenditure of the higher education sector in the Netherlands is higher than in many other countries.

R&D by public research institutes (7.4)

- In 2011, R&D spending by public research institutes in the Netherlands was 1.3 billion euros. This represents 11 percent of total R&D spending.
- Employment of R&D personnel in public research institutes declined between 2000 and 2011 from almost 14,000 to over 11,000 FTEs.

Funding of R&D (7.5)

- In 2011, total R&D spending in the Netherlands using in-house personnel was 12.1 billion euros. Of this, the business sector financed over 6 billion euros.
- In 2011, 4.3 billion euros originated from government; this represents 36 percent of the total.
- Funding from abroad accounted for 11 percent of R&D funding.
- Companies spend most of the funds they free up for R&D within their own company or with other companies in the Netherlands. In 2011, this was 5.6 billion euros of the 7.3 billion euros that companies spent in total on R&D.
- In 2011, Dutch companies financed 1.2 billion euros of R&D abroad.
- In the Netherlands, the indirect financing (tax credits) of R&D by government is greater than its direct financing. This is also the case in France, the United States and Denmark.

8 Knowledge potential

Human capital is the key theme of this chapter. A great deal of attention is devoted to education in the Netherlands, particularly to the natural sciences, ICT and technology fields of study. The chapter concludes with a section about the ICT skills of Dutch people.

Education in the Netherlands (8.1)

- A growing number of younger people are enrolling in education programmes. Increasing numbers of students are staying in school when they are no longer required to attend school or resume their education after a break.

- In the 2003/'04 school year 36,000 students obtained their senior general secondary education (HAVO) diploma. In 2011/'12 this number had increased to 42,000.
- In 2003/'04 27,000 pre-university (VWO) students passed their exams. In 2011/'12 this number of graduates had risen to 33,000.
- In the senior general secondary education (HAVO) stream, the percentage of graduates with a science profile increased from 27 percent in the 2003/'04 school year to 36 percent in 2010/'11. In pre-university education, this share increased from 46 percent to 55 percent.
- The number of senior secondary vocational education (MBO) graduates has been increasing every year since the 2000/'01 academic year. In 2000/'01 129,000 MBO students obtained their diploma; in 2010/'11 there were 175,000.
- In the 2012/'13 academic year 422,000 students were enrolled in higher professional education (HBO). The corresponding figure for 2000/'01 was only 313,000.
- The number of students enrolled in university education (WO) progressively rose between 2000/'01 and 2011/'12. In the 2000/'01 academic year, 166,000 students were enrolled in a university education programme. Eleven years later this had risen to 245,000.
- Fewer students were enrolled in higher professional education (HBO) and university education (WO) in the 2012/'13 academic year than the previous year and for both of these forms of higher education this represented an end to a period of uninterrupted growth.
- In the 2011/'12 academic year the 'engineering, manufacturing and construction' and 'natural science, mathematics and computing' science fields of study together made up 14 percent of all HBO bachelor's degrees.
- More first-year students are enrolled in the HBO 'computing' and 'natural science and mathematics' education programmes in 2012/'13 than four years previously. The number of HBO graduates in these fields of study could therefore increase over the coming years.
- In the 2011/'12 academic year the science fields of study together made up 15 percent of all WO bachelor's degrees. The corresponding figure for WO master's degrees was 16 percent.
- In all science fields of study the number of first-year students enrolled in university (WO) programmes in the 2012/'13 academic year is higher than in 2008/'09. The number of WO graduates in these fields of study could therefore increase over the coming years as well.
- In 2012, 16.5 percent of the Dutch population aged 25 to 65 participated in a training programme or took a course. This is far above the EU average of 9 percent.

– In 2011, almost 1.5 million people aged 15 to 65 participated in a training programme or took a course in the context of post-initial education.

Knowledge in the Netherlands and in an international context (8.2)

– For Dutch citizens who are going to study abroad, English-language countries are attractive. In 2010, almost 30 percent of these students studied in the United Kingdom; 11 percent departed for the United States or Canada. In addition, the neighbouring countries Belgium and Germany are especially popular.
– Approximately 53,000 individuals with a foreign nationality studied in the Netherlands in 2010. A large proportion of them came from Germany: 45 percent.
– In 2010, the number of foreign students in the Netherlands was approximately 2.5 times as high as the number of Dutch students abroad. This same proportion on average applies to all EU countries.
– In 2010, 32 percent of the Dutch population aged 25 to 65 was highly educated. In Denmark and Spain, the proportion of people with a high education was approximately the same as in the Netherlands. In Japan and the United States, this proportion is much higher.
– The increase in highly educated individuals in the Netherlands is much higher than in many other countries. This increase in the Netherlands was 42 percent in 2010.
– In comparison with other countries, the proportion of graduates in science fields of study in the Netherlands is low. Dutch women in particular are poorly represented in science fields of study.

ICT skills (8.3)

– In 2012, 29 percent of Dutch computer users had many computer skills. One in five had few skills and one in ten had no skills.
– 43 percent of men had many computer skills, while this percentage was 15 percent for women.
– The computer skills of the Dutch population have barely increased since 2006.
– In 2012, 43 percent of the Dutch population aged 75+ had used a computer at one time.
– Of these older computer users, 2 percent had many computer skills. Almost one in three had few skills and more than half had no skills.
– Over a quarter of Dutch internet users had many internet skills in 2012. Almost half of internet users had few internet skills.
– One in three men had many internet skills in 2012. Among women this was one in five.
– In 2012, 61 percent of internet users had average skills or many internet skills. The corresponding figure for 2006 was only 46 percent.

– In 2012, 34 percent of the Dutch population aged 75+ had used the internet at one time.
– A quarter of these older internet users had no internet skills. Seven in ten had few such skills and eight percent had average internet skills.

9 Capita selecta

The last chapter of this publication contains three contributions that broaden and deepen the theme of this publication.

Social media and business (9.1)
– This article explores the background to the use of social media in the business sector in further detail.
– In addition, it describes a number of analyses that supplement the figures in section 5.4 concerning the ways in which companies use social media.

Cooperative patent applications (9.2)
– This article explores the question of how often a Dutch company submits a joint patent application to the Netherlands Patent Centre (NLOC) and to the European Patent Office (EPO).
– In addition, this article investigates whether companies that jointly apply for a patent are more productive than companies that apply for a patent on their own.

Review of Marktplaats (Market Place) users (9.3)
– This article describes an analysis of the data submitted to Statistics Netherlands by Marktplaats (a subsidiary of eBay).
– It sketches a picture of the regional distribution of the use of Marktplaats and the characteristics of the Marktplaats user.

Key indicators, national

	2006	2007	2008	2009	2010	2011	2012
ICT and the economy[1]	**% volume change on previous year**						
ICT-investments	11.8	5.8	4.4	–7.6	–4.4	.	.
ICT sector production value	4.5	4.0	2.3	–4.9	1.9	2.3	.
ICT sector employed persons labour volume	3.8	3.6	4.1	–2.4	–2.1	1.7	.
ICT sector gross vaue added	6.0	7.1	3.4	–4.2	2.2	2.3	.
of which							
ICT manufacturing sector	–1.1	6.0	0.6	–12.1	20.2	7.0	.
ICT services sector	6.7	7.2	3.6	–3.5	0.7	1.8	.
Companies in the ICT-sector[2]	**number**						
Total	.	36,475	40,430	44,650	46,985	50,230	54,705
ICT and labour	**number x 1,000**						
Job openings in the ICT sector	11.4	11.5	12.2	5.3	7.0	7.9	7.0
Telecommunications infrastructure	**number x mln**						
Fixed telephone connections: PSTN+ISDN[3]	5.8	4.5	3.9	3.5	3.0	2.6	2.4
Fixed telephone connections: VoIP[3]	1.6	2.4	2.9	3.4	3.8	4.2	4.4
Mobile telephone connections	17.1	18.5	19.7	19.7	19.2	20.1	19.9
Broadband connections: Cable[3]	1.9	2.1	2.2	2.4	2.6	2.8	2.9
Broadband connections: ADSL[3]	3.0	3.4	3.6	3.6	3.6	3.4	3.3
Broadband connections: Optical fibre[3]	.	.	.	0.1	0.2	0.3	0.3
Digital television connections: Satellite[3]	0.7	0.8	0.9	0.9	0.9	0.8	0.8
Digital television connections: Cable[3]	1.0	1.6	2.0	2.5	3.0	3.4	3.6
Digital television connections: Terrestrial[3]	0.3	0.5	0.7	0.9	0.9	0.8	0.8
Digital television connections: IPTV[3]	0.1	0.2	0.3	0.3	0.7	1.0	1.2
ICT use by households and individuals	**% of total**						
PC ownership households[4]	84	86	88	91	92	94	93
Internet access households[4]	80	83	86	90	91	94	94
Broadband access households[4]	66	74	74	77	84	83	82
Electronic shopping individuals[5]	61	66	67	75	77	79	80
ICT use by companies[6][7][8]	**% of companies**						
Companies with internet access	99	99	96	98	100	.	100
Companies with broadband internet	87	85	86	90	93	.	97
Companies with a website	80	86	84	82	83	.	84

Source: Statistics Netherlands; TNO for telecommunications infrastructure.

1) Figures for 2010 and 2011 are provisional.

2) Provisional figures.

3) The figures for 2012 are up to and including the 2nd quarter of 2012.

4) Private households with at least one person aged 12 up to and including 74 years.

5) Of individuals with internet use.

6) Companies with ten or more employees.

7) Due to a change in methodology, the figures from 2008 onwards are not easily comparable to the figures for earlier years.

8) For the period 2006–2010 this concerns the situation in December of the relevant year. The 2012 figure pertains to January 2012.

Key indicators, international

	EU-15	EU-27	Bel-gium	Den-mark	Fin-land	France	Ger-many	Ire-land	Nether-lands	Swe-den	United King-dom	United States
ICT and the economy	**%**											
Contribution of ICT sector to the value added of the business sector, 2009	.	.	7.1	9.1	10.9	7.4	7.1	11.4	8.9	10.9	9.6	9.4
Share of employed ICT workers, 2010[1]	.	.	3.1	4.4	4.5	3.1	3.5	.	4.0	5.4	3.3	4.0
Telecommunications infrastructure	**number per 100 inhabitants**											
Fixed telephone connections, 2011	.	.	.	45	20	63	63	.	43	.	53	47
Mobile telephone connections, 2011	.	.	.	128	166	95	132	.	120	.	131	93
Broadband connections, June 2012[2]	.	.	.	38	30	36	34	.	39	.	34	28
Optical fibre connections, June 2012	.	.	.	6	0.6	0.4	0.2	.	1.8	.	0.9	2
ICT use by households and individuals, 2012	**% of total**											
Households with internet access	.	76	78	92	87	80	85	81	94	92	83	.
Households with broadband internet	.	72	75	85	85	77	82	65	83	87	80	.
Individuals making online purchases[3][4]	.	44	45	70	65	57	65	46	69	74	73	.
ICT use by companies, 2012[5]	**%**											
Companies with broadband Internet	94	92	94	93	100	98	91	91	98	97	93	.
Companies engaged in electronic selling[6]	15	14	23	26	17	11	22	23	18	27	18	.
Share of revenues in 2011 generated by e-commerce	15	15	14	.	18	14	17	21	13	20	19	.
Research & Development (R&D)	**% of GDP**											
R&D intensity, 2011[7]	2.08	1.94	2.04	3.09	3.78	2.25	2.84	1.72	2.04	3.37	1.77	2.77

Sources: Statistics Netherlands; TNO for telecommunications infrastructure; OECD, Eurostat.

1) As a percentage of the labour force (narrow definition). The narrow definition of ICT workers is based on the methodology described by the OECD (2004).
The percentages of the United States are not directly comparable with those of European countries because the classifications have not been harmonised.

2) Excluding mobile connections.

3) Individuals aged 16 up to and including 74 years who made online purchases in the twelve months prior to the survey.

4) Denmark, the Netherlands: 2011 instead of 2012.

5) Companies with ten or more employees, limited number of sectors (see section 5.1).

6) Electronic sales of 1 percent or more of the company's total sales value (revenues).

7) Provisional figures.

1. Introduction

This chapter first reviews the government's ICT and innovation policy. What are the spearheads in the Netherlands and in Europe? The chapter continues with a reading guide for this publication. Finally, a theoretical model concerning knowledge and innovation is discussed which demonstrates how various aspects of the knowledge economy are interrelated.

1.1 ICT, R&D and innovation policy framework

For affluent countries, knowledge is an important means for ensuring continued economic growth. The strategy of acquiring market share by competing on price cannot hold its own for any length of time on existing markets. Innovation makes it possible to secure a competitive advantage over other market players by developing new products or processes.

Trade in knowledge

In a knowledge economy, companies and institutes invest in research. In addition, they trade in the knowledge that they have acquired via research. This trade in knowledge manifests itself in many ways. Part is because companies and institutes recruit 'knowledge workers'. These are employees who have specific knowledge and skills. In addition, the trade in knowledge is effected by companies that contract out their R&D or invest in ICT. Furthermore, knowledge itself can be sold, for example via patents. Certain knowledge flows cannot be expressed in monetary terms and are consequently not directly measurable. Examples include cross-border knowledge flows within multinational companies and the exchange of knowledge that takes place in collaborative projects. The trade in knowledge is essential to economic growth because it causes companies and institutes to share their knowledge with each other. As a result, knowledge is optimally translated into innovations: new applications that can produce profits.

New sectors

Innovations appearing on the market can result in the creation of new sectors (Bos and Stam, 2011). Entrepreneurs can explore the potential of new economic

activities through experimentation. Although the success of such experimentation is unpredictable, it can help to define the future economic structure, such as the emergence of internet providers in a technological sense and, in a non-technological one, low-cost air carriers in commercial aviation. In a process of creative destruction (Schumpeter, 1942), innovative newcomers give rise to new branches of industry that supplant old ones. This approach puts more emphasis on the importance of new companies than on that of established companies.

Successful innovation has a higher chance of advancing in a properly functioning network of companies and knowledge institutes that invest in research and development (R&D) (Statistics Netherlands, 2010). An economy therefore benefits from government policy focused on companies and institutes that jointly develop knowledge. The following section deals with the most important knowledge ambitions and ICT spearheads at the European and the national level.

European knowledge policy

The European Commission (EC) launched the 'Europe 2020 Strategy' in March 2010 (European Commission, 2010a). According to this strategy, the European Union (EU) must, in addition to being a political and economic union, also be an innovative one by 2020. The purpose of the 'innovation union' is to improve preconditions and access to funding for research and innovation so that innovative ideas more quickly produce products and services that drive growth and create jobs. To this end, the European Commission is working to improve links between systems for research and innovation within the EU, to foster top universities of international repute, to lower thresholds for entrepreneurs, and to intensify cooperation between science and the business sector. The European Commission believes that innovation will increase Europe's competitiveness. The 2020 target is for 3 percent of the EU's total GDP to be invested in R&D. In 2011, the R&D intensity was 1.94 percent (OECD, 2012a).

Knowledge policy in the Netherlands

The national-level commitments concerning the main objectives of the Europe 2020 Strategy are contained in the National Reform Programme. The Netherlands has announced that it wants to have more knowledge converted into new products and services. Although the European Commission's target is 3 percent for Europe, the Dutch government's target is for 2.5 percent of the nation's GDP to be invested in R&D by 2020 (Ministry of Economic Affairs, Agriculture and Innovation, 2011a).

The government is calling on universities and research institutes to provide greater encouragement to researchers to undertake valorisation-related work. Valorisation is the process through which knowledge is converted into commercially feasible products, processes or services.
By means of a 'top sector approach', the Dutch government works together with companies and knowledge institutes to strengthen economic activities that are currently or potentially competitive. A knowledge and research agenda is being prepared for each 'top sector', such as energy, high-tech materials and systems, the agro-food industry, the creative industries and life sciences (Ministry of Economic Affairs, Agriculture and Innovation, 2011b). In September 2012, the Ministry of Economic Affairs reported on the progress of the top sector approach and reported a number of advances (Ministry of Economic Affairs, 2012). The ministry has freed up funds for creating favourable fiscal preconditions for R&D and for financing innovative entrepreneurship. In addition, the government is attempting to reduce the burden imposed by laws and regulations. The business community, knowledge institutes and government organisations are working on innovation via joint innovation contracts. They are also taking initiatives designed to create a better fit between education and work, and to interest more people in an engineering or science education. Finally, government is taking initiatives designed to promote the export of the top sectors.

The central government drew up the 'Knowledge Investment Agenda 2006-2016' (KIA) at an earlier stage (Innovation Platform 2006; Dutch House of Representatives, 2009; Ministry of Education, Culture and Science, 2009). According to this agenda, the knowledge and creativity of people in the Netherlands will determine the country's future. In addition to an investment plan, which was to provide up to as much as an additional 12 billion euros in public and private structural knowledge investments each year, the KIA also set out three goals. The first goal was to realise the best possible educated labour force with as guideline the principle that everyone should be able to discover, develop and use their own talents. The second goal was to become and remain a world leader in a number of key scientific areas and to make better use of knowledge. Finally, the KIA's goal was for the Netherlands to be among the top five of the world's most competitive knowledge economies and a European leader in terms of sales generated by companies through innovation.
In 2010 it became clear that the goals specified in the KIA were not feasible in practice. The key reason was that companies and government were not investing enough in education, research and innovation. According to a KIA report, existing companies did not sufficiently innovate and the increase in new innovative companies turned out to be inadequate (KIA, 2010a). In a revised version of the KIA agenda in 2010, the government made the goal of becoming one of the five

best performing knowledge and innovation countries measurable. By 2020, public spending on knowledge and innovation in the Netherlands must have structurally grown by between 4.5 billion and 6 billion euros per year.[1)] By 2020, private investments must structurally have increased by between 2.5 billion and 4.5 billion euros per year (KIA, 2010b).

Europe's Digital Agenda

The European Commission has laid out its ICT policy in 'A Digital Agenda for Europe' (European Commission, 2010b). The Commission's objective is to maximise the economic and social potential of ICT, and especially the internet: 'The overall aim of the Digital Agenda is to deliver sustainable economic and social benefits from a digital single market based on fast and ultra-fast internet and interoperable applications.'

The EC's aim is to create conditions that transform ICT into an enabler for economic growth. One of the objectives is to promote the internal digital market in the EU so that consumers have greater choices and products benefit from a greater sales area. The European policy also focuses on the security and reliability of digital networks and services. If there are any doubts concerning security or protection of privacy on the internet, people will resist making intensive use of the internet. The Commission views access to very fast internet as a necessary condition for facilitating new services as a means of realising economic growth. The objective consequently is for every European to have access to fast internet at a reasonable price. The policy's progress and the impact of measures are reported each year in the 'Digital Agenda Scoreboard' and the 'Annual Progress Report'.

In December 2012, the Commission identified seven new priorities for the period 2013–2014 (European Commission, 2012a). The first is a new broadband regulation designed to stimulate companies to invest in very high-speed broadband networks. Furthermore, the EC wants to promote digital government services. In addition, the Commission wants the labour force to acquire sufficient digital skills as a means of filling ICT job openings and reduce unemployment. Internet security is also a high priority for 2013–2014. As a fifth area for action, the European Commission wants to promote an internal market for digital products and services by modernising copyrights. Aside from this, the EC wants to introduce cloud computing initiatives. A last priority is to develop a strategy for the electronics industry, especially the micro- and nano-electronics industry.

[1)] In real terms, on top of the already foreseen growth, 2010 price levels.

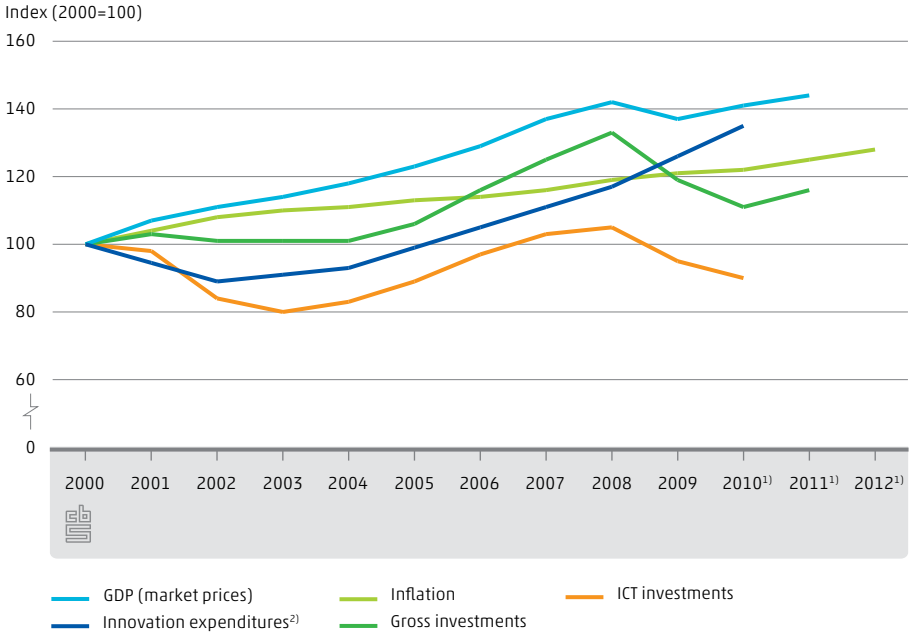
The 'Digitale Agenda.nl'

Dutch ICT policy makers base their national ICT strategies on the European policy formulated in 'A Digital Agenda for Europe'. The 'Digitale Agenda.nl' describes the Dutch ICT policy for 2011–2015 (Ministry of Economic Affairs, Agriculture and Innovation, 2011c). The emphasis of this policy document is on how to apply ICT as an enabler for economic growth. The first assumption in this regard is the conviction that smart ICT-based entrepreneurship contributes to providing entrepreneurs with additional entrepreneurial and innovative opportunities. This is evident in the desire to reduce the government's degree of regulation, for example, by making it easier for companies to electronically exchange information with the government. The government also wants to increasingly make government data available to entrepreneurs as a means of enabling them to use this data for supplying new products or services. The government also believes that there is room for increased scale by working within a common European market. ICT can facilitate such increase in scale to a significant degree.
The second assumption is that an open, accessible, secure and fast ICT infrastructure is of major importance for creating a sound entrepreneurial climate. Sufficient confidence in the security of ICT is a prerequisite for making extensive use of ICT. This is why the government is focused on measures designed to increase confidence in ICT, as well as its security.
A third key factor is for companies to have sufficient ICT knowledge and to effectively use this knowledge. The 'Digitale Implementatie Agenda.nl' proposes specific measures designed to achieve the objectives in each of these areas.

Spending on innovation stays up to par

In 2009, a period of steady economic growth came to an end in the Netherlands. The economic decline manifested itself in various facets of the Dutch economy. In 2009, GDP fell by around 4 percent relative to 2008, and a sharp drop occurred in investments, while inflation gradually increased. In 2010, the GDP recovered somewhat and this recovery continued on into 2011. Figure 1.1.1 illustrates the trend of several key economic variables over the past few years and compares these variables with spending on innovation and investments in ICT. This makes it possible to properly assess how these knowledge indicators have evolved over the last decade.

1.1.1 Innovation expenditures and ICT investments in economic perspective, 2000-2010



Source: Statistics Netherlands, National Accounts and R&D surveys.

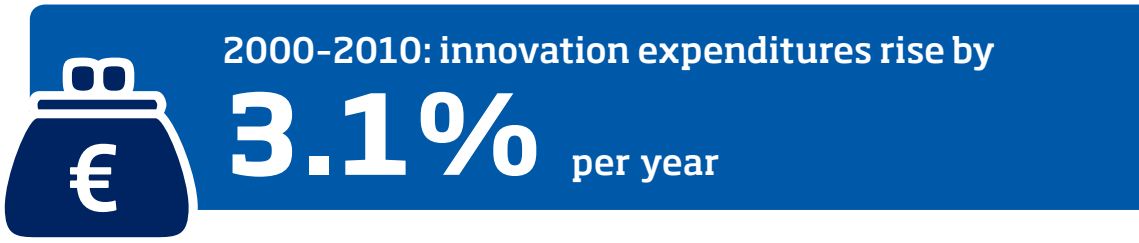
1) Provisional figures.

2) Figures on innovation expenditures are only available for even years.

The innovation-related rate of spending by companies in the period 2000–2010 stayed below the GDP growth rate. On average, innovation spending over this period increased by 3.1 percent annually, while the GDP on average rose by 3.5 percent per year. After 2002, innovation spending rose faster than the GDP, however. Even when the economic decline began, innovation spending continued to increase. ICT investments peaked around 2000, though contraction set in quickly following the end of the internet hype on the financial markets. These investments would be on the rise again since 2004, however. In 2007 they exceeded the 2000 level for the first time. This growth was driven by substantially increased investments in software (Statistics Netherlands, 2011). ICT investments once again declined in 2009; a decline that persisted through 2010.

An extended period of lower than GDP growth in innovation spending and ICT investments would appear to be unfavourable. After all, they are an indicator of the level of entrepreneurial confidence and as such they are important indicators of future economic growth. It is also important, however, for the growth rate of innovation expenditures and investments to at least exceed the rate of inflation and

over the longer term this was indeed the case with respect to innovation spending. The growth in ICT investments only exceeded the rate of inflation from 2004 until and including 2007; a period in which the economy had been growing for some time. It is well known that investments generally exhibit a delayed response to economic growth.



A qualification must be made with respect to interpreting this figure, however. Although innovation expenditure and ICT investments do indeed tell us something about innovation-related efforts and the importance of ICT as a factor of production, they do not in themselves provide a good indication regarding the quality of the knowledge infrastructure, since this infrastructure depends on many factors, such as the degree to and way in which the business sector, government organisations, institutes and universities cooperate. Increased spending on innovation or ICT does not always result in increased actual innovation.

1.2 Purpose of this publication

This publication describes the economic and social role of knowledge and technology. The various chapters include frequent comparisons of developments in the Netherlands with those in other countries. This publication is the third edition of an annual series and was prepared in cooperation with the Netherlands Organisation for Applied Scientific Research (TNO) and with support from the Ministry of Economic Affairs.
ICT, knowledge and the economy is descriptive in nature. As regards its structure, the guideline for this publication is the availability of official statistics about the themes ICT, R&D and innovation, and the description of the interfaces between them.
This publication provides background information, knowledge and assessment frameworks for a broad target group of policymakers, researchers and companies. For this reason, the publication aims to present a broad overview of available figures and show the interrelationships between the subjects described.

The terms and statistical data contained in this publication are largely determined in consultation with other statistical agencies in the European Union. Eurostat, the statistical office of the European Commission, plays a coordinating role in this regard, which makes it possible to accurately reflect Dutch performance relative to other European countries. International comparisons are therefore frequently made. The definitions and classifications that Eurostat uses, often remain in keeping with those of the Organisation for Economic Cooperation and Development (OECD), which also makes it possible to compare figures concerning the Netherlands with those of non-European countries.
A special page of the Statistics Netherlands website (www.cbs.nl/ICT-knowledge-economy) contains documents that augment this publication. One of these documents is a statistical annex that contains a few tables that provide additional statistical information.

1.3 Structure of this publication

The key to developing new economic activities is for companies to innovate. If the knowledge and skills of the labour force continue to lag the international scene, the Netherlands will not be able to compete as effectively with other economies on knowledge. A current picture of the Dutch knowledge economy is crucial in terms of properly identifying developments. This publication illustrates this picture with a core section on ICT that remains a feature each year, and a rotating section on R&D and innovation.

ICT foundation, rotating section on R&D and innovation

Telecommunications and the way in which households and companies use ICT, constitute the core of the ICT theme in this publication. These subjects will be featured each year. The figures are for the most part taken from official, European harmonised annual statistics. The chapter on telecommunications concerns a cooperative arrangement with the Netherlands Organisation for Applied Scientific Research (TNO). The ICT infrastructure described in this chapter is a necessary condition for using ICT.
The section of the publication that deals with R&D and innovation will change each year in connection with the two-year cycle of the innovation survey. Every two years, the Community Innovation Survey (CIS) is carried out in a harmonised way in all EU Member States. The results of this survey will be presented in this publication as soon as they become available. New national findings about innovation will

appear in all even years. This means that since 2012 this publication extensively discusses the figures concerning innovation in even years. The international findings of the CIS survey are also available in odd years. In odd years, this publication includes a short chapter on innovation whose central theme is focused on international comparisons. Due to the two-year innovation cycle, R&D also has a two-year cycle. In odd years this series include an elaborate chapter on R&D. In even years the R&D topic is only discussed in summary form. New R&D-related findings are published every year.
In addition to the subjects mentioned, this series also focuses on knowledge potential in the Netherlands. This subject, together with the related R&D theme, is extensively discussed in odd years. In even years, the knowledge potential subject does not form part of the publication. The rotation of subjects results in a publication series in which the emphasis is on knowledge development in odd years and on technology and application in even years.
This publication deals with the subjects ICT, R&D and innovation, and explains their interrelationship. This is manifested in a specific focus on the ICT sector in the sections dealing with R&D and innovation. In addition, this publication describes the way in which R&D-intensive sectors use ICT.

Reading guide

The next section provides a short description of the contents of each chapter in this publication.

Chapter 2 deals with the contribution of ICT to the Dutch economy. The subjects addressed in this chapter include the ICT sector and the Dutch economy, ICT-related employment, ICT expenditures and international trade in ICT.

Chapter 3 focuses on the telecommunications infrastructure in the Netherlands. The various sections in this chapter focus on the most important services of the telecom sector, namely the internet, telephony, radio and television.

Chapters 4 and 5 present the way in which households and companies use ICT. Chapter 4 is focused on households and individuals. The first section in this chapter surveys the ICT facilities. The second section provides an overview of the most important internet activities of Dutch citizens. The section also discusses the diversity of internet activities. The last section of this chapter deals with online shopping.

Chapter 5 discusses how companies apply ICT. This includes specific attention to the differences between various sectors and between large and small companies.

The first section describes how company employees use ICT. The internet is the central theme of the second section: what type of internet connections do companies have and how do they use the web? The third section in this chapter devotes attention to software applications used in business. This is followed by a section that deals with the way in which companies use social media. The chapter ends with a section on the e-commerce theme: online purchasing and selling.

Chapter 6 on innovation describes the findings of the most recent European survey on innovation among companies, using 2008–2010 as the reference period. International comparisons form the key theme of this chapter. It focuses on the share of innovative companies, broken down by technological and non-technological innovation.

Chapter 7 describes the findings of the R&D survey among companies and the public sector in 2011. The first section discusses the overall R&D picture in the Netherlands and provides a comparison of the R&D expenditures in various sectors. The second section deals with the R&D activities of companies in the Netherlands. The third section deals with R&D in higher education and the fourth section deals with R&D conducted by public research institutes. The chapter concludes with a section that covers the degree to which various parties in the Netherlands finance R&D.

Chapter 8 describes the knowledge potential present in the Netherlands. The first section deals with the figures about participants in the various education levels in the Netherlands. This section also includes data about the graduates in various fields of study. The second section deals with the figures about incoming and outgoing students: foreign students in the Netherlands and Dutch students abroad. In addition, the section deals with the education level of the labour force and the share of science and ICT students in higher education. The concluding section of this chapter discusses the computer and internet skills of the Dutch population.

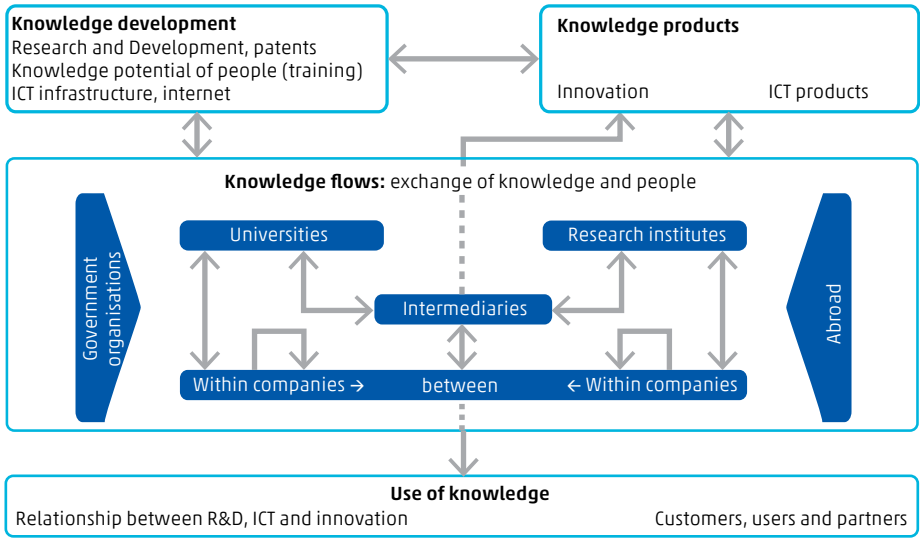
The concluding chapter of this publication contains a number of capita selecta. These concern in-depth contributions that deal with subjects covered elsewhere in this publication.

A knowledge and innovation model

Knowledge and collaboration are recurring themes in this publication. The National Innovation System (NIS) is a model which is based on these concepts. It describes the knowledge flows between government entities, universities, research institutes

and companies. The model also describes the flow among companies and the interactions with foreign countries. The concept for this model appeared for the first time in an analysis of technological innovation in Japan (Freeman, 1988). After the OECD further developed the model it acquired a recognised status. In the meantime the OECD has been using the model as an overarching framework for theoretical insights into a country's innovation processes (OECD, 2005; OECD, 2009). The model contributed to the establishment of common indicators by various countries. These indicators make it possible to evaluate various aspects of the model more accurately in international terms.

1.3.1 National innovation system[1)]



Source: TNO, Statistics Netherlands.

1) The NIS has been adapted. The upper block (R&D, knowledge potential, ICT infrastructure) is the input and has a direct relationship with the output (Innovation and ICT products). The middle block is the throughput (Knowledge flows); two types of throughput are displayed in the lower block. Knowledge products are related to output.

Figure 1.3.1 shows the building blocks used to describe the knowledge economy, including aspects that are dealt with in greater detail in this publication. The model consists of four parts that are explained below.
In countries that have a well-functioning system of innovation, all elements of the model are well-developed. Applied research is a key condition for ensuring the sustained dynamism of an innovation system. The quality and quantity of research, its market orientation and the commercialisation of knowledge ensure the continued flow of knowledge, which keeps a country's innovation system dynamic (Nauta and Gielen, 2009).

Knowledge development

The first part (top left) consists of research and development, knowledge potential and ICT infrastructure. These are preconditions for ultimately achieving innovation. Research in companies and institutes forms the knowledge basis for product development.

The scope of R&D activities indicates a country's or sector's level of ambition with respect to investing in knowledge, rather than merely using knowledge developed elsewhere. The OECD has harmonised the description of R&D for various countries. The terms and definitions used are set out in the Frascati Manual (OECD, 2002). Patents form an important outcome of a country's R&D activities. When companies and institutes file many patent applications this is an indication of a knowledge-intensive economy.

Knowledge potential in practice often concerns a highly educated labour force. Although all studies in higher education are important within a knowledge economy, greater value is usually attributed to studies in natural sciences and engineering and technology. It is precisely these fields of education that produce future R&D personnel. Knowledge potential also concerns lifelong learning; that is, the continuous development of skills and knowledge through the completion of education programmes and training courses both in work-related and leisure contexts.

ICT infrastructure concerns investments and services on which an information society relies. ICT can in itself be an innovation. More than this, however, it is also what is known as an 'enabling technology': ICT makes other innovations possible. Moreover, knowledge can be disseminated more quickly and made available at virtually all times and places through internet and broadband networks.

Knowledge products

Innovations are knowledge products. They are an expression of a society's capacity to reinvent and revitalise itself. This capacity is a crucial factor in economic growth. Innovation is the development of new or significantly improved products (product innovation) or the introduction of new or significantly improved production processes (process innovation). Innovation roughly consists of two main categories: technological and non-technological innovation. The focus with respect to innovation has traditionally been on its technological aspect; on what a company produces (product innovation) and on how the company produces it (process innovation). Non-technological innovation concerns organisational innovation and marketing innovation. These four innovation concepts are described in the Oslo Manual, an internationally used document prepared in cooperation between the EU and the OECD that contains guidelines for measuring innovation in companies (OECD, 2005).

The model in Figure 1.3.1 views innovation as a system. It presents innovation as an interactive process that requires different actors to intensively communicate with each other. Users of knowledge, such as companies, government organisations and universities, constitute the innovation system through mutual relationships of exchange. This system supplies the infrastructure that enables the kind of economic modernisation through which a country or region can remain internationally competitive.
ICT is a key field of innovation. The spread of the internet through television, smartphones and navigation systems illustrates how ubiquitous this technology has now become. Due to its many manifestations, ICT can also be classified as a 'general purpose technology' that creates the infrastructure through which companies can innovate on an extensive scale (Statistics Netherlands, 2010).

Knowledge flows

Intensive cooperation enables organisations to develop and exchange their knowledge more quickly and effectively. A successful economic system often has intensive, interactive networks between companies, knowledge institutes and government organisations. These connections ensure a continuous flow of knowledge, resources and talent. The mutual benefit of cooperation is rooted in the fact that new combinations of the existing knowledge of both partners are created and, moreover, the partners jointly produce new knowledge (Statistics Netherlands, 2010).
International cooperation in particular has become increasingly relevant over the past decades due to globalisation. Not only are companies involved in international trade, they are also moving their own activities to other countries and outsourcing them abroad. The same holds true for R&D activities. A key factor in this respect is that companies exchange knowledge internationally and enter into cooperative relationships.

Use of knowledge

Companies and knowledge institutes enter into cooperative relationships with other actors, such as customers, suppliers, competitors and partner companies. The presence of high-quality customers and the availability of venture capital play a role in this part of the model (Nauta and Gielen, 2009). A good network of customers and users of an innovation not only constitutes the sales market but is also essential to the continued development of innovations and generation of ideas for new products or processes. In addition to their existing networks, companies and knowledge institutes must continuously develop new relationships to exploit new knowledge. A network with proven successes is attractive to foreign companies, new entrepreneurs and scientists. A knowledge economy this way reinforces its international position.

2. ICT and the economy

ICT plays an important role in the Dutch economy. This chapter discusses the contribution of ICT to various macroeconomic indicators, such as value added, investments and labour volume. In addition, this chapter deals with the international trade in ICT and job openings in the ICT sector, as well as whether the number of job openings in the ICT sector is declining as fast as it is in other sectors.

2.1 The ICT sector and the Dutch economy

Roughly speaking, the ICT sector consists of two components: the ICT manufacturing sector and the ICT services sector. The ICT manufacturing sector comprises companies that primarily design and produce information and communication equipment, while the ICT services sector comprises companies that support the process related to electronic information processing and communication. For example, they develop software or provide ICT-related consulting services.
The OECD has developed a precise delineation for the ICT sector (Figure 2.1.1). Many countries use this definition in their statistical publications. This makes it easier to compare figures about the ICT sector from different countries. This chapter uses this international definition of the ICT sector as well, unless otherwise specified.

2.1.1 Definition of the ICT sector in accordance with the SIC 2008

SIC 2008	Description of Activity
ICT manufacturing sector	
261	Manufacture of electronic components and printed circuit boards
262	Manufacture of computers and peripheral equipment
263	Manufacture of communication equipment
264	Manufacture of consumer electronics
268	Manufacture of information carriers
ICT services sector	
465	Wholesale of ICT equipment
582	Software publishing
61	Telecommunications
6201	Writing, producing and publishing of software
6202	Information technology consultancy activities
6209	Other information technology service activities
631	Data processing, web hosting and related activities; web portals
951	Repair of computers and communication equipment

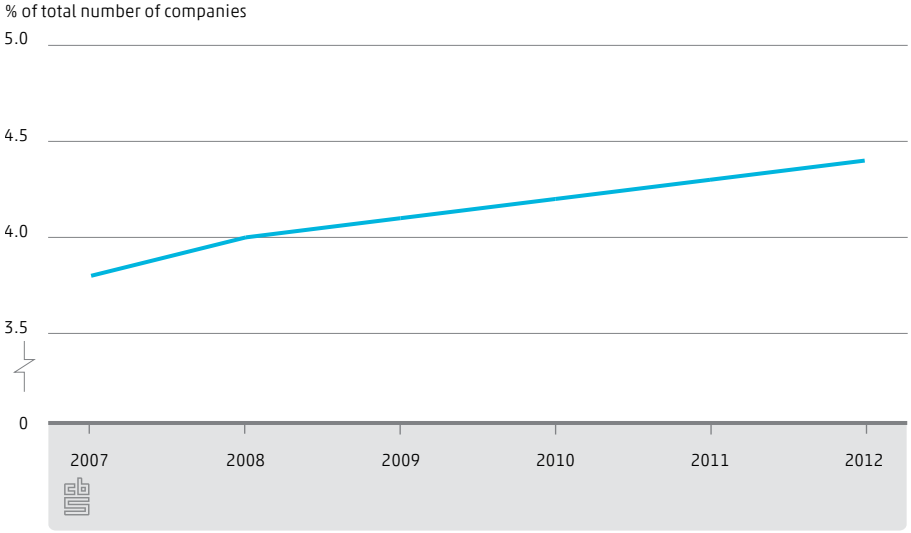
Source: OECD/Statistics Netherlands.

4.4% of Dutch companies operate in the ICT sector

ICT sector an ever increasing part of the business community

In 2012, 4.4 percent of Dutch companies was active in the ICT sector (Figure 2.1.2). The corresponding figure for 2007 was only 3.8 percent. The share of the ICT sector therefore rose significantly. This is virtually entirely attributable to the ICT services sector. In fact, the Netherlands has far more companies in the ICT services sector than in the ICT manufacturing sector. In 2012, almost 54,000 companies were active in the ICT services sector. The corresponding figure for the ICT manufacturing sector was 745. In 2007, the Netherlands had almost 36,000 ICT service providers and 645 companies in the ICT manufacturing industry.

2.1.2 ICT companies as a percentage of total number of companies, 2007-2012[1)]

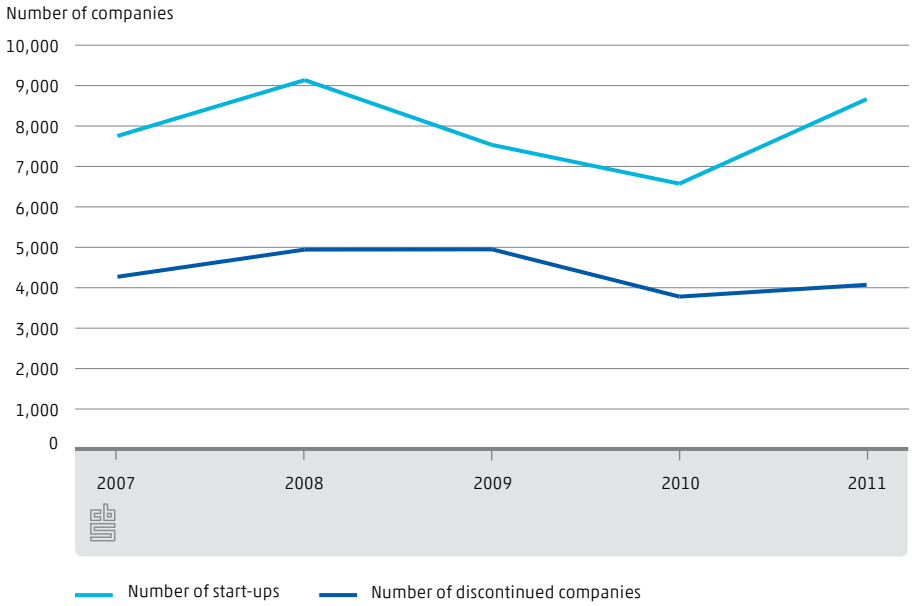


Source: Statistics Netherlands.

1) Provisional figures.

In 2011, 8,666 ICT companies were founded in the Netherlands. The corresponding figure for 2010 was significantly less: 6,574 (Figure 2.1.3). The share of this figure is particularly high for the ICT services sector. This is partly explainable by the fact that the ICT services sector has a low entry threshold. The start-up costs for a service provider are often much lower than the start-up costs for a manufacturing company.
Furthermore, a higher number of ICT companies closed its doors in 2011 than in 2010: over 4,000 compared to almost 3,800 in 2010. However, in both years this was significantly less than in 2009 when almost 5,000 ICT companies disappeared. This concerns the termination of companies without having another company continue an important part of the activities. When a company halts its operations due to a merger or a name change, this is therefore not included in the figures. Figure 2.1.3 clearly shows that in the period 2007–2011 there were significantly more new companies than the number of companies that disappeared.

2.1.3 Start-ups and closures in the ICT sector, 2007-2011[1)]



Source: Statistics Netherlands.

[1)] Provisional figures.

In 2011, 5.3 percent of all company start-ups was a new ICT company. This share was reasonably stable in the period 2007–2011. The same applies to discontinued companies. In 2011, 4.6 percent of discontinued Dutch companies was active as an ICT company.

ICT sector shows recovery

In 2011, Dutch ICT companies achieved higher revenues than in 2010. The growth amounted to 2.3 percent (Table 2.1.4). In 2009, the ICT sector's revenues shrank considerably, but in 2011 the sector recovered and grew by 1.9 percent. This growth persisted through 2011. The gross added value, which is the difference between production and intermediate consumption, rose by 2.3 percent in 2011. As such, ICT companies performed better than the Dutch economy as a whole. The gross value added in the Netherlands rose by 1.2 percent.

Both the ICT manufacturing sector and the ICT services sector achieved growth in revenues in 2011. For the manufacturing industry this represents the second consecutive year of growth. Revenues in 2011 grew by 4.1 percent. This is a significantly lower increase than in 2010. The gross value added of the ICT manufacturing industry also rose in 2011, by 7 percent.

The growth in revenues of ICT service providers amounted to 1.7 percent in 2011. This represents a turnaround after two years of contraction. The gross value added achieved by ICT service providers rose by 1.8 percent.

A small number of multinational enterprises determines the picture of the Dutch ICT manufacturing industry. These large internationally operating companies partly form a part of the Dutch manufacturing industry. A significant share of these companies is however vested abroad. Figures about the Dutch economy only describe the companies and business units vested in the Netherlands. Whether a company is owned by Dutch parties is not a consideration in this regard. Consequently not all expenses and revenues are reflected in Table 2.1.4. This can result in a distorted picture when for example, Dutch business units incur costs for research and development, and foreign business units earn the resulting revenues by producing new ICT goods.

2.1.4 The ICT sector compared with the Dutch economy, 2006-2011

	2006	2007	2008	2009	2010[1)]	2011[1)]
	percentage volume change on previous year					
Production value (turnover)						
ICT manufacturing sector	1.5	–3.8	1.6	–9.5	10.5	4.1
ICT services sector	5.5	6.6	2.5	–3.6	–0.6	1.7
of which						
telecommunications	2.8	5.5	–0.3	–3.3	–0.1	0.5
IT and information services	9.0	7.8	5.5	–3.8	–1.1	2.9
Total ICT sector	4.5	4.0	2.3	–4.9	1.9	2.3
Netherlands	3.6	4.1	2.0	–3.7	1.2	0.7
Gross value added						
ICT manufacturing sector	–1.1	6.0	0.6	–12.1	20.2	7.0
ICT services sector	6.7	7.2	3.6	–3.5	0.7	1.8
of which						
telecommunications	4.5	6.2	1.3	–3.1	1.8	0.0
IT and information services	9.2	8.2	5.5	–3.8	–0.2	3.2
Total ICT sector	6.0	7.1	3.4	–4.2	2.2	2.3
Netherlands	3.3	4.0	2.1	–3.3	2.1	1.2
Investments						
ICT manufacturing sector[2)]	2.8	–18.3	8.6	–12.5	–10.1	.
ICT services sector	8.4	2.8	3.7	–15.4	–6.1	.
of which						
telecommunications	7.5	–5.8	0.9	–12.3	–14.7	.
IT and information services	12.1	35.0	11.2	–23.5	19.9	.
Total ICT sector	7.5	–0.5	4.4	–15.0	–6.7	.
Netherlands	7.5	5.5	4.5	–12.0	–7.2	5.7
Labour volume of employed persons						
ICT manufacturing sector	0.0	–1.4	1.2	–2.7	1.5	–1.2
ICT services sector	4.9	4.9	4.8	–2.3	–3.0	2.4
of which						
telecommunications	–1.4	–3.2	–5.9	–7.2	–7.3	0.1
IT and information services	7.0	7.4	7.7	–1.2	–2.1	2.9
Total ICT sector	3.8	3.6	4.1	–2.4	–2.1	1.7
Netherlands	1.6	2.2	1.5	–1.1	–0.6	0.5

Source: Statistics Netherlands, National Accounts.

1) Provisional figures.

2) In terms of investments, the ICT manufacturing sector is defined as SIC group 26. The data related to these investments is not detailed enough to be able to display it in accordance with the internationally agreed-upon definition of the ICT manufacturing sector.

Modest recovery of the telecom sector

Telecom companies as well as IT service providers within the ICT services sector realised an increase in revenues. However, this increase is less pronounced among telecom companies than it is among IT service providers. After three consecutive years of contraction, the telecom sector in 2011 once again experienced a growth in revenues albeit a rather modest one: 0.5 percent. IT service providers increased their revenues in 2011 by 2.9 percent compared to 2010. Revenues still declined in the two prior years.
The gross value added of the telecom sector remained unchanged in 2011. IT service providers on the other hand created more value added: 3.2 percent. After two years of contraction, this represents an increase for this sector.

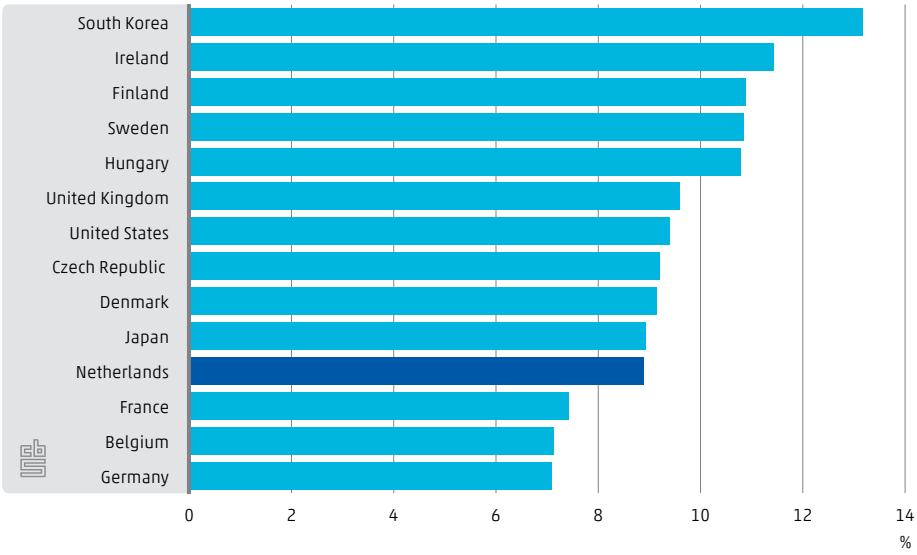
The labour volume in the ICT sector grew by 1.7 percent in 2011. As such, the number of employed persons in the ICT sector increased faster than in the entire Dutch economy. This growth of the ICT sector is entirely attributable to the ICT services sector. In the ICT manufacturing industry the number of employed persons by contrast decreased by 1.2 percent. In the ICT services sector, the number of employed persons primarily increased in IT services.

In 2010, the ICT sector invested 6.7 percent less than in 2009. This represents less of a contraction than in 2009, when business investments were over 15 percent lower than the year before. Business investments in the total economy also decreased in 2010; by 7.2 percent.
Investments in the ICT manufacturing industry, as well as in the ICT services sector decreased in 2010. The decrease was larger in the manufacturing industry than in the services sector. IT service providers form a striking exception. They invested considerably more in 2010 compared to 2009: almost 20 percent.

Value added of the Dutch ICT sector not high internationally

In 2009, ICT companies accounted for 8.9 percent of the business sector's value added in the Netherlands. In South Korea, the share of the ICT sector was much higher: 13.2 percent (Figure 2.1.5). The ICT sector is a relatively important component of the Irish economy as well. The share of ICT companies in Germany and Belgium is lower than in the Netherlands.

2.1.5 ICT sector percentage of value added in business sector, international, 2009



Source: OECD.

Importance of telecom sector decreasing

The production of the telecom sector was 18.7 billion euros in 2011 (Figure 2.1.6). This represents an increase of 1.5 percent over 2010. Telecom companies in 2011 did not produce as much as they did in the period 2006–2008 when the annual production was around 20 billion euros.

In 2011, the value added of the Dutch telecom sector was 8.4 billion euros. This represents 1.55 percent of the gross domestic product (GDP). This means that the telecom sector's contribution to GDP continues to drop. In 2006, the telecom companies' share of the GDP was almost 2 percent.

Investments in fixed assets by telecom companies stayed below 2 billion euros in 2010. This is significantly lower than in previous years. Investments in the telecom sector comprised 1.94 percent of total investments in 2010. This share continued to shrink in the period 2006–2010.

The labour volume in the telecom sector amounted to 30,000 full-time equivalents in 2011. This put a halt to the persistent drop in employment during the period 2006–2010.

The telecom sector's share of the total labour volume in the Netherlands in 2011 was 0.45 percent. This share has also contracted in recent years.

2.1.6 Telecommunications sector key figures, 2006-2011[1)]

	2006	2007	2008	2009	2010[2)]	2011[2)]
	mln euro (current prices)					
Telecommunications sector						
Production (basic prices)	19,616	20,249	19,460	18,508	18,463	18,748
Gross value added (basic prices)	9,299	9,423	8,781	8,219	8,275	8,387
Investments in fixed assets	2,666	2,555	2,632	2,302	1,983	.
	full-time equivalents (x 1,000)					
Labour volume of employed persons	38	37	35	32	30	30
	%					
Share of the total economy						
Gross added value (basic prices)	1.94	1.86	1.66	1.61	1.57	1.55
Investments in fixed assets	2.51	2.23	2.16	2.12	1.94	.
Labour volume of employed persons	0.58	0.55	0.51	0.48	0.45	0.45

Source: Statistics Netherlands, National Accounts.

1) SIC 2008 code 61 (Telecommunications).

2) Provisional figures.

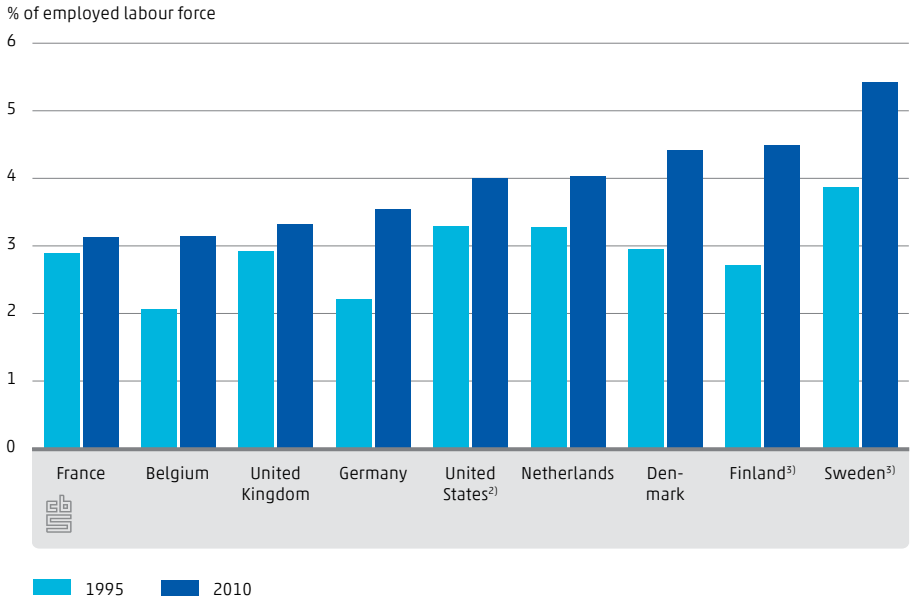
2.2 ICT and employment

This section deals with employment in the ICT sector. It focuses on the trend in the number of employed ICT workers and job openings in the ICT sector.

Increasingly more ICT workers

In 2010, 4 percent of the Dutch workforce was comprised of ICT workers. The corresponding figure for 1995 was only 3.3 percent. In many other countries the share of ICT workers in the employed labour force has also risen since 1995 (Figure 2.2.1). This growth was more pronounced in Sweden, Finland and Denmark than in the Netherlands. Especially Sweden had a large share of ICT workers in 2010: 5.4 percent of the employed labour force. In France, the percentage of ICT specialists has increased very little over 15 years.

2.2.1 Employed ICT workers (narrow definition), 1995 and 2010[1)]



Source: OECD.

1) The narrow definition of ICT workers is based on the methodology described by the OECD (2004).
2) The percentages of the United States are not directly comparable with those of European countries because the classifications have not been harmonised.
3) Finland and Sweden: 1997 instead of 1995.

Fewer ICT job openings

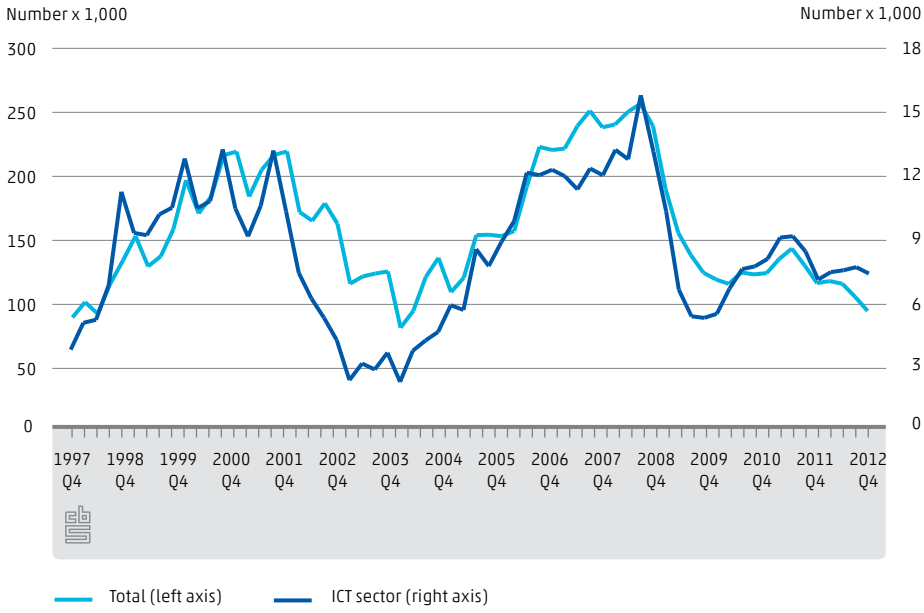
In the fourth quarter of 2012, there were 6,900 ICT job openings in the Netherlands (Figure 2.2.2). This represents a drop of almost 300 compared to a quarter earlier. This put a stop to a period of three consecutive quarters in which the number of ICT job openings steadily increased. However, at the end of 2012, the number of available ICT job openings was higher than a year earlier.

The decline in the number of job openings was less pronounced in the ICT sector compared to the economy as a whole. In total, there were 94,900 job openings in the Netherlands at the end of 2012. This was over 10 percent less than in the third quarter. In the ICT sector, the number of job openings dropped by 4 percent.

The number of ICT job openings reached a peak in the second quarter of 2008. At that time ICT companies had almost 15,000 job openings. This number had dropped by half by the end of 2012. The number of ICT job openings dropped tremendously, especially at the end of 2008 and the beginning of 2009, by almost 10,000 in a year's time. A short period of slight recovery was followed by a new setback during the second half of 2011.

The number of ICT job openings is exhibiting approximately the same pattern as the total number of job openings in the Netherlands. However, the trend in the number of ICT job openings is somewhat more favourable in 2012. More job openings were available in the ICT sector at the end of 2012 than there were at the end of 2011. This does not apply to the economy as a whole.

2.2.2 Job openings in the ICT sector and the rest of the economy, 1997-2012[1)]



Source: Statistics Netherlands, Survey of job openings.

1) The ICT sector here is defined as comprising the SIC 2008 61, 62 and 63 groups.

2.3 ICT expenditure

Domestic expenditure on ICT goods and services comprises the following three categories. First, this comprises the investment in ICT capital, such as hardware, software and electronic networks, by companies and government organisations. The second category of ICT spending comprises intermediate consumption by companies and government organisations, for example the maintenance of computers. The last category comprises consumption by households, such as the purchase of computers and smartphones.

ICT investments continue to decline

In 2010, Dutch companies and government organisations invested 4.4 percent less in ICT capital than in 2009 (Figure 2.3.1). This decline is not as high as it was in 2009, when it was approximately 8 percent. In total companies and government organisations invested 13.7 billion euros in ICT capital in 2010. As such, ICT investments represented 13.4 percent of total investments in the Netherlands. This share has been increasing somewhat again since 2008. ICT investments did not decline as fast as the total investments in the Netherlands, which shrunk by 7.2 percent. Companies and government organisations especially invested significantly less in electronic networks in 2010 compared to 2009. The decrease amounted to 22.8 percent. Investments in electronic networks represent but a small portion of total ICT investments: 11 percent. Investments in electronic networks have declined steadily since 2006.
More than half of ICT investments in the Netherlands are investments in software. In 2010, Dutch companies and government organisations invested 3 percent less in software than in 2009. Investments in software had already begun to decline in 2009. The decline in 2010 was less pronounced in comparison to 2009, however.

2.3.1 Investments in ICT capital, 2006-2011

	2006	2007	2008	2009	2010[1)]	2011[1)]
	mln euro (current prices)					
Computer hardware	4,545	4,896	4,557	4,131	3,996	.
Software	7,710	8,343	9,120	8,240	8,093	.
Electronic networks	2,460	2,280	2,218	2,004	1,566	.
Total ICT	14,715	15,519	15,895	14,375	13,655	.
Total investments Netherlands	106,373	114,340	121,849	108,774	102,031	106,690
	%					
Computer hardware	31	32	29	29	29	.
Software	52	54	57	57	59	.
Electronic networks	17	15	14	14	11	.
Total ICT	100	100	100	100	100	.
% of total investments Netherlands	13.8	13.6	13.0	13.2	13.4	.
	percentage volume change on previous year					
Computer hardware	16.4	14.8	4.0	–3.2	1.7	.
Software	7.5	4.1	7.0	–9.4	–3.0	.
Electronic networks	16.5	–7.7	–4.2	–9.2	–22.8	.
Total ICT	11.8	5.8	4.4	–7.6	–4.4	.
Total investments Netherlands	7.5	5.5	4.5	–12.0	–7.2	5.7

Source: Statistics Netherlands, National Accounts.

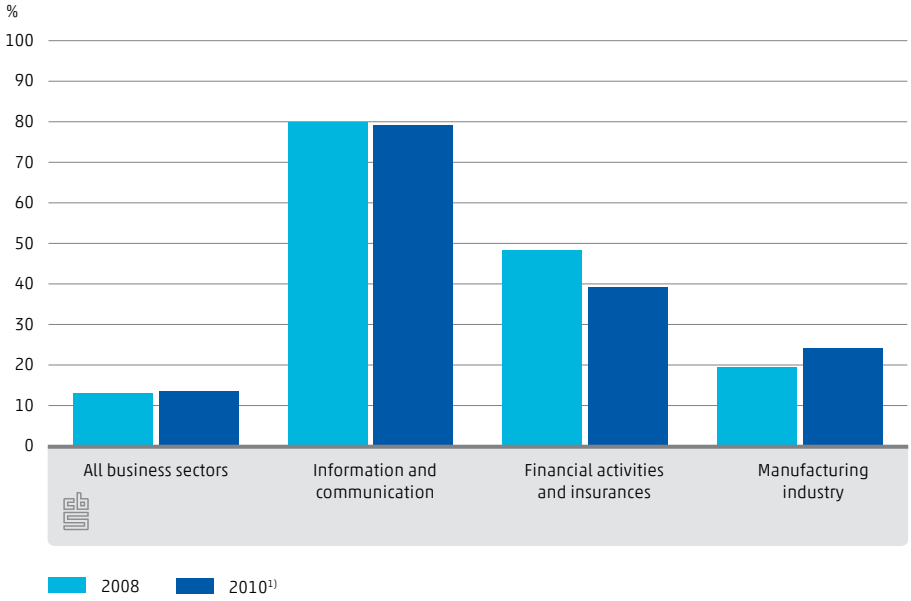
[1)] Provisional figures.

Hardware was the only category in which Dutch companies and government organisations invested more in 2010 than 2009, although the increase was modest: 1.7 percent. Investments in hardware represented 29 percent of the total ICT investments in the Netherlands in 2010.

ICT sector: 79 percent of all investments is in ICT

ICT is a very important investment item in some business sectors, while other sectors barely invest in ICT. The 'Information and Communication' sector especially invests a great deal in ICT. In 2010, 79 percent of investments in this sector was ICT-related (Figure 2.3.2). This is roughly the same as it was in 2008. Companies in the financial sector also invest a relatively high amount in ICT. In 2010, ICT investments represented 39 percent of the total investments in this sector. As such, this share is significantly lower than it was in 2008, when it was almost 50 percent. In the manufacturing industry, the share of ICT in total investments by contrast grew. While in 2008, this figure was 19 percent, in 2010 it had increased to 24 percent.

2.3.2 ICT investments as a percentage of total investments, 2008 and 2010



Source: Statistics Netherlands, National Accounts.

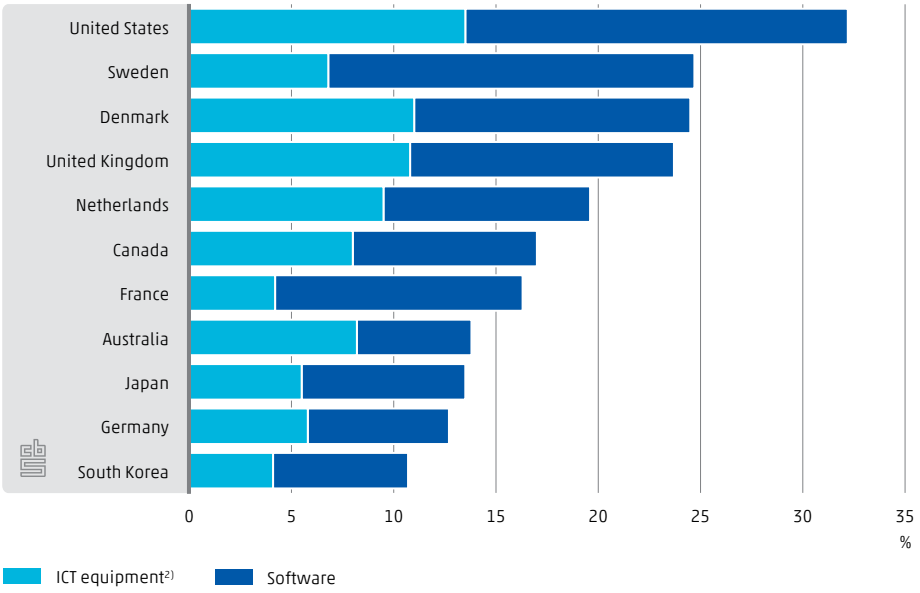
[1)] Revised provisional figures.

The statistical annex to this publication contains a table with figures about the share of ICT investments in the total investments of additional business sectors. The statistical annex can be consulted online at www.cbs.nl/ICT-knowledge-economy.

The Netherlands: high degree of investment in ICT equipment

ICT goods become obsolete much faster than many other capital goods. Consequently it is essential for companies to continue to invest in ICT, so that they have access to current hardware and software versions. In 2010, the Netherlands was one of the countries that invested relatively heavily in ICT equipment (Figure 2.3.3). Investments in ICT equipment represented 9 percent of total investments in the Netherlands. In the United States this figure was 13 percent. Sweden, Denmark and the United Kingdom also invest to a relatively high degree in ICT equipment.

2.3.3 ICT investments as a percentage of total investments, international, 2010[1)]



Source: OECD.

1) France and Sweden: 2009 instead of 2010; Japan and Australia: 2008 instead of 2010; Netherlands, Austria, United Kingdom and Denmark: 2007 instead of 2008.
2) IT equipment and communications equipment.

Software investments as a percentage of total Dutch investments was 10 percent in 2010. This makes software a somewhat higher investment item than ICT equipment in the Netherlands. The same applies to many other countries. In the

United States, investments in software are as high as 19 percent of total investments. The United States therefore is the front runner in this area as well. Differences in the disciplines in which companies specialise is an important explanatory factor for the gap in ICT investments between the United States and European countries. Indeed, ICT-intensive sectors are well represented in the American economy.

ICT expenditure reaches almost 50 billion euros

In 2011, ICT expenditure in the Netherlands amounted to 48 billion euros (Table 2.3.4). This is the same as it was in 2006. ICT expenditure rose in 2007, but was followed by a sharp decline in 2009. This was in turn followed by a slight recovery.
ICT expenditure on the one hand comprises ICT spending by companies and government organisations that is not classified as investments. Spending on hardware maintenance is an example of this. On the other hand ICT expenditure comprises household spending on ICT equipment: i.e. consumption.

2.3.4 Intermediate consumption and household consumption of ICT goods and services, 2006-2011

	2006	2007	2008	2009	2010[1)]	2011[1)]
	mln euro (current prices)					
Total ICT expenditures	47,990	50,045	49,828	46,837	47,477	47,803
Intermediate consumption	34,431	36,127	36,223	34,072	34,763	34,999
Consumption	13,559	13,918	13,605	12,765	12,714	12,804
Total ICT goods	15,034	15,667	15,610	14,180	14,734	14,880
Intermediate consumption	11,263	11,667	11,606	10,530	11,084	11,299
Consumption	3,771	4,000	4,004	3,650	3,650	3,581
Total ICT services	32,956	34,378	34,218	32,657	32,743	32,923
Intermediate consumption	23,168	24,460	24,617	23,542	23,679	23,700
Consumption	9,788	9,918	9,601	9,115	9,064	9,223
Total consumption	390,317	407,971	423,230	427,677	434,875	439,268

Source: Statistics Netherlands, National Accounts.

[1)] Provisional figures.

In 2011, companies, government organisations and consumers collectively spent 15 billion euros on ICT goods and 33 billion euros on ICT services. The total intermediate consumption of ICT was 35 billion euros, while consumption amounted to almost 13 billion euros. In other words, companies and government organisations spend about 2.5 times as much on ICT as do consumers.

ICT consumption declining

Household spending on ICT dropped significantly between 2007 and 2009: from almost 14 billion euros to 12.8 billion euros. At the same time, total household consumption increased during that period. ICT expenditure consequently decreased as a percentage of total household spending. In 2011, households allocated 2.9 percent of their spending to ICT goods and services. The corresponding figure for 2006 was still as high as 3.5 percent. This decrease is almost completely due to the fact that between 2007 and 2009 households spent far less on ICT.

2.4 International trade in ICT

The international ICT market is growing. Companies have been trading ICT goods with international partners on a large scale for some time. Especially due to the internet it is becoming increasingly easier to exchange ICT services internationally as a result of which physical distances are becoming less relevant.

ICT imports are declining; exports are rising

In 2010, the Netherlands imported 72.3 billion euros worth of ICT. The corresponding figure for 2011 was 68.4 billion euros; a drop of 5 percent (Table 2.4.1). The total import value in the Netherlands also rose; by 8 percent. ICT comprised 15.3 percent of total Dutch imports in 2011. The corresponding figure for 2006 was still as high as 18.2 percent.
Especially the import of ICT goods declined significantly in 2011. ICT goods represent the lion's share of the total ICT imports: 91 percent in 2011. In 2011, the import of ICT services remained roughly the same as the 2010 level.

In 2011, the Netherlands exported 12.9 billion euros worth of ICT. This is 6 percent higher than in 2010, when ICT exports amounted to 12.2 billion euros. Total Dutch exports grew somewhat faster: by 8 percent. The share of ICT in the total Dutch exports dropped somewhat in the period 2006–2011. In 2006, this share was 3 percent; by 2011, it had declined to 2.6 percent.
In 2011, the Netherlands exported 5 billion euros worth of ICT goods and 7.8 billion euros in ICT services. Especially the export of ICT goods rose significantly in 2011: by 10 percent. The export of ICT services rose by 3 percent.

2.4.1 Import and export of ICT goods and services, 2006-2011

	2006	2007	2008	2009	2010[1)]	2011[1)]
	mln euro (current prices)					
Import						
ICT goods	57,706	59,829	60,213	53,757	64,692	62,090
ICT services	6,166	6,291	6,204	5,908	6,338	6,294
Total ICT imports NL	63,872	66,120	66,417	59,964	72,270	68,384
Total imports NL	351,669	377,234	404,047	352,983	412,487	445,826
Export						
ICT goods	4,963	5,038	4,974	4,194	4,596	5,026
ICT services	6,903	7,643	7,799	7,296	7,584	7,840
Total ICT exports NL	11,866	12,681	12,773	11,587	12,180	12,866
Total exports NL	393,475	424,229	453,442	393,050	460,493	499,620
Re-export						
ICT goods	53,713	55,716	56,565	50,581	61,346	59,294
ICT services	557	509	531	528	405	298
Total ICT re-exports NL	54,270	56,225	57,096	51,584	62,055	59,592
Total re-exports NL	151,881	166,795	178,053	155,781	190,768	204,109
Total ICT exports (goods, services and re-exports)	66,136	68,906	69,869	63,171	74,235	72,458
Breakdown of the export of ICT goods and services	%					
ICT goods	8	7	7	7	6	7
ICT services	10	11	11	12	10	11
Re-exports	82	82	82	81	83	82
Total	100	100	100	100	100	100
Percentage of ICT goods and services in						
Total imports	18.2	17.5	16.4	16.9	17.2	15.3
Total exports	3.0	3.0	2.8	2.9	2.6	2.6
Total re-exports	35.7	33.7	32.1	32.8	32.4	29.2

Source: Statistics Netherlands, National Accounts.

[1)] Provisional figures.

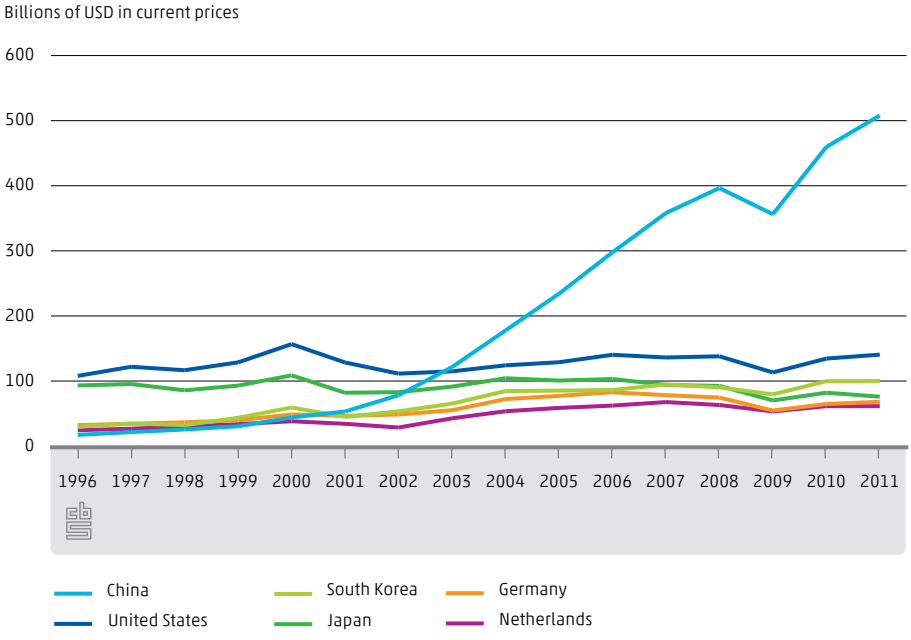
Major share is re-export

The major share of Dutch ICT export concerns re-export. In 2011, this was true for 82 percent of the total export of ICT. This share stayed virtually the same between 2006 and 2011. Re-export involves the import of products by a resident for the purpose of re-export without subjecting the products to further processing. Dutch distribution centres are examples of companies that operate this way. ICT forms a key part of the Dutch re-export. In 2011, ICT goods and services comprised 29.2 percent of total re-export. The share of ICT in Dutch re-export has, however, dropped since 2006. In that year, 35.7 percent of total re-exports consisted of ICT-related goods and services.

The Netherlands is a major exporter of ICT goods

The Netherlands is among a group of countries with a high export value of ICT goods (OECD, 2013). In 2011, the value of exported Dutch ICT goods was 61.4 billion US dollars. This is the same as it was in 2010 (Figure 2.4.2). China has been the largest exporter of ICT goods in the world since 2003. The difference with other countries is enormous. The export value of Chinese ICT goods was 508 billion US dollars in 2011. This is almost ten times as much as in 2001. Only in 2009 did the Chinese export of ICT goods decline as a result of the crisis. The value of exports in other countries dropped during that year as well.

2.4.2 Export of ICT goods, international, 1996-2011

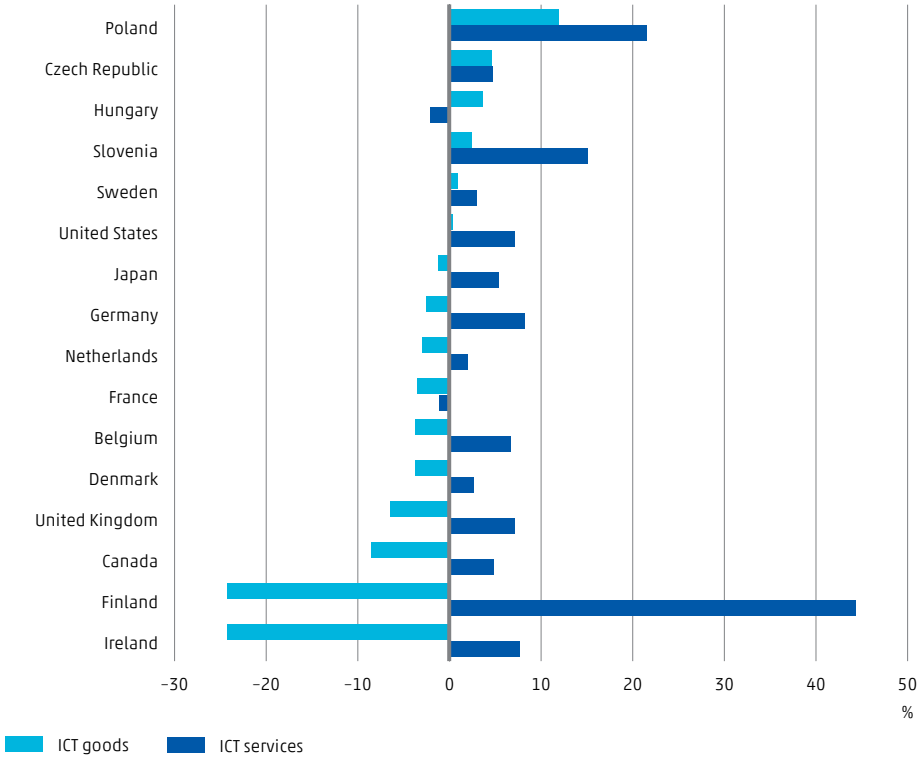


Source: OECD.

Export of ICT services is growing

Between 2007 and 2010, the Dutch export value of ICT services grew by an average of 3 percent per year. In many other countries the export of ICT services grew during this period as well (Figure 2.4.3). Finland had the strongest growth: an astonishing 45 percent per year.
The export of ICT goods presents a mixed picture. In the Netherlands, exports contracted by 2 percent per year. The growth in the export of ICT goods was particularly strong in Eastern European countries. By contrast it declined significantly in Finland and Ireland; by an average of 24 percent. Finland's ICT exports exhibit a striking trend. In this country, a strong growth in the export of ICT services is going hand in hand with a strong decline in the export of ICT goods.

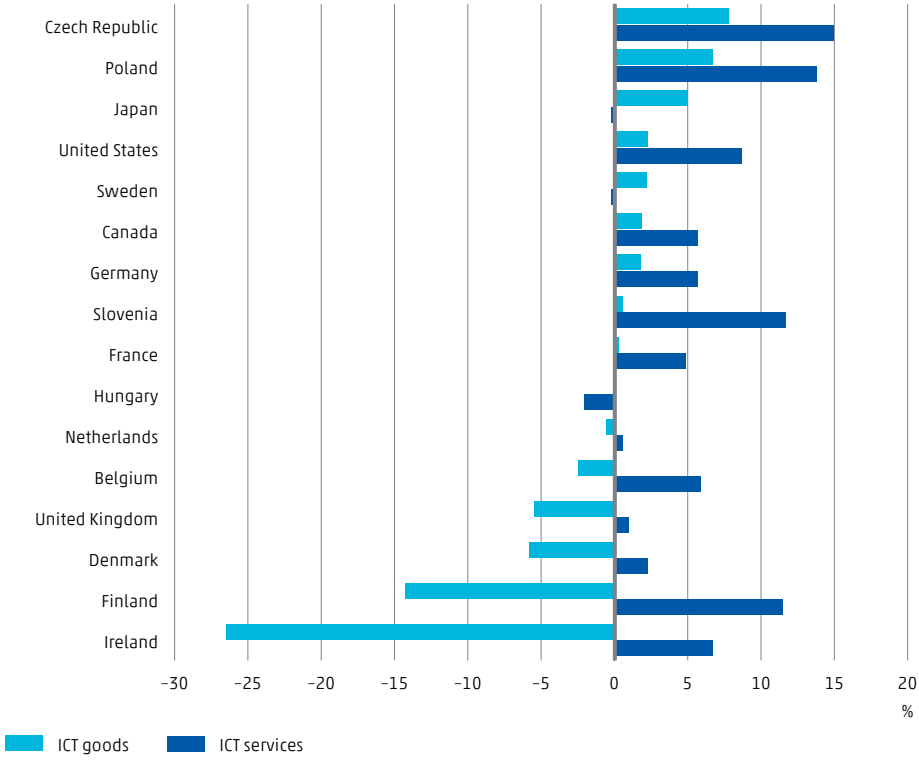
2.4.3 Average annual growth in ICT exports, international, 2007-2010



Source: OECD.

There was barely any change in the Dutch import of ICT between 2007 and 2010. During this period the import of ICT goods, as well as ICT services remained virtually stable. The picture is internationally rather one-sided and shows that the import of ICT services is growing. Growth was strong in several Eastern European countries, and in addition Finland and the United States experienced a strong increase in the import of ICT services. The differences are much greater when it comes to ICT goods. The Czech Republic and Poland experienced strong growth in the import of ICT goods. Japan also experienced significant growth. By contrast, Ireland and Finland experienced a very significant drop. In Ireland the import of ICT goods declined by as much as 27 percent per year between 2007 and 2010.

2.4.4 Average annual growth in ICT imports, international, 2007-2010

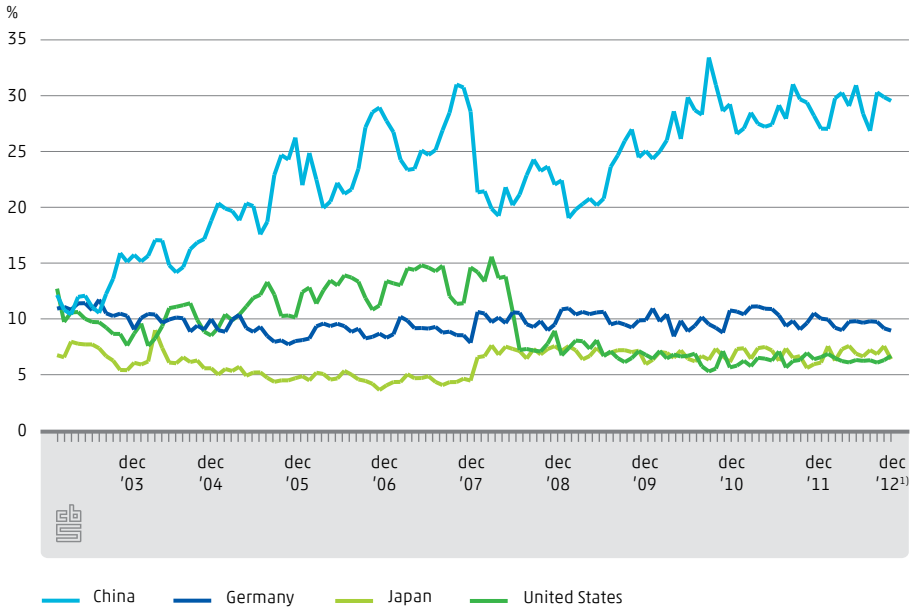


Source: OECD.

One third of ICT goods come from China

At the end of 2012, 30 percent of the ICT goods imported by the Netherlands came from China. This percentage has risen strongly over the years. China's share of Dutch ICT imports at the beginning of 2003 was still a mere 12 percent (Figure 2.4.5). Germany's share in 2012 was more than three times smaller than China's share: 9 percent. Germany is a reasonably stable trading partner in terms of the import of ICT goods; between 2003 and 2012 consistently around 10 percent of the Dutch import of ICT goods originated from Germany. The United States and Japan are also key countries for the Dutch import of ICT goods. The share originating from the United States showed a sharp decline in 2008. Since that time the share originating from the United States has been stable.

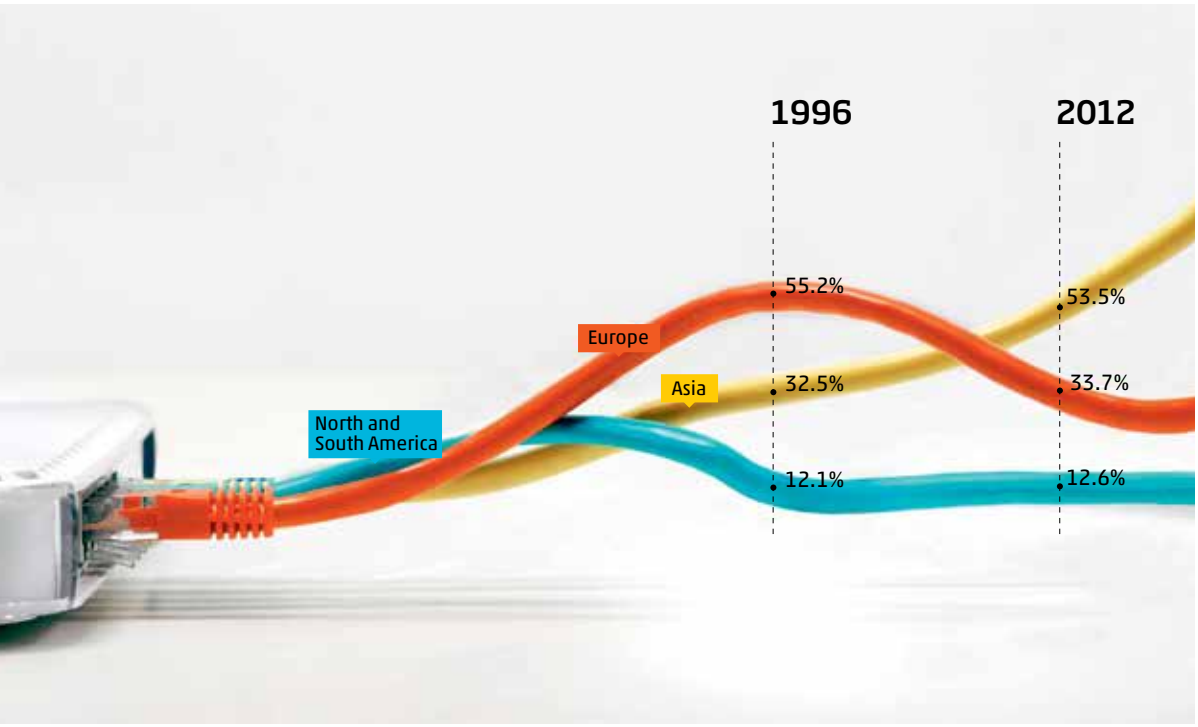
2.4.5 Share in the Dutch import of ICT goods, 2003-2012



Source: Statistics Netherlands.

1) Provisional figures.

Primarily due to the emergence of China, the Netherlands is importing increasingly fewer ICT goods from Europe. In 1996, 55 percent of the Dutch import of ICT goods originated from Europe. By 2012 this had dropped to only 34 percent. By contrast, the Dutch import of ICT goods from Asia increased: 53 percent in 2012, compared to 33 percent in 1996. The percentage of imported ICT goods from other continents remained stable between 1996 and 2012.

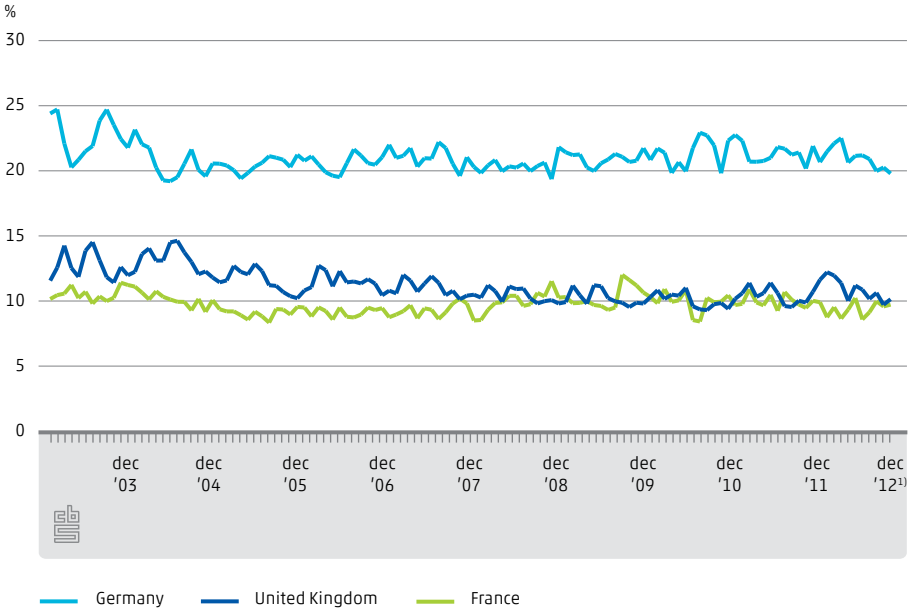


Dutch import of ICT goods by continent of origin

Dutch ICT goods primarily exported to Germany

The Netherlands primarily exports its ICT goods to Germany, the United Kingdom and France. Germany has been the key destination for the export of Dutch ICT goods for years. In 2012, one fifth of the Dutch ICT export value went to Germany (Figure 2.4.6). During the period 2003–2012 this percentage generally fluctuated between 20 and 25 percent. The United Kingdom and France in 2012 accounted for 10 percent of the export of Dutch ICT goods.

2.4.6 Share in the Dutch export of ICT goods, 2003-2012



Source: Statistics Netherlands.

1) Provisional figures.

3. Telecommunications

To be able to efficiently apply information and communication resources requires a solid infrastructure. This ICT infrastructure is the key theme of this chapter. The initial focus is on the internet, after which it shifts to telephony. The chapter concludes with a section on television and radio.

3.1 Internet

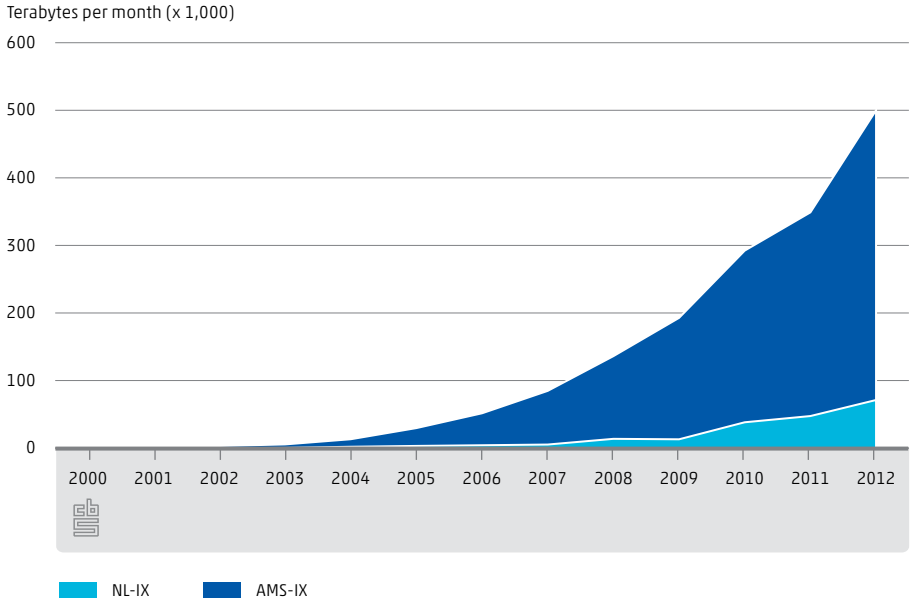
The internet is taking on an increasingly more important role in day-to-day life. The web has become virtually always and everywhere accessible for many people via mobile devices, such as smartphones and tablets. This is creating ever increasing demands on the infrastructure that supports the internet. This section discusses how the internet infrastructure is adapting to this increasing pressure.

Internet traffic is growing exponentially

The volume of internet traffic once again rose sharply in 2012. The Amsterdam Internet Exchange (AMS-IX) is one of the largest internet exchanges in the world. This exchange recorded 429,000 terabytes of data traffic in December 2012 (Figure 3.1.1). This represents 36 times the contents of a normal DVD per second. In December 2011, this data traffic still amounted to approximately 300,000 terabytes. The AMS-IX not only processes the internet traffic among subscribers of Dutch internet providers. This important internet exchange also routes the international internet traffic in the Netherlands. Increasingly more people are using the internet more often, for example via smartphones. This is causing the volume of internet traffic to continue to increase. In addition, data traffic is growing due to the constantly more demanding applications such as online HD-quality videos.
The other important Dutch internet exchange, the NL-IX, also processed more data traffic in 2012 than in 2011. In the last quarter of 2012, 71,000 terabytes were routed via the NL-IX compared to 47,000 in the same period of 2011. This represents an increase of 50 percent. The data traffic of both exchanges grew faster in 2012 than it did in 2011.

Internet traffic also continues to increase in volume internationally. This is illustrated by the DE-CIX, the largest internet exchange in Europe. At the beginning of 2013, this exchange processed 2.5 terabytes per second. The corresponding figure for 2010 was only 1 terabyte per second (DE-CIX, 2013). By comparison, the AMS-IX broke the 2 terabyte per second barrier for the first time in November 2012 (AMS-IX, 2013).

3.1.1 Volume of internet traffic via AMS-IX and NL-IX, 2000-2012[1)]



Source: AMS-IX; NL-IX.

1) AMS-IX: measured in the month December of the year specified; NL-IX: measured in the last quarter of the year specified.

New IP addresses: from version 4 to version 6

Increasingly more devices are connected to the internet: computers, smartphones, as well as household equipment. This has created a shortage of available internet protocol numbers. These numbers make up the 'IP address', which is used to communicate with the internet. In September 2012, the last IP addresses from the fourth version of this system (IPv4) were made available. This created a need for a new version. IPv6 became the successor to IPv4. As of 1999, a virtually unlimited number of new internet addresses has become available with this new version. Internet users are now migrating to IPv6. In the Netherlands, 18 of the 100 most visited websites were accessible via this new version in October 2012. Of the 500 most popular websites in Europe, 8 percent made use of IPv6 in June 2012.

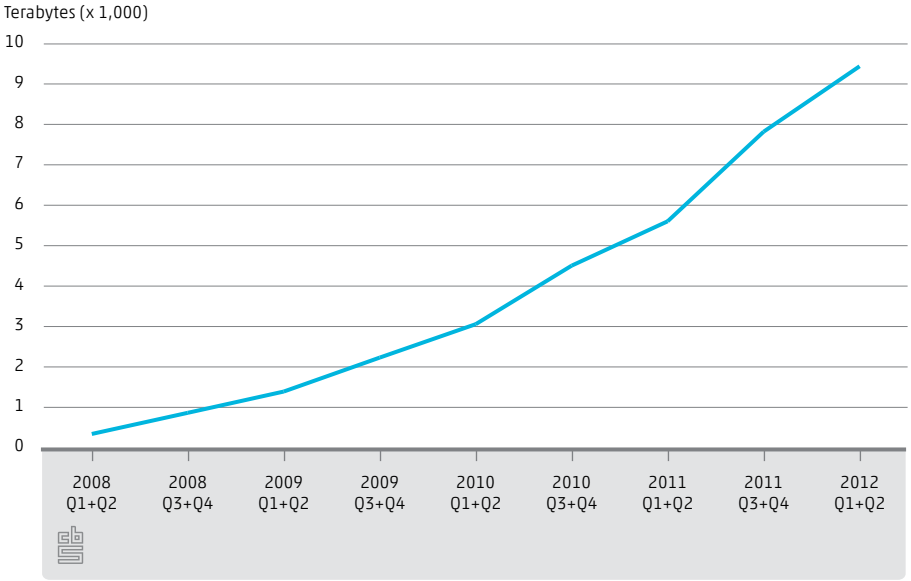
Sources: TNO (2013) and http://new.ipv6-taskforce.nl.

9,500 terabytes
of mobile traffic

The mobile internet is growing extremely fast

Mobile data traffic has increased significantly in recent years. Since the appearance of tablets and smartphones on the market, they have created a tremendous demand for mobile data traffic. The total mobile data traffic in the Netherlands in the first half of 2008 was 342 terabytes. In the same period of 2012, this volume had increased to almost 9,500 terabytes (Figure 3.1.2). However, the volume of mobile data is still only a fraction of the volume that is routed exclusively across fixed connections.
The mobile internet figures do not include data traffic routed via WiFi. After all, WiFi does not make use of the network for mobile data traffic.

3.1.2 Mobile internet data volume, 2008-2012



Source: OPTA.

Video services consume the most data

A global survey of data use via the mobile internet shows that video streaming caused the most data traffic in the second half of 2011. Video services accounted for 42 percent of the total mobile data consumption. As such these services represent an increasingly larger share of the total. The corresponding figure for 2010 was 35 percent.

Source: Allot Mobile Trends (2013).

High broadband coverage in the Netherlands

In technical terms, almost all households in the Netherlands have the option of acquiring a broadband connection. The term broadband internet comprises the most modern fixed internet connections, such as cable, DSL and optical fibre. Cable and DSL connections in the Netherlands have a coverage of almost 100 percent (Statistics Netherlands, 2012a). In addition, optical fibre cables have been installed for increasingly more Dutch households. This technology is the successor to the DSL network.

Broadband increasingly faster

Dutch networks are becoming increasingly faster. For example, all cable companies have converted virtually all of their networks to optical fibre and apply the new EuroDOCSIS 3.0 standard, which makes very high-speed connections possible. Optical fibre to the home also forms part of the very high-speed connections. Cable and optical fibre deliver download speeds of more than 120 Mbps, while DSL delivers download speeds of up to 80 Mbps. Standard broadband internet is not the only service with 100 percent coverage in the Netherlands. The very high-speed fixed connections are accessible to virtually all households as well (Figure 3.1.3). Figure 3.1.4 shows that this gives the Netherlands a significant lead over other countries. Finland and Denmark follow far behind with a coverage for these high-speed networks of 68 and 62 percent, respectively.

3.1.3 Cable internet coverage, 2012

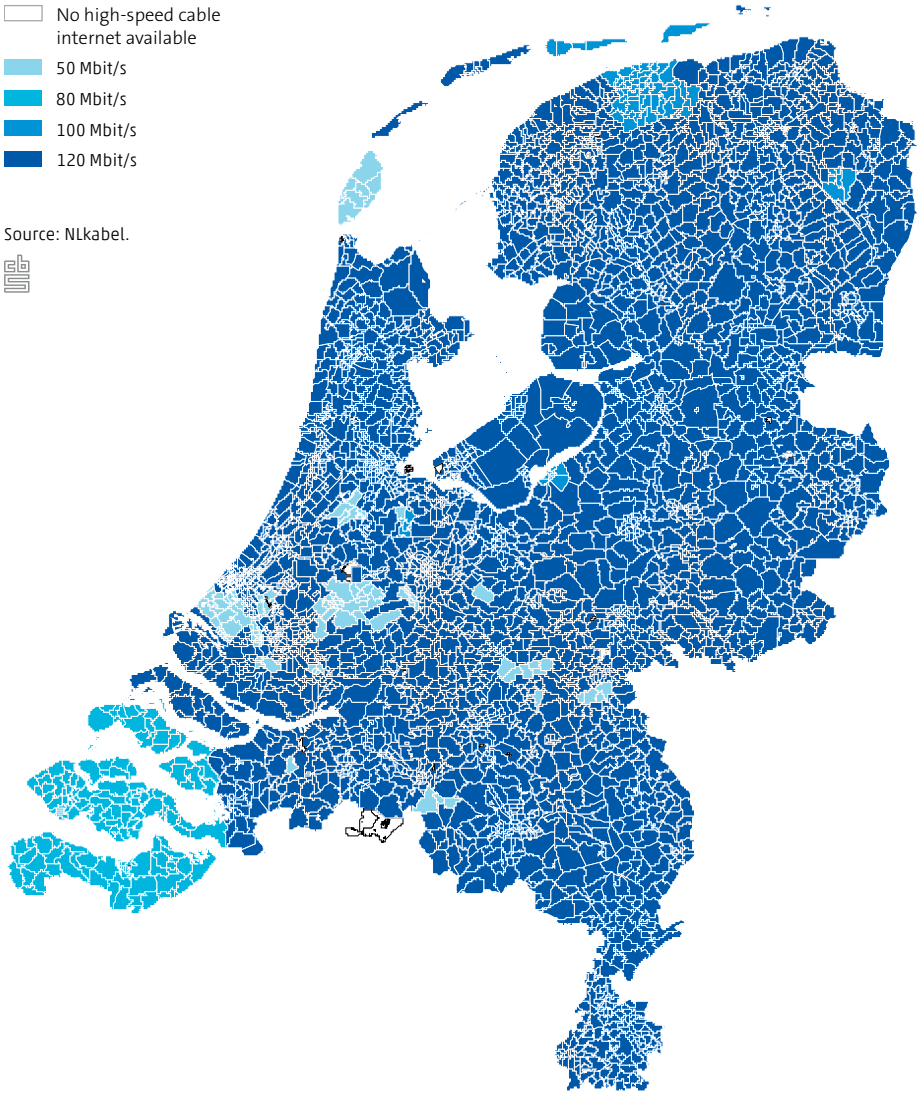
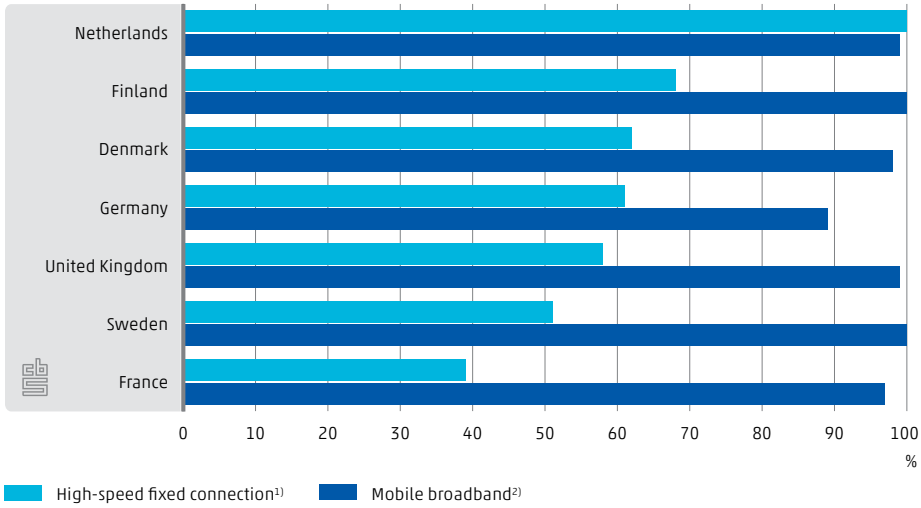


Figure 3.1.4 also shows that in many countries high-speed mobile internet has a reach of virtually 100 percent. Like high-speed fixed connections, mobile broadband is available almost everywhere in the Netherlands. High-speed mobile internet coverage is almost 100 percent in Sweden and Finland as well. Germany was somewhat lagging in this area in 2011.

3.1.4 High-speed internet coverage, international, 2011



Source: European Commission.

1) New generation fixed connections, such as VDSL, FTTH and DocSIS 3.
2) HSDPA.

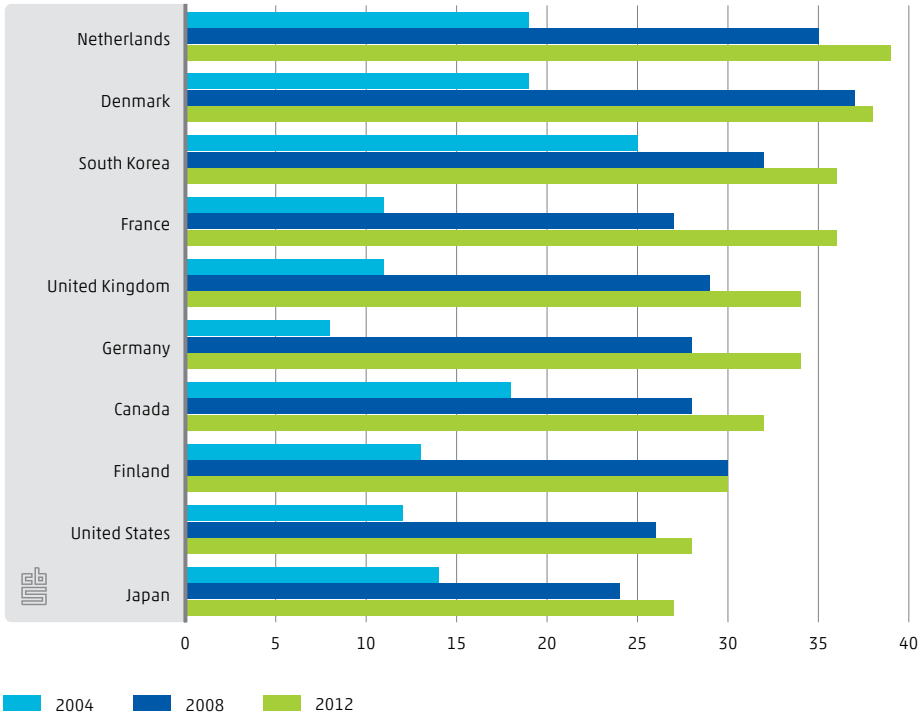
The Netherlands also has the highest number of connections

Because broadband is available everywhere, Dutch households and companies virtually exclusively use broadband connections. In 2012, the Netherlands had 39 fixed connections per 100 inhabitants. This is the highest number of the countries in Figure 3.1.5. Denmark (38), South Korea and France (both 36) are not far behind. The Netherlands and Denmark have been the two countries with highest number of broadband connections for some time. The growth in the number of connections has slowed somewhat in recent years since the number is already quite high.

Fixed broadband primarily via DSL or cable

DSL and cable are by far the most often used forms of broadband in the Netherlands. By mid-2012, 51 percent of all broadband connections ran over DSL and 44 percent via cable. The corresponding figure for 2011 was 55 and 42 percent, respectively. DSL therefore gave up some of its share and cable became somewhat more popular in 2012. The share of optical fibre connections increased from 3 percent in 2011 to 5 percent in 2012.

3.1.5 Number of fixed broadband connections per 100 inhabitants, international, 2004-2012[1)]

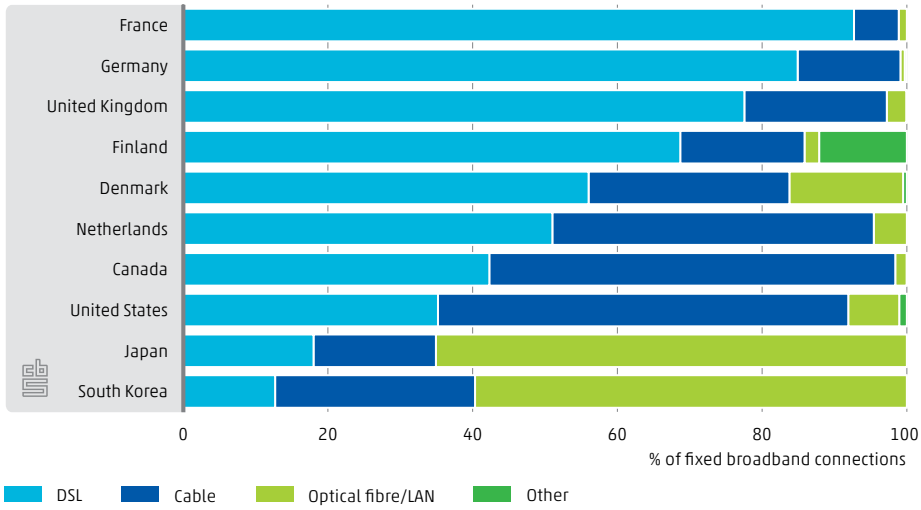


Source: OECD.

[1)] Situation in June of the relevant year.

Figure 3.1.6 shows that the international differences in the most used internet connections are large. The cable infrastructure and the fixed telephone network in the Netherlands have traditionally been well developed. As a result, many Dutch households have an internet connection via cable or DSL. In Canada and the United States, the cable internet share is even higher than it is in the Netherlands: 56 percent in both countries. In Germany and France, the cable network is less widely spread. This is why cable in these countries does not form a large part of the total fixed broadband market. In Germany, 93 percent of broadband connections runs over DSL; the corresponding figure in France is 85 percent. Japan and South Korea have relatively many optical fibre connections. In these countries six in ten broadband connections run over optical fibre to the home.

3.1.6 Broadband internet access technology, international, 2nd quarter 2012



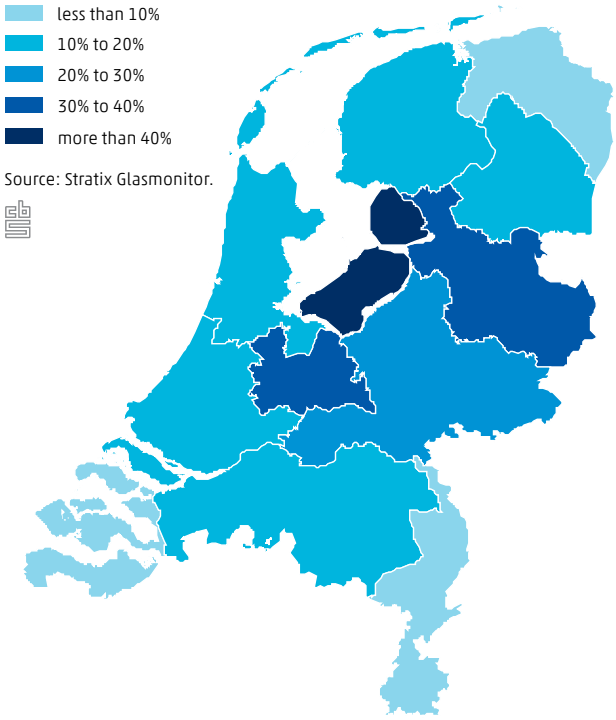
Source: OECD.

Optical fibre network takes shape

Increasingly more Dutch households have optical fibre to the home. In 2012, 20 percent of households in the Netherlands had access to the optical fibre network. The corresponding figure for 2011 was only 14 percent. Not all of these households also have an internet subscription via optical fibre, but they do have the technical option.

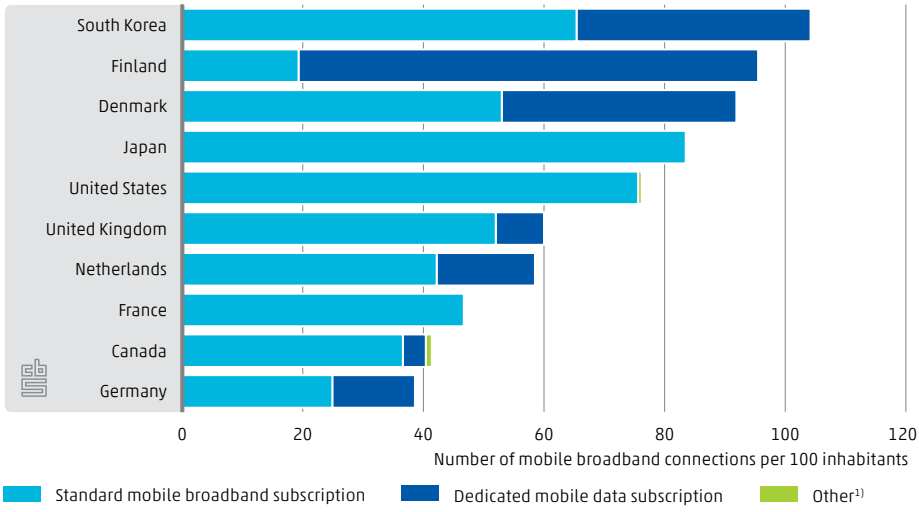
Figure 3.1.7 shows that the province of Flevoland has the highest proportion of homes with an optical fibre connection. In 2012, this proportion was approximately two thirds. The provinces Overijssel (36 percent) and Utrecht (33 percent) also score high. Optical fibre is not yet widely available in the province of Zeeland. The coverage of optical fibre in a province is often still limited to several densely populated areas.

3.1.7 Households connected to optical fibre, by province, 2012



Source: Stratix Glasmonitor.

3.1.8 Standard and dedicated mobile broadband subscriptions, international, 2nd quarter 2012



Source: OECD.

1) Satellite and 'terrestrial fixed wireless'.

59 mobile broadband subscribers per 100 inhabitants

In 2012, there were 59 mobile broadband connections per 100 inhabitants in the Netherlands. In South Korea this number was 104. This is the highest number of the countries in Figure 3.1.8. Finland (96) and Denmark (92) also have a high number of mobile broadband subscriptions. Mobile broadband is often combined with a mobile telephony subscription. Such subscriptions are very well suited for smartphones. In addition, there are dedicated mobile data connections: mobile broadband subscriptions that do not comprise mobile telephony. These connections are well suited for mobile internet, for example on a laptop or tablet. In 2012, 28 percent of the mobile broadband connections in the Netherlands was a dedicated mobile data subscription. This share was much higher in Finland: 80 percent.

4G: a new mobile internet generation

The newest generation of mobile internet connections is known as 4G. This technology is also known as Long Term Evolution (LTE) and is the successor to 3G. At the end of 2012, the Dutch government auctioned licences for new frequency bands that support 4G. By using the current as well as the new frequencies, Dutch telecom companies are better able to deal with the high demand for mobile internet and mobile telephony. 4G also enables them to offer their customers a still faster form of mobile internet. The auction produced 3.8 billion euros for the Dutch government. After the auction, telecom companies started work on making generally existing transmission towers suitable for 4G. The first 4G networks have been activated at certain sites in the urban agglomeration in Western Holland since the beginning of 2013. Additional sites are expected to come on stream in the Netherlands over the course of 2013. The schedule calls for 4G to be available across the nation by the middle of 2014. The construction of LTE networks is also gathering steam in Europe. The European Commission recently decided that member states must free up additional room in the radio spectrum for 4G networks. In addition, the EU pronounced that investments in high-speed mobile networks continues to be necessary. In 2013, the Commission allocated 50 million euros for research into 5G, the next generation of mobile networks.

Sources: TNO (2013), Radiocommunications Agency Netherlands (2012) and the European Commission (2012b).

3.2 Telephony

The way in which the Dutch population is using telephony is changing rapidly. Fewer households have a fixed telephone connection. Telephone calls are more often routed via internet applications, such as Skype, and the number of mobile subscriptions is growing. In addition, the function of the mobile telephone is changing. Many people are now using their smartphone for internet browsing and to communicate via internet applications, such as WhatsApp and social media. These changes have drastic consequences for the telecom market.

Fixed telephone not declining any further

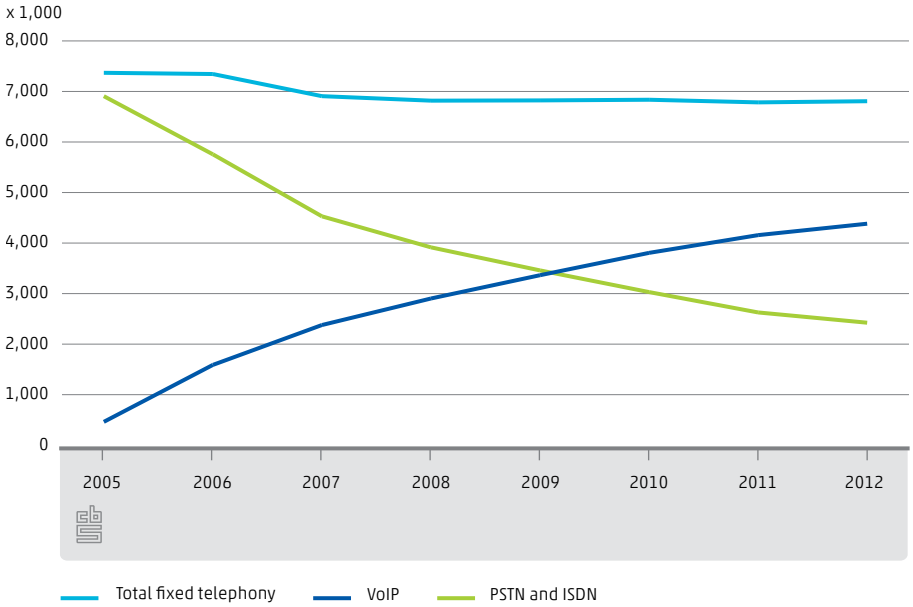
In 2012, the Netherlands had 6.8 million fixed telephone connections. This is significantly less than the peak of almost 10 million which was reached in 2000. The year 2001 started a decline that has since come to a halt. Since 2007 the total number of fixed telephone connections has remained more or less the same (Figure 3.2.1). However, there has been a shift in the type of fixed connection. The traditional PSTN and ISDN telephone network is losing ground, while the number of telephone connections via the internet (VoIP) is rising. In 2012, the Netherlands had 4.4 million VoIP connections, compared to 4.1 million in 2011. The number of traditional connections in 2012 was 2.4 million. The year before it was still 2.6 million. Packages that allow consumers to acquire multiple telecom services, such as TV, the internet and VoIP, in a single subscription have been gaining in popularity for some years.

In 2011, there were 43 fixed telephone connections per 100 inhabitants in the Netherlands. The corresponding figure for 2001 was 51. The international trend also shows a decline in the number of fixed connections. In comparison to other countries, the Netherlands has few fixed telephone connections per 100 inhabitants.

20 million mobile telephone connections

At the end of 2012, the Netherlands had almost 20 million mobile telephone connections (Figure 3.2.2). This figure comprises subscriptions as well as prepaid use. The number of connections was somewhat higher in 2011. Telecom providers regularly terminate prepaid numbers that have been inactive for an extended period of time. As a result, the number of connections slightly declined in 2012.

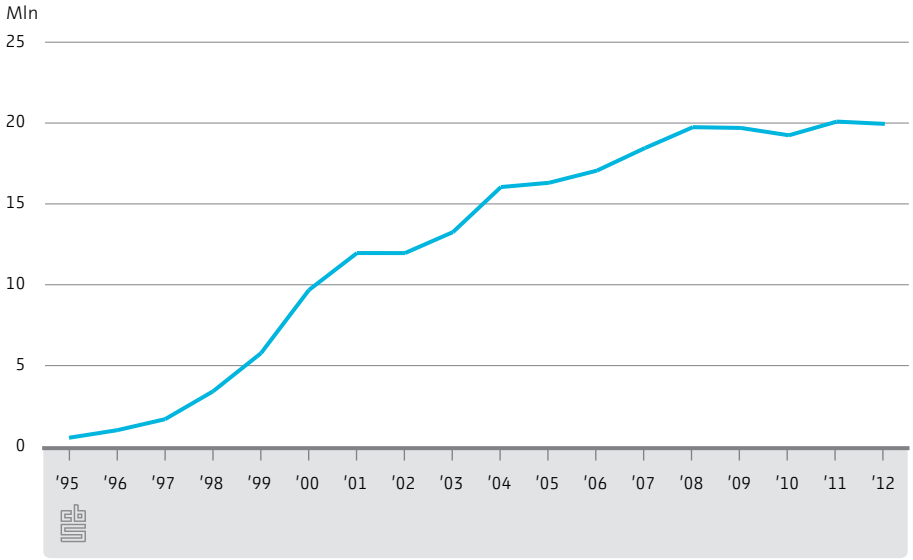
3.2.1 Fixed telephone connections, by access technology, 2005-2012[1)]



Source: TNO.

1) 2012 is the situation of the second quarter.

3.2.2 Number of mobile telephone connections in the Netherlands, 1995-2012



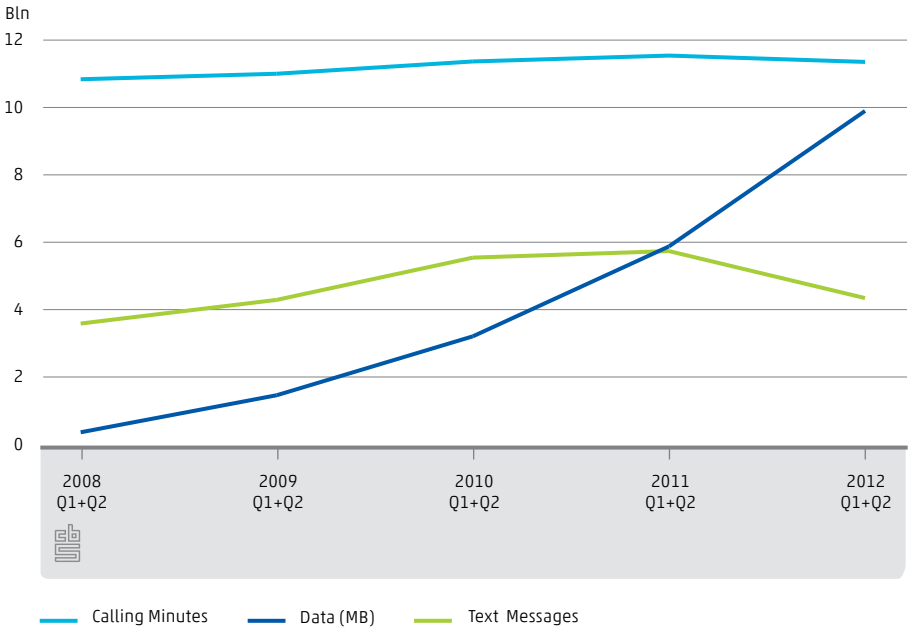
Source: TNO.

The Netherlands still has considerably more mobile telephony subscriptions than the number of inhabitants. Some people use multiple mobile telephones, for example, one for business use and one for personal use. In addition, this figure includes other devices that have a SIM card, such as laptops and tablets.

Data traffic is displacing text messages

The function of the mobile phone has changed significantly. Up until a few years ago, the telephone was primarily used as a device for making telephone calls and sending/receiving text messages. Since the appearance of the smartphone many people use the telephone primarily for accessing the internet. As a result mobile connections are now processing far more data traffic and the number of text messages has significantly declined. The total mobile data traffic in the first half of 2012 was 9,500 terabytes (Figure 3.2.3). This is 68 percent higher than the year before. The number of text messages sent declined from 5.7 billion in 2011 to 4.3 billion in 2012. The number of calling minutes declined as well, although this was limited to 2 percent. The number of calling minutes remained fairly stable throughout the entire 2008–2012 period. Making telephone calls the traditional way therefore continues to be appealing, in spite of competing internet services, such as Skype.

3.2.3 Trends in mobile network-based services, 2008-2012



Source: OPTA.

Especially the text messages are being displaced by data traffic; generally via popular applications such as WhatsApp, Facebook and Twitter. Smartphones also use a great deal of data via WiFi connections, but the figures in Figure 3.2.3 exclusively relate to traffic via mobile networks. These networks do not include WiFi.

3.3 Television and radio

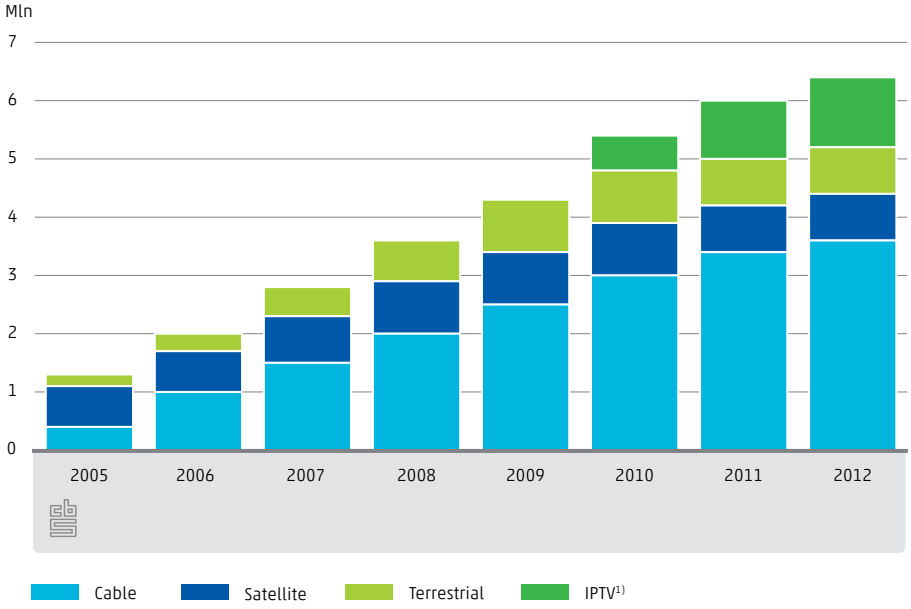
Consumers have access to various options for receiving TV: cable, DSL, optical fibre to the home (IPTV), terrestrial and satellite. Digital subscriptions are displacing traditional analogue TV subscriptions. Digital radio is also becoming more popular.

6,300,000
digital TV subscriptions in the Netherlands

Digital TV is on the rise

The number of digital television subscriptions in the Netherlands continued to rise in 2012. In total, the Netherlands had 6.3 million digital TV subscriptions. This is 3 percent higher than in 2011. Cable by far has the most digital subscriptions: 3.6 million (Figure 3.3.1). This represents a market share of 57 percent. This market share has been fairly stable since 2010.
Increasingly more people are watching TV via an internet connection (IPTV). This is different from watching services via a browser. In case of IPTV, a viewer uses his normal TV unit, however the signal is routed via an internet connection. In 2010, the Netherlands had over 590,000 IPTV subscriptions; by 2012 this number had doubled to 1.2 million. The IPTV market share was 11 percent in 2010, compared to 18 percent in 2012. As such, IPTV now is the most often used TV subscription method after cable. IPTV's growing market share is at the expense of satellite and terrestrial TV. In 2012, each of these two forms of TV reception had approximately 750,000 subscriptions. This is approximately 150,000 less for satellite as well as terrestrial, compared to 2010.

3.3.1 Digital television connections, by reception method, 2005-2012



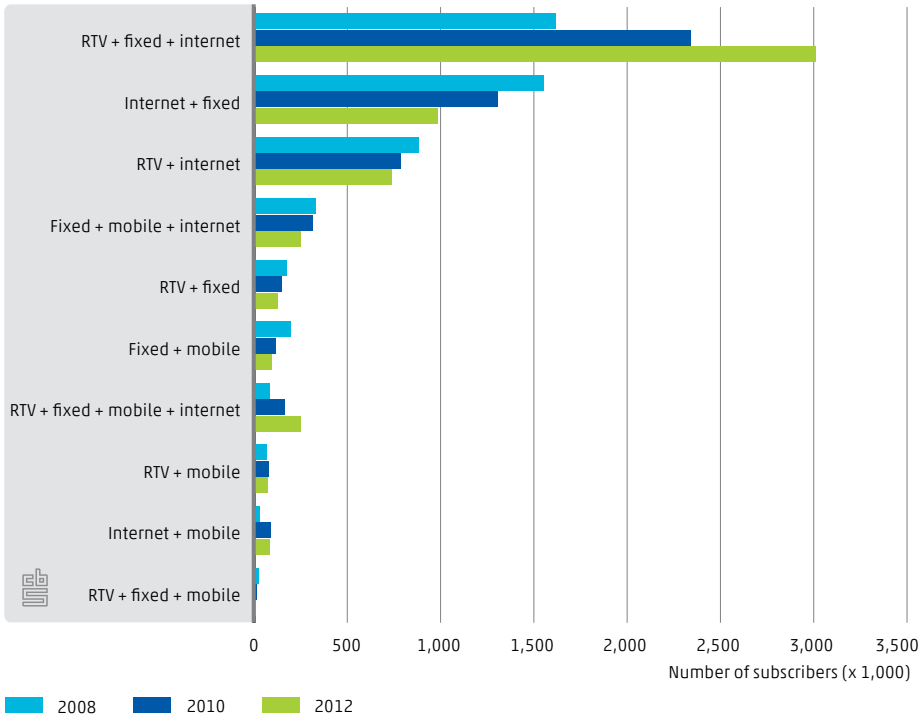
Source: TNO.

1) IPTV figures are only available as of 2010.

Bundled telecom services

Many Dutch households obtain multiple telecom services from a single provider. In 2012, 5.6 million subscribers had a combined package of two or more services. This bundling of services is referred to as 'multiplay'. By far the most popular package contains radio, TV, fixed telephony and internet. In 2012, over 3 million subscribers had a package of this nature (Figure 3.3.2). The corresponding figure for 2010 was only 2.3 million; a 29 percent increase. Another package with a large number of subscribers contains internet and fixed telephony. In 2012, almost 1 million households had opted for this package. The radio, TV and internet combination was popular as well: 739,000 subscribers. However, this number is smaller than it was in 2010. The package that in addition to radio, TV, fixed telephony and internet, also contains mobile telephony showed the highest growth in terms of the number of subscribers. In 2012, this figure was still rather modest, 250,000, although this is 52 percent higher than it was in 2010.

3.3.2 Multiplay, 2008-2012[1)2)]



Source: OPTA.

1) Second quarter 2012.
2) 'RTV' is radio and TV. 'Fixed' means telephony via a fixed line (including VoIP). 'Mobile' is a mobile telephone connection and 'internet' refers to a fixed or wireless broadband internet connection.

Digital radio provides more channels

Digital radio offers similar benefits to digital television: the signal generally delivers better sound quality than FM and provides room for many more channels. In addition, this enables radio stations to transmit additional information as part of the digital signal, for example to update the car's navigation system with traffic congestion information.

Digital radio employs various standards. Dutch stations use T-DAB for transmitting digital radio terrestrially. Public broadcasting is now transmitting via T-DAB in the urban agglomeration in Western Holland and in the provinces of Flevoland, Gelderland and North-Brabant. In addition to T-DAB, the Netherlands is using several other technologies for digital radio. Cable delivers digital radio via DVB-C, while DSL and optical fibre to the home broadcast radio signals via IP. In addition, digital radio is broadcast terrestrially as part of the TV signal. Most radio stations can also be listened to online.

One in eight has heard of T-DAB

In 2012, 13 percent of the Dutch population had ever heard of T-DAB (Table 3.3.3). This is approximately the same as the year before when it was 12 percent. This technology therefore barely gained in terms of recognition in 2012. Primarily men, well-educated individuals and individuals between 45 and 65 years of age have ever heard of T-DAB.
A specific radio receiver is required to listen to digital radio. In 2012, 3.9 percent of the Dutch population owned such a device. The corresponding figure for 2011 was 3.2 percent. T-DAB therefore has not made much progress in this respect either in 2012.

3.3.3 Familiarity with digital radio via T-DAB and ownership of required equipment, 2011 and 2012

	Heard about T-DAB at one time		Has a T-DAB receiver at home	
	2011	2012	2011	2012
	% of individuals aged 12 up to and including 74 years			
Total	11.8	12.6	3.2	3.9
Gender				
Men	16.3	17.5	4.4	5.3
Women	7.2	7.7	2.0	2.5
Age				
12 to 25 years	8.7	8.8	3.0	3.6
25 to 45 years	12.2	12.8	3.9	4.2
45 to 65 years	12.0	14.3	2.7	4.5
65 to 75 years	15.2	13.7	2.6	2.0
Level of education				
Primary education	9.2	10.7	2.1	2.6
Secondary education	13.1	12.3	3.7	4.3
Higher education	13.6	15.6	4.0	5.1

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

4. ICT use by households and individuals

In 2013, ICT has a major impact on daily life. Almost every Dutch citizen has access to the internet; at home via a fixed connection or elsewhere via a smartphone. This chapter describes the devices and internet connections used by the Dutch population, as well as the popular applications. How does the Netherlands compare to other European countries?

4.1 ICT facilities in households

Computers, the internet and mobile telephones have been common in the Netherlands for some years. Many people no longer only use the internet at home or at work, but virtually everywhere. Especially due to the availability of smartphones with high-speed internet connections the internet is available always and everywhere. As a result ICT is taking on an increasingly more prominent role in society.

'ICT use by households and individuals' survey

Since 2005, Statistics Netherlands has been conducting the 'ICT use by households and individuals' survey every year. The purpose of the survey is to obtain information about the way in which households and individuals use ICT equipment and the internet. Each year approximately 4,500 people participate in this survey. These are individuals aged 12 up to and including 74, resident in the Netherlands. Starting in 2012, individuals aged 75 or older have also been included in the survey. However, this chapter does not refer to the figures for the 75+ population. Section 8.3 does however address the ICT skills of this group of older individuals. For some topics, the survey also considers the household as a whole. For example, for the question 'Does your household have a computer?'. This then concerns Dutch households with at least one person aged 12 up to and including 74 years. The survey does not include the residents of care institutions, correctional facilities and shelters.

The member states of the European Union have agreed to harmonise this survey: all countries use the same questions and the same definitions. This makes it possible to compare Dutch figures with those of other countries. The European survey excludes individuals aged 12 up to and including 15 years and 75 years or older. Statistics Netherlands did survey these groups, however. The official results concerning the Netherlands each time indicate the segment of the population to which the findings relate. The Dutch figures used for making comparisons with

other European countries are based on the population aged 16 up to and including 74. As a result it is possible that the Dutch figures in international comparisons deviate somewhat from the figures Statistics Netherlands publishes about the Netherlands alone.

Ownership of a PC is a matter of course

It is no longer possible to imagine Dutch households without a PC. In 2012, 93 percent of households had a desktop or laptop (Table 4.1.1). This amounted to 6.2 million households comprising 12.5 million individuals. Over the last decade, increasingly more households acquired a PC, although this growth has sharply levelled off in recent years. The saturation point has been reached. In 2012, 94 percent of households had access to the internet. This percentage is therefore somewhat higher than the percentage of households with a PC. A possible explanation is that some households do not use a desktop or a laptop for accessing the internet and instead exclusively use other devices such as tablets and smartphones. The percentage of households with internet access is also reaching its saturation point. This percentage did not increase any further in 2012.
Broadband internet has also become very commonplace in the Netherlands. For some years, over eight in ten households have had a broadband connection. The corresponding figure for 2002 was a mere 15 percent.

4.1.1 ICT facilities used by households and individuals, 2002-2012

	2002	2005	2006	2007	2008	2009	2010	2011	2012	2007	2008	2009	2010	2011	2012
	% of households									absolute (mln)					
Households[1]										6.6	6.5	6.6	6.5	6.6	6.7
PC (desktop/laptop)	76	83	84	86	88	91	92	94	93	5.7	5.7	6.0	6.0	6.2	6.2
Access to the internet	63	78	80	83	86	90	91	94	94	5.4	5.6	5.9	6.0	6.2	6.3
Broadband internet connection	15	54	66	74	74	77	84	83	82	4.8	4.8	5.1	5.5	5.5	5.5
	% of individuals									absolute (mln)					
Individuals[2]										12.8	12.9	12.9	13	13	13.2
PC (desktop/laptop)	81	87	88	90	92	93	94	96	95	11.6	11.8	12.1	12.3	12.5	12.5
Access to the internet	69	83	85	88	91	93	94	95	96	11.3	11.7	12.0	12.2	12.5	12.6
Broadband internet connection	17	59	71	79	78	79	87	87	84	10.1	10.0	10.3	11.3	11.3	11.1

Source: Statistics Netherlands, POLS: 2002; ICT Use by Households and Individuals: 2005–2012.

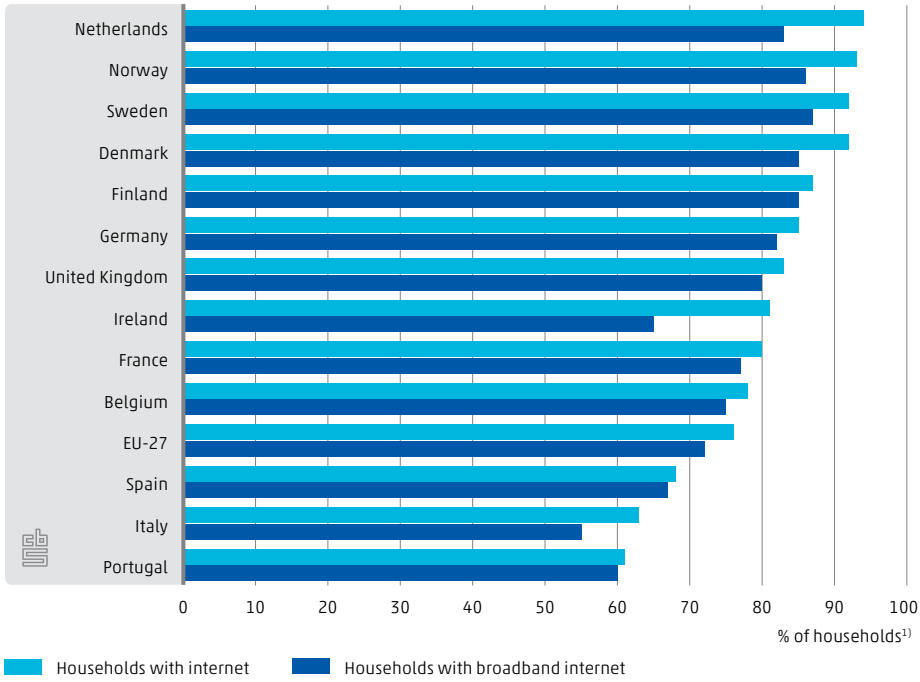
[1] Private households with at least one person aged 12 up to and including 74 years.

[2] Individuals aged 12 up to and including 74 years in private households.

The Netherlands is a leader in terms of internet access

In the Netherlands, 94 percent of households has access to the internet. This is higher than in many other countries (Figure 4.1.2). Over nine in ten Norwegian, Swedish and Danish households also have an internet connection. This proportion is lower in Italy and Portugal: over six in ten. Of all households in the EU, over three quarters has an internet connection.
The Netherlands also has a high share of broadband connections. Only in Scandinavian countries is the percentage of households with a broadband connection somewhat higher. Of all households in the EU, 72 percent had a broadband connection in 2012. In Southern Europe, the proportion of households with broadband was significantly lower than the average.

4.1.2 Households with internet access and broadband internet, international, 2012



Source: Eurostat.

1) Private households with at least one person aged 16 up to and including 74 years.

Households: smartphones and laptops are displacing the desktop

Progressively fewer Dutch households are using a desktop computer. In 2005, 93 percent of households with internet was using a desktop. By 2012, this figure had declined to 73 percent (Table 4.1.3). Households are increasingly using other devices for accessing the internet. In 2012, the laptop was the most commonly used device; eight in ten households had a laptop. The corresponding figure for 2005 was a mere 27 percent. Especially smartphones continue to grow in numbers. In 2012, six in ten households had a smartphone. This is five times as many as in 2005. This involves households in which at least one individual has a smartphone.
Other devices were also more popular in 2012 than in previous years. For example, in 2005 there were barely any households that used a game console to access the internet. In 2012, 22 percent of households used a game console to access the internet.

4.1.3 Internet access devices, 2005-2012[1)]

	2005	2006	2007	2008	2009	2010	2011	2012
	% of households with internet[2)]							
Desktop	93	91	89	84	83	78	76	73
Laptop	27	32	42	54	62	68	74	78
Smartphone	12	13	19	22	28	35	50	59
Game console	1	1	4	7	12	16	19	22
TV with set-top box	0	1	3	4	8	10	15	20

Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) This does not yet include tablets.

2) Private households with at least one person aged 12 up to and including 74 years.

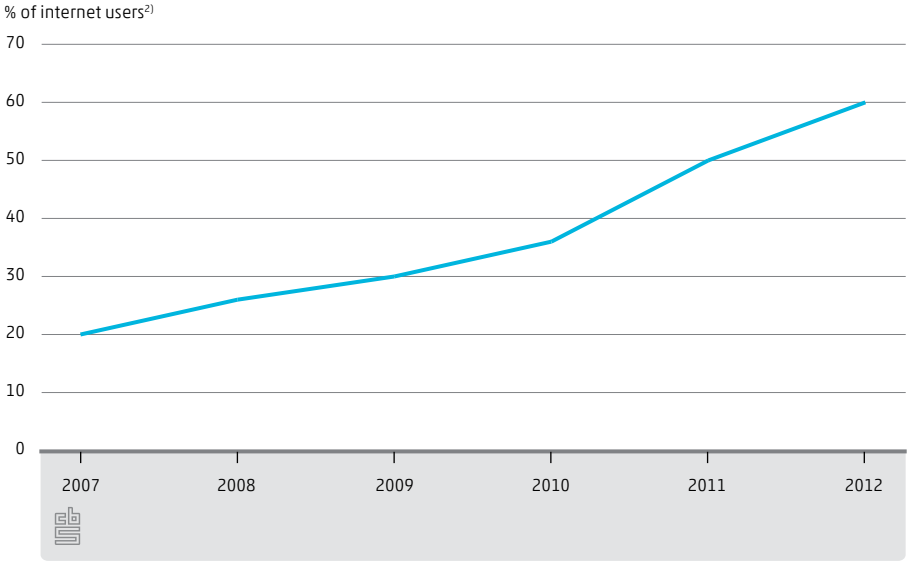
Internet users: increasingly more often mobile

Increasing numbers of people are using mobile devices for accessing the internet. In 2012, 60 percent of internet users used a smartphone or laptop, for example, for mobile internet access. The corresponding figure for 2011 was 50 percent and in 2007 it was only 20 percent (Figure 4.1.4).

Internet users are increasingly using smartphones. In 2012, 47 percent of internet users used a smartphone (Figure 4.1.5). The corresponding figure for 2007 was still only 8 percent. The smartphone has become popular in recent years in particular.

In 2010, only 21 percent of internet users had a smartphone. Two years later this figure had more than doubled.
One in three internet users in 2012 used a laptop with mobile internet; one in five used a tablet.

4.1.4 Use of mobile devices for internet access, 2007-2012[1)]



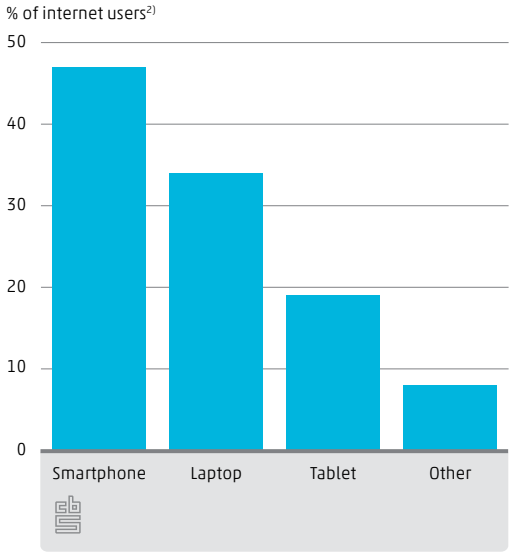
Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) Use of mobile devices, such as laptops and smartphones, excluding use at home or at work.
2) Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

Especially many younger people use mobile devices for accessing the internet (Figure 4.1.6). Of the population aged 12 to 25 years, 85 percent used a mobile internet access device. Many internet users in the 25 to 45 year age bracket also had a mobile device: 69 percent. Internet users aged 65 to 75 made significantly less use of mobile devices. The proportion of older people using mobile devices has grown significantly, however: from 13 percent in 2011 to 23 percent in 2012.

For individuals younger than 45 years of age, smartphones are the most commonly used mobile internet access device. The 65+ age group primarily uses laptops for mobile internet access.

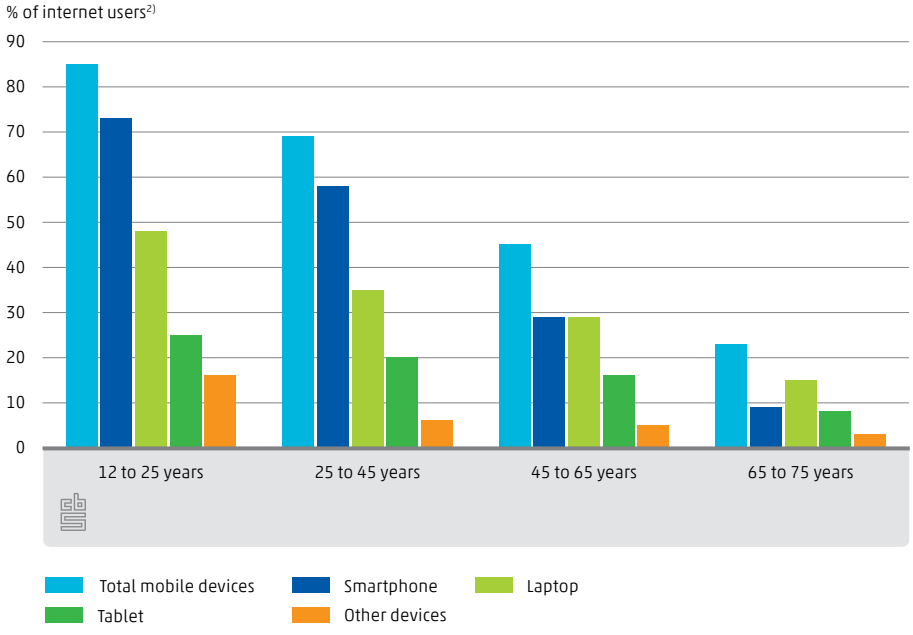
4.1.5 Use of mobile devices for internet access, 2012[1)]



Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) Use of mobile devices, excluding use at home or at work.
2) Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

4.1.6 Use of mobile devices for internet access, by age, 2012[1)]



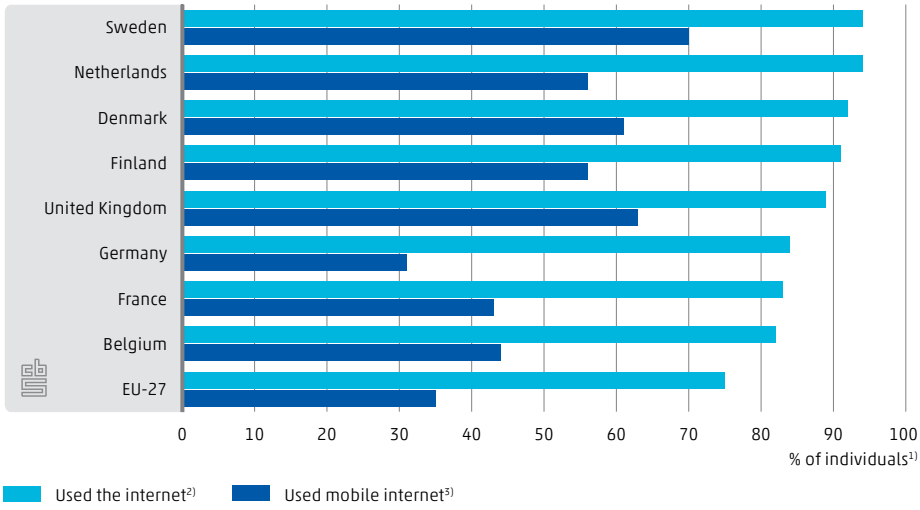
Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) Use of mobile devices, excluding use at home or at work.
2) Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

Internet use in the Netherlands ranks among the top in Europe

The percentage internet users in the Netherlands is the highest in Europe: 94 percent. Only Sweden matches this percentage (Figure 4.1.7). Denmark and Finland also score high. Of all EU residents, 75 percent accessed the internet in 2012. The Dutch population also uses the mobile internet much more frequently than the EU average. In 2012, 56 percent of the Dutch population used the mobile internet. The EU average was 35 percent. Sweden, Denmark and the United Kingdom surpass the Netherlands in this area.

4.1.7 Use of the internet and mobile internet, international, 2012



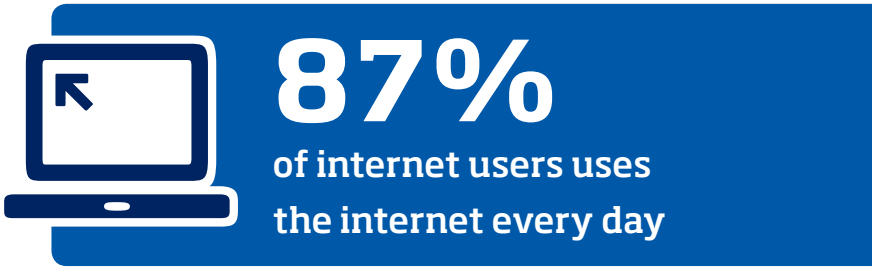
Source: Eurostat.

1) Individuals aged 16 up to and including 74 years.
2) Used the internet in the twelve months prior to the survey.
3) Used a mobile device, such as a smartphone, laptop or tablet, to access the internet.

87 percent uses the internet on a daily basis

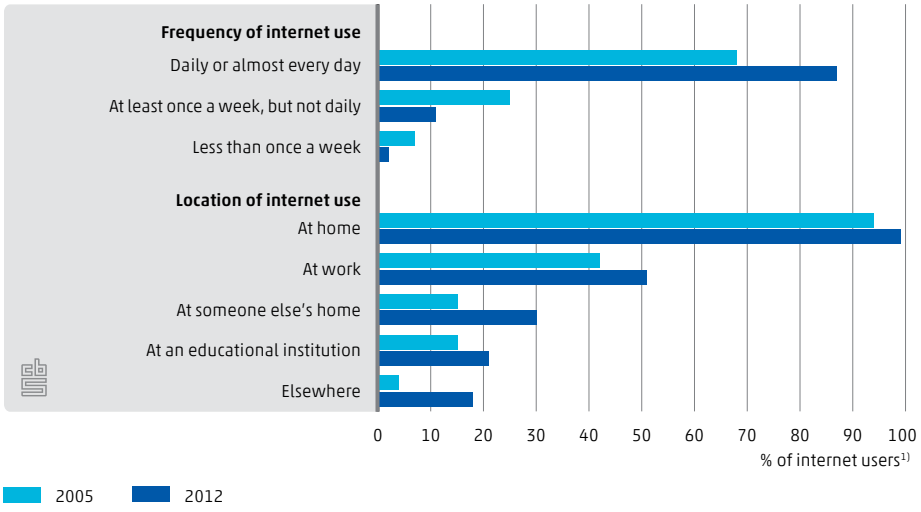
In 2012, 87 percent of all internet users accessed the internet virtually every day (Figure 4.1.8). This is significantly higher than the proportion of daily internet users in 2005. In recent years, there has been little growth; the percentage of daily internet users was already 86 percent in 2011.

Almost every internet user uses the web at home. The workplace is also a common location from which to access the internet. In 2012, 51 percent of internet users went online at work. The corresponding figure for 2005 was 42 percent.



In 2012, far more people used an internet connection at someone else's home than in 2005. Indeed, increasingly more households have a WiFi connection and increasingly more individuals use smartphones and tablets as a means of accessing the internet via these wireless connections, including in someone else's home.

4.1.8 Frequency and location of internet use, 2005 and 2012



Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

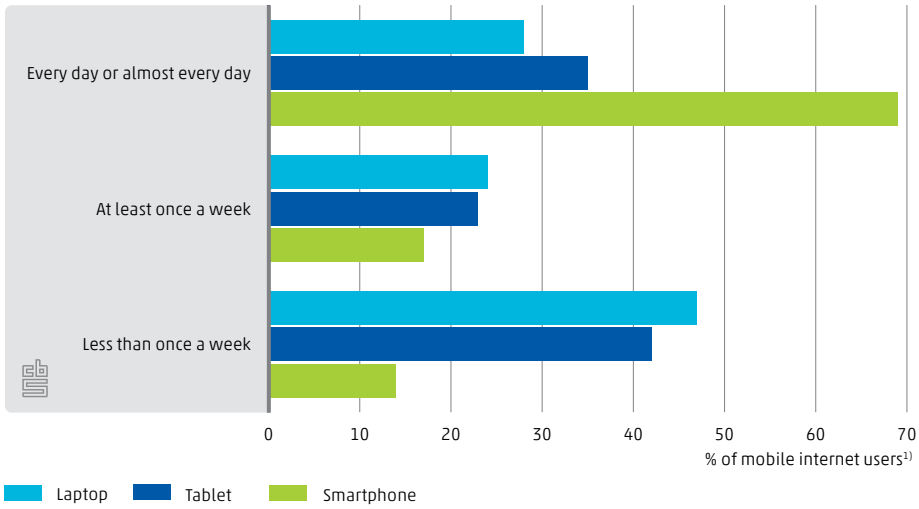
Daily mobile internet users: primarily smartphones

69 percent of all daily mobile internet users used a smartphone (Figure 4.1.9). Over one third of them used a tablet and 28 percent used a laptop for mobile internet access.

People that do not access the internet on a daily basis through mobile means make far less use of smartphones: approximately 15 percent of them uses a smartphone for mobile internet access. They far more often use a laptop. Individuals who access

the internet less than once a week using mobile means, far more often use a tablet than daily mobile internet users.

4.1.9 Frequency of use of mobile internet access devices, 2012



Source: Statistics Netherlands, ICT Use by Households and Individuals.
1) Individuals aged 12 up to and including 74 years who used the mobile internet in the three months prior to the survey.

4.2 Activities and services on the internet

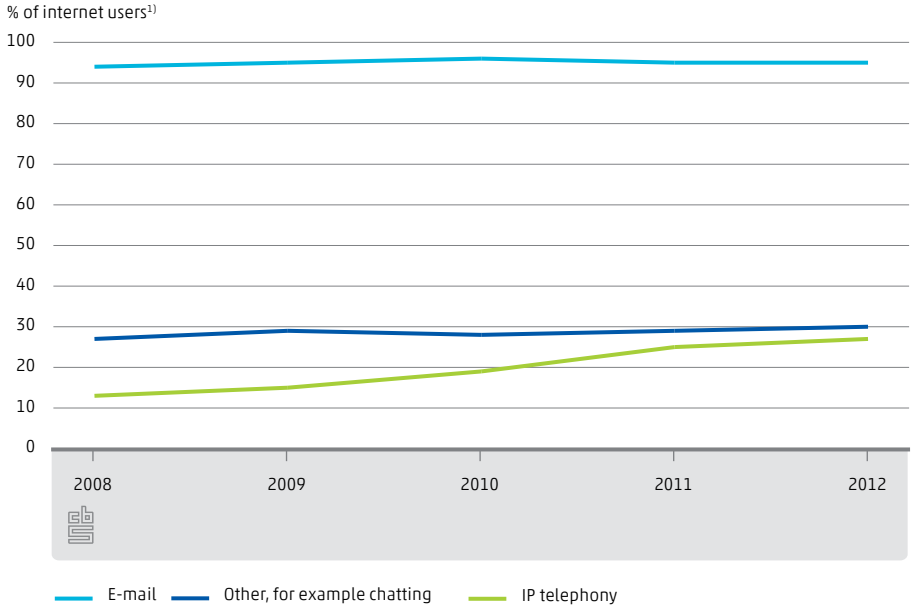
Many Dutch citizens use the internet to communicate and to look for information. Many other applications are also rapidly gaining in popularity. This section explores why Dutch citizens use the internet.

Especially to communicate

Communicating has been the most important internet activity of individuals for many years. Virtually every internet user communicated in one form or another over the internet in 2012. The major portion communicated via e-mail: 95 percent. This proportion has been stable for some years. In addition, the proportion of chatting

internet users has not changed a great deal since 2008, and is approximately 30 percent each year (Figure 4.2.1). The use of IP telephony has significantly increased in recent years. In 2008, 13 percent of internet users made telephone calls via internet applications, such as Skype. This figure had doubled to 27 percent by 2012.

4.2.1 Communication via internet, 2008-2012



Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

The same percentage of men and women use e-mail. In 2012, 94 percent of men used e-mail, while 95 percent of women did so. Men use the internet more frequently than women for IP telephony and to chat. In 2012, 30 percent of male internet users made telephone calls via the internet. For women, this proportion was 24 percent. One third of men used the internet to chat compared to one quarter of women.

Almost all internet users make use of e-mail, regardless of their age. Age is a differentiating factor in other forms of internet communications, however. For example, over half of young people used the internet to chat in 2012, whereas the proportion of people aged 65 to 75 who did so was much lower: 10 percent. Furthermore, relatively more young people aged 12 to 25 use IP telephony than the 65+ age group (34 and 20 percent, respectively).

Important source of information

The internet is not only important as a means of communication, but also as a source of information. Nine in ten internet users used the internet in 2012 to search for online information on goods or services (Table 4.2.2). This proportion has been roughly the same since 2005. Many people also use the internet to listen to radio or watch TV. This share has grown significantly, especially between 2005 and 2009. Since then it has been fairly stable. The number of internet users reading online newspapers has increased in recent years, however. This share increased from 49 percent to 59 percent between 2009 and 2012. Playing games and listening to music have also become common internet activities. Far fewer internet users download software or look for a job online.

4.2.2 Information and entertainment via the internet, 2005-2012

	2005	2006	2007	2008	2009	2010	2011	2012
	% of internet users[1]							
Search for information about goods and services	87	88	89	86	87	90	87	89
Listen to radio or watch TV	26	35	42	52	57	58	60	60
Games, images or music[2]	50	55	56	65	57	56	59	60
Download or read newspapers	35	43	45	47	49	53	56	59
Make use of travel-related services	49	50	54	55	51	55	52	55
Download software	27	31	34	37	34	32	30	33
Apply and/or search for a job	19	22	21	18	19	21	20	21

Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

2) Play or download games, view or download images, or play or download music.

Online banking an integral part of life

In 2012, eight in ten internet users engaged in online banking (Table 4.2.3). This proportion has been at a high, stable level for some years. Internet users in the 25 to 45 age group are the most active in this area. In 2012, 92 percent of them engaged in online banking.

4.2.3 Use of the internet for financial services, by age, 2005-2012

	Online Banking								Other Financial Services							
	2005	2006	2007	2008	2009	2010	2011	2012	2005	2006	2007	2008	2009	2010	2011	2012
	% of internet users[1]															
Total	58	67	72	74	78	81	82	82	5	8	7	8	6	9	9	12
12 to 25 years	40	49	54	56	59	63	62	63	2	3	4	5	3	6	7	10
25 to 45 years	69	78	83	85	89	91	93	92	5	9	8	8	7	9	9	14
45 to 65 years	59	70	75	76	79	83	85	84	7	11	10	11	7	9	10	12
65 to 75 years	47	55	53	63	64	73	68	75	4	7	7	9	10	10	10	10

Source: Statistics Netherlands, ICT Use by Households and Individuals.

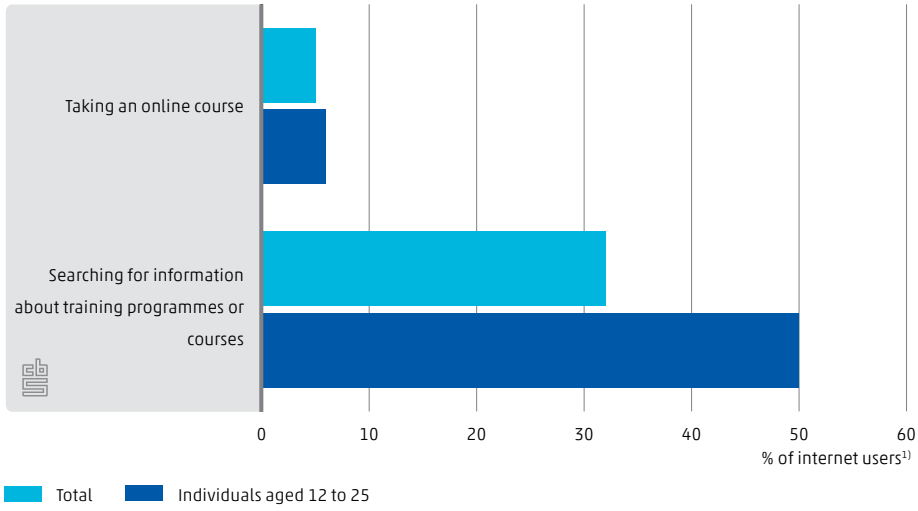
[1] Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

In addition to online banking, individuals can also perform other kinds of financial activities via the internet, such as trading shares or other financial products. This type of online service is not yet very popular, but the number of internet users making use of these services is increasing somewhat. In 2011, this share was 9 percent; by 2012, it was 12 percent. 14 percent of internet users in the 25 to 45 age group performed such financial transactions over the internet. The corresponding figure for those between 12 to 25 years of age was 10 percent.

Half of young people search online for information about education and training

In 2012, 5 percent of internet users took an online course. In addition, 32 percent searched for information over the internet about training programmes or courses (Figure 4.2.4). The corresponding proportion for individuals aged 12 to 25 was 50 percent.

4.2.4 Online courses or training programmes, 2012

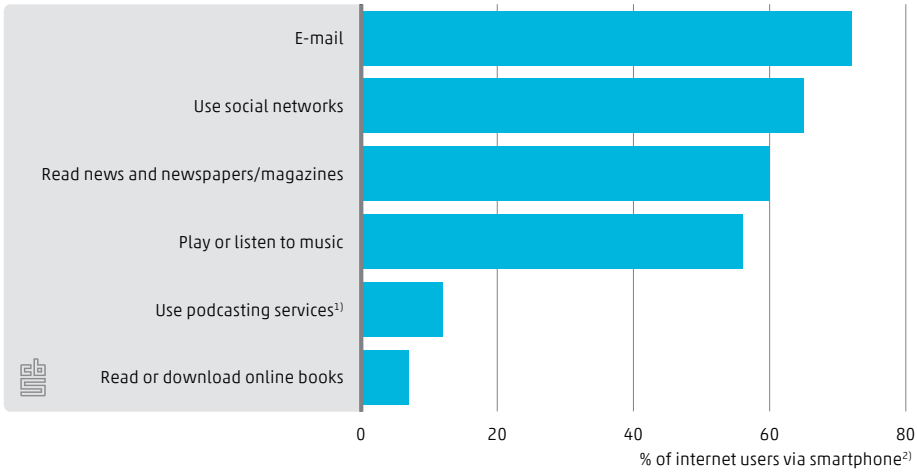


Source: Statistics Netherlands, ICT Use by Households and Individuals.
1) Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

Use of the internet via smartphones

Figure 4.2.5 shows which activities internet users use via their smartphones. Almost three quarters of them use their smartphone for e-mail. In addition, it is customary to use the smartphone for playing games, listening to music or keeping up with the news. Not many internet users use their smartphone for podcasting services or reading online books.

4.2.5 Internet use via smartphones, 2012



Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) Services designed to automatically receive audio and video files.
2) Individuals aged 12 up to and including 74 years who used the internet via a smartphone, outside of their home or work, in the three months prior to the survey.

Two of three smartphone users participate in social networks via their smartphone. The next part of this section describes how the Dutch population use social media. Social media can be used to share information by, for example, posting messages to an online discussion forum, weblog or social network. There are various types of social media. Table 4.2.6 illustrates the classification used by Statistics Netherlands for this purpose.

Social networks are popular

Social networks are the most often used form of social media in the Netherlands. In 2012, two thirds of Dutch internet users was active in a social network (Table 4.2.6). Users can establish contact with other participants and share messages and files, such as photos and videos via a social network. Young people aged 12 to 25 make the most use of social media. Social networks are especially popular among this age group: in 2012, 95 percent of young internet users had a social network account. People in the older age group are far less often active in social networks. Slightly more than one fifth of the 65 to 75 age group participated in social networks in 2012.

4.2.6 Use of social media, 2012

	Post messages on chat site or online discussion forum	Read or maintain weblogs	Social networks				Other social media
			total social networks	exchange text messages (instant messaging)	professional network (such as LinkedIn)	other social network (such as Hyves, Facebook or Twitter)	
	% of internet users[1]						
Total	30	22	66	35	22	56	29
Gender							
Men	33	24	67	38	26	53	28
Women	27	19	66	32	17	59	30
Age							
12 to 25 years	52	27	95	67	14	88	4
25 to 45 years	31	24	77	36	31	66	20
45 to 65 years	19	19	50	21	22	34	44
65 to 75 years	10	11	23	8	5	17	67
Level of education							
Primary education	34	16	67	42	8	60	28
Secondary education	29	21	65	32	18	56	31
Higher education	27	29	68	31	41	51	27

Source: Statistics Netherlands, ICT Use by Households and Individuals.

[1] Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

In particular, many highly educated internet users use professional social networks such as LinkedIn: over four in ten in 2012. Among the less educated this figure was 8 percent. Men more often use a professional network than women. In addition, this type of website is also popular among individuals aged 25 to 45. In 2012, 31 percent of them had a professional network account.

Not only websites such as Hyves, Facebook, Twitter en LinkedIn are social networks. Instant messaging is also considered part of social networks. Instant messaging is an application that enables a user to immediately communicate with others that are online at that point in time. In 2012, 35 percent of internet users took part in instant messaging. The corresponding figure for those between 12 to 25 years of age was 67 percent.

4.3 Online shopping

The previous section described how the Dutch population uses the internet. Online shopping was not addressed in that section. Online shopping has grown significantly over the last decade. This section is completely dedicated to this topic.

Further increase in the number of e-shoppers

In 2012, 9.8 million Dutch citizens had done some online shopping at one time or another (Table 4.3.1). This once again represents an increase over the previous year. In other words, the popularity of online shopping continues to increase. The extensive availability of products, the convenience of the internet and the possibility of comparing products in terms of price and quality probably play an important role in this regard.

Not only the number of e-shoppers is increasing. The frequency at which the Dutch population is engaging in online shopping is also increasing. In 2012, 7.1 million individuals frequently ordered goods or services over the internet. This represents 57 percent of all internet users. In 2002, the Netherlands had 1.9 million frequent e-shoppers, representing 21 percent of all internet users at the time.[1)] Online shopping has become an important internet activity for many Dutch citizens.

Many e-shoppers in the Netherlands

In 2012, 79 percent of internet users aged 16 to 75 in the Netherlands engaged in online shopping. As a result, the Netherlands, together with a number of other countries, including Sweden, Denmark and Germany, is among a group of countries with a relatively high number of e-shoppers (Figure 4.3.2). The United Kingdom had the highest percentage (82 percent). In Italy, people were far less likely to use the internet for online shopping; the proportion there was 29 percent.

1) Frequent e-shoppers are individuals who made online purchases in the three months prior to the survey.

8 in 10
internet users shop online

4.3.1 Online shopping, 2002-2012[1)]

	2002	2005	2006	2007	2008	2009	2010	2011	2012
	absolute numbers (mln)								
E-shopper	3.6	5.9	6.6	7.5	7.7	8.8	9.3	9.5	9.8
frequent e-shopper	1.9	3.9	4.5	5.3	5.4	6.0	6.6	6.7	7.1
infrequent e-shopper	1.7	2.0	2.1	2.2	2.4	2.7	2.7	2.8	2.7
Not an e-shopper	5.3	4.8	4.2	3.8	3.7	3.0	2.7	2.5	2.4
Total internet users	8.9	10.7	10.9	11.3	11.5	11.8	12.0	12.1	12.3
	% of internet users								
E-shopper	40	55	61	66	67	74	77	79	80
frequent e-shopper	21	36	41	47	47	51	55	55	57
infrequent e-shopper	19	19	20	19	21	23	22	23	22
Not an e-shopper	60	45	39	34	33	25	23	21	19
Total internet users	100	100	100	100	100	100	100	100	100

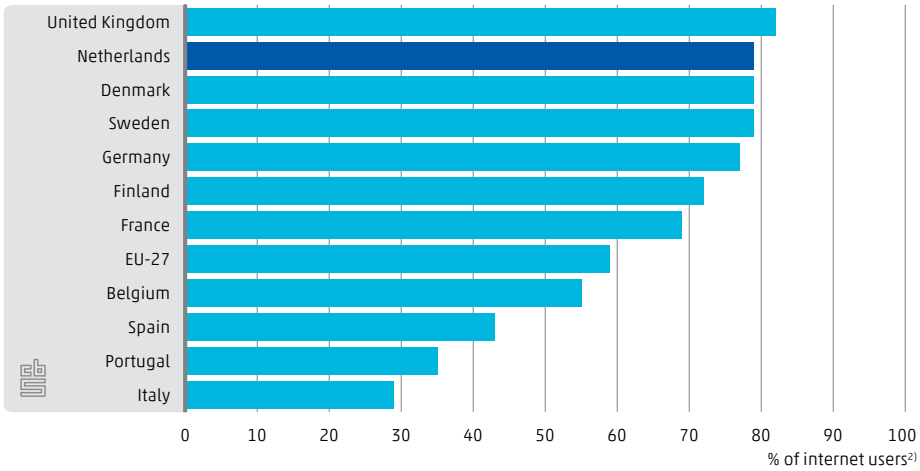
Source: Statistics Netherlands, POLS (2002) and ICT Use by Households and Individuals (2005–2012).

1) Individuals aged 12 up to and including 74 years who are also internet users.
Frequent e-shoppers made an online purchase in the three months prior to the survey.
Infrequent e-shoppers did so more than three months ago.

The Dutch frequent e-shopper: 25 to 45 years, well educated

In the Netherlands, more men than women frequently shop online. In 2012, 60 percent of male internet users regularly purchased products via the web, compared to 55 percent of women (Figure 4.3.3). Internet users aged 25 to 45 more frequently shop online than other age groups. In 2012, 70 percent of this group was a frequent e-shopper. The proportion among the 65+ age group was 34 percent. There also are significant differences between highly educated and less-educated individuals. Of the highly educated internet users, 72 percent regularly purchased something via the internet in 2012. The corresponding figure for less-educated individuals was 40 percent.

4.3.2 E-shoppers, international, 2012[1)]

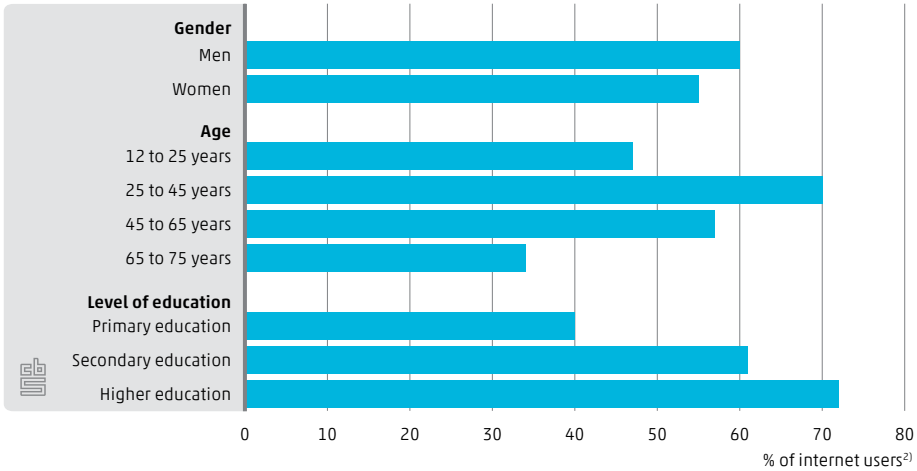


Source: Eurostat.

[1)] Individuals aged 16 up to and including 74 years who engaged in online shopping in the twelve months prior to the survey.

[2)] Individuals aged 16 up to and including 74 years who used the internet in the twelve months prior to the survey.

4.3.3 Frequent e-shoppers by personal characteristics, 2012[1)]



Source: Statistics Netherlands, ICT Use by Households and Individuals.

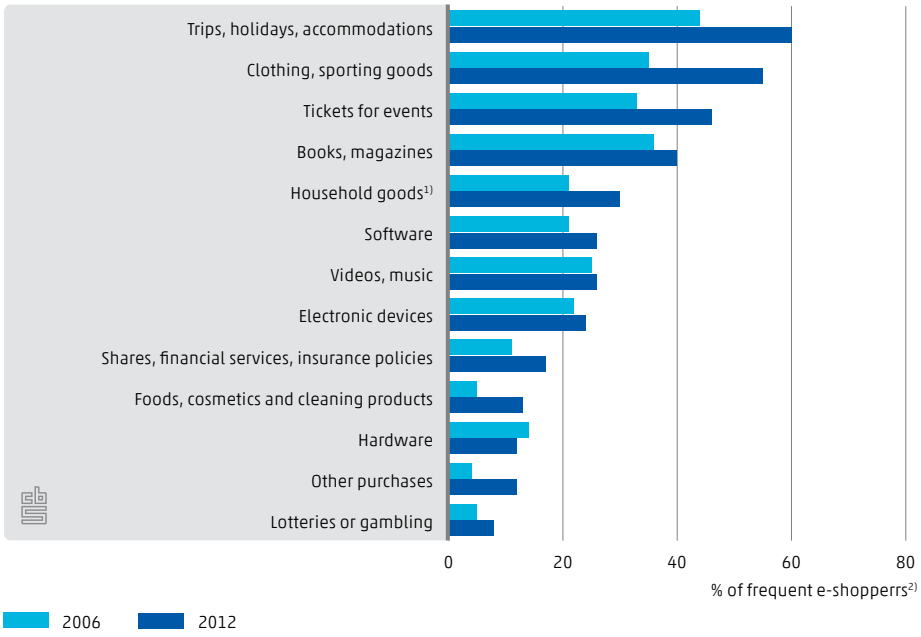
[1)] Individuals aged 12 up to and including 74 years who made online purchases in the three months prior to the survey.

[2)] Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

Many trips and holidays

Trips, holidays and accommodations have been the most common type of online purchases made for some years (Figure 4.3.4). In 2012, six in ten frequent e-shoppers booked trips and holidays online. Many people also purchase clothing, books, magazines and tickets for events via the web. In 2012, more internet users made online purchases in almost all of the different purchase categories than in 2006. The clothing and sporting goods categories had the highest growth. In 2006, 35 percent of internet users purchased clothing and footwear via the web; in 2012 this was 55 percent. The online purchase of trips, holidays, accommodations and tickets for events also experienced significant growth.

4.3.4 Online purchases by type, 2006 and 2012



Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) For example furniture, washing machines and toys.

2) Individuals aged 12 up to and including 74 years who made online purchases in the three months prior to the survey.

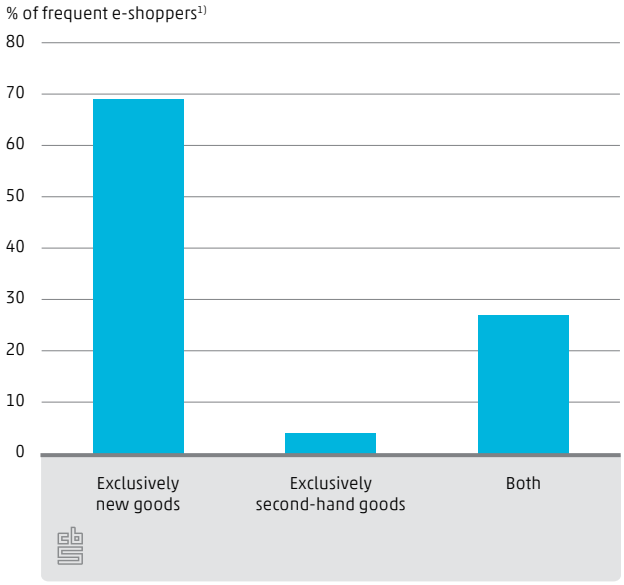
Men often purchase different products than women over the internet. For example, in 2012 more women than men purchased clothing online. Of all women who regularly made online purchases, 64 percent purchased clothing over the internet. The corresponding figure among men was 47 percent. By contrast, men more frequently purchased software over the internet than women: 35 and 17 percent

of frequent e-shoppers, respectively. Men also more often purchased hardware and electronics over the internet than women.

Especially new goods

Almost 70 percent of frequent e-shoppers exclusively purchased new goods over the internet in 2012 (Figure 4.3.5). Almost one quarter purchased new as well as second-hand goods and 4 percent exclusively purchased second-hand goods.

4.3.5 Online purchases of new and/or second-hand goods, 2012

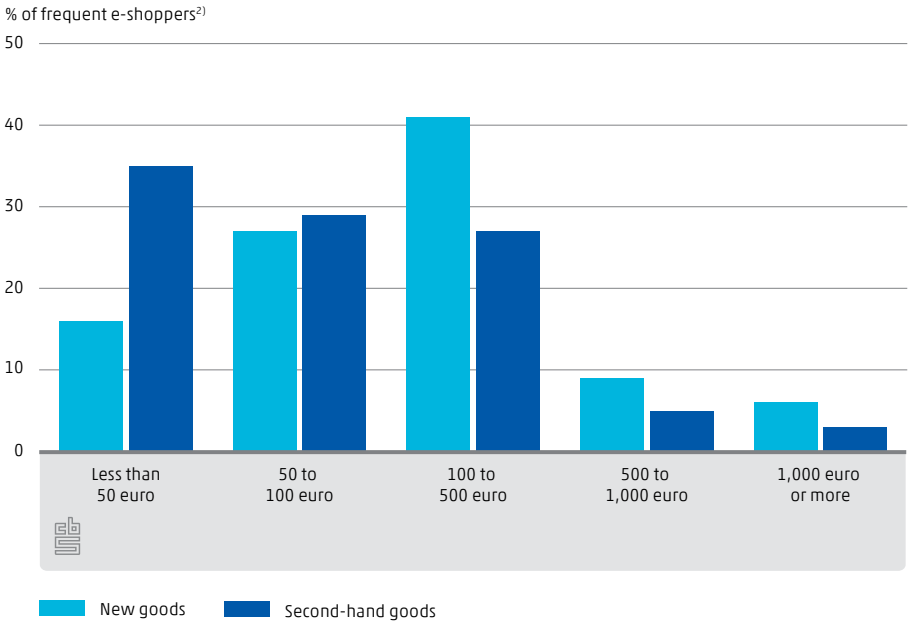


Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) Individuals aged 12 up to and including 74 years who made online purchases in the three months prior to the survey.

In the three months prior to the survey, 41 percent of the frequent e-shoppers in total spent 100 to 500 euros on new goods purchased over the internet (Figure 4.3.6). During that period a large percentage spent a total of 50 to 100 euros on new goods: 27 percent. Far fewer people spent 1,000 euros or more on online purchases during the three months prior to the survey, namely 6 percent. E-shoppers spend less on second-hand goods than they spend on new goods. Of the frequent e-shoppers, 35 percent spent not more than 50 euros on second-hand goods in the three months prior to the survey. Few people spent more than 500 euros over a period of three months on the purchase of second-hand goods via the internet.

4.3.6 Total expenditures on the online purchase of new and second-hand goods, 2012[1)]



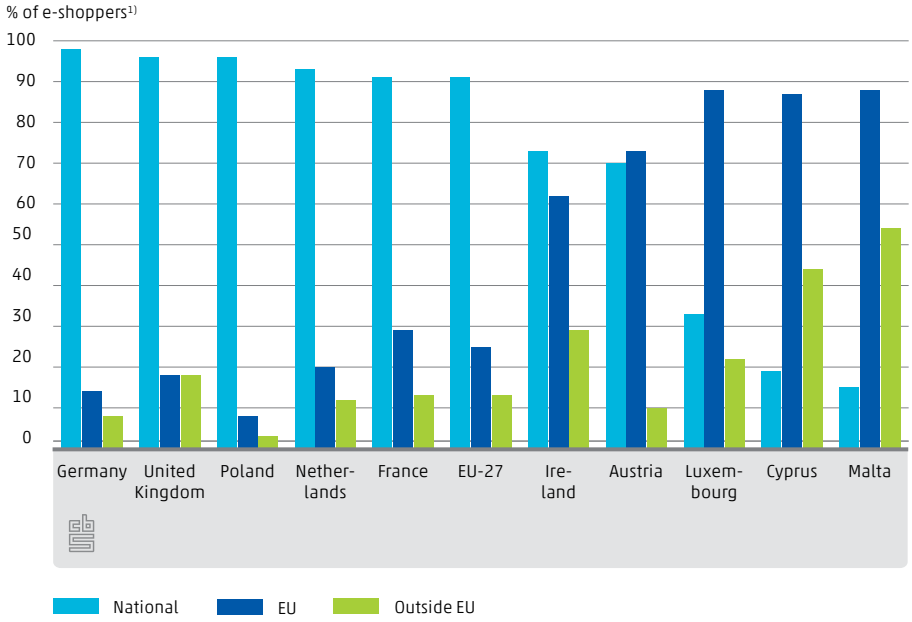
Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) Total expenditure on goods purchased over the internet in the three months prior to the survey.
2) Individuals aged 12 up to and including 74 years who made online purchases in the three months prior to the survey.

Most online purchases originate in own country

The major share of Dutch e-shoppers made their purchases from suppliers in their own country in 2012: 93 percent. One fifth purchased goods from other EU countries and 12 percent purchased goods outside the EU (Figure 4.3.7). In most other EU member states, internet users primarily purchase goods from their own country as well. In small countries, such as Luxembourg, Malta and Cyprus, most internet users purchase their goods abroad. This is also true of Austria. E-shoppers from Germany and Poland purchase few goods outside their own country.

4.3.7 Online purchase of goods or services, by supplier origin, international, 2012



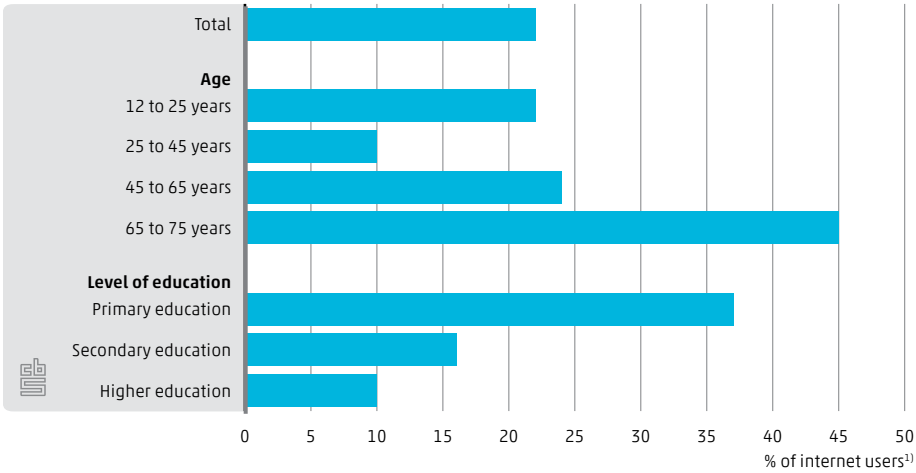
Source: Eurostat.

[1)] Individuals aged 16 up to and including 74 years who made online purchases in the twelve months prior to the survey.

One in five internet users does not shop online

Increasingly more people shop online. However, there also is a group of internet users who do not make any purchases over the internet. In 2012, 22 percent of internet users still had never purchased anything online (Figure 4.3.8). Especially the older population does not shop online. Of the internet users aged 65 to 75 years, 45 percent had never purchased anything via the web in 2012. The proportion of internet users that did not make any online purchases is significantly higher among less-educated individuals than it is among highly educated individuals. In 2011, Statistics Netherlands inquired into the reasons for internet users not to shop online. The most important reason for not shopping online proved to be a preference for traditional shopping, for example to be able to try on clothing in a shop. Six in ten persons who do not shop online, in 2011 had a preference for traditional shopping (Statistics Netherlands, 2012a).

4.3.8 Internet users who do not shop online by personal characteristics, 2012



Source: Statistics Netherlands, ICT Use by Households and Individuals.

1) Individuals aged 12 up to and including 74 years who used the internet in the three months prior to the survey.

5. ICT use by companies

ICT is essential for companies. For example, a significant part of their sales is conducted online. A solid ICT infrastructure and equipment such as computers and smartphones are indispensable in this respect and are steadily increasing in importance as well. New applications that help companies improve their processes and make them more efficient are constantly emerging.

5.1 The workforce and ICT

Information and communication technologies (ICT) have penetrated the Dutch business sector at a high pace over the last few decades. Companies in many sectors are improving their competitive position by effectively applying ICT. For example, through means of ICT, companies can develop new products and processes, and optimise existing ones (European Commission, 2009). ICT can also benefit companies in other ways, for example because employees have a preference for employers with advanced ICT. More and more companies are embracing the current trend towards flexible working arrangements, independent of place and time. A solid ICT infrastructure is essential in this respect. The Netherlands, together with Switzerland and Denmark, is among the countries with the best ICT infrastructure in the world (Economist Intelligence Unit, 2011). Not all companies use ICT to the same degree. For example, it would not be very sensible for a restaurant to invest a great deal in technologies that facilitate telework for employees. By contrast, in companies with many knowledge workers a system of this nature can make business operations more efficient and make the company attractive as an employer. Economic considerations of this nature determine how a company deploys ICT.

Computer and internet use stable

In 2012, 66 percent of employees regularly used a computer to perform their work. This percentage has been stable since 2008. This also applies to the proportion of employees using the internet for their work. In 2012, this was 60 percent, compared to 57 percent in 2008.
The differences between sectors are great (Figure 5.1.1). In financial institutions, such as banks and insurance companies, almost everyone uses a computer and the internet for their work. In the construction industry and in the hospitality sector this proportion is much smaller; the work in these sectors is generally less suited for this. Nevertheless, 44 and 31 percent of the workforce, respectively, regularly uses the internet.

‘ICT use by companies’ survey

Statistics Netherlands each year conducts a survey to assess how companies use ICT. The ‘ICT use by companies’ survey uses a sample of approximately 10,000 companies with ten or more employees. Not all sectors form part of the surveyed population. For example, the survey excludes the agricultural sector. The following table provides an overview of the sectors included in the survey. In addition, for each sector the table includes a short name, which is used in the figures and tables contained in this chapter.

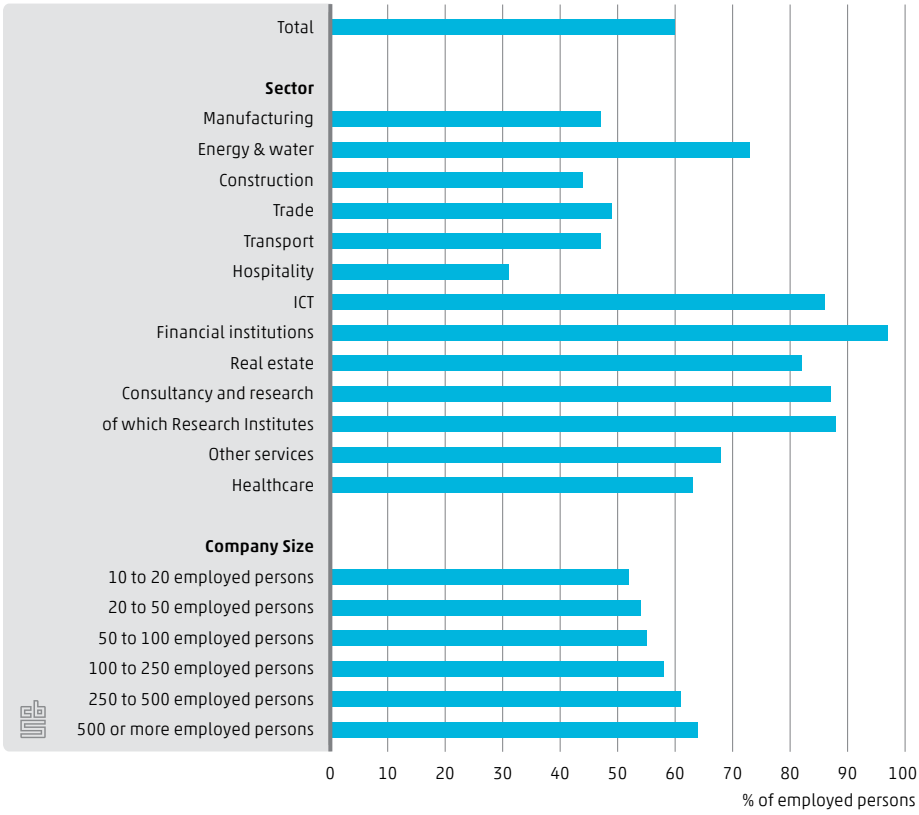
Name in this publication	SIC2008 sector
Manufacturing	C Manufacturing industry
Energy & water	D Production and distribution of electricity, natural gas, steam and cooled air,
	E Extraction and distribution of water; waste and waste water management and decontamination
Construction	F Construction industry
Trade	G Wholesale and retail trade; car repair
Transport	H Transport and storage
Hospitality	I Accommodation, food and beverages
ICT	J Information and communication
Financial institutions	K Financial activities and insurances[1)]
Real estate	L Operation of and trade in real estate
Consultancy and research	M Professions and scientific and technical activities
including Research Institutes	72 Research and Development
Other services	N Administrative and supporting services
Healthcare	Q Healthcare and welfare

[1)] Only SIC codes 64.19, 64.92, 65.1, 65.2, 66.12 and 66.19.

Because ICT applications are evolving at a very high pace, the content of the ICT questionnaire is constantly changing as well. In the eighties, a key question was whether companies had computers and whether they employed ICT personnel. The emphasis in recent years has been more on issues like the internet, e-commerce and software applications. These significant substantive changes mean that extended time series are not available. On the other hand, it is of course possible to compare the Netherlands with other countries in Europe, because EU countries individually have been using the same questions and definitions since 2001.

StatLine, the online Statistics Netherlands database, contains all findings of the ‘ICT use by companies’ survey. This database is available at http://statline.cbs.nl.

5.1.1 Employed persons who use a computer with internet access at work, 2012[1)]



Source: Statistics Netherlands, ICT use by companies.

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

Relatively more people work with computers and the internet in large companies than in small companies, but the differences are slight. In companies with 10 to 20 employees, 57 percent of employees regularly used a computer in 2012, whereas the corresponding figure for companies with 500 or more employees was 70 percent. In small companies, 52 percent used the internet, compared to 64 percent in large companies.

The Netherlands: many employees work with the internet

In the Netherlands, a significantly larger proportion of employees work with the internet than the average in the EU. The EU average was 45 percent in 2012;

according to the international definition this was 57 percent in the Netherlands.[1)] This percentage was higher than in Germany (52 percent) and France (45 percent). Of the EU countries, Sweden had the highest proportion: 69 percent. At 22 percent, Bulgaria scored lowest.
The differences between countries are strongly related to the national economic structures. Indeed, in certain sectors the use of the internet by employees is more important than in other sectors. As a result countries with a high number of manufacturing companies, for example, score lower than countries with a large service sector.

The European definition differs from that used in the Netherlands

The EU countries have reached agreement concerning the sectors to be included in the ICT survey. This means that the findings of the European countries are comparable. In addition to this internationally agreed-on population, Statistics Netherlands has included several additional sectors in the survey: the financial institutions and healthcare. The findings concerning the Netherlands as a result may be somewhat different in the international comparisons. For example, according to the national definition, 60 percent of Dutch employees used the internet in 2012. Compared with other countries, when the European definition is used, this percentage is somewhat lower: 57 percent.

Six in ten companies allow teleworking

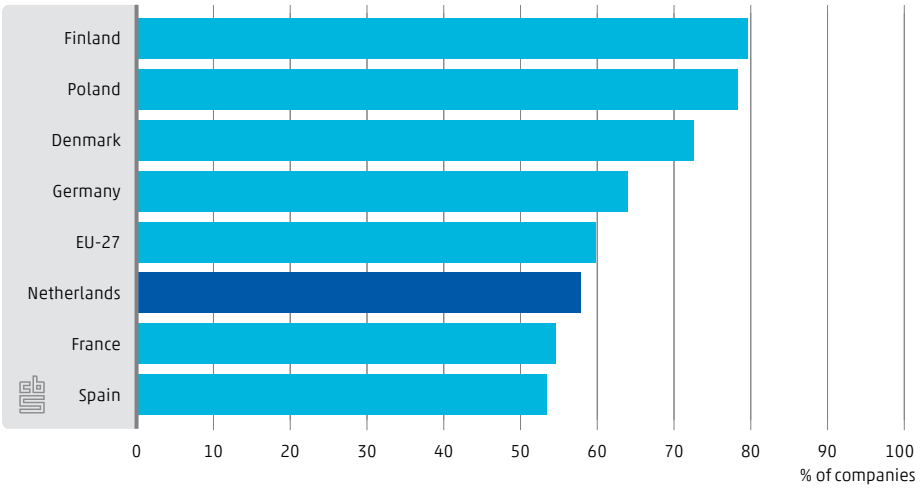
Increasingly more companies support teleworking. In 2012, the proportion of companies supporting teleworking was 58 percent. Teleworking here is defined as the ability of employees to use the company's ICT systems from outside the company's premises. This not only involves access to e-mail, but also, for example, to files, the intranet and software applications. The Netherlands in this respect is at the EU average. Finland has the largest proportion of companies facilitating teleworking: 80 percent.

Especially the financial sector and ICT companies support teleworking on a large scale in the Netherlands; nine in ten companies in both sectors. In the hospitality

1) See text box about the differences between national and European figures.

sector this proportion is much smaller: 26 percent. Almost all companies with 500 or more employees provide teleworking facilities (96 percent). For companies with 10 to 20 employees, this share was significantly lower, but was still 47 percent.

5.1.2 Companies with teleworkers, international, 2012[1)]



Source: Eurostat.

[1)] Companies with ten or more employed persons, excluding financial institutions and healthcare.

Teleworking at
58% **of companies**

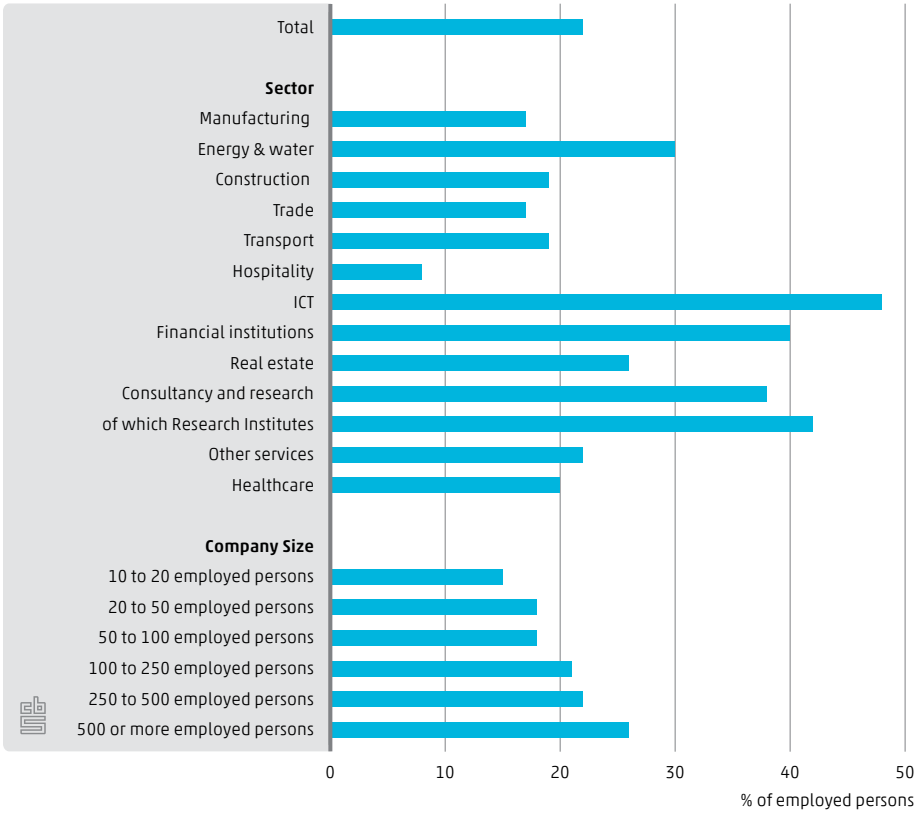
Employees: 22 percent can telework

When a company supports telework, often not all employees have that possibility. After all, the type of work does not always allow for it. For example, it is easier for office workers who frequently work with computers to telework than it is for an employee who works in a company restaurant. Twenty two percent of all employees telework.

Figure 5.1.3 shows, by sector and company size, the percentage of employees who can telework. The proportions differ significantly by sector. Relatively more

employees can telework in ICT companies (48 percent) and in the financial sector (40 percent). In the hospitality sector this proportion is only 8 percent. The percentage teleworkers is higher in large companies than in small companies. In companies with 500 or more employees the proportion is 26 percent; in companies with 10 to 20 employees it is 15 percent.

5.1.3 Employed persons who can telework, 2012[1)]



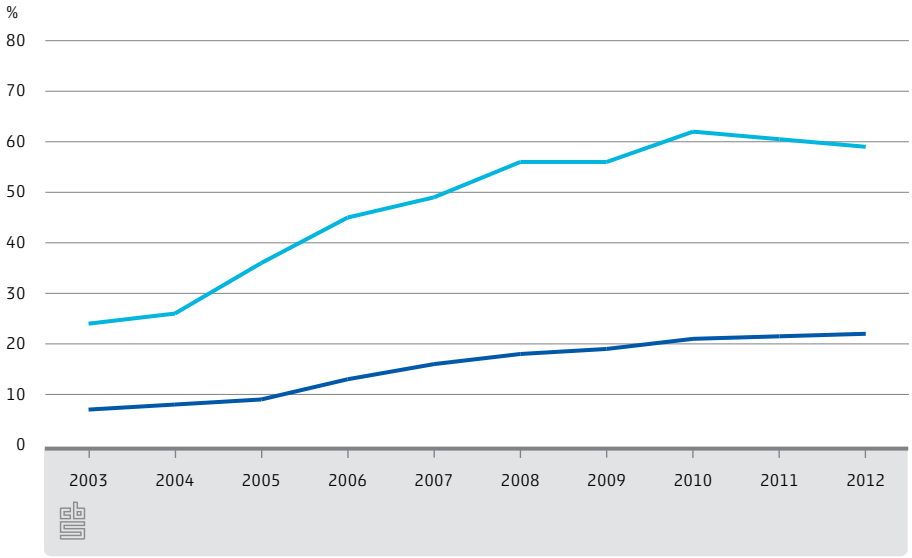
Source: Statistics Netherlands, ICT use by companies.

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

Teleworking is advancing

Teleworking has been advancing for approximately ten years. The percentage of companies that provide teleworking facilities has more than doubled since 2003. In fact the proportion of teleworkers has tripled. In 2003, only 7 percent of employees could telework. The corresponding figure for 2012 was 22 percent. Figure 5.1.4 illustrates this growth.

5.1.4 Teleworking, 2003-2012[1)2)]



Source: Statistics Netherlands, ICT use by companies.

1) Companies with ten or more employed persons.
2) 2003 to 2010, inclusive, concerns December; 2012 concerns January. There are no figures for 2011.

ICT job openings

In 2011, 8 percent of companies had job openings for ICT specialists that they were able/unable to fill. ICT specialists are employees whose work for the most important part consists of ICT. For example, they may be engaged in designing, developing, installing and managing ICT systems.
Aside from the ICT sector, financial institutions and research institutions also had many ICT job openings (Table 5.1.5). A striking finding is that care institutions also required relatively many ICT specialists; many more than the hospitality sector or the construction industry, for example. Large companies far more often have ICT job openings than small companies. Almost half of companies with at least 500 employees recruited ICT specialists. For companies with 10 to 20 employees the corresponding figure was only 4 percent.

Difficult to find ICT workers

Almost half of companies with ICT job openings had difficulty filling them in 2011: 44 percent (Table 5.1.5). In other words, in spite of the deteriorating economic conditions there still was a shortage of ICT specialists. The ICT sector had the most difficulty finding suitable ICT workers. Of the ICT companies with job openings for ICT workers, 53 percent had difficulty filling these positions. By contrast, this percentage was low for healthcare institutions: 24 percent. Large and small companies had approximately the same degree of difficulty filling ICT job openings.

5.1.5 Companies with ICT job openings, 2011[1)]

	ICT job openings[2)]	ICT job openings were difficult to fill
	% of companies	% of companies with ICT job openings
Total	8	44
Sector		
Manufacturing	6	41
Energy & water	17	41
Construction	1	16
Trade	5	48
Transport	6	39
Hospitality	0	31
ICT	49	53
Financial institutions	26	45
Real estate	6	43
Consultancy and research	12	44
including research institutes	24	44
Other services	5	51
Healthcare	12	24
Company size		
10 to 20 employed persons	4	44
20 to 50 employed persons	7	41
50 to 100 employed persons	11	43
100 to 250 employed persons	19	42
250 to 500 employed persons	32	51
500 or more employed persons	49	49

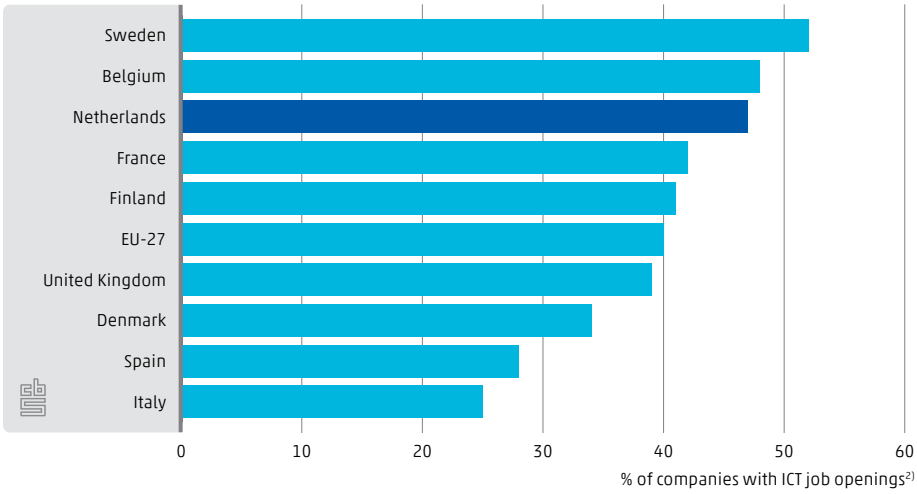
Source: Statistics Netherlands, ICT use by companies.

1) Companies with ten or more employed persons.

2) Companies that hired/wanted to hire ICT specialists.

In 2011, in the Netherlands there was a greater shortage of ICT workers than the EU average (Figure 5.1.6). In the EU-27, 40 percent of companies with ICT job openings had difficulty filling these positions, versus 47 percent in the Netherlands. In Italy and Spain companies found it relatively easy to hire ICT workers.

5.1.6 Companies with difficulty filling ICT job openings, international, 2011[1)]



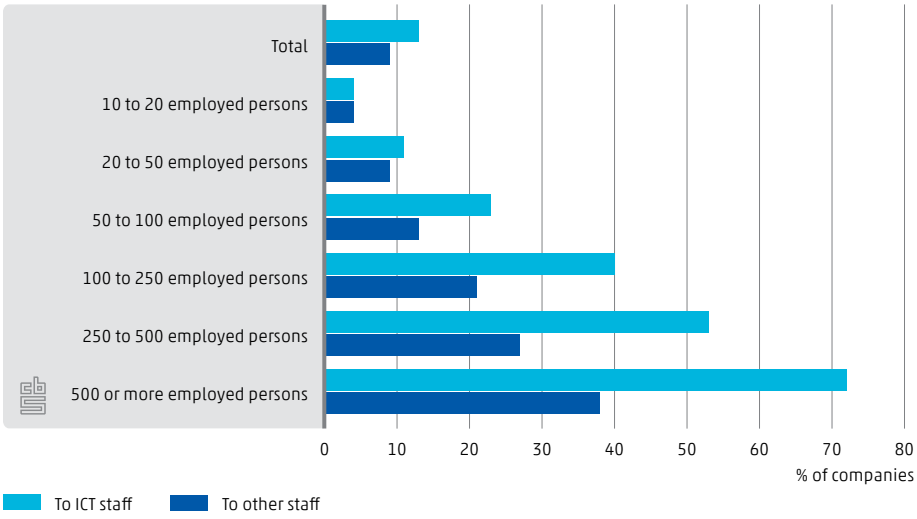
Source: Eurostat.

1) Companies with ten or more employed persons, excluding financial institutions and healthcare.
2) Companies that hired/wanted to hire ICT specialists.

Especially large companies offer their staff ICT courses

Companies can acquire ICT knowledge in-house by hiring new ICT specialists. Another option is to expand the knowledge of existing staff. In 2011, 13 percent of companies provided their ICT workers with the option of taking ICT courses (Figure 5.1.7). A somewhat smaller proportion of companies provided non-ICT workers with the option of taking an ICT course, namely 9 percent. Especially large companies invest in courses designed to develop the ICT knowledge of their staff.

5.1.7 Companies that offer their staff ICT courses, 2011[1)]



Source: Statistics Netherlands, ICT use by companies.

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

5.2 Internet access and use

Access to the internet is a matter of course for companies in the Netherlands. Almost all companies with ten or more employees have access to the internet. In 2012, 97 percent of companies used a broadband connection: a high-quality fixed or mobile connection such as optical fibre, cable, DSL or 3G.

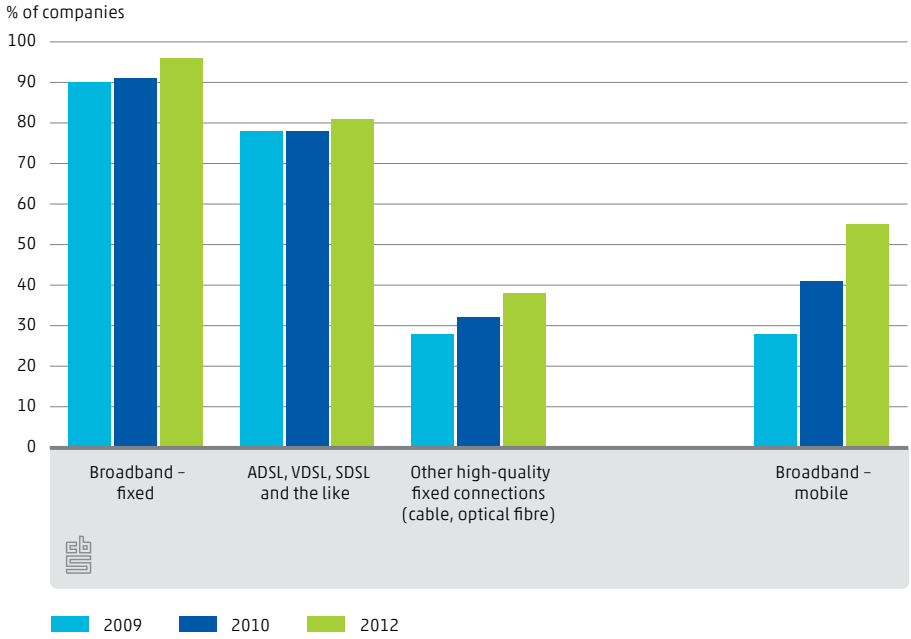
Increasingly more companies use the mobile internet

In 2012, 96 percent of companies had a fixed broadband connection and 55 percent had a mobile broadband connection (Figure 5.2.1).[2)] In 2009, only 28 percent of companies used a mobile broadband connection. This percentage has therefore grown quickly.

[2)] Broadband internet via mobile telephone networks, for example UTMS (3G) or 4G. The connection is established, for example, via a laptop, tablet or smartphone. Non-mobile wireless networks, such as WiFi within a company, are not included in this.

The ICT sector and the financial sector have the largest share of companies with mobile broadband: over eight in ten. Mobile broadband use was lowest for companies in the hospitality sector. The share in this sector was 35 percent in 2012. Furthermore, 95 percent of companies in the hospitality sector had a fixed broadband connection. In other words, virtually all companies in this sector are using high-speed internet.
Large companies are more inclined to use mobile broadband than small companies. In 2012, 89 percent of companies with at least 500 employees had mobile broadband, whereas the corresponding figure for companies with 10 to 20 employees was 44 percent. The mobile internet will be dealt with more elaborately at the end of this section.

5.2.1 Broadband internet in companies by type of connection, 2009-2012[1)2)]



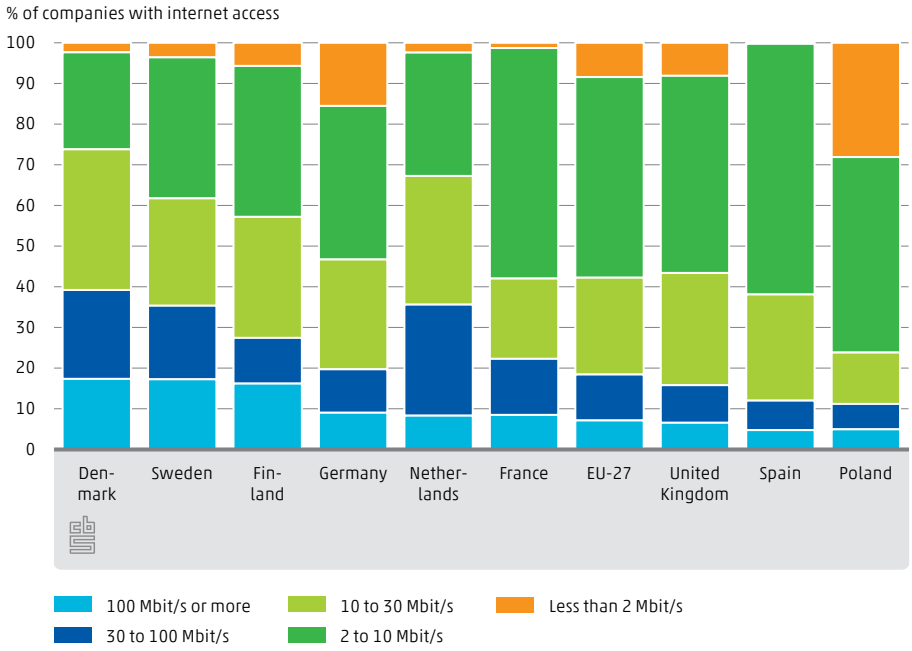
Source: Statistics Netherlands, ICT use by companies.
1) Companies with ten or more employed persons.
2) 2009 and 2010 concern December; 2012 concerns January. There are no figures for 2011.

Dutch companies use fast internet

Dutch companies have faster internet connections than the average in the EU. In 2012, 36 percent of Dutch companies had an internet connection that was faster than 30 Mbit per second. The corresponding average in the EU was 18 percent

(Figure 5.2.2). The front runner is Denmark where 39 percent has a fast connection. In almost all countries under consideration, an internet connection with a speed of between 2 and 10 Mbit per second is the most common. Connections that are slower than 2 Mbit per second are becoming increasingly rare. However, the share of this type of slow connection is still fairly high in Poland and Germany.

5.2.2 Maximum speed of fastest internet connections in companies, international, 2012[1)2)]



Source: Eurostat.

1) Companies with ten or more employed persons, excluding financial institutions and healthcare.
2) Fixed or mobile connection.

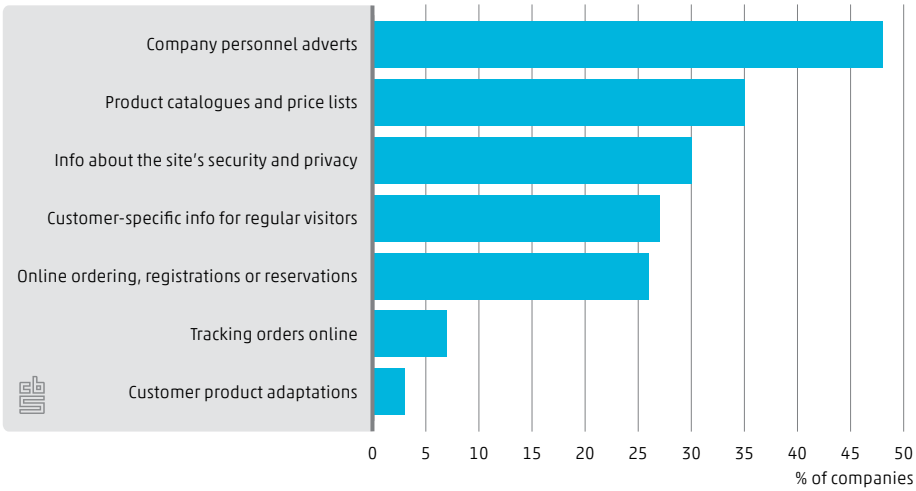
Many companies have a website

In 2012, 84 percent of Dutch companies had their own website. This share showed very little growth in recent years. The Netherlands nevertheless scores significantly higher than the 2012 EU average of 71 percent. Finland had the highest proportion: 91 percent. Other northern countries also scored high: 89 percent of companies in Denmark and Sweden had a website. In France, this proportion was 64 percent.

Companies often use their website for posting personnel advertisements. Half of all companies in 2012 had posted their own job openings on their website

(Figure 5.2.3). One in three companies has posted an overview of their products and prices. In one quarter of these companies, customers can also order these products online and in 7 percent they can furthermore track the progress of their order online.

5.2.3 Company website features, 2012[1)]



Source: Statistics Netherlands, ICT use by companies.
1) Companies with ten or more employed persons.

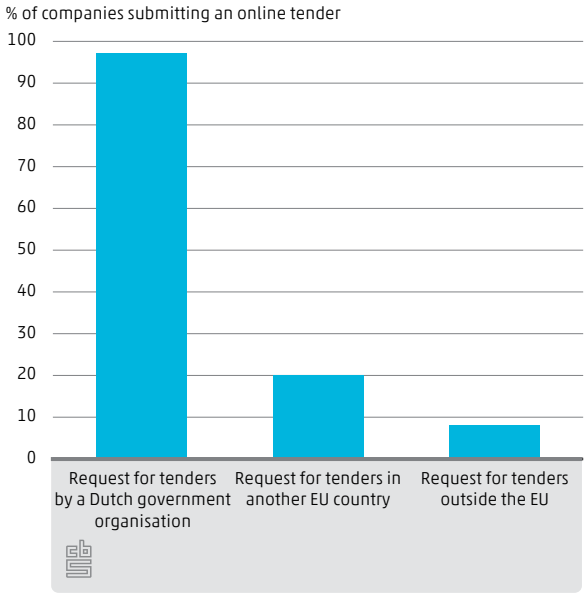
There are major differences between sectors concerning the way in which companies use their website. For example, in certain sectors far more companies conduct sales via the internet than in other sectors. Travel agencies and companies active in the accommodation sector most often provided the option of making online bookings: 85 and 75 percent, respectively. The construction industry had the smallest share of companies that conduct sales via their website: 11 percent. Over eight in ten construction companies have their own website, but they therefore hardly use it for online selling.

Online tenders

Companies can also often easily find information about public tenders over the internet. Some government organisations also give companies the option of proposing products or services online for public tendering projects. This is referred to as eTendering. Dutch as well as foreign government organisations use eTendering for receiving submissions for public tenders. In 2011, 20 percent of

Dutch companies consulted tender documents via the internet. Twelve percent of all companies submitted a tender online in response to a request for tenders. Almost all of these companies did so for a request of tender issued by a Dutch government organisation. In addition, 20 percent of the companies that participated in eTendering responded to a request for tenders issued in another EU country and 8 percent responded to a request for tenders issued outside the EU (Figure 5.2.4).

5.2.4 Dutch companies submitting online tenders, 2011[1)]



Source: Statistics Netherlands, ICT use by companies.

1) Companies with ten or more employed persons.

Mobile internet

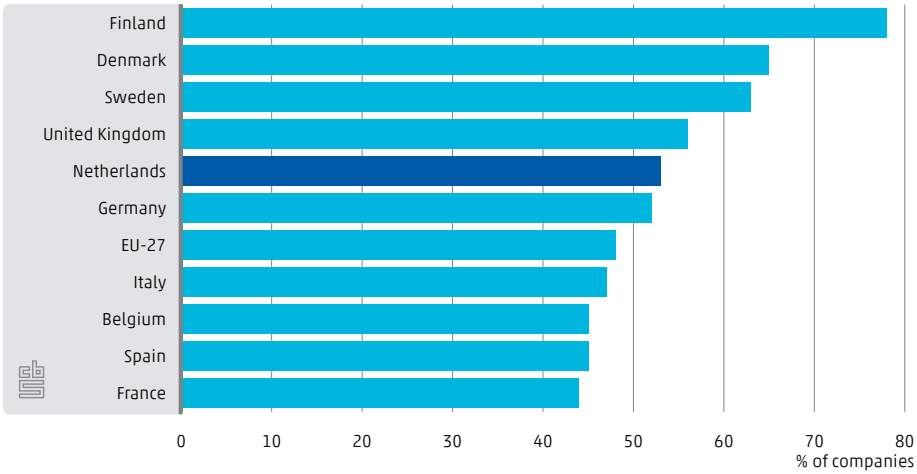
As mentioned earlier, increasingly more companies are using the mobile internet. In 2012, 53 percent of Dutch companies gave their employees laptops, tablets or smartphones for mobile internet use (Figure 5.2.5). This is slightly higher than the EU average. Here too North European countries are front runners; Finland's share in fact was 78 percent.

In the Netherlands, companies in the financial sector and in the ICT sector are most likely to provide mobile internet equipment to their employees. The proportion in both sectors in 2012 was eight in ten companies. The hospitality sector is the least active in this area: 27 percent.

Almost half of all companies are providing their employees with laptops or tablets for mobile internet use: 46 percent. Another 46 percent provides its employees with smartphones. The differences between sectors are small.

Figure 5.2.5 shows that 53 percent of Dutch companies provides employees with devices for mobile internet use. Often, by far not all employees in these companies receive such devices. In 2012, 19 percent of Dutch employees had a laptop, tablet or smartphone with mobile internet provided by the company. The corresponding average in the EU was 14 percent (Figure 5.2.6). Finland and Sweden are front runners in this respect as well; one in three employees there had access to the mobile internet via a company-supplied device.

5.2.5 Companies providing their staff with mobile internet devices, international, 2012[1)]



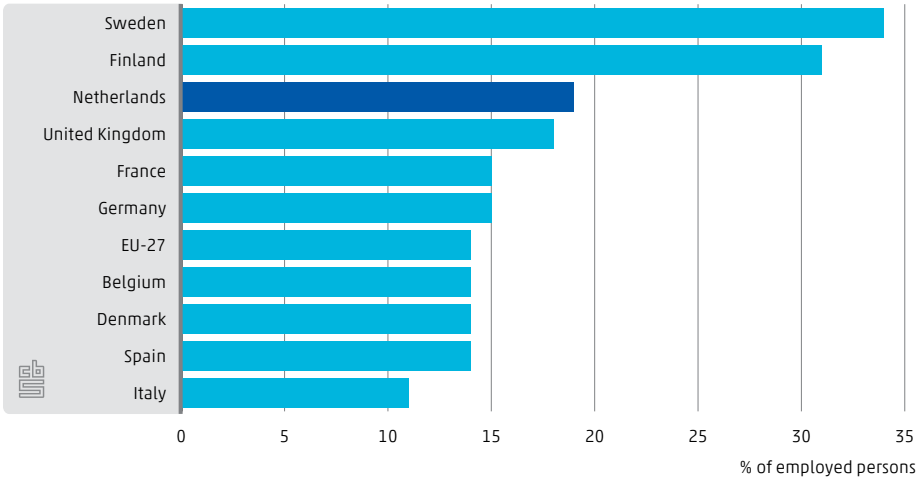
Source: Eurostat.

[1)] Companies with ten or more employed persons, excluding financial institutions and healthcare.

Primarily for e-mail

Companies primarily provide their employees with mobile internet for e-mailing (Figure 5.2.7). In addition, many companies consider it important for their employees to have access to information and to company files via mobile internet. Mobile access to company software, such as ERP systems, is a less important reason for companies to provide mobile internet devices.

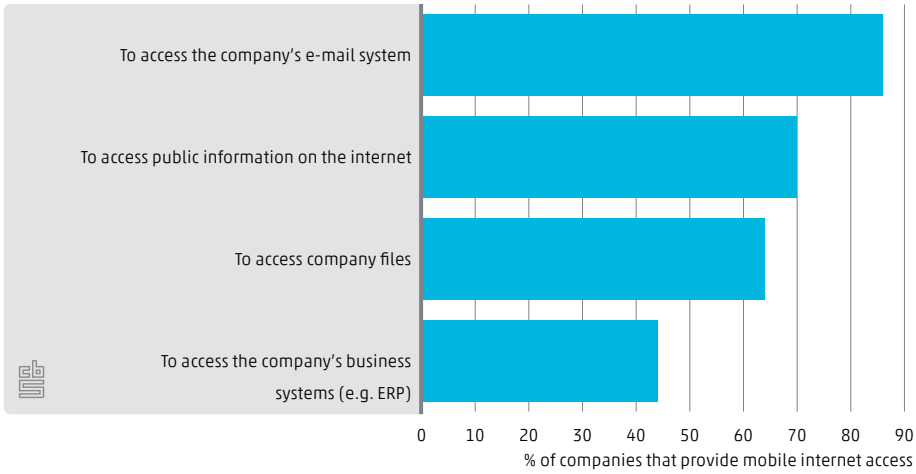
5.2.6 Employed persons with a portable company-supplied mobile internet device, international, 2012[1)]



Source: Eurostat.

1) Employed persons in companies with ten or more employed persons, excluding financial institutions and healthcare. Portable devices include laptops, tablets or smartphones.

5.2.7 Reasons for providing employees with mobile internet devices, 2012[1)]



Source: Statistics Netherlands, ICT use by companies.

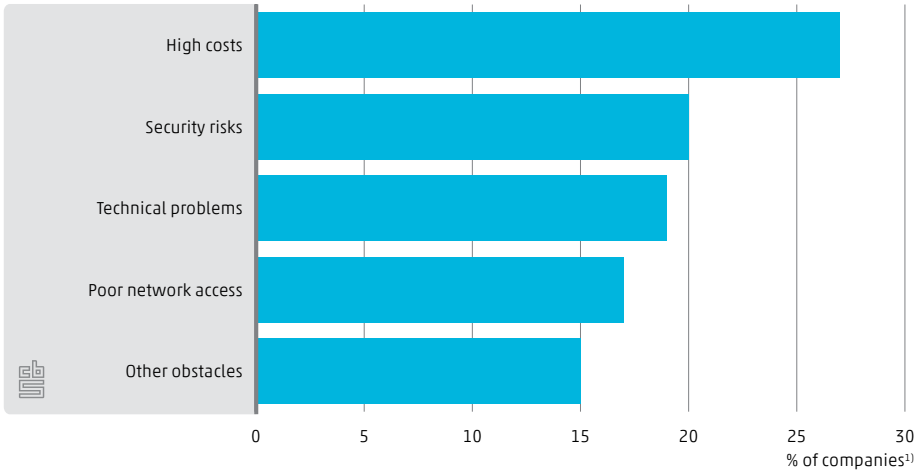
1) Companies with ten or more employed persons.

Mobile internet obstacles

A significant proportion of companies are faced with obstacles that prevent them from using the mobile internet. A key issue is the high cost of the mobile internet; in 2012, 27 percent of companies considered mobile internet too expensive (Figure 5.2.8). Security-related issues represented an obstacle to using mobile internet for 20 percent of companies. This concerns the risk that companies inadvertently disclose confidential information or lose data. Technical problems, for example related to the integration of the mobile internet into business systems, were an issue for 19 percent of companies. In addition, 17 percent considered the poor access to mobile telephone networks a hindrance. Other obstacles, such as staff adaptation issues, insufficient knowledge or legal obstacles, played a role for 15 percent of companies. One in three companies do not consider mobile internet necessary. This especially applies to the hospitality sector.

The reach of the mobile internet in the Netherlands is good; only 17 percent of companies view poor reach as an obstacle. In Finland, for example, this percentage is 27 percent. The corresponding average in the EU is 21 percent.
The statistical annex to this publication contains a table with obstacles experienced by companies in various countries in relation to the use of the mobile internet. The annex can be consulted at www.cbs.nl/ICT-knowledge-economy.

5.2.8 Obstacles to the use of the mobile internet, 2012



Source: Statistics Netherlands, ICT use by companies.
1) Companies with ten or more employed persons.

5.3 Software

ICT is an enabler for improving the exchange of business intelligence. Companies increasingly more often use connected systems for the purpose of automatically disseminating information. This happens not only within a company, but also among business partners, such as suppliers and buyers. This section describes how companies apply such automatically linked systems.

Supply chain management

Many production chains comprise chains of companies that on the basis of procurement, processing and sales collectively form a whole, a 'supply chain'. A classic example of such a production chain is the process that via suppliers and manufacturers runs from the extraction of raw materials to wholesalers and retailers to the ultimate consumer. The output of one participant in such a chain forms the input into the next chain. Through means of supply chain management, the companies in a production chain coordinate their activities. The objective is to improve the results of the individual companies, as well as that of the chain as a whole, over the long term. ICT systems are an important tool in the application of supply chain management. After all, business partners can coordinate their ICT systems as a result of which both parties, and consequently the entire production chain, operate more efficiently. Companies realise this efficiency gain, for example by entering into mutual partnerships for the long term. This provides suppliers with greater certainty concerning future orders and this can translate into favourable prices for the buyer. In addition, companies can also reduce their overhead through means of supply chain management by communicating more efficiently with each other. Finally, companies can reduce the number of faulty orders, by placing orders automatically.

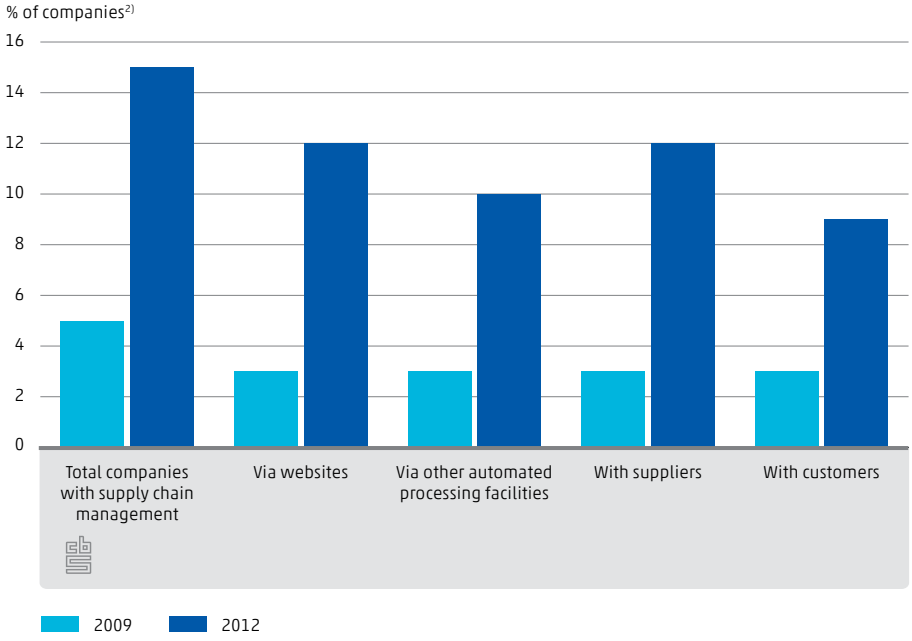
Primarily large companies

In 2012, 15 percent of companies in the Netherlands applied some form of supply chain management. The corresponding figure for 2009 was a mere 5 percent. The difference between small and large companies is considerable. Of the companies with 10 to 20 employees, 12 percent was involved in supply chain management in 2012, while for companies with 500 or more employees this was 43 percent. This is probably due to the fact that small companies use less advanced ICT systems

than large companies. Furthermore, small companies often do not have the capital needed to make major investments in integrated systems.
The differences between sectors are not as big. Many companies in the wholesale and retail trade use supply chain management: 24 percent. The transport sector (22 percent) and the financial sector (23 percent) also score high. Construction companies are less likely to apply supply chain management: 7 percent.

Supply chain management can be effected via websites or web portals, but also via other standardised systems, such as EDI or XML. In 2012, 12 percent of Dutch companies used websites for supply chain management; 10 percent used other channels (Figure 5.3.1). A company can apply supply chain management on the customer side as well as the supplier side. Collaboration with suppliers is somewhat more customary. In 2012, 12 percent of companies applied supply chain management with suppliers; 9 percent coordinated its systems with those of its customers.

5.3.1 Supply chain management, 2009 and 2012[1)]

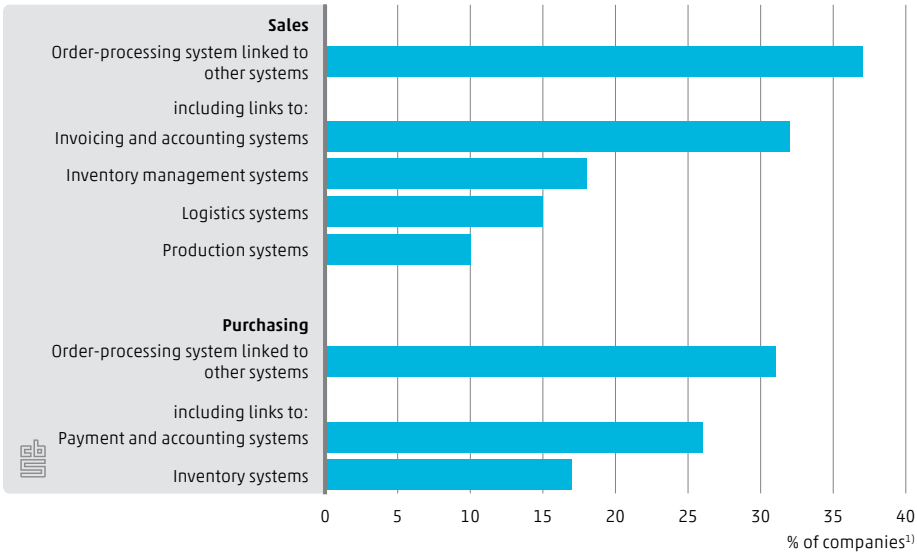


Source: Statistics Netherlands, ICT use by companies.
1) 2009 concerns December; 2012 concerns January.
2) Companies with ten or more employed persons.

Linking systems within a company

Companies link their company ICT systems together for supply chain management. Linking different systems together within a company is often also efficient. For example, companies can link the system they use to record sales orders to their invoicing system. This way an employee can immediately see which orders have been received by the company and use this information to generate the relevant invoices. This obviates the need for departments within the company to communicate with each other, for example via e-mail, in this respect. Invoices are immediately and automatically generated.
In 37 percent of companies, the sales order system was linked to other systems in 2012 (Figure 5.3.2). One in three companies had linked their sales order system to an invoicing system; 18 percent had linked it to inventory management applications and 15 percent to logistics systems. Ten percent of companies had an automated interface between their sales order system and their production system.

5.3.2 Interfaced order-processing ICT applications, 2012



Source: Statistics Netherlands, ICT use by companies.
1) Companies with ten or more employed persons.

Purchase order applications were somewhat less likely to be linked to sales order systems. In 2012, 31 percent of companies had an automated interface between their purchase order system and other business applications. A quarter of the

companies had linked their purchase order system to a payment system; 17 percent had linked it to an inventory management system.
Large companies more frequently link their sales order-processing system to other applications than small companies. In 2012, 57 percent of companies with 500 or more employees had such automated interfaces. For companies with 10 to 20 employees the corresponding figure was 32 percent. The picture for purchase order systems is comparable.

In the EU in 2012, 41 percent of companies had linked their sales order system to other business applications. The Netherlands scores average in this respect: 38 percent. As such the Netherlands is comparable to Germany (34 percent) and France (38 percent). The picture is not much different for linked purchase order systems. Thirty-one percent of Dutch companies had linked their purchase order systems to other applications; the corresponding average in the overall EU was 34 percent.

A quarter of companies uses ERP systems

Enterprise Resource Planning (ERP) software systematically consolidates data from different business units, such as purchasing, production and logistics. Companies use ERP software as a means of increasing their productivity. Because these types of software packages enable them to establish links between, for example, purchasing, inventory and sales, the business process can be better managed. Customer Relationship Management (CRM) software supplements ERP systems. Companies use CRM software for the purpose of collecting and disseminating customer data throughout the company as a means of expanding sales opportunities. ERP software consequently is more focused on the input of the production chain, while CRM is primarily focused on the output: sales and marketing. Consequently there are major differences in the way in which various sectors use ERP and CRM systems (Table 5.3.3).

In 2012, 24 percent of Dutch companies used ERP software. Many manufacturing companies use ERP software packages. The share of ERP users is high among energy companies and in the property sector as well. The hospitality sector scores low. One in twenty companies in that sector had an ERP system in 2012. CRM software is especially appealing to service sectors. This is because CRM software packages are primarily focused on sales and marketing. Companies in the ICT sector and financial institutions often use CRM systems. They not only do this for the purpose of storing customer data, but also for the purpose of analysing this data. Marketing is very important in these sectors. Clearly a significant share of these companies believe that CRM software can help them improve sales strategies.

5.3.3 Use of ERP and CRM software, 2012

	ERP software	CRM software for storing customer data	CRM software for analysing customer data
	% of companies[1)]		
Total	24	28	19
Sector			
Manufacturing	43	32	22
Energy & water	39	37	26
Construction	15	14	7
Trade	29	33	25
Transport	18	19	12
Hospitality	5	9	7
ICT	31	53	39
Financial institutions	14	46	37
Real estate	36	38	12
Consultancy and research	23	37	24
including research institutions	29	39	24
Other services	17	26	17
Healthcare	13	20	9
Company size			
10 to 20 employed persons	12	19	12
20 to 50 employed persons	26	30	20
50 to 100 employed persons	45	42	28
100 to 250 employed persons	55	48	35
250 to 500 employed persons	58	49	37
500 or more employed persons	61	54	42

Source: Statistics Netherlands, ICT use by companies.

1) Companies with ten or more employed persons.

Companies with ERP software are more productive

Since 2006, Statistics Netherlands has been participating in an international project that conducts research into the impact of ICT on company performance. The research makes use of datasets obtained from different company surveys. The 'ICT use by companies' survey is one of the sources for this research. The project researched whether companies that use certain enterprise software are more productive than other companies. This enterprise software includes ERP software packages, CRM software packages and supply chain management systems. An important and relatively new aspect of this research is that it assesses the value added derived from using multiple software packages at the same time in terms of a company's productivity.

The results show that companies that use enterprise software are significantly more productive than companies without this type of software packages. In addition, the findings show that companies are especially productive when they combine ERP software with CRM software packages or supply chain management systems.
Additional information about this project is available at www.esslimit.eu.

In the Netherlands, the proportion of companies using an ERP system is roughly equal to the European average. Twenty-two percent of all companies in the EU used ERP software in 2012, whereas in the Netherlands the corresponding figure was 26 percent. Sweden scores highest: 38 percent. In Germany and Austria many companies use CRM systems for the purpose of storing customer data: four in ten. In the Netherlands, this proportion is also roughly equal to the EU average. This average was 26 percent in 2012, compared to 29 percent in the Netherlands.

5.4 Social media and companies

Social media have grown into a popular means of communication in a very short period of time. Websites such as Facebook and Twitter are interesting platforms with major commercial opportunities for companies. This section discusses how companies use social media.

Four in ten companies use social media

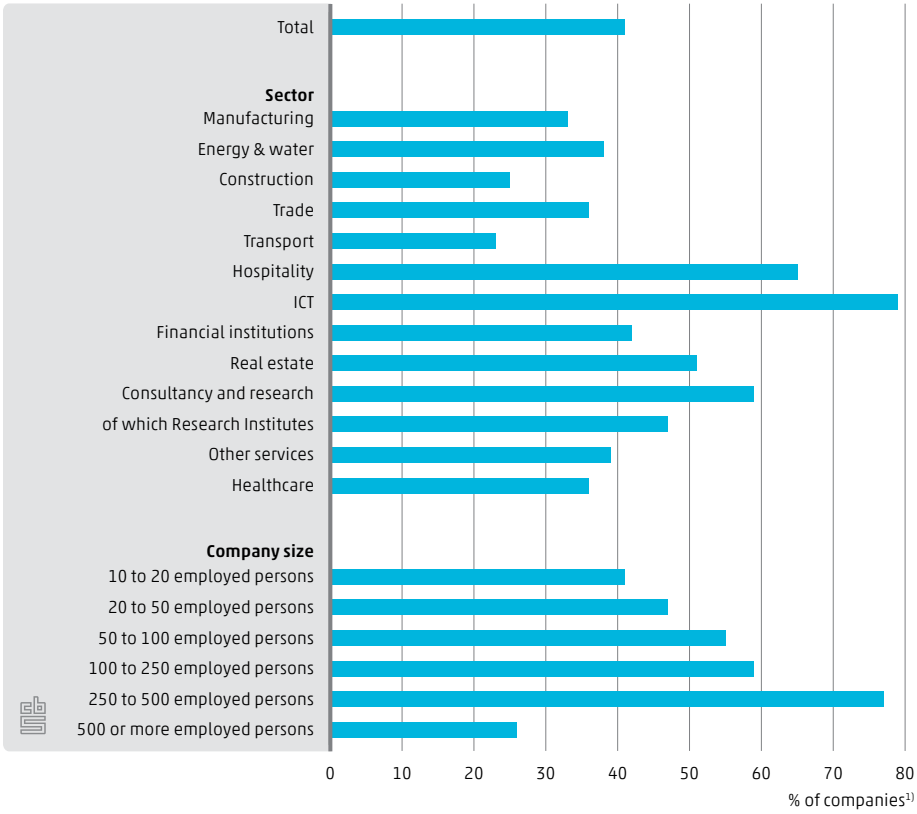
In 2012, 41 percent of companies used at least one form of social media.[3)] Large companies use social media more often than small companies; over three quarters of companies with 500 or more employees communicate via social media. For companies with 10 to 20 employees the corresponding figure was 36 percent.

Especially many companies in the ICT sector use social media: 79 percent. In the hospitality sector this percentage is also high. This is striking because companies

[3)] The 2012 'ICT use by companies' survey classifies social media as follows:
- Social networks such as Facebook, LinkedIn, Hyves and Yammer;
- Blogs or microblogs such as Twitter;
- Websites that share multimedia (videos, photos), such as YouTube, Flickr and Picasa;
- Wiki-based resources designed to share knowledge.

in this sector lag the average in many ICT areas. Only a small part of personnel working in the hospitality sector works for example with computers or with the mobile internet. By contrast, this sector is the front runner when it comes to social media. Apparently social media such as Facebook and Twitter hold many opportunities for companies in the hospitality sector.

5.4.1 Companies that use at least one form of social media, 2012



Source: Statistics Netherlands, ICT use by companies.

1) Companies with ten or more employed persons.

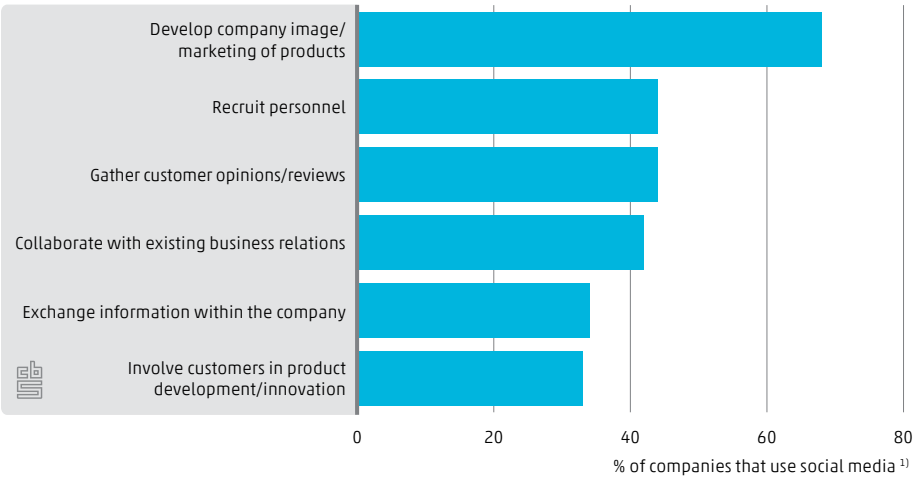
41%

of companies use social media

Especially for marketing

Most companies that use social media do so for the purpose of developing the company's image and for marketing their products (68 percent). Over four in ten companies recruit personnel, gather customer opinions or collaborate with business relations via social media. A smaller proportion of companies uses social media for the purpose of exchanging information within the company or for involving customers in product development.

5.4.2 Application of social media by companies, 2012



Source: Statistics Netherlands, ICT use by companies.
1) Companies with ten or more employed persons.

ICT companies: many applications of social media

Companies in the ICT sector use many different social media applications. ICT companies are highly focused on technological developments. This is also evident from the many opportunities they perceive in social media. Only a single sector scores significantly higher for a specific application than the ICT sector: financial institutions more often recruit personnel through means of social media.

Seven in ten large companies recruit personnel via social media. This share is much lower in small companies: 34 percent. What is furthermore striking is that small companies relatively often collaborate with business partners via social media, while many large companies by contrast use social media for the purpose of exchanging information within the company. In relation to other applications, large

and small companies do not differ all that much. Marketing is the main purpose for large as well as small companies.

5.4.3 Application of social media, by sector and company size, 2012

	Develop company image/ marketing of products	Recruit personnel	Gather customer opinions/ reviews	Collaborate with business relations	Exchange information within the company	Involve customers in product develop-ment/ innovation
	% of companies that use social media[1]					
Total	68	44	44	42	34	33
Sector						
Manufacturing	60	35	33	35	24	27
Energy & water	71	58	50	42	38	24
Construction	56	26	24	37	21	21
Trade	72	34	47	38	24	33
Transport	59	34	35	42	35	31
Hospitality	72	37	54	32	25	37
ICT	74	61	51	52	54	42
Financial institutions	62	69	46	34	53	37
Real estate	71	31	53	36	37	27
Consultancy and research	69	57	46	51	49	37
Other services	70	63	42	49	36	32
Healthcare	69	46	49	44	42	33
Company size						
10 to 20 employed persons	66	34	41	44	30	34
20 to 50 employed persons	70	45	45	41	32	32
50 to 100 employed persons	71	54	46	42	38	34
100 to 250 employed persons	69	57	46	37	40	31
250 to 500 employed persons	67	61	54	37	43	33
500 or more employed persons	71	71	57	40	57	32

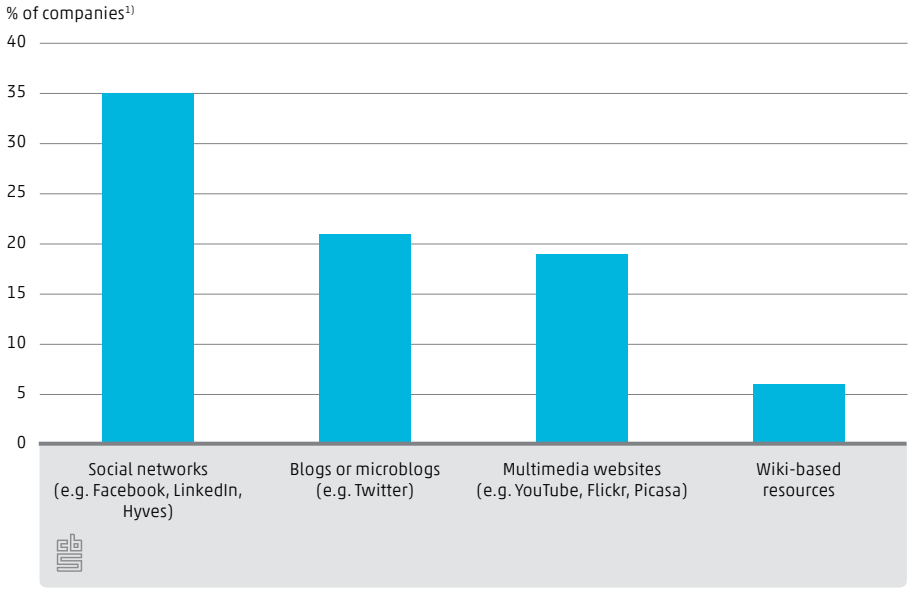
Source: Statistics Netherlands, ICT use by companies.

[1] Companies with ten or more employed persons.

Social networks are the most popular

Social networks are the most popular form of social media among companies. In 2012, 35 percent of companies used a network such as Facebook or Hyves. One in five companies posted blogs/microblogs or shared videos and photos via websites. A smaller proportion used Wiki-based resources for sharing knowledge: 6 percent.

5.4.4 Use of social media by companies, by type, 2012



Source: Statistics Netherlands, ICT use by companies.
1) Companies with ten or more employed persons.

Seven in ten ICT companies use social networks

The ICT sector is the most active in every form of social media. In 2012, 71 percent of ICT companies used social networks. The construction industry and the transport sector are the least active in all types of social media. The hospitality sector is the front runner in social networks, blogs and microblogs, but scores average in terms of other types of social media.

Of the large companies, 67 percent used social networks in 2012. This proportion was 31 percent for small companies. Large companies also more often use other types of social media such as Twitter, YouTube and Wikis than small companies.

The capita selecta in this publication contains an elaborate article about social media and the business sector (Section 9.1). This article provides a broad background and provides additional figures about the way in which companies use social media.

5.4.5 Use of types of social media, by sector and company size, 2012

	Social networks (e.g. Facebook, LinkedIn, Hyves)	Blogs or micro-blogs (e.g. Twitter)	Multimedia-websites (e.g. YouTube, Flickr, Picasa)	Wiki-based resources
	% of companies[1]			
Sector				
Manufacturing	25	14	18	5
Energy & water	31	23	24	7
Construction	19	7	9	1
Trade	30	19	18	3
Transport	19	9	9	3
Hospitality	61	37	22	4
ICT	71	52	40	32
Financial institutions	30	18	18	13
Real estate	48	28	17	3
Consultancy and research	54	36	26	13
Other services	42	22	20	6
Healthcare	31	22	22	6
Company size				
10 to 20 employed persons	31	18	15	4
20 to 50 employed persons	35	21	19	6
50 to 100 employed persons	40	27	23	9
100 to 250 employed persons	46	29	28	10
250 to 500 employed persons	50	36	35	16
500 or more employed persons	67	51	43	25

Source: Statistics Netherlands, ICT use by companies.

[1] Companies with ten or more employed persons.

5.5 E-commerce

Trade over the internet has become commonplace. Section 4.3 in this publication describes how people shop online. In addition to the websites used by consumers for ordering goods there are other forms of e-commerce as well. For example, companies also conduct trade electronically with each other. Such trade can be conducted via websites as well as via other electronic channels, such as EDI.

What is e-commerce?

E-commerce is defined as trade via electronic networks, such as the internet. The OECD defines e-commerce as follows: 'The sale or purchase of goods or services over computer networks by methods that are specifically designed for the purpose of receiving or placing orders' (OECD, 2011). Statistical agencies adopt this definition when they survey e-commerce. E-commerce not only covers goods, but services as well. For example, when a consumer takes out an insurance policy online, this is also considered a form of e-commerce. An order placed via e-mail is *not* considered e-commerce.

Websites used by companies to sell their products are the best-known forms of e-commerce. Many consumers shop online, but companies can also be customers of web shops. Even when a buyer does not pay electronically, sales via a website are considered e-commerce. In addition, the device used by the buyer to place his/her order is irrelevant: a desktop, laptop, tablet or smartphone.

Consumers can also trade among themselves via websites. Marktplaats and Speurders are familiar examples of this in the Netherlands. This section does not deal with this type of e-commerce.[1)]

A less well-known form of e-commerce is conducted via EDI: Electronic Data Interchange. This form is limited to trade among individual companies. Business systems communicate with each other via EDI messages. These messages are prepared in a standard format that is suitable for automated processing. Examples of familiar formats are XML and EDIFACT. Companies can send these messages automatically over the internet or other electronic networks.

The figures in this section solely concern the e-commerce of companies established in the Netherlands. They do not include orders placed by Dutch residents with companies abroad. By contrast, purchases made by foreign consumers from Dutch companies are included in the figures.

[1)] The capita selecta in this publication includes an article that describes the analysis of the Marktplaats user data by Statistics Netherlands (Section 9.3).

One in five companies sells via e-commerce

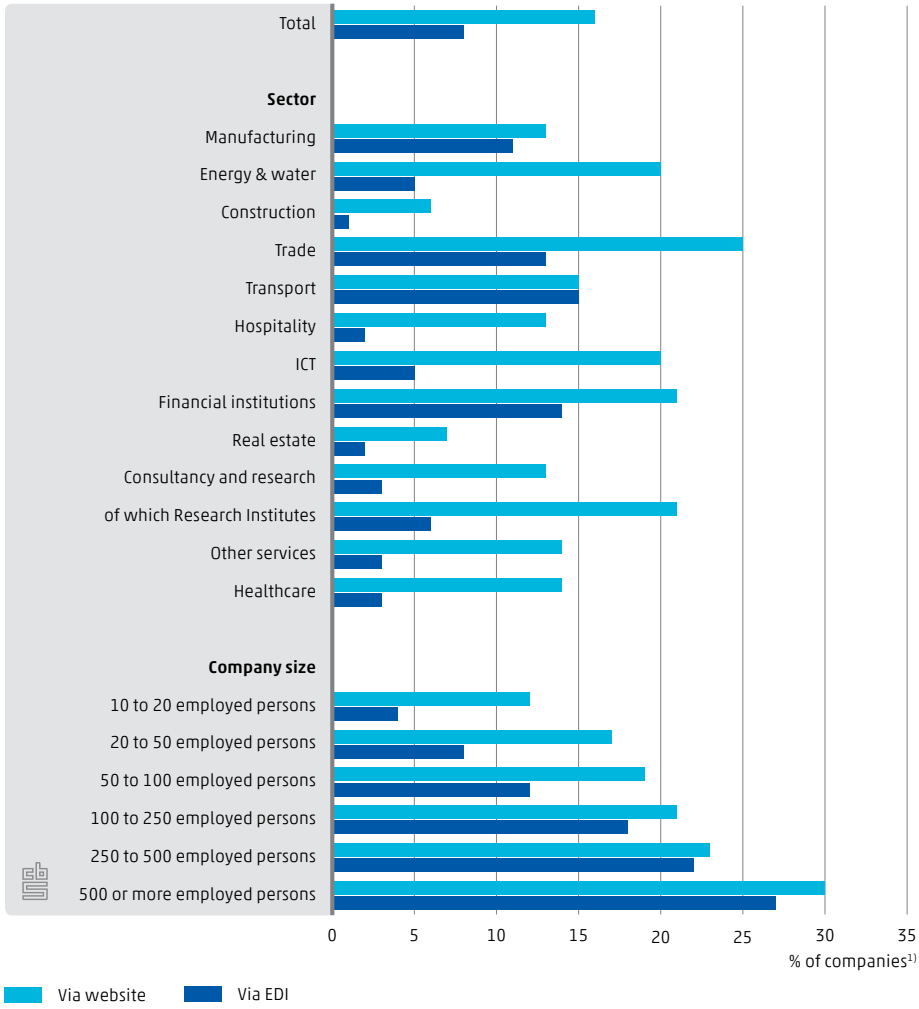
In 2011, 18 percent of companies were involved in electronic sales. Companies more often received orders via a website than via EDI in this respect. 16 percent of companies sold goods or services via a website versus 8 percent via EDI (Figure 5.5.1).
E-commerce is far more common among large companies than among small companies. In 2011, 38 percent of companies with 500 or more employees were involved in electronic selling. For companies with 10 to 20 employees the corresponding figure was 13 percent. Large companies use EDI roughly as often as websites for electronic sales. Among small companies there is a large difference in this respect: 12 percent use websites and only 4 percent use EDI. EDI therefore is primarily more popular among large companies.

To use EDI requires significant investments by companies. Indeed, they have to develop and maintain these systems. This makes EDI an attractive option for a limited group of companies; the investments are primarily profitable for large companies. The threshold for websites for electronic selling is considerably lower. Many small companies consequently have web shops as well.

Primarily trading companies

Many companies in the wholesale and retail trade sell via websites: 25 percent. Many financial institutions (21 percent) and energy companies (20 percent) also use websites to sell their services. This percentage is also high in the ICT sector. The construction industry has few companies that sell their products via websites: 6 percent.
The hospitality sector presents a mixed picture. On the one hand e-commerce is popular among companies in the accommodation sector, such as hotels: 46 percent use websites to sell their services. On the other hand only 3 percent of cafés and restaurants sell via a web shop. In terms of the business services sector, the travel industry especially stands out: 63 percent of travel agencies and travel organisations sell via a website.

5.5.1 Companies selling via a website or EDI, 2011



Source: Statistics Netherlands, ICT use by companies.

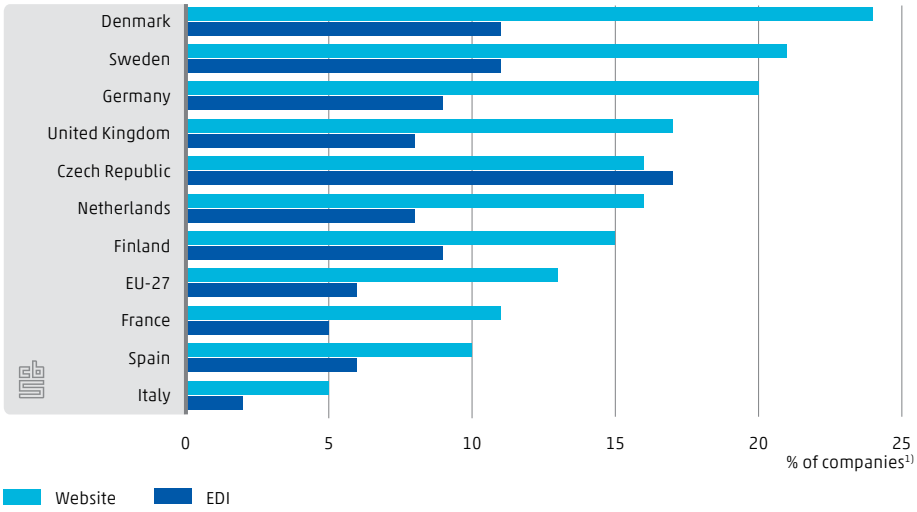
1) Companies with ten or more employed persons.

Four sectors comprise a significantly higher proportion of companies that sell via EDI than the average. In these sectors it is fairly common to exchange orders via EDI messages. This includes the transport sector. In 2011, 15 percent of these companies sold products via EDI. Financial institutions, trading companies and the manufacturing industry often use this method as well.

The Netherlands above EU average

The Netherlands has somewhat more companies that sell their products via a website than the European average. However, the percentage in the Netherlands does not differ very much from the EU average: 16 percent in the Netherlands versus 13 percent in the EU (Figure 5.5.2). In the EU, Denmark and Sweden have the largest proportion of companies that receive orders via a website: 24 and 21 percent, respectively. In Norway even more companies sold via a website: 35 percent.

5.5.2 Companies selling via a website or EDI, international, 2011



Source: Eurostat.

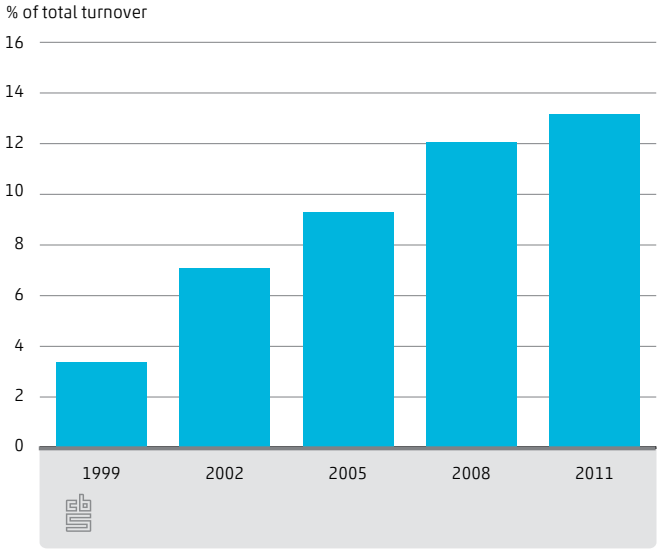
1) Companies with ten or more employed persons, excluding financial institutions and healthcare.

The Netherlands scores higher than the EU average for EDI as well, although the difference is not great: 8 percent in the Netherlands versus 6 percent in the EU. The Czech Republic is the front runner. In 2011, 17 percent of the companies there received their orders via EDI messages. In the Czech Republic more companies sell via EDI than they do via websites. The reverse is true for most other countries.

Revenues derived from e-commerce are growing

An increasingly larger share of the revenues earned by companies are generated via electronic channels. In 1999, 3 percent of the total revenues earned by companies in the Netherlands was derived from e-commerce. The corresponding figure for 2011 was 13 percent (Figure 5.5.3). The importance of e-commerce rose sharply between 1999 and 2008. After this period growth flattened out somewhat.

5.5.3 E-commerce revenue trend, 1999-2011[1)]



Source: Statistics Netherlands, ICT use by companies.

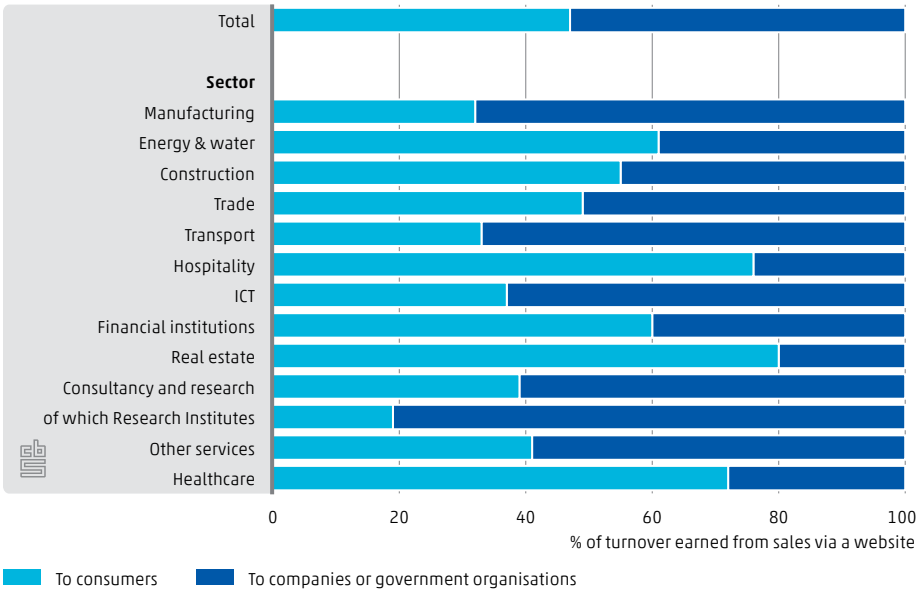
[1)] Companies with ten or more employed persons.

In the EU, on average 15 percent of operating revenues was derived from e-commerce. At 13 percent the Netherlands deviated little from this. This also applies to France (14 percent) and Germany (17 percent). The Czech Republic was the leader in the EU with 24 percent of its revenues derived from electronic commerce. This was especially due to EDI sales. In Italy companies derived only 6 percent of their revenues from electronic channels.

Sales to consumers and companies

Companies earn revenues via websites by selling to consumers and to other companies or government organisations. The average company realised 47 percent of its web revenues in 2011 from consumer sales versus 53 percent from sales to other companies or government organisations (Figure 5.5.4). The manufacturing industry sells a great deal to companies via web shops. The same applies to the transport sector and to research institutions. Property companies, the hospitality sector and healthcare institutions primarily sell to consumers via their websites.

5.5.4 Sales via a website, by type of customer, 2011[1)]



Source: Statistics Netherlands, ICT use by companies.

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

Electronic purchasing

In 2011, 12 percent of Dutch companies made purchases via e-commerce. These are companies that purchased at least 1 percent of their total purchase value via e-commerce (Table 5.5.5). Especially companies in the wholesale and retail trade purchase a great deal via e-commerce. For one in five trading companies, electronic purchases comprise 1 percent or more of the company's total purchase value. For one in ten this was at least half of their total purchase value. For a significant group

of trading companies, e-commerce therefore constitutes a substantial purchasing channel.

Especially large companies make their purchases via websites or EDI. In 2011, e-commerce accounted for at least 1 percent of the total purchase value in 32 percent of large companies. This percentage is considerably lower in small companies. This difference can probably be explained by the fact that large companies more often make purchases on a large scale and that they have more highly developed ICT systems than small companies.

5.5.5 Companies making purchases via e-commerce, 2011

	≥ 1% of the total purchase value	≥ 5% of the total purchase value	≥ 10% of the total purchase value	≥ 50% of the total purchase value
	% of companies[1)]			
Total	12	10	8	4
Sector				
Manufacturing	11	8	6	2
Energy & water	10	7	7	4
Construction	11	9	7	4
Trade	19	17	15	10
Transport	11	9	6	3
Hospitality	8	8	8	2
ICT	15	13	11	4
Financial institutions	9	8	6	2
Real estate	10	6	2	1
Consultancy and research	10	8	6	3
including research institutions	13	12	8	3
Other services	6	4	3	1
Healthcare	6	5	4	2
Company size				
10 to 20 employed persons	11	9	8	4
20 to 50 employed persons	11	9	7	4
50 to 100 employed persons	15	13	10	5
100 to 250 employed persons	18	14	11	5
250 to 500 employed persons	21	18	13	6
500 or more employed persons	32	27	23	11

Source: Statistics Netherlands, ICT use by companies.

1) Companies with ten or more employed persons.

6. An international perspective of innovation

This chapter puts the Dutch figures on innovation in an international perspective. Is the Netherlands more innovative than other countries? Do many Dutch companies develop new products or do they perform well on new marketing strategies?

6.1 Innovative companies

Knowledge is an important production factor in a modern economy. A society develops new knowledge by investing in Research & Development (R&D) and education. This knowledge ultimately produces practical applications: innovations. An economy benefits a great deal from innovative products that others are unable to produce due to a lack of knowledge. As a result it is important to know how a knowledge economy relates to other, competing economies. This chapter compares the Dutch findings of the European innovation survey with those of other countries.

Operationalising innovation

The European innovation survey (Community Innovation Survey, CIS) operationalises the innovation concept through means of various questions incorporated into the questionnaire. This operationalisation is in line with the OECD's widely recognised Oslo Manual that provides points of reference for measuring innovation in companies (OECD, 2005). This manual makes a distinction between the following forms of innovation.

1. Product innovation: **the company has introduced one or more new or significantly improved products. These can be goods or services that are new to the market or that are only new to the company.**

2. Process innovation: **the company has started to use one or more new or significantly improved processes or methods. These new processes or methods can be related to:**

- **the production of goods or services;**
- **the logistics (delivery or distribution) of inputs (goods or services); or**
- **supporting process activities, such as maintenance systems or purchasing, accounting or estimating methods.**

These processes or methods can be new to the market or only new to the company.

3. Ongoing or abandoned product or process innovation: the company has worked on product and/or process innovations as described above, but terminated this work and/or has not yet completed this activity.

4. Organisational innovation: the company has introduced one or more of the following innovations:
- new operating procedures;
- new methods for organising professional responsibilities and decision-making;
- new methods for organising external relationships with other companies or institutions.

5. Marketing innovation: the company has introduced innovations in one or more of the following areas:
- the aesthetic design or packaging of products;
- the way in which the company uses new media for marketing products
- the way in which the company positions products in the market or uses new sales channels;
- the way in which the company determines product pricing.

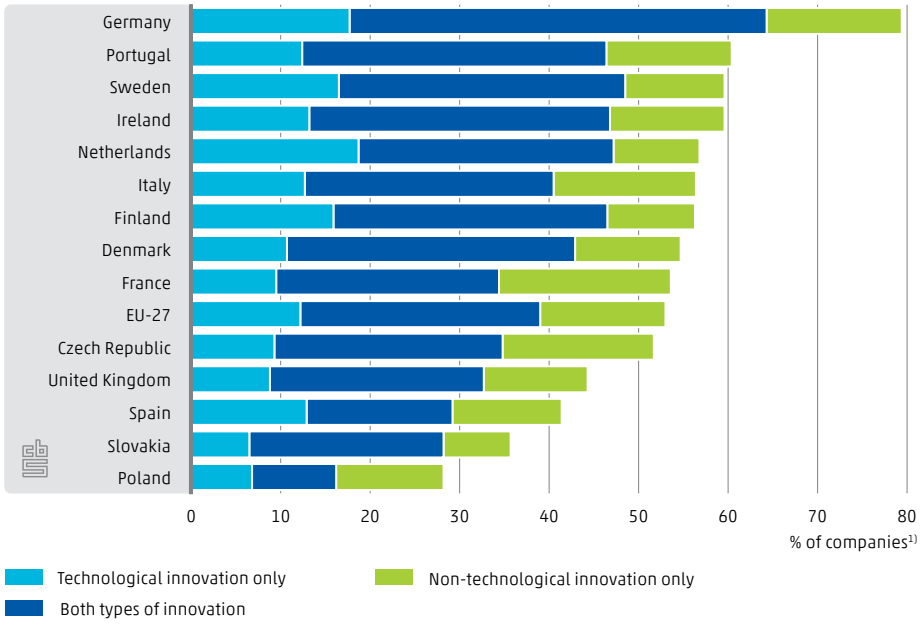
The literature makes a distinction between technological innovation and non-technological innovation. A technologically innovative company works on product and/or process innovation irrespective of whether it has completed these or not. At least one of the first three categories presented above applies to technologically innovative companies.
A non-technologically innovative company has introduced one or more organisational and/or marketing innovations. Innovations that were terminated or that have not yet been completed are not included here. At least one of the last two categories presented above therefore applies to these companies.
Companies can, of course, be simultaneously technologically and non-technologically innovative.

The term 'innovative' originally only referred to technological innovation. According to the classical or narrow definition an innovator therefore is a company that is at least technologically innovative. The broad definition also includes non-technological innovation as part of the concept.

The Netherlands ranks as a medium innovator

According to the broader innovation concept, 57 percent of Dutch companies was innovative during the 2008–2010 period. This places the Netherlands in the middle group in Europe (Figure 6.1.1). In the overall EU, 53 percent of companies was innovative. The proportion of innovators according to the broad definition is lower in the Netherlands than in Portugal and Sweden, for example. Especially in Germany many companies are innovative: almost 80 percent of companies there were engaged in technological or non-technological innovation. In the United Kingdom, Spain and especially Poland, companies are less innovative than the average.

6.1.1 Innovation according to the classical and the broad definition, 2008-2010



Source: Eurostat.

1) Companies with ten or more employed persons.

In most countries, companies are involved in technological as well as non-technological innovation. This is clearly evident from Figure 6.1.1. In addition, the Netherlands has a relatively large share of companies that exclusively devote themselves to technological innovation. The following sections separately deal with technological and non-technological innovation in further depth.

Figures used in international comparisons differ from national results

The EU countries have reached agreement concerning the sectors to be included in the innovation survey. This means that the findings of the European countries are comparable. In addition to this internationally agreed-on population, Statistics Netherlands has included several additional sectors in the survey. To be able to properly compare the Netherlands with other countries, the results for the Netherlands used in this chapter are based on the limited group of sectors agreed on internationally. As a result, the figures in this chapter may deviate from the findings that Statistics Netherlands has published elsewhere; for example in *'ICT, knowledge and the economy 2012'*.

6.2 Technological innovation

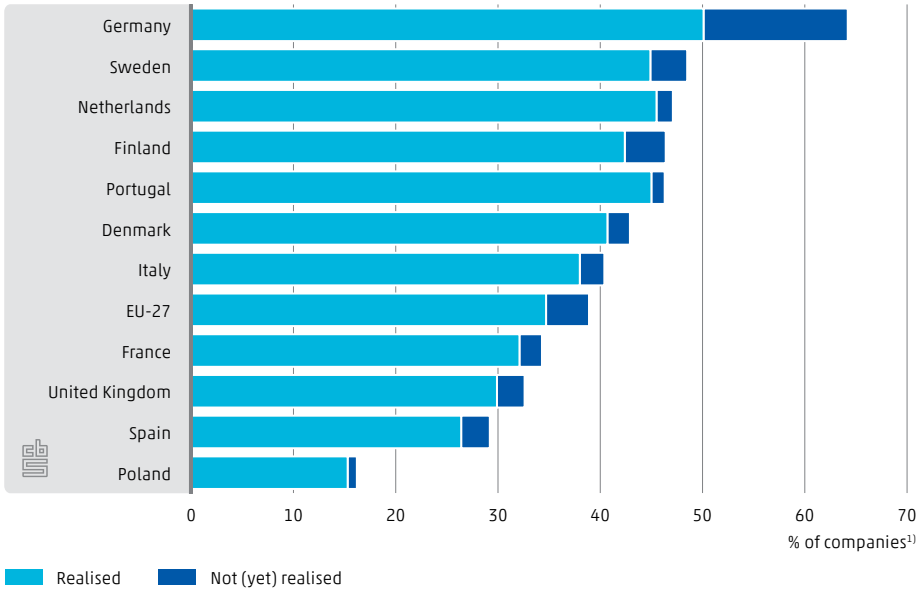
The previous section indicated that according to the classical definition innovators are limited to those companies with technological innovations. On the one hand, technological innovations include the new products that a company introduces to the market. The other forms of technological innovation are process innovations, such as new production processes within a company.
This section discusses how technological innovation in the Netherlands compares to technological innovation in Europe. The number of innovators is addressed, as well as the share of revenues companies earn on the basis of innovative products. The focus then shifts to the way in which companies collaborate on innovation with other companies or institutions.

The Netherlands scores high in terms of technological innovation

Figure 6.2.1 shows that the Netherlands has many technological innovators. During the period 2008–2010, 47 percent of Dutch companies was working on technological innovations. The efforts of 45 percent of these companies resulted in an actually realised innovation. The efforts of the other innovators had not yet resulted in an actually realised innovation by the end of 2010.

The Netherlands has more technological innovators than most other European countries. In the overall EU, 39 percent of companies was technologically innovative. Especially the Northern European countries have a large number of technological innovators. Germany takes the crown: 64 percent of its companies are technologically innovative. What is striking, however, is that a large share of these German companies had not yet realised the innovation by the end of 2010. In many Eastern and Southern European countries the percentage of innovative companies is below the European average. This is also true for the United Kingdom.

6.2.1 Technological innovation, 2008-2010



Source: Eurostat.

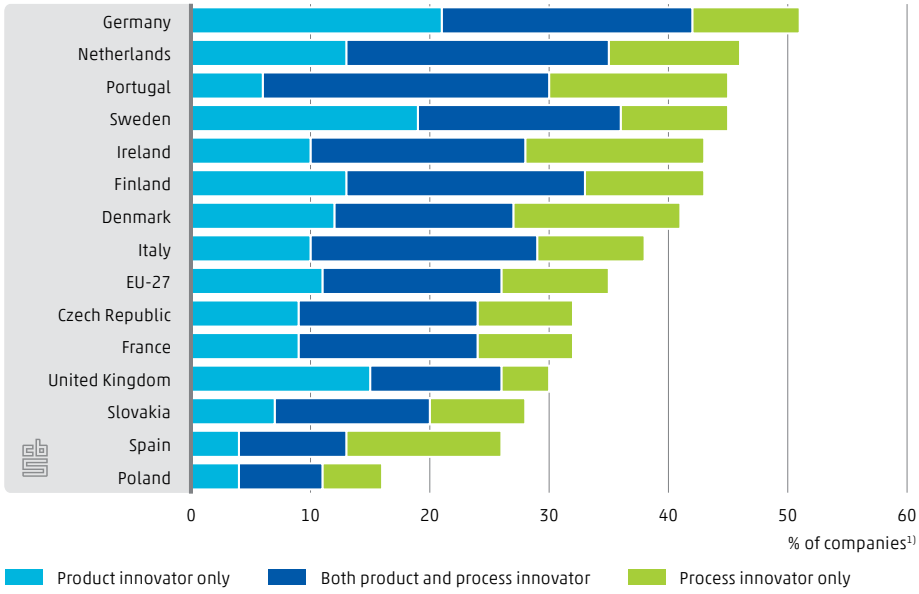
[1)] Companies with ten or more employed persons.

Product innovation does not always mean new processes

During the period 2008–2010, 35 percent of Dutch companies realised a new product (Figure 6.2.2). The percentage of companies with new processes was somewhat less: 32 percent. Considerably fewer companies introduced product as well as process innovations: 22 percent. Relatively few companies in EU countries realised both types of innovation. In other words, if a company launches a new product this does not always mean that it has also introduced new processes, or vice versa.

Most countries have approximately the same number of product innovators as process innovators. Many companies in Germany and the United Kingdom have introduced new products to the market. By contrast, many companies in Spain have renewed their processes.

6.2.2 Realised product and process innovations, 2008-2010



Source: Eurostat

1) Companies with ten or more employed persons.

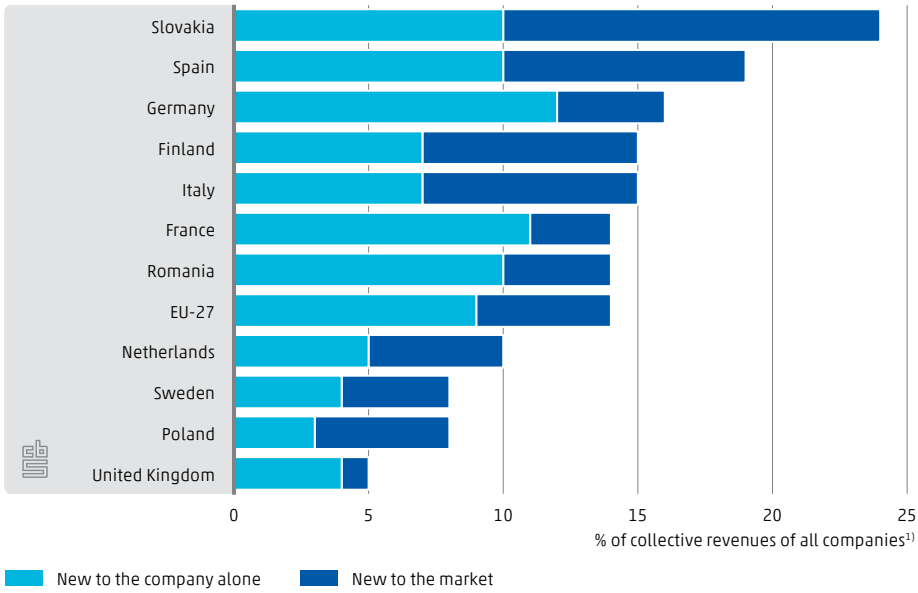
10 percent of revenues derived from new products

The number of innovative companies provides an indication of the degree to which an economy renews itself, but it is not a barometer of the economic importance of innovation. The revenues companies derive from new products are a better reflection of the importance of innovation for an economy.

In 2010, Dutch companies realised approximately 10 percent of their collective revenues from new products (Figure 6.2.3). Approximately half of this was realised with products that were new to the market. The other half was realised with products that had already been introduced to the market by other companies, but that were new to the relevant company. In the overall EU, companies realised 13 percent of total revenues from new products. The percentage in the Netherlands is therefore somewhat lower than the European average.

In Germany and France, companies derived relatively high revenues from innovative products. However, the products concerned were primarily new to the company alone and therefore had already been previously introduced by other companies. In the Netherlands the share in the revenues from products that were entirely new to the market by contrast was higher than it was in Germany and France.
The high percentages in Spain and Slovakia are striking. In Slovakia the products that were entirely new to the market in fact represented the major share.

6.2.3 Total share in revenues of new or significantly improved products, 2010

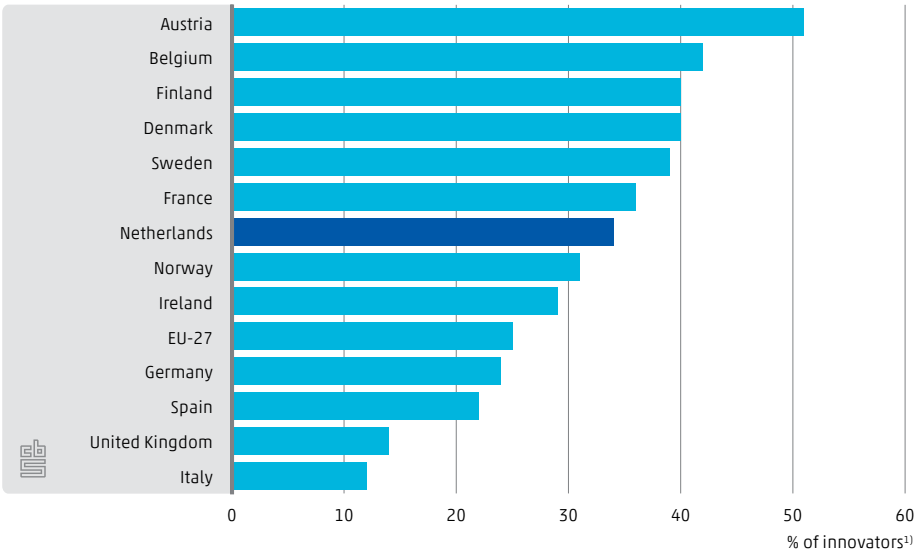


Source: Eurostat.
1) Companies with ten or more employed persons.

Many Dutch innovators collaborate with each other

Scientists working in isolation in a laboratory are by far not the only way in which innovations come about. The general perception nowadays is that the best way for companies to innovate is in a network in which different participants exchange knowledge. Figure 6.2.4 for several countries illustrates the proportion of innovators that collaborates with partners for the purpose of developing new products or processes.

6.2.4 Partnership in innovation, 2008-2010



Source: Eurostat.

1) Technologically innovative companies with ten or more employed persons that have at least one collaborating partner.

In the period 2008–2010, one in three Dutch innovators was engaged in innovative activities in collaboration with others. In the overall European Union this was an average of one in four. In the Netherlands more innovative companies therefore share their knowledge with partners than the European average. The percentage of collaborating partners is especially high in Austria: 51 percent. In Italy and the United Kingdom far fewer companies jointly develop innovations.

In most EU countries, innovators collaborate with suppliers. In addition, many companies collaborate with their customers on new products or processes.

Suppliers and customers often have a great deal of knowledge about a company's products and processes. This makes them interesting partners for companies that want to innovate.

The statistical annex to this publication contains a table with detailed figures about innovation and collaboration. The statistical annex can be consulted online at www.cbs.nl/ICT-knowledge-economy.

6.3 Non-technological innovation

Companies are considered technologically innovative when they introduce new products or processes. In addition, companies can adopt innovative organisational practices or new marketing methods. This section discusses how Dutch companies apply these forms of non-technological innovation.[1)] Here too the focus is on how the Netherlands compares to other European countries.

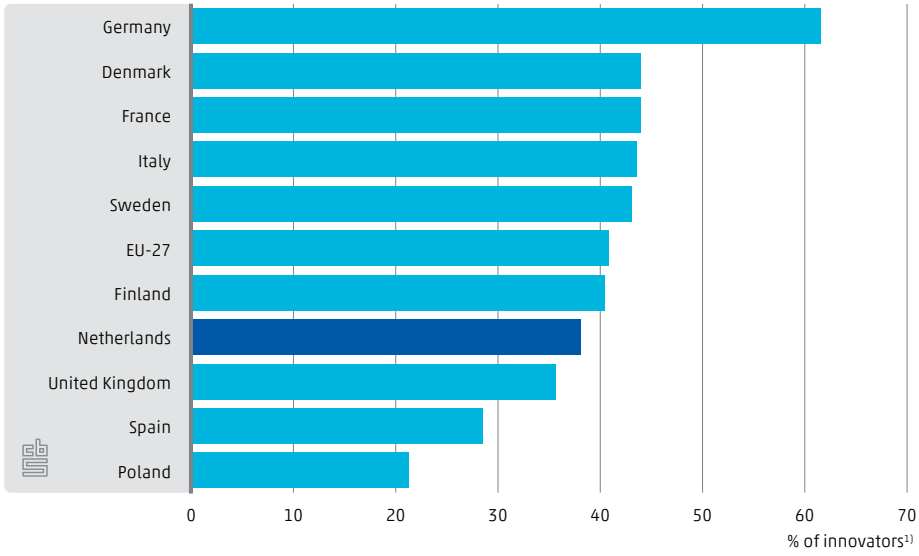
The Netherlands scores average

During the period 2008–2010, 38 percent of Dutch companies was non-technologically innovative: they introduced new organisational methods or renewed their marketing techniques. In Europe, this proportion was 41 percent. The Netherlands therefore does not deviate a great deal from the EU average (Figure 6.3.1). In Germany over six in ten companies realised a non-technological innovation. In addition to having a large share of technological innovators, Germany therefore also has many companies that are innovative in other areas.

Figure 6.3.2 provides a breakdown by organisational and marketing innovations. The Netherlands had an average share of companies with new organisational methods in the period 2008–2010: 30 percent. The corresponding average in the overall EU was 31 percent. Germany scored highest; almost half of German companies introduced an organisational innovation.

1) Non-technological innovation is independent of technological innovation; a company that is non-technologically innovative can in addition also be technologically innovative.

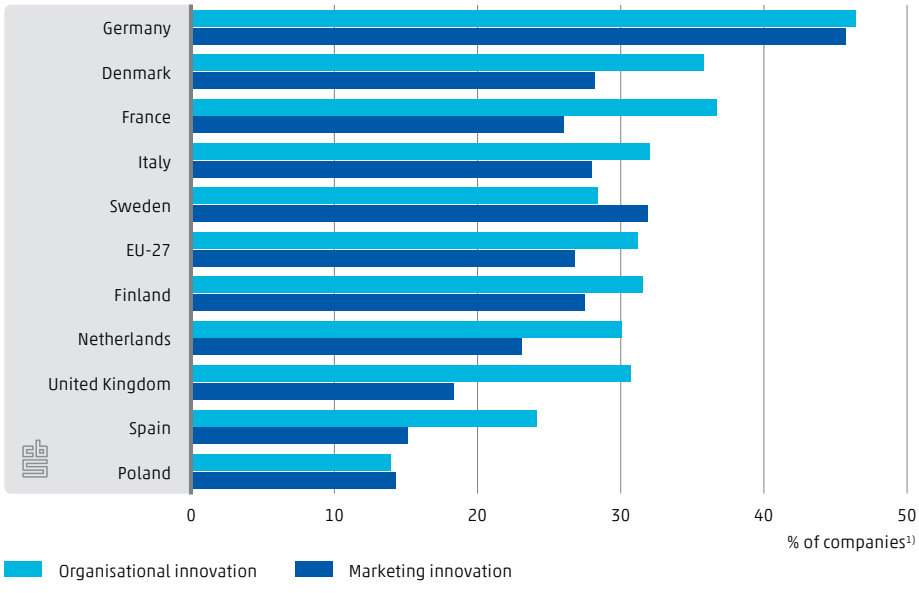
6.3.1 Companies with non-technological innovations, 2008-2010



Source: Eurostat.

1) Companies with ten or more employed persons.

6.3.2 Organisational and marketing innovation, 2008-2010



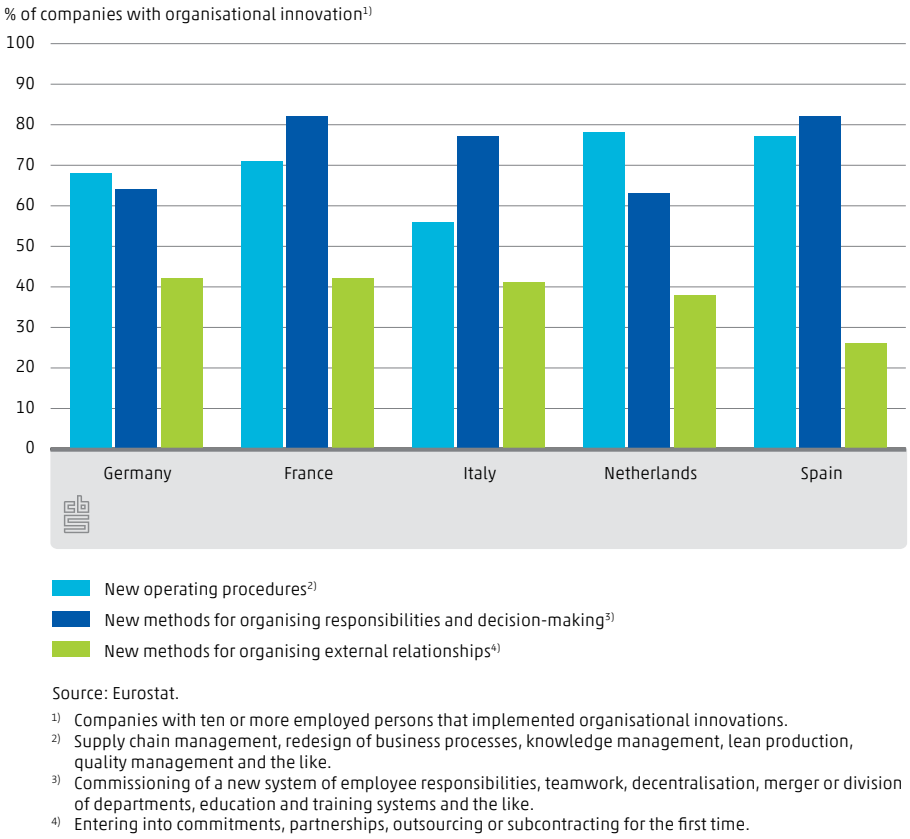
Source: Eurostat.

1) Companies with ten or more employed persons.

New marketing methods are less common than organisational innovations. This not only applies to the Netherlands, but to most other European countries as well. In the Netherlands, 23 percent of companies implemented new marketing methods in the period 2008–2010. The corresponding figure for the EU as a whole was 27 percent. Marketing innovations are also the most common among German companies: 46 percent.

Figure 6.3.3 further splits out organisational innovations into three categories: new operating procedures, new methods for organising professional responsibilities and decision-making, and new methods for organising external relationships with others. Companies may have implemented one or more of these innovations.

6.3.3 Forms of organisational innovation, 2008–2010



Source: Eurostat.

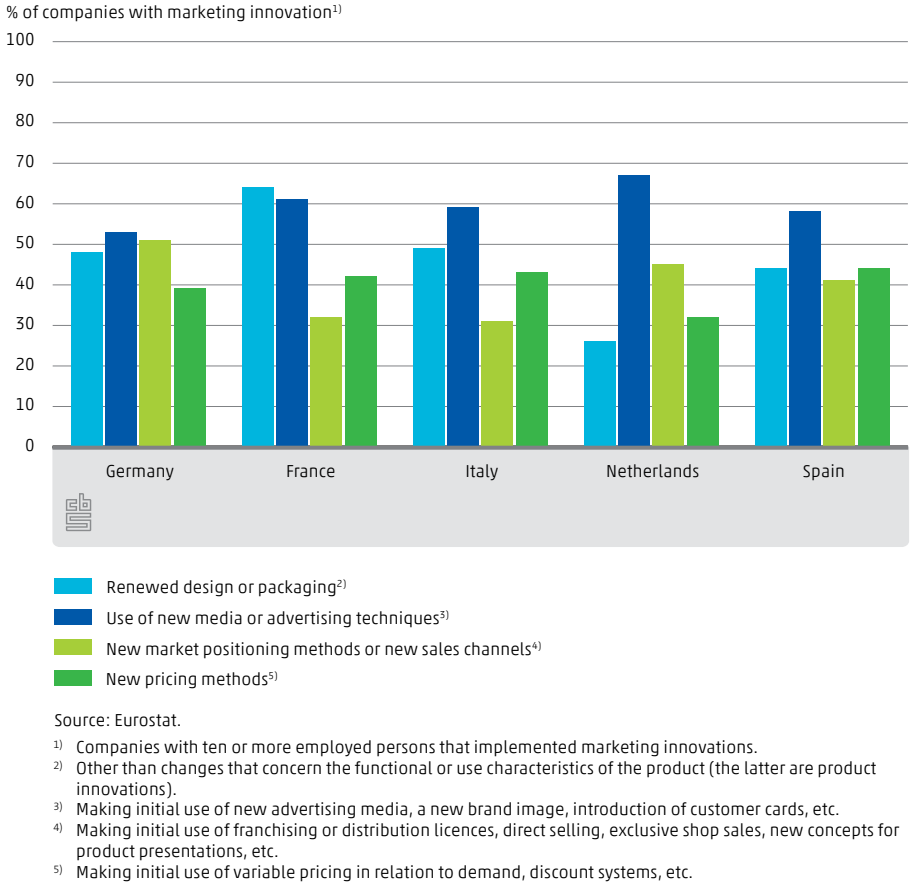
1) Companies with ten or more employed persons that implemented organisational innovations.
2) Supply chain management, redesign of business processes, knowledge management, lean production, quality management and the like.
3) Commissioning of a new system of employee responsibilities, teamwork, decentralisation, merger or division of departments, education and training systems and the like.
4) Entering into commitments, partnerships, outsourcing or subcontracting for the first time.

Companies are primarily organisationally innovative due to the implementation of new methods for organising responsibilities and decision-making. This applies to most EU countries but not to the Netherlands. For example, in Spain and France,

82 percent of organisationally innovative companies applied these methods, while the percentage in the Netherlands was only 63 percent. On the other hand, Dutch companies more often implemented new operating procedures. Eight in ten organisational innovators in the Netherlands changed their operating procedures in the period 2008–2010. In all EU countries, innovations in the way in which companies deal with external relations are the least common.

Figure 6.3.4 shows the share of companies that has introduced marketing innovations. This concerns a drastic change in the design or packaging of goods, the use of new media or advertising techniques, new market positioning methods and new pricing methods for goods and services.

6.3.4 Forms of marketing innovation, 2008-2010



Source: Eurostat.

1) Companies with ten or more employed persons that implemented marketing innovations.
2) Other than changes that concern the functional or use characteristics of the product (the latter are product innovations).
3) Making initial use of new advertising media, a new brand image, introduction of customer cards, etc.
4) Making initial use of franchising or distribution licences, direct selling, exclusive shop sales, new concepts for product presentations, etc.
5) Making initial use of variable pricing in relation to demand, discount systems, etc.

Many European marketing innovators in the period 2008–2010 adopted new media or new advertising techniques. In the Netherlands, two in three companies with marketing innovations introduced such new media or new advertising methods. This places the Netherlands among the countries that score high in this area. By contrast, the Netherlands has few companies that introduced new packaging or changes in product design: 26 percent of companies with marketing innovations. In many countries the corresponding figure was higher than 40 percent.

The statistical annex to this publication contains figures concerning the different types of organisational and marketing innovations for all EU countries. The statistical annex can be consulted online at www.cbs.nl/ICT-knowledge-economy.

7. Research and development

Research and development (R&D) are important for an economy that primarily competes on knowledge and not as much on price. The ability to create products that others are not (yet) able to create provides market advantage and therefore opportunities for growth. R&D consequently is not exclusively a matter for the business sector; it is also important to science.

7.1 R&D in the Netherlands

Investing in R&D is important for the development of new knowledge and know-how. R&D is characterised by research that is oriented towards innovation. According to the international definition adhered to by statistical agencies, R&D is *'creative work undertaken on a systematic basis in order to increase the stock of knowledge, including knowledge of man, culture and society, and the use of this stock of knowledge to devise new applications'* (OECD, 2002). A practical elaboration of this definition as used by Statistics Netherlands in its surveys and publications is provided in the box on the next page. Traditionally, R&D has encompassed fundamental and applied research in new knowledge and technology that at a later stage may lead to specific new products and processes.

There is a difference between fundamental research and applied research. The essence of fundamental research is that a company or institution increases the stock of scientific knowledge (*Research*). Knowledge institutes such as universities and research institutes focus mainly on this kind of research. By contrast, in applied research, companies and institutions focus on further developing ideas into vastly improved processes and products (*Development*). Companies relatively often are engaged in this type of research.
Both the traditional, technologically driven R&D carried out by companies themselves and the R&D carried out by specialised knowledge agencies, in which partners collaborate and share knowledge, are important for the success of R&D activities in the Netherlands. Research institutes and design and engineering firms are examples of joint venture partners.

R&D generates new knowledge that can result in innovations. Generally these are technological innovations: new products and processes. In addition, R&D can also produce non-technological innovations. Examples of this include new organisational and marketing methods.
R&D does not only involve having a company or institution develop new knowledge itself. Exploiting knowledge developed elsewhere and exchanging

existing information are also important. An easily accessible knowledge infrastructure is essential for this purpose. When companies, government organisations and knowledge institutes carry out a great deal of R&D activities and collaborate in this respect, a country is better able to compete. This also makes a country attractive to foreign investors. Substantial R&D activities in a sector or country also entail high-quality employment.

This section provides a sketch of the total R&D expenditures and the associated R&D personnel in 2011. The share of the various sectors in this respect and the Netherlands' position in an international perspective are discussed.

Definition of R&D

In its surveys, Statistics Netherlands asks companies and institutes about their R&D expenditure and working years. In this connection, it is important to be aware of the precise activities encompassed by R&D.
Research carried out within an R&D framework seeks to achieve originality and innovation. It therefore entails a creative and systematic search for solutions to practical problems, such as those pertaining to production. R&D also includes strategic and fundamental research in respect of which acquiring background knowledge and increasing (pure) scientific knowledge rather than securing direct economic gain or solving problems are the main priorities for a company or knowledge institute. In addition, R&D comprises activities designed to further develop ideas or prototypes into practical processes and production-ripe products.

R&D does *not* include the following activities:
- **routine measurements or inspections;**
- **market research;**
- **education and training;**
- **activities carried out in support of patents and licences;**
- **purchased technology or making advanced (production) equipment operational;**
- **rewriting existing software or making it customer-specific;**
- **industrial design, unless the objective is to systematically make ergonomic improvements.**

Unless otherwise specified, this publication defines R&D expenditure as the expenditures incurred by companies and institutes on R&D performed by their in-house personnel in the Netherlands. In this respect the company can finance

the R&D itself, but it can also carry out R&D for payment under contract to other companies or institutes. This definition of R&D expenditure therefore does not include R&D activities of companies based in the Netherlands that are performed abroad. Conversely, the definition does include R&D activities performed in the Netherlands that are financed from abroad. R&D financing with the aid of subsidies provided for by the Promotion of Research and Development Act is not deducted.[1] This means that a company's expenditure on subsidised R&D staff counts as R&D expenditure even if the company (later) recovers part of this expenditure through payroll tax. This approach ensures that the figures about the Netherlands are comparable with the results of other countries.

[1] WBSO: Research and Development (R&D) tax credit. This Act provides for a tax stimulus for (private) R&D by reducing the payroll tax owed by a company for R&D staff.

R&D expenditure 12 billion euros in the Netherlands

In 2011, Dutch companies and institutions spent over 12 billion euros on R&D (Table 7.1.1). The Dutch business sector carried out over half of all R&D in the Netherlands: 56 percent. Institutions of higher education (universities, university medical centres and higher professional education institutes) accounted for one third of total R&D spending. Public research institutes, such as the Netherlands Organisation for Applied Scientific Research (TNO) and private non-profit organisations accounted for the remaining 11 percent of Dutch R&D.

€ 12,141,000,000
spent on R&D in the Netherlands

Companies and institutions do not always carry out R&D for themselves or even for their own sector. For example, companies carry out R&D under contract to government organisations and universities carry out R&D under contract to companies (also see Table 7.5.1).

7.1.1 R&D conducted with in-house staff: expenditures, labour input and R&D intensity, 2011

	Unit	Companies	Public research institutions[2]	Higher education sector[3]	Total
R&D expenditure	€ mln	6,826	1,321	3,994	12,141
R&D personnel	FTEs (x 1,000)	72.9	11.2	32.2	116.3
R&D expenditure as a percentage of GDP[1]	%	1.13	0.22	0.66	2.02

Source: Statistics Netherlands, National Accounts and R&D survey.

1) R&D expenditure as a percentage of the gross domestic product (GDP) is still provisional, because the GDP is still provisional.

2) Including private non-profit organisations (PNPs).

3) Universities, the faculty of University Medical Centres (UMCs) and Universities of Applied Sciences (HBO).

Company share is small in the Netherlands

In many other EU countries the business sector's share of total R&D spending is higher than it is in the Netherlands. In 2011, Dutch companies accounted for 56 percent of total R&D spending, while in the overall EU this figure exceeded 60 percent. In Germany, Sweden, Denmark and Finland the proportion was two thirds.

The smaller proportion in the Netherlands is partially due to the fact that companies themselves spend relatively little on R&D. Expressed as a percentage of the GDP, the R&D expenditure is also lower than that of the above-referenced countries (also see Figure 7.2.2 in Section 7.2). On the other hand, the R&D expenditure of the higher education sector in the Netherlands is higher than in many other countries (also see Figure 7.3.3 in Section 7.3). This also causes the relative share of companies to be lower. In most countries, including the Netherlands, the amount spent on R&D by public research institutes constitutes only a small part of total R&D expenditures.

More than 116,000 FTEs labour input devoted to R&D

In 2011, Dutch companies and institutions together devoted 116,000 FTEs labour input to R&D. Here too companies accounted for the largest share: 63 percent. Higher education accounted for 28 percent of the R&D labour input.

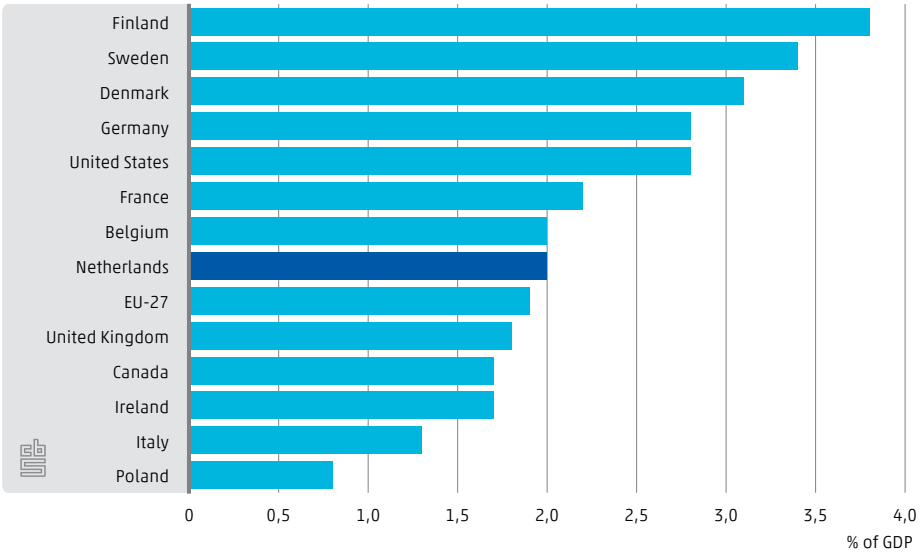
The business sector spent 94,000 euros for each FTE labour input devoted to R&D, while in the higher education sector this figure was 124,000 euros. The public research institutes at 118,000 euros fell between the two. In addition to the cost of wages, R&D expenditure comprises other operating costs attributable to R&D, with exception of depreciation costs. Instead, R&D investments are counted as R&D

expenditure. This means that R&D spending by companies and institutions consists of more than just the cost of wages.

R&D expenditures international

Table 7.1.1 also reports what is referred to as the R&D intensity. This is defined as R&D expenditure divided by GDP, and expresses the amount of R&D expenditure as a percentage of the total economy. As a result this figure indicates to what extent R&D expenditures keep pace with the economy. In addition, this makes it possible to compare the R&D expenditure of different countries. Figure 7.1.2 illustrates the R&D intensity for several countries in 2011. The R&D intensity in the Netherlands was 2.0 percent. This is slightly higher than the EU-27 average of 1.9 percent. The Netherlands' figure is also higher than that of Italy, Canada and the United Kingdom. It is considerably lower than the R&D intensity of Germany, Denmark, Sweden and Finland; countries to which the Netherlands regularly compares itself.

7.1.2 R&D intensity, international, 2011[1)2)]



Source: Statistics Netherlands, OECD.

1) Provisional figures.
2) R&D expenditure as a percentage of GDP.

The R&D intensity is a clear, useful and factually accurate indicator; however the underlying reality is always more nuanced. Due to differences in terms of sector structure, countries cannot simply be compared without qualification. The Netherlands has relatively few industrial companies and that in part explains why the Netherlands spends less on R&D. The manufacturing sector generally accounts for more R&D than the services sector, although the services sector performs R&D activities as well. It is therefore possible for countries to have comparable R&D intensity for the manufacturing and services sectors separately, while the R&D intensity at the national level differs considerably because a country has a far larger manufacturing base. This element is a factor in the goals set by Dutch policy makers. They have set the R&D expenditure target at 2.5 percent of Dutch GDP by 2020 (Ministry of Economic Affairs, Agriculture and Innovation, 2011a). As such they have adjusted the EU's generic goal for the Netherlands. In fact the European Commission (EC) has set the R&D intensity target for the overall European Union at 3 percent by 2020 (European Commission, 2010a). Previously the EC's ambition was to achieve this intensity of 3 percent by 2010. Only a minority of EU countries in reality achieved this goal.

7.2 R&D in the business sector

Statistics Netherlands has slightly modified the method used to determine the R&D figures for the Netherlands. This change was first applied to the figures for 2011. This means that as of 2011, the R&D expenditures of companies with less than ten employees are included in the figures. This provides a more comprehensive picture of company R&D expenditures in the Netherlands. In addition, Statistics Netherlands has incorporated a number of changes in how the sample is structured. Finally, Statistics Netherlands has decided to apply a slightly different R&D definition effective 2011. Part of the definition of R&D contained in Section 7.1 states that it is carried out on a 'systematic basis'. As of 2011, Statistics Netherlands is applying a broader interpretation of this requirement. The result is that the small-scale and incidental R&D activities of companies now also form part of the R&D in the Netherlands. All of this means that the 2011 R&D findings for companies are not readily comparable to the figures produced in previous years. For this reason, this section only discusses the 2011 figures.

Most R&D still carried out by the manufacturing industry

Table 7.2.1 presents the R&D activities carried out by companies, broken down by sector and company size. The manufacturing industry accounted for the largest share of R&D spending by the business sector: 58 percent. By contrast, only a quarter of all companies performing R&D are part of the manufacturing industry. As such, the average R&D expenditure per company in the manufacturing industry is four times as high as it is in the services sector: 865,000 versus 215,000 euros. This is partly due to the fact that R&D in the manufacturing industry is more technical in nature as a result of which spending on equipment and laboratories is higher. This is also evident in the R&D expenditures per FTE labour input: these are higher in the manufacturing industry than in the services sector.
There is still one other reason for the manufacturing industry's large share of R&D expenditures. The manufacturing industry in particular includes several large multinational enterprises that spend very high amounts on R&D. This pushes the average R&D expenditure per company in the manufacturing industry to an extremely high level. This is evident in the average R&D expenditure of companies with 250 or more employees, which amounts to 6.9 million euros per company. To a very significant extent this is due to the large multinational companies in the manufacturing industry. Indeed, R&D expenditures within the business sector are highly skewed. R&D companies with 250 or more employees represent only 3 percent of all R&D companies, while collectively they accounted for 54 percent of all R&D expenditures in 2011.

7.2.1 R&D conducted with in-house staff: companies, 2011

	R&D companies		R&D expenditure		R&D personnel	
	number	% of total	€ mln	% of total	FTEs (x 1,000)	% of total
Sector						
Manufacturing industry	4,586	26	3,968	58	34.6	47
Services	11,730	66	2,521	37	34.2	47
Other	1,565	9	336	5	4.1	6
Company Size						
0 to 10 employees	9,729	54	569	8	11.2	15
10 to 50 employees	5,393	30	829	12	12.1	17
50 to 250 employees	2,222	12	1,725	25	19.9	27
250 or more employees	536	3	3,702	54	29.6	41
Total	17,880	100	6,826	100	72.9	100

Source: Statistics Netherlands, R&D survey.

The methodology changes introduced by Statistics Netherlands have increased the R&D figures, especially for the services sector. First, this is due to the fact that effective 2011, Statistics Netherlands also includes companies with fewer than ten employees in the figures. Many of the small R&D companies are active in the services sector. In terms of the number of R&D companies, R&D staff and R&D expenditures, a disproportionate share of the smaller companies ends up in the services sector. In addition, it is reasonable to assume that the broader interpretation of the R&D concept in particular generates higher figures for the services sector. After all, service companies can be expected to conduct proportionately more small-scale and incidental R&D projects than manufacturing companies. The bottom line is that two thirds of the companies that performed R&D in 2011 were part of the services sector. However, the services sector's share of the total R&D spending by companies was much smaller: 37 percent.

R&D expenditure of small companies

In order to limit the administrative burden imposed on the business community, companies with fewer than ten employees were previously excluded from the Statistics Netherlands R&D surveys. The reason for this was that this would require a disproportionately large number of companies to complete the questionnaire in order to be able to reliably estimate the R&D expenditure of small companies, while they probably do not do a great deal of R&D. The costs therefore outweighed the benefits.

In the meantime, Statistics Netherlands has acquired access to the data administered by NL Agency as the implementing agency of the WBSO: Research and Development (R&D) tax credit. WBSO is an act that provides a fiscal facility for companies, knowledge centres and self-employed persons who perform R&D work. The WBSO was introduced in 1994 and at the present time is the most important scheme for promoting private R&D expenditure in the Netherlands. The WBSO administration includes information about the income tax deductions available to companies with employees (entities liable to deduct and transfer payroll tax) as well as for companies without employees (self-employment). In addition, the WBSO database contains information about the number of R&D hours and the salary paid for these R&D hours.

Statistics Netherlands has linked the companies in the WBSO database to its General Business Register. This enabled Statistics Netherlands to assign characteristics to these companies such as the sector (SIC 2008), size category and region.

The WBSO database also includes information about the number of R&D hours, the corresponding gross wage and the fiscal benefits received under the WBSO for companies with fewer than ten employees. Statistics Netherlands uses this information to estimate variables that are part of the R&D survey. Statistics Netherlands estimates the missing variables by, among other things, making use of the information available for companies with 10 to 50 employees that did complete a questionnaire. These estimates are produced by sector in order to take the differences in business activities properly into account.
All the required R&D statistical information is available this way for every company that received a WBSO grant. This information makes it possible for Statistics Netherlands to estimate the magnitude of each sector and size category. Statistics Netherlands adds these results to the results produced by the regular R&D survey in order to come up with the total R&D expenditure of the business sector in the Netherlands.

In 2011, the R&D expenditures of small companies amounted to 8 percent of the total R&D expenditures of the business sector. Strictly speaking, this estimate represents a lower limit of the R&D activities conducted by small companies. After all, the estimate is only based on companies that made use of the WBSO. Small companies that are engaged in R&D but did not submit a WBSO application are not included in this figure.

Small companies also contribute to R&D

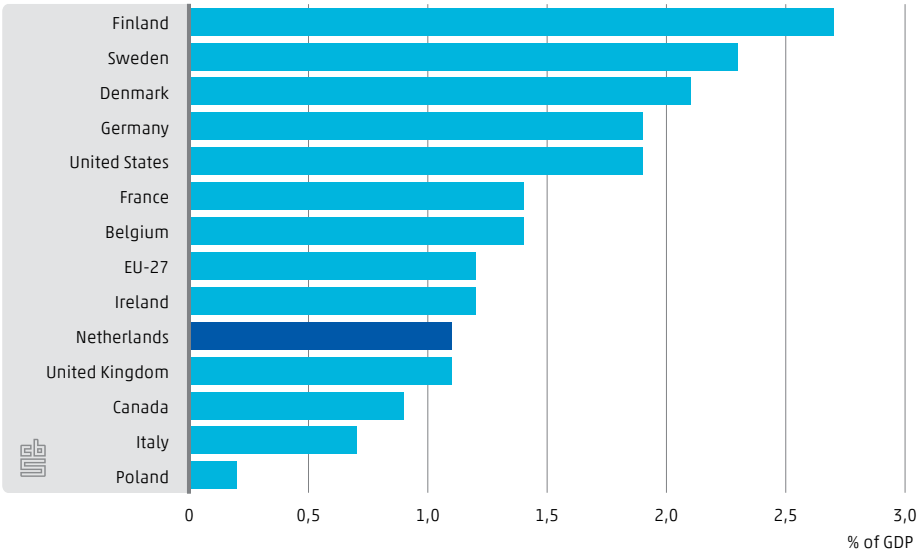
Small companies form a large portion of the companies conducting R&D. This is in part due to the fact that there are simply more small than large companies. Many of these small companies are active in the services sector and partly as a result of this their R&D expenditure per company is lower. Their R&D spending per FTE labour input devoted to R&D is also somewhat lower than that of large companies. Almost 85 percent of companies engaged in R&D in 2011 had fewer than 50 employees. These companies accounted for 20 percent of total R&D spending and 32 percent of R&D personnel (expressed as FTEs).
Large companies are a mirror image of small companies. There are relatively few companies with at least 50 employees and they are primarily active in the manufacturing sector. Large companies are characterised by high R&D expenditures per company and per FTE labour input. Collectively they account for 80 percent of total R&D spending and 68 percent of R&D employment in the business sector. A skewed distribution of R&D activities of this nature within the business sector is

not unique to the Netherlands. There are other, especially small, countries where a limited number of large multinational companies accounts for the lion's share of R&D. The R&D in these countries is highly dependent on a small number of companies. After all, the R&D-related decisions taken by these determinative companies have a major impact on the total R&D of the business sector. This makes a knowledge economy vulnerable. On the other hand, these large companies can have a positive influence on the R&D activities of other companies, universities and research institutes. The skewed relationship between the R&D in large and small companies therefore has its benefits and drawbacks, but in any event, the fact that small companies in the Netherlands also invest in R&D is a positive factor.

R&D expenditure by Dutch companies is slightly below the EU average

The R&D expenditure by Dutch companies slightly lags the EU average (Figure 7.2.2). In 2011, R&D spending by the business sector represented 1.1 percent of the Dutch GDP. The EU average was 1.2 percent. In Denmark, Sweden and Finland, company R&D spending amounted to more than 2 percent of the GDP.

7.2.2 R&D intensity, business sector, international, 2011[1)2)]



Source: Statistics Netherlands, OECD.

1) Provisional figures.
2) Business Sector's R&D expenditures as a percentage of GDP.

7.3 R&D in the higher education sector

R&D in the higher education sector comprises three components: the scientific research conducted by universities, the research conducted by the faculties of University Medical Centres (UMCs), and the research conducted by the Higher professional education institutes (hbo). The research conducted by the faculties of the UMCs is the research that was in the past conducted by the medical faculty of a university. In recent years these medical faculties for the most part were merged into the UMCs. Personnel that in the past had teaching and research responsibilities in a medical faculty now do similar work as UMC employees. The statistics about education and research group these activities under higher education, even where these activities involve the employees of a healthcare institution. This makes it possible to compare the Dutch figures with those of other countries.

Higher education: 4 billion euros spent on R&D

In 2011, institutions of higher education spent almost 4 billion euros on R&D. As such they generated one third of total R&D spending in the Netherlands. In 2000, the higher education sector spent 2.2 billion euros on R&D. This amount therefore almost doubled over a period of eleven years (Table 7.3.1).

7.3.1 R&D conducted with in-house staff: higher education sector

	Unit	2000	2005	2009	2010	2011
R&D institutions	**number**	22	61	61	65	65
Scientific education[1)]		22	22	22	26	26
Higher professional education		–	39	39	39	39
R&D expenditure	**€ mln**	2,213	3,021	3,711	3,691	3,994
Scientific education[1)]		2,213	2,947	3,604	3,564	3,848
Higher professional education		–	74	107	127	146
R&D personnel	**FTEs x 1,000**	25.6	28.8	29.5	30.2	32.2
Scientific education[1)]		25.6	27.9	28.4	29.0	30.8
Higher professional education		–	0.9	1.2	1.2	1.4

Source: Statistics Netherlands (based on figures from the Association of Universities in the Netherlands (VSNU), the Dutch Federation of University Medical Centres (NFU) and the Netherlands Association of Universities of Applied Sciences (Vereniging Hogescholen).

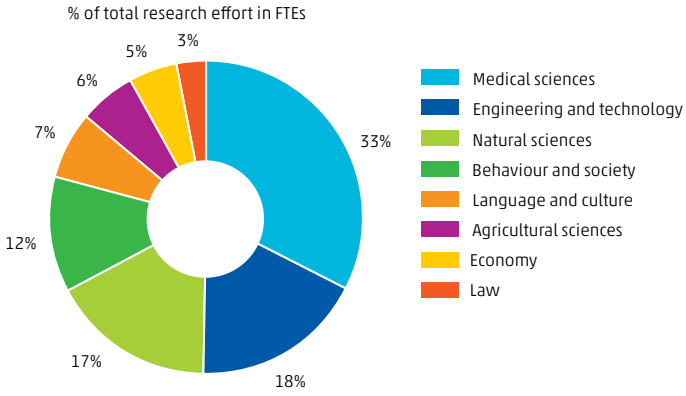
[1)] Including the R&D conducted by the faculties of University Medical Centres (UMCs).

R&D personnel in the higher education sector increased from almost 26,000 FTEs in 2000 to over 32,000 FTEs in 2011. These are mostly scientific employees, but also concern support staff. The higher professional education institutes (hbo) only make a modest contribution to R&D in the higher education sector: 146 million euros and 1,400 FTE labour input in 2011.

Medical sciences constitute the largest area for research

The 'Medical sciences' in 2011 comprised one third of the total research effort (Figure 7.3.2). This research largely takes place within UMCs. In addition, universities also conduct research in the area of medical sciences. Research into veterinary medicine, for example, exclusively takes place in a university and not in a UMC.

7.3.2 Research effort of academic staff in scientific education by field of science, 2011[1)]



Source: Statistics Netherlands (based on figures from the Association of Universities in the Netherlands (VSNU) and the Dutch Federation of University Medical Centres (NFU)).

1) Inclusive of the research conducted in the faculties of UMCs, but exclusive of the research conducted in the Universities of Applied Sciences (HBO).

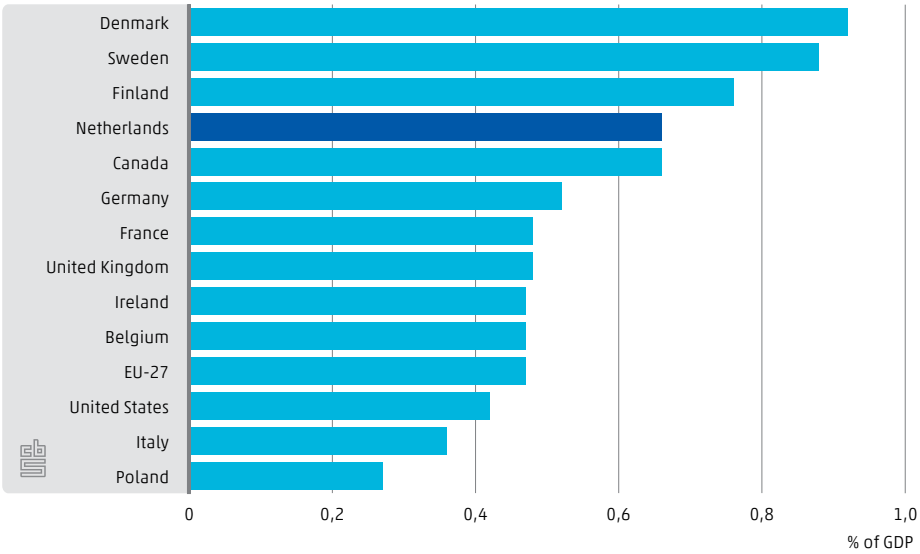
The fields of science 'Engineering and technology' and 'Natural sciences' also form a key component of the scientific research conducted in the Netherlands. 'Economy' and 'Law' are smaller scientific areas.

33% Medical sciences form the most important field of science

Higher education, international

The R&D expenditure of the higher education sector in the Netherlands is higher than in many other countries (Figure 7.3.3). In 2011, it represented 0.66 percent of the GDP. This is above the EU-27 average, and is also higher than in the United Kingdom, France and Germany. In Sweden and Denmark, the R&D intensity of the higher education sector is significantly higher than in the Netherlands: 0.9 percent of the GDP. In spite of the high intensity in Sweden and Denmark, the share of higher education in the total R&D spending of these countries is lower than in the Netherlands. This is due to the fact that the business sector in these countries also spends more on R&D than in the Netherlands.

7.3.3 R&D intensity higher education sector, international, 2011[1)2)]



Source: Statistics Netherlands, OECD.

1) Provisional figures.
2) R&D expenditures in the higher education sector as a percentage of GDP.

7.4 R&D by public research institutes

Public research institutes are organisations that primarily receive their funding from the government. Another characteristic of a public research institute is that the government for the most part determines the organisation's focus of research. A few examples of such institutes include the Netherlands Organisation for Applied Scientific Research (TNO), the Agricultural Research Service (DLO), the Foundation for Fundamental Research on Matter (FOM), the Netherlands Cancer Institute (NKI) and the Energy Research Centre of the Netherlands (ECN). These are large research institutes that collectively account for the lion's share of the R&D in this sector. In 2011, R&D spending by public research institutes in the Netherlands was 1.3 billion euros. This represents 11 percent of total R&D spending (Table 7.4.1). Over the course of the years, the R&D expenditure of public research institutes has increased somewhat. In 2000, it amounted to 1 billion euros. Almost eleven years later it has increased by almost 300 million euros. Employment of R&D personnel by contrast declined between 2000 and 2011 from almost 14,000 to over 11,000 FTEs.

7.4.1 R&D conducted with in-house staff: public research institutes[1)]

	Unit	2000	2005	2009	2010	2011
R&D institutions	**number**	105	129	82	76	88
R&D expenditure	**€ mln**	1,049	1,216	1,327	1,279	1,321
R&D personnel	**FTEs x 1,000**	13.7	12.7	11.4	11.4	11.2

Source: Statistics Netherlands, R&D Surveys.

1) Including private non-profit organisations (PNPs).

7.5 Funding of R&D

The expenditure on R&D performed by in-house staff is an important indicator in the R&D statistics. The foregoing part of this chapter therefore extensively dealt with this aspect. In addition to research performed by in-house staff, a company or an institution can also purchase research from another organisation. In such instances the R&D's financier is not the organisation actually performing the R&D. For example, this is the case in contract research. In addition, there are more general forms of R&D financing. For example, the government provides a significant portion of the funds for the research conducted in the higher education sector. This

section describes the degree to which various parties in the Netherlands finance R&D.

Companies finance half of R&D in the Netherlands

In 2011, total spending in the Netherlands on R&D performed by in-house personnel was 12.1 billion euros (Table 7.5.1). Of this, the business sector financed over 6 billion euros. This is approximately half. For the most part this is R&D performed for the company itself, using company funds. However, it also comprises contract research performed by one company for another.
The government is the second major financier of R&D in the Netherlands. In 2011, 4.3 billion euros originated from the government, or 36 percent of the total. Almost three quarters of this amount goes to financing R&D in the higher education sector. Only a small portion is designated for the business sector: 6 percent. In 2011, public research institutes received 22 percent of the government's R&D financing.
Foreign countries are the third major financier of R&D in the Netherlands. In 2011, 11 percent of R&D financing originated from other countries. Foreign countries primarily pay for R&D performed by the business sector, but other sectors also receive financing from abroad. For the higher education sector and public research institutes this often comprises contributions from the EU. For companies this predominantly consists of financial flows within multinationals with a parent organisation or subsidiary in the Netherlands.
In terms of identifying the origin of funds, the private non-profit organisations (PNPs) are stated separately. This is because they have evolved into mainly financiers of R&D that increasingly less perform their own R&D. The financial contributions of PNPs constitute a substantial flow of funds for the higher education sector and then especially in the area of health.
The business sector itself is the largest financier of R&D conducted by companies. On the other hand, government is the largest financier of the R&D conducted by public research institutes and the higher education sector.

Destination of R&D funds

The foregoing dealt with the financing of R&D conducted by companies and institutions in the Netherlands: the origin of funding. A second perspective is the destination of the funds that companies, institutions and governments in the Netherlands allocate to R&D.

Companies spend most of the funds they free up for R&D within their own company or with other companies in the Netherlands. In 2011, this was 5.6 billion euros of the 7.3 billion euros that companies spent in total on R&D. Foreign countries are another important destination of the R&D funds freed up by the business sector. In 2011, Dutch companies financed 1.2 billion euros of R&D abroad.
The total R&D spending by the business sector is higher than the company spending on R&D performed by their own staff in the Netherlands. This means that the business sector on balance finances the R&D of other sectors, including R&D performed abroad. For example, in 2011, the business sector allocated 326 million euros for R&D to the higher education sector; in reverse, this figure only amounted to 5 million euros.

7.5.1 Source and destination of R&D funds, 2011

	Destination of R&D funds					
	total	business sector	public research institutions[2]	higher education sector	abroad	national R&D expenditure
	€ mln					
Total	12,141	6,826	1,321	3,994	1,226	12,044
Business Sector	6,061	5,585	149	326	1,218	7,278
Government[3]	4,315	266	938	3,111	8	4,323
Higher Education Sector	39	5	33	0	0	39
Private non-profit organisations	404	48	55	302	0	404
Abroad	1,323	922	146	255		
	%					
Total	100	100	100	100	100	100
Business Sector	50	82	11	8	99	60
Government[3]	36	4	71	78	1	36
Higher Education Sector	0	0	3	0	0	0
Private non-profit organisations	3	1	4	8	0	3
Abroad	11	14	11	6		

Source: Statistics Netherlands, R&D Surveys.

1) The offset of R&D costs under the WBSO scheme is not reflected in the statement of the source and destination of funds.

2) Including private non-profit organisations (PNPs).

3) Public research institutes as financiers of R&D are classified under government.

National R&D expenditure

The national R&D expenditure is defined as the total spending by companies, institutions and government organisations on R&D in the Netherlands. This is exclusive of the R&D performed by organisations in the Netherlands for foreign financiers, but inclusive of the R&D contracted out abroad by Dutch parties.
In 2011, residents of the Netherlands spent 12.044 billion euros on R&D (Table 7.5.1). This constitutes the national R&D expenditure. The total in-house staff-related R&D expenditure was 12.141 billion euros. The difference between these figures consists of two components. First, the amount spent by foreign financiers in the Netherlands is not counted in the national R&D expenditure. In 2011, this figure amounted to 1.323 billion euros. Second, the amount spent by Dutch parties abroad is, on the contrary, included: 1.226 billion euros.
The national R&D expenditure is then calculated as follows:
- **the total in-house staff-related R&D expenditure (12.141 billion euros)**
- **less the expenditure of foreign financiers (1.323 billion euros)**
- **plus the R&D expenditure of Dutch parties abroad (1.226 billion euros).**

This adds up to a total national R&D expenditure of 12.044 billion euros in 2011.

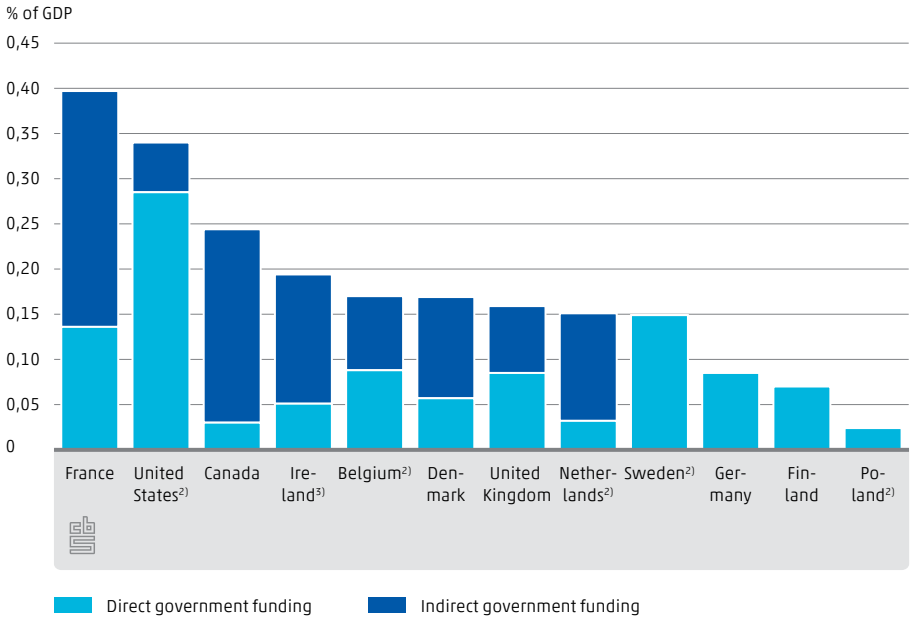
The foreign R&D balance was 97 million euros: 1.323 billion euros minus 1.226 billion euros. This means that in 2011 foreign parties spent 97 million euros more on R&D in the Netherlands than Dutch parties spent on R&D abroad.

Fiscal incentives

Governments often consider R&D to be of such importance that they do not allow the market alone to decide on how much R&D is performed by companies and institutions. Government finances a large number of public research institutes, among other things. The contract research government organisations contract out to companies also constitutes a form of direct government financing of R&D. In addition, many countries have introduced fiscal schemes that promote R&D in the business sector. In the Netherlands, the above-referenced WBSO: Research and Development tax credit, has been in effect for many years. This scheme reduces the tax companies are obliged to remit for R&D personnel. Figure 7.5.2 illustrates the direct and indirect government financing of R&D in the business sector. Indirect government financing means that R&D companies are required to pay lower taxes. In a number of countries, this indirect financing of R&D activities is greater than the

direct financing. For example, this is the case in France, the United States, Denmark and the Netherlands. Some countries do not have a fiscal incentives scheme. This includes Sweden, Germany and Finland. For that matter, R&D spending by the business sector is relatively high in these countries and the respective governments may therefore consider such incentives unnecessary. The R&D spending of companies in Denmark was at a comparable level to that of Sweden, Germany and Finland in 2011. Denmark did have substantial fiscal incentives, however. In other words, countries with high company R&D expenditures are not always without fiscal incentives.

7.5.2 Direct and indirect government R&D funding in the business sector, 2010[1)]



Source: OECD.

1) Does not include fiscal incentives provided by local governments. Finland, Germany and Sweden do not have fiscal R&D incentives. The data related to indirect government financing in the United States concern only a part of the incentives.
2) 2009 instead of 2010.
3) 2008 instead of 2010.

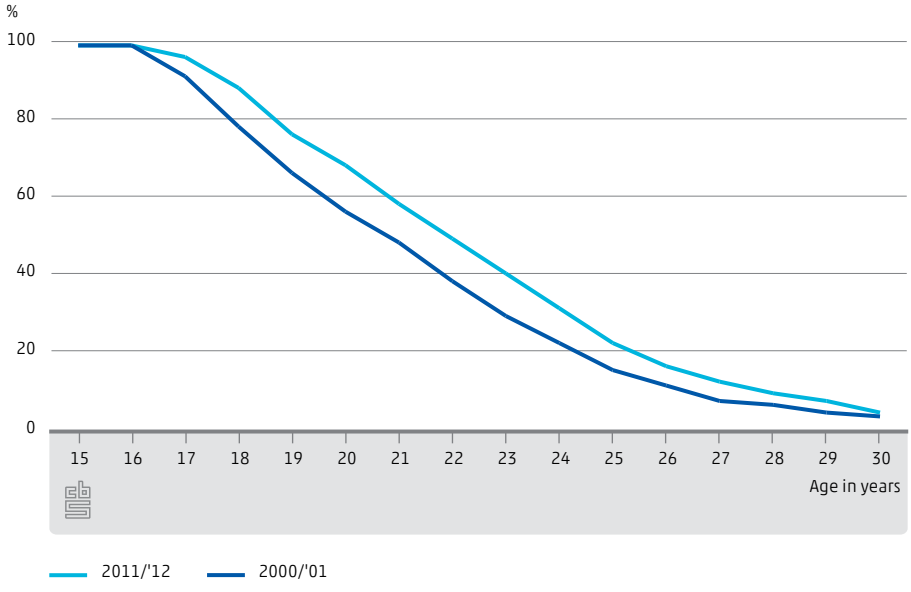
8. Knowledge potential

Human capital is the key theme of this chapter. It describes enrolment in senior general secondary education (havo), pre-university education (vwo), senior secondary vocational education (mbo) and higher education. In addition, the chapter also focuses on the highly educated segment as a proportion of the Dutch labour force. Furthermore, special attention is devoted to the natural sciences, ICT and technology fields of study. These fields of study are of importance to research and development. The chapter concludes with a section about the ICT skills of Dutch people.

8.1 Education in the Netherlands

A growing number of younger people are enrolling in education programmes. Increasing numbers of students are staying in school when they are no longer required to attend school, or resume their education after a break (Statistics Netherlands, 2012b). Figure 8.1.1 illustrates the differences in education enrolment in the 2000/'01 and 2011/'12 academic years, by age. This figure clearly demonstrates that education enrolment has increased during this period. In 2011/'12, in every age group aged 17 and up, more younger people were enrolled in education than in 2000/'01.

8.1.1 Enrolment in education by age, 2000/'01 and 2011/'12[1)2)]



Source: Statistics Netherlands, Education Statistics.

1) Academic year 2011/'12: provisional figures.
2) Enrolment in part-time and full-time education.

Education in the Netherlands

English definitions of abbreviations used for the various levels of secondary and higher education:

secondary education

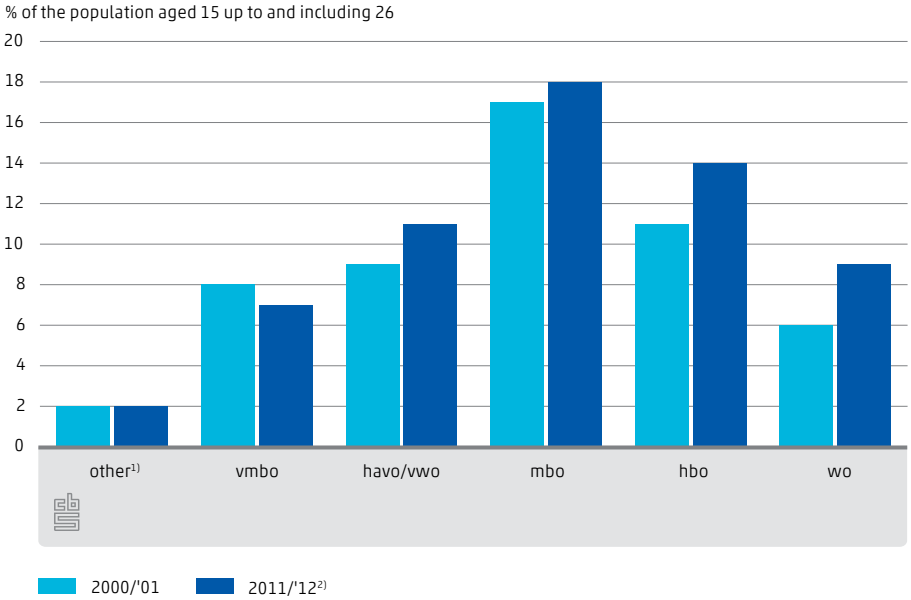
bbl	**apprenticeship-based track of mbo1**
bol	**school-based track of mbo**
havo	**senior general secondary education**
lwoo	**extra learning support in vmbo**
mavo	**junior general secondary education**
mbo	**senior secondary vocational education**
vavo	**basic secondary education for adults**
vmbo	**preparatory secondary vocational education**
vwo	**pre-university education**

higher education

ho	**higher education**
hbo	**higher professional education**
wo	**university education**

More students were enrolled in senior general secondary education (havo) and pre-university education (vwo) in 2011/'12 than there were in 2000/'01 (Figure 8.1.2). By contrast, enrolment in preparatory secondary vocational education (vmbo) decreased during that period. In 2011/'12 43 percent of 16-year-olds were enrolled in havo or vwo and 30 percent in vmbo. In 2000/'01, this figure was the same for both types of education: 35 percent. Enrolment in senior secondary vocational education (mbo), higher professional education (hbo) and university education (wo) also grew. From 18 years of age, enrolment in mbo in 2011/'12 is higher than it was in 2000/'01 for all ages. Enrolment in hbo and wo increased for all ages as well. Of all 20- and 21-year-old individuals in the population, 41 percent was enrolled as a student in hbo or wo in 2011/'12. In 2000/'01 this was less than one third. It is important that a relatively increasing number of young people complete studies in order to maintain the level of highly educated individuals in the Netherlands.

8.1.2 Enrolment in full-time and part-time education by type of education, 2000/'01 and 2011/'12



Source: Statistics Netherlands, Education Statistics.

1) First stage secondary education, special (secondary) education and practical education.
2) Provisional figures.

Number of havo and vwo graduates shows strong growth

Not only is the enrolment in havo and vwo increasing, but the number of graduates in these education streams is also increasing. In the 2003/'04 school year 36,000 students obtained their havo diploma. In 2011/'12 this number had increased to 42,000. This represents an increase of 16 percent. The increase in the number of vwo graduates was even higher: 20 percent. In 2003/'04 27,000 vwo students passed their exams. By 2011/'12 this number of graduates had risen to 33,000.

In the final years of havo and vwo, students can select one of four subject clusters, namely Natural science and Technology (NT), Natural science and Health (NG), Economics and Society (EM) or Culture and Society (CM). A combination of subject clusters is also possible. Traditionally, more boys than girls opt for Natural science and Technology and more girls than boys opt for Culture and Society. The introduction of a modernised second stage in havo and vwo in the 2007/'08

academic year caused profound shifts in choice of subject cluster.[1] Previously, Economics and Society had been the most frequently chosen subject cluster in both the havo and vwo streams. The interest in this cluster significantly decreased in the vwo stream (Figure 8.1.3). In 2003/'04, 34 percent of vwo graduates opted for the Economics and Society cluster. By 2010/'11 this had dropped to only 21 percent. In that academic year, a combined Natural science cluster was the most popular among vwo graduates. Havo graduates in 2010/'11 primarily opted for the Economics and Society cluster. Since 2003/'04 the combined Natural science and Technology, and Natural science and health clusters especially have become more popular among havo graduates.

Computer science in havo and vwo

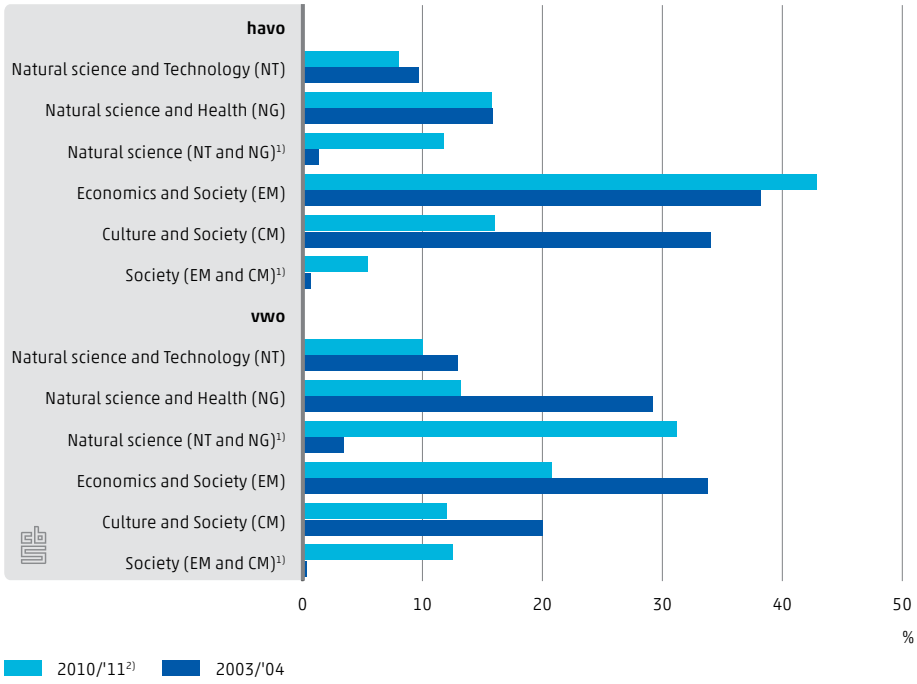
Some schools offer havo and vwo students the option of taking computer science. The Royal Netherlands Academy of Arts and Sciences (KNAW) reported on a survey of this discipline in December 2012 (KNAW, 2012). The report suggests that the Computer Science discipline has not been materially adjusted to the requirements of today since its introduction. The KNAW furthermore observes that increasingly fewer schools are offering a computer science programme. The report recommends that a new mandatory Computer Science and Communications subject be introduced in the first stage of the havo and vwo programmes. Another recommendation is to drastically renew the optional Computer Science subject in the senior years of the havo and vwo programmes.

Since the 2003/'04 academic year increasing numbers of havo and vwo students obtained diplomas with a Natural science cluster, while the number with a Social cluster dropped. Following the introduction of the modernised second stage, this trend continued to strengthen. The share of Natural science subject clusters of havo graduates increased from 27 percent in 2003/'04 to 36 percent in 2010/'11. In vwo, this share increased from 46 to 55 percent. Because many more vwo graduates opted for a double science cluster, significantly more students also have the Natural science and Technology cluster as part of their programme. Of male students graduating from the vwo programme, half had a Natural science and Technology cluster in the 2010/'11 academic year. For female students this was one third.

[1] Starting from the 1998/'99 academic year, so-called subject clusters were introduced into the senior years of the havo and vwo programmes. The 'Second Phase New Style' was introduced in the fourth year of the havo and vwo streams in the 2007/'08 academic year. This changed the composition of the subject combinations and the distinction between major and minor subjects was dropped.

Especially among female students the increase is high; in the past they often opted for Natural science and health, but hardly ever for Natural science and Technology.

8.1.3 Havo and vwo graduates by subject cluster, 2003/'04 en 2010/'11



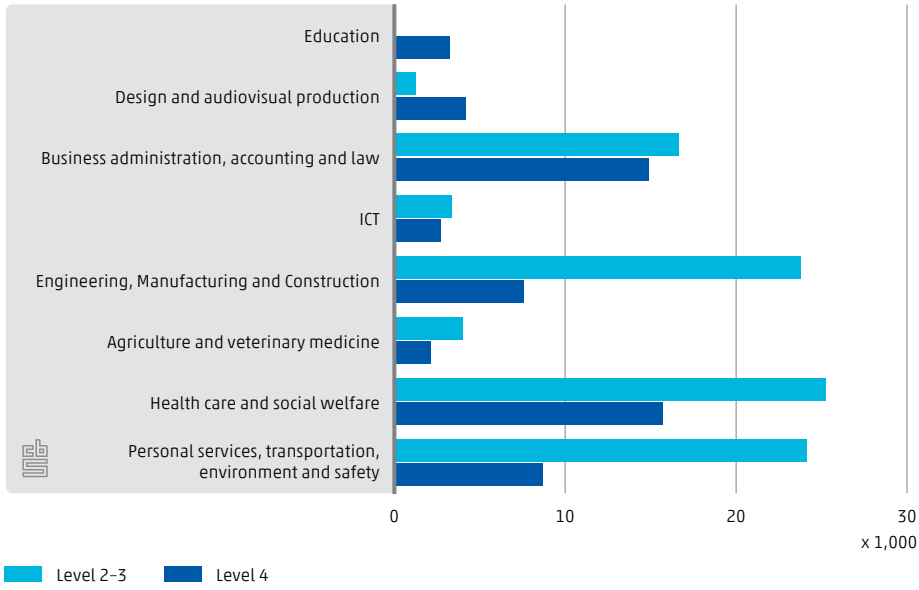
Source: Statistics Netherlands, Education Statistics.

1) Double subject cluster.
2) Provisional figures.

Increasingly more mbo graduates

The number of mbo graduates has been increasing every year since the 2000/'01 academic year. In 2000/'01 129,000 mbo students obtained their diploma; in 2010/'11 there were 175,000. This represents an increase of 36 percent over a period of ten years. There are four levels in the mbo stream. The number of graduates increased at every level between 2000/'01 and 2010/'11, with the exception of specialist training (Level 4b). Only the lowest mbo level, assistant training, does not provide a basic qualification for entry into the labour market. In 2010/'11, 158,000 mbo students obtained a Level 2 diploma or higher. The majority of these graduates had studied in the field of 'health care and social welfare': 41,000 (Figure 8.1.4). In the field of 'engineering, manufacturing and construction', 31,000 mbo students obtained a Level 2 or higher diploma; in the 'ICT' field this number was 6,000 in 2010/'11.

8.1.4 MBO level 2 and higher graduates, by discipline and level, 2010/'11[1)]



Source: Statistics Netherlands, Education Statistics.

[1)] Provisional figures.

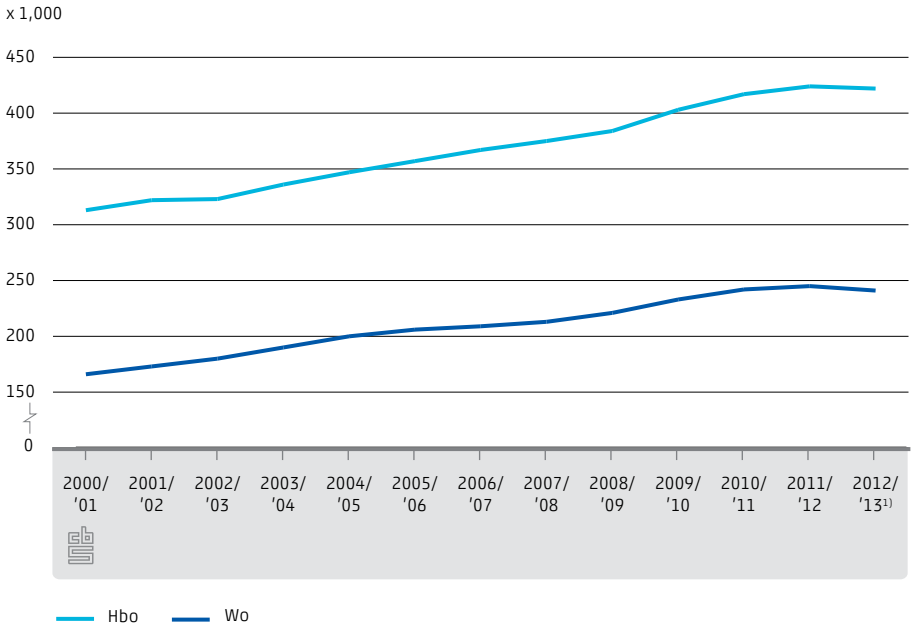
The majority of graduates in the field of 'engineering, manufacturing and construction' obtained a Level 2 diploma; the basic vocational training. In 2010/'11 the number of such graduates was over 14,000. Almost 10,000 students graduated with a Level 3 diploma and 8,000 graduated with a Level 4 diploma. The number of graduates in this technical field was higher at all levels in the 2010/'11 academic year than it was five years previously; in total this represents an increase of 10 percent. However, the number in the 2010/'11 academic year was 5 percent lower than a year earlier.

The field of ICT produces fewer graduates than the 'engineering, manufacturing and construction' field. In the 2010/'11 academic year, 6,000 mbo students graduated in the field of ICT. Almost half of these students obtained a diploma at the highest mbo level: 45 percent. A third graduated at Level 3 and almost a quarter at Level 2. In 2005/'06 there were almost 7,000 mbo graduates in the field of ICT. This number has since dropped. The number of Level 4 mbo graduates in the field of ICT especially dropped in the 2010/'11 academic year compared to five years previously.

Higher professional education and university students: rising trend, but decrease in 2012/'13

In the 2012/'13 academic year, 422,000 students were enrolled in higher professional education (hbo). The corresponding figure for 2000/'01 was only 313,000. In twelve years' time, the number of hbo students therefore grew by 35 percent. Between 2000/'01 and 2011/'12 the number of students enrolled in hbo increased each year. This number dropped for the first time since then in the 2012/'13 academic year, by almost 2,000.

8.1.5 Students enrolled in higher professional education (hbo) and university education (wo), 2000/'01-2012/'13



Source: Statisics Netherlands, Education Statistics.

1) Provisional figures.

The number of students enrolled in university education (wo) progressively rose between 2000/'01 and 2011/'12 as well. This exclusively concerns university education programmes financed by government. In the 2000/'01 academic year, 166,000 students were enrolled in a university education programme. Eleven years later this had risen to 245,000. This represents an increase of 48 percent in the number of university students. The majority of this increase in growth is due to the fact that more women are studying. The number of women enrolled in a university

study programme rose by 58 percent over a period of eleven years. Over the same period, the number of men enrolled in a university study programme rose by 38 percent. The number students with a non-western, foreign background enrolled in wo has also grown considerably (Statistics Netherlands, 2012c). Just as in the hbo stream, the enrolment in the wo stream also declined in 2012/'13, namely by 4,000.

Fewer students were enrolled in higher professional education (hbo) and university education (wo) in the 2012/'13 academic year than in the previous year and for both of these forms of higher education this represented an end to a period of uninterrupted growth. Two components play a role in this regard. First, fewer new students enrolled in higher education in the 2012/'13 academic year than in previous years. This is partially due to the fact that the number of 17- to 19-year olds declined in the Netherlands. Second, exceptionally many students obtained their diploma in the previous, 2011/'12 academic year, resulting in a very high outflow of students. In the 2011/'12 academic year, the number of hbo bachelor graduates was 6 percent higher than the year before. The percentage growth in the number of university bachelor graduates and university masters graduates was 16 percent and 14 percent, respectively. These considerable increases may be related to the government measures announced for the higher education sector. This made it especially attractive for students to quickly complete their studies (Van der Heide and Van Miltenburg, 2013; VSNU, 2013).

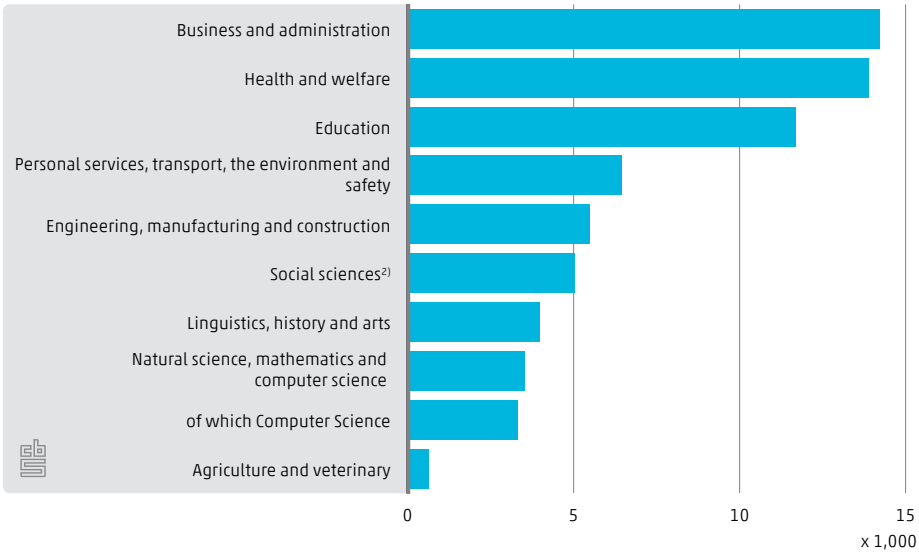
Higher professional education bachelor's fields of study

In the 2011/'12 academic year, over 14,000 students obtained an hbo bachelor's degree in the field of 'business and administration'. As such the number of graduates in this field was higher than in any other field (Figure 8.1.6). 'Health and welfare' and 'education' are common fields of study as well in the hbo stream. These three fields of study collectively comprised 61 percent of all graduates in the 2011/'12 academic year.

The 'engineering, manufacturing and construction' and 'natural sciences, mathematics and computer science' subject clusters in hbo are of particular importance to research and development. Graduates in these fields of study often end up carrying out R&D work during their career. In the 2011/'12 academic year these science fields of study collectively made up 14 percent of all hbo bachelor's degrees. In the 'engineering, manufacturing and construction' field of study, 5,484 students obtained an hbo bachelor's degree in 2011/'12. In the 'natural sciences, mathematics and computer science' field of study there

were 3,539 graduates. The majority of them graduated in computer science: 3,318 students.
In the 'natural sciences, mathematics and computer science' field of study there were 1,960 graduates with an hbo bachelor's degree in the 2000/'01 academic year. Ten years later this number had risen to 3,235. And in 2011/'12 this number increased by another 9 percent to 3,539. The number of hbo bachelor graduates in the 'engineering, manufacturing and construction' field of study reached a peak in the 2001/'02 academic year when 6,320 bachelor's degrees were awarded. After this, the number of graduates declined to 5,003 in 2007/'08. Four years later, in 2011/'12, the number of hbo bachelor's graduates in 'engineering, manufacturing and construction' once again increased to 5,484.

8.1.6 Hbo bachelor graduates by field of study, 2011/'12[1)]



Source: Statistics Netherlands, Education Statistics.

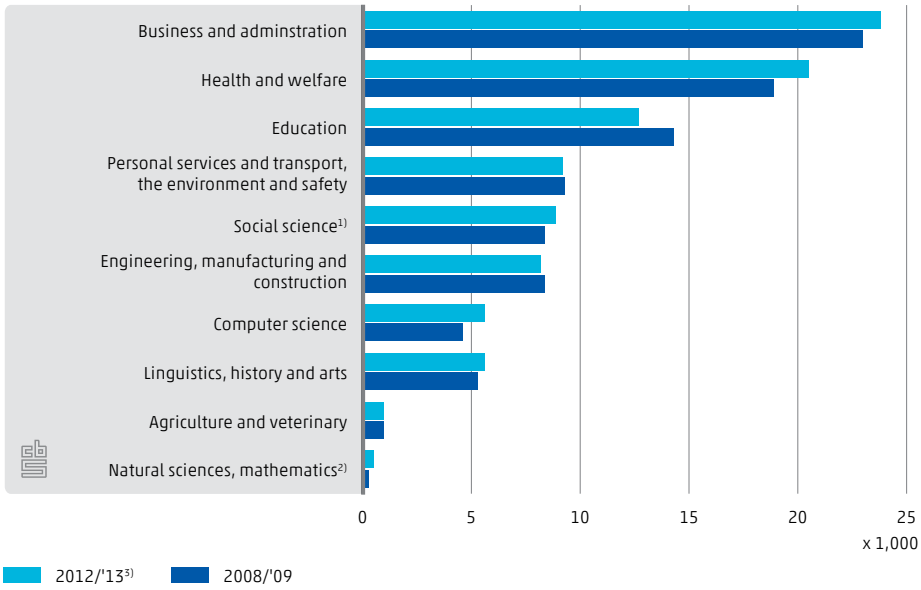
1) Provisional figures.
2) Isced 3, excluding 'business and administration' (Isced 34).

The proportion of women graduating with an hbo bachelor's degree in one of the sciences fields of study is small. In 2011/'12, 16 percent of graduates in the 'engineering, manufacturing and construction' field of study was a woman; in the 'natural sciences, mathematics and computer science' field of study this was 15 percent. In many other countries, the percentage of women science students enrolled in higher education is considerably higher than in the Netherlands. The following section (8.2) explores this subject in greater depth.

Potential increase in the number of hbo science diplomas over the coming years

The number of first-year students enrolled in higher professional education (hbo) in recent years provides an indication of the number of hbo graduates over the coming years. In the 2012/'13 academic year the total enrolment by first-year students in hbo decreased by 2 percent. The number of hbo graduates is therefore expected to decrease somewhat over a number of years, assuming that the percentage of students failing to complete their studies will remain more or less stable.

8.1.7 Trend in first-year higher professional education enrolment by field of study, 2008/'09 and 2012/'13



Sources: Statisics Netherlands, Education Statistics.

1) Isced 3, excluding 'business and adminstration' (Isced 34).
2) Isced 4, excluding 'computer science' (Isced 48).
3) Provisional figures.

In many separate fields of study, the number of first-year hbo students enrolled in the 2012/'13 academic year is slightly higher than four years ago (Figure 8.1.7). Especially the 'health and welfare' and 'business and administration' fields of study have grown considerably. The number of first-year students in the 'education' field of study in the 2012/'13 academic year is significantly less than in 2008/'09. Students are perhaps less interested in this field of study because for several years

now they have been required to complete mandatory language and arithmetic tests when they apply to a primary education teacher-training college (PABO).
The picture in the science fields of study is quite different. The number of first-year students enrolled in 'engineering, manufacturing and construction' has declined only slightly since 2007/'08, while the interest in this field grew somewhat last year. More first-year students enrolled in 'computer science' and 'natural sciences and mathematics' subject clusters in 2012/'13 than four years previously. If the dropout rates do not rise, the number of hbo graduates in these fields of study could therefore increase over the coming years.

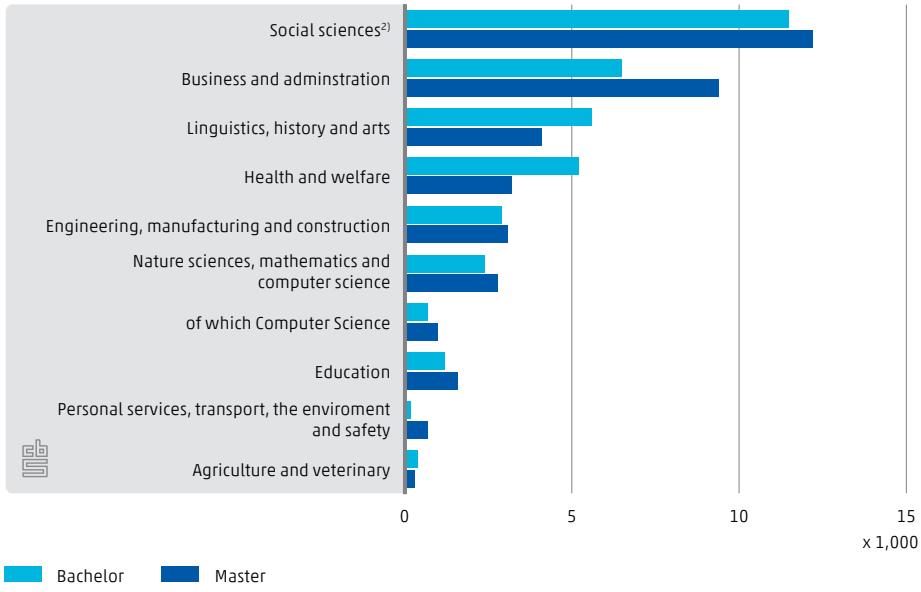
University education fields of study

Most university students are enrolled in the 'social sciences' field of study (Figure 8.1.8). This not only applies to bachelor's degrees, but to master's degrees as well. In the 2011/'12 academic year 11,474 university bachelor students obtained a degree in the 'social sciences'. In addition, 12,188 university master's students obtained a degree in this field of study. Many students also graduated from the 'business and administration' field of study. Collectively, these two fields of study accounted for 50 percent of all university bachelor's degrees awarded in the 2011/'12 academic year. The corresponding figure for university master's degrees was even higher: 58 percent.

In the 2011/'12 academic year the 'engineering, manufacturing and construction' and 'natural sciences, mathematics and computer science' fields of study together made up 15 percent of all university bachelor's degrees. The corresponding figure for university master's degrees was 16 percent. In the hbo stream, the 'natural sciences, mathematics and computer science' field of study mainly comprises computer science students. The proportion of students enrolled in the natural sciences and mathematics at the university level is significantly higher than the corresponding enrolment in hbo. This is primarily due to the fact that universities offer more studies in the natural sciences and mathematics than the hbo sector. In the 2011/'12 academic year, 676 students obtained a university bachelor's degree in computer science, while 993 students obtained a university master's degree in this field. This represents 2 and 3 percent of all graduates, respectively.
The number of university students graduating with a master's degree in the 'natural sciences, mathematics and computer science' field of study has increased in recent years. In the 2008/'09 academic year there were 2,191 such graduates and by 2011/'12 the number had increased to 2,751. The number of computer science graduates fluctuated over this time. In the 2011/'12 academic year, this number was 16 percent higher than the year before. In the 'engineering, manufacturing

and construction' field of study the number of graduates increased year over year. In 2007/'08 2,358 students graduated with this degree and by 2011/'12 this number had risen to 3,055. This number, like the number of computer science graduates, was 16 percent higher in 2011/'12 than in 2010/'11.

8.1.8 University bachelor and master's graduates by field of study, 2011/'12[1)]



Source: Statistics Netherlands, Education Statistics.

1) Provisional figures.

2) Isced 3, excluding 'Business and adminstration' (Isced 34).

The proportion of female students enrolled in the sciences at the university level (wo) is significantly higher than in higher professional education (hbo). In the 2011/'12 academic year, 29 percent of the university science graduates with a master's degree were women. Of the graduates with a bachelor's science degree in hbo, 16 percent were women. This concerns the 'natural sciences, mathematics and computer science' and 'engineering, manufacturing and construction' fields of study collectively. The proportion of female computer science graduates at the university level is approximately the same as in hbo. Of the computer science graduates with a master's degree, 16 percent were women. Of the graduates with a bachelor's degree in computer science in hbo, 14 percent were women.

3,055 university graduates with a master's degree in engineering in 2011/'12

Potential increase in science degrees at the university level as well

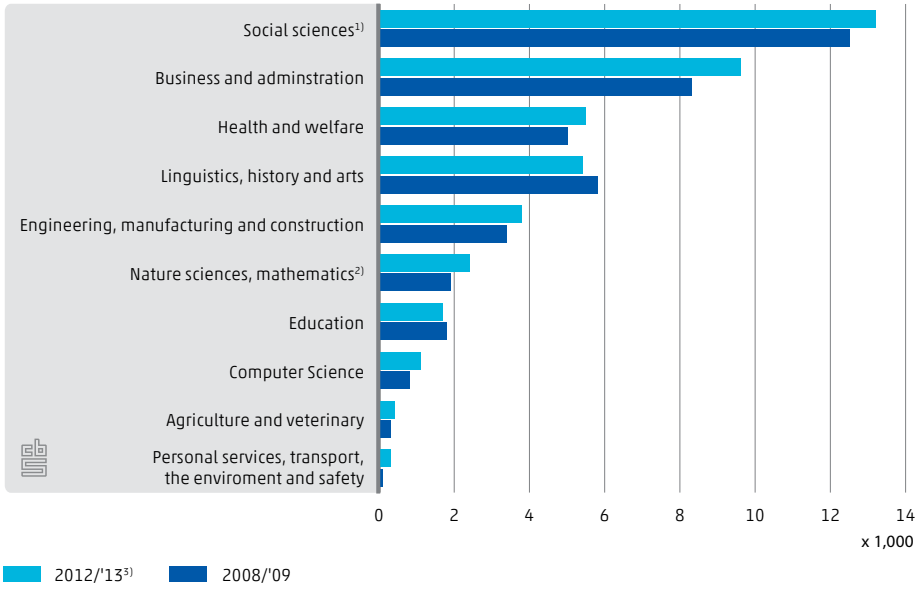
As in hbo, the number of first-year students enrolled in university education (wo) in recent years provides an indication of the number of university graduates over the coming years. In the 2012/'13 academic year the total enrolment by first-year students in wo (bachelor and master's degrees) decreased by 3 percent. The number of university graduates is therefore expected to decrease somewhat over a number of years, assuming that the dropout rate does not fall. In almost all fields of study, the number of first-year university students enrolled in the 2012/'13 academic year is slightly higher than four years ago (Figure 8.1.9). Especially the 'business and administration' field of study grew considerably. This was also the case in hbo. The drop in the 'education' field of study experienced by the hbo stream is less pronounced in the wo stream. Aside from this, only the 'linguistics, history and arts' field of study experienced a drop in the enrolment of first-year students in the 2012/'13 academic year compared to 2008/'09.

In the science fields of study the number of first-year students enrolled in wo increased. In 2008/'09, 3,397 first-year students were enrolled in 'engineering, manufacturing and construction'. This had increased to 3,766 by 2012/'13.

The number of first-year students enrolled in the 'computer science' field of study grew from 817 in 2007/'08 to 1,094 four years later. In the 'natural sciences and mathematics' field of study the number increased from 1,910 to 2,424. If the drop-out rates do not rise, the number of university graduates in these fields of study could therefore increase over the coming years.

Not only the number of first-year students in the university science fields of study increased. The percentage of first-year university students in a science field of study also increased. In the 2007/'08 academic year, 15.3 percent of all enrolled first-year students was a student in one of the science fields of study. Four years later, this proportion had grown to 16.8 percent. This means that relatively speaking as well, more students are opting for a science field of study in 2012/'13 than in 2007/'08. The increase among women was somewhat higher than among men. The proportion of women in the science fields of study is still small, but did grow somewhat in recent years.

8.1.9 Trend in first-year university bachelor and master, 2008/'09 and 2012/'13



Source: Statistics Netherlands, Education Statistics.

1) Isced 3, excluding 'business and adminstration' (Isced 34).
2) Isced 4, excluding 'computer science' (Isced 48).
3) Provisional figures.

Lifelong learning and post-initial education

The participation of primarily young people in mainstream, government-funded education was the central theme of the foregoing part of this chapter. The final part of this section focuses on the continued education pursued by people who have completed their initial education. In part they also pursue their education via mainstream, government-funded education, but, in addition, many people pursue continuing training and courses for their leisure time. The next section illustrates how many people take courses or participate in training programmes, and provides various background characteristics for this group.

Lifelong learning is increasingly considered a matter of course. In a society that is in a constant state of flux and in which successive technologies are emerging at a fast pace, it is not only important for individuals to be sufficiently trained, it is also important for them to continuously develop their skills through further education and training (Borghans et al., 2009). The necessity of this is also recognised by European policy makers. In March 2000, the European Council declared its intention of making the EU the most competitive and dynamic knowledge-based economy in

the world. In this context, European policy makers formulated a number of specific objectives, one of which was for 15 percent of Europe's entire population aged 25 to 65 to participate in some form of training programme or course, either work-related and leisure-based, by 2020 (this percentage is referred to as the 'lifelong learning indicator'). The Dutch government has set an even higher target and is aiming to achieve a participation rate of 20 percent by 2020 (Ministry of Education, Culture and Science, 2011; see also Hartgers and Pleijers, 2010).

Dutch target for 2020 has not yet been achieved

While the Netherlands in 2012 met the European target for lifelong learning, the Dutch target for 2020 has not yet been achieved. In 2012, 16.5 percent of the Dutch population aged 25 to 65 participated in a training programme or took a course. This is far above the EU average of 9 percent.
The European indicator for lifelong learning is a fairly rough measure. Every individual aged 25 to 65 years who takes a training programme or a course is counted in this figure. The indicator therefore also includes students in hbo and wo who are taking a relatively long time to complete their studies, as well as a few students in mbo. On the other hand, a 23-year-old employee who is completing an in-company training course, for example, is not included.
To create a more accurate picture, Statistics Netherlands uses the 'post-initial education' concept. This concept includes everyone participating in training programmes and courses after their initial education, in other words after completing their initial period of full-time education. All forms of part-time education form part of the post-initial education. In addition, full-time education also forms part of the post-initial education when the relevant person did not participate in any education during the previous five years. Statistics Netherlands determines which portion of the population aged 15 to 65 years, which is no longer attending initial education, participates in post-initial education. Slower pupils and students are therefore disregarded because they are still attending initial education. On the other hand, a 23-year-old employee who is completing an in-company training course, for example, is also included in this figure.

One and a half million people participate in post-initial education

In 2011, almost 1.5 million people aged 15 to 65 participated in a training programme or took a course in the context of post-initial education (Table 8.1.10). The degree of participation was 15.3 percent. Of all individuals in this age group

who no longer attended initial education, 15.3 percent took part in post-initial education. This percentage was slightly higher than in 2010. For years, more women than men have been participating in post-initial education. This was also the case in 2011. In 2011, more men participated in post-initial education than the year before, while participation by women declined slightly (Statistics Netherlands, 2012b).

8.1.10 Post initial education - key figures

	Absolute numbers				Degree of participation[1]			
	2003	2005	2010	2011[2]	2003	2005	2010	2011[2]
	x 1,000				%			
Total	1,486	1,333	1,434	1,458	15.3	13.9	15.0	15.3
Gender								
Men	741	655	682	715	15.1	13.6	14.3	15.0
Women	745	678	752	744	15.5	14.2	15.8	15.6
Age								
15 to 25 years	206	113	117	114	25.9	16.6	18.3	17.8
25 to 35 years	456	405	403	413	20.6	19.9	21.6	22.1
35 to 45 years	429	408	401	401	16.6	15.7	16.6	17.0
45 to 55 years	277	278	342	352	12.2	12.0	13.9	14.2
55 to 65 years	117	129	171	178	6.4	6.6	7.9	8.2
Prior education[3]								
Vmbo, mbo-1, avo	335	224	245	280	10.4	7.8	9.4	10.5
Mbo-2 and 3	221	169	173	162	13.1	11.6	12.3	12.0
Mbo-4	272	260	278	266	17.3	14.8	15.4	15.1
Havo, vwo	168	157	142	177	21.7	19.9	21.0	23.7
Hbo, wo	480	515	588	567	20.3	19.8	20.0	19.5
Labour market position								
Employed Labour force	1,190	1,052	1,185	1,217	17.7	15.8	16.8	17.3
Unemployed labour force	49	62	56	53	13.8	14.3	14.9	14.1
Non-labour force	246	219	193	189	9.4	8.9	9.1	9.1

Source: Statistics Netherlands.

1) As a percentage of the corresponding population group that is no longer attending initial education.

2) Provisional figures.

3) Vmbo: preparatory secondary education; mbo: senior secondary vocational education; hbo: higher professional education; wo: university education.
Avo stands for 'general secondary education'. This is the first stage of the senior general secondary education (havo) and pre-university education (vwo).

With a 2011 participation rate of 22.1 percent, individuals aged 25 to 35 took part most frequently in post-initial training programmes in relative terms. The older the age group, the lower the participation rate, amounting to only 8.2 percent among individuals aged 55 to 65. Relatively more individuals in all age groups participated in post-initial education in 2011 than in 2005. People who are already highly educated more frequently participate in post-initial education than those with a lower level of prior education. Approximately one fifth of all individuals with an hbo or wo degree participates in post-initial education. Furthermore, members of the labour force in employment more frequently participate in post-initial education than others.[2)]

8.2 Knowledge in the Netherlands and in an international context

The first part of this section deals with students who go abroad for the purpose of studying. It covers Dutch students studying abroad, as well as foreign students who study in the Netherlands. This section then deals with the level of education of the Dutch population and that of the labour force in employment in particular. Is the Dutch population highly educated, in an international context? The section concludes with a focus on the highly educated and the science students.

International students

The introduction of the bachelor-master system in the Netherlands and other EU countries some years ago has made it easier for students in higher education to complete all or part of a degree programme in another country. Dutch students go abroad and foreign students come to the Netherlands to study.
To sketch out a picture of the international student traffic, this section applies the concept of 'international student'. This is a student who has a nationality that is different from that of the country in which he or she studies. Information is available from many countries in accordance with this definition. This makes the Dutch figures highly consistent with those of other countries. In addition, this

2) All individuals who work at least twelve hours per week – employees, independents and co-working family members – are considered part of the labour force in employment.

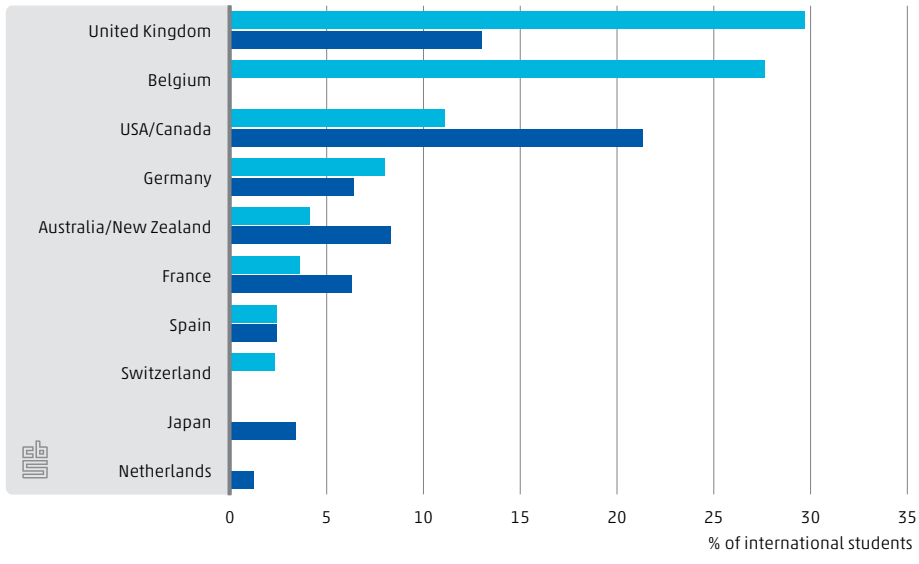
section only deals with students that have enrolled in a full degree programme. Students who went abroad to complete only a portion of their education are not considered.

In 2010, 177 million students worldwide were enrolled in a higher education study programme. Of this number over four million studied in a country that was different from their own nationality. This represents 2.3 percent. The number of international students worldwide has almost doubled since 2000, when this number was over two million. As a percentage of the total number of students, the growth was less pronounced; in 2011, this percentage was already 2.1 percent as well. Over the last ten years many more individuals have enrolled in higher education throughout the world.

There is a preference for English-language countries

English-language countries are especially popular among international students. More than one fifth of all international students went to the United States or Canada; 13 percent went to the United Kingdom and 8 percent went to Australia or New Zealand (Figure 8.2.1). Of the total international student traffic, 1.2 percent came to the Netherlands.

8.2.1 Countries of destination for international students from the Netherlands and worldwide, 2010



Source: OECD.

For Dutch students going to study abroad, English-language countries are an attractive option as well. In 2010, almost 30 percent of these students studied in the United Kingdom; 11 percent departed for the United States or Canada. In addition, the neighbouring countries Belgium and Germany are especially popular. Approximately three quarters of Dutch students who went to study abroad stays within the European Union.

Many German students in the Netherlands

Approximately 53,000 individuals with a foreign nationality studied in the Netherlands in 2010. A large proportion of them came from Germany: 45 percent. At 4 percent, a significantly lower percentage came from Belgium. Part of the German international students are individuals who live in the border regions and who each day commute to a Dutch university or higher professional education institute. Of all German students in the Netherlands, 53 percent is not registered as a resident of the Netherlands. This also holds true of Belgian students in the Netherlands, more than half of whom is not registered in the Netherlands as a resident.
Almost 8 percent of the international students in the Netherlands came from China. This is a high proportion and the Netherlands is not an exception in this regard. Of all international students in the world, more than half comes from Asia, especially China, India and Korea (OECD, 2012b).

In 2010, the number of foreign students in the Netherlands was approximately 2.5 times as high as the number of Dutch students abroad. This same proportion on average applies to all EU countries. The Netherlands therefore is not an exception in Europe. In 2010, almost 20,000 Dutch students were enrolled in a full degree programme abroad. This represents approximately 3 percent of all students in higher education in the Netherlands that year.

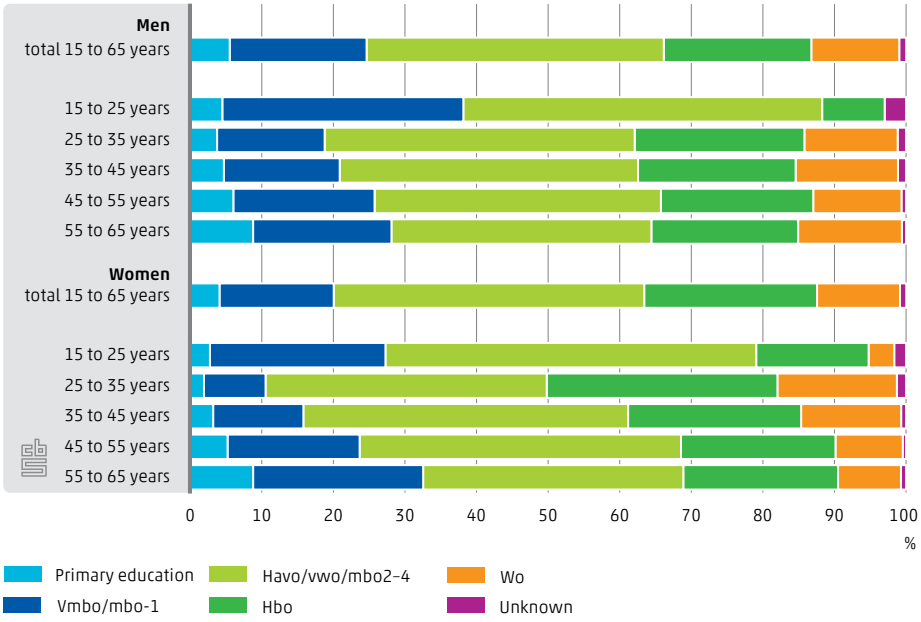
Dutch population increasingly well educated

The Dutch population's level of education has increased in recent years. More people than before are pursuing education and they are graduating at increasingly higher education levels. The number of individuals without a basic qualification shrank significantly between 2001 and 2011. A basic qualification is at a minimum a diploma at the senior general secondary education (havo), pre-university education (vwo) or senior secondary vocational education 2 (mbo-2) level.
In 2001, 39 percent of the Dutch population aged 15 to 65 did not have a basic qualification; by 2011 this had fallen to 31 percent. In addition, increasing numbers

of Dutch citizens have completed a degree in higher education. In 2001, this was true for 20 percent of the population and by 2011 this had grown to 28 percent. The labour force in employment, that is individuals with a job of at least twelve hours per week, is also increasingly well-educated. On average these individuals are better educated than the rest of the population. In 2001, 29 percent of the labour force in employment did not have a basic qualification. By 2011, this had dropped to 23 percent. The proportion of individuals who had completed a degree programme in higher education increased from 26 percent in 2001 to 34 percent in 2011.
More women than men have been graduating from higher education for several years. In addition, women complete their studies faster than men. This picture is clearly visible in the level of education of the youngest age groups in the labour force in employment (Figure 8.2.2). Young women are more often highly educated than young men. Furthermore, it is striking that women aged 25 to 35 are far more often well-educated than women who are older than 35. This illustrates the advance of women in higher education in recent years. Another factor that applies to women, even more so than to men, is the fact that the higher the level of education, the higher the labour force participation rate. The difference in the proportion of well-educated individuals among younger and older men is much less pronounced than among women.

Between 2001 and 2011, the proportion of highly educated women in the labour force in employment increased more sharply than the proportion of highly educated men. This difference will become more pronounced in the future. The proportion of highly educated women in the labour force in employment is increasing with every younger age group. This is less so among men. In 2011, 49 percent of women aged 25 to 35 had completed an hbo or wo education. The corresponding proportion for men in this age group was 37 percent. Factors that play a part in this age group are that relatively more women than men graduate and that women complete their studies more quickly.

8.2.2 Education level of employed labour force, 2011[1)]



Source: Statistics Netherlands, Labour Force Survey.

1) Vmbo: preparatory secondary education; mbo: senior secondary vocational education; havo: senior general secondary education; vwo: pre-university education; hbo: higher professional education; wo: university education.

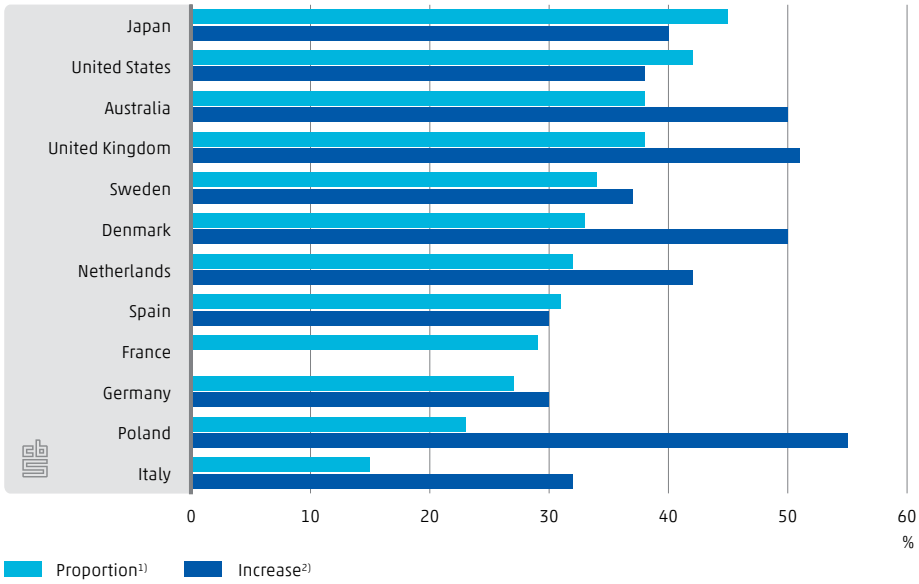
In terms of highly educated individuals, the Netherlands is not tops internationally

In 2010, 32 percent of the Dutch population aged 25 to 65 was highly educated (Figure 8.2.3). This means that they had an hbo or university degree. In Denmark and Spain, the proportion of people with a high education was approximately the same as in the Netherlands. In Japan and the United States, this proportion is much higher. In 2010, more than four in ten individuals had completed a higher education degree in these countries. Australia and the United Kingdom also score higher than the Netherlands.

32% of the Dutch population has a high level of education

The increase in highly educated individuals provides information about the trend in the proportion of highly educated individuals in the population. This increase is the proportion of individuals who have obtained a degree in higher education for the first time, within the typical graduation age group.[3] If this proportion is high, many young people are highly educated. This means that the proportion of highly educated individuals can be expected to grow in the future.

8.2.3 Highly educated individuals, international, 2010



Source: OECD.

1) Highly educated individuals as a percentage of the population aged 25 up to 65.
2) Graduates with a first degree in higher education, as a percentage of the typical graduation age group.

The increase in highly educated individuals in the Netherlands is much higher than in many other countries. This increase in the Netherlands was 42 percent in 2010. The increase in highly educated individuals was especially high in Poland: 55 percent. The United Kingdom, Australia and Denmark also score higher than the Netherlands. At 30 percent, Germany is lagging somewhat.

3) If an individual obtains more than one degree, only the first degree counts towards this figure. This means that each individual can only be counted once.

The proportion of highly educated Dutch individuals in 2010 was the same as that in 2008. The increase in highly educated individuals rose slightly. In 2008 it was 41 percent, compared to 42 percent in 2010. The proportion of highly educated individuals will probably increase as well. This is because the increase in highly educated individuals in the Netherlands is higher than the proportion of highly educated individuals. This means that younger individuals are often more highly educated than their preceding generations.
Furthermore, a country's various demographic characteristics also affect the proportion of highly educated individuals. A country with a relatively high number of old people, for example, often has a small proportion of highly educated individuals because old people are frequently less educated. The emigration of large numbers of highly educated individuals likewise reduces a country's proportion of such individuals.

The Netherlands: few natural science and engineering graduates in higher education

In comparison with other countries, the proportion of graduates in natural science and engineering fields of study in the Netherlands is low. Of the Dutch students who obtained a degree in higher education in 2010, 14 percent graduated with a such a degree. This concerns the 'natural sciences, applied mathematics and computer science' and 'engineering, manufacturing and construction' fields of study. The EU average was 22 percent (Table 8.2.4).

8.2.4 Proportion of natural science and engineering graduates in higher education, international, 2010

	Total	Men	Women
	% of total number of graduates in higher education		
Netherlands	14	26	5
Belgium	17	31	7
Denmark	19	29	12
EU-27	22	37	12
United Kingdom	23	36	12
Italy	23	34	15
Ireland	24	38	13
Germany	26	43	14
Sweden	26	46	14
France	26	42	14
Austria	29	46	13
Finland	32	57	15

Source: Eurostat.

Dutch women in particular are poorly represented in natural science and engineering fields of study. Of the Dutch women who obtained a degree in higher education in 2010, 5 percent graduated with such a degree. The European average for women is 12 percent. Dutch men also lag the EU average. The proportion of men is 26 percent, while the EU average is 37 percent. In Finland the proportion of natural science and engineering students is very high. Especially Finnish men frequently opt for a degree in these fields.

8.3 ICT skills

Almost everyone in the Dutch population makes use of computers. In 2012, 95 percent of the population aged 12 to 75 used a computer at one time. The Dutch government considers it very important for people to become increasingly skilled in the use of computers. If the Dutch population is well versed in the use of computers and the internet, they are in a better position to exploit the opportunities offered by ICT. The purpose of the 'Digivaardig & Digibewust' government programme is to strengthen the ICT skills of the Dutch population.[4)] One of its objectives, for example, is to increase the number of people who are well versed in the use of computers and the internet. Statistics Netherlands surveys the Dutch population's computer and internet skills each year.

Four in five computer users use the 'cut and paste' function

In 2012, 83 percent of computer users had copied or moved files or folders at one time (Figure 8.3.1). In addition, 83 percent had copied or pasted information in a document at some time. Furthermore, many people had moved files, for example, from a computer to a smartphone. Few computer users have had the occasion to install an operating system such as Windows or Linux: 32 percent. Only one in ten has ever used a computer language to write a program.

In 2012, 29 percent of computer users had many computer skills (Figure 8.3.2). One in five computer users had few skills and one in ten had no skills. In other words, although these individuals did use a computer at some time, they performed

4) Visit www.digivaardigdigibewust.nl for more information about the 'Digivaardig & Digibewust' programme.

activities other than those measured by the survey. The activities covered by the survey are described in the text box on the next page.

How does Statistics Netherlands measure computer skills?

Statistics Netherlands questioned people about the activities they performed on their computer at some time, as a means of establishing their computer skills. The researchers questioned the people surveyed about the following ten activities:

- **copying or moving a file or folder;**
- **copying or pasting information in(to) a document;**
- **using simple formulas in a spreadsheet;**
- **preparing presentations using software such as PowerPoint in which illustrations, sound, videos or graphs are included;**
- **exchanging files between computers and other devices, such as telephones, picture cameras or music players;**
- **compressing folders or files, for example using WinZip;**
- **installing new devices, such as a printer or modem;**
- **changing software settings, excepting internet browsers;**
- **installing a new, or replacing an old, operating system such as Windows or Linux;**
- **writing a computer program using a programming language.**

The researchers then used the following four categories to classify the surveyed individuals:

- **no skills: had not performed any of these activities;**
- **few skills: had performed one, two or three activities;**
- **average skills: had performed four, five, six or seven activities;**
- **many skills: had performed eight or more activities.**

Men are far more skilled in the use of computers than women

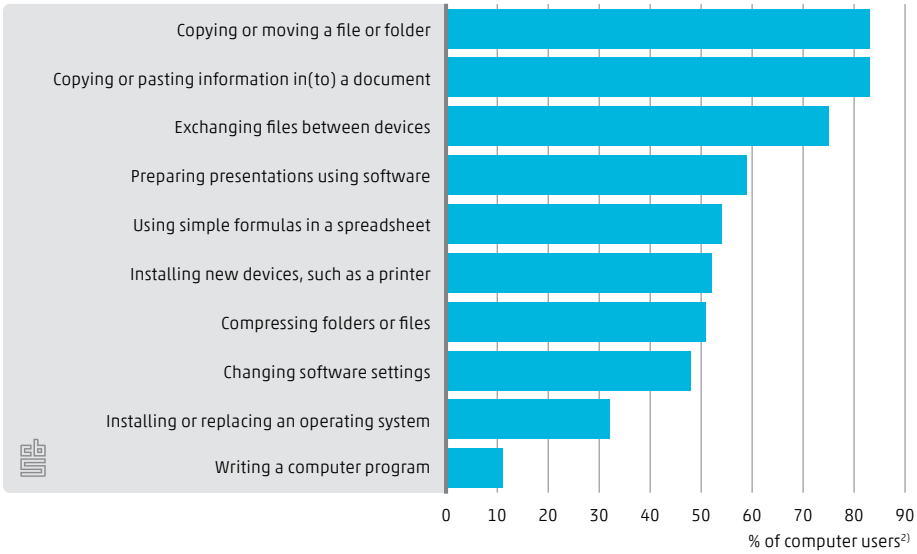
Men are far more skilled in their use of computers than women. In 2012, 43 percent of men had many computer skills, while this percentage was 15 percent for women (Figure 8.3.3). In fact, the highly skilled category constituted the largest group among men.

Computer users in the 25 to 45 age group are the most skilful. In 2012, 38 percent of them had many computer skills. The group with the least computer skills is the 65+ age group; of those in the 65 to 75 age group, one third had few skills and a third had no computer skills.

People who are highly educated have more computer skills than people with low levels of education.

In 2012, 47 percent of highly educated individuals had many computer skills. The corresponding figure for less educated individuals was 13 percent. Almost one fifth of less educated individuals had no computer skills. Among highly educated individuals this figure was only 3 percent.

8.3.1 Computer activities, 2012[1)]

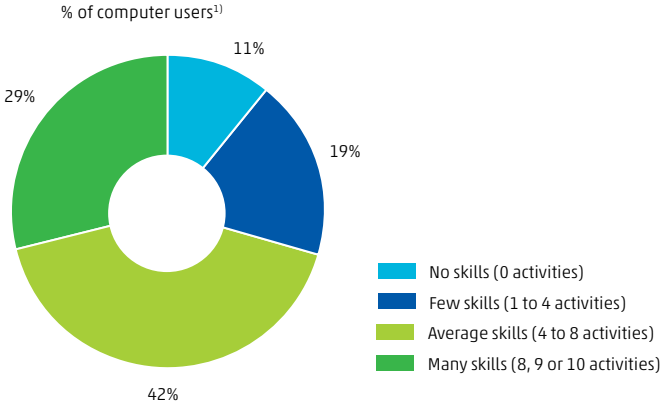


Source: Statistics Netherlands, ICT use by households and individuals.

[1)] Activities that individuals have ever performed on their computer.

[2)] Individuals aged 12 up to and including 74 years who have used a computer at some time.

8.3.2 Computer skills, 2012



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

1) Individuals aged 12 up to and including 74 years who have used a computer at some time.

8.3.3 Computer skills by personal characteristics, 2012

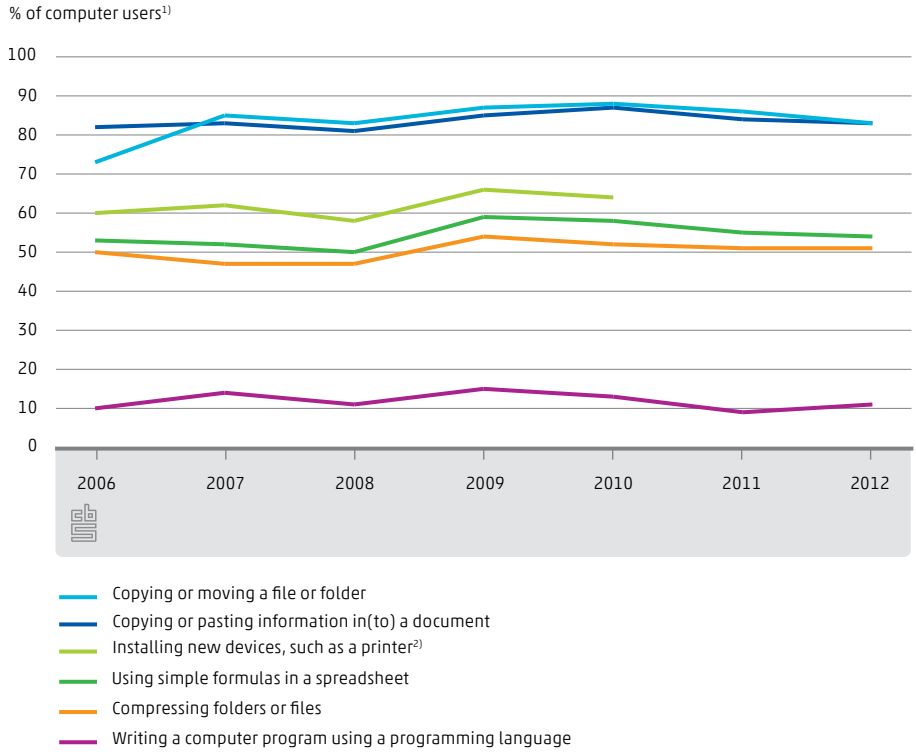
	None (0 activities)	Few (1 to 4 activities)	Average (4 to 8 activities)	Many (8, 9 or 10 activities)
	% of computer users[1)]			
Gender				
Men	8	13	36	43
Women	13	25	48	15
Age				
12 to 25 years	2	11	59	28
25 to 45 years	6	14	42	38
45 to 65 years	15	24	36	25
65 to 75 years	32	32	26	10
Level of education				
Primary education	18	25	43	13
Secondary education	9	20	42	29
Higher education	3	10	40	47
Total	11	19	42	29

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

1) Individuals aged 12 up to and including 74 years who have used a computer at some time.

For six of these computer activities it is possible to display the trend effective from 2006 (Figure 8.3.4).[5] For each of these activities, the percentage remained fairly stable over the period 2006–2012. The computer skills of the Dutch population therefore barely increased over this period. Especially since 2009 there has even been a slight decrease in most computer skills. This may be due to the fact that hardware and software are becoming increasingly user-friendly. This eliminates the need for many computer actions.
In all of these years 'copying and pasting' are the most common computer activities. Writing a computer program using a programming language is the least integrated computer skill.

8.3.4 Computer activities, 2006-2012



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

1) Individuals aged 12 up to and including 74 years who have used a computer at some time.
2) Due to a change in the questions asked, the 2011 and 2012 figures are not comparable to those of earlier years. This is why these figures are lacking from this figure.

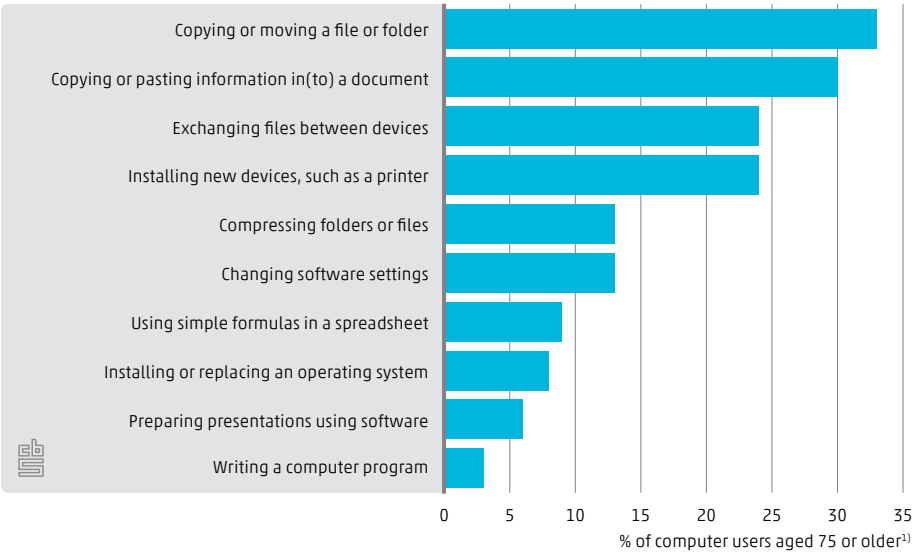
5) No time series is available for the computer activities 'preparing presentations using software', 'exchanging files between computers and other devices', 'changing software settings' and 'installing or replacing operating systems'.

The previous part of this section dealt with the computer skills of individuals aged 12 up to and including 74 years. Starting in 2012, Statistics Netherlands has also included individuals aged 75 or older in the survey. The findings among this group of older individuals is discussed next.

43 percent of the 75+ age group uses a computer

In 2012, 43 percent of the Dutch population aged 75+ had used a computer at one time. Of these older computer users, one in three had copied or moved a file or folder at some time (Figure 8.3.5). Almost a quarter had exchanged files between devices, or had installed new equipment. Other computer activities are far less prevalent. Older people are not all that different from younger people in terms of how they use their computer. To be sure, people aged 75+ perform the various activities not as often as younger people, but they too 'cut and paste' relatively often and write a program far less often. On the other hand, relatively fewer older people ever used a software tool to develop a presentation, or used formulas in a spreadsheet. Of course these are activities that are primarily performed by those in employment.

8.3.5 Computer activities of the 75+ age group, 2012

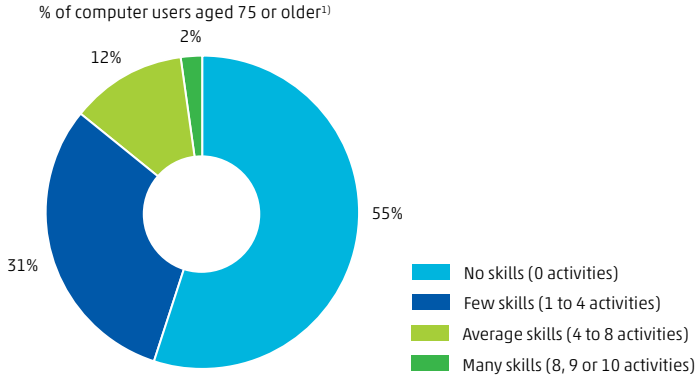


Source: Statistics Netherlands, ICT use by households and individuals.

1) Individuals aged 75 or older who have used a computer at some time.

In 2012, 2 percent of the older computer users had many computer skills (Figure 8.3.6). Almost one in three had few skills and more than half had no skills. As such, the 75+ age group scores significantly lower in terms of computer skills than individuals between 12 and 75 years of age. The 75+ age group without computer skills (55 percent) is also significantly greater than the 65–75 age group without computer skills (32 percent).

8.3.6 Computer skills of the 75+ age group, 2012



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

1) Individuals aged 75 or older who have used a computer at some time.

In addition to computer skills, Statistics Netherlands also measures the internet skills of the Dutch population. The remainder of this section deals with this topic.

How does Statistics Netherlands measure internet skills?

Statistics Netherlands questioned people about the activities they performed on the internet at some time as a means of establishing their internet skills. The researchers questioned the people surveyed about the following eight activities:

- **using a search engine to find information;**
- **sending an e-mail with attachments;**
- **posting messages to chat rooms, newsgroups or discussion forums;**
- **using the internet to make telephone calls, for example via Skype;**
- **designing a webpage;**
- **sharing a folder for exchanging music or videos;**

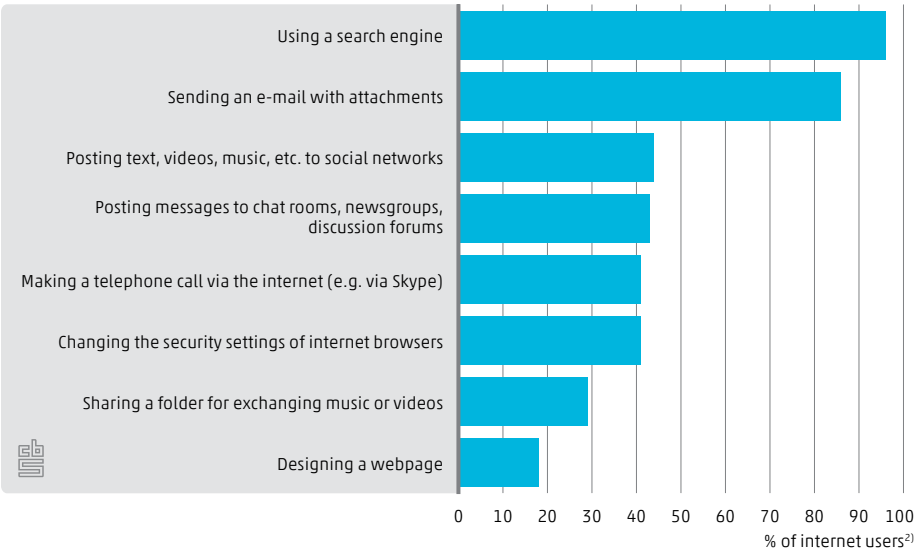
- **posting text, games, pictures, videos or music to websites, for example on social network pages such as Hyves, Facebook or Twitter;**
- **changing the security settings of internet browsers.**

The researchers then used the following four categories to classify the surveyed individuals:
- **no skills: had not performed any of these activities;**
- **few skills: had performed one, two or three activities;**
- **average skills: had performed four or five activities;**
- **many skills: had performed six, seven or eight activities.**

Use of search engines is common

Almost all Dutch internet users used a search engine at some time in 2012 (Figure 8.3.7). In addition, the lion's share had sent e-mails with attachments: 86 percent. Far fewer internet users ever designed a webpage. In 2012, less than one in five internet users had gained experience with this at some time (18 percent).

8.3.7 Internet activities, 2012[1)]

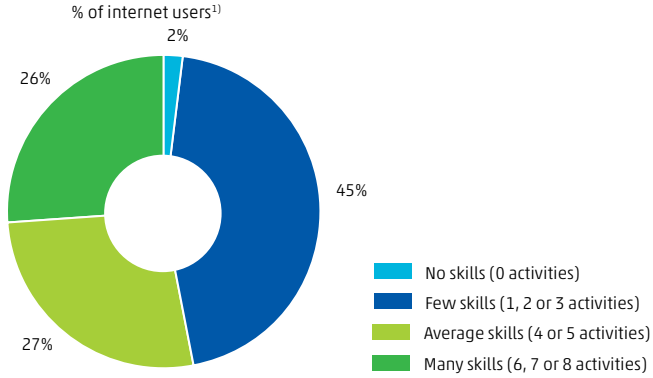


Source: Statistics Netherlands, ICT use by households and individuals.

1) Activities that individuals have ever performed on the internet.
2) Individuals aged 12 up to and including 74 years who have used the internet at some time.

In 2012, over a quarter of internet users had many internet skills (Figure 8.3.8). A similar proportion had average skills. Almost half of internet users had few internet skills (45 percent). The proportion of internet users without any skills is small: 2 percent.

8.3.8 Internet skills, 2012



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

1) Individuals aged 12 up to and including 74 years who have used the internet at some time.

Men are also more skilled with the web

Men are not only more skilled with computers, they are also more skilled with the web than women. One in three men had many internet skills in 2012. Among women this was one in five (Figure 8.3.9). The difference between men and women is smaller in terms of internet skills than it is with respect to computer skills.

Young internet users are the most skilled on the web. In 2012, 43 percent of individuals aged 12 to 25 had many internet skills. The 65+ age group had the least internet skills. Of those aged 65 to 75, 75 percent had few skills and 7 percent had no skills.
Over one in three highly educated individuals had many internet skills in 2012. Among the less educated, this was one in five. Here too the differences in internet skills are smaller than in computer skills.

8.3.9 Internet skills by personal characteristics, 2012

	None (0 activities)	Few (1, 2 or 3 activities)	Average (4 or 5 activities)	Many (6, 7 or 8 activities)
	% of internet users[1)]			
Gender				
Men	2	40	26	32
Women	2	50	28	19
Age				
12 to 25 years	1	21	35	43
25 to 45 years	1	37	30	32
45 to 65 years	3	59	23	15
65 to 75 years	7	75	14	4
Level of education				
Primary education	5	49	27	20
Secondary education	2	47	26	24
Higher education	0	37	28	35
Total	2	45	27	26

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

1) Individuals aged 12 up to and including 74 years who have used the internet at some time.

Internet skills have increased considerably

In 2012, the Dutch population had far more internet skills than in 2006 (Figure 8.3.10). In 2012, 61 percent of internet users had average or many internet skills.[6)] The corresponding figure for 2006 was only 46 percent. The Dutch population in particular became more skilful in the use of the internet between 2006 and 2009. After this there was little further change.

There was an increase in internet skills in all age groups (Figure 8.3.11).[7)] The proportion of individuals aged 12 to 25 with average or many internet skills grew from 70 percent in 2006 to 81 percent in 2012. The group of individuals aged 25 to 45 had an even higher growth rate: from 48 percent in 2006 to 68 percent in 2012. The proportion of individuals aged 45 to 65 with average or many internet skills was still relatively small in 2006: 28 percent. The corresponding figure for 2012 was

6) The percentages in Figure 8.3.10 concerning internet skills in 2012 vary from those in Figure 8.3.8 (see text box 'Internet Skills: 2012 versus 2006').

7) The percentages in Figure 8.3.11 concerning internet skills in 2012 vary from those in Table 8.3.9 (see text box 'Internet Skills: 2012 versus 2006').

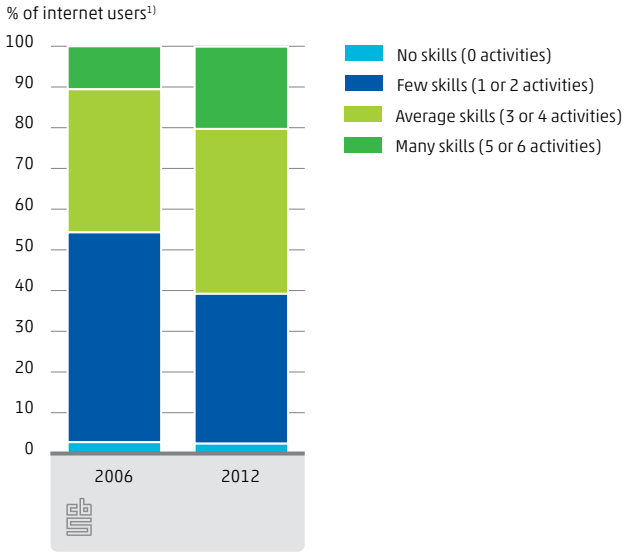
48 percent. Finally, in the 65+ age group, the proportion of individuals with many internet skills grew from 20 percent in 2006 to 35 percent in 2012.

Internet skills: 2012 versus 2006

Statistics Netherlands in 2012 analysed eight internet activities in order to establish the internet skills of the Dutch population. Two of these activities did not form part of the 2006 survey. This concerns the activities 'posting text, games, pictures, videos or music to websites, for example on social network pages such as Hyves, Facebook or Twitter' and 'changing the security settings of internet browsers'.
To be able to compare the internet skills of these two years, Statistics Netherlands is only using the six activities that were surveyed in both years: using a search engine, sending e-mails, posting messages to chat rooms, making a telephone call via the internet, designing a webpage, and sharing folders for exchanging music or videos.
The researchers then used the following four categories to classify the surveyed individuals with this method:

- **no skills: had not performed any of these activities;**
- **few skills: had performed one or two activities;**
- **average skills: had performed three or four activities;**
- **many skills: had performed five or six activities.**

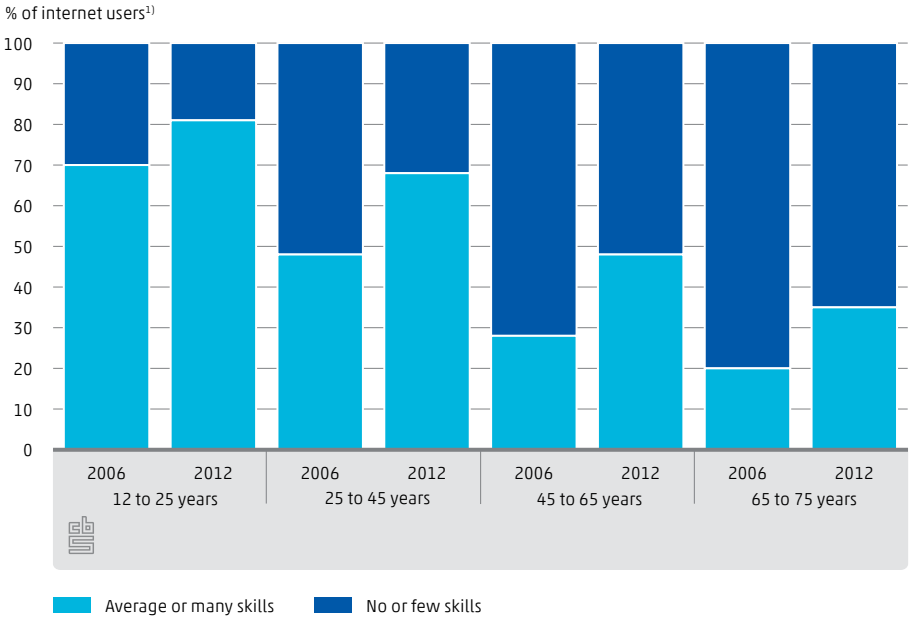
8.3.10 Internet skills, 2006 and 2012



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

1) Individuals aged 12 up to and including 74 years who have used the internet at some time.

8.3.11 Internet skills by age category, 2006 and 2012



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

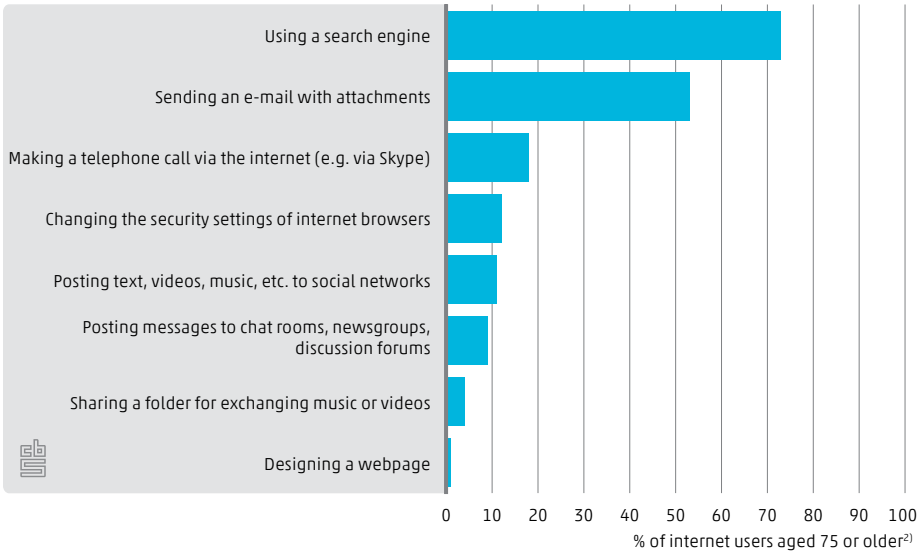
1) Individuals aged 12 up to and including 74 years who have used the internet at some time.

As it did for computer skills, starting in 2012, Statistics Netherlands also analysed the internet skills of individuals aged 75 and older. The remainder of this section deals with the internet skills of this group of older individuals.

One in three individuals in the 75+ age group makes use of the internet

In 2012, 34 percent of the Dutch population aged 75+ had used the internet at some time. Of these older internet users, 73 percent had used a search engine at some time (Figure 8.3.12). Over half (53 percent) had sent an e-mail with attachments at some time. Older individuals less often perform other internet activities. Almost one in five (18 percent) had used the internet to make a phone call, for example via Skype. Only 1 percent of older individuals had developed a webpage at some time. The internet use of the 75+ age group is less diverse than that of the younger internet users. Aside from search engines and e-mail, older internet users use few different internet applications. While searching for information and e-mailing are the most often used internet activities among individuals aged 12 to 65, a significant portion of these users also uses social networks and discussion forums, for example. The 75+ age group barely does so.

8.3.12 Internet activities of the 75+ age group, 2012[1)]

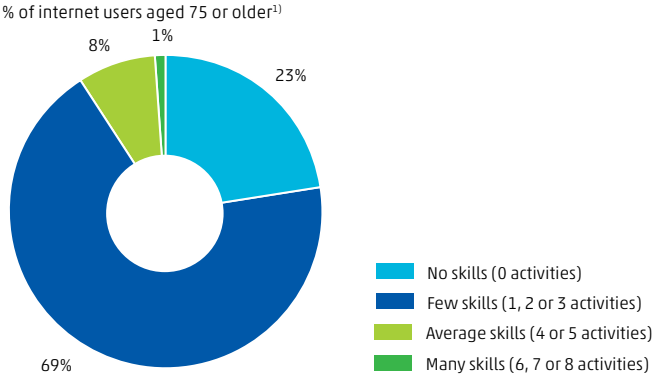


Source: Statistics Netherlands, ICT use by households and individuals.

1) Activities that individuals have ever performed on the internet.
2) Individuals aged 75 and older who have used the internet at some time.

Older individuals are not very skilled on the internet. A quarter of internet users aged 75 and older had no internet skills in 2012. Seven in ten had few such skills and 8 percent had average internet skills. The proportion with many internet skills was very small (Figure 8.3.13).

8.3.13 Internet skills of the 75+ age group, 2012



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

1) Individuals aged 75 and older who have used the internet at some time.

The 75+ age group scores significantly lower in terms of internet skills than individuals between 12 and 75 years of age. The 75+ age group without internet skills (23 percent) is also significantly greater than the 65–75 age group without internet skills (7 percent).

9.

Capita selecta

This chapter contains three contributions that broaden and deepen the theme of this publication. This first article provides a broad analysis of the way in which companies use social media. The second contribution deals with patents and productivity; are companies that jointly with others apply for patents more productive? The chapter concludes with an analysis of the data Statistics Netherlands received from 'Marktplaats', a subsidiary of eBay.

9.1 Social media and business

One of the most important developments that has occurred on the internet over the last decade is the emergence of social media. Today, it is almost impossible to imagine the current virtual society without social media, while only ten years ago they were still a rarity. The use of social media has gone beyond the hype stage.
Most of the social media were started up with a non-commercial interest. However, in recent years, increasingly more companies have become active on social media[1]. They recognise the importance and reach of social media. A large number of their customers, as well as their competitors, can be found there.[2] Due to the growing participation of companies, social media are becoming commercialised.
This article explores the background of the use of social media in the business sector in further detail. In addition, a number of analyses are provided that complement the figures presented in Chapter 5 concerning the use of social media. The annual 'ICT use by companies' survey conducted by Statistics Netherlands – which in 2012 dealt with this topic for the first time – was used for this purpose.

Authors: N.M. Heerschap and S.A. Ortega Azurduy

The emergence of social media

The emergence of social media is the result of an interaction between different developments. First, the emergence of social media was made possible by technological innovation, such as the more pervasive availability of broadband, larger storage capacities and processing speeds at lower prices, and especially the development of easy-to-use software tools. This provided internet users with

[1] The emphasis in this article is on companies, but this could just as well have been government organisations, institutions or social organisations.
[2] In terms of customers, the relationship could be with consumers (B2C), as well as between companies (B2B).

the possibility of creating and editing content, such as text, video or audio, and to ultimately post it on or download it from the internet themselves. This is referred to as "user-generated content" that users want to share with others via the internet. This situation creates a fertile breeding ground for the emergence of services that support these developments, namely the social media. These services provide a platform on the internet for producing, creating and sharing content, as well as opportunities for communicating, collaborating, meeting and gaming. These are activities that meet the intrinsic needs of people, such as contact, belonging, recognition and self-expression.[3] The best known social media in the Netherlands are Facebook, Twitter, Hyves, YouTube and LinkedIn. In addition, new services are continuously emerging with more or less success. Aside from technological innovation, meeting people's needs and the availability of (continuously new) easy-to-use and generally free services, the influence of a growing group of users that grew up with the internet and the use of social media are also playing an essential role in the emergence of social media. This is a group of 'digital natives' with good ICT skills and with a strong connection with the internet as a communication tool. Finally, the rapid emergence of mobile internet access via smartphones and tablets, together with the development of 'apps', has contributed to the growth of social media. This 'portable revolution' provides the freedom of making use of social media wherever and whenever wanted. Research, for example, shows that the increase in mobile internet use in 2012 has made an important contribution to the growth of social media (Nielsen and NM Incite, 2012; Comscore, 2013).

In short, the emergence of social media coincides with the shift on the internet from passive surfing with one-sided communication, to active interaction with two-sided or multiple-sided communication. Whereas initially the internet was primarily used for consulting information, since the turn of the century there has been increasing participation, interaction and personal creation via the internet. This is also referred to as 'internet 2.0'.

A definition

In this article, social media are defined as services on the internet that enable users to use, disseminate, modify and create content that in principle is visible to all internet users, but where sometimes it is possible to limit visibility to a select sub-group of internet users (see also Kaplan and Heanlein, 2010).

[3] See Maslow (1943).

Social media concern the provided functionality as well as the created content. The target group, first of all, is the internet user in general, but steadily more professionals, companies, institutions and government organisations are active on social media.
Social networks are a subset of social media, whose use is specifically focused on stimulating communication and interaction with other internet users. Access to and use of social networks are generally only possible by creating a profile, a virtual calling card with personal information.

Forms of social media

The following are the most important forms of social media:

1. ***Blogs.*** **Blogs are the oldest forms of social media. Created from webpages on which internet users disseminate information in the form of a logbook about a wide range of topics, ranging from their own personal lives to specific subject areas. Generally, this involves text, but it can also include photos, videos and audio. The best known example is Twitter (as a *microblog* with 140 symbols, also referred to as 'instant messaging'). The services allow internet users – followers – to subscribe to the messages of other users of the platform.**
2. ***Forums and reviews.*** **A specific form of blogs, which involves the discussion and assessment of subject areas, products and services. Examples can be found in the travel sector, music and electronics.**
3. ***Content communities.*** **The objective of this form of social media is to share content with other internet users. This may involve, for example, text, photos, videos and audio. Providing elaborate comments is not the intent here. The degree of interaction is limited.**
4. ***Social networks.*** **This form of social media was explicitly designed to bring internet users into contact with each other as a basis for communicating with friends, acquaintances and others, inviting each other, and to share and discuss content. More so than in the case of blogs, creating and maintaining personal information as a calling card is key (the so-called profile).**
5. ***Virtual worlds.*** **This concerns virtual three-dimensional worlds in which internet users can act as creatures of their own creation (so-called avatars) as a basis for interacting with each other, similar to the real world.**
6. ***Joint projects, including wikis.*** **Joint projects make it possible to collectively generate content through means of the contributions of many internet users at the same time. The users jointly create the end product. The best known example of this is the Wikipedia encyclopedia.**

7. ***RSS (Really Simple Syndication).*** **Instead of having to go to blogs, social network sites etcetera, an RSS feed makes sure one receives a message when new content is available.**

Sources: Kaplan and Heanlein (2010) and Qualman (2013).

The importance of social media

Although the rising curve is levelling off, the impressive growth in the use of social media over the last decade is supported by research. In the Netherlands the well-known social media sites have millions of users. In addition, the time people spend on social media is also growing strongly (ComScore, 2013; Nielsen and NM Incite, 2012; Newcom, 2013). The research conducted by Statistics Netherlands in 2011 and 2012 also supports this view, that the use of social media in Dutch society has since become widespread (Statistics Netherlands, 2012). This primarily involves younger people and to a lesser degree older people.[4)] The notion that social media are a hype has long since been superseded. The use of social media is an irreversible trend for people to interact and communicate with each other and with companies as well.

Social business

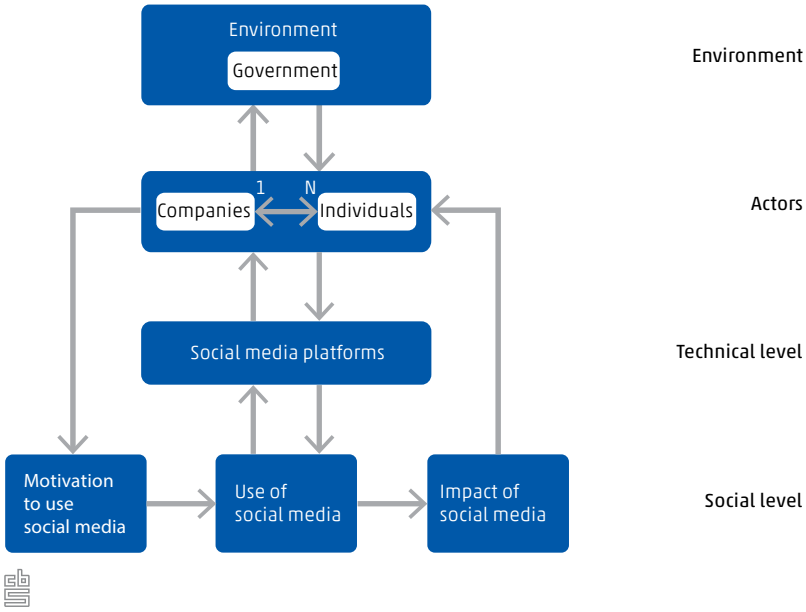
Because companies are increasingly acknowledging the growing interest and extensive reach of social media, they are becoming increasingly active on social media. In this context, one may refer to it as 'social business'.
Social business is defined as all business activities that make use of social media and that enable useful relationships to be established between people, information and resources in an efficient and effective way. These internal and external relationships can influence and lead decision-making processes, actions and results of a company (MIT Sloan Review, 2013).

[4)] Section 4.2 of this publication extensively covers the ways in which individuals use social media.

A social media framework

Figure 9.1.1 provides a broader social media framework. The diagram includes four levels, namely: the environment, the actors, the technical level and the social level. The cyclical and iterative process forms the core, in which – as the starting point – individuals and companies (actors) for specific reasons are motivated to use social media. The use in turn can subsequently have an impact on the behaviour and preferences of individuals and the operation of companies. This cycle of motivation-use-impact (social level) is influenced by the environment, including the government's regulatory policy, but conversely, the impact of social media can also influence the environment. The use of social media is technically facilitated by the various social media platforms (technical level). A structured, systematic and controlled use of social media by companies can be viewed as 'social business'.

9.1.1 General social media framework



Opportunities for companies

Companies can use various methods to rely upon social media, whereby one option does not preclude another (Li and Bernoff, 2011; Qualman, 2013). These methods can be thought of as 'listening' and 'interacting'. The following describes these two options.

Listening, including monitoring

A first step that companies can take into the world of social media is to monitor what is being written about their organisation, product or service. What is my online image? Monitoring can change over into listening, with the primary objective of gaining insight into the behaviour and preference of current and potential customers. That is crucial information for a company. In comparison to traditional market research, the use of social media makes more information much more quickly available, and makes it possible to continuously measure this information at lower costs. These 'big data' can provide new insights that can influence the decision-making processes within the company, for example for the purpose of improving products or business processes. Monitoring and listening involve a passive posture on the part of the company, exposing it to relatively few risks.

Interacting, including in-house content creation and reacting

Interacting on social media means that the company enters into a dialogue with (potential) customers. A process of question, answer, and reaction emerges. In this regard, it is crucial for the company to organise itself such that it is capable of adequately processing the incoming questions and reactions on time. With this opportunity of actively participating in social media companies can get involved in:

- *Broadcasting*. This involves the dissemination of information about the organisation, product or service in order to influence the preferences and buying behaviour of customers. For example, by posting a short video, joining a social network where customers are present, participating in blogs or setting up a community.[5)] This does not only involve sending out a message, but actually also listening and entering into dialogue.
- *Activating*. Companies stimulate customers to actively make a contribution to spreading brand awareness and advertising their organisation, product or service on social media ('social word of mouth'). For example, by means of positive reviews or blogs. This has a greater impact than when the company

[5)] This can include 'webisodes', for example, in which the promotion of a product is packaged in the form of a miniseries. To attract attention, companies on social media increasingly more often assume the role of an entertainment organisation or a publicist, for example.

alone is recommending its own products. Due to the speed of dissemination and the extensive reach of social media, there is a leverage effect. Activating works especially well if consumers are able to identify themselves with the specific organisation or products. Activating is a higher-risk approach than listening and broadcasting, because the activated community expects a reaction from the company. It is also more difficult, because with this activity a company must appeal to and stimulate influential content 'creators' on social media.

- *Supporting.* This involves the opportunities offered by social media for the services provided by a company. For example, by supporting the consumer with information via blogs and videos, or better yet, by enabling customers to support each other via forums and wikis. Customers receive faster answers to their questions and the company saves on maintaining a call centre, for example. Furthermore, just like listening and broadcasting, it yields new insights. Supporting requires an active posture on the part of the company, because it has to react to the feedback received from customers. This increases the risk to the company, because customers can talk about anything: not only about the products and the service, but also about prices, negative experiences, the company's activities, as well as those of its competitors.
- *Adopting.* This is the most drastic step in the use of social media, namely involving the customer in developing, improving and innovating products, services and business operations. The social media networks are directly integrated into the business processes.

If listening to and interacting with customers results in the modification of products or processes, or in innovation, then there is a next step, namely *reacting*. This creates the following sequence of options: listening, interacting and reacting (Qualman, 2013). A company must first listen before it can interact. Only if a company listens it will have sufficient insight and credibility to enter into a dialogue with (potential) customers. Once the company starts to interact, it must also be ready to react.

Which of the above-referenced opportunities are exploited depends on the company's strategy. For example, is the company focused on broadcasting on the basis of marketing objectives, is adopting the aim by involving customers directly in the innovation process, or does the company consider it important to support employees with internal social media as a means of working more efficiently? More customers participate in social media in some sectors than others and this can influence the strategy for using social media. And finally, in terms of the available choices, there is little difference between the company's relationships with consumers and the company's relationships with other companies. While companies have fewer relationships with other companies than consumers, the link with other companies is of a stronger nature.

Social media and business activities

The above-referenced opportunities for using social media are of course also related to the various business activities. The latter not only includes marketing and customer relations, but virtually all facets of a company can be affected by the use of social media. Table 9.1.2 provides a summary of the possible opportunities.

9.1.2 Opportunities for using social media in relation to business activities

	Monitoring	Listening	Broadcasting	Activating	Supporting	Adopting
Purchasing	X	X	X		X	X
Marketing	X	X	X	X		
Customer relations	X	X	X		X	
Sales			X	X		
Services	X	X	X		X	
R&D and innovation		X	X			X
Recruiting staff		X	X	X		
Internal company deployment		X	X	X	X	X

In case of *purchasing*, the focus is, for example, on acquiring information about and insight into the quality of (potential) suppliers, and exchanging insights among suppliers and companies via social media.

Marketing concerns the dissemination of information via social media for promoting and branding products and services, including profiling the company itself as a means of influencing customer preferences and buying behaviour. Due to the potential scope and reach of social media the influence can be great. Qualman (2013) in this respect even speaks about 'word of mouth on digital steroids' to illustrate the potential power of social media. In contrast to the traditional method of marketing, social media are far more concerned with listening and entering into a dialogue with customers. The use of social media offers opportunities for improving *customer relations* ('customer engagement') and gaining better insight into consumer preferences and behaviour. For example, this can be achieved through listening to customers or creating and supporting communities around products, as well as by analysing available data for market and competitor analyses. Having access to knowledge concerning customer behaviour and preferences, including changes in behaviour and preferences, is of essential importance to companies. This also applies to information about competitors that can be collected via social media.

In case of *sales*, social media primarily play a role by activating mouth-to-mouth advertising or by referring to the company's website, for example. Research would appear to indicate that the degree to which sales can be linked directly to social media is still very small (Mulpuru et al., 2012). Furthermore, it is difficult to identify

how social media precisely influence consumer buying behaviour. However, it would appear, at least as far as specific products and services are concerned, that buying behaviour is influenced to a certain degree by the opinions and preferences aired via discussions on social networks or via forums and reviews (Qualman, 2013).

In terms of *services*, the use of social media offers consumers the possibility of more quickly providing feedback, to which companies in turn can react much faster. This can contribute to higher customer satisfaction. For example, research shows that in the United States, increasingly more people collect their information, ask questions and voice complaints via social media (Nielsen and NM Incite, 2012). Companies often create 'webcare teams' for this purpose that focus on the way in which the company and its products are portrayed on the internet, particularly via social media. Action is subsequently taken in response.

The use of social media enables companies to develop better (new) ideas and test existing ideas faster, in support of *R&D and innovation*. This not only involves goods and services, it can also involve process improvements and the re-evaluation of strategies and policy. Innovation then no longer emerges from the company itself (the old paradigm), but also from a dialogue with the involved social networks consisting of customers, suppliers and other stakeholders. The ultimate step consists of directly integrating social media networks into the business processes.

The use of social media can support companies with their *human resource policy and recruiting activities*. First, this can be effected by creating a positive image of the company on the internet, so that the company is seen as an attractive employer. In addition, social media can support the personnel recruitment process. Potential benefits include cost savings, improved access to target groups with specific knowledge and faster elapsed times to find the right candidate, among other things.

Finally, social media can support the *internal business operations*, for example with social networks and wikis. This offers opportunities for exploiting and activating information and expertise within a company not only in smarter ways, but also faster. This provides the potential for stimulating communication, collaboration, knowledge-sharing and creativity.

Impact of social media

According to the literature, the use of social media can have an impact on many areas of a company (Qualman, 2013; Forrester, 2011; Kiron et al., 2012). Qualman in fact speaks about a fundamental change in the way in which companies will operate and conduct business in the future. In addition to the possibly to be expected increase in customer loyalty, improved service, better image, acquiring

new customer groups and ultimately higher revenues and increased profits, the use of social media can also produce other effects. A number of these effects are mentioned below.

Companies will be increasingly confronted with the power of the 'crowd'. Consumers are much better informed, for example, because they talk to each other and can compare prices together. This influences their preferences and buying behaviour. Competition increases and furthermore, at least for certain products, shifts from the local to the global level. This can cause the profit margins of companies to come under pressure. A further step is when (potential) customers ('empowered customers') are given influence over the development of goods and services and as such customers can exercise influence on a company's strategy and business operations. The ultimate step consists of directly integrating social media networks into the business processes. This reduces the distinction between what is happening within and outside of a company. The internally-oriented focus shifts towards a more outwardly-oriented focus with networks of customers, suppliers, other stakeholders and if necessary, even competitors.

On the other hand, the use of social networks makes it possible for companies to gain more, better and much faster insight into the preferences and behaviour, as well as the changes in such preferences and behaviour of (potential) customers and the environment, and into their competitors' strengths and weaknesses. Social media make it possible to set a better strategic policy, for example concerning the introduction of goods and services to the market, pricing and the level of service. Due to the greater reach of the message and an open dialogue with (potential) customers and suppliers, it also becomes possible to better implement that strategy. The same effects take place within companies when on the one hand the goal is to acquire information and involve employees in the strategy and on the other hand to implement the strategy within the company.

By speaking with consumers via social media or by integrating social networks into the production process, feedback is obtained far more quickly as a result of which product and service innovations and improvements can be implemented more quickly. Ideas are generated more quickly, in part because there is a significant upscale in information and knowledge flows (distributed knowledge). Any errors are identified more quickly and can also be repaired more quickly. This makes it possible to shorten product cycles and time-to-market processes. The internal use of social media creates opportunities for more collaboration, better and faster communication, sharing of information and knowledge, and increased employee commitment. A necessary condition for exploiting the opportunities inherent to social media in support of R&D and innovation is that employees and companies are willing to share their information, knowledge and expertise with others, including other companies. This requires a culture shift because the principles of openness, transparency and shared knowledge are at odds with the existing

business models and prevailing balances of power, in which, for example, the possession of knowledge also means having power in an organisation.
The use of social media can lead to lower operating costs of a wide range of business management processes. Therefore, it becomes possible to produce goods and services that previously were too expensive to produce due to excessively high transaction costs, for example for management, coordination and the collection of information. The viability of goods and services with low demand also increases because the use of social media considerably increases the market in which they can be sold (micro-payments).[6] On the other hand, the revenues may be lower, but that also applies to the costs. The use of social media can result in the redistribution of knowledge, competences and power within companies, whereby departmental boundaries are becoming steadily less important. In addition, it can also result in a shift of the hierarchical model of leadership to network structures in which leadership is primarily focused on entering into and facilitating networks, albeit based on a clear vision.
In addition, social media will force companies to be open and transparent, and to be publicly accountable for their actions. Social media make it possible to immediately say something about a company, either positive or negative. Until recently, sources such as information and knowledge were primarily in the hands of companies and organisations. Because of social media increasingly more people, including those outside companies or organisations, have access to these sources. Social media could increase competition in areas that previously were the exclusive domain of companies and organisations because they reduce the threshold for starting up commercial or other activities. The latter not only occurs because access to knowledge and information has become easier, but also because the operating costs may be lower.

What does the research show?

Just like the research into the use of social media by individuals, the research into the use of social media by companies is primarily concerned with the use of social media, or lack thereof. To a lesser extent, research is focused on the why and the purpose for which companies use social media. Aside from case studies, research into the actual impact of social media is barely available.[7] Due to differences in various variables, such as the population of companies, the definition of social media and the methodology used, results from such studies are hard to compare.

[6] See the book, *The Long Tail, Why the Future of Business is Selling Less of More'* by Chris Anderson, 2006.
[7] See Qualman (2013) for examples of case studies.

In addition, there is a lack of reliable time series and comparable figures between countries.
In the 2012 survey 'ICT use by companies', Statistics Netherlands included for the first time questions concerning the use of social media by Dutch companies having ten or more employees. The next part of this article presents the analysis of the data from this survey as a complement to the figures presented in Section 5.4 of this publication.

More social media at the end of the supply chain

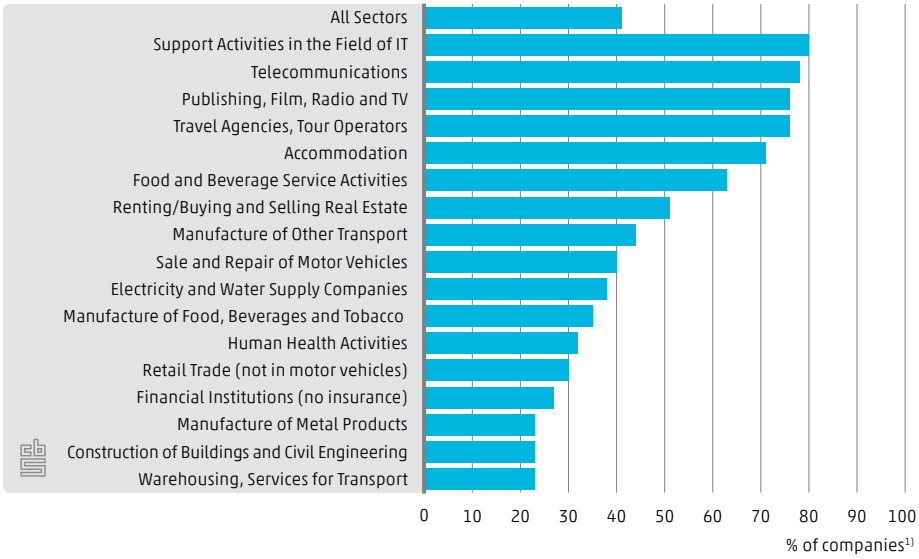
In 2012, four in ten companies in the Netherlands made use of social media in one way or another. The 'Support Activities in the Field of IT', 'Telecommunications', 'Publishing, Film, Radio and TV', 'Travel Agencies, Tour Operators' and 'Accommodation' sectors score high in this respect (Figure 9.1.3). This is consistent with the research conducted by Kiron in which CEOs in the United States were asked about the importance of social media to their sector (Kiron et al., 2012). One key reason identified for the more than average use of social media was that these sectors have a culture that is open to new ideas and in which innovation plays an important role. In Kiron's research, the 'Education' sector scores high and the 'Public Administration and Services' sector scores relatively low. Neither of these sectors was included in the research conducted by Statistics Netherlands.

Furthermore, Figure 9.1.3 shows that especially companies situated at the end of the supply chain score higher in terms of the use of social media than companies situated at the beginning of the supply chain. For example, the 'Warehousing, Services for Transport', 'Constructions Buildings and Civil Engineering' and 'Manufacture of Metal Products' sectors score the lowest. A striking finding is the low use of social media by the 'Human Health Activities', 'Retail Trade' and 'Financial Institutions (no insurance)' sectors compared to the average. In the case of financial institutions, such as banks, this may be due to the fact that this is a highly regulated sector, as well as due to restrain as a result of the financial crisis.

80%

of IT companies use social media

9.1.3 Use of social media by sector, 2012



Source: Statistics Netherlands, ICT use by companies.
1) Companies with ten or more employed persons.

Large IT companies are the highest users of social media

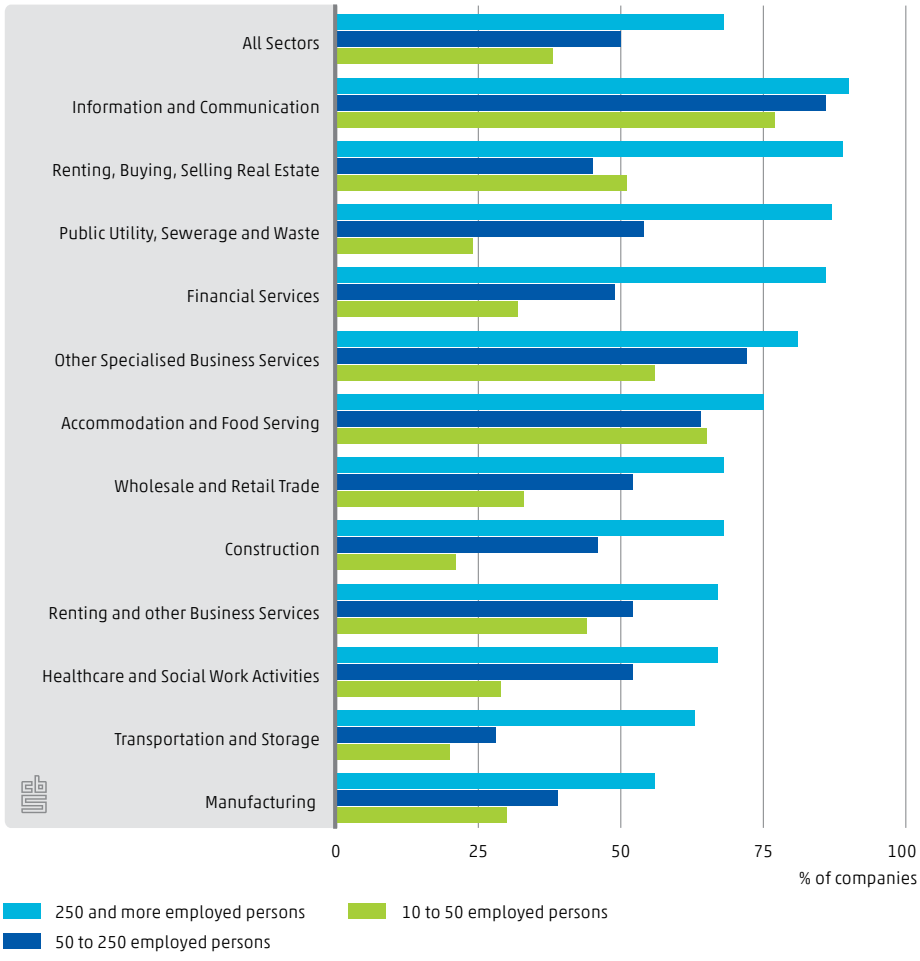
Based on the size of companies, the Statistics Netherlands' research indicates that as the size of a company decreases, the use of social media also decreases (Figure 9.1.4).[8] A plausible explanation for this is that large companies have sufficient resources to experiment with new technologies, such as social media. As the size of the company decreases, fewer resources, time and knowledge are available for deploying social media.
Another reason mentioned is that smaller companies rather tend to hesitate about the use of social media, because they find it difficult to make their voice heard among the immense volume of messages on social media (Hiscox, 2012). They tend to give preference to advertising campaigns that are focused on their specific target group or to mouth-to-mouth advertising. Although it does not easily lend itself to comparisons, Kiron's research paints a somewhat different picture (Kiron et al., 2012). This research indicates that large companies as well as small companies make greater use of social media than medium-sized companies. The

8) It should be noted that the Statistics Netherlands' research does not include companies with fewer than ten employed persons.

reason mentioned is that small companies do not have any resources for expensive traditional campaigns and therefore turn to social media for this purpose. The deployment of social media is easily accessible. Furthermore, in this way small companies can relatively cheaply draw the attention of large groups of customers to their products and services. They can aggrandize themselves and appear larger than they really are. The 'Renting, Buying, Selling Real Estate' and 'Accommodation and Food Serving' sectors in the research conducted by Statistics Netherlands are consistent with the picture painted by Kiron. These sectors comprise relatively many small companies.

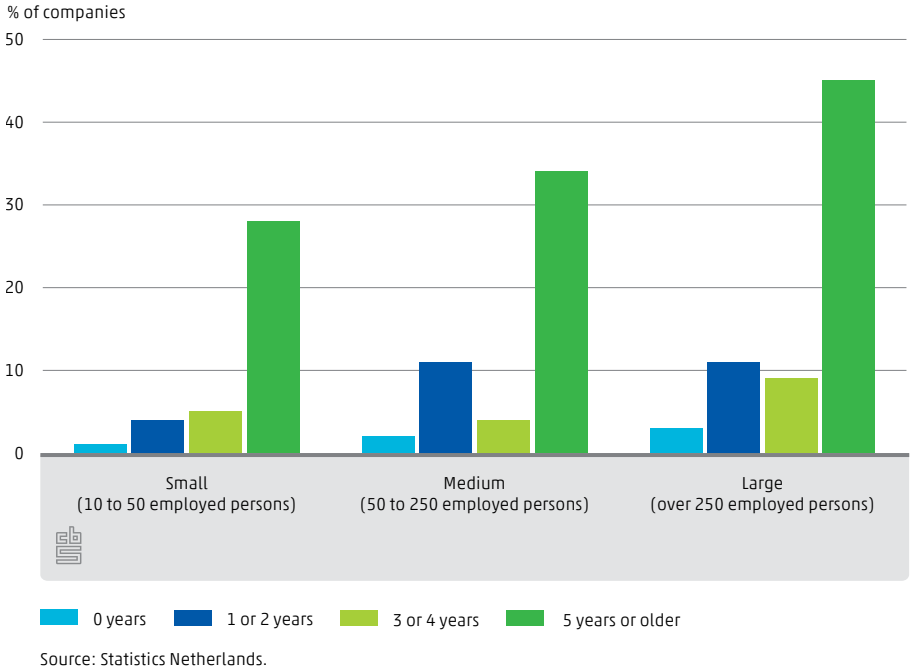
Based on the age and size of companies, the Statistics Netherlands research by and large indicates that as the age and size of companies increase, the use of social media also increases (Figure 9.1.5).

9.1.4 Use of social media by sector and company size, 2012



Source: Statistics Netherlands, ICT use by companies.

9.1.5 Use of social media by companies, by company age and size, 2012



Source: Statistics Netherlands.

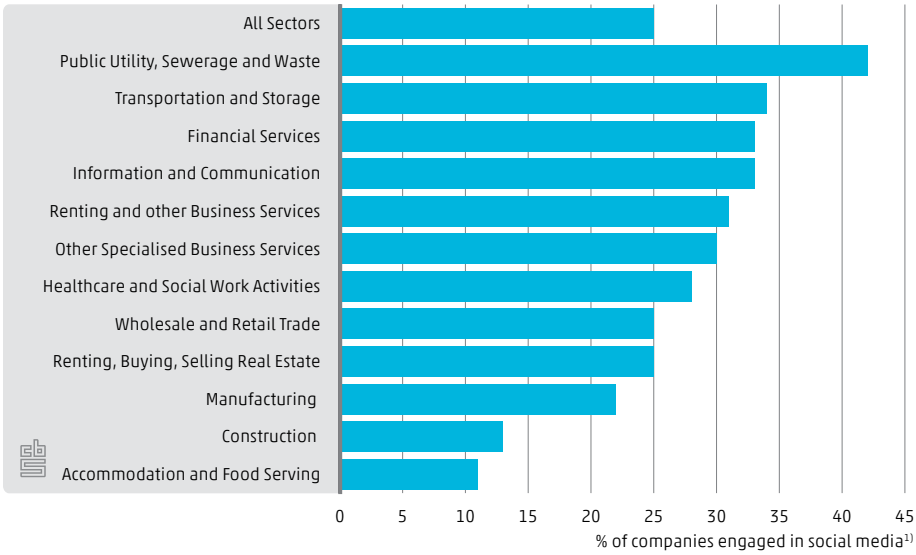
Characteristics of the use of social media

The sections below only deal with companies that use social media. The question is: what characterises the use of social media by these companies?

Formal Policy

Figure 9.1.6 shows that of the companies that use social media, approximately one quarter has a formal policy in this area. Zooming in on the various sectors it becomes clear that especially the 'Public Utility, Sewerage and Waste', 'Transportation and Storage' and 'Financial Services' sectors score high. It is striking that these are precisely the sectors that only use social media to a limited extent (see Figure 9.1.3). As mentioned earlier, a contributing factor here may be that these sectors are highly regulated. The 'Accommodation and Food Serving' sector is least likely to have a formal policy when it comes to companies that use social media.

9.1.6 Application of a formal policy to the use of social media, by sector, 2012



Source: Statistics Netherlands, ICT use by companies.
1) Companies with ten or more employed persons.

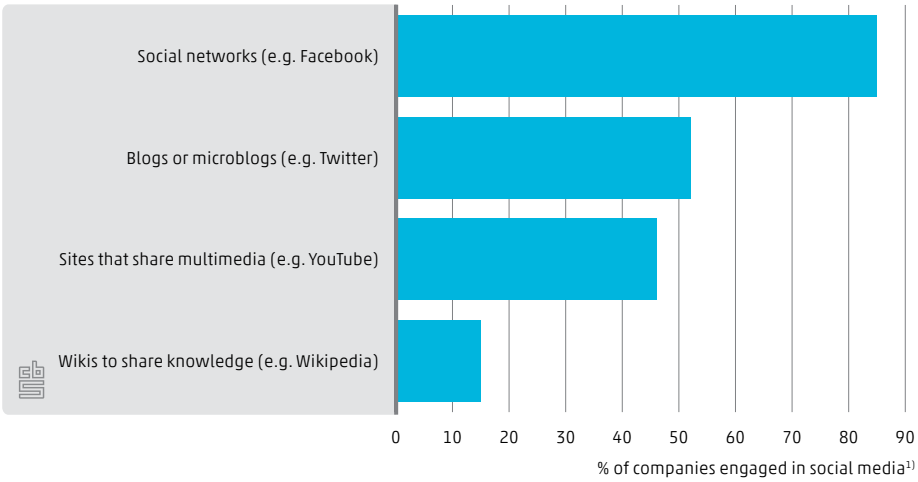
Type of social medium

Companies that use social media especially make use of social networks, such as Facebook and LinkedIn. The least popular medium is the wiki type (Figure 9.1.7).

Objective of using social media

The Statistics Netherlands survey also questioned respondents about their objective of using social media. It turns out that social media are especially used for marketing purposes; 68% of companies that use social media use it for this purpose. This holds also when the respondents are broken down by sector. Approximately 40 percent of companies that use social media do so for recruiting staff, reacting to and obtaining customer feedback, and collaborating with business relations. Companies use social media the slightest for product development and exchanging knowledge within the organisation. In other words, the use of social media is first and foremost aimed at (potential) customers, and only then at business relations and employees.

9.1.7 Use of social media by companies, by type of social medium, 2012



Source: Statistics Netherlands, ICT use by companies.
1) Companies with ten or more employed persons.

Table 9.1.8 provides a breakdown of the objectives of using social media by sector. What is striking here is that the 'Information and Communication' sector scores the highest in respect of almost all objectives and that, by contrast, the 'Construction' sector scores the lowest. Another striking finding is the high score of the 'Financial Services' sector for recruiting staff and exchanging knowledge within the organisation.

These results are consistent with the research conducted by Kiron (2012). Kiron identifies marketing and customer relations, innovation, lower operating costs, competitive advantage and tackling the competition as the key objectives of using social media. Strikingly a research conducted by TNS NIPO among Dutch companies found out that 25 percent of companies uses social media because 'everyone is using social media' and 54 percent does in order to 'gain experience with it' (TNS NIPO, 2012).

Social media and innovation

Table 9.1.9 compares the degree to which sectors use social media with regard to various sector characteristics, especially the degree of innovation. For example, the innovative culture in the 'Information and Communication' sector correlates with a high use of social media. By contrast, the 'Accommodation and Food Serving'

sector also scores high in terms of the use of social media, but this is not exactly an innovative sector. However, the average age of its employees is relatively low.

Finally, a number of company characteristics was entered into a logistic regression model. This model shows that especially the characteristics marketing innovator, organisation innovator and company size correlate with the use of social media. The age of the staff barely appears to play a role.

9.1.8 Objectives of the use of social media by companies, by sector, 2012

	Marketing products/ company image	Customer feedback, responding to questions	Engaging the customer in product development	Collaborating with business relations	Recruiting staff	Sharing knowledge within the company	Formal policy for the use of social media
	% of companies engaged in social media[1)]						
Information and Communication	74	51	42	52	61	54	33
Wholesale and Retail Trade	72	47	33	38	34	24	25
Accommodation and Food Serving	72	54	37	32	37	25	11
Public Utility, Sewerage and Waste	71	50	24	42	58	38	42
Renting, Buying, Selling Real Estate	71	53	27	36	31	37	25
Renting and other Business Services	70	42	32	49	63	36	31
Other Specialised Business Services	69	46	37	51	57	49	30
Healthcare and Social Work Activities	69	49	33	44	46	42	28
All Sectors	**68**	**44**	**33**	**42**	**44**	**34**	**25**
Financial Services	62	46	37	34	69	53	33
Manufacturing	60	33	27	35	35	24	22
Transportation and Storage	59	35	31	42	34	35	34
Construction	56	24	21	37	26	21	13

Source: Statistics Netherlands, ICT use by companies.

Highest value

All sectors

Lowest value

Concluding observations

The dominant picture in literature and research concerning the use of social media by companies shows an unprecedented optimism concerning its impact and the benefits to be gained. Social media affects all facets of a company ranging from marketing, R&D and innovation to HRM, business processes, leadership and culture. The issue no longer is whether companies, government organisations and social organisations should deploy social media, but how well they will be able to optimally use these tools. Social technology is cheap, is easy to deploy and makes it possible to put people into contact with each other who after all already have

the desire to establish such contacts. Companies can enter into a dialogue with customers, suppliers as well as their own employees, collaborate, and generate and secure ideas for innovation and improvements. The local market is transforming into a global market, with a corresponding increase in consumer power. As such, they will continuously judge the products, services and activities of companies. Social technologies consequently will (fundamentally) change the way in which people communicate, collaborate and conduct business. Companies that join in will acquire a considerable competitive advantage. Companies that fail to do so will eventually price themselves out of the market.

9.1.9 Characteristics of companies that use social media, by sector, 2012

	Use of social media	Product innovator	Process innovator	Organisation innovator	Marketing innovator	Marketing innovator who considers ICT (very) important	Average company age[1]	Average age of employees
	% of companies[2]	% of companies engaged in social media[2]					year	
Information and Communication	79	58	36	36	37	31	5.8	39.1
Accommodation and Food Serving	65	9	13	20	21	18	5.2	37.8
Other Specialised Business Services	59	38	32	36	34	26	5.6	39.1
Renting, Buying, Selling Real Estate	51	11	24	21	24	20	5.8	40.6
Renting and other Business Services	47	22	21	28	23	18	5.1	38.3
Financial Services	42	38	44	37	39	36	5.8	40.6
All Sectors	**41**	**31**	**29**	**31**	**28**	**23**	**5.6**	**39.6**
Healthcare and Social Work Activities	39	27	32	40	22	18	5.3	40.1
Public Utility, Sewerage and Waste	38	35	53	44	22	17	5.3	40.2
Wholesale and Retail Trade	36	33	33	30	31	27	5.8	39.0
Manufacturing	33	44	37	33	33	23	6.0	40.3
Construction	25	12	15	26	17	12	5.8	40.1
Transportation and Storage	23	29	38	32	16	13	5.6	39.6

Source: Statistics Netherlands, ICT use by companies.

1) Formation date of statistical unit.

2) Companies with ten or more employed persons.

Highest value

All sectors

Lowest value

Youngest

Oldest

From a statistical perspective, the growing use of social media and the importance companies attach to it is confirmed by research. However, in terms of the actual impact and benefits of social media on company performance, research is still

scarce. The available research does not (yet) allow the conjecture that the use of social media by companies leads to, for example, improved profiling of a company and its products, improved customer loyalty, lower operating costs, greater (internal) collaboration and faster innovation, resulting in higher productivity and ultimately greater profit, to be confirmed. Research into the use of social media by companies up to the present time is purely focused on the degree to which social media are being used, the objectives of deploying social media and the company activities for which social media are being used. In terms of small companies, for example with ten employees or less, there is virtually a complete lack of statistics. This calls for more thorough research into the impact and benefits of the use of social media in companies. The impact on the way in which business will be conducted in the future and the way in which companies operate potentially appears to be high. The (statistical) issue is whether the unprecedented optimism concerning the impact and the realisable benefits is justified.

One thing that is clear is that social media, in whatever form, are not going to disappear. New generations are growing up with social media. Given their growth, social media appear to be bypassing the traditional mass media. In comparison to traditional mass media they offer relatively cheap and accessible opportunities for disseminating or acquiring information. Furthermore, their reach is much greater and the rate of dissemination is considerably faster. Companies are no longer able to circumvent it. Nevertheless, six in ten companies in the Netherlands do not make any use of social media and the majority of those that do use it, probably are still in the experimental phase. Research shows that especially the intangible nature of social media causes companies to be reticent (Forrester, 2011 and Kiron et al., 2012). As such, the benefits associated with the use of social media are difficult to express in terms of a hard return on investment. Often, there also is a lack of an integrated company-wide vision and approach concerning how the deployment of social media can support a company's strategy. Management too often still views the deployment of social media as an isolated innovative project and not as a critical success factor for creating a healthy future for the organisation. The notion that the use of social media can also create potential risks and security problems often results in the use of social media for external contacts to be restricted to a small group of selected employees. Other impeding factors include a limited budget, other priorities, too little expertise, few opportunities for reacting to feedback from the market, lack of familiarity, complexity, and privacy issues concerning the use of information acquired via social media.

9.2 Cooperative patent applications

Knowledge of others can help a company conduct its research more efficiently. This sometimes makes it attractive for companies to collaborate in research and development. Such partnerships often result in joint patents. This section describes the interrelationship between joint patents and productivity.

Author: N. Vellekoop

Knowledge networks

Companies regularly partner in the area of innovation. By making use of a knowledge network, a company does not need to develop all required knowledge itself. This enables a company to more efficiently exploit its investments in research and development (R&D). Many investments in R&D have a high degree of uncertainty. It is not certain whether there is an outcome, nor what the outcome will be. This means that trust is a key factor for creating a stable partnership in a knowledge network. Trust among companies is difficult to measure. The outcome of a partnership is relatively easier to measure. In the community innovation surveys (CIS) companies are asked whether they collaborate in the field of innovation. Another source is the patent register. Patents stimulate innovation.[9] After all, they give the owner the right to be the only one to exploit the innovation for a determined period of time. This temporary monopoly increases the chance that companies will recover their investment in innovations. A company can apply for a patent on its own, as well as in partnership with one or more partners. This section describes the results of a research into the application for joint patents and productivity. The central issue in this research is whether companies that jointly apply for a patent are more productive than companies that apply for a patent on their own. Scientific research into partnerships in innovation and R&D has been conducted for some time. Research into joint patent applications is relatively new.[10]

[9] Other views of the relationship between patents and innovation can be found in an overview article by Boldrin and Levine (2013).

[10] Among others, see Hagedoorn (2003), Hagedoorn, Van Kranenburg, and Osborn (2003), Belderbos, Carree, Diederen, Lokshin, and Veugelers (2004), and Fosfuri, Helmers, and Roux (2012).

Relationship between joint patents and productivity

Conceptually speaking, there are three levels of collaboration among companies. The first level is that companies 'simply' collaborate on research and development. At the next level, companies develop an innovation that they jointly patent. The interaction between these two levels is already enough to explain the existence of joint patents. The notion is that the prospect of a joint patent optimally stimulates the collaborating companies to invest in advance, rather than to freeride on the investments of someone else.[11)]
The third level is when companies (tacitly) collaborate on the sales market, whereby a joint patent can play a role in the formation of a partnership. Once a patent has been granted, companies can also collaborate on the licensing market, which involves introducing the use of knowledge to the market. It may be presumed that companies do not make these decisions independently of each other. A partnership for research and development, for example, can fail if there is a lack of agreement on how any returns will be shared or patented. Even if the relationship is successful, it does not have to result in innovation that leads to a patent application. For example, one company may buy out the other company and patent the innovation on its own.

Various relationships between taking out a joint patent and the individual productivity of a company can be conceived of in advance. Companies can benefit from economies of scale and specialisation if they conduct research and development in collaboration with others. By sharing knowledge and methods, companies increase the chance of an innovation. By improving their use of resources for research and development, companies can also deploy other production factors more efficiently. According to this reasoning there is a positive relationship between joint patents and productivity due to cost efficiency.
A different positive relationship is also conceivable, but operates on the basis of a different mechanism. Suppose that companies only take out a joint patent if they operate on different product markets. The joint patent makes the two companies a monopolist in their own market segment. The gain from the monopoly has a positive effect on the operating result. In this case there is a positive relationship between productivity – measured on the basis of the operating result: the turnover – and joint patent development, however the explanation is different.

A negative relationship is also possible. Large companies less often have a need for a partnership to engage in R&D. If larger companies subsequently are also more

[11)] Belderbos, Cassiman, Faems, Leten, and Van Looy (2012).

productive than smaller companies, then there is a negative relationship between productivity and joint patent development. Joint patents in that case are more typical for less productive companies.
Without a theoretical framework it is impossible to interpret an observed relationship between joint patents and productivity. The objective of this section therefore is to provide a description of the correlation as a means of promoting further research into collaboration between companies in the field of innovation.

Issues that need investigation

The following issues are key:

1. How often does a Dutch company submit a joint patent application to the Netherlands Patent Centre (NLOC) and to the European Patent Office (EPO)?
2. Are companies that jointly apply for a patent more productive than companies that apply for a patent on their own?

The first issue concerns descriptive statistics. Production functions are estimated for the second issue. These production functions are used to compare the productivity of companies that jointly apply for a patent with that of companies that apply for a patent on their own.

Registers as a source of information

This research makes use of databases that contain information about patents. Such registers constitute an interesting source of information for research into innovation. Generally speaking, a patent application or a grant of patent follows a period of investment in R&D. A patent application or a grant of patent consequently is an indicator of R&D activities. The official R&D and innovation surveys contain various questions about investments in innovation and the corresponding returns. These surveys use random samples, which has its drawbacks. For example, the response can be selective and the observation is limited to several thousand companies. These issues can obscure the analyses of the relationships between investments and returns. A patent register as a supplementary source can provide clarification in this respect.
This research uses all patent applications submitted by Dutch companies to the Dutch Patent Office (NLOC) and the European Patent Office (EPO) over the period 2000 to 2009 inclusive. The patent application identifies whether it was submitted by one or more companies. The source data not only concerns patent applications submitted by Dutch companies. Private individuals or foreign companies without a subsidiary in the Netherlands can also apply for patents.

The data does not differentiate between these. On the other hand it is possible to discern whether a company is submitting a joint application with one of these two parties.

Characteristics of joint patent applications

Table 9.2.1 provides a breakdown of all patent applications submitted to the EPO and NLOC by Dutch companies. The first column contains the number of Dutch companies with at least one application that year. The second column contains the number of Dutch companies with at least one joint application. There were 1,008 companies that made one or more patent applications to the EPO in 2005. Of these 1,008 companies there were 156 that submitted a joint application that year. A company can apply for a patent in several years. Over the entire period 2000 to 2009 inclusive, 5,898 (unique) Dutch companies submitted at least one application to the EPO. Of this number, 860 companies submitted at least one joint application (14.6 percent). The corresponding number of companies that submitted an application to the NLOC over this period was 2,765 unique companies and of this number 508 companies submitted a joint application (18.4 percent). There are no major shifts over this period of time.

A company can apply for multiple patents in any one year. This is reflected in the last three columns of Table 9.2.1. In total, 4,003 Dutch companies submitted a patent application to the EPO in 2000. Of this number, 160 were classified as an application by more than one company. As a percentage, over the period 2000–2009, this figure fluctuates between 1.9 and 4.4 percent for the EPO and between 5.0 and 8.0 percent for the NLOC. This is comparable to the findings of Fosfuri, Helmers and Roux (Fosfuri et al., 2012). In the United States, the percentage of joint applications is even lower. Fosfuri, Helmers and Roux point to the differences in the allocation of licences: in Europe a joint owner may block a licence, while in the United States a patent holder, without the cooperation of the other owners, may grant licences and is not obliged to share the proceeds from these licences.

Of the patents submitted by more than one applicant, the majority is applied for by two partners (Table 9.2.2). Between 9 and 12 percent of the joint applications submitted to the NLOC are submitted by three partners. Four or more applicants occurs a few times and more often for the NLOC than the EPO – most certainly when only considering collaboration between Dutch companies (the last three columns of Table 9.2.2).

9.2.1 Patent applications to the EPO and NLOC by Dutch companies, 2000-2009

	Companies with more than one application	Companies with one or more joint applications	Companies with one or more joint applications	Applications	Joint applications	Joint applications
	number		%	number		%
EPO						
2000	990	97	9.8	4,003	160	4.0
2001	898	119	13.3	4,442	161	3.6
2002	902	105	11.6	4,814	114	2.4
2003	1,008	132	13.1	5,069	111	2.2
2004	984	116	11.8	4,771	113	2.4
2005	1,008	156	15.5	4,820	99	2.1
2006	873	142	16.3	5,070	98	1.9
2007	884	109	12.3	5,123	126	2.5
2008	876	107	12.2	4,597	204	4.4
2009	755	83	11.0	4,615	196	4.2
total				47,324	1,382	2.9
NLOC						
2000	580	108	18.6	2,031	102	5.0
2001	620	101	16.3	1,783	104	5.8
2002	542	89	16.4	1,791	110	6.1
2003	546	76	13.9	1,888	118	6.3
2004	616	94	15.3	1,801	110	6.1
2005	618	71	11.5	1,817	146	8.0
2006	678	106	15.6	1,674	112	6.7
2007	699	78	11.2	1,647	99	6.0
2008	637	100	15.7	1,887	120	6.4
2009	599	92	15.4	1,699	93	5.5
total				18,018	1,114	6.2

Source: EPO and NLOC.

860 companies submitted a joint application to the EPO between 2000 and 2009

9.2.2 Number of patents with number of applicants, joint applications, 2000-2009

	All types of partnerships[1]			Collaboration among companies[2]		
	EPO	NLOC	total[3]	EPO	NLOC	total[3]
	%					
Number of applicants						
2	92.3	83.9	88.6	96.0	88.4	93.1
3	6.6	12.4	9.2	3.9	9.3	5.9
4 or more	1.1	3.7	2.2	0.1	2.3	0.9
total	100.0	100.0	100.0	100.0	100.0	100.0
Number of patents	1,383	1,118	2,500	877	526	1,402

Source: EPO and NLOC.

[1] All applicants, including collaboration between a company in the Netherlands and, for example, a private individual or a foreign company.

[2] All partnerships between companies in the Netherlands.

[3] The total comprises all patent applications with more than one applicant.

9.2.3 Patent applications and joint patent applications by category, 2000-2009

	Applications	Joint applications	Joint applications
	number		%
EPO			
A: Human necessities	7,039	273	3.9
B: Performing operations, transporting	4,978	226	4.5
C: Chemistry, metallurgy	6,730	208	3.1
D: Textiles, paper	461	5	1.1
E: Fixed constructions	1,602	106	6.6
F: Mechanical engineering, lighting, heating, weapons, blasting	1,743	97	5.6
G: Physics	12,290	220	1.8
H: Electricity	10,838	192	1.8
Total	45,681	1,327	2.9
NLOC			
A: Human necessities	4,698	304	6.5
B: Performing operations, transporting	5,098	302	5.9
C: Chemistry, metallurgy	733	46	6.3
D: Textiles, paper	116	3	2.6
E: Fixed constructions	2,416	172	7.1
F: Mechanical engineering, lighting, heating, weapons, blasting	1,618	98	6.1
G: Physics	2,216	128	5.8
H: Electricity	1,123	61	5.4
Total	18,018	1,114	6.2

[1] A patent may also have more than one code. Only the first code is presented. At the EPO, 1,643 patents did not have a code.

The classification of a patent is also contained in the patent register. The classification of patents is highly detailed, but to provide an initial impression, this analysis considers the application's main category. A patent application can be classified into multiple main categories. Table 9.2.3 only presents the first main category. At the EPO an above-average number of joint applications is classified in categories E, F, B and A. At the NLOC this only includes categories E and A. This could be an indication that companies in certain sectors collaborate more than average on innovation.

Linking company data to patent applications

The patent applications are linked to all Dutch companies contained in the financial statistics for Non-Financial Companies (NFO) for the years 2000 to 2009, inclusive. Large companies are included on the basis of an integral survey and the small companies on the basis of secondary data (Statistics Netherlands, 2013). Approximately 11 percent of the records in the NFO database cannot be linked to companies in the patent database. Records with a negative value or a zero value for one of the following variables are not selected: revenues, cost of wages, cost of capital and intermediate consumption. The financing ratio is defined as equity plus provisions divided by the balance sheet total. Values with a financing ratio greater than one or smaller than zero are also eliminated. After establishing the links and making the selections, an unbalanced panel emerges with a total of 22,000 business years. Over the period 2000 to 2009 inclusive there are 4,000 unique companies that submitted a patent application to the NLOC or the EPO.

Table 9.2.4 reflects the financial core data of all companies. The monetary values have been deflated using deflators at the industrial level, two-digit Standard Industrial Classification (SIC). For the SIC categories for which there are no production price indices, the average unweighted price index of the observed SIC categories is used. The R&D expenditures come from the Innovation and R&D surveys and concern the R&D expenditures incurred with in-house personnel. All other variables are obtained from the NFO database. Companies that over the period 2000 to 2009 inclusive submitted at least one patent application to the NLOC or the EPO, on average are larger companies with higher revenues, higher costs of wages and capital, higher intermediate consumption and significantly higher R&D expenditures. The financing ratio is slightly lower.

9.2.4 Characteristics of companies and patent applicants, 2000-2010[1)]

	All companies		Companies with at least one patent application	
	mean	st. dev.	mean	st. dev.
Revenues	7,084	152,594	117,848	769,786
Wage costs	1,067	16,562	17,278	95,835
Cost of capital	378	12,177	9,019	81,185
Intermediate consumption	5,344	130,311	87,471	616,658
R&D expenditures	35	4,021	1,543	28,622
Financing ratio	0.55	0.293	0.466	0.259
N	1,232,899		24,028	

1) All expenditures are in thousands of euros adjusted for the producer price index (2005 = 100).
After making the selections and establishing the linkages, there are a total of 282,355 unique companies that on average are observed for 4.4 years over this time period.
In terms of all patent applicants, there are 4,084 individual companies that are included in the panel for an average of 5.9 years.

Estimating productivity

To provide an impression of the relationship between joint patent applications and productivity, production functions are estimated. The companies are classified into one of two groups. The first group contains all companies in the Netherlands. The second group contains all Dutch companies that applied for a patent with the EPO or the NLOC at one time over the period 2000 to 2009 inclusive. Next, the second group of patent applicants is assessed to determine if there is a difference in productivity in terms of applying for a patent individually or jointly. From Table 9.2.4 it is evident that the group of patent applicants and the group of non-applicants are dissimilar groups that cannot be compared.

Method for estimating the production function

The dataset is an unbalanced panel: not all companies are observed in all years. The natural logarithm (log) is taken of all continuous variables. An advantage of the logarithmic transformation is that the estimated coefficients provide an indication of the elasticity. For example, coefficient 'a' identifies the average percentage increase in a company's turnover when the wage bill increases by 1 percent. The production function is a Cobb-Douglas production function and is comparable to preceding literature.[1)]

$$\log(Q_{it}) = a \log(L_{it}) + b \log(K_{it}) + c \log(V_{it}) + d\, dPat_{it} + n_i + t_t + e_{it}$$

This production function is estimated using the *ordinary least squares* (OLS) method, whereby the standard errors are adjusted for heteroscedasticity and autocorrelation at the company level.

Explanation of variables

Q_{it} real turnover of company i in year t.

L_{it} real wage bill of company i in year t.

K_{it} real capital cost of company i in year t, calculated as the sum of depreciation and amortisation plus interest expenses.

V_{it} real intermediate consumption of company i in year t, consisting of the operating costs.

$dPat_{it}$ a dummy variable with value 1 if company i in year t applied for a patent and value 0 if that is not the case. In addition, a specification is estimated which includes a cross term if the patent applied for in year t concerns a joint patent. An alternative dummy variable, for example, could consist of the number of patents submitted by company i in year t. The *perpetual inventory* method, for example, could be used to estimate the inventory of patents for a company. This method was not used in this research, because the grants of patent are only included in the EPO database. There are two additional reasons why the dummy variable approach is preferred over an estimate of the inventory of patents. First, the distribution of companies applying for patents is skewed – among the population of companies that applied for a patent at one time, there are a few companies that applied for the majority of the patents. Second, the point in time at which the application is submitted is presumed to be closer to the actual point of innovation than the grant of patent.

n_i individual fixed effect for company i.

t_t year dummy.

e_{it} error term.

[1] For example see Bloom and Van Reenen (2002).

9.2.5 Company productivity, log turnover is the explanatory variable, 2000-2009[1)2)]

	All companies		Patent applicants only			
	1	2	3	4	5	6
Wage cost (log)	0,418***	0,400***	0,341***	0,342***	0,342***	0,342***
Standard error	0.001	0.002	0.019	0.017	0.017	0.017
Cost of capital (log)	0,047***	0,040***	0,045***	0,045***	0,045***	0,045***
Standard error	0.001	0.001	0.010	0.009	0.009	0.009
Intermediary consumption (log)	0,508***	0,486***	0,549***	0,550***	0,550***	0,550***
Standard error	0.001	0.002	0.014	0.013	0.013	0.013
Patent applied for				-0,012**	-0,012**	-0,012**
Standard error				0.005	0.006	0.006
Patent jointly applied for					0.004	0.008
Standard error					0.015	0.017
Company dummies	no	yes	yes	yes	yes	yes
Year dummies	yes	yes	yes	yes	yes	yes
R-squared	0.916	0.916	0.968	0.968	0.968	0.968
Number of observations	1,098,722	1,098,722	21,902	21,902	21,902	21,902
Number of companies	265,238	265,238	4,027	4,027	4,027	4,027

1) The first two columns pertain to all companies in the Netherlands in the period 2000–2009. Columns (3) up to and including (6) pertain to companies that applied for at least one patent in this period. The regression analyses include year and company dummies, but these are not shown in order to increase the table's readability.

2) *** is significantly different from zero at 1 percent, ** at 5 percent and * at 10 percent.

Table 9.2.5 reflects the estimates of the production function, with each column representing a separate estimate. The year effects are estimated but not shown. The first two columns reflect the estimates for all Dutch companies (after making the selections). The 0.418 estimate for the wage costs in column (1) means that if the cost of wages increases by 1 percent, revenues will increase by 0.418 percent. The coefficients for the cost of wages, cost of capital and intermediate consumption in the estimation add up to 1, which points to constant returns to scale. This means that a doubling of a production factor is related to a doubling of output. All coefficients of the input factors are estimated with high precision, with small standard errors and significantly different from zero at 1 percent.
The columns (3) up to and including (6) yield different specifications for the production function (see text box) for the group of companies that applied for a patent at some point. This group is significantly smaller than the group of all Dutch companies. Applying for a patent in any one year has a negative relationship with productivity in that year and is associated with a decline of 1.2 percent in revenues. This estimate is significantly different from zero at the level of 5 percent. Jointly applying for a patent with other companies is associated with a positive

relationship; however, this relationship is not significantly different from zero. Column (5) comprises all joint patent applications of a Dutch company with another partner. This other partner could be a private individual, or a company established abroad. Column (6) comprises the joint patent applications involving two or more Dutch companies. The coefficient is twice as large as that in column (5), but neither one is significantly different from zero.

Conclusion

Of all applications submitted to the EPO by Dutch companies, 2.9 percent is jointly submitted by one or more companies. The corresponding figure for NLOC is 6.2 percent. Instead of considering the number of patent applications, it is also possible to consider the number of companies. At the EPO, 14.6 percent of companies submitted a joint patent application. The corresponding figure for NLOC is 18.4 percent. In terms of all patent applications, the joint patent applications are clearly in a minority. In proportion to the number of companies that jointly submitted a patent application, joint patent development is a phenomenon that deserves attention.
Applying for a patent is associated with a decline of 1.2 percent in revenues. In this respect it is impossible to make a distinction between companies that jointly apply for a patent and companies that do not do so. Although the relationship (sign) is positive, the effect is statistically insignificant.

9.3 Review of Marktplaats users

Marktplaats.nl is a website that brings together the demand and supply of (second-hand) goods. In terms of visitor numbers, Marktplaats – a subsidiary of eBay – has been one of the largest websites in the Netherlands for years and as such is one of the largest intermediaries on the second-hand market. Statistics Netherlands received a dataset with all advertisements and the associated highest offer and associated characteristics for the purpose of investigating to what extent this data can be used to generate 'official' statistics. This article describes some of the findings resulting from linking the Marktplaats data with Statistics Netherlands data at the postal code level. The result is a picture of the regional distribution of the use of Marktplaats and the characteristics of the Marktplaats user.

Author: E.R. Schürmann

Introduction

'The Dutch population is making room for Sinterklaas' toys'.[12] *'The ice beckons, resulting in a massive run on skates'.*[13] *'Horses en masse on Marktplaats'.*[14] These are examples of regularly recurring headlines in the media about Marktplaats that establish a relationship between a public holiday, the weather or an economic trend and the offer of goods in a specific advertising category. The information to which Marktplaats has access as an online advertising medium stirs the imagination in part due to these types of news headlines. Given the many thousands of advertisements placed by users each day and the large variety of categories, it is always possible to distil an interesting fact from this information. Statistics Netherlands received a dataset with all of these advertisements and the associated characteristics from Marktplaats for the years 2006 up to and including 2011. The anticipated possible uses of this data were as follows: (1) to produce an estimate of the sale of second-hand goods among private individuals (consumer-to-consumer (C2C)); (2) to search for potential relationships between this data and Statistics Netherlands' economic indicators, such as consumer confidence and retail trade sales trends; and (3) to link this data to Statistics Netherlands data at the regional level as a means of creating greater insight into the regional distribution in the use of Marktplaats and the characteristics of the Marktplaats user. This article primarily deals with the third (3) aspect.

About the dataset

This dataset is not of a type that Statistics Netherlands often works with. It is not a random sample of observations from a predefined population frame and not a register that strives for completeness. This makes it impossible to remove extreme values or curious elements from the dataset in traditional ways. The strategy that was therefore adopted was to let the data speak for itself as much as possible. Nevertheless, a number of categories containing not moveable goods were left out of consideration, such as real estate, services and personals. In addition, all items with an asking price exceeding one hundred thousand euros were also left out of consideration. A bicycle with an asking price of 1,234,567 euros, or 9,999,999 euros is not likely to be sold at that price on Marktplaats. In 2010, approximately 100 of the 1.9 million advertisements in the category 'Bicycles and mopeds' were removed on the basis of asking price. Collectively, these 100 advertisements represented

[12] Online version of newspaper Trouw, dated 30 November 2012.
[13] Online version of newspaper NRC, dated 1 February 2012.
[14] Online version of newspaper Volkskrant , dated 28 September 2010.

more than half of the total asking price of 775 million euros. The one hundred thousand amount is of course arbitrary. At the present time the data still includes five upright bicycles with an asking price of more than 10,000 euros. This illustrates the many challenges dealt with during the analysis. In addition, the variables in the dataset do not necessarily describe what is interesting from a statistical perspective, but rather what is necessary to record from the perspective of operating a website. Adhering to fixed classifications is not the highest priority for Marktplaats. If it turns out that visitors place very few of their advertisements in a certain category or by contrast, very many, it is logical for Marktplaats to combine these categories, or split them up. This makes using the data to create time series very difficult.

A practical problem

The statistical unit of the dataset is 'the advertisement'. All characteristics of the Marktplaats user in the dataset originate from the advertisement. In most instances this is not problematic, but there are exceptions.
Example: A user places two advertisements: one from his home address with the associated postal code, and one from his work address with the associated postal code. In both postal codes the relevant advertiser is a unique advertiser. He is therefore counted in both postal codes.
Due to the tremendous volume of data and the small number of these types of exceptions, no corrections were made for this.

Link with Statistics Netherlands data

Because the Marktplaats data does not contain any information at the personal level, the postal codes included with the advertisements were used as the starting point for the analyses. In addition to several socio-economic population characteristics, this also makes it possible to calculate the distance between the advertiser and the highest bidder for each advertisement. This makes it possible to determine the reach – in a physical sense – of the market for second-hand goods. The next part of this article deals with the background characteristics of Marktplaats users, such as age and income. The users are characterised on the basis of the characteristics of the postal code area specified as part of the advertisement. The postal code is known for the majority of advertisements and consequently for the associated advertisers. After all, it is of interest to advertisers to have their advertisements displayed in the regional search commands of potential buyers. It was also possible to determine the postal code for a portion of the individuals

who made the highest bid. This was the case for bidders who had placed an advertisement at some time in the past and who used the same user-id for this purpose. This therefore pertains to a select group of bidders.
This article presents the 2010 Marktplaats data because it best fits the reference data of the Statistics Netherlands dataset '2008–2010 Key Figures for Postal Code Areas'.[15)]

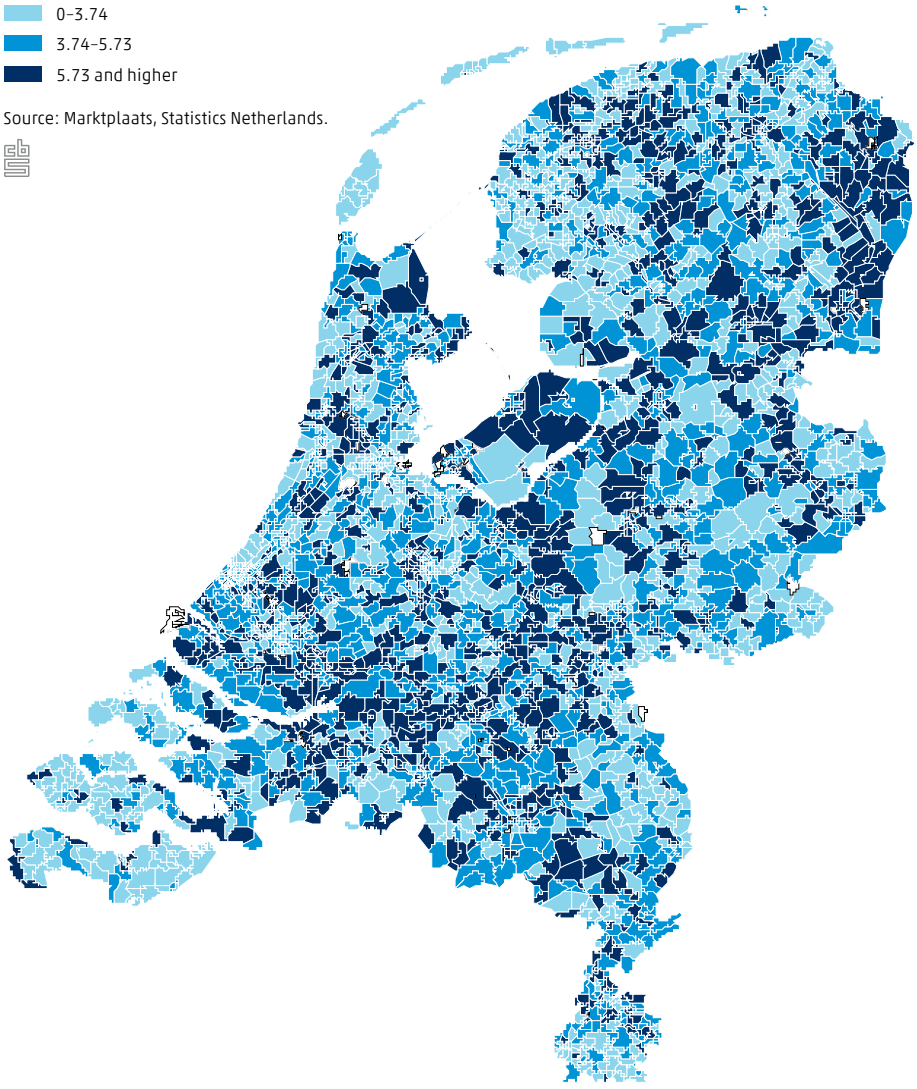
Geographical spread of Marktplaats use

To provide an idea of the geographical spread of Marktplaats use, Figure 9.3.1 displays the distribution of the number of advertisements per resident across the 2010 postal code areas. It is striking that the advertisement density is low in a large part of the province of Zeeland and on the Frisian Islands. A possible explanation for this is that the added value of an intermediary such as Marktplaats may be higher where the potential sales market is greater. In relatively peripheral and less densely populated areas there is less demand from the immediate surroundings. This reduces the probability that an advertisement will result in a transaction and this is why people probably place fewer advertisements. By contrast, people in the provinces of South-Holland, Utrecht, North-Brabant, Drenthe and Groningen place many advertisements.

Figure 9.3.3 displays the number of bidders per resident by postal code. The difference between the north and the south of the Netherlands is more clearly visible in this figure than in Figure 9.3.2. As mentioned earlier, this only includes the highest bidders on an advertisement, who also placed an advertisement themselves at some time in the past.

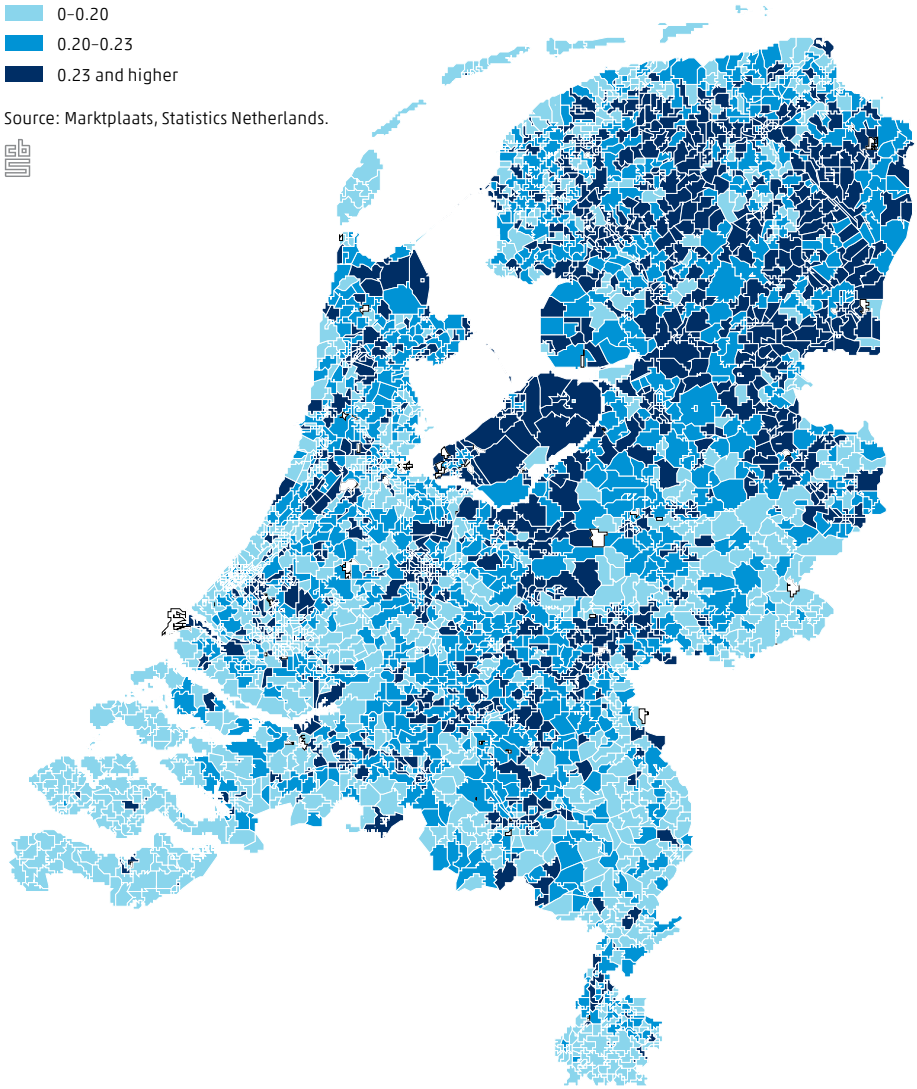
[15)] The '2008–2010 Key Figures for Postal Code Areas' database contains information about the number of income earners and the average taxable monthly income in postal code areas for December 2008. In addition, the database contains demographic data by postal code area in 2010.

9.3.1 Advertisements per resident, 2010



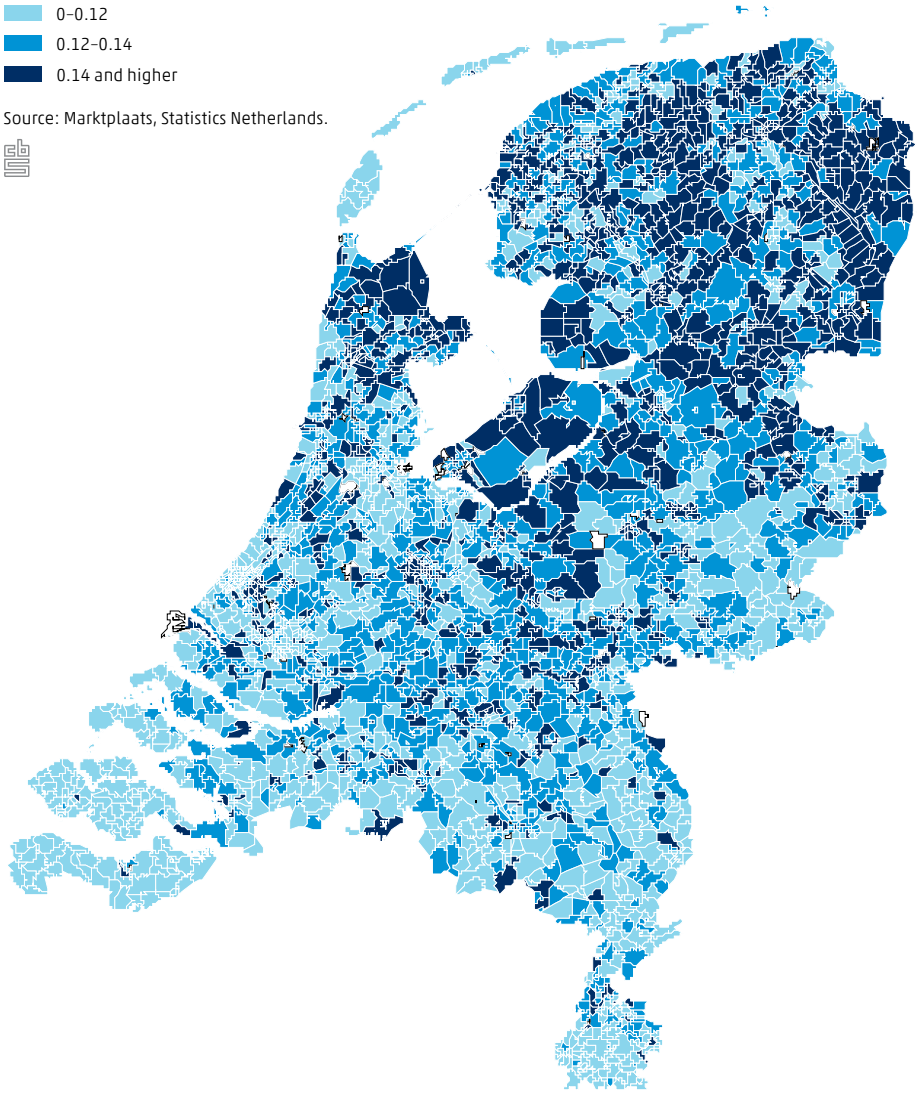
Source: Marktplaats, Statistics Netherlands.

9.3.2 Advertisers per resident, 2010



Source: Marktplaats, Statistics Netherlands.

9.3.3 Bidders per resident, 2010



Source: Marktplaats, Statistics Netherlands.

Characteristics of the Marktplaats user

To be able to say something about the socio-economic characteristics of Marktplaats users, Statistics Netherlands linked the postal codes of the advertisements to the regional Statistics Netherlands data. The average characteristics of the total Dutch population were first calculated on the basis of the postal code areas to serve as reference. Next, these values were recalculated using the number of advertisers per postal code as weights in order to establish the average characteristics of the Marktplaats user.

Calculation of characteristics

To determine the characteristics of Marktplaats users, Statistics Netherlands multiplied the characteristics of the postal code areas by the number of Marktplaats users, after which the average of the characteristics of all postal codes was calculated. To determine the characteristics of the Netherlands as a reference, the number of residents was used as a weighting factor, except in case of surrounding address density, where the number of households was used.
Example:
Area 1 has ten residents, four of whom are income earners. The average income per income earner is 3,500 euros. Collectively, these four income earners earn 4 x 3,500 euros = 14,000 euros. Per resident this is 14,000 euros / 10 = 1,400 euros. There are five Marktplaats users in this area.
Area 2 has eight residents, three of whom are income earners. The average income per income earner is 2,000 euros. Collectively, these three income earners earn 3 x 2,000 euros = 6,000 euros. Per resident this is 6,000 euros / 8 = 750 euros. There are six Marktplaats users in this area.
For all residents in both areas, the total income is 10 x 1,400 euros + 8 x 750 euros = 20,000 euros for 10 + 8 = 18 residents. This is 20,000 euros / 18 = 1,111 euros per resident. For all Marktplaats users in these areas, the income is 5 x 1,400 euros + 6 x 750 euros = 11,500 euros for 5 + 6 = 11 residents. This is 11,500 euros / 11 = 1,045 euros per Marktplaats user. Indexed on 100, this is 1,045 / 1,111 x 100 = 94 for Marktplaats users.
The conclusion to be drawn from this is that the average income of Marktplaats users is 6 percent lower than the average for these areas.

The differences between Marktplaats users and the total Dutch population are not of the same size for all characteristics. In this comparison, the proportion of the different groups in the total population has been set to 100 as the reference. Table 9.3.4 should be interpreted as follows: the proportion of the 75+ age group of the Marktplaats user populations is 76.6. This is 23.4 percent lower than the proportion of this group in the total population. Postal code areas with relatively many 75+ individuals are therefore under-represented among Marktplaats users. The proportion of non-Western foreigners is smaller than is to be expected on the basis of the total population, while the proportion of individuals aged 25 to 45 on the other hand is larger among Marktplaats users.

The picture changes somewhat when the characteristics of the postal code areas are weighted by the number of advertisements. Areas with relatively many advertisements in this case count more heavily. The proportion of older individuals then increases, for example. This is because in areas with many older people, the number of advertisements per advertiser is slightly higher than the average. By contrast, the proportion of non-Western foreigners declines even further. Relatively few advertisements are therefore placed from these areas. Furthermore, relatively many advertisements originate from less-populated areas: the areas with a low surrounding address density. This could in part be caused by business-oriented advertisers located outside the population centres.

9.3.4 Characteristics of Marktplaats users, 2010

	Marktplaats users[1]	Marktplaats users weighted by the number of advertisements[2]
	index (total population = 100)	
Population Characteristics		
0 to 15 years	101.3	100.2
15 to 25 years	102.8	99.3
25 to 45 years	106.0	105.0
45 to 65 years	99.1	100.9
65 to 75 years	89.9	92.0
75 years and older	76.6	81.4
Non-western foreigners	87.2	79.6
Men	101.1	101.3
Women	98.9	98.7
Surrounding address density	98.4	90.6
Taxable monthly income per resident	100.6	98.5

Source: Marktplaats, Statistics Netherlands.

1) Characteristics by postal code area weighted by advertisers on Marktplaats.

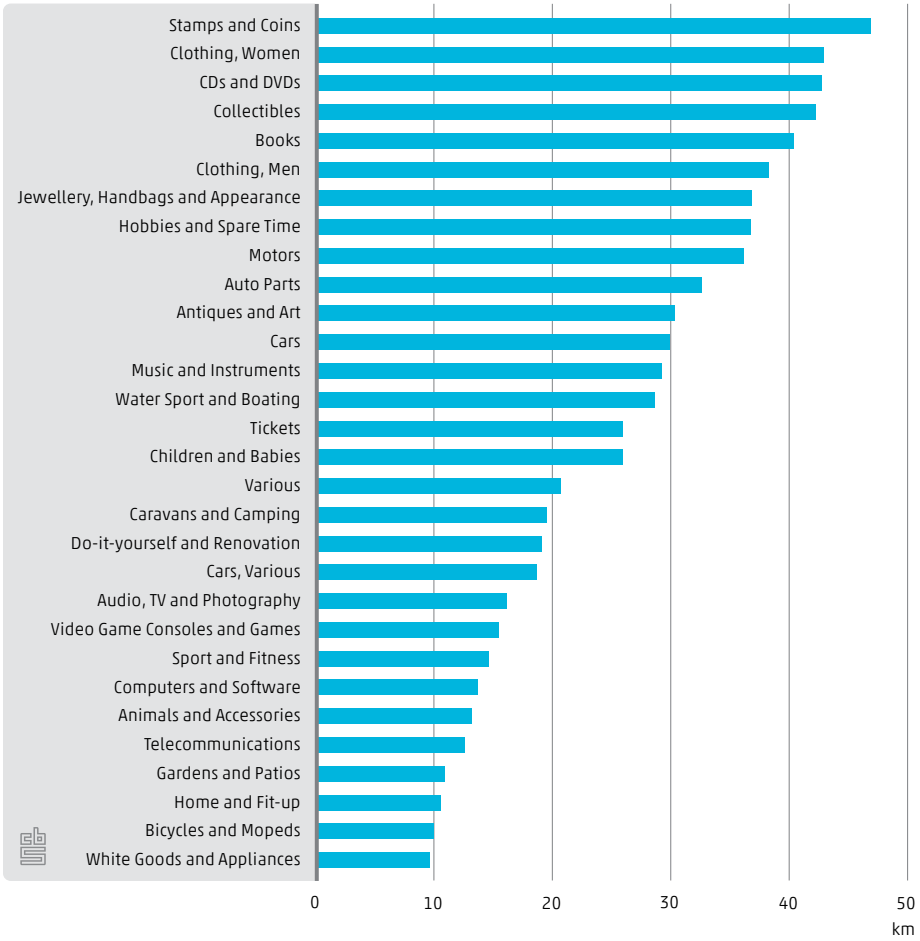
2) Characteristics per postal code area weighted by the number of advertisers, weighted by the number of advertisements.

Distances between buyer and seller

The distances between advertisers and sellers could provide an indication about the readiness of potential buyers to travel. For more expensive items, buyers can be expected to be ready to travel greater distances, because the transaction costs (travel costs) in that case proportionately are not as high. Of course this only affects items that an advertiser cannot easily send by post. In case of items such as stamps and coins, the transaction costs are often independent of the distance between advertiser and bidder. After all, if an advertiser sends an item via post, then the destination (within the Netherlands) does not affect the postage. Many buyers will pick up other items, such as bicycles and white goods, from the advertiser themselves. In that case the transaction costs are indeed dependent on the distance between advertiser and bidder.
Trust in the advertiser and the item offered for sale can also affect the readiness of a potential buyer to travel. Perhaps he would like to see a stamp with his own eyes before he decides to buy. In that case there is a relationship between the distance and the transaction costs as well.
The offer itself is also of importance in terms of the readiness to travel. The offer of baby clothes, for example, is relatively extensive and it can be assumed that a potential buyer would not have to travel too far for this. On the other hand, there may be an extremely rare collectible item for which the potential buyer is prepared to travel greater distances.
Due to the tremendous number of advertisements in every product category, there are a number of instances in which the distance between the bidder and advertiser is more than two hundred kilometres. Due to these type of outliers, the maximum distance is not a good indicator of the geographic size of the market. To nevertheless create a picture of the size of the market for every product category, Figure 9.3.5 displays the median: the distance between buyer and seller of the median advertisement. In 2010, 50 percent of the advertisements in the category 'White goods and appliances' received the highest bid from a bidder within a radius of 9.7 kilometres. The corresponding figure for books is 40.4 kilometres.

Not only the item's price and category are of importance, the advertiser's location also affects the distance between buyer and seller. Along the outer boundaries of the Netherlands, advertisers experience greater difficulty finding a buyer than advertisers located in the centre of the Netherlands. On average, bidders located in central areas are able to find their goods closer to home. They can literally go in any direction (Figure 9.3.6).

9.3.5 Median distance between bidder and advertiser per category, 2010

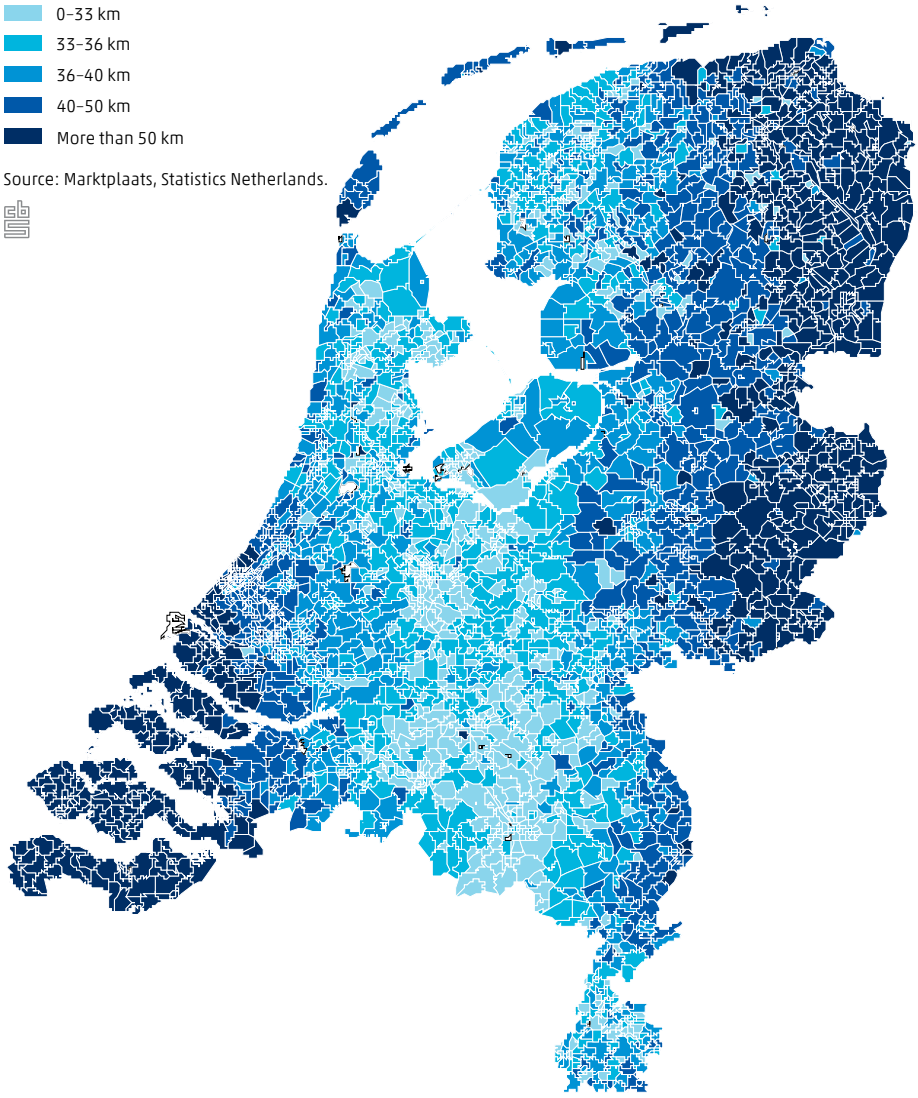


Source: Marktplaats, Statistics Netherlands.

Conclusions

Relatively more people make use of Marktplaats in the north of the Netherlands than in the south. Regions inhabited by many older people are less active on Marktplaats, but users in these areas do place relatively many advertisements. Areas with many non-Western foreigners make little use of Marktplaats, while the use in areas with a large proportion of people aged 25 to 45 years is high.
The geographical size of the second-hand market is dependent on the advertising category. Whether the advertiser can send the item by post appears to be of particular importance in this respect. In addition, whether the item fits into the trunk of a passenger car also seems to play a role for many buyers in their decision to make a bid.

9.3.6 Distance between bidder and advertiser (all advertisements), 2010



Source: Marktplaats, Statistics Netherlands.

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Glossary

This glossary contains a summary of the most important concepts and definitions used in this publication.

Basic price
The selling price excluding trade and transport margins by third parties and the balance of product tax (including VAT) and product subsidies.

Broadband (internet)
A high-quality communication connection with the internet such as cable, ADSL and optical fibre. This also includes fixed leased lines with high data transfer rates, as well as fast mobile connections, such as UMTS, HSDPA, 3G and LTE/4G. The OECD defines broadband as connections with the internet that have a total data transfer rate of at least 256 Kbps. The term 'fast internet' in this publication refers to at least a broadband connection.

Capital goods
The total value of fixed assets. These are production resources that last longer than one year and represent a significant value. This includes tangible assets (such as buildings and machines) as well as intangible assets (such as software).

Chain integration (supply chain management)
The electronic exchange of business information with the objective that the company and the business relation keep each other informed of business information, such as the availability of the delivery of products and services, and their respective stocks on hand.

Consumer spending
Goods and services that are used to directly satisfy individual or collective needs. A distinction is made between government consumption and household consumption, and between actual individual consumption and actual collective consumption.

E-commerce
Receiving or placing orders by means of electronic networks, irrespective of the method of payment and delivery. This definition does not include orders by telephone, fax or e-mail.

Electronic shopping
The online ordering of goods and services by consumers. Electronic shopping is one of the forms of e-commerce.

Export
Export is defined as the goods and services that are sold abroad by residents. In terms of the export of goods, they must have been delivered abroad from the economic area of the Netherlands. If this includes the trade and transport margins up to the Dutch border, this is designated as free on board (FOB). Export also includes the expenditures of foreign tourists, border residents and diplomats in the Netherlands.

Full-time equivalent (FTE)
A measure to calculate the labour volume by recalculating all jobs in a year into their full-time equivalent.

Government consumption
Government spending on goods and services that are used to directly satisfy individual or collective needs of members of the community.

Gross domestic product (market prices) (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 of all sectors together, plus some transactions not allocated to sectors, is the gross value of the income generated in the Netherlands, or the GDP (at market prices). The other transactions include the balance of product-related taxes and subsidies and imputed minus paid VAT. Gross here means that depreciation is not subtracted from the value added. Economic growth is the volume growth of the gross domestic product expressed as a percentage.

ICT capital
ICT capital (goods) comprises (comprise) ICT goods and services used to produce other goods and that form part of the production process for more than a year. Examples include computers and software.

ICT expenditure
Spending on ICT goods and services consisting of company and government investments in ICT capital, the intermediate consumption of ICT goods and services by companies and government, and the consumption of ICT goods and

services by households. ICT expenditures consist of intermediate consumption and consumption.

Import
Import is defined as the goods and services that are sold to residents (of the Netherlands) from abroad. The import of goods therefore does concern goods destined for residents that have been brought into the Netherlands economic area from abroad. If this includes the trade and transport margins up to the border of the exporting country this is designated as free on board (FOB). The import of services is related to the expenditure of Dutch companies abroad, such as transportation costs, banking fees and business trips. The payment for software produced by foreign companies is also considered as the import of services. In case of government, import includes the expenditure on embassies abroad, among other things.
Import by households includes things such as imported consumer goods and direct consumer spending abroad by Dutch tourists, border residents, diplomats and military personnel.

Innovators
Companies that apply product and/or process innovations or that perform activities aimed at innovation. A product innovation is the market introduction of new or highly improved goods or services in terms of possibilities of application, for example new or improved software, user-friendliness, components or subsystems. Goods are usually tangible objects like smartphones, furniture or packaged software, though music, movies and software that can be downloaded are also goods. Services are usually intangible and include insurances, education and training programmes, aviation, consulting and the like.
Process innovation is the application of a new or highly improved production process, distribution method or support activity for goods or services. This definition does not include purely organisational innovation and marketing innovation. The innovation must be new for the company but does not necessarily have to be so for the sector or market. It does not matter whether the innovation was originally developed by the company in question or by other companies, including in this regard customers and suppliers.
Innovation activities are taken to mean the purchase of machines, equipment, software and licences, as well as new construction and development, education and training, marketing and applied R&D if these are specifically aimed at the development, and/or implementation of a product or process innovation. Innovation activities also include fundamental R&D, even if such activity is not related to product or process innovation.

Intermediary consumption
Intermediate consumption includes all products that during the reporting period are used in the production process. This can include raw materials, semi-finished goods and fuels, as well as services such as communication services, cleaning services and external auditing services that may or may not have been purchased during the reporting period. Intermediate consumption is evaluated at purchase prices excluding deductible VAT.

Internet users
Individuals who use the internet. Most of the figures on internet users presented in this publication concern individuals who used the internet in the three months prior to the Statistics Netherlands survey and who range in age from 12 up to and including 74 years. In the case of international ICT data, the figures are based on results of the survey conducted among individuals aged 16 up to and including 74 years.

Job opening
A job opening for which, within or outside a company or institution, personnel is sought that can be placed immediately or as soon as possible.

Knowledge economy (or information society)
A society in which the production factor knowledge takes on increasing importance in relation to labour, raw materials and capital. A significant portion of economic growth in an information society is engendered by (technological) knowledge.

Labour volume
The amount of labour used in the production process expressed in terms of full-time equivalents or hours worked. A full-time equivalent is calculated by converting all jobs (full-time and part-time) in any one year to full-time equivalents (FTEs).

Mobile internet
internet connection via a mobile network (not WiFi) using a portable computer, tablet or smartphone.

National accounts
Statistical system that provides a quantitative, systematic and full description of the economic process within a country and of the economic relationships with foreign countries.

Production
Production comprises the value of all goods destined for sale (including unsold goods) and the receipts for proven services. In addition, production comprises products with a market equivalent produced for own use, such as in-house investments, including in-house developed software for use within the company itself. Production is valued at basic prices.

Production factor
The resources required for the production process. The traditional production factors are: natural resources, labour and capital.

Re-export
Goods that are transported via the Netherlands and that in the process become the (temporary) property of a resident, without it being subjected to industrial processing. Re-export, among other things, concerns goods that are cleared by Dutch distribution centres and that are delivered to other countries. Re-export, in contrast to transit, forms part of the import and export.

Research and Development (R&D)
An activity aimed at originality and innovation and consisting of the creative, systematic and planned search for solutions to practical problems. The activity also includes strategic and fundamental research in respect of which acquiring background knowledge and increasing (pure) scientific knowledge rather than securing direct economic gain or solving problems are the main priorities. In addition, the activity includes the development and finalisation of ideas or prototypes into usable processes and products that can readily be produced.

Revenue
Revenue represents the total proceeds of goods and services sold.

R&D expenditure
Expenditure on R&D performed by in-house staff in the Netherlands. This definition therefore does not include R&D outsourced to other companies or institutions or R&D performed abroad. R&D financing with the aid of subsidies provided for by the WBSO: Research and Development (R&D) tax credit. This means that a company's expenditure on subsidised R&D staff counts as R&D expenditure even if the company recovers part of this expenditure through payroll tax.

R&D intensity
R&D intensity is defined as R&D expenditure divided by GDP (gross domestic product). This measure expresses the magnitude of R&D relative to the size of the total economy.

Valorisation
Valorisation is the process that converts knowledge into commercially feasible products, processes or services (money).

Value added
The income created by the production process. This can be calculated as the difference between value of production and intermediate consumption. It constitutes the income available for compensating the involved production factors.

Volume change
The weighted average of the changes in the volume and quality of the parts of particular goods or service transactions or the value added.

Contributors

Authors

M.M.P. Akkermans
M.I. Hartgers
N.M. Heerschap
H.N. de Heij
A.D. Kuipers
G. van Leeuwen
A. van der Meulen
S.A. Ortega Azurduy
D. Pronk
E.R. Schürmann
G.P.E.A. Sleijpen
N. Vellekoop
L. Wielenga-van der Pijl

With contributions from

M. Andriessen (NL Kabel)
J.R.A. Cook
A.M. van der Giessen (Netherlands Organisation for Applied Scientific Research (TNO))
J. Julianus (Ministry of Economic Affairs)
G.J.H. Linden
S.G.E. de Munck (Netherlands Organisation for Applied Scientific Research (TNO))
G.H. Wassink

Editors

B. de Groot
L.E. Hoeksma (language editor)