EUROPEAN
COMMISSION

Brussels, 10.5.2017
SWD(2017) 160 final

COMMISSION STAFF WORKING DOCUMENT

Europe's Digital Progress Report 2017

Europe's digital progress report 2017

Contents

1. Connectivity: Broadband market developments in the EU

The Digital Economy and Society Index (DESI) is a composite index that summarises relevant indicators on Europe's digital performance and tracks the progress of EU Member States in digital competitiveness.

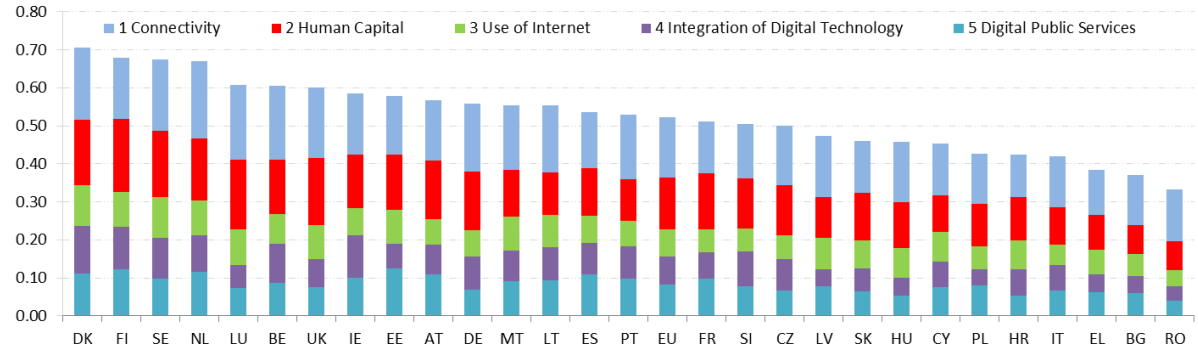
Denmark, Finland, Sweden and the Netherlands have the most advanced digital economies in the EU followed by Luxembourg, Belgium, the UK and Ireland. Whereas, Romania, Bulgaria, Greece and Italy have the lowest scores on the index.

Figure 1.1. The five dimensions of the DESI

1 Connectivity	Fixed Broadband, Mobile Broadband, Broadband speed and prices
2 Human Capital	Basic Skills and Internet Use, Advanced skills and Development
3 Use of Internet	Citizens' use of Content, Communication and Online Transactions
4 Integration of Digital Technology	Business digitisation and eCommerce
5 Digital Public Services	eGovernment

Source: European Commission, Digital Scoreboard

Figure 1.2. Digital Economy and Society Index (DESI) 2017 ranking



Source: DESI 2017, European Commission

As for Connectivity, the highest score was registered by the Netherlands followed by Luxembourg and Belgium. Croatia, Bulgaria and Poland had the weakest performance in this dimension of the DESI.

The Connectivity score looks at both the demand and the supply side of fixed and mobile broadband. Under fixed broadband, it assesses the availability as well as the take-up of basic and high-speed next-generation access (NGA) broadband and also considers the affordability of

retail offers. On mobile broadband, the availability of 4G, radio spectrum and the take-up of mobile broadband are included.

A comparative assessement of fixed broadband across countries shows Luxembourg, Netherlands and the UK as the strongest performers. In contrast, Poland, Romania, Slovakia and Latvia are shown to be among the weakest performers. NGA subscriptions are particularly advanced in Belgium, Romania, the Netherlands and Portugal.

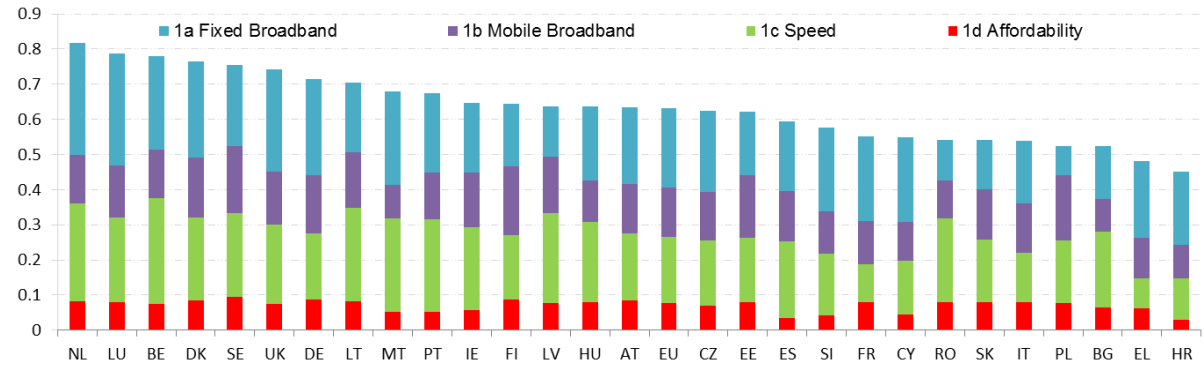
As for mobile broadband, the Nordic countries (Finland, Sweden and Denmark) lead Europe along with Estonia and Poland, while the lowest scores were registered by Bulgaria, Malta and Croatia.

Figure 1.3. EU average of Connectivity Indicators in DESI 2017

Connectivity Indicators in DESI 2017	EU
1a1 Fixed Broadband Coverage % households	**98%** 2016
1a2 Fixed Broadband Take-up % households	**74%** 2016
1b1 Mobile Broadband Take-up Subscriptions per 100 people	**84** June 2016
1b2 4G coverage % households (average of operators)	**84%** 2016
1b3 Spectrum % of the target	**68%** 2016
1c1 NGA Coverage % households	**76%** 2016
1c2 Subscriptions to Fast Broadband % subscriptions >= 30Mbps	**37%** June 2016
1d1 Fixed Broadband Price % income	**1.2%** price 2016, income 2015

Source: DESI 2017, European Commission

Figure 1.4. Digital Economy and Society Index (DESI) 2107, Connectivity



Source: DESI 2017, European Commission

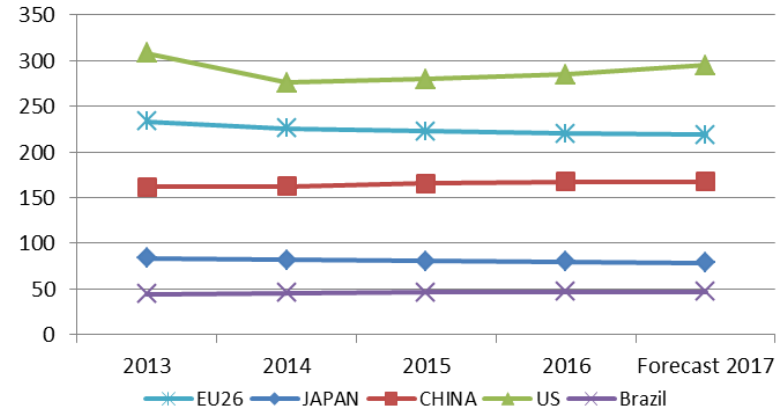
Total telecom services revenues have declined by 6 % in Europe since 2013. Mobile and fixed voice revenues have decreased by 23 % since 2013. An increase in mobile data and internet services was not enough to offset the major decline in voice services.

Telecom operators in Europe generated less revenue than the US operators. Revenues fell from EUR 233 billion in 2013 to EUR 220 billion in 2016 in Europe. At the same time, the US

revenues also slightly declined from EUR 308 billion to EUR 295 billion, which is higher than Europe despite its smaller population.

Note: this analysis is based on detailed figures from 26 Member States, which covered about 98% of the total EU market (total telecom carrier services).

Figure 1.5. Total telecommunication revenues per region, billion EUR, 2013-2017



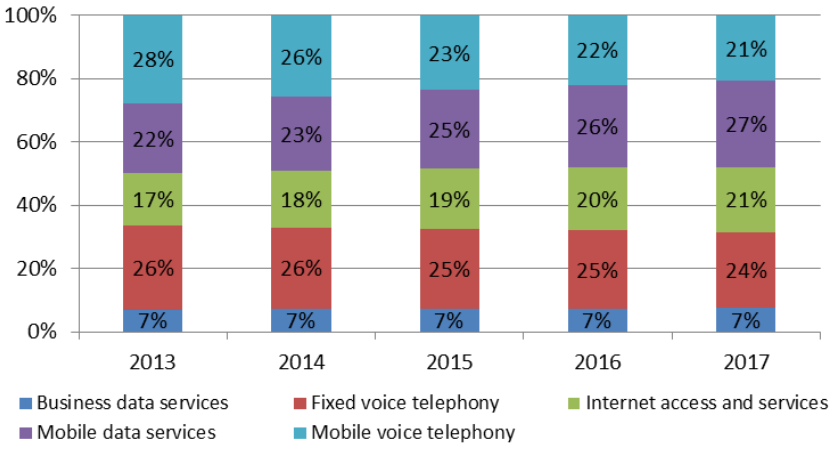
Source: 2016 EITO in collaboration with IDC.

Analysis of telecommunications revenues (carrier services) by segment shows a decline in voice services (both fixed and mobile) revenues. Fixed voice services have fallen by 15.3 % since 2013, compared to 29.9% for mobile services over the same period. Together, fixed and mobile voice services will represent 48 % of total telecom revenues in 2017, compared with 54 % in 2013.

Mobile data services will represent 27 % of total revenues, up from 22 % in 2013. The growth in mobile data services could not, however, compensate for the major decline in voice services.

Note: this analysis is based on figures from 7 Member States, Belgium, France, Germany, Italy, Spain, Greece, Spain and the UK, which covered about 70 % of the total EU market (total telecom carrier services).

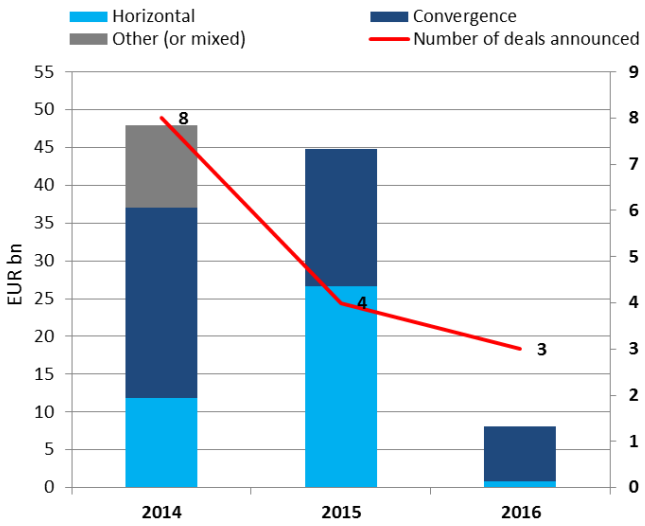
Figure 1.6. European telecommunications revenues by segment, % of total, 2013 – 2017



Source: 2016 EITO in collaboration with IDC.

In 2016, M&A activity among European telco operators decreased, especially when it comes to in-market consolidation. In-market consolidation of large networks continued to raise competition concerns, unlike the combination of large mobile and fixed networks.

Figure 1.7. Large telco mergers and acquisitions 2014-2016, value and number of deals announced



*Source: EC, based on company statements and press reports**

**Mergers valued at EUR 500 million or higher*

***In the case of joint ventures the reported Enterprise Value (EV) of one of the merging parties (with the higher EV) was used as a proxy. When not reported, the EV was estimated.*

Unlike in 2014 and 2015, no large-scale mergers were agreed in 2016 which would have led to the integration of large networks in the same market. Whilst Orange and Bouygues were in talks for an acquisition of Bouygues, no agreement has been reached.

The largest telco merger announced in 2016 was the merging of Vodafone`s and Liberty Global`s Dutch operations, creating a converged fixed-mobile player. In Spain, Masmovil, a fixed and virtual mobile operator, acquired the smallest mobile network, Yoigo. With this acquisition it becomes the fourth fixed-mobile player in a market characterised by a high level of fixed-mobile convergence. In Italy Enel Open Fibre acquired joint control over Metroweb - both provide wholesale broadband access services through fiber networks.

The European Commission continued to identify competition concerns stemming from the combination of large networks in the same markets (prohibition of Hutchison`s proposed acquisition of O2 in the UK and approval of Hutchison/VimpelCom JV in Italy conditional on the

divestment of sufficient assets that will allow a new operator to enter the market). However, no competition concerns were raised due specifically to the combination of fixed and mobile networks, even if these were large networks (e.g. Liberty Global/Base in Belgium)

Broadband coverage: Basic broadband is available to everyone in the EU, while fixed technologies cover 98 % of homes. Next generation access (NGA) covers 76 %, up from 71 % six months ago. Deployment of 4G mobile continued to increase sharply. Rural coverage improved substantially in 4G and NGA.

Basic broadband is available to all in the EU, when considering all major technologies (xDSL, cable, fibre to the premises - FTTP, WiMax, HSPA, LTE and Satellite). Fixed and fixed-wireless technologies cover 98 % of EU homes.

NGA technologies (VDSL, Cable Docsis 3.0 and FTTP) capable of delivering at least 30 Mbps download are available to 76 %.

4G mobile (LTE) coverage increased by seven percentage points and reached 96 % (of homes covered by at least one operator).

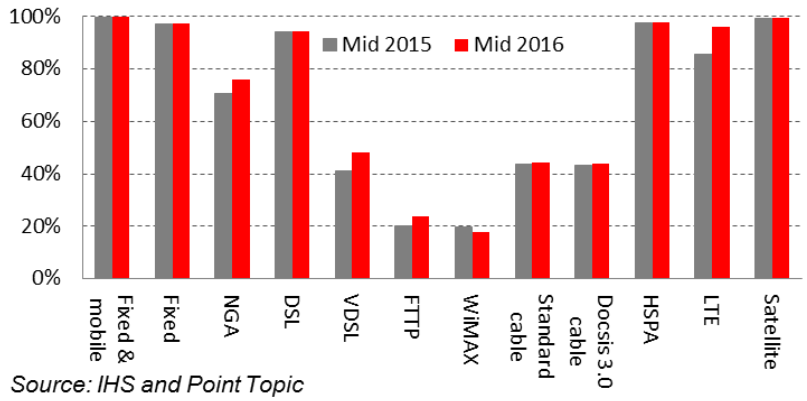
Rural 4G coverage went up from 36 in 2015 % to 80 % in 2016. NGA is available in 40 % of rural homes, compared with 30 % a year ago.

Our target (Digital Agenda for Europe)

Basic broadband for all by 2013: 100 % in 2016

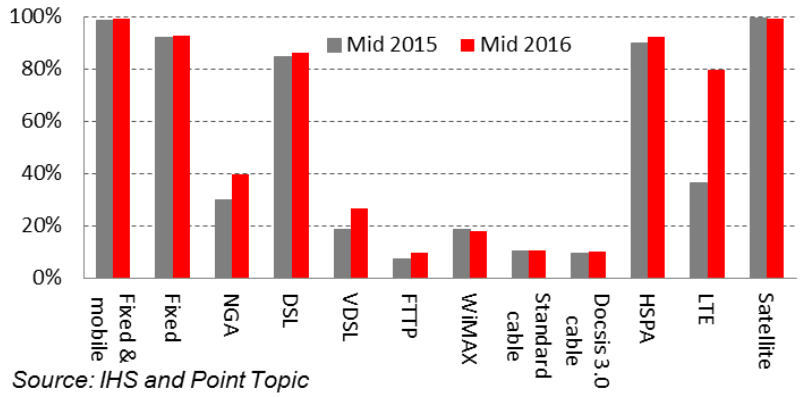
Fast broadband (>30Mbps) for all by 2020: 76 % in 2015

Figure 1.8. Total coverage by technology at EU level, 2015-2016



Source: IHS and Point Topic

Figure 1.9. Rural coverage by technology at EU level, 2015-2016



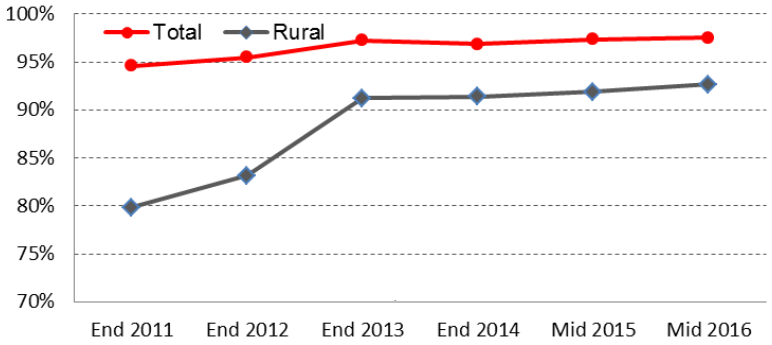
Source: IHS and Point Topic

Coverage of fixed broadband increased slightly to 98 %. In about half of the Member States more than 99 % of homes are covered. At the same time, Poland, Slovakia and Romania are lagging behind with less than 90 %.

Primary internet access at home is provided mainly by fixed technologies. Among these technologies, xDSL has the largest footprint (94 %) followed by cable (44 %) and WiMAX (18 %). Fixed coverage is the highest in the Member States with well-developed DSL infrastructures, and is over 90% in all but three Member States.

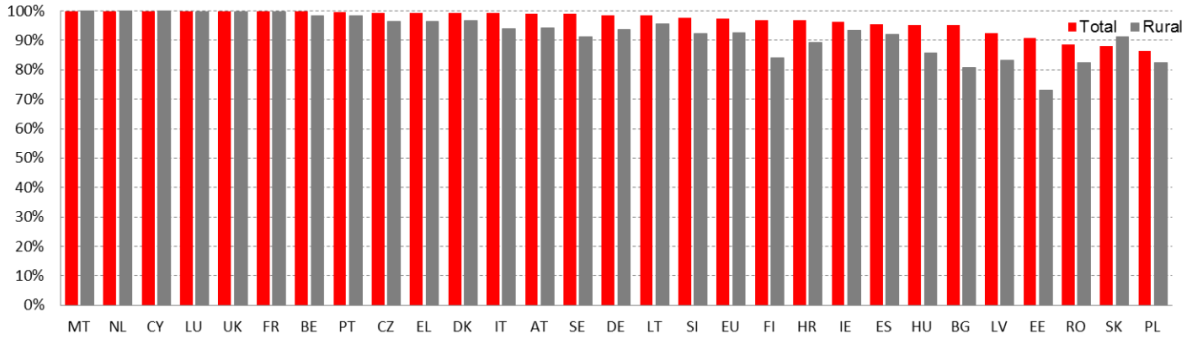
Overall coverage of fixed broadband has only marginally increased since 2011, but rural coverage improved by 13 percentage points. Developments have slowed down, as Member States have diverted their focus to NGA and wireless technologies.

Figure 1.10. Fixed broadband coverage in the EU, 2011-2016



Source: IHS, VVA and Point Topic

Figure 1.11. Fixed broadband coverage, June 2016



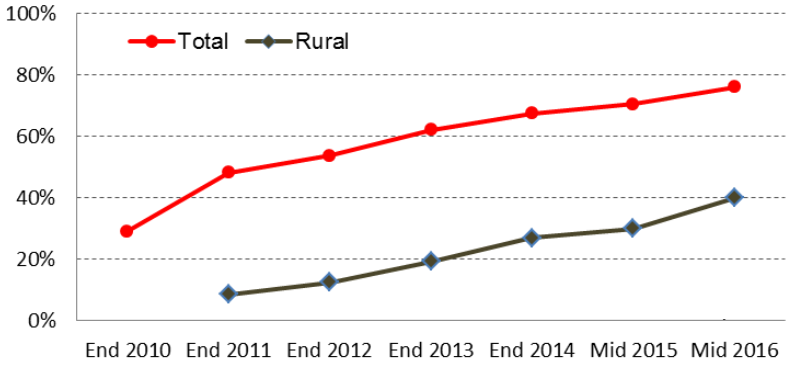
Source: IHS and Point Topic

Coverage of next generation access (NGA) technologies continued to increase and reached 76 %. NGA is getting more widespread in rural areas, covering 40% of homes.

For the purpose of this report, Next Generation Access includes VDSL, Cable Docsis 3.0 and FTTP. At mid-2016, VDSL had the largest NGA coverage at 48 %, followed by Cable (44 %) and FTTP (24 %). Most of the upgrades in European cable networks had taken place by 2011, while VDSL coverage is now 2.5 times larger than four years ago. VDSL increased most in Italy last year, growing from 41% in 2015 to 72% in 2016. There was a remarkable progress also in FTTP (from 10 % in 2011 to 24 % in 2016), but FTTP coverage is still low.

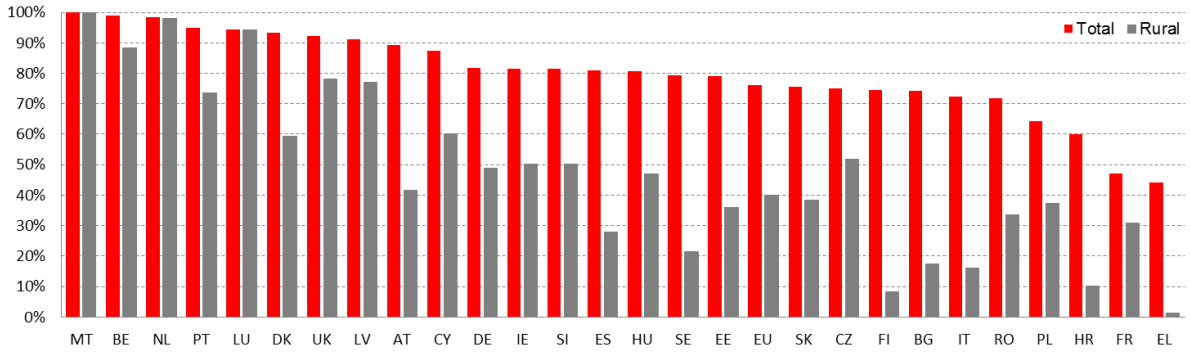
Rural NGA coverage went up by 10 percentage points, reaching 40 % of homes. NGA in rural areas is provided mainly by VDSL.

Figure 1.12. Next generation access (NGA) broadband coverage in the EU, 2010-2016



Source: IHS, VVA and Point Topic

Figure 1.13. Next generation access (FTTP, VDSL and Docsis 3.0 cable) coverage, June 2016

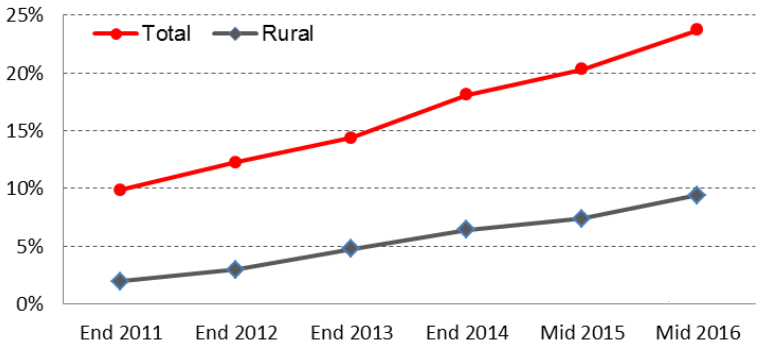


Source: IHS and Point Topic *Data not available for Lithuania*

Coverage of fibre to the premises (FTTP) grew from 10 % in 2011 to 24 % in 2016, while it remains a primarily urban technology. Portugal and Latvia are the leaders in FTTP in Europe.

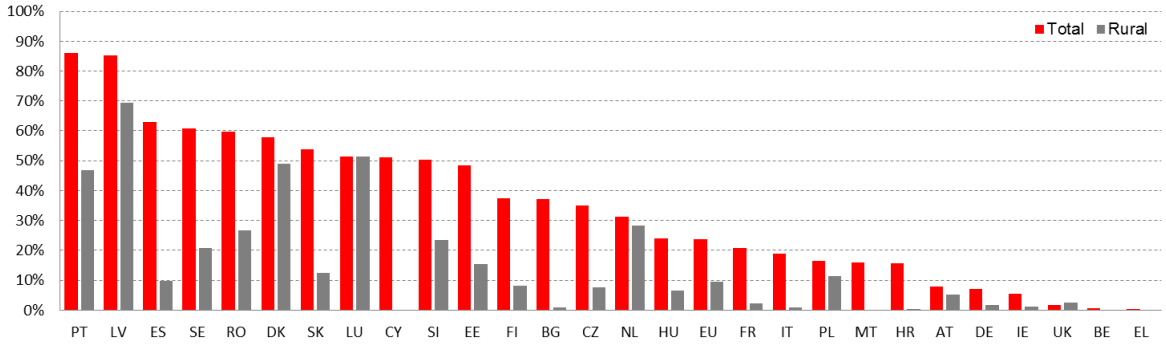
FTTP is catching up in Europe, as coverage for homes more than doubled since 2011. However, the FTTP footprint is still significantly lower than that of cable Docsis 3.0 and VDSL. In Portugal and Latvia more than 80 % of homes can already subscribe to FTTP services, while in Greece, Belgium, UK, Ireland, Germany and Austria less than 10 % can do so. FTTP increased the most in the Czech Republic last year (from 17 % to 35 %). FTTP services are available mainly in urban areas with the exception of Latvia, Denmark, Luxembourg, Romania and Netherlands, where more than 25 % of rural homes also have access to it.

Figure 1.14. Fibre to the premises (FTTP) coverage in the EU, 2011-2016



Source: IHS, VVA and Point Topic

Figure 1.15. Fibre to the premises (FTTP) coverage, June 2016



Source: IHS and Point Topic *Data not available for Lithuania*

Overall fixed broadband and NGA broadband coverage by region

Figure 1.16. Overall fixed broadband coverage by region, June 2016

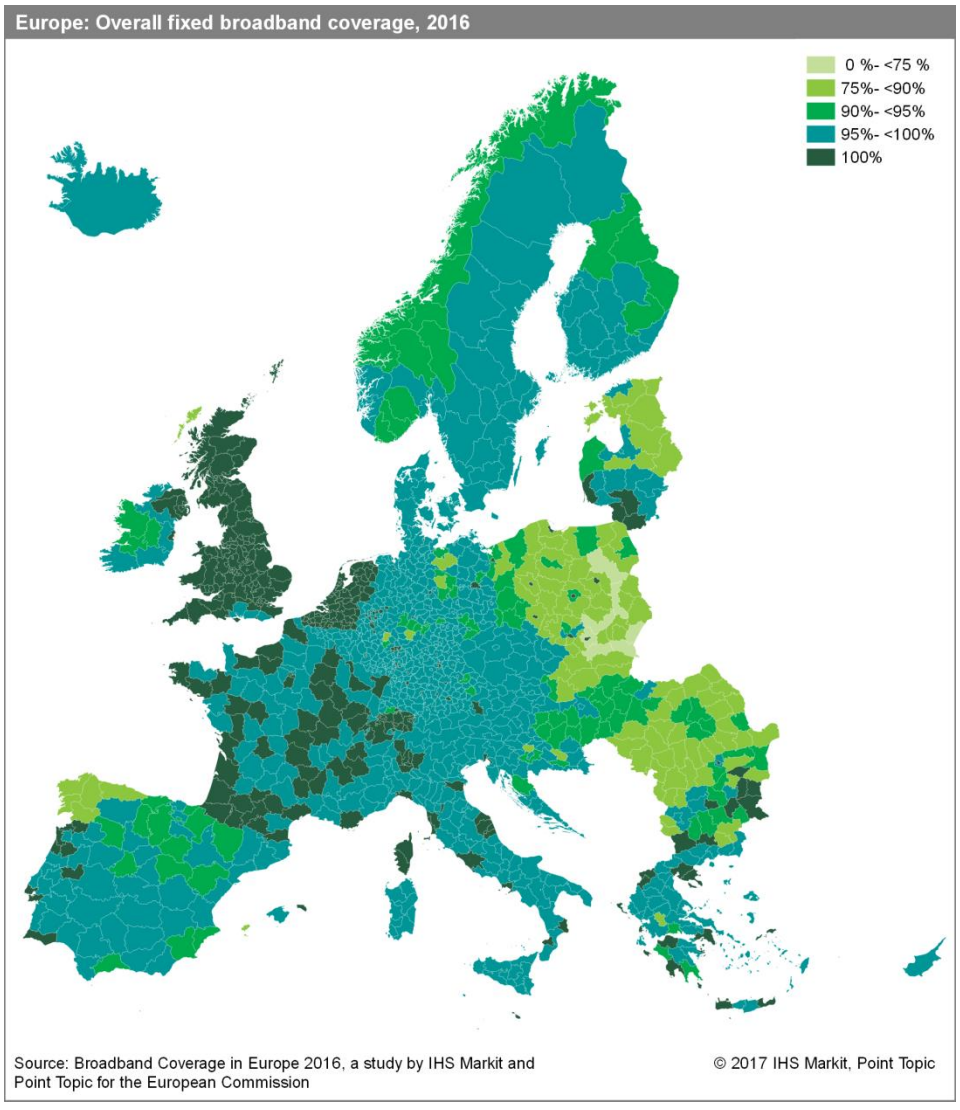
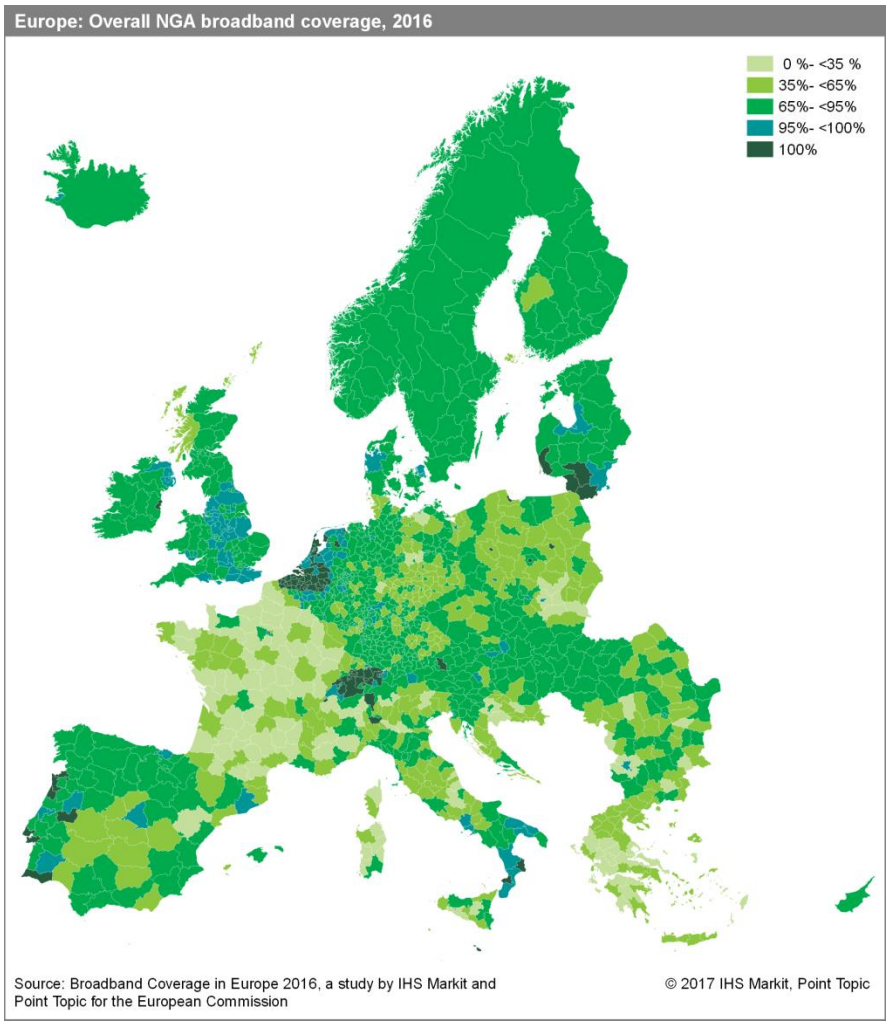


Figure 1.17. NGA broadband coverage by region, June 2016



Source: IHS and Point Topic

4G mobile coverage: 96% of homes are covered by at least one operator in Europe (overall coverage), up from 86% a year ago. Rural coverage went up from 36% in 2015 to 80% in 2016. Average 4G availability[1] stands at 84%.

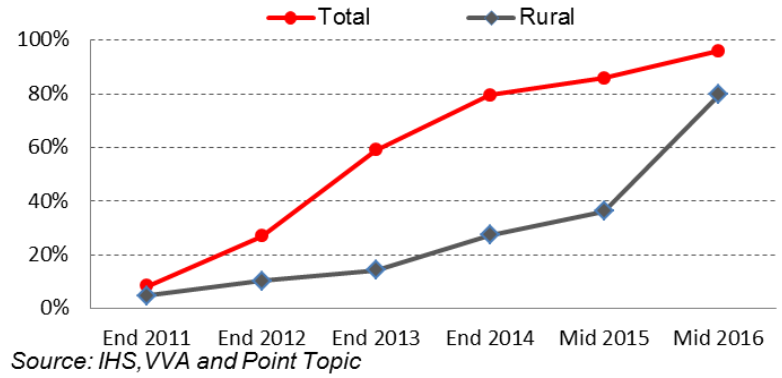
In 2016, deployment of 4G (LTE) continued and focused mainly on rural areas: overall coverage went up to 96 % of homes. In rural areas, already 80% of homes are covered by at least one operator.

Average 4G availability (calculated as the average of each operator's coverage) falls somewhat below the overall coverage and stands at 84%.

[1] This is a new indicator measuring the average of mobile telecom operator's coverage within each country. A different indicator was used to measure 4G coverage in previous versions of the Digital Scoreboard. The old 4G indicator measured the overall coverage of operators, and it showed higher figures than the new indicator.

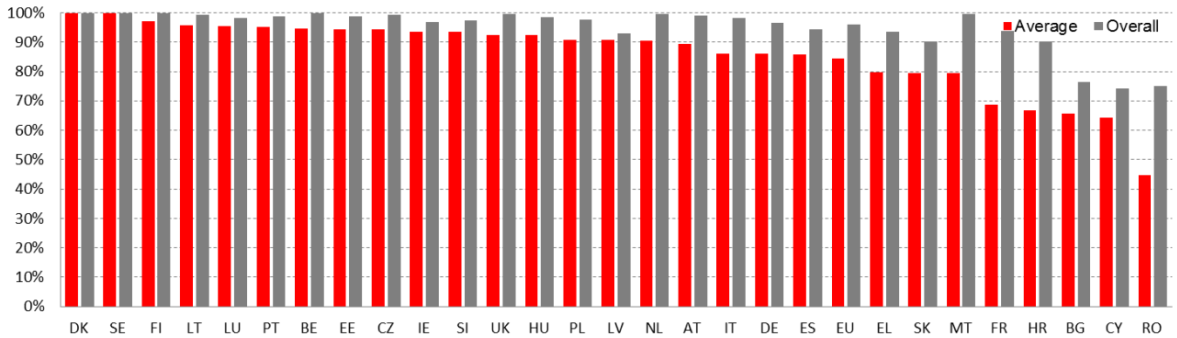
Average 4G coverage is above 90% in about half of the Member States, and is the lowest in Romania at 45%

Figure 1.18. 4G mobile broadband coverage in the EU, 2011-2016



Source: IHS, VVA and Point Topic

Figure 1.19. 4G (LTE) coverage, June 2016

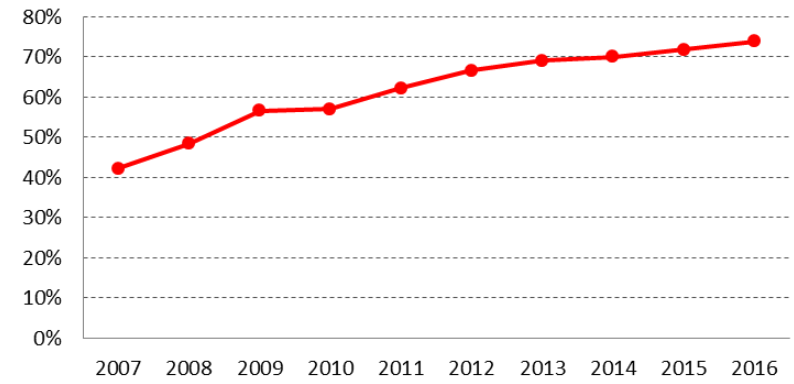


Source: IHS and Point Topic *Average coverage in Malta refers to 2015*

74 % of EU homes had a fixed broadband subscription in 2016. Luxembourg, the Netherlands and the UK registered the highest figures in the EU, while Italy, Bulgaria and Poland had the lowest take-up rates.

Although fixed broadband is available to 98 % of EU homes, 26 % of homes do not have a subscription. Growth in take-up was very strong until 2009, but then slowed down in the last few years, partially due to fixed-mobile substitution. At Member State level, take-up rates ranged from only 55 % in Italy to 96 % in Luxembourg.

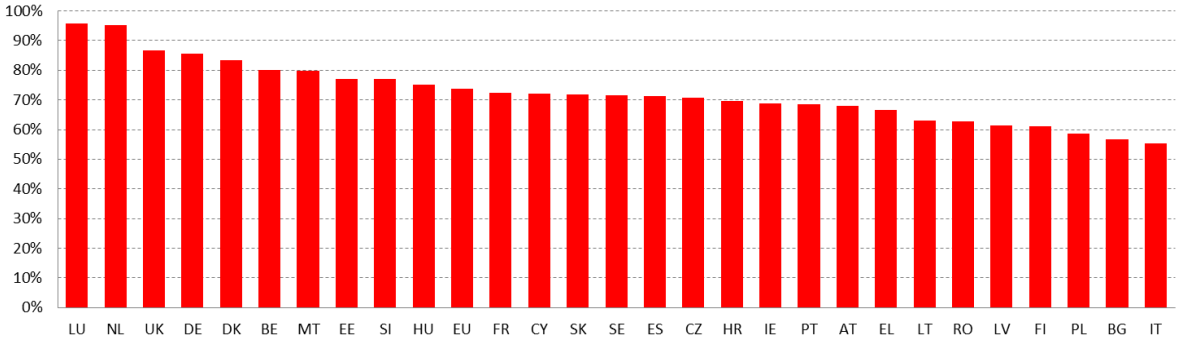
Figure 1.20. Households with a fixed broadband subscription at EU level (% of households), 2007-2016*



Source: Eurostat (ICT usage in households and individuals)

** Note: Penetration figures include also mobile subscriptions until 2009.*

Figure 1.21. Households with a fixed broadband subscription, 2016

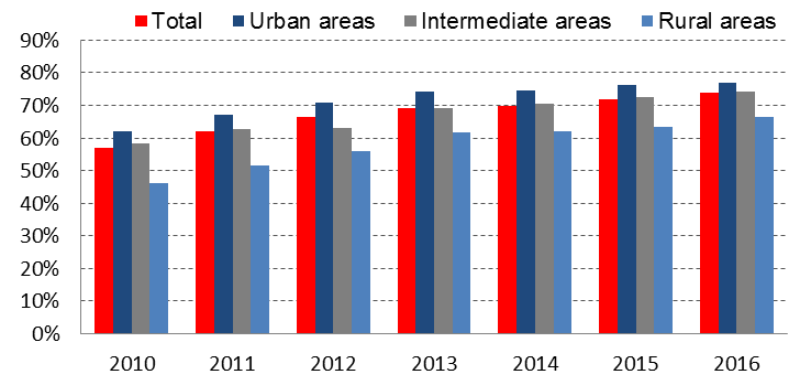


Source: Eurostat (ICT usage in households and individuals)

66 % of rural homes had a fixed broadband subscription across the EU in 2016. Luxembourg, the Netherlands, the UK and Germany registered the highest figures, while in four Member States, less than half of the homes subscribed.

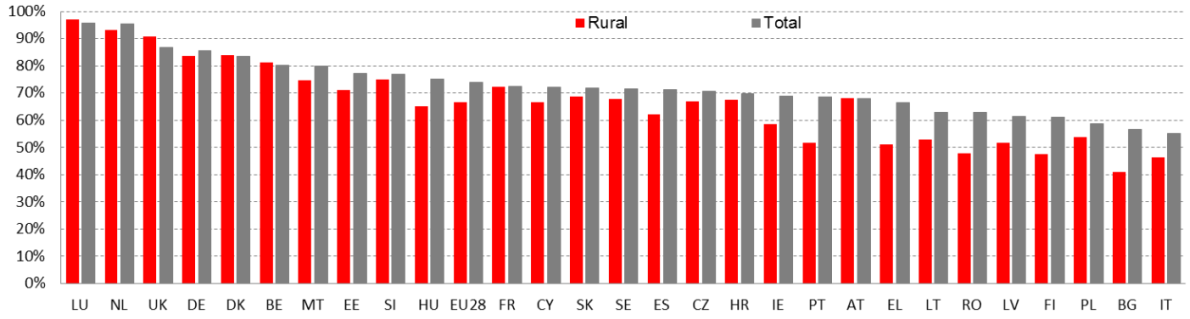
There is a substantial gap between rural and national penetration rates, although the gap has closed over the last six years, from 11 percentage points in 2010 to 7 percentage points in 2016. In Luxembourg, Netherlands, Germany, Belgium, Denmark, Austria, Croatia and Slovenia, rural and national penetration rates are almost identical. However, in Portugal, Bulgaria, Greece and Romania, where rural take-up is among the lowest in Europe, there are significant gaps of 15-17 percentage points compared to the national take-up.

Figure 1.22. Households having a fixed broadband connection per area at EU level (% of households), 2010-2016



Source: Eurostat (ICT usage in households and individuals)

Figure 1.23. Household fixed broadband penetration rural/total (% of households), 2016

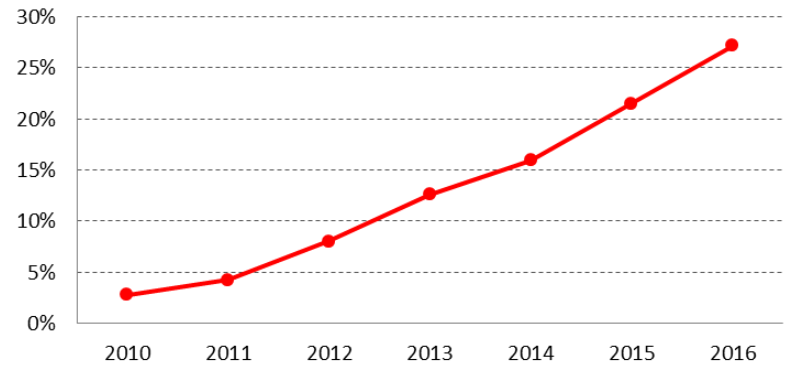


Source: Eurostat (ICT usage in households and individuals)

27 % of European homes subscribe to fast broadband access of at least 30 Mbps. There has been a significant increase since 2010. Belgium and the Netherlands are the leaders in Europe in fast broadband take-up.

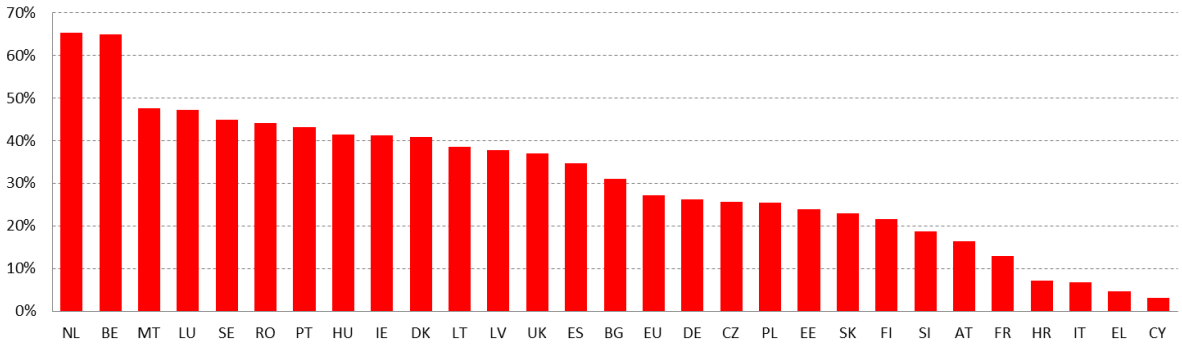
There has been a sharp upward trend in the take-up of fast broadband in the EU since 2010, triggered also by continuous deployment of infrastructure. Most cable subscriptions were migrated to high-speed plans, and high-speed VDSL and fibre services are also catching up. In Belgium and the Netherlands two thirds of homes already subscribe to fast broadband, while in Croatia, Greece, Italy and Cyprus, high-speed services still remain marginal.

Figure 1.24. Percentage of households with a fast broadband (at least 30Mbps) subscription at EU level, 2010-2016



Source: Communications Committee

Figure 1.25. Fast broadband (at least 30Mbps) household penetration, July 2016

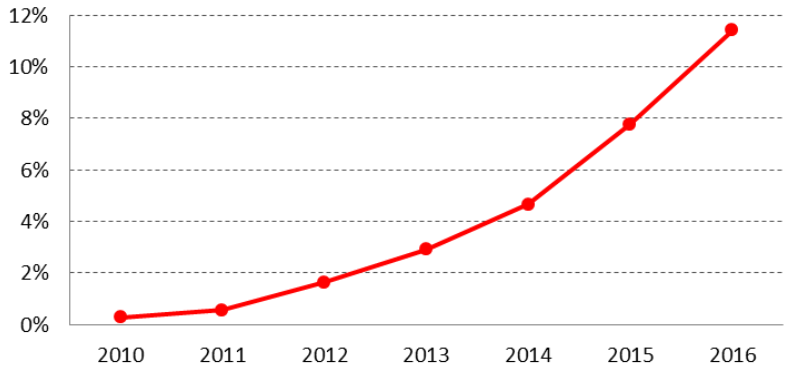


Source: Communications Committee

11 % of European homes currently subscribe to ultrafast broadband (at least 100 Mbps), a marked improvement from 0.3 % six years ago. Romania, Sweden, the Netherlands and Latvia are the most advanced in ultrafast broadband adoption.

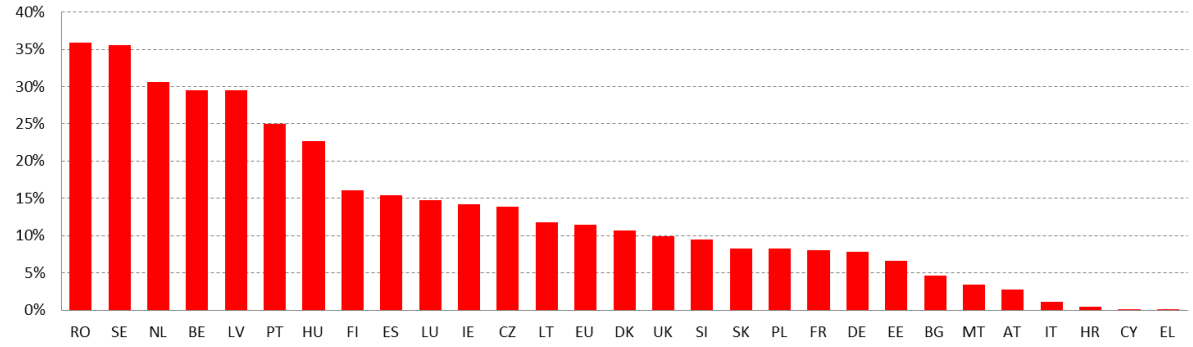
The Digital Agenda for Europe set the objective that at least 50 % of homes should subscribe to ultrafast broadband by 2020. In June 2016, 49 % of homes were covered by networks capable of providing 100 Mbps. As service offerings are emerging, take-up is growing sharply. The penetration is the highest in Romania and Sweden with over one third of homes subscribing to at least 100 Mbps. In Greece, Italy and Croatia take-up is low primarily due to the lack of superfast infrastructure. However, there may also be other factors involved as in Cyprus, where the infrastructure is available for many homes, take-up also continues to be slow.

Figure 1.26. Percentage of households with an ultrafast broadband (at least 100Mbps) subscription at EU level, 2010-2016



Source: Communications Committee

Figure 1.27. Percentage of households with an ultrafast broadband (at least 100Mbps) subscription, July 2015

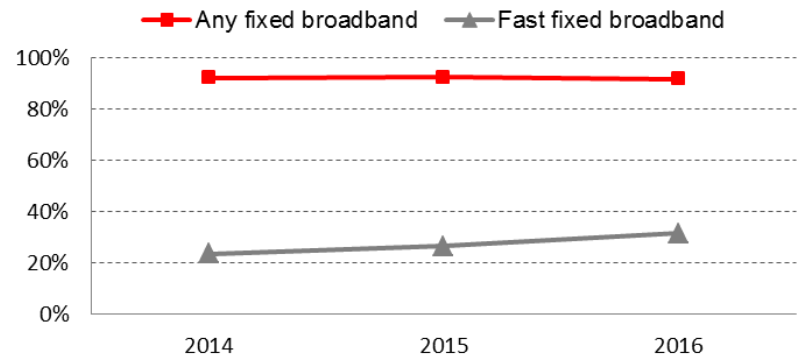


Source: Communications Committee

At EU level, 92 % of companies have a fixed broadband subscription. However, only 32 % benefit from fast broadband (at least 30Mbps). While almost all large companies use broadband, 8 % of small enterprises are not yet connected.

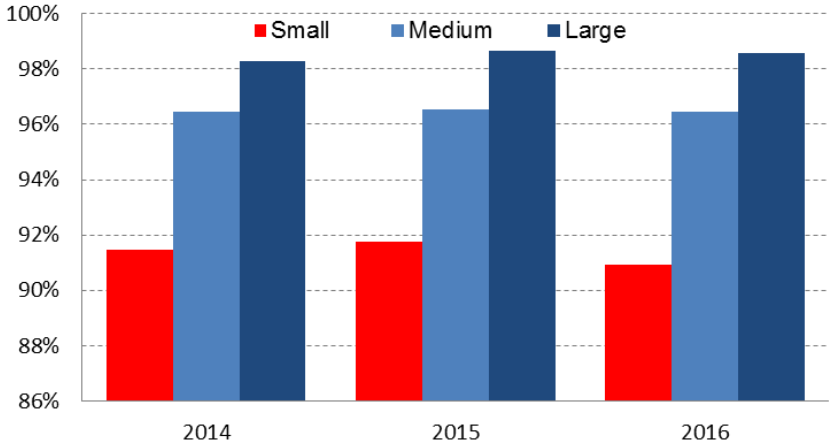
While the vast majority of European businesses use broadband, only one third of companies and 27% of private homes subscribed to fast broadband in 2016. The penetration of fast broadband varies greatly between companies of different size. While 62 % of large companies benefit from broadband speed of at least 30 Mbps, only 29% of small enterprises do so. Nevertheless, the penetration of fast broadband went up from 24 % to 32 % among all enterprises during the last two years.

Figure 1.28. Enterprises having a fixed broadband connection at EU level, 2014-2016



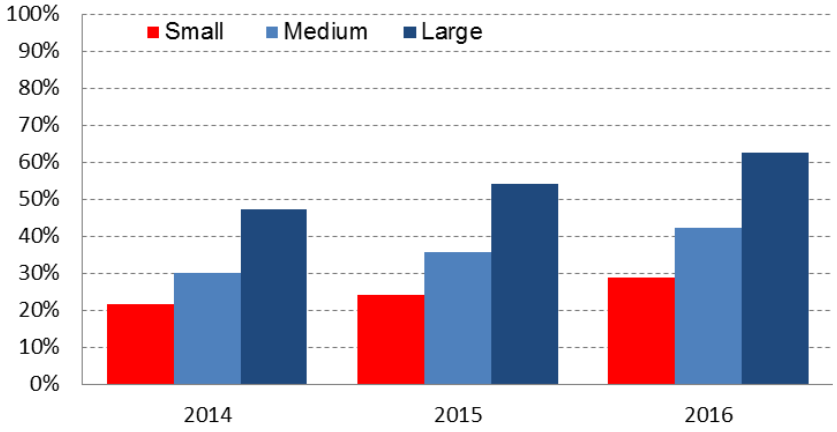
Source: Eurostat (ICT usage and e-commerce in enterprises)

Figure 1.29. Percentage of enterprises having a fixed broadband connection, by Enterprise size at EU level, 2014-2016



Source: Eurostat (ICT usage and e-commerce in enterprises)

Figure 1.30. Percentage of enterprises having a fast fixed broadband connection, by Enterprise size at EU level, 2014-2016

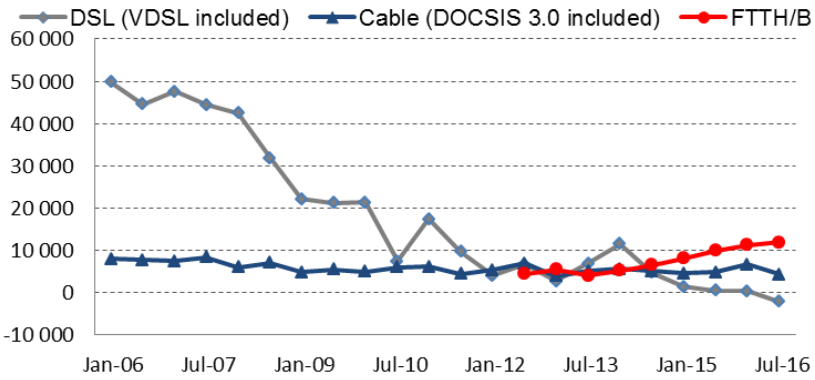


Source: Eurostat (ICT usage and e-commerce in enterprises)

67 % of subscriptions are xDSL, although xDSL is slightly losing market share. Cable is second with 19 % of the market. Fibre to the Home/Building is emerging.

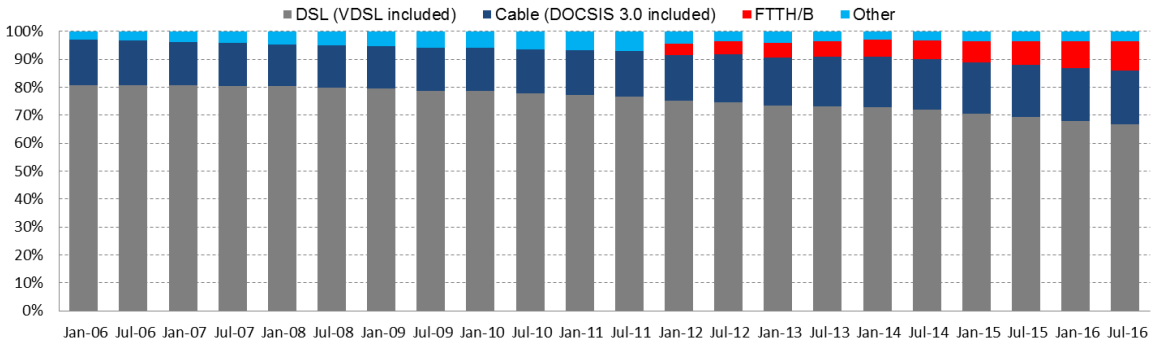
Although DSL is still the most widely used fixed broadband technology, its market share declined from 80 % in 2009 to 67 % in 2016. The second half of 2016 was the first time, when the number of xDSL subscriptions declined. The main challenger — cable — increased slightly its share during the same time period, but most of the gains were posted by alternative technologies such as FTTH/B. Nevertheless, DSL continues to be predominant, and its market share can be strengthened thanks to the increasing VDSL coverage.

Figure 1.31. Fixed broadband net adds by technology at EU level, 2006-2016



Source: Communications Committee

Figure 1.32. Fixed broadband subscriptions — technology market shares at EU level, January 2006 to July 2016



Source: Communications Committee

xDSL is particularly important in Greece and Italy, and has the lowest market share in Bulgaria, Lithuania and Romania. Cable has a very high market share in Belgium, Hungary, Malta and the Netherlands. FTTH/B is the most widely used technology in Lithuania, Latvia, Romania, Bulgaria and Sweden.

The share of xDSL ranges from 12 % in Bulgaria to 100 % in Greece. DSL is generally less dominant in Eastern Europe. Looking at alternative technologies, cable is present in all but two Member States and it is the major technological competitor of DSL in the majority of the Member States.

FTTH and FTTB together represent 11 % of EU broadband subscriptions up from 9 % a year ago. In these technologies, Europe continues to lag behind global leaders such as South Korea and Japan.

Figure 1.33. Share of fibre connections in total fixed broadband, July 2016

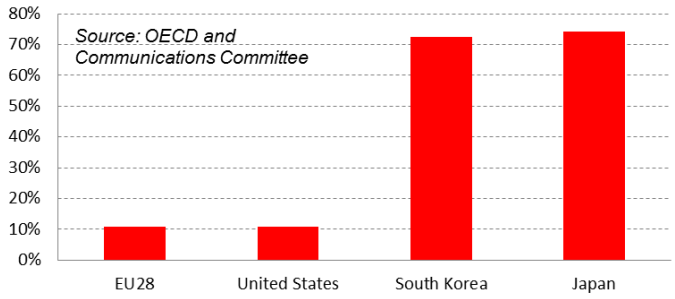
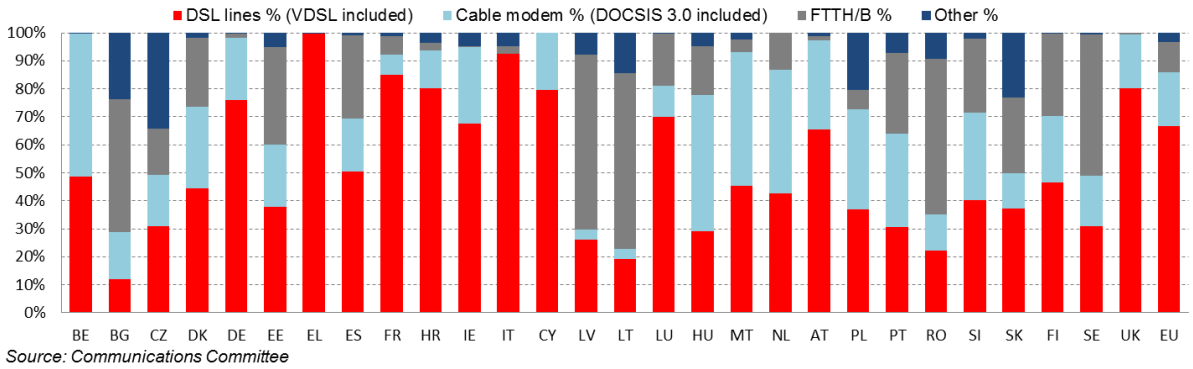


Figure 1.34. Fixed broadband subscriptions — technology market shares, July 2015



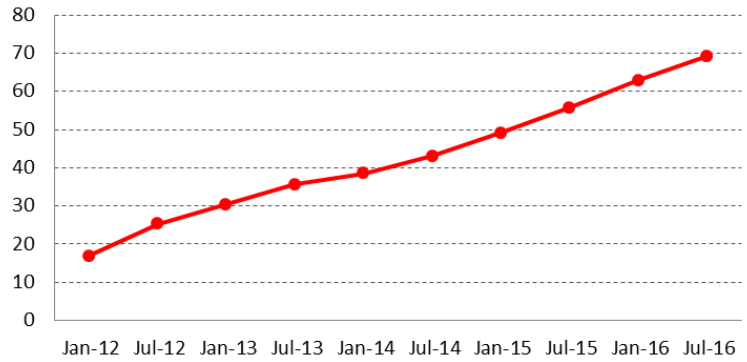
Source: Communications Committee

NGA subscriptions went up sharply by 20 million in the last two years, and already 42 % of all subscriptions are NGA. In Belgium, Romania and the Netherlands, over three quarter of fixed broadband subscriptions are NGA, while the same ratio is less than 10 % in Greece and Cyprus

NGA subscriptions in the EU doubled during the last three years and account for 42 % of all EU fixed broadband subscriptions. At least two thirds of broadband subscriptions are NGA in

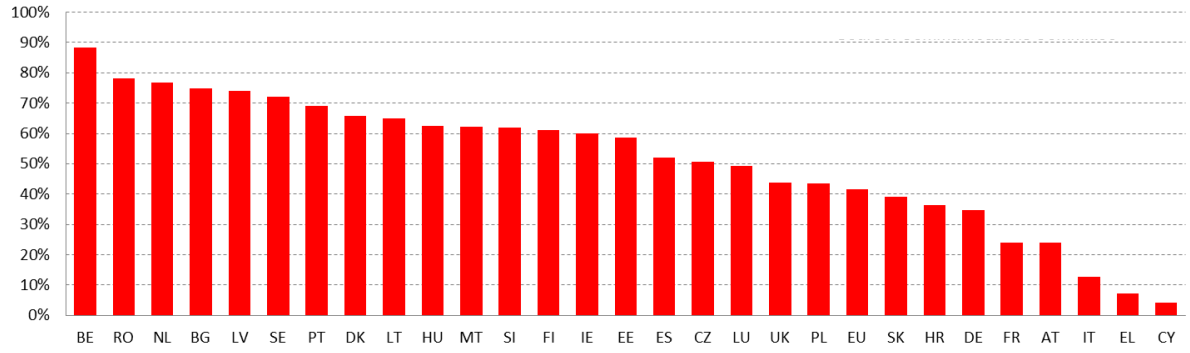
Belgium, Romania, the Netherlands, Bulgaria, Latvia, Sweden, Portugal and Denmark. Whereas, Cyprus, Greece, Italy, Austria and France are lagging behind all other Member States

Figure 1.35. Evolution of NGA (FTTH, FTTB, VDSL, Cable Docsis 3.0 and other NGA) subscriptions (in millions) in the EU, 2012-2016



Source: Communications Committee

Figure 1.36. NGA (FTTH, FTTB, VDSL, Cable Docsis 3.0 and other NGA) subscriptions as a % of total fixed broadband subscriptions, July 2016

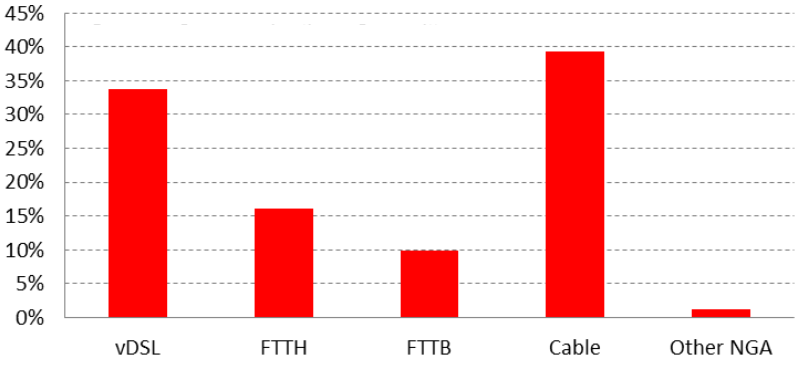


Source: Communications Committee

Cable Docsis 3.0 is currently the most widespread NGA technology in the EU both in coverage and take-up. VDSL subscriptions went up by 47% in the last twelve months.

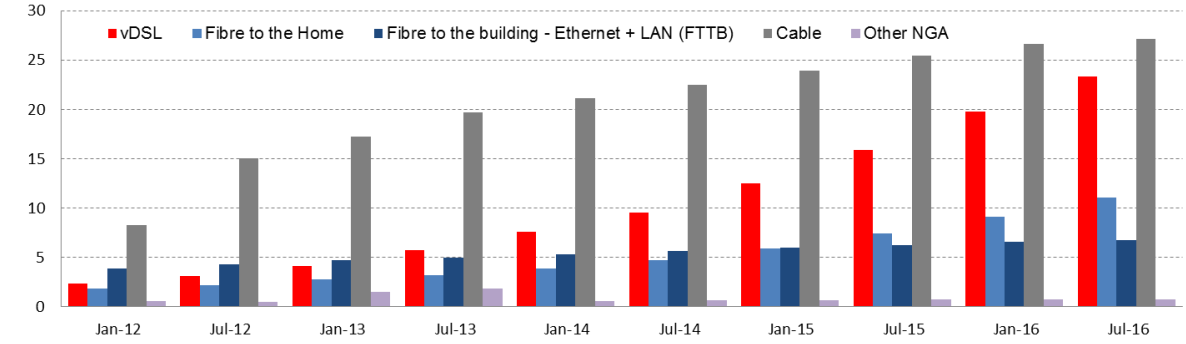
39 % of NGA subscriptions are Docsis 3.0, which is relatively high given cable broadband in total represents only 19 % of all EU fixed broadband subscriptions. While almost all the cable networks have been upgraded to NGA, only 51 % of the xDSL network is VDSL-enabled. Nevertheless, VDSL coverage went up by 17 % and the number of subscriptions by 47 % in the last twelve months. FTTH and FTTB have a 16 % and 10 % share in total NGA subscriptions, respectively.

Figure 1.37. Share of different NGA technologies in total NGA subscriptions at EU level, July 2016



Source: Communications Committee

Figure 1.38. NGA subscriptions (millions) by technology at EU level, January 2012 to July 2016



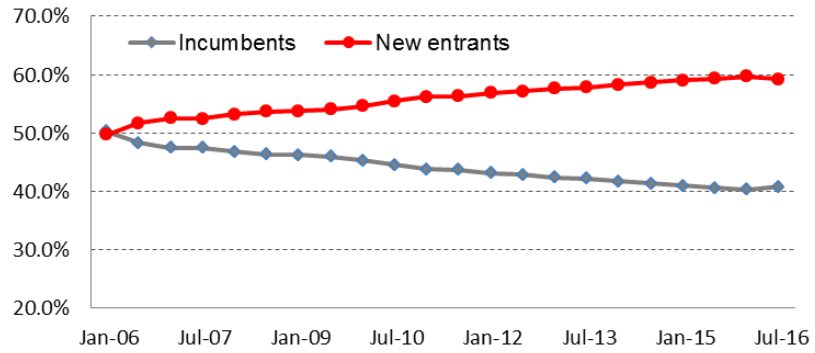
Source: Communications Committee

Competition in the fixed broadband market: new entrant operators are continuously gaining market share, but incumbents still control 41 % of subscriptions.

Incumbent operators are market leaders in almost all Member States, although their market share is decreasing gradually. During the last 10 years, new entrant operators have consistently posted higher net gains then the incumbents in each year, although a reverse in this trend has been observed over the last six months. Overall, market share of incumbents in the EU has decreased by 10 percentage points since 2006.*

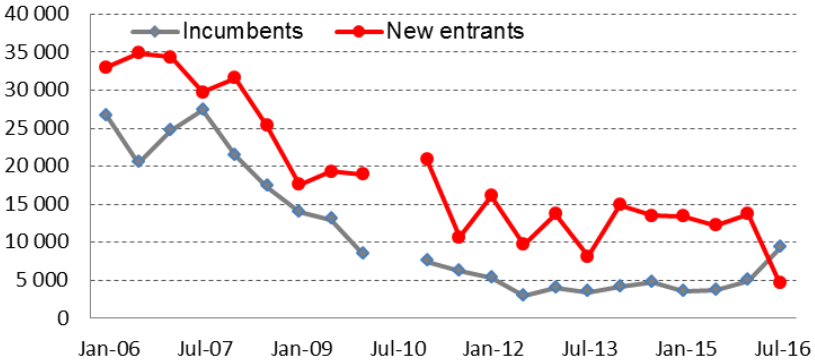
** Break in series in July 2010 due to modification of historical data.*

Figure 1.39. Fixed broadband subscriptions — operator market shares at EU level, January 2006 to July 2016



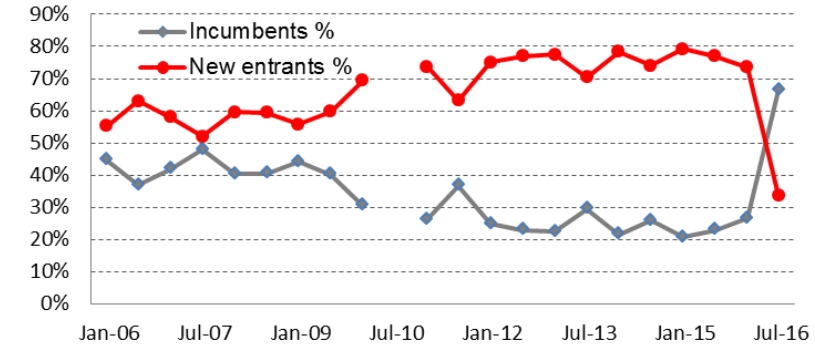
Source: Communications Committee

Figure 1.40. Fixed broadband subscriptions growth per day by operator at EU level, January 2006 to July 2016[2]



Source: Communications Committee

Figure 1.41. Fixed broadband subscriptions growth per day by operator at EU level, % of total, January 2006 to July 2016[3]



Source: Communications Committee

[2] Break in series in July 2010 due to modification of historical data.
[3] Break in series in July 2010 due to modification of historical data.

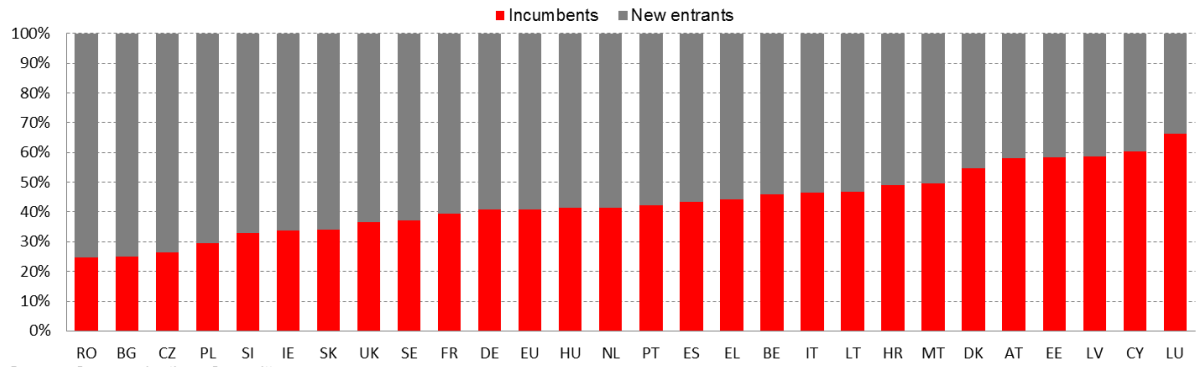
1. Connectivity: Broadband market developments in the EU (continued)

Market shares of incumbents are shown to have large differences across Europe. In 7 out of the 28 Member States, at least half of the subscriptions are provided by incumbent operators

Market shares are calculated at national level for incumbents and new entrants. However, broadband markets are geographically fragmented suggesting that a large number of homes are served by only one provider (most likely by the incumbent operator in this case).

Incumbents have the highest subscription market share in Luxembourg and Cyprus, where the small market size may favour concentration. In contrast, incumbents are the weakest in Europe in Romania, Bulgaria, the Czech Republic and Poland where most subscribers use technologies other than xDSL.

Figure 1.42. Fixed broadband subscriptions — operator market shares, July 2016



Source: Communications Committee

In the DSL market, unbundling reduced the dominance of incumbents, but in VDSL incumbents hold 66 % of subscriptions. Nevertheless, NGA is provided mainly by new entrants because of the high share of cable.

New entrant operators can compete with incumbents by using either the incumbent's network or their own network to offer internet access. In Greece, competition is entirely based on regulated access to the incumbent's access network, while in Italy and France over 80 % of subscriptions are DSL. In Eastern European Member States, competition is rather based on competing infrastructures. This applies also to Belgium, Malta, Portugal and the Netherlands.

Figure 1.43. Market share of incumbents by technology (% of subscriptions) at EU level, July 2016

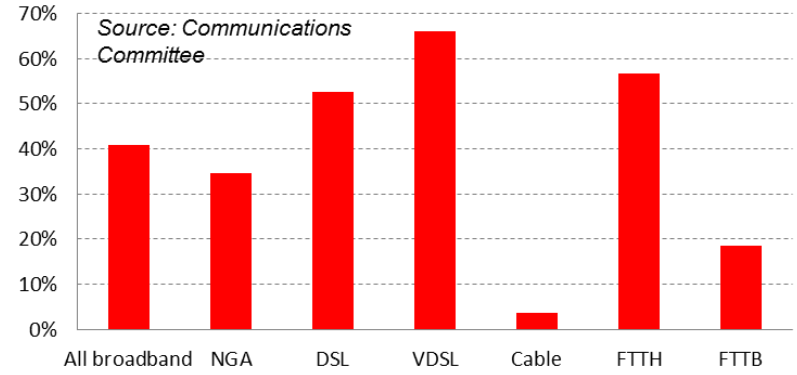
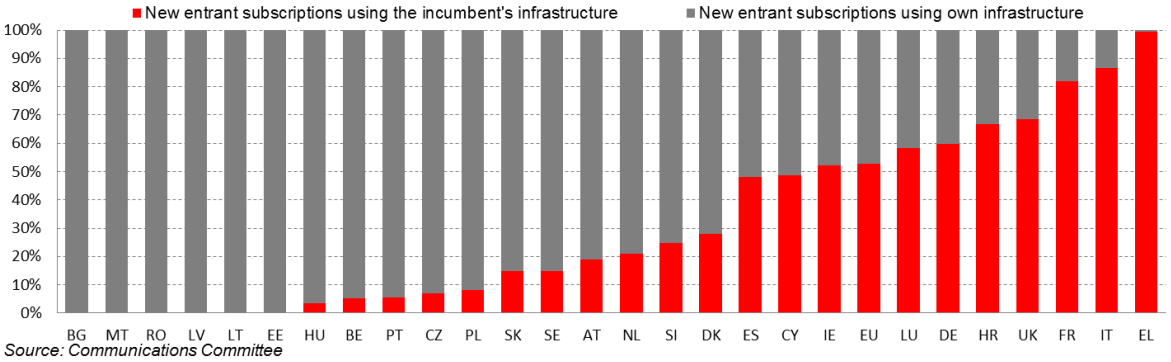


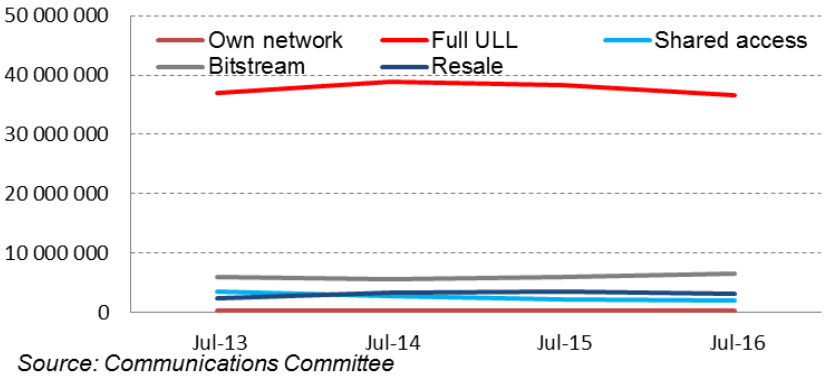
Figure 1.44. New entrants' subscriptions — using own infrastructure or the incumbent's network (% of total), July 2016



53 % of DSL subscriptions belong to incumbents. New entrants mainly use Local Loop Unbundling to sell DSL. In six Member States, the new entrants' presence in the DSL market is marginal.

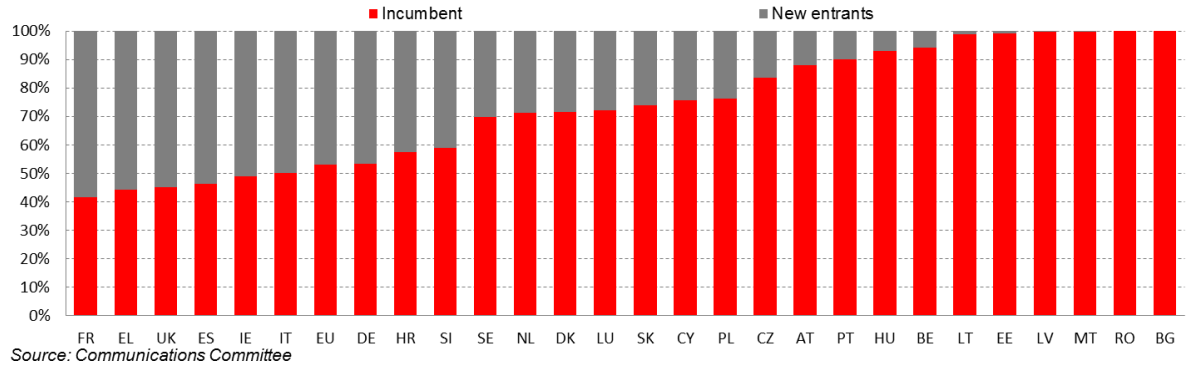
In Bulgaria, Romania, Malta, Latvia, Estonia and Lithuania, there is literally no competition in the DSL market. These Member States, however, have strong platform competition. Alternatively, in France, Greece, the UK, Spain, Ireland and Italy new entrants account for the majority of xDSL subscriptions. In all these Member States, competition is tight due to the possibility of entry via DSL subscriptions provided through Local Loop Unbundling, although in Italy bitstream is also important.

Figure 1.45. Number of DSL subscriptions by new entrants at EU level, given different types of access (VDSL excluded), 2013-2016



Source: Communications Committee

Figure 1.46. DSL subscriptions — operator market shares (VDSL included), July 2016



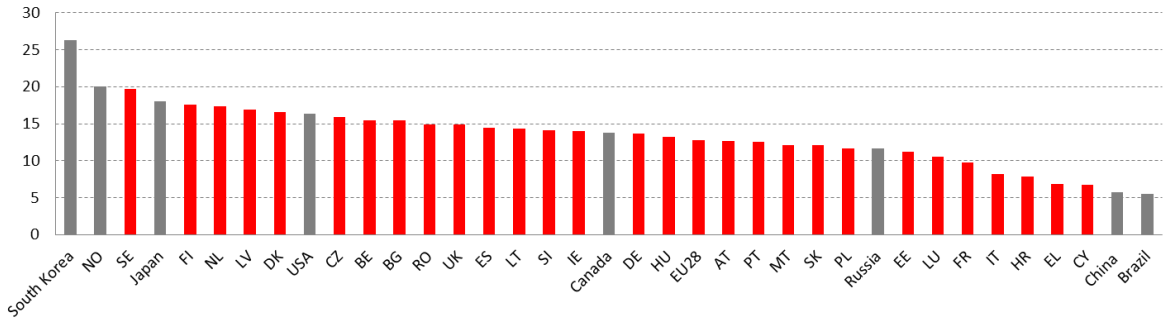
Source: Communications Committee

Average connection speed ranges from 7 Mbps to 20 Mbps in Europe. Sweden, Finland, the Netherlands and Latvia are among the top countries in Europe and worldwide.

South-Korea is the world leader in average internet connection speed at 26.3 Mbps, followed by Norway and Sweden at 20 Mbps. The EU has an average speed of 13 Mbps, which is well below the preceding leading countries, Japan (18Mbps) and also USA (16Mbps). While five Member States have higher speeds than the US, the slower speeds in the EU can be explained by a lower usage of FTTH technology and less coverage of cable.

The worst performing countries include Cyprus, Greece, Croatia, Italy and France with speeds of less than 10 Mbps. With the exception of Cyprus, all these countries have a relatively low coverage of fast broadband technologies (NGA).

Figure 1.49. Average connection speed (Mbps) by country, 2016



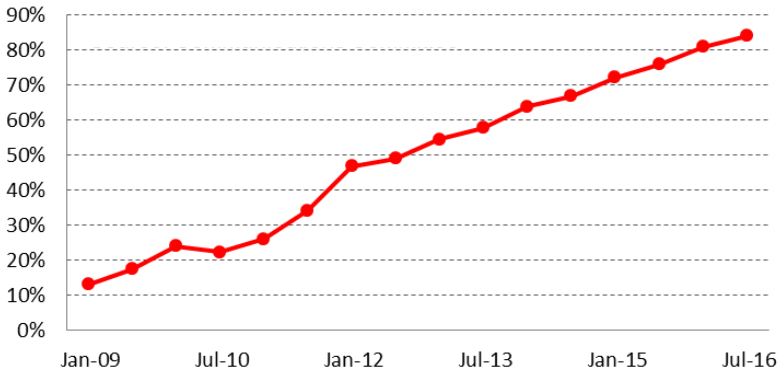
Source: Akamai, Q3 - 2016

There are 84 active mobile broadband SIM cards per 100 people in the EU, up from 34 four years ago. The growth was linear over the last four years with over 40 million new subscriptions added every year.

Mobile broadband represents a fast growing segment of the broadband market. More than 60 % of all active mobile SIM cards use mobile broadband.

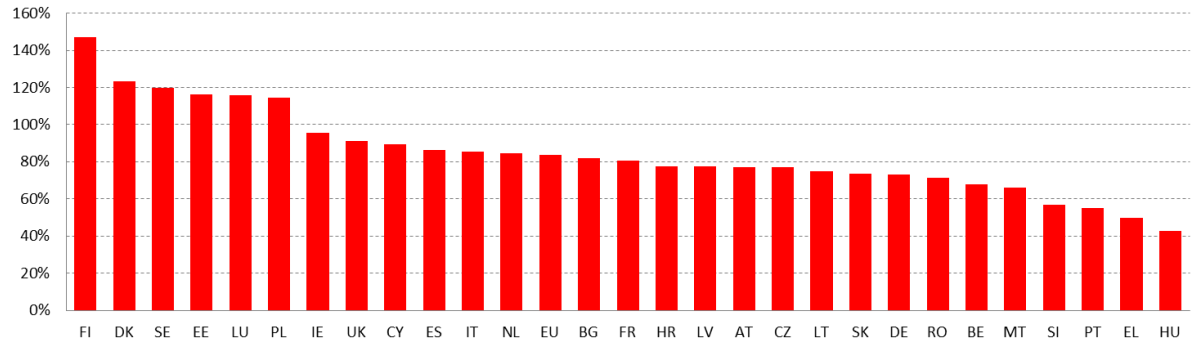
In the Nordic countries and Estonia, Luxembourg and Poland, there are already more than 100 subscriptions per 100 people, while in Hungary and Greece the take-up rate is still below 50 %. Most of the mobile broadband subscriptions are used on smartphones rather than on tablets or notebooks.

Figure 1.50. Mobile broadband penetration at EU level, January 2009 to July 2016



Source: Communications Committee

Figure 1.51. Mobile broadband penetration by country, July 2016



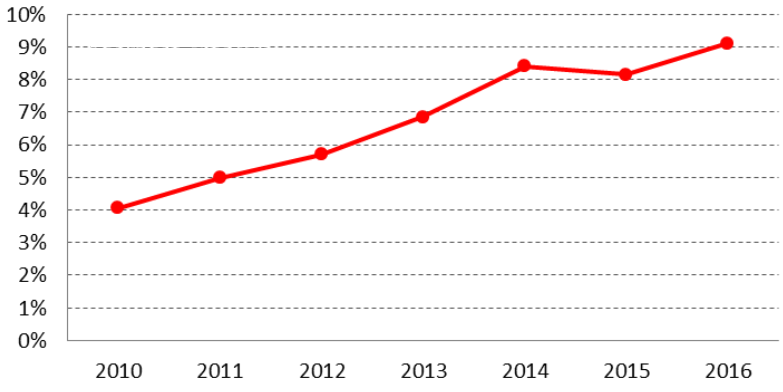
Source: Communications Committee

Mobile broadband is still mainly complementary to fixed broadband. In 2016, 9.1 % of EU homes accessed the internet only through mobile technologies. Finland and Italy were leaders in mobile access to internet with 30% and 22 % of homes using it in 2016.

Europeans access the internet primarily with fixed technologies at home. However, there are a growing number of homes with only mobile internet use. The percentage of homes with purely mobile broadband access grew from 4.1 % in 2010 to 9.1 % in 2016. This indicates that mobile broadband still mainly complements rather than substitutes fixed broadband.

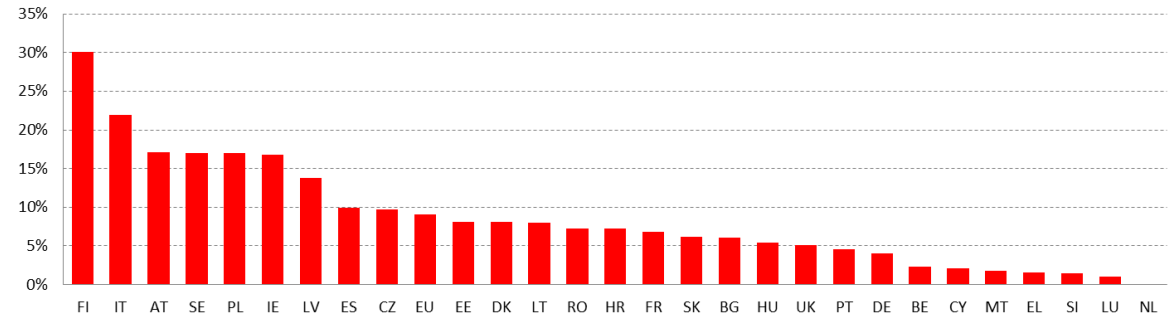
The Netherlands was the Member State with the lowest mobile only access at less than 0.1 %. By contrast, Finland and Italy were leaders in mobile access to internet with 30 % and 22 % of homes in 2016.

Figure 1.52. Households using only mobile broadband at EU level, (% of households), 2010-2016



Source: Eurostat (ICT Households and Individual survey)

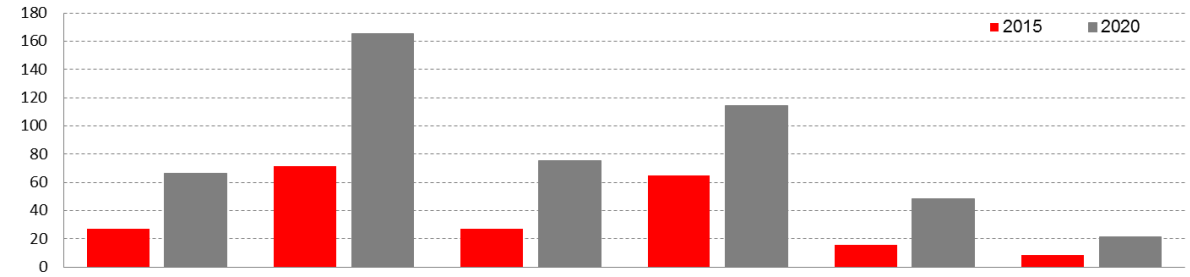
Figure 1.53. Households using only mobile broadband at home, (% of households), 2016



Source: Eurostat (ICT Households and Individual survey)

Internet traffic per capita in western Europe[4] is currently 27 GB per month. By 2020, this figure is estimated to go up to 66.5 GB, while in the US it will be 165 GB.

Figure 1.54. IP traffic per capita (Gigabytes per month and region), 2015 - 2020



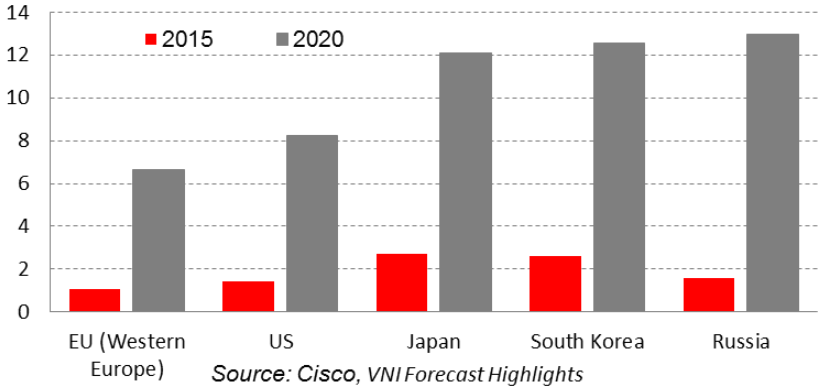
Source: Cisco, VNI Forecast Highlights

Internet traffic per capita in Western Europe is well below those of the US and South Korea. Although, with rapid growth in recent years, it is projected to reach the current levels of US and South Korea by 2020.

Mobile data traffic is a fraction of total IP traffic, and this will remain so despite the large increase forecast by Cisco. Similarly to the overall traffic, mobile IP traffic per capita in the EU is substantially below the US and South Korea. Nevertheless, Western European traffic is estimated to be six times higher in 2020 than in 2015.

[4] France, Germany, Italy, Spain, Sweden, United Kingdom, Denmark, Netherlands, Belgium, Ireland, Norway and Iceland.

Figure 1.55. Mobile IP traffic per capita (Gigabytes per month and region), 2015-2020



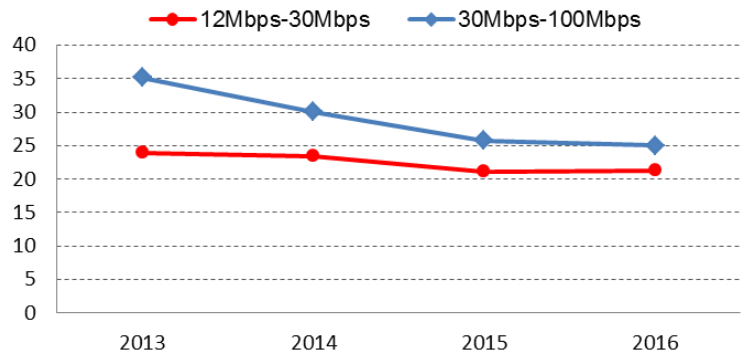
Source: Cisco, VNI Forecast Highlights

Prices[5] of fast broadband access tend to decrease over time but vary widely across Member States.

Broadband access prices (minimum prices, calculated on Purchasing Power Parity) vary between EUR 11 and EUR 43 for a standalone offer with a minimum download speed of 12 Mbps. The minimum prices were the lowest in Sweden (EUR 11), Bulgaria (EUR 12) and Hungary (EUR 12) and the highest in Spain (EUR 43), Slovenia (EUR 34) and Cyprus (EUR 33).

In the range of minimum download speed of 30 Mbps, European average stands at EUR 25 with a slight decrease from last year.

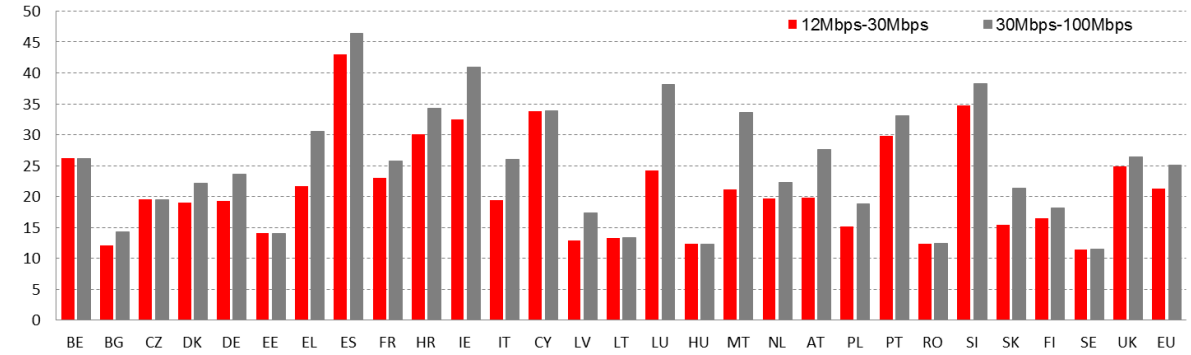
Figure 1.56. Broadband retail prices (EUR PPP) — standalone offers at EU level, 2013-2016



Source: Empirica and Van Dijk

[5] Based on least expensive prices available and expressed in euros adjusted for purchasing power parity, VAT included.

Figure 1.57. Fixed broadband retail prices (EUR PPP) — standalone offers at EU level, Autumn 2016

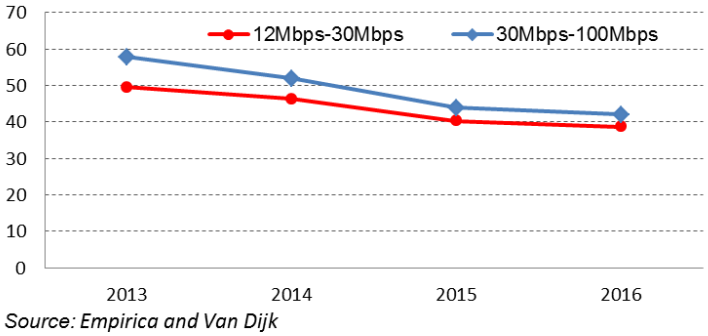


Source: Empirica

Prices[6] of triple play bundles including fast broadband access, fixed telephony and television went down by 27 % since 2013.

The minimum prices for triple play bundles including broadband access (with a download speed between 30 and 100 Mbps), fixed telephony and television vary between EUR 18 and EUR 75 in the EU. The minimum price was the lowest in Bulgaria (EUR 18), Lithuania (EUR 21) and Sweden (EUR 22) and the highest in Ireland (EUR 75), Belgium (EUR 60), Portugal (EUR 59) and Croatia (EUR 56). Prices decreased over time, with the EU average going down from EUR 58 in 2013 to EUR 42 in October 2016.

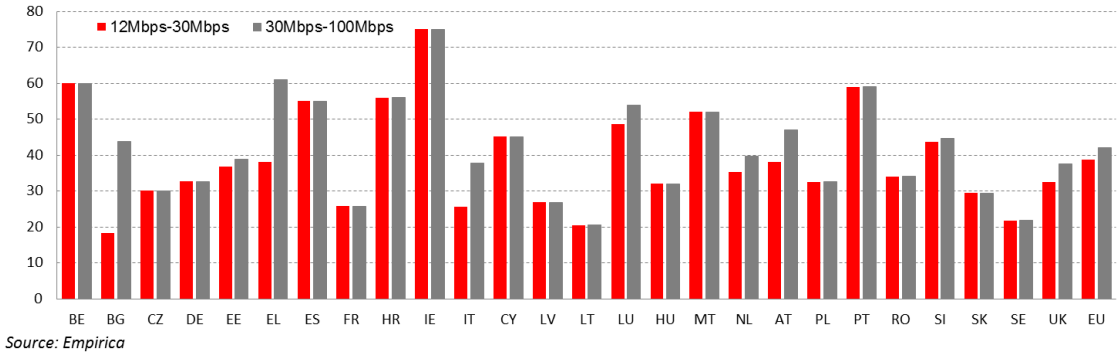
Figure 1.58. Broadband retail prices (EUR PPP) — bundles including broadband, fixed telephony and television at EU level, 2013-2016



Source: Empirica and Van Dijk

[6] Based on least expensive prices available and expressed in euros adjusted for purchasing power parity, VAT included.

Figure 1.59. Broadband retail prices (EUR PPP)[7] — bundles including broadband, fixed telephony and television, Autumn 2016



Source: Empirica

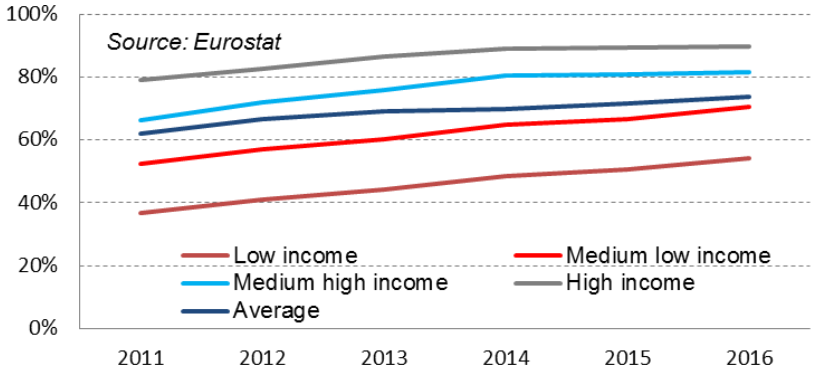
Broadband take-up tends to be lower in Member States where the cost of broadband access accounts for a higher share of income, but this correlation is not strong. The lowest income quartile of the EU population has a significantly lower take-up rate.

Considering overall take-up, European average is 74 % of homes with Luxembourg, the Netherlands at the highest positions and Italy, Bulgaria and Poland lagging behind.

Income plays an important role in broadband take-up. The lowest income quartile has only 54 % take-up rate of fixed broadband as opposed to 90 % in the highest income quartile.

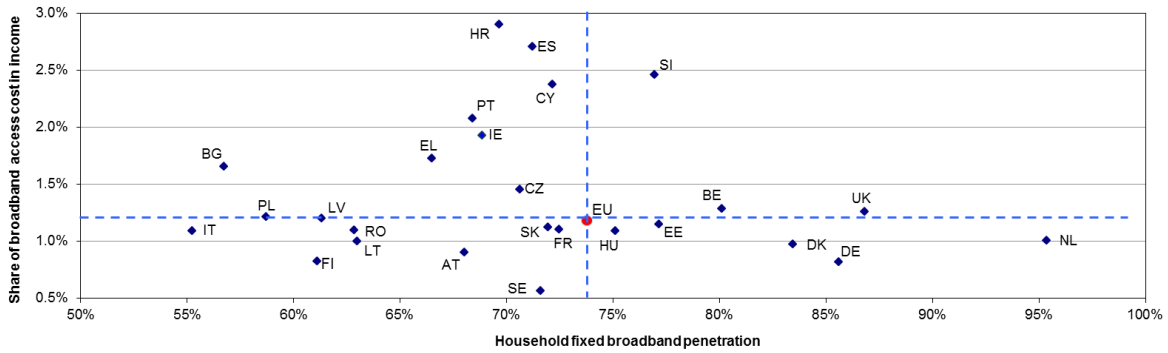
The gap between the lowest income quartile and the national average is particularly large in Bulgaria, Romania, Hungary, Slovenia, Lithuania, Czech Republic, Croatia, Spain and Slovakia.

Figure 1.60. Fixed broadband household penetration by income quartiles at EU level, 2011-2016



[7] No data available for Finland and Denmark.

Figure 1.61. Household fixed broadband penetration and share of broadband access cost (standalone 12-30Mbps download) in disposable income, 2016



Source: Commission services based on Eurostat and Empirica

Member States are catching up in transposing the Cost Reduction Directive (Directive 2014/61/EU).

Since the major source of costs in network deployment is civil engineering costs (accounting for up to 80 % of the total costs), Directive 2014/61/EU includes measures to reduce the cost of deploying high-speed electronic communication networks. The Directive includes measures:

• facilitating access to physical infrastructures of all network operators (i.e. telecom operators, as well as energy, or other utilities);

• improving coordination of civil engineering works;

• providing transparency of permit granting procedures; and

• equipping and accessing buildings with in house physical infrastructure (e.g. mini-ducts) capable of hosting high-speed networks.

The deadline for Member States to transpose this Directive expired on 1 January 2016.

The transposed measures had to apply at the latest as of 1 July 2016 except for the obligation to equip buildings with in-building physical infrastructure and with an access point which applies to new buildings or major renovation works where planning permission has been submitted after 31 December 2016.

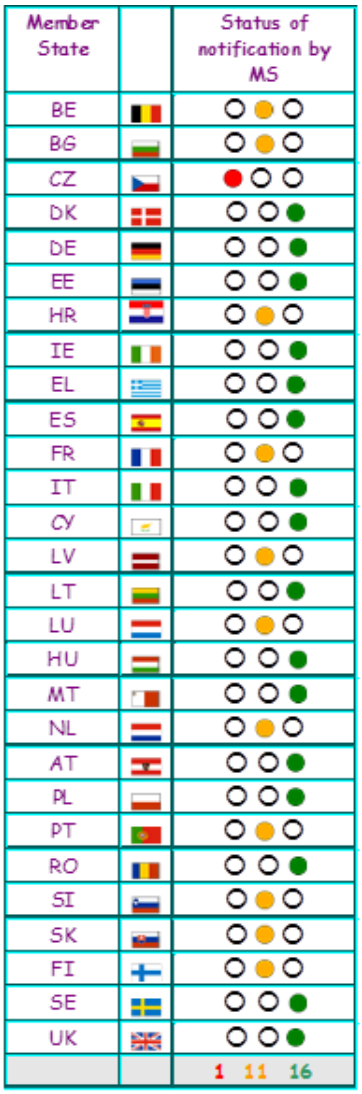
In March 2016, the Commission opened infringement proceedings against 27 Member States (all Member States except Italy) who had not yet completed the transposition of the Directive into national law. As a second step, the Commission sent reasoned opinions to 19 Member States in September 2016, urging them to implement measures of cost reduction in deploying high-speed electronic communications networks. Infringement proceedings against seven Member States (Denmark, Ireland, Malta, Poland, Romania, Spain and Sweden) have in the meantime been closed following complete transposition of the Directive. The Commission is

currently assessing further responses by Member States to reasoned opinions. As a next step, the Commission is analysing the conformity of the transposition for the countries that have notified complete transposition of the Directive. Information about national measures transposing the Directive is available here and ongoing infringement proceedings here.

Member States are catching up in transposing the Broadband Cost Reduction Directive (Directive 2014/61/EU).

As of 31 March 2017, 16 Member States have notified to the Commission complete transposition of the Directive (Austria, Cyprus, Denmark, Estonia, Germany, Greece, Hungary, Ireland, Italy, Lithuania, Malta, Poland, Romania, Spain, Sweden, UK). Eleven Member States have notified partial transposition of the Directive (Belgium, Bulgaria, Croatia, Finland, France, Latvia, Luxembourg, the Netherlands, Portugal, Slovakia, Slovenia) while one Member State has not notified any transposition measure so far (Czech Republic). Delays in transposing and applying the measures provided in the Directive may limit opportunities to reduce deployment costs and exploit synergies, which is particularly important in those areas where NGA coverage is lagging behind or upgrades of networks are needed.

Figure 1.62. Transposition of the Broadband Cost Reduction Directive



Member State		Status of notification by MS
BE		○ ● ○
BG		○ ● ○
CZ		● ○ ○
DK		○ ○ ●
DE		○ ○ ●
EE		○ ○ ●
HR		○ ● ○
IE		○ ○ ●
EL		○ ○ ●
ES		○ ○ ●
FR		○ ● ○
IT		○ ○ ●
CY		○ ○ ●
LV		○ ● ○
LT		○ ○ ●
LU		○ ● ○
HU		○ ○ ●
MT		○ ○ ●
NL		○ ● ○
AT		○ ○ ●
PL		○ ○ ●
PT		○ ● ○
RO		○ ○ ●
SI		○ ● ○
SK		○ ● ○
FI		○ ● ○
SE		○ ○ ●
UK		○ ○ ●
		1 11 16

Following the adoption of the 2014 Recommendation on relevant markets, a reduction of *ex ante* regulation is progressively observed as competition in the telecommunications markets across the EU develops

Under EU telecommunications legislation, appropriate regulatory measures on operators should be imposed only following a market analysis showing that a given market is not effectively competitive. This market analysis needs to be periodically carried out by the competent national regulatory authority.

The figure 1.63. shows an overview of markets which are still subject to *ex ante* regulation (red colour), have already been fully or partially deregulated (green/yellow colour), as well as the rounds of market analysis carried out since the adoption of the Regulatory Framework back in 2002. The 2014 Recommendation on relevant markets excluded from regulation two fixed

telecoms markets and redefined two other markets in order to reflect market and technology developments. For markets not included in the Recommendation, *ex ante* regulation can be imposed only if a market analysis shows that the market does not tend towards effective competition.

Since the adoption of the 2014 Recommendation, the Commission observes a progressive reduction of *ex ante* regulation as the competition in the telecommunications markets across the EU developes. This trend confirms the Commission's assumption that those markets tend towards effective competition in the Member States. Most markets outside the scope of the Recommendation which are still regulated have only been reviewed once or twice since the entry into force of the Regulatory Framework and market regulation may no longer reflect the effective competitive dynamics observed since the last round. Therefore ensuring a timely review of relevant markets is key to aligning market regulation with technological and market developments.

Figure 1.63. Article 7 cases

Article 7 cases as at 30/03/2017

	Effective competition - no ex ante regulation
	No effective competition - ex ante regulation
	Partial competition - partial ex ante regulation

1	1st round-competition/regulation
2	2nd round-competition/regulation
3	3rd round-competition/regulation
4	4th round-competition/regulation

	2014 RECOMMENDATION					2007 REC.		2003 RECOMMENDATION								
	Call term. on fixed network	Voice call term. on mobile networks	Wholesale local access	Wholesale central access	Wholesale high-quality access	Access to PSTN for res & non-res.	Call orig. on fixed network	Local/nat. Call for res.	Internat. call for res.	Local/nat. call for non-res.	Internat. call for non-res.	Retail LL	Transit on fixed network	Trunk segments LL	Access & call orig. on mobile network	Broadcast Transmis.
	Market 1	Market 2	Market 3a	Market 3b	Market 4	ex-Mkt 1	ex-Mkt 2	ex-Mkt 3	ex-Mkt 4	ex-Mkt 5	ex-Mkt 6	ex-Mkt 7	ex-Mkt 10	ex-Mkt 14	ex-Mkt 15	ex-Mkt 18
Austria	3	4	3	3	4	3	3	3	2	4	3	4	1	2	1	3
Belgium	2	2	2	2	1	2	1	3	1	3	1	1	2	1	1	w
Bulgaria	5	3	2	2	3	2	3	2	2	2	2	1	1	1		
Croatia	1	1	1	1	1	1	1	1		1		1		1		
Cyprus	2	3	4	4	2	3	3	3	2	3	2	2	3	2	3	3
Czech Republic	4	4	3	3	3	4	4	2	2	2	1	2	1	1	1	2
Denmark	3	4	3	3	4	3	3	2	2	1	1	2	1	1	1	1
Estonia	3	4	3	3	3	3	3	1	1	1	1	1	1	2	1	3
Finland	2	1	3	3	1	2	3	2	1	2	1	2	2	1	v	3
France	4	4	4	4	2	4	4	1	1	1	1	2	1	2	w	4
Germany	4	5	3	3	2	3	3	2	1	2	1	2	2	1	1	3
Greece	3	3	4	4	2	3	2	3	1	3	1	2	3	2	1	1
Hungary	3	5	3	3	3	6	3	3	3	3	3	3	2	2	2	2
Ireland	3	1	2	2	2	3	2	2	2	2	2	2	2	2	1	2
Italy	3	4	3	3	2	3	2	2	2	2	2	2	3	2	2	2
Latvia	5	4	3	3	3	1	3	4	3	4	3	3	2	1	1	1
Lithuania	4	3	3	3	2	1	2	3	2	3	2	1	2	2	1	5
Luxemburg	3	3	2	2	2	3	3	2	2	2	2	2	1	1	1	
Malta	3	3	2	2	3	3	3	2	2	2	2	3	2	2	2	1
Netherlands	4	4	5	3	3	4	3	2	2	2	2	2	2	2	1	2
Poland	2	3	2	3	1	2	2	2	2	2	2	2	1	1	2	2
Portugal	2	2	3	3	3	2	2	2	2	2	2	1	1	3		2
Romania	2	2	2	1	1	2	2	1	1	1	1		2			1
Slovakia	4	4	3	3	3	4	4	2	2	2	2	2	2	1	1	2
Slovenia	2	5	3	3	2	3	3	2	1	1	1	2	3	1	3	3
Spain	3	3	3	3	3	4	3	2	2	2	2	2	2	3	2	3
Sweden	4	4	3	3	3	3	3	1	1	1	1	2	2	1	1	4
United Kingdom	3	4	2	4	4	4	3	2	2	2	2	4	2	4	1	2

More EU harmonised spectrum underpins future spectrum needs within the EU, while assignment in national markets differs.

Following the adoption in April 2016 of Commission Implementing Decision (EU) 2016/687, harmonising the 700 MHz band, the total amount of spectrum harmonised at EU level for wireless broadband use reached 1090 MHz during the reporting year. The authorisation process for this band was already completed by three Member States (Finland, France and Germany) and the other Member States are expected to authorise the band by 2020, unless there are are justified reasons[8] for a delay until mid 2022 at the latest.

Moreover, with a view to reaching the target of 1200 MHz for wireless broadband set by the radio spectrum policy programme (RSPP), the Commission is working on the possible extension of the 1.5 GHz band to provide additional download capacity for 5G services representing an extension of 51 MHz.

The 800 MHz band (the 'digital dividend') is currently assigned (in two cases not entirely) in 26 Member States, 11 of which had been granted a derogation from the original deadline under Article 6(4) of the RSPP. Two Member States have not yet assigned and/or made available the 800 MHz band; while Malta asked for an extension of the derogation it had been granted, Bulgaria benefits from the exception due to incumbent military use under Article 1(3) RSPP.

When excluding the recently harmonised 700 MHz bands, a 4 percentage points (from 69 to 73 %) increase in the EU-harmonised spectrum assigned on average across Member States for wireless broadband use can be reported since last year. The swift assignment of the 700 MHz band in 3 Member States was a positive development which paves the way for other Member States to take the necessary measures to meet the 2020 deadline.

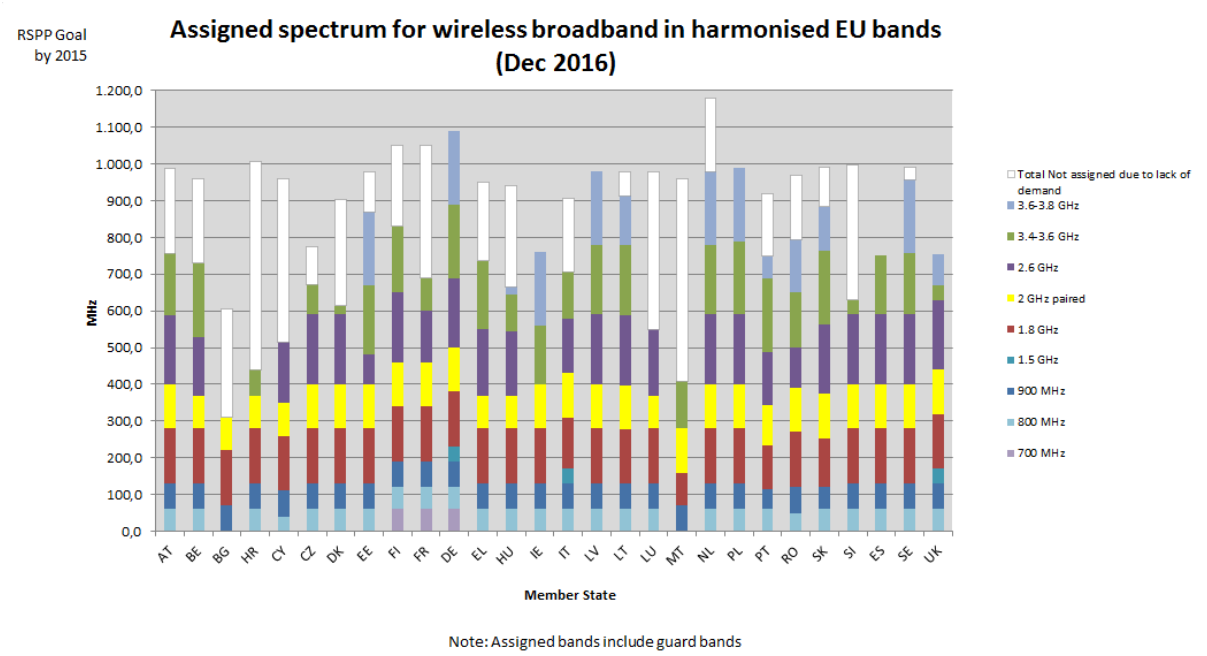
Bands above 1 GHz have the potential for additional capacity. Whilst these remained partly unassigned in many Member States, they will play an even more relevant role in the deployment of 5G services.

Lack of assignment may be due to different reasons depending on the circumstances in each Member States, such as delays in making the spectrum available and in the timely carrying out of assignment procedures, lack of market interest, use for defence purposes, etc.

In view of these different circumstances and regulatory conditions applicable to different bands, lack of assignment does not necessarily mean non-compliance with EU law.

[8] A limited list of justified reasons is contained in the annex of the Decision of the European Parliament and the Council on the use of the 470-790 MHz band in the Union.

Figure 1.64. Assigned spectrum in harmonised EU bands, December 2016[9]



Note: Assigned bands include guard bands

Development of national broadband plans

Since the adoption of the digital agenda for Europe (DAE) 2020 targets — i.e. coverage of 30 Mbps download for all Europeans and take-up of 100 Mbps subscriptions for at least 50 % of European households — most Member States have gradually adopted national broadband plans (NBPs). They are devised to integrate all relevant aspects of an effective broadband policy and resources enabling policy makers and public authorities to properly plan public interventions in the telecommunications sector.

At the time of writing, a large majority of Member States had already started implementing their NBPs, albeit with various time horizons ranging from 2017 to 2022. Some NBPs are integrated within broader strategic approaches, others are documents specifically dedicated to broadband deployment. In some countries, multiple official documents drafted by different national authorities exist that specify aspects related to such broadband developments.

Content-wise, nearly all Member States' NBPs focus on reaching minimum download speeds — in most cases in terms of coverage (availability of commercial offer on a given territory) and sometimes also penetration (actual take-up in the form of internet access subscriptions). In contrast, emphasis on upload data rates is rather exceptional (e.g. Denmark, Italy, Luxembourg

[9] Spectrum figures have been slightly updated after the publication of the Digital Economy and Society Index in the Netherlands, Romania, Bulgaria, Belgium, Malta, Hungary, Denmark, Slovakia and Slovenia.

or Ireland). In addition, operational measures to foster demand for digital applications and high-speed internet access are relatively infrequent.

Notably, some Member States have held consultations on their draft national broadband plans. These include for instance the Czech Republic ('Digital Czech Republic'), France ('National Programme for Very High Speed Broadband') and the Slovak Republic ('National Strategy for Broadband Access in the Slovak Republic).*

Some Member State (Sweden, Germany and Austria) have already started to adapt the targets of their National Broadband Plans to the new EU broadband targets for 2025 proposed by the Commission in its September 2016 Communication "Connectivity for a Competitive Digital Single Market - Towards a European Gigabit Society" (see https://ec.europa.eu/digital-single-market/en/connectivity-european-gigabit-society).

** OECD OECD countries with public consultation procedures prior to drafting their national broadband plans are: Canada ('Improving Canada's Digital Advantage'), Ireland ('Next Generation Broadband'), Japan ('Path of light'), and the United States ('Connecting America: The National Broadband Plan')*

Broadband targets in national broadband plans

Although some NBPs do not have targets on penetration/uptake or have set targets on other features (e.g. upload speeds), the following general observations can be made:

- 11 Member States surpass the DAE-2020 targets (Austria, Belgium, Bulgaria, Denmark, Estonia, Finland, Germany, Hungary, Luxembourg, Slovenia and Sweden),
- 14 Member States are convergent with the DAE-2020 targets (Croatia, Cyprus, Czech Republic, Greece, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Slovakia and Spain),
- 3 Member States fall short of meeting the DAE-2020 targets (France, Romania and the United Kingdom).

Declared broadband targets in NBPs are, first and foremost, guideposts, whose practical feasibility and actual success will depend on the utilisation of appropriate means, including legal measures and financial resources. Therefore, it is important that Member States have the necessary resources and tools in place, rather than merely policy targets, to facilitate the effective rollout of broadband infrastructure on their territories.

The following figure shows a visualization of the broadband targets of the Member States in comparison to the DAE connectivity targets.

Figure 1.65. National Broadband Plans

MS	NBP-Targets	MS	NBP-Targets
Austria	99 % coverage with 100 Mbps by 2020	Italy	100 % coverage with 30 Mbps by 2020. 85 % HH penetration of 100Mbps services by 2020
Belgium	50 % HH penetration with 1 Gbps by 2020	Latvia	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Bulgaria	100 % coverage with 30 Mbps by 2020. 50 % of households and 80 % of businesses subscribing >100 Mbps by 2020	Lithuania	100 % coverage with 30 Mbps by 2020. 50 % penetration with 100 Mbps by 2020
Croatia	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020	Luxembourg	100 % coverage with 1 Gbps by 2020
Cyprus	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020	Malta	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Czech Republic	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 MBps service by 2020	Netherlands	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Denmark	100 % coverage with 100 Mbps download and 30 Mbps upload by 2020	Poland	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Estonia	100 % coverage with 30 Mbps by 2020. 60 % HH penetration with 100 Mbps by 2020	Portugal	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Finland	99 % of all permanent residences and offices should be located within 2 km of an optic fibre network or cable network that enables connections of 100 Mbps by 2019	Romania	80 % coverage with 30 Mbps by 2020. 45 % HH penetration with 100 Mbps service by 2020
France	100 % coverage with 30 Mbps by 2022	Slovakia	100 % coverage with 30 Mbps by 2020.
Greece	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps by 2020	Slovenia	96 % coverage with 100 Mbps, 4% coverage 30 Mbps by 2020.
Germany	100 % coverage with 50 Mbps by 2018	Spain	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Hungary	100 % coverage with 30 Mbps by 2018. 50 % HH penetration with 100 Mbps service by 2020	Sweden	95 % coverage with 100 Mbps by 2020
Ireland	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020, expecting upstream bandwidth around 17 to 21 Mbps.	United Kingdom	95 % coverage with 24 Mbps by 2017

Source: Atene KOM: Study on National Broadband Plans in the EU (SMART 2014/0077) — draft/ongoing.

Funding national broadband plans

In a number of cases, Member States have decided to use extensively the European Investment and Structural Funds (ESIF) — notably the ERDF and the EAFRD — for a total programmed amount of over EUR 6 billion by 2020.

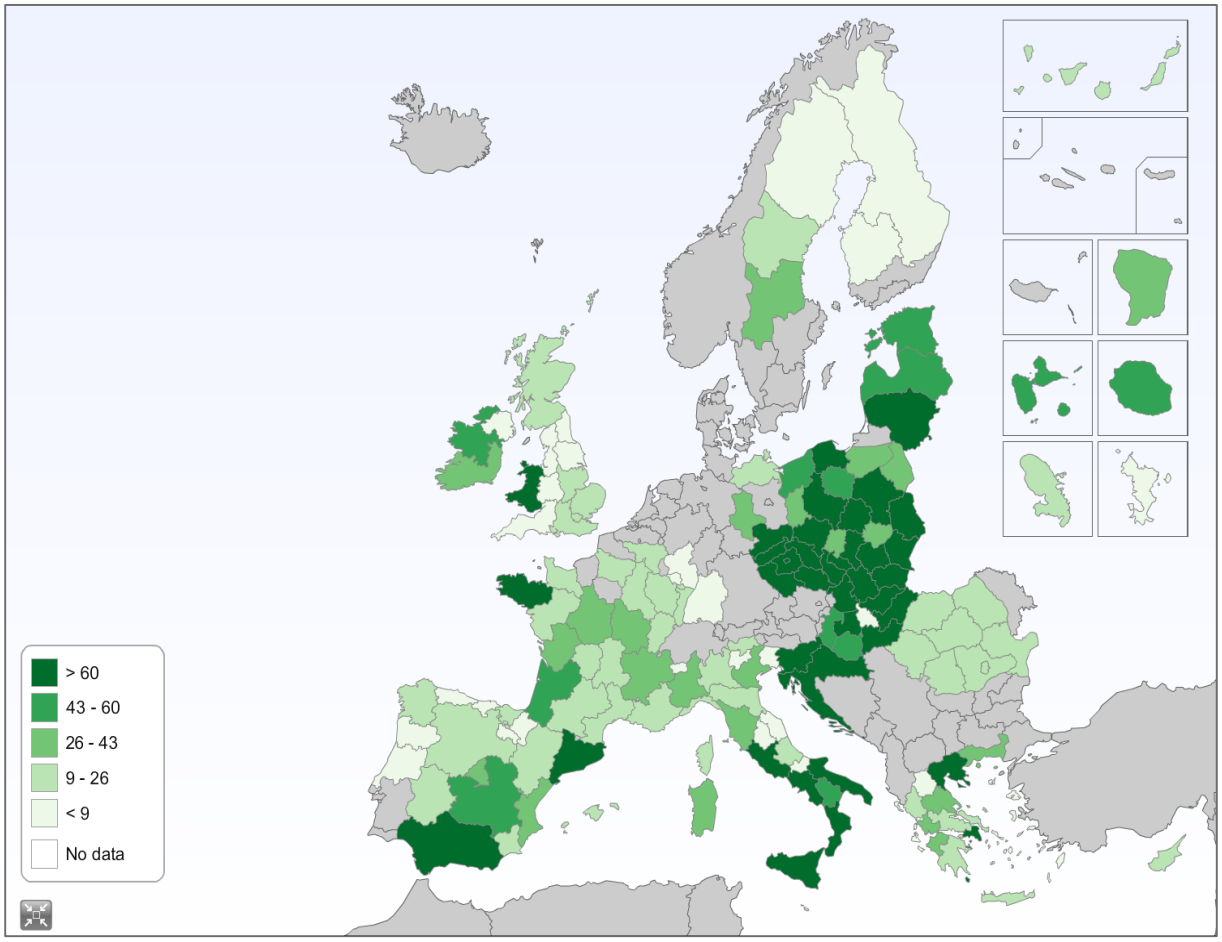
Countries like Poland and Italy plan to invest more than a EUR 1 billion of ERDF each; France, the Czech Republic, Spain and Hungary are in a range of EUR 400 million to EUR 700 million of ERDF each; Croatia, Greece and Slovakia between EUR 200 million and EUR 400 million of ERDF each.

For EAFRD, Italy has programmed the biggest budget on broadband infrastructure amounting nearly EUR 273 million. Germany and Sweden have also allocated significant budget, around

EUR 223 million for Germany an EUR 157 for Sweden. Investments from EAFRD planned from the remaining thirteen Member States range from EUR 65 to 0.3 million.

In addition, financial instruments, including the European Fund for Strategic investments and the forthcoming Connecting Europe Broadband Fund, aim at maximising the leverage of public funding dedicated to the roll-out the next generation of broadband networks.

Figure 1.66. ERDF investment in broadband and digital networks in ESIF Operational Programmes (million EUR)



Source: European Commission, ICT monitoring Tool (http://s3platform.jrc.ec.europa.eu/ict monitoring).

2. Human Capital: Digital Inclusion and Skills

Finland, Luxembourg, United Kingdom and Sweden obtained the highest scores under the Human Capital dimension of DESI. Romania, Bulgaria, Greece and Cyprus got the lowest ones.

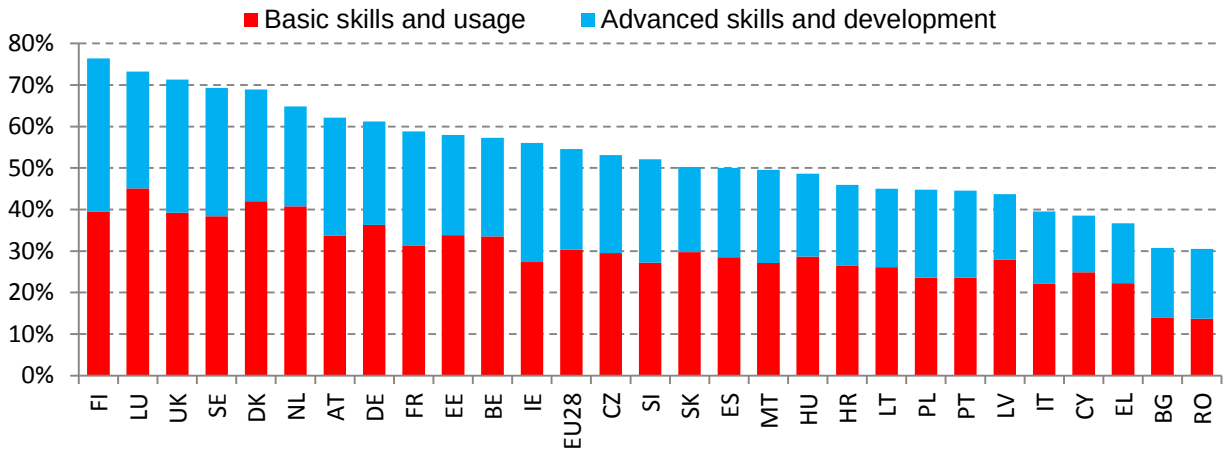
The Human Capital dimension of DESI has two sub-dimensions covering **'basic skills and usage'** and **'advanced skills and development'**. The former includes indicators on internet use by individuals and digital skills - individuals with at least basic skills in the Digital Skills Indicator. The latter includes indicators on ICT specialist employment and graduates in STEM (Science, Technology Engineering and Mathematics) disciplines. According to 2016 data, Finland, the UK and Sweden were the highest scorers under both the basic skills and usage and advanced skills and development sub-dimensions. Romania, Bulgaria, Greece and Cyprus rank lowest overall on the Human Capital dimension of DESI.

Table 2.1: Indicators included in the Human Capital dimension, DESI 2017

	EU 28
2a1 Internet Users % individuals (aged 16-74)	79% (2016)
2a2 Basic Digital Skills % individuals (aged 16-74)	56% (2016)
2b1 ICT Specialists % employed individuals	3.5% (2015)
2b2 STEM Graduates Graduates in STEM per 1000 individuals (aged 20 to 29)	19 (2014)

Source: European Commission, Digital Scoreboard

Figure 2.1: Human Capital Component DESI 2017, by Member State

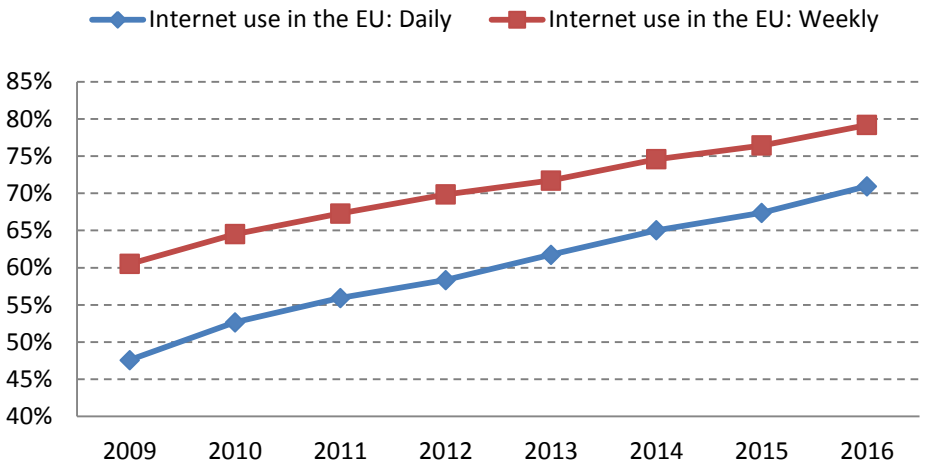


Source: Eurostat - Community survey on the ICT usage in households and by individuals

79% of EU citizens go online weekly, whereas 71% do so every day. 63% of disadvantaged people use the internet weekly. Despite ongoing improvements, the elderly and those with low education levels or on low incomes continue to be at risk of digital exclusion.

Growing numbers of Europeans are using the internet on a regular basis. In 2016, 79% of EU citizens went online at least weekly and 71% daily or almost (compared with, respectively, 76% and 67% a year earlier).

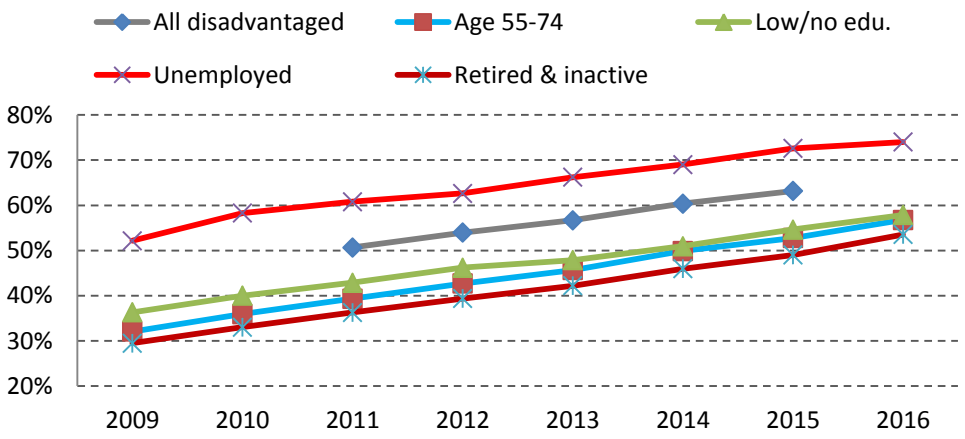
Figure 2.2: Daily and weekly use of internet in the EU (% of individuals aged 16-74)



Source: Eurostat - Community survey on the ICT usage in households and by individuals

In 2016, regular internet use grew particularly fast among disadvantaged groups: 63% of the total in 2015 compared to 60% a year earlier. 57% of those aged 55 to 74 went online at least weekly, a 4 pp. increase year on year. The same applies to those with low education levels (4 pp. increase to 58%) and the retired or inactive (from 49% to 54%). People on low incomes also use the internet less often: 61% of them did so weekly in 2016 compared to 58% a year earlier. These figures signal undeniable progress yet underscore the need to further pursue ongoing efforts to fight digital exclusion.

Figure 2.3: Weekly internet use by disadvantaged groups (% of population)

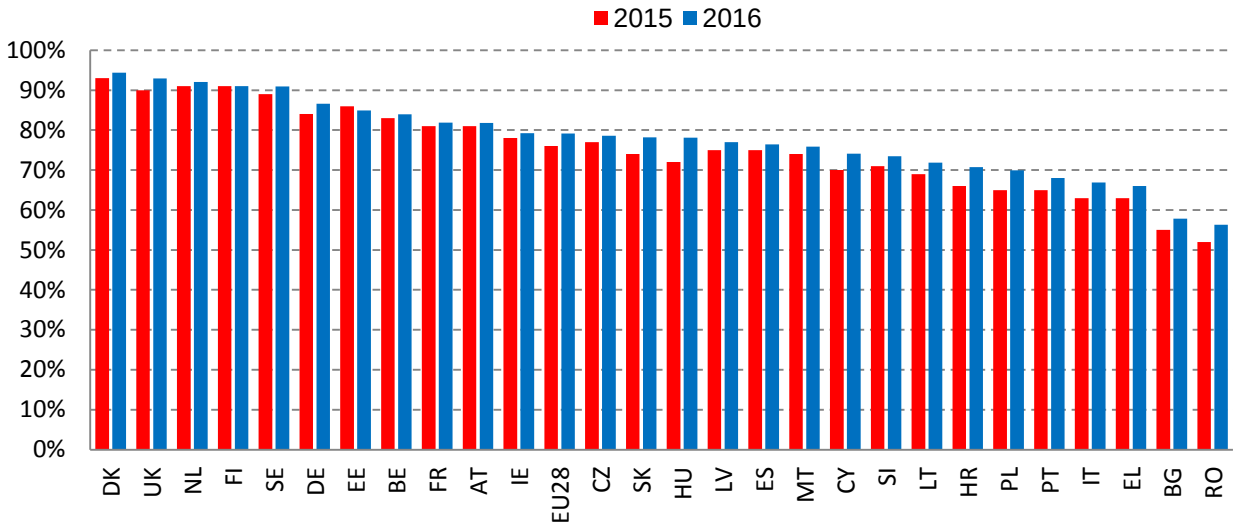


Source: Eurostat - Community survey on the ICT usage in households and by individuals

The trend towards convergence in weekly internet use among EU Member States continued in 2016, although major gaps still exist.

Despite the relative high dispersion of rates of regular internet use across Member States, three main groups can be distinguished: **(1) Countries with the vast majority of their population using the internet regularly**: Scandinavian countries, Luxemburg, the Netherlands and the United Kingdom, all of which feature rates exceeding 90%; **(2) Countries in the process of rapidly catching up with the "top pack"**, such as Estonia and Germany, and **(3) Countries with rates still significantly below the EU average** (and as low as 56% and 58% in, respectively, Romania and Bulgaria in 2016). Most Member States in the latter group have, however, made significant progress in recent years; e.g. between 2010 and 2016 regular internet use increased by 25 pp., 24 pp. and 22 pp. in, respectively, Greece, Cyprus and Romania. Hungary (+ 6 pp.), Croatia and Poland (both +5 pp.), in turn, saw the greatest annual increases in 2016. This evolution partly reflects low starting levels of regular internet use.

Figure 2.4: Regular Internet use* in the EU (% individuals aged 16-74)



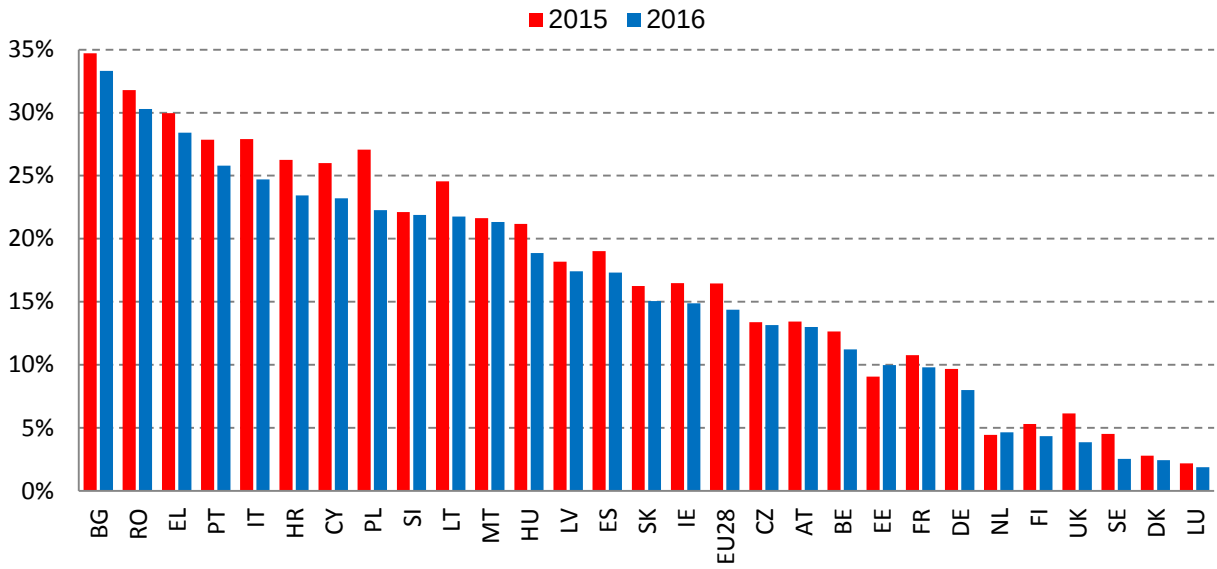
Source: Eurostat - Community survey on the ICT usage in households and by individuals

*At least once a week.

The number of non-internet users fell further in 2016, particularly in Member States with large shares of non-users. However, still today, 14% of the EU population has never used the internet.

The share of non-internet users continued its decline in 2016 to 14% (compared to 16% in 2015). As for regular internet use figures, the numbers of new internet users increased in the vast majority of Member States last year. Proportionally, the most significant increases ocurred in those with comparatively larger shares of "off-line" population; e.g. Poland reduced the share of people aged 16-74 who have never used the internet by 5 pp., whereas Croatia, Cyprus, Lithuania and Italy all achieved reductions of about 3 p.p. The Member States where the share of non-internet users fell the most between 2010 and 2016 are Romania (-27 pp.), Greece (-24 pp.), Cyprus (-22 pp.) and Portugal (-20 pp.).

Figure 2.5: Individuals who never used internet (% of individuals aged 16-74)

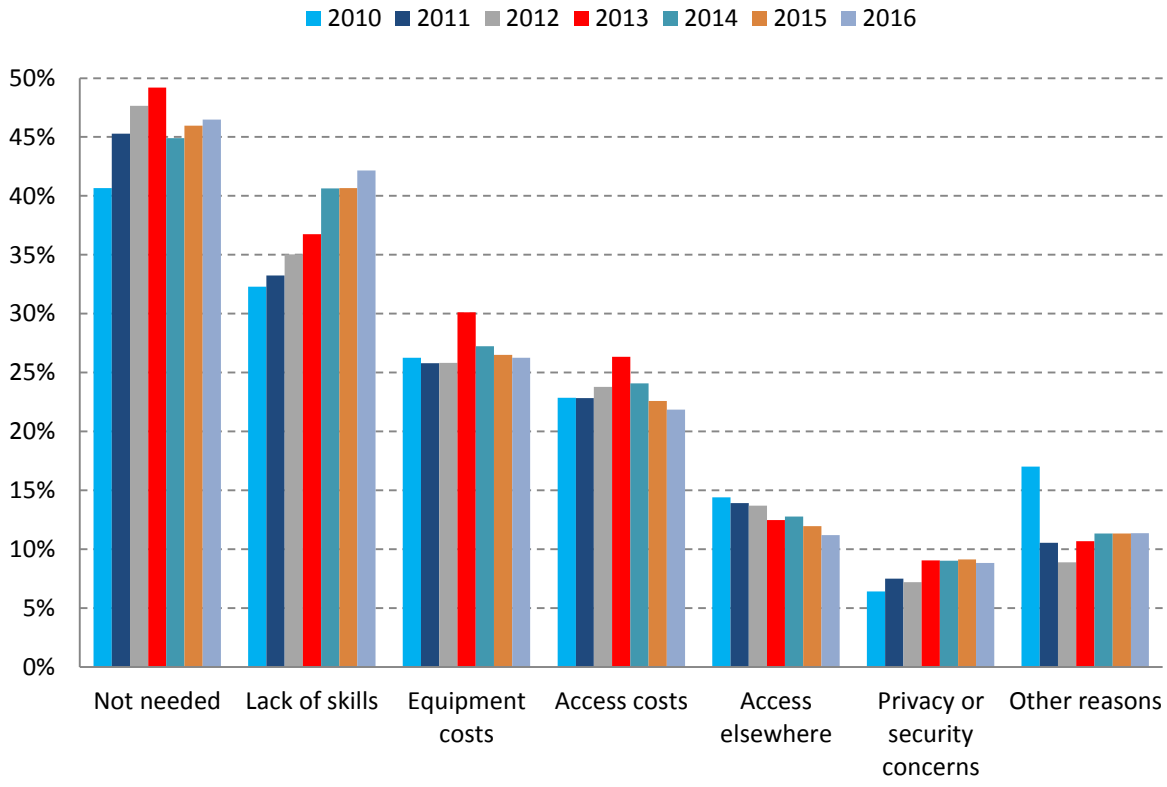


Source: Eurostat - Community survey on the ICT usage in households and by individuals

Lack of need or interest, insufficient skills and cost-related barriers are the most common reasons given by households for not having internet access at home. Lack of skills is an increasingly important factor in this respect.

The three main reasons evoked by households for not having internet access continue to be the lack of need or interest (46% of households without internet access in 2016), insufficient skills (42%) and the high costs of equipment (26%) and access (22. Cost-related factors are of much greater importance in the case of poorer households as well as those with dependent children. In a context of accelerating technological change and digitisation of the daily lives of Europeans, lack of relevant skills is, understandably, the fastest-growing factor deterring households from having internet access at home (+10 pp. since 2010). In the same vein, the pre-eminence of perceived lack of need as deterring factor may be related to that very skills deficit; e.g. low awareness of potential benefits from accessing the internet at home.

Figure 2.6: Barriers to internet access at home in the EU28 (% of households without internet access)



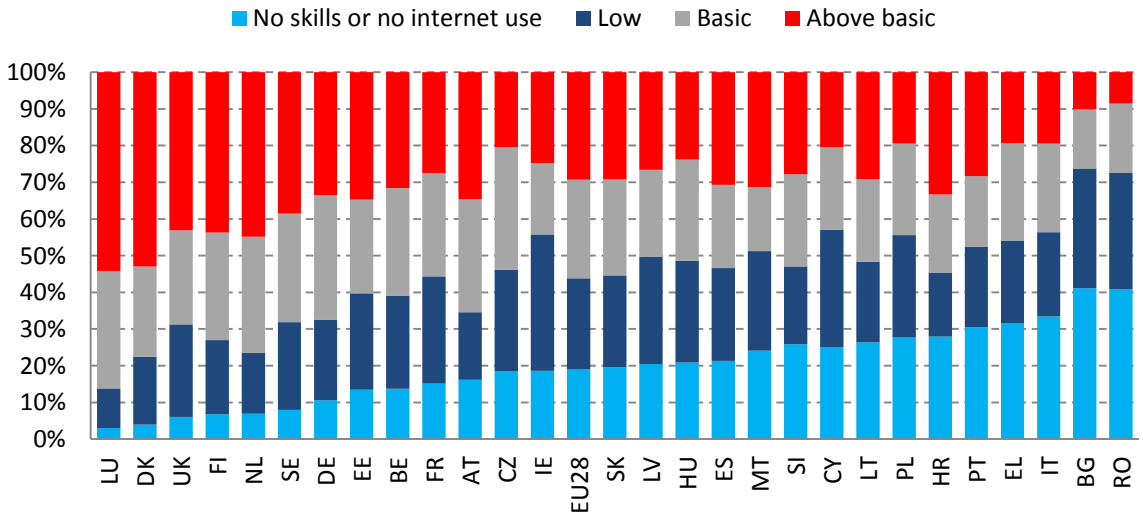
Source: Eurostat - Community survey on the ICT usage in households and by individuals

In 2016, 44% of the EU population had an insufficient level of digital skills. 19% had none at all, as they did not use the internet.

According to the **Digital Skills Indicator**[10], a composite indicator based on the European Commission's digital competence framework[11], 19% of the EU population had no digital skills in 2016, the main reason being that they did not use the internet or did so only seldom. 44% of the EU population in 2016 can be considered as lacking sufficient digital skills insofar as they had either low or no digital skills , which means they did not possess the minimum, basic digital skills to meet current needs. Despite constituting an improvement from last year, these figures (which in 2015 reached, respectively, 21% and 45%) signal a strong need for ratcheting up efforts to enhance the digital skills of Europeans (an estimated 60m+ people in the EU have learned to use the Internet over the past decade), thus ensuring that they do not miss out on the life-enriching opportunities and economic benefits of functioning effectively online.

There **are large disparities across Member States**, with the share of people without digital skills ranging from 3 % in Luxembourg to 41 % in Bulgaria and Romania. In ten of them (Portugal, Poland, Slovenia, Croatia, Lithuania, Italy, Greece, Cyprus, Bulgaria and Romania), at least one-quarter of the population had no digital skills in 2016. Moreover, in Bulgaria and Romania, nearly three-quarters of the adult population can be considered as lacking basic digital skills. Many of these Member States are also among those with the largest shares of internet users with low digital skills (e.g. 55% in Bulgaria compared to an average 30% for the EU as a whole).

Figure 2.7: Digital skills of the EU population, 2016 (% individuals aged 16-74, by level of skills*)



Source: Commission services based on Eurostat data

*To be classified as *low skilled*, an individual has to have carried out activities from only one of the four Digital Competence dimension included in the index (information, communication, content-creation and problem-solving). To be considered as

[10] http://ec.europa.eu/newsroom/dae/document.cfm?action=display&_doc_id=9979

[11] https://ec.europa.eu/jrc/en/digcomp/digital-competence-framework

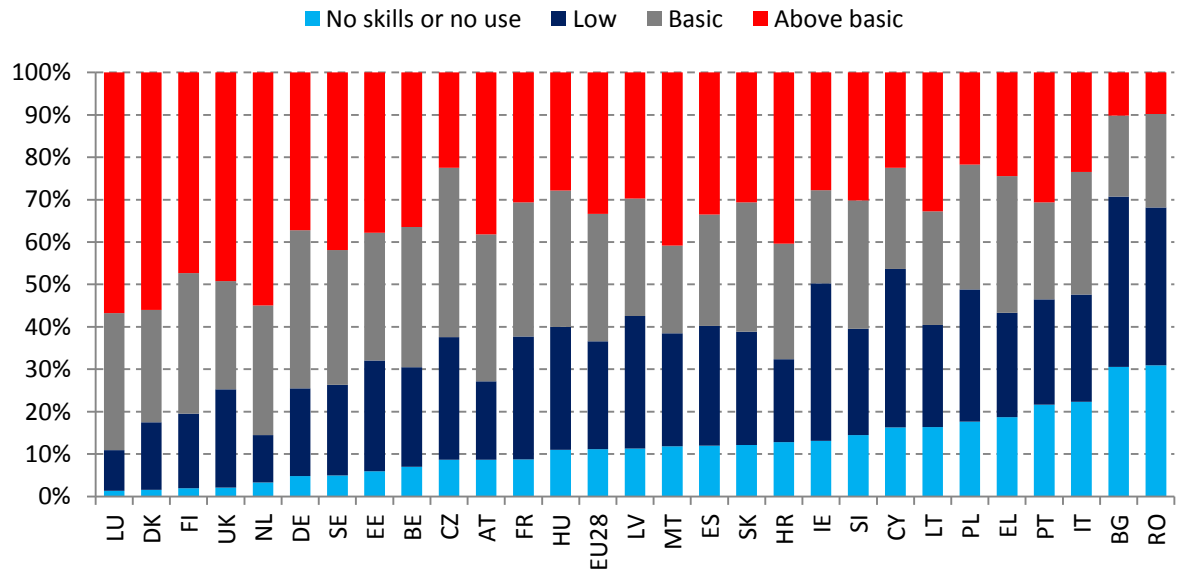
having *basic skills*, an individual has to have *basic* in at least one dimension, but *no skills* in none. To be classified as *above basic*, the individual has to score *above basic* in each of the four dimensions.

In 2016, 37% of the EU labour force had an insufficient level of digital skills. 11% had no digital skills at all, as they did not use the internet.

Although most jobs currently require a basic level of digital skills[12][13], **11% of the EU's labour force in 2016 still had none** (2 pp. improvement compared to 2015). In countries like Portugal, Italy, Bulgaria and Romania, this figure exceeds one-fifth of the labour force (more than 30% in Romania and Bulgaria). If we factor in those who have only a low level of skills, nearly 37% of the EU's labour force could be considered to be insufficiently digitally skilled (about 70% in Bulgaria and Romania).

The present situation suggests that **massive efforts continue to be required to up-skill and re-skill the European labour force as well as the population at large** so they can fully benefit from the digital transformation that is currently underway. As underscored by the OECD, ensuring that everyone has the right digital skills for an increasingly digital and globalised world is essential to promote inclusive labour markets and to spur innovation, productivity and growth.[14]

Figure 2.8: Digital skills of the labour force, 2016 (% of the labour force, by level of skills)



Source: Commission services based on Eurostat data

[12] SWD(2016) 195 final.

[13] In 2014, 71% of EU employees surveyed in the European Skills and Jobs survey (ESJ) declared that they need *some fundamental level of digital skills* to perform their jobs. Cedefop (2016), The Great Divide: Digitisation and digital skills gaps in the EU workforce', ESJsurvey Insights, No. 9, Thessaloniki: Greece.

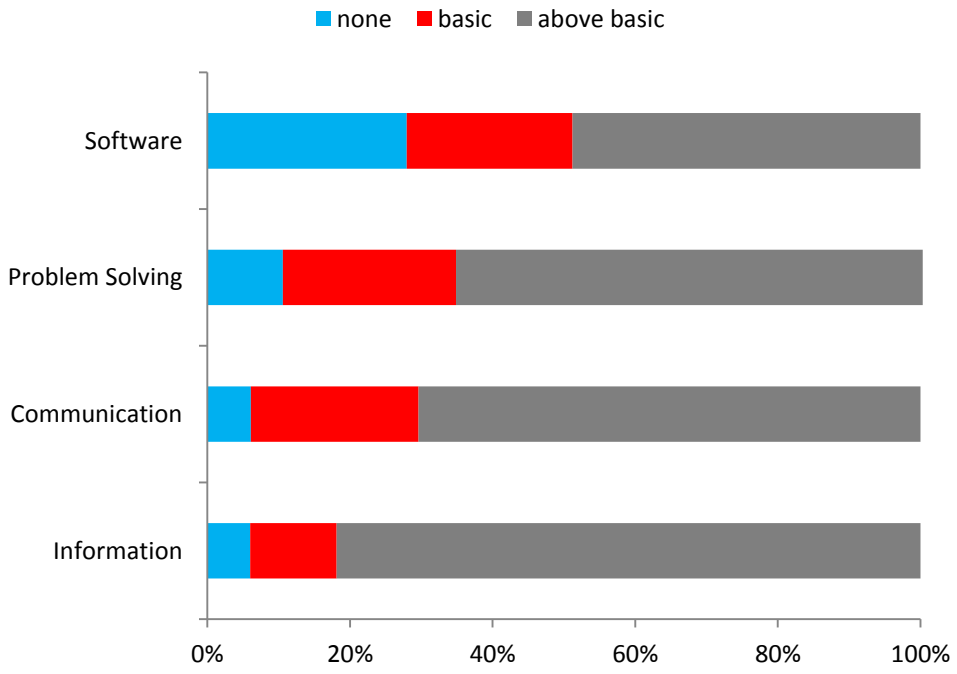
[14] OECD (2016), "Skills for a Digital World", Policy Brief on the Future of Work, OECD Publishing, Paris.

Only a small share of the EU's internet users has advanced software skills, which are becoming increasingly critical to access the labour market. In 2016, 28% of European internet users had no software-related skills.

Across competence dimensions, the most urgent need for improvement relates to software and content creation. Indeed, the share of internet users with no skills in this area (i.e. those who had not carried out any of the activities considered under this dimension, which range from relatively basic text treatment and spreadsheet-based work to video editing and coding) reached 28% in 2016 compared to about 6% for those not having performed any of the information or communication activities. The largest shares of internet users without software/content creation skills are found in Bulgaria (52%), Romania (50%) and Ireland (44%), compared to software-savvier populations in Luxembourg, Denmark and Croatia (respectively, 69%, 63% and 59% of internet users with above basic software skills) in 2016.

Among those considered, the **least-practiced activities** include **writing code** in a programming language (only 7% of internet users) and using **spreadsheet advanced functions** (29%). This is all the more critical since advanced digital skills are becoming a key prerequisite for entry into many jobs[15] and have a wide range of applications, even beyond domains where they are needed for core tasks.

Figure 2.9: Digital skills by competence dimension and level of skills, 2016 (% of internet users)



Source: Commission services based on Eurostat data

[15] Berger and Frey (2016), quoted in Cedefop (2016), 'The Great Divide: Digitalisation and digital skill gaps in the workforce', #ESJsurvey Insights, No. 9, Thessaloniki: Greece.

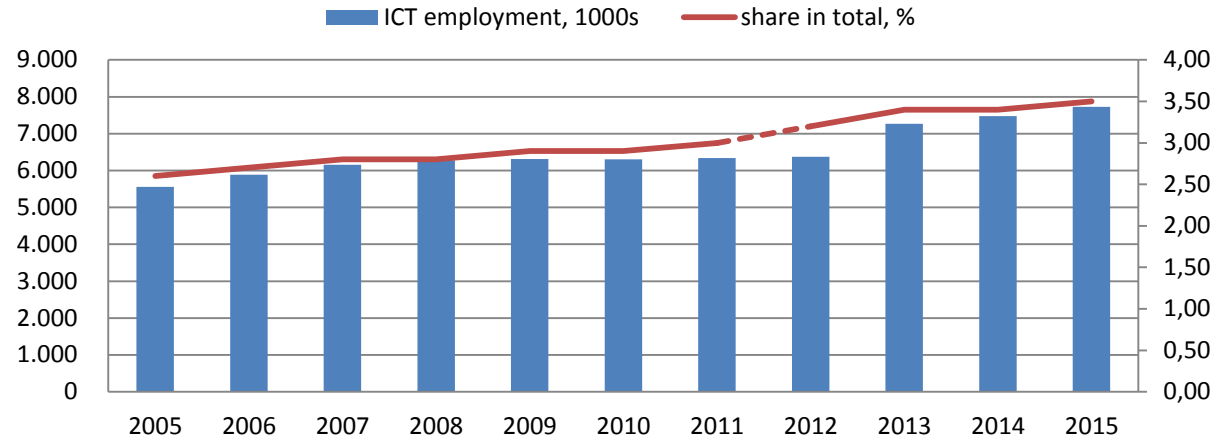
Employment of ICT specialists grew by more than 2 million workers in the EU over the past decade, leading to a 35% increase in the share of ICT jobs in total employment.

Between 2005 and 2015, **employment of ICT specialists in the EU grew by 2.2 million to reach 7.7 million in 2015**. This amounts to a 35% increase in the share of ICT jobs in total employment, from 2.6% to 3.5%. The compound annual growth rate over the same period stood at about 3% (allowing for breaks in the time series). This is to be compared the much slower growth in total employment, which returned to pre-crisis levels only in 2014.

All EU Member States have seen an important increase in ICT specialist employment over the past decade (2005 to 2015). In absolute terms, the largest increases occurred in DE (659,000), FR (381,000), the UK (192,000) and Italy (135,000). However, growth in ICT specialist employment has also been very substantial in many smaller countries. According to 2015 data, the Member States with the highest shares of ICT specialists in total employment are Finland (6.5%), Sweden (6.1%), Netherlands and the UK (both 5%). The UK employs the largest number of ICT specialists in absolute terms (1.54 million in 2015), although Germany (1.47 million) has nearly doubled its ICT employment over the past decade and is rapidly catching it up.

Despite the positive evolution in recent years, **the gap between demand and supply of ICT specialists in the EU is expected to grow from 373 000 in 2015 to about 500,000 by 2020**[16]. In other words, the **employment potential of specialised ICT skills remains underexploited**.

Figure 2.10: Employment of ICT specialists in the EU, in absolute terms ('000) and as share of total employment, 2005-2015



Source: Eurostat

[16] Empirica (2017). Innovation Leadership Skills for the High-Tech Economy - Demand, Supply and Forecasting. High-Tech and Leadership Skills for Europe Conference – Brussels, 26th January 2017.

Through its Digital Skills and Jobs Coalition, the Commission seeks to further reduce digital skills gaps by fostering the sharing, replication and upscaling of best practices in areas such as training and matching for digital jobs, certification and awareness raising.

Building on the positive results of the Grand Coalition for Digital Jobs 2013-2016 and the EU e-skills strategy, and in coordination with the work under Education and Training 2020, The Commission has launched the **Digital Skills and Jobs Coalition**[17], which brings together Member States and stakeholders and aims at **developing a large digital talent pool and ensuring that individuals and the labour force in Europe are equipped with adequate digital skills**. This is to be done by means of pledging action and identifying and sharing best practices (including in terms of innovative funding opportunities) that can be replicated and scaled up. The Commission will monitor progress annually as part of the EDPR. The Digital Skills and Jobs Coalition is one of the 10 concrete actions under the New Skills Agenda for Europe, which prioritises digital skills in all its actions.

More than 80 stakeholders, representing large and smaller companies, education providers and NGOs **have already made concrete commitments** to help reduce digital skills gaps, encompassing a broad range of actions in areas such as training and matching for digital jobs, certification and awareness raising. Likewise, **National Coalitions for Digital Jobs** seeking to facilitate high-impact actions at local level have already been launched **in 13 Member States** and more are under development.

[17] https://ec.europa.eu/digital-single-market/en/digital-skills-jobs-coalition

3. Use of the Internet and Privacy

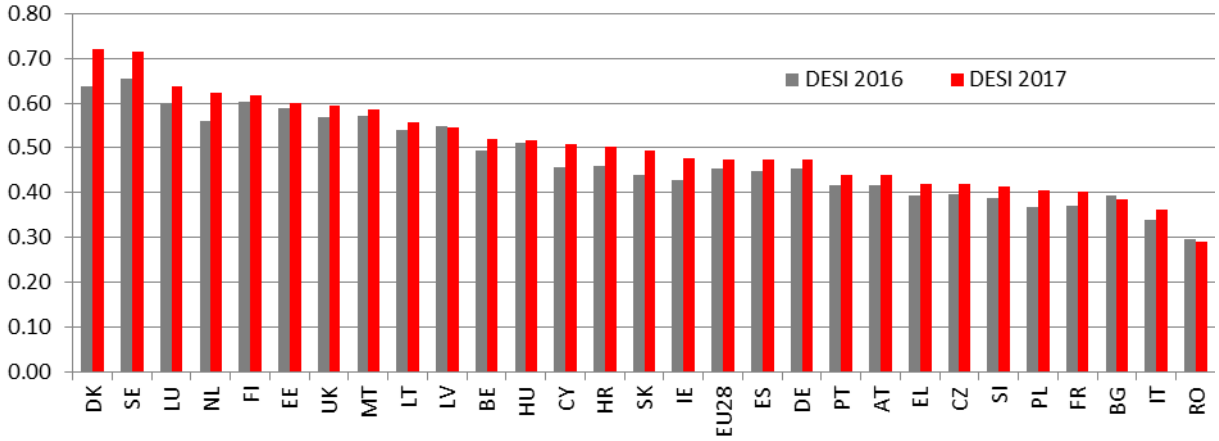
People in the EU engage in a **range of online activities** — they consume content, communicate, shop, use online banking services and much more. Such activities are captured in DESI dimension 3, on internet use. Denmark, Sweden and Luxemburg have the most active internet users, followed by the Netherlands, Finland and Estonia. Romania, Italy and Bulgaria are the least active. **Denmark and the Netherlands showed the biggest increases** in their DESI scores, +8 pp. and +7 pp. respectively between DESI 2016 and DESI 2017; with Denmark overtaking Sweden to rank first and the Netherlands increasing its rank from 9th to 4th position. Bulgaria fell in the rankings from joint 22nd (with Greece and Slovenia) to 27th and Romania remained at the bottom of the rankings.

Figure 3.1: Indicators included in the Use of the Internet dimension of the DESI 2017:

DESI – Use of Internet indicators	
News (% of internet users)	70% (2016)
Music, videos and games (% of internet users)	78% (2016)
Video on demand (% of internet users)	21% (2016)
Video calls (% of internet users)	39% (2016)
Social networks (% of internet users)	63% (2016)
Banking (% of internet users)	59% (2016)
Shopping (% of internet users)	66% (2016)

Source: Eurostat - Community survey on the ICT usage in households and by individuals (the survey covers individuals aged 16 to 74)

Figure 3.2: Digital Economy and society (DESI), Use of the Internet, 2016 and 2017



Source: European Commission, Digital Scoreboard

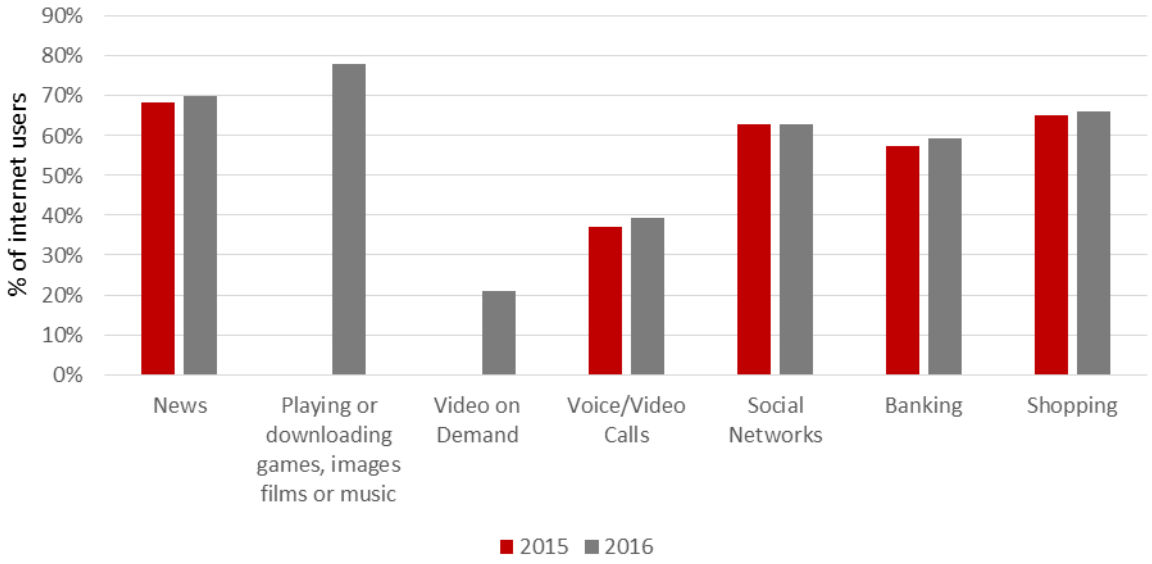
Growth in the use of online services is generally slow

Between 2015 and 2016, progress in the different activities used as indicators in the Use of Internet dimension of the DESI has been generally slow. **Increases** were observed in the percentage of internet users **reading news online**, engaging in **voice or video calls** and doing **online banking** — 2 percentage points each. Use of social networks and online shopping (+1 pp) did not really change between 2015 and 2016. The development of **video on demand** and **playing or downloading games, images, films or music** cannot be tracked due to missing data for 2015.[18]

Internet users in the EU are active in **obtaining content** online, with 78 % downloading music, videos and games, 70 % reporting reading news online and 21 % using video on demand services.

EU citizens also use the internet for **communication**. Almost two fifths of internet users place calls (video or audio) over the internet, and 63 % interact using social networks. For **online transactions**, users did their banking activities online (59 %) and two thirds of them reported having shopped online in 2016.

Figure 3.3: Indicators in the Use of Internet component, EU-28 (% of internet users)



Source: Eurostat - Community survey on the ICT usage in households and by individuals

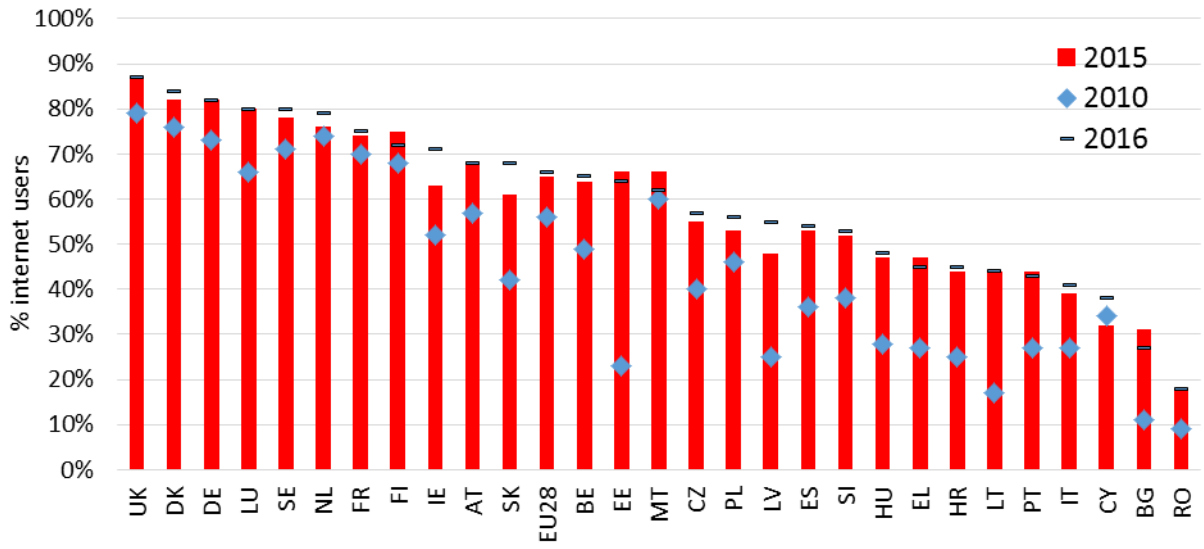
[18] There is a break in series for these indicators as the questions have changed.

eCommerce: Significant increases in ordering goods and services online.

Since 2010, the proportion of internet users ordering goods and services online has increased by 10 percentage points, to 66 % in 2016. As with many other online activities, eCommerce is higher among younger, higher educated and employed people. These groups also had higher growth over the last six years showing that other groups are not yet catching up.

eCommerce by internet users in the EU vary greatly between countries from 18 % in Romania to 87% in the United Kingdom. However, countries where online shopping among online citizens was less common in 2010 have generally speaking seen higher growth over the last 6 years than the ones at already high levels. Still, even where shares were high in 2010, there has been an increase in online shopping. The big increase for Estonia between 2010 and 2015 is due to a change in methodology that happened in 2014.

Figure 3.4: Individuals ordering goods and services online in the last 12 months, EU-28, 2010, 2015 and 2016 (% of internet users)



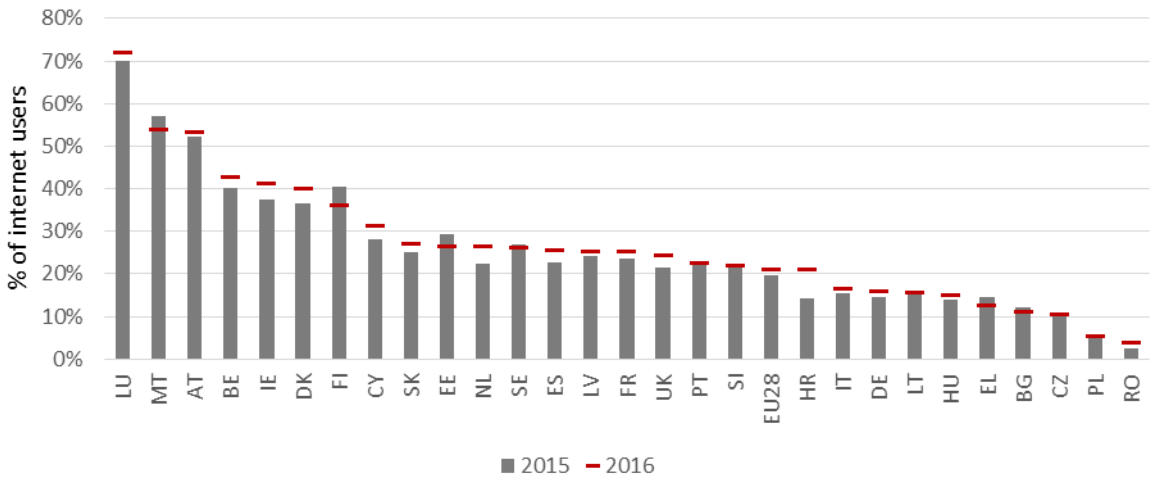
Source: Eurostat - Community survey on the ICT usage in households and by individuals

eCommerce: one fifth of internet users in the EU ordered cross-border goods or services online in 2016.

While 66 % of internet users in the EU shop online, only 21 % engage in cross-border eCommerce. While cross-border online shopping is advancing, it is doing so rather slowly, having increased 9 percentage points since 2010. The extent of cross-border eCommerce differs substantially between Member States, ranging from 4 % in Romania to 72 % in Luxembourg. Buying cross border is influenced by many factors including country size and language. For example, Luxemburg, Malta and Austria which have relatively small home markets and language connections with other large European countries exhibit higher shares of cross-border eCommerce.

The 2015 survey of online consumers showed that, for cross-border purchases from other EU Member States, delivery costs (27 %), high return shipping costs (24 %) and long delivery times (23 %) are among the main consumer concerns. A large number of perceived obstacles relate to key consumer rights, such as return and replacement (getting a faulty product replaced or repaired, 20 %; returning a product consumers did not like and getting reimbursed, 20 %). Concerns related to redress were also frequently quoted, i.e. the difficulty of solving problems if something goes wrong (23 %).

Figure 3.5: Internet users that ordered goods or services for private use over the internet in the last 12 months from sellers from other EU countries



Source: Eurostat - Community survey on the ICT usage in households and by individuals

Almost 60 % of EU Internet users use online banking.

Online banking is a common activity among internet users. **59%** of internet users in the EU **did their banking online in 2016**.

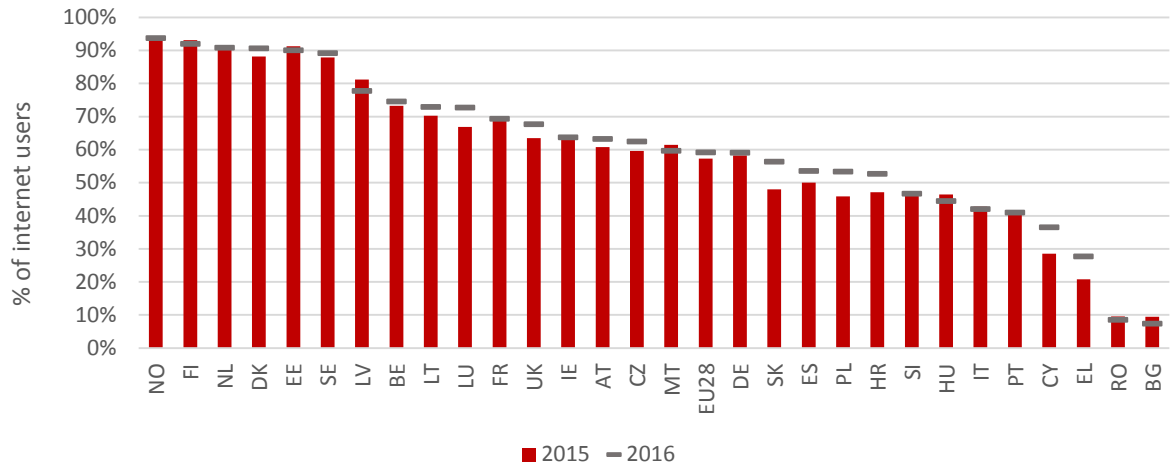
High shares of internet users doing online banking are recorded in **Finland (92 %), the Netherlands and Denmark (91 % each), Estonia (90%) and Sweden (89 %)** for 2016. Large differences exist between the Member States, with **Bulgaria (7 %)** and **Romania (8 %)** having the lowest figures**.**

Countries with high levels of online banking among internet users also tend to have higher rates of eCommerce.

Overall in the EU the use of online banking is gradually progressing. Since 2010 **the percentage** of internet users doing online banking has **increased by around 7 pp. from 52 % to 59%**. Between 2015 and 2016 there was an increase of 2 pp.

In most countries, the share of internet users doing online banking increased marginally in the last year. However, in a few they fell; notably, in Bulgaria and Romania, those countries with the lowest shares: -2 pp. for each. However, the share of internet users doing online banking also fell in Hungary (-2 pp).

Figure 3.6: Individuals who have used the internet, in the last 3 months, for internet banking



Source: Eurostat - Community survey on the ICT usage in households and by individuals

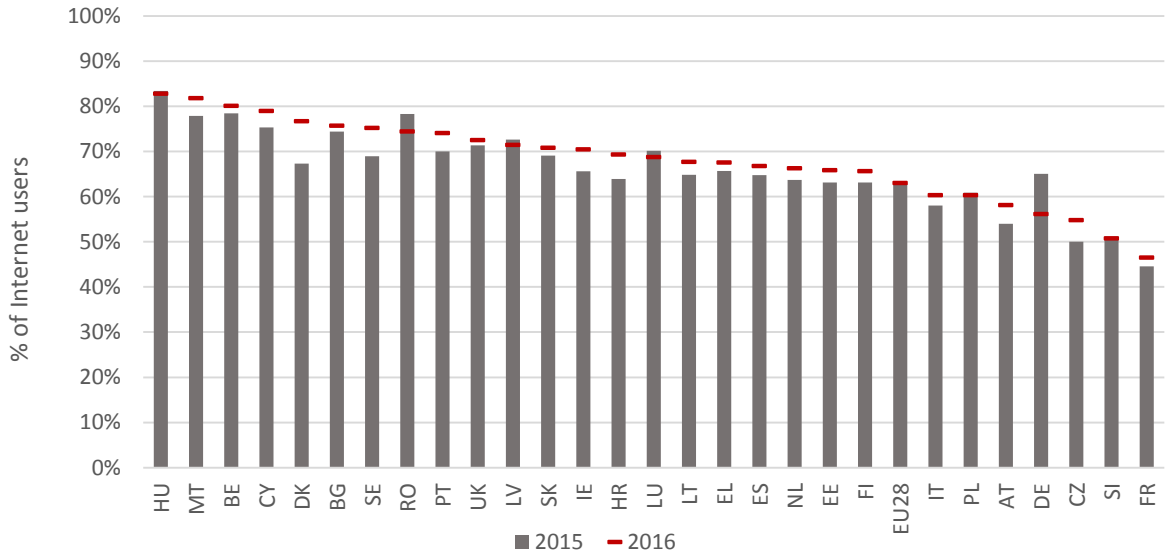
Participation in social networks online is slowly increasing in most EU countries.

Social networks have been around for some time and their use is a common and popular activity among internet users. In 2016, 63 % of internet users participated in social networks, unchanged from 2015. Among 16- to 24-year-olds, the share of users is close to saturation at 88%, while the older age groups still see growth in the share of users.

The country with the largest proportion of internet users on social networks is Hungary (83 %), closely followed by Malta (82 %), Belgium (80 %), and Cyprus (79 %).

Most EU countries saw an increase in the share of internet users participating in social networks between 2015 and 2016. Denmark saw the biggest increase (10 pp.).
Some countries saw relatively large declines (Germany -9 pp. and Romania -4 pp.). However, Germany saw a substantial increase the year before (+16 pp between 2014 and 2015). France has the lowest share of users (47 %) and has not seen any significant increase over the last five years (only +1 pp. since 2011).

Figure 3.7: Individuals who used the internet in the last three months to participate in social networks



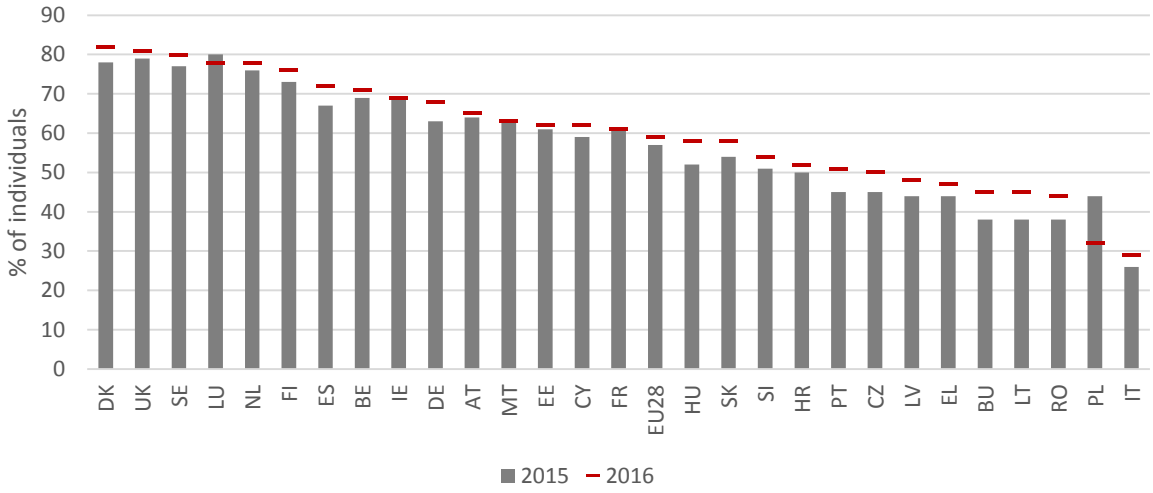
Source: Eurostat - Community survey on the ICT usage in households and by individuals

Internet use has gone mobile.

Mobile use of the internet in Europe really started to take off in around 2010. Today 59 % of individuals in the EU (aged 16-74 years) use a mobile device to access the internet when they are away from home or work. Mobile internet increases the opportunity to access online services. all countries have seen significant growth over the last few years and this growth continues, even amongst countries that have already reach quite high shares.

If growth in use continues, mobile devices could be expected to overtake computers as the primary tool for accessing services and content online. There is of course a correlation between internet use in general and the use of internet on a mobile phone. Still, some countries have a higher share of mobile users among their internet users than others. In Spain, 88 % of internet users are mobile, while in Poland the number is only 42 %.

Figure 3.8: Individuals using mobile devices to access the internet on the move

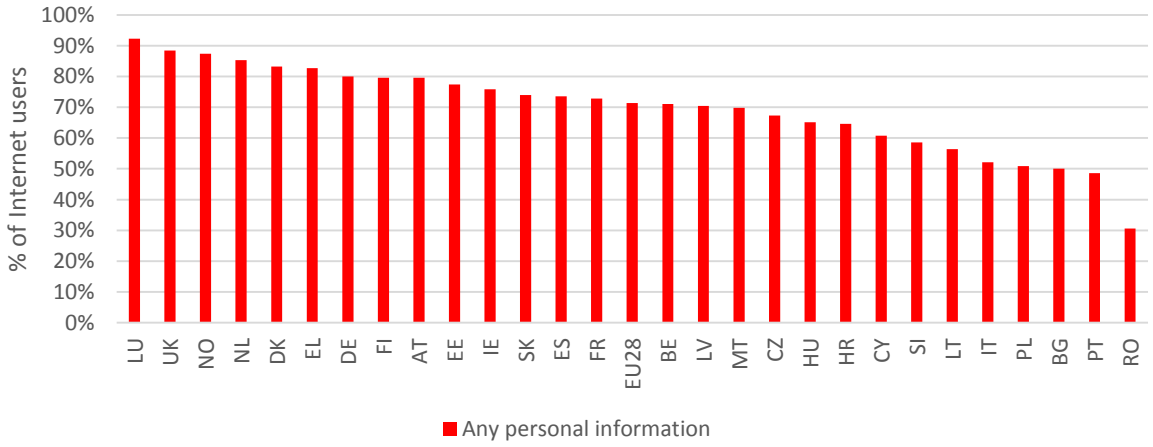


Source: Eurostat - Community survey on the ICT usage in households and by individuals

Privacy: 71 % of internet users in the EU provided personal information online in 2016.

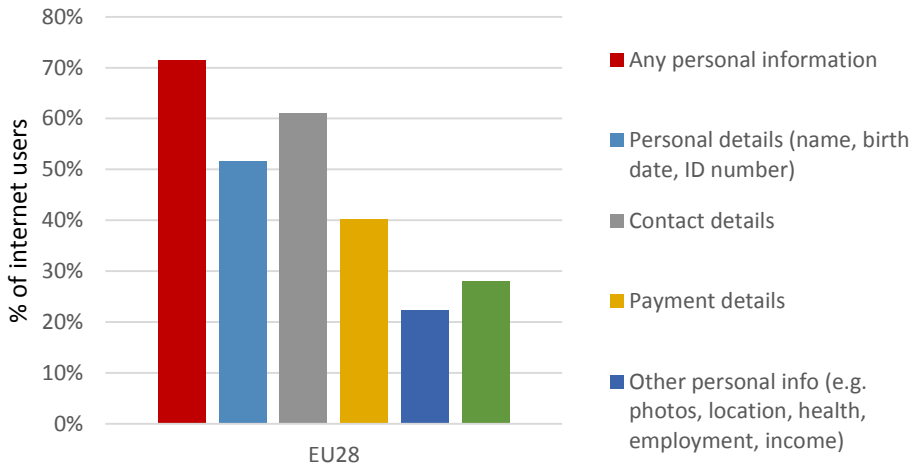
In 2016, 71 % of internet users in the EU provided some type of personal information online (personal details, contact details, payment details or other personal information such as photos, location, health, employment or income).[19] Across countries, figures ranged from 31 % in Romania to 92 % in Luxemburg. The most frequently provided information concerned their contact details (61 %). However, 52 % provided personal details relating to either their name, date of birth or ID card number. 40% provided payment details and 22 % provided other personal information (e.g. photos, location, health, employment or income). 28% of internet users did not provide any personal information online. This figure is quite large and it could be the case that some people are unaware that they do so.

Figure 3.9: Individuals who provided personal information online, 2016 (% of internet users)



Source: Eurostat - Community survey on the ICT usage in households and by individuals

Figure 3.10: Individuals who provided information online, by type, 2016 (% of internet users)



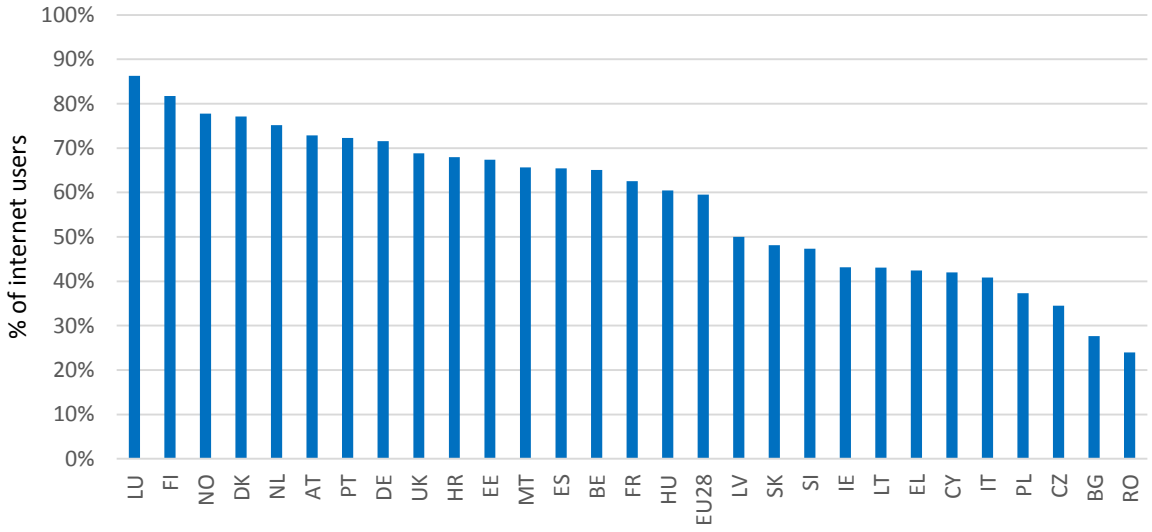
[19] No data available for Sweden

Source: Eurostat - Community survey on the ICT usage in households and by individuals

Privacy: 60 % of internet users limited access to their personal information online

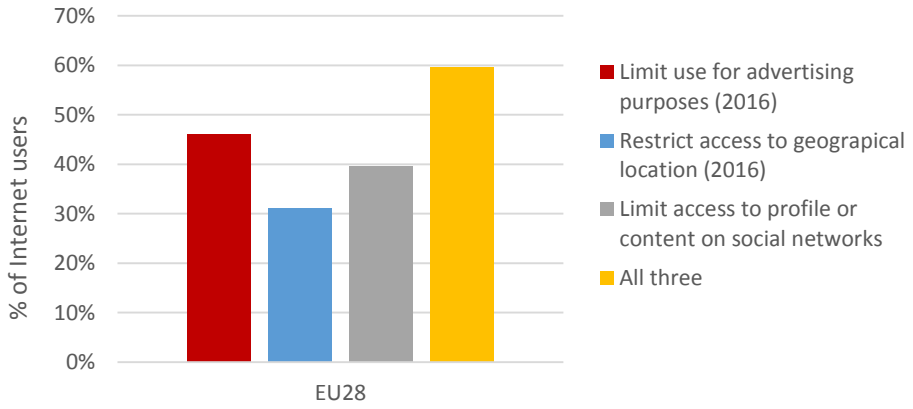
EU legislation gives consumers the right to limit the use of the personal information they provide online. Many Internet users make active use of this by refusing to allow the use of personal information for advertising purposes, restricting access to their geographical location or by limiting access to their profiles or content on social networking sites. On average in the EU 60 % of internet users in 2016 limited access to their personal information in this way.[20] While in Luxembourg as many as 86% of the internet users undertake such limiting actions, in Romania it is only 24 %. While 46 % of the internet users refused to allow the use of their personal information for advertising purposes, 40 % limited access to their profile or content on social networking sites and 31 % restricted access to their geographical location.

Figure 3.11: Internet users who limited access to their personal information online, 2016



Source: Eurostat - Community survey on the ICT usage in households and by individuals

Figure 3.12: Individuals who limited access to their personal information online, by type, 2016 (% of internet users)



[20] No data available for Sweden.

Source: Eurostat - Community survey on the ICT usage in households and by individuals

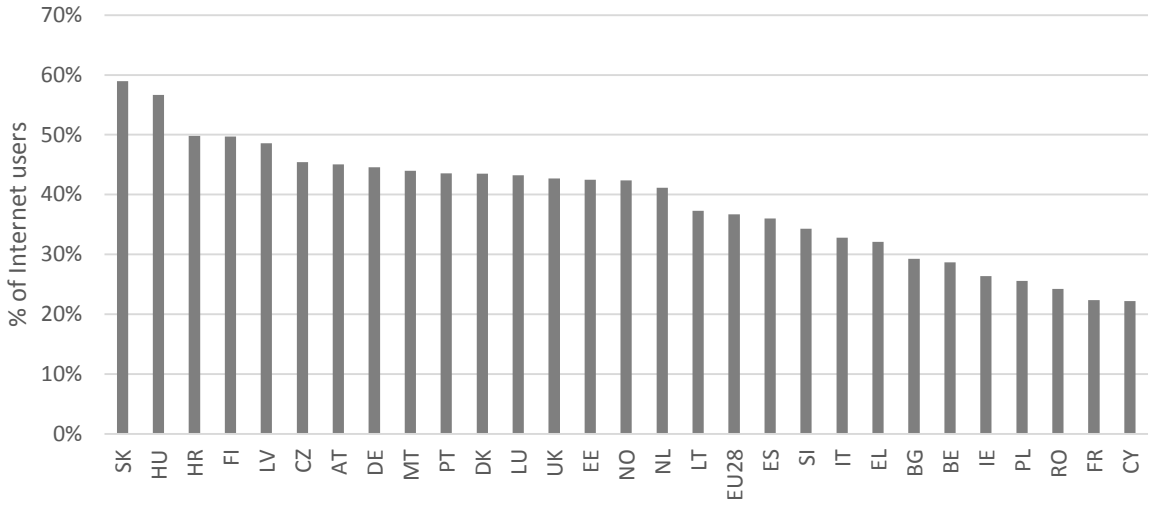
Privacy: However, Only 37 % of internet users read privacy policy statements before providing personal information online

When asked if they read privacy policy statements before providing personal information on the internet only 37 % of internet users in the EU said they did in 2016.[21] In fact in all countries but two, Slovakia and Hungary, the figure is at or below 50%.

Across countries, the rate of internet users reading privacy policy statements differs substantially.

While over half the internet users in Slovakia (59 %), Hungary (57 %), Croatia (50 %) and Finland (50 %) do so, in Cyprus (22 %), France (22 %) and Romania (24 %) it is less than a quarter.

Figure 3.13: Individuals reading privacy policy statements before providing personal information online, 2016 (% of internet users)



Source: Eurostat - Community survey on the ICT usage in households and by individuals

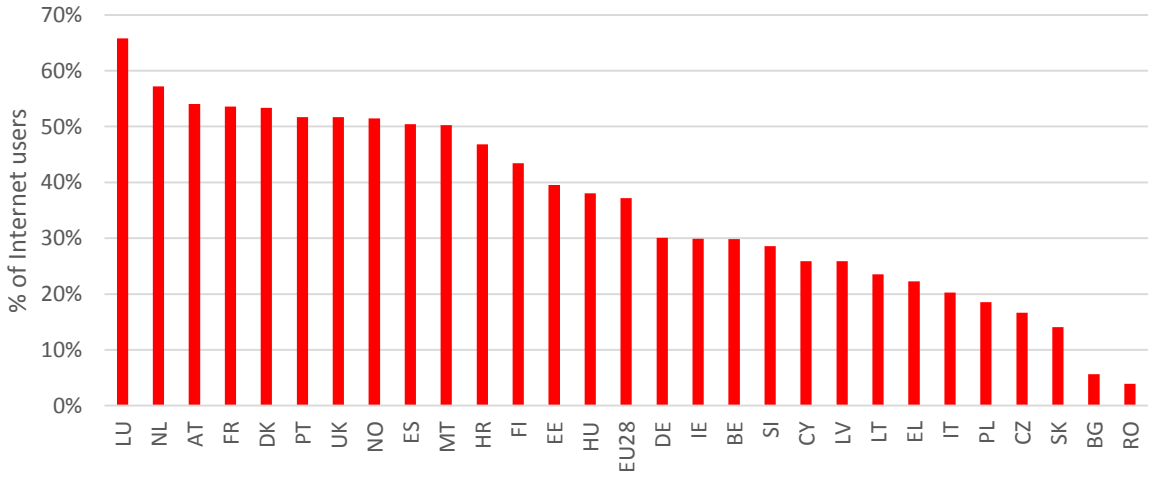
[21] No data available for Sweden

Privacy: only 37 % of internet users check that websites are secure before providing personal information

When asked whether they had checked that the websites where they needed to provide personal information were secure (e.g. https sites, safety logo or certificate) 37 % of EU citizens who had used the internet in the previous 12 months said they had done so.[22]

While in Luxemburg almost two thirds of internet users check the security of websites before providing their personal information, in Bulgaria and Romania it is only 6 and 4 %, respectively.

Figure 3.14: Individuals who check that websites are secure before providing personal information online, 2016 (% of internet users)



Source: Eurostat - Community survey on the ICT usage in households and by individuals

[22] No data available fro Sweden

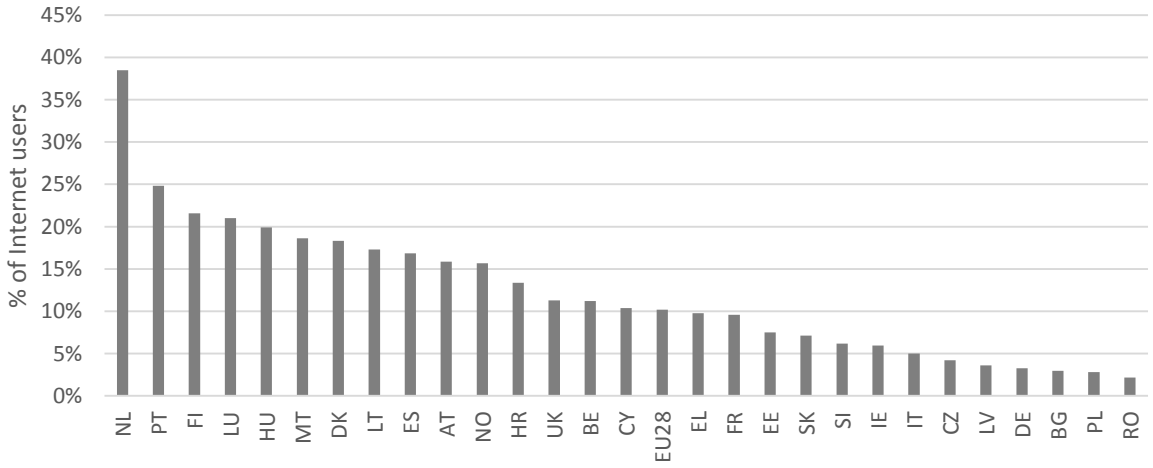
Privacy: Very few internet users ask websites to update or delete their personal information

As yet, very few internet users in Europe take advantage of their "right to be forgotten" i.e. their right to ask websites or search engines to update or delete personal information they hold about them online. When questioned, only 10 % of people who used the internet in the last 12 months had asked websites or search engines to update or delete the information they held about them.[23] However, figures vary widely across the EU. Internet users in the Netherlands for example are much more active in requesting changes to their personal information online, with 38 % having done so in 2016. This contrasts sharply with shares at or below 25 % for all other EU countries. In a handful of countries (Germany, Bulgaria, Poland and Romania) only 2 – 3 % of internet users have requested updates or deletion of personal information.

The "Right to be Forgotten" ruling – In its ruling of 13 May 2014 the EU Court said: … c) Individuals have the right - under certain conditions - to ask search engines to remove links with personal information about them. This applies where the information is **inaccurate, inadequate, irrelevant** or **excessive** for the purposes of the data processing (para 93 of the ruling). The court however clarified that **the right to be forgotten is not absolute** but will always need to be balanced against other fundamental rights, such as the freedom of expression and of the media (para 85 of the ruling). As such, **a case-by-case assessment is needed** in considering the types of information in question, its sensitivity for the individual's private life and the interest of the public having access to that information. The role the person requesting the deletion plays in public life might also be relevant.

Source: Factsheet on the "Right to be Forgotten" ruling (C-131/12)

Figure 3.15: Individuals who ask websites to update or delete their personal information, 2016 (% of internet users)



Source: Eurostat- Community survey on the ICT usage in households and by individuals

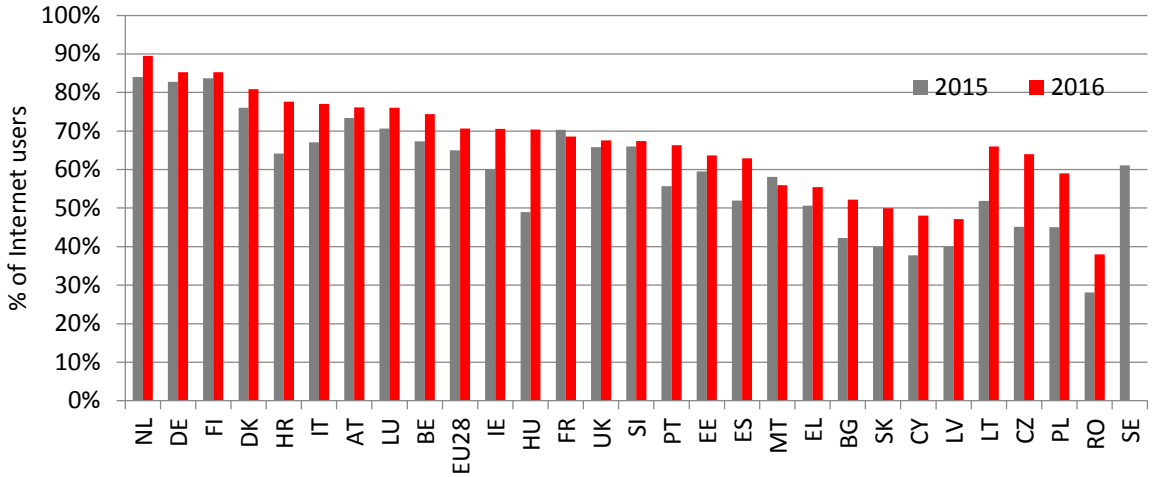
[23] No data available for Sweden

Privacy: Awareness about cookies for advertising purposes

71% of internet users in the EU are aware that cookies can be used to trace online activity for advertising purposes. This marks a substantial increase in awareness over 2015 (+ 6 pp.). Awareness about the possibility to track online behaviour increased in almost all European countries over this period. The biggest increases in awareness were observed in Hungary (+ 21 pp.) and the Czech Republic (+ 18 pp.). By contrast, there was a marginal decline in awareness amongst internet users in France and Malta.

However, levels of awareness vary substantially across the EU. While over 80 % of internet users in the Netherlands, Germany, Finland and Denmark are aware that cookies can be used to trace online activity for advertising purposes, only 38 % of Romanians are aware of this. In general the awareness is higher in countries with higher levels of Internet use and digital skills.

Figure 3.16: Individuals who know that cookies can be used to trace online activity (% of internet users)



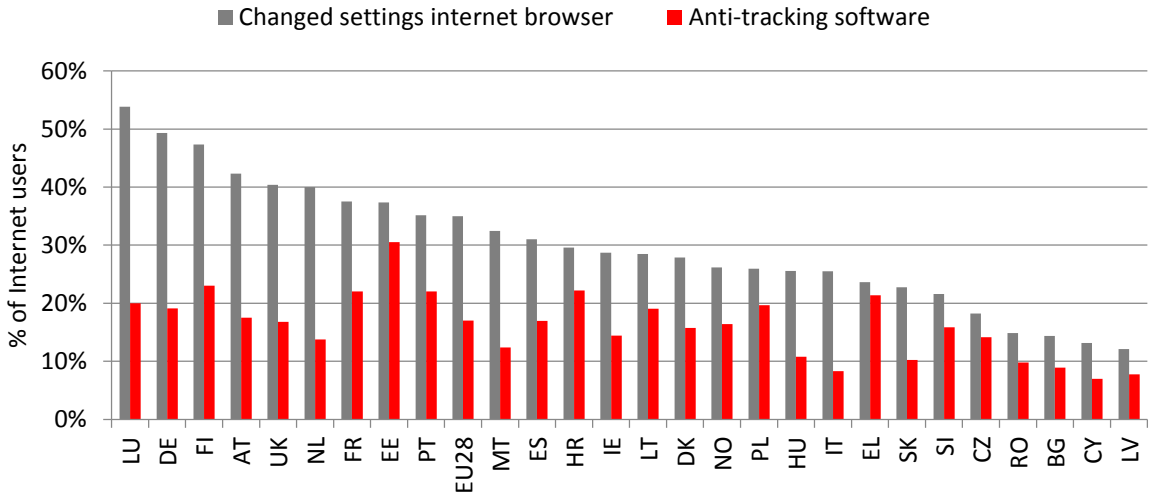
Source: Eurostat - Community survey on the ICT usage in households and by individuals

Privacy: Users who limit their traceability online by anti-tracking software or browser settings

There are two ways to limit a website's ability to track user behaviour and history on the internet. The first is to limit the number of cookies by changing the internet browser settings. A more advanced method is to use special anti-tracking software (software that limits the ability to track the activities on the internet). This can limit cookies as well as other traces online. On average in the EU, changing browser settings (35 %) is more widely spread among European internet users than is using anti-tracking software (17 %). And this is the case for all countries.

Across Member States, changing browser settings is most wide spread amongst internet users in Luxemburg (54 %), Germany (49 %) and Finland (47%) and less spread in Latvia (12 %), Cyprus (13 %) and Bulgaria (14%). Use of anti-tracking software is highest in Estonia (31 %) and Finland (23 %). It is lowest in Cyprus (7 %), Italy and Latvia (both 8 %).

Figure 3.17: Internet users who limit their online traceability by changing the settings and by using anti-tracking software, 2016



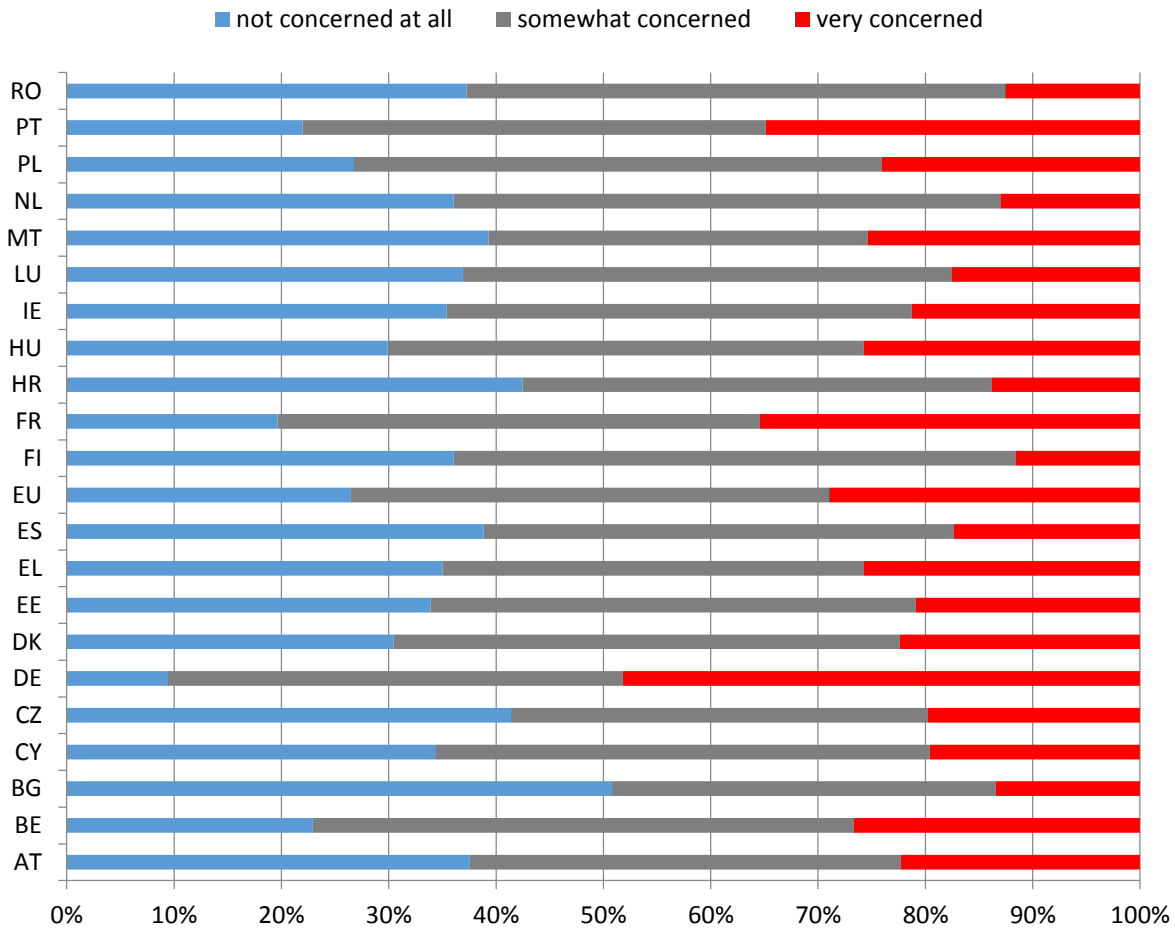
Source: Eurostat – Community survey on the ICT usage in households and by individuals

Privacy: Concern about online activities being recorded for advertising

Most internet users are concerned about their online activities being recorded. Indeed on average in the EU 73 % of internet users are concerned to some extent.[24] While 44 % are somewhat concerned, 29 % say they are very concerned. Only 26 % are not at all concerned.

There is some variation across Member States in the degree of concern. In particular, German internet users show the highest rates of concern over their online activities being recorded. 90 % of internet users in Germany are to some extent concerned. 48 % are very concerned. The French internet users are also relatively more concerned with shares of 80 % and 35 %, respectively. Relatively less concerned over being recorded online is displayed by internet users in Slovenia, Slovakia and Bulgaria. Although even here more than 40 % of internet users are to some extent concerned.

Figure 3.18: Individuals' concern about their online activities being recorded, 2016 (% of internet users)



Source: Eurostat – Community survey on the ICT usage in households and by individuals

[24] EU data do not include Italy, Latvia, Sweden and the United Kingdom.

4. Integration of Digital Technology

On Integration of Digital Technology, Denmark scored highest, followed by Ireland, Sweden and Belgium. Romania, Bulgaria, Poland and Latvia scored lowest.

EU28	Value 2017		Value 2016
4a1 Electronic Information Sharing	**36%**		**36%**
% enterprises	2015		2015
4a2 RFID	**3,9%**		**3,9%**
% enterprises	2014		2014
4a3 Social Media	**20%**	↑	**18%**
% enterprises	2016		2015
4a4 eInvoices	**18%**		na
% enterprises	2016		2015
4a5 Cloud	**13%**		na
% enterprises	2016		2015
4b1 SMEs Selling Online	**17%**	↑	**16%**
% SMEs	2016		2015
4b2 eCommerce Turnover	**9,4%**		**9,4%**
% SME turnover	2016		2015
4b3 Selling Online Cross-border	**7,5%**		**7,5%**
% SMEs	2015		2015

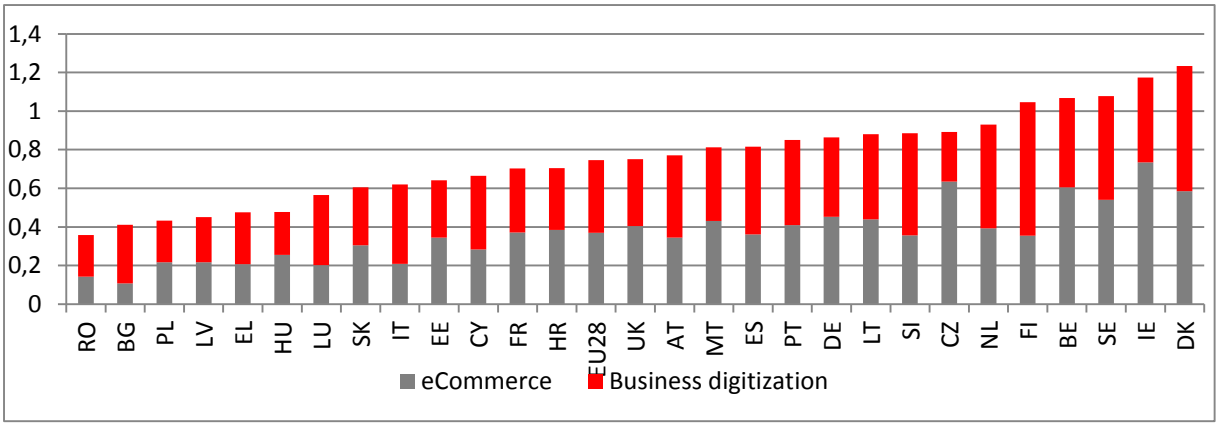
Source: European Commission, Digital Scoreboard based on Eurostat Community survey ICT usage and e-commerce in enterprises

Integration of Digital Technology covers (a) 'business digitisation' and (b) 'eCommerce'. 'Business digitisation' has five indicators (as % of firms using): electronic information sharing, RFID, social media, eInvoices and cloud solutions. eCommerce has three indicators: the percentage of small and medium-sized enterprises (SMEs) selling online, eCommerce turnover as a percentage of total turnover of SMEs, and the percentage of SMEs selling online cross-border. This DESI dimension is used also to measure the Digital Transformation output in the DTM scoreboard[25].

In CZ and IE the driver is eCommerce, whereas the adoption of eBusiness technologies dominate BG, IT, FI and LU performance.

Figure 4.1. DESI2017 scores for the Integration of digital technology

[25] See: http://ec.europa.eu/growth/tools-databases/newsroom/cf/itemdetail.cfm?item_id=9076

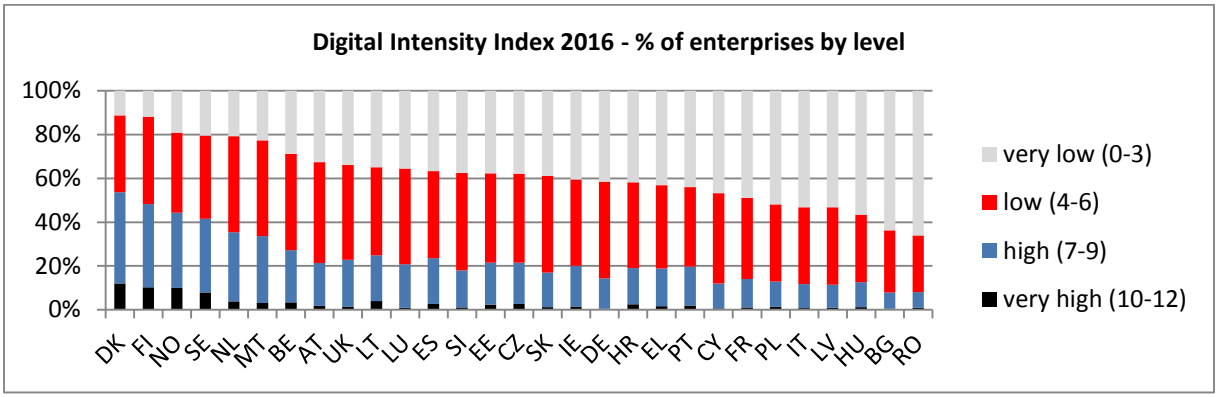


Source: Commission services based on Eurostat Community survey on ICT usage and e-commerce in enterprises

Merely a fifth of companies in the EU-28 is highly digitised, but the situation across countries is varied: while half of companies in Denmark are highly digitised, in Bulgaria and Romania it is less than one in ten.

The Digital Intensity Index (DII) is a micro-based index that measures the availability at firm level of 12 different digital technologies: internet for at least 50 % of employed persons, recourse to ICT specialists, fast broadband (30 Mbps or above), mobile internet devices for at least 20 % of employed persons, a website, a website with sophisticated functions, social media, paying for advertising on the internet; the purchase of advanced cloud computing services; sending eInvoices, eCommerce turnover accounting for over 1 % of total turnover and business-to-consumer (B2C) web sales of over 10 % of total web sales. The value for the index therefore ranges from 0 to 12.

Figure 4.2. Digital Intensity Index 2016



Source: Eurostat Community survey ICT usage and e-commerce in enterprises

Only in three EU countries is the percentage of firms with a very high DII (i.e. possessing at least 10 out of the 12 monitored digital technologies) above 5 %: DK, SE and FI.

By contrast, in some countries such as RO, BG, HU, LV, IT, and PL the majority (more than 50%) of businesses have not yet invested heavily in digital technologies (i.e. has a very low DII), often having just a simple website and a couple of computers.

In the short term, social media, eInvoices and mobile applications are driving the digital transformation of European businesses. Also cloud computing shows high growth rates but only in large enterprises.

The table below shows the degree of penetration and speed of adoption of the different technologies monitored by the Digital Intensity Index. While some seem to be reaching saturation (e.g. having a simple website, access to ICT specialist skills and ERP), at least where large companies are concerned, for the majority there is still room for improvement.

Figure 4.3. Key indicators tracking digitization processes

Key indicators tracking digitization processes	Year	% of EU28 enterprises			Variation 2016 on 2015	
		Large	SMEs		Large	SMEs
Having a **web site** or homepage	2016	94%	77%		0%	2%
access to **ICT specialist** skills	2016	90%	64%		-1%	0%
Website has some **interactive functionalities**	2016	73%	57%		0%	2%
Use any **social media**	2016	68%	44%		5%	6%
>50% of the persons employed **use computers** & Internet	2016	48%	39%		0%	1%
have **ERP** software package to share information	2015	80%	34%		not available in 2016	
use Customer Relationship Management **(CRM)**	2015	62%	32%		not available in 2016	
fastest **broadband** connection is at least 30 Mb/s	2016	62%	31%		8%	5%
>20% of workers with **portable devices** for business use	2016	36%	30%		4%	3%
Pay to **advertise** on the internet	2016	34%	25%		not comparable with 2015	
selling online (at least 1% of turnover)	2016	38%	17%		0%	1%
sending **eInvoices** suitable for automated processing	2016	38%	17%	*	3%	4%
share electronically **supply chain** management data	2015	47%	16%		not available in 2016	
Buy medium-high **Cloud Computing** services	2016	29%	13%	**	5%	1%
Exploit **B2C eCommerce**	2016	9%	7%	(x)	0%	1%

(x) Enterprises where web sales are more than 1% of total turnover and B2C web sales more than 10% of the web sales

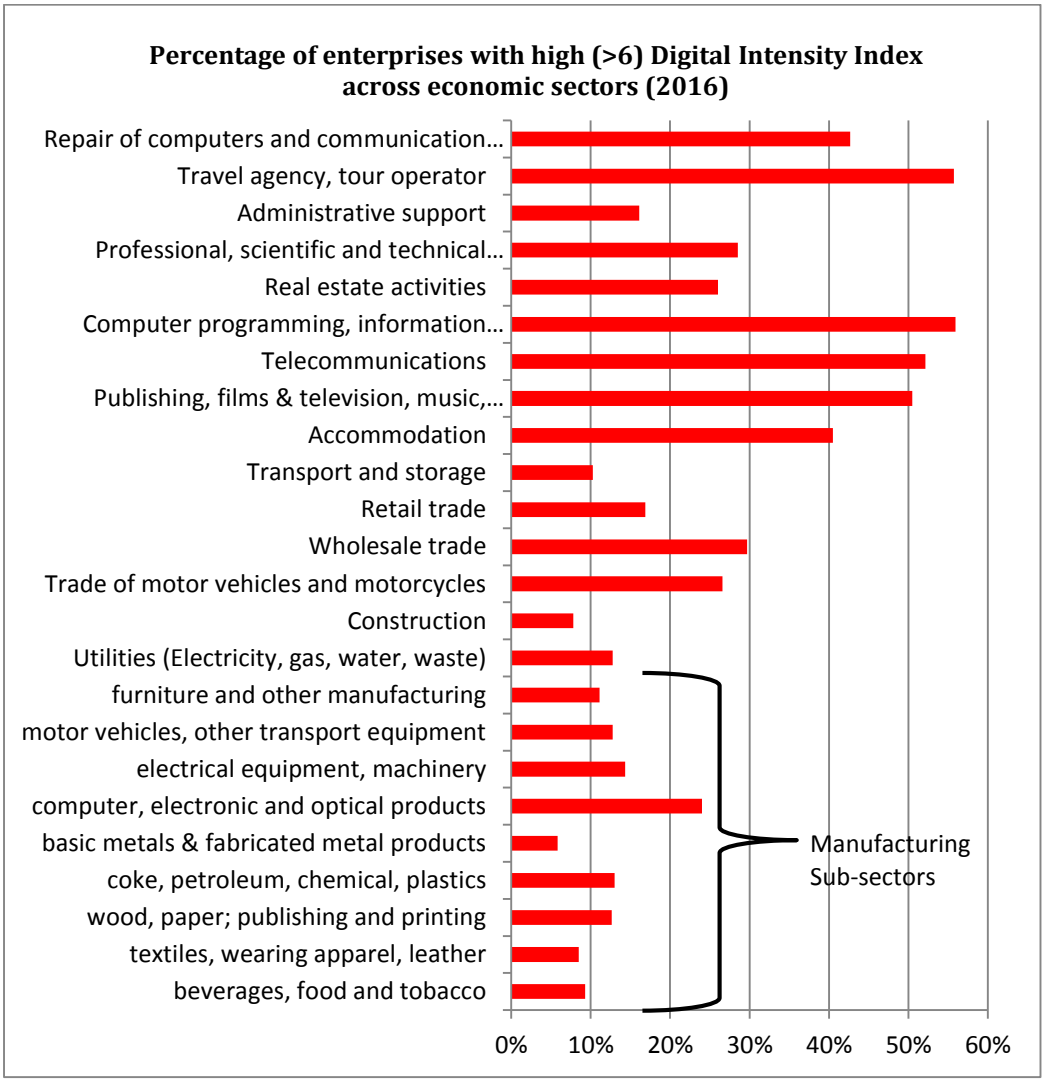
* Estimated using 20 countries collecting the optional indicator in 2015

** Estimated using 17 countries collecting the optional indicator in 2015

Source: Eurostat Community survey ICT usage and e-commerce in enterprises

The digitisation of economic sectors is progressing at different speeds, according to their own specific needs and starting points.

Figure 4.4. EU Enterprises with high (>6) Digital Intensity Index across economic sectors (2016)



Source: Eurostat Community survey ICT usage and e-commerce in enterprises

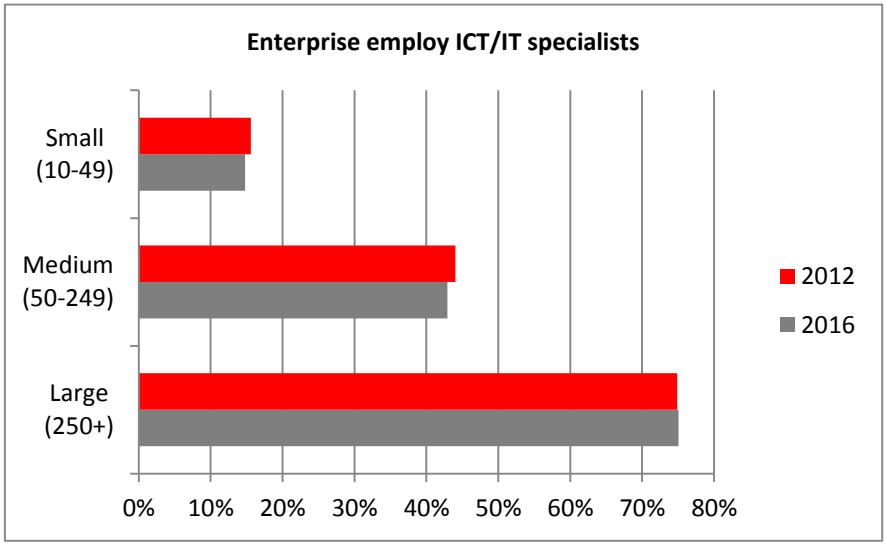
As can be expected, it is the different segments of the ICT sector (from telecoms to the manufacture of computers) that tend to be the most digitised sectors of the economy. However, other sectors such as accommodation, travel agencies, cultural industries (publishing, film&television, music) and the wholesale trade are also highly digitised.

The pattern of sectoral variability in digitisation is similar across EU countries with some positive exceptions of higher digitisation than expected if looking only at the countries and sectoral marginal averages: Information and Communication in CY, HU, PL, SI; Manufacturing in FI; Construction in DK; Trade in SI; Accommodation in IT, PT, SI; Real Estate in FR; Professional Services in BE, Travel Agencies in IT, PL.

Size is a major factor facilitating the digital transformation of enterprises. SMEs are slowly closing the gap with large companies and there are a lot of opportunities still to be exploited.

The adoption of digital technologies varies strongly with company size. Large enterprises have a scale advantage and more capacity to employ at least some IT/ICT specialists.

Figure 4.5. Enterprises employing ICT/IT specialists, % of enterprises

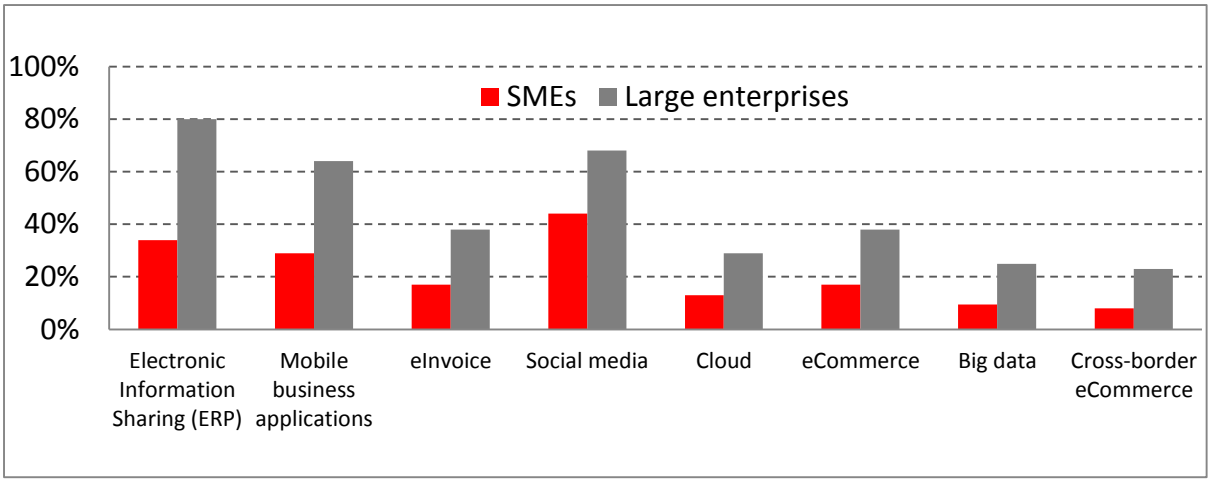


Source: Eurostat Community survey ICT usage and e-commerce in enterprises

The result is that data sharing infrastructure such as ERP is much more common in large companies. However, SMEs are relatively active on social media (44 %) and the usage of mobile internet to allow employees to exploit business application is also becoming more common; there was an increase from 20 to 29% from 2012 to 2016, while for large enterprises it remained stable at 64% over the same period.

There are nevertheless a lot of technological opportunities still to be exploited by SMEs with big data, cross-border eCommerce, cloud services and automation.

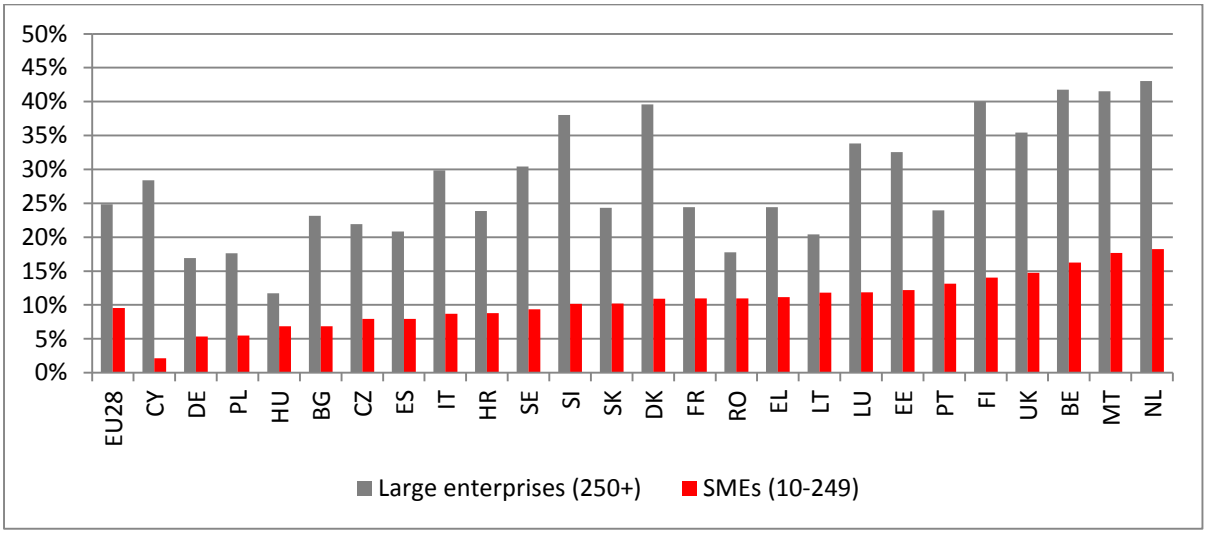
Figure 4.6. Adoption of some key digital technologies by company size, 2015 or 2016, % of enterprises



Source: Eurostat Community survey ICT usage and e-commerce in enterprises

Companies are beginning to utilise big data analytics to gain business insights

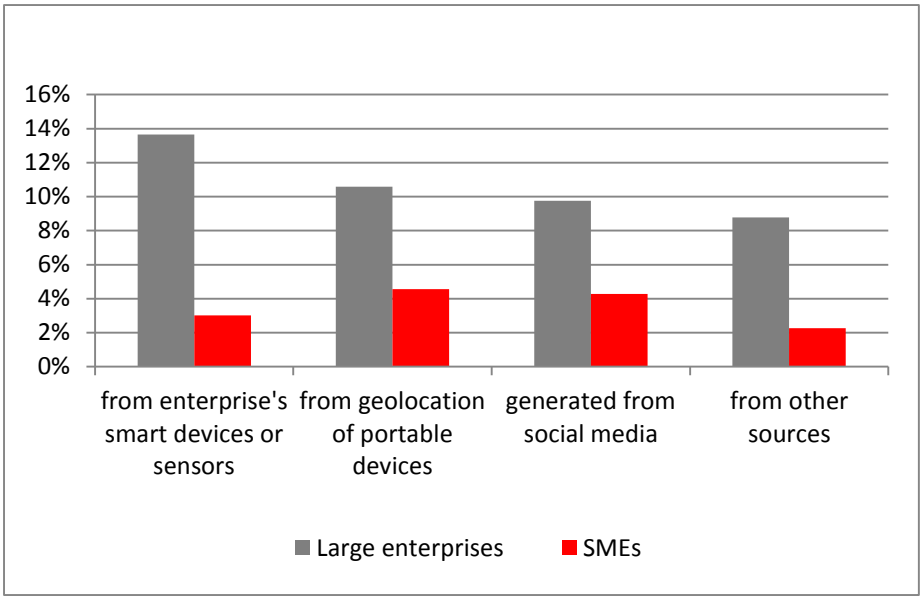
Figure 4.7. % of Enterprises analysing big data from any data source, 2015



Source: Eurostat Community survey ICT usage and e-commerce in enterprises

10% of SMEs and 25% of large enterprises report using some type of big data sources, showing that data driven business models are becoming a reality accessible to every entrepreneur. The most common in large enterprises are those coming from own internal processes and sectors like telecom, electricity, gas, water are in the lead. But data coming from geolocation and social media are more important and more often exploited by SMEs. SMEs from NL, MT, BE or UK seem ahead of those from other countries.

Figure 4.8. Type of big data sources by company size, % enterprises, 2015



Source: Eurostat Community survey ICT usage and e-commerce in enterprises

5. Digital Public Services

For Digital Public Services, Estonia had highest score, followed by Finland, Netherlands and Denmark. Romania, Hungary and Croatia had the lowest scores.

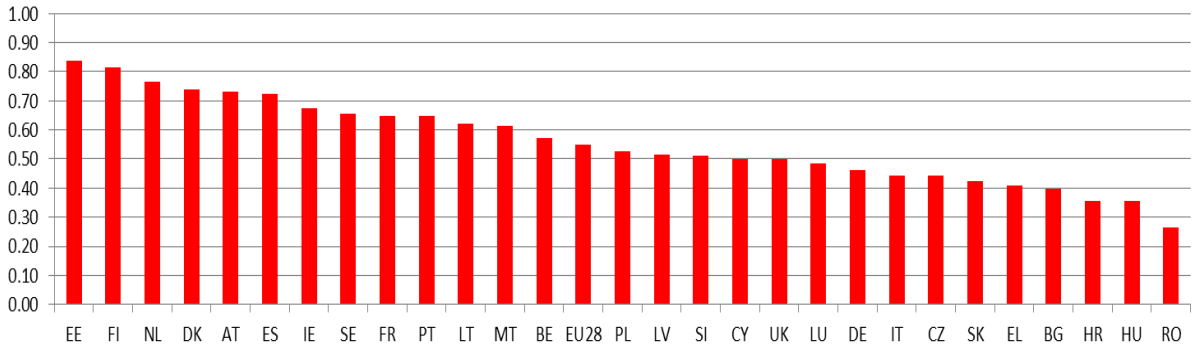
The Digital Public Services dimension consists of four indicators: the percentage of internet users who have sent completed forms to a public administration via the internet (eGovernment users indicator); the level of sophistication of a country's eGovernment services (the pre-filled forms indicator, which measures the extent to which data that is already known to the public administration is pre-filled in forms presented to the user); the level of completeness of a country's range of eGovernment services (the online service completion indicator, which measures the extent to which the various steps in an interaction with the public administration can be performed completely online), and the government's commitment to open data (open data indicator).

Figure 5.1: Indicators included in the Digital Public Services dimension of the DESI 2017:

Digital Public Services Indicators in DESI 2017	EU28 value
5a1 eGovernment Users	**34%**
% internet users (last year)	2016
5a2 Pre-filled Forms	**49**
Score (0 to 100)	2016
5a3 Online Service Completion	**82**
Score (0 to 100)	2016
5a4 Open Data	**59%**
% of maximum score	2016

Source: European Commission, Digital Scoreboard and Eurostat - Community survey on the ICT usage in households and by individuals (the survey covers individuals aged 16 to 74)

Figure 5.2: DESI 2017, Digital Public Services dimension, by country



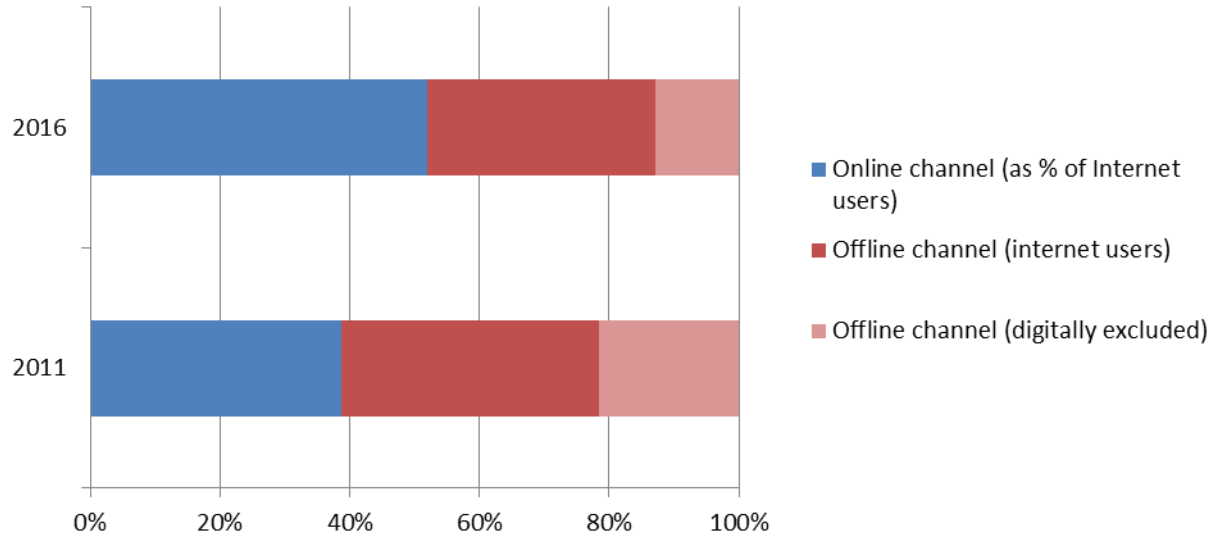
Source: European Commission, Digital Agenda Scoreboard

More than half of the population needing public services chooses the online channel - both old and new internet users alike

Among the citizens needing to submit forms to the public administrations in 2016, 13 % used the offline channel because they did not use internet at all. Of the remaining 87%, all of them internet users, 52 % chose the online channel, while 35% preferred an offline interaction with the public authorities. This marks a considerable progress compared with 2011 when only 39 % of the population was sending completed forms online, and the percentage of those who couldn't because they were not internet users was of 21 %. Overall progress on eGovernment use (13 p.p.) is greater than the reduction in the digitally excluded (8 p.p.) meaning that also previous internet users start approaching more complex services like eGovernment. In total, in five years more than 28 million citizens in the EU27 (excluding IT for lack of data) abandoned the use of paper forms in order to embrace digital solutions.

The percentage of citizens needing to submit forms (for which information is lacking) has been assumed to be analogous to the percentage of internet users needing to submit a form (for which information is available).

Figure 5.3: eGovernment usage potential (preferred channel for submitting forms to public authorities by citizens), EU27



Source: European Commission calculations based on Eurostat - Community survey on the ICT usage in households and by individuals. EU27: EU28 excl. IT

'Digital natives' and their grandparents learn eGovernment. Their lowly educated parents…not so much

Among young people with all levels of education there has been a marked progression in the use of eGovernment, proving that digital natives' online activities are not limited to social media and digital content fruition, but they do extend to more complex services. Similarly, among the elderly there has been a marked progression (between 5 p.p. and 11 p.p.), and again across all education levels (even after taking into account demographic effects, i.e. the transition between age classes between 2011 and 2016). Considering that internet use (and therefore potential eGovernment use) has expanded greatly in this age group (i.e. from 48% to 65% of the population), this progress is remarkable, signalling that eGovernment services are one of the applications of choice for elders users, possibly one of the driving factors behind their digitisation. On the other hand, the middle-aged population with lower education has one of the lowest uses of eGovernment (39%) and it also showed the lowest progress between 2011 and 2016. This is unfortunate because they are probably one of the categories more in need of public services like services for the unemployed, public subsidies (since low education correlates with low income and unemployment).

Figure 5.4: Individuals who submitted completed forms to public authorities over the internet by age groups and education levels (as % of internet users who need to submit official forms), EU27, 2011 and 2016

	Individuals that submitted forms to public authorities over the internet (as % of internet users who need to submit official forms), EU27								
Age-education classes	16-24 years low education	16-24 years medium education	16-24 years high education	25-54 years low education	25-54 years medium education	25-54 years high education	55-74 years low education	55-74 years medium education	55-74 years high education
2011	32.6%	44.5%	61.9%	37.3%	43.3%	64.9%	32.9%	40.1%	57.6%
2016	46.6%	64.5%	73.5%	39.3%	53.7%	74.6%	37.9%	48.3%	68.7%
pop growth of respective class	-7%	1%	18%	6%	1%	20%	42%	38%	39%

Source: European Commission calculations based on Eurostat - Community survey on the ICT usage in households and by individuals. EU27: EU28 excl. IT

The measurement of eGovernment supply, some methodological notes.

The supply side of eGovernment is measured through a 'user journey' approach. Researchers pose as ordinary users of eGovernment services in an event (i.e. life event) that requires some official action (e.g. a marriage). They go through the steps of meeting the relevant administrative requirements using public authority websites and the online channel where possible.	Eight life events are analysed over two years (with data for four complete measurements in 2012-2013, 2013-2014, 2014-2015 and 2015-2016) in different areas of government: • losing/finding a job • enrolling at university • moving • starting a small claims procedure • buying/owning a car • Family life • starting a business • regular business operations

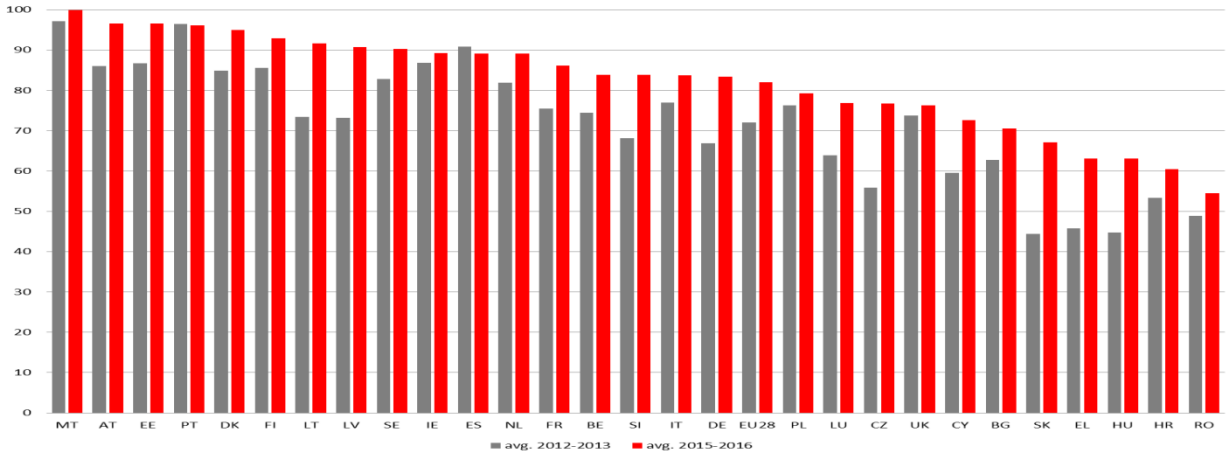
This methodology looks at different aspects of service provision, but the two examined here are the following: Online Service Completion and Pre-filled Forms. The Online Service Completion indicator measures the share of the life event(s) that can be completed online. The Pre-filled forms indicator measures the amount of data that is pre-filled in Public Services' online forms. Both indicators range from 0 (complete absence of required features) to 100 (all features included) and are components of the DESI dimension 'Digital Public Services'.

The source for the eGovernment supply data is the eGovernment Benchmark Report

There is progress in putting government services online but more effort needs to be done by countries lagging behind. Administrative burden reduction through the use of interconnected databases is still in its infancy

Five countries in the EU-28 are very close to having a fully developed digital channel for public services with scores above 95 %: MT (100%), AT, EE, PT and DK. Although countries at the bottom are (mostly) catching up, seven of them still have one out of four services not available online (RO, HR, HU, EL, SK, BG, CY).

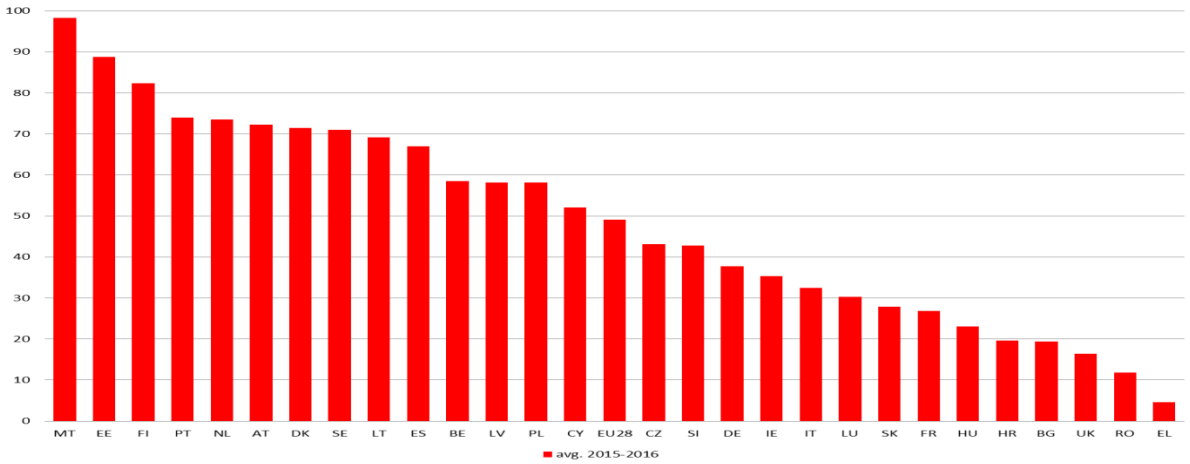
Figure 5.5: Online Service Completion (2012-2013 and 2015-2016)



Source: eGovernment Benchmark Report

The use of inter-connected registers with the purpose of avoiding re-submission of data by the user is not yet widespread. Pre-filled forms are available, for half of EU countries, for less than half of the cases where this could be possible, and sometimes much less than that. Some notable exceptions are MT, EE and FI, with seven other countries following suit.

Figure 5.6: Pre-filled Forms (2015-2016)



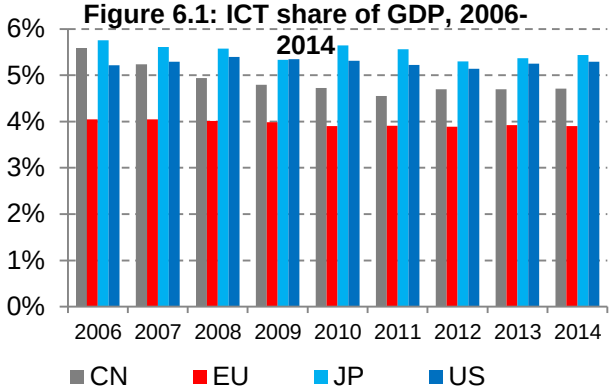
Source: eGovernment Benchmark Report

6. R&D AND ICT SECTOR

The Information and Communication Technologies (ICT) sector value added amounted to EUR 593 billion in 2014. ICT services represented 91% of total ICT value added. ICT services (excluding telecoms) were the main sector and the only one to be expanding.

Value added in the ICT sector accounted for 4.2 % of EU GDP in 2014 (comprehensive definition*). However, according to the operational definition* which enables world comparisons, value added in the ICT sector in the EU (3.9 %) was behind Japan (5.4 %), the US (5.3 %) and China (4.7 %) in 2014.

Figure 6.1: ICT share of GDP, 2006-2014

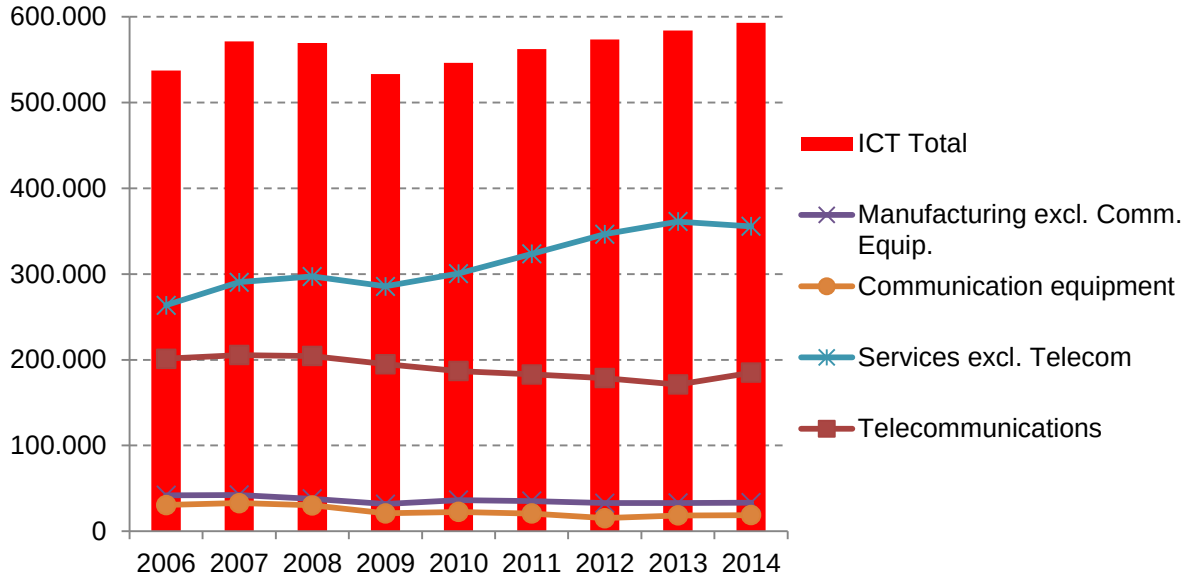


Source: European Commission, PREDICT database

The EU ICT sector **value added** amounted to EUR 593 bn in 2014. After a slowdown in 2009, the ICT sector experienced a recovery. A breakdown by sub-sector shows the predominance of ICT services (EUR 541 bn and 91 % of total ICT value added in 2014) over ICT manufacturing industries (EUR 52 bn and 9 % of total ICT value added in 2014). The ICT services sector (excluding telecommunications) is the only one that saw an increase in value added over the medium-term period (2006-2014) up to EUR 356 bn. The communication equipment sector experienced the sharpest decline over the medium-term period (2006-2014). After peaking at EUR 33 bn in 2007, it fell to EUR 15 bn in 2012, but recovered to EUR 19 bn in 2014.

** See methodological note.*

Figure 6.2: Value Added in the ICT sector, 2006-2014 (€m)

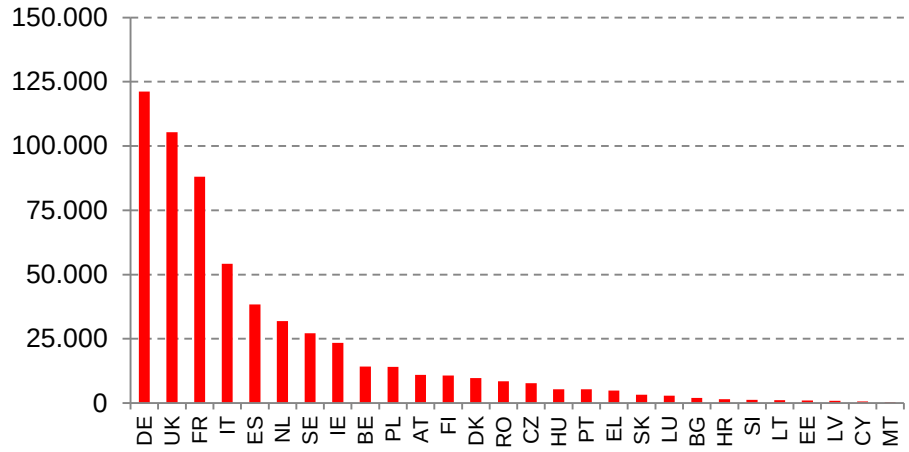


Source: European Commission, PREDICT database

The five largest economies (Germany, the United Kingdom, France, Italy and Spain) are the five biggest contributors to ICT value added in 2014. However, a medium-sized country like Ireland has by far the highest ICT share of GDP (12.1 % in 2014).

Unsurprisingly, the five largest economies were also the **five biggest contributors** to ICT value added in 2014: Germany (EUR 121 bn or 20 %), the United Kingdom (EUR 105 bn or 18 %), France (EUR 88 bn or 15 %), Italy (EUR 54 bn or 9 %) and Spain (EUR 38 bn or 6 %). Together, these five countries represented 68 % of total EU ICT value added in 2014.

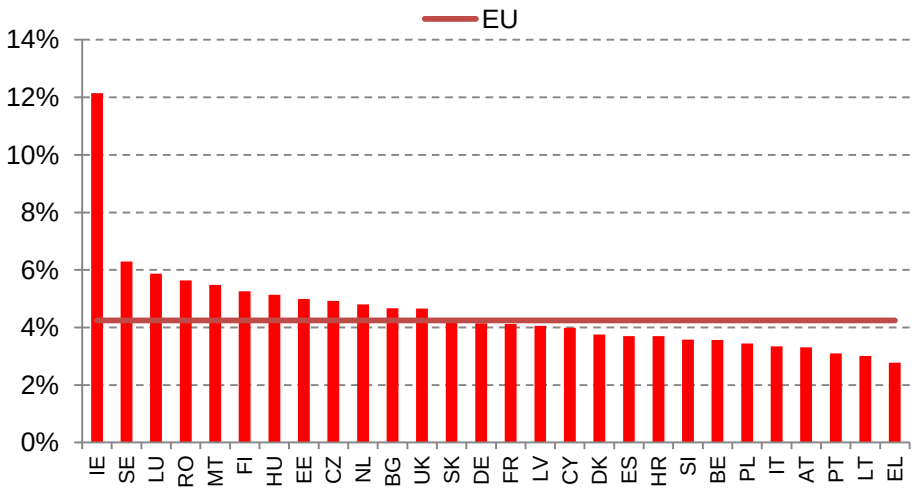
Figure 6.3: Value Added in the ICT sector, 2014 (€m)



Source: European Commission, PREDICT database

Ireland had by far the highest ICT share of GDP, with a rate of 12.1 % in 2014, while Greece was lagging behind with less than 3 %. After Ireland, countries with the highest share of ICT included Sweden (6.3 %) and Luxembourg (5.9 %). Some Member States (Romania, Hungary, and Estonia) also had a high rate (5 % or higher) of ICT as a share of GDP. In most other Member States, ICT remained broadly stable as a proportion of GDP over the medium-term period (2006-2014), except in Ireland where the rate increased by 4.2 pp. and in Finland where the rate fell by 3.3 pp..

Figure 6.4: ICT share of GDP, 2014

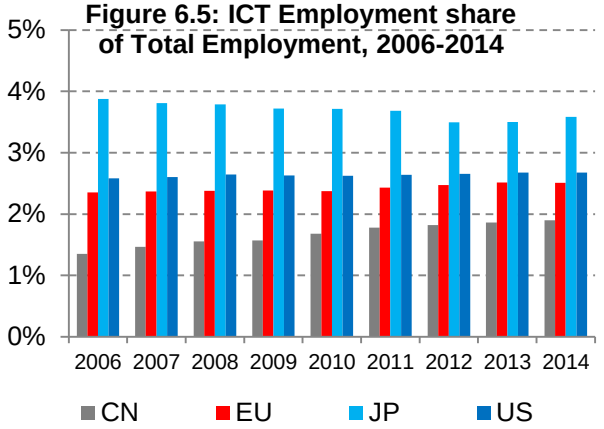


Source: European Commission, PREDICT database

The ICT sector employed 6.3 m people in 2014. The main employer was the ICT services sector (excluding telecommunications) with 4.5 m people in 2014. The share of employment in the ICT sector relative to total employment was 2.8 % in Europe in 2014.

Employment in the ICT sector represented 2.8 % of EU total employment in 2014 (comprehensive definition*), remaining stable over the medium-term period. According to the operational definition* which enables world comparisons, in comparison with the US (2.7 %), the EU (2.5 %) fared better than China (1.9 %), but all three lagged markedly behind Japan (3.6 %) in 2014.

Figure 6.5: ICT Employment share of Total Employment, 2006-2014

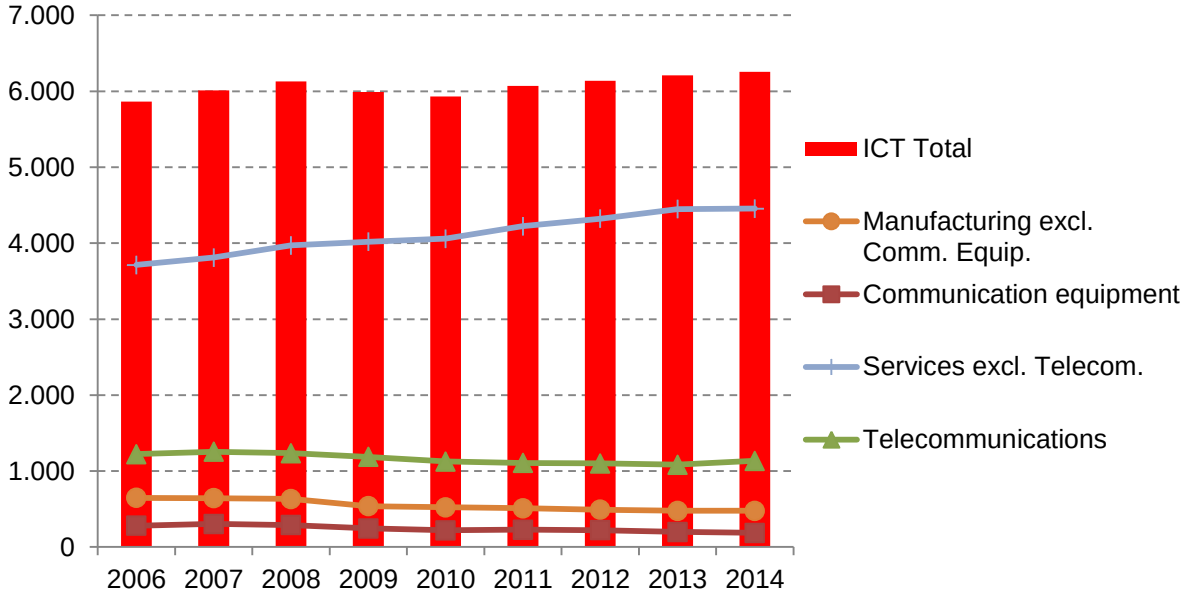


Source: European Commission, PREDICT database

The ICT sector employed 6.3 m people in 2014, the highest in the observed period. The ICT services sector (excluding telecommunications) employed 4.5 m people and accounted for 71 % of total ICT employment in 2014. It is the only sector that recorded a structural increase (of 20 %) over the medium-term period (2006-2014). The telecommunications sector employed 1.1 m people in 2014, a number which fell over the medium-term period by 7 %. The ICT manufacturing industries sector (excluding communication equipment) employed 477 000 people in 2014 and this number fell since 2006 by 26%. The communication equipment sector recorded the sharpest structural decline in 2014, falling to 186 000 people (-34 %).

** See methodological note*

Figure 6.6: Employment in the ICT sector, 2006-2014 (1000 persons)

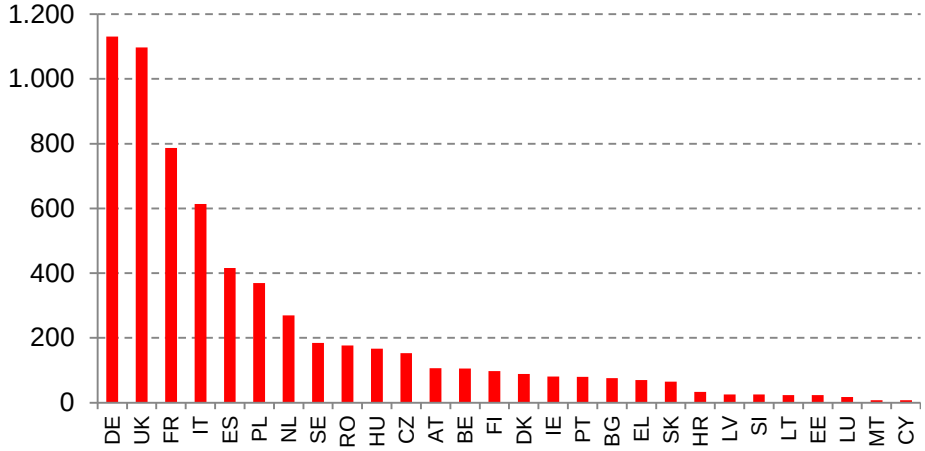


Source: European Commission, PREDICT database

The five largest economies (Germany, the United Kingdom, France, Italy and Spain) are the five biggest employers in the ICT sector in 2014. However, small countries like Luxembourg and Malta had the highest rate of ICT employment as a share of total employment in 2014.

As in the case of value added, the five largest economies were also the **five largest employers** in the ICT sector in 2014: Germany (over 1.1 m people or 18 %), the United Kingdom (1.1 m people or 17 %), France (787 000 people or 13 %), Italy (614 000 people or 10 %) and Spain (416 000 people or 7 %). Together, the five largest employers represented 64 % of total ICT employment in 2014.

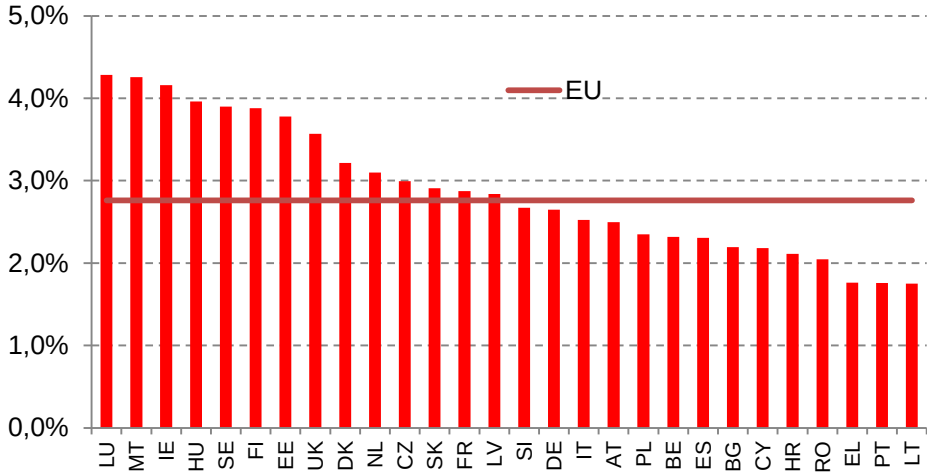
Figure 6.7: Employment in the ICT sector, 2014 (1000 persons)



Source: European Commission, PREDICT database

Luxembourg and Malta were in pole position with 4.3 % of ICT employment as a share of total employment in 2014, and Lithuania had the lowest rate of only 1.8 %. Other countries that were performing well in 2014 included Ireland (4.2 %) and Hungary (4.0 %). Sweden and Finland followed closely behind with 3.9 % rates. Over the medium-term period (2006-2014), the share of ICT employment as a proportion of total employment remained stable in most countries, but small countries like Latvia, Estonia and Luxembourg made significant progress, increasing by more than 1 p.p..

Figure 6.8: ICT Employment share of Total Employment, 2014

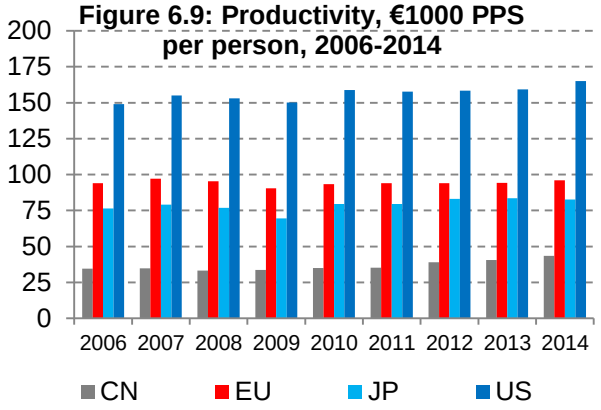


Source: European Commission, PREDICT database

Productivity in the ICT sector amounted to EUR 95 000 per person in 2014. Productivity in the telecommunications sector is by far the highest. However, as regards productivity in the ICT sector, the EU compares with Japan but lagged markedly behind the US.

Regarding the **productivity** of the ICT sector (according to the operational definition* which enables world comparisons), the EU (EUR PPS 96 000 per person) is markedly behind the US (EUR PPS 165 000 per person), higher than Japan (EUR PPS 83 000 per person), but far higher than China (EUR PPS 44 000 per person), which in this respect is still an emerging country.

Figure 6.9: Productivity, €1000 PPS per person, 2006-2014

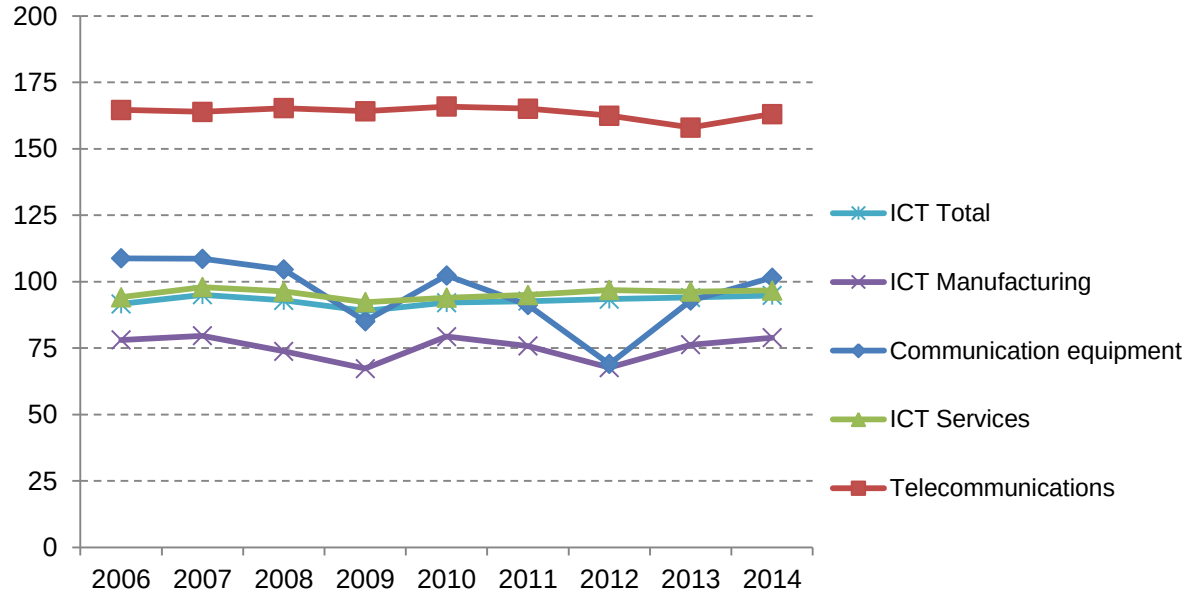


Source: European Commission, PREDICT database

Productivity in the ICT sector (comprehensive definition*) amounted to EUR 95 000 per person in 2014, remaining broadly stable over the medium-term period (2006-2014). In the ICT manufacturing sector, productivity was below average (EUR 79 000 per person in 2014); moreover, it is volatile and pro-cyclical in relation to the business cycle. The communication equipment sector is even more sensitive to the business cycle. Unlike the manufacturing sector, productivity in the ICT services sector as a whole (i.e. services and trade), which stood at EUR 97 000 per person in 2014, is not sensitive to business cycles. Productivity in the telecommunications sector is by far the highest (at EUR 163 000 per person in 2014).

** See methodological note.*

Figure 6.10: Productivity - ICT sector (Comprehensive definition), Thousands of current euros per person, 2006-2014

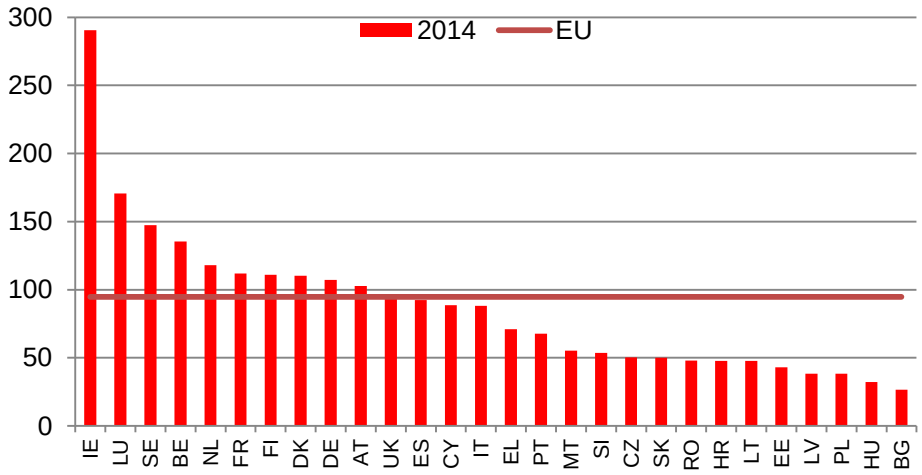


Source: European Commission, PREDICT database

As for labour productivity, the highest score was registered by Ireland followed by Luxembourg, Sweden and Belgium. Poland, Hungary, and Bulgaria had the weakest performance in this indicator.

In terms of labour productivity in the ICT sector, Ireland (EUR 291 000 per person) by far led the way in 2014, but Luxembourg (EUR 171 000 per person) and Sweden (EUR 147 000 per person) fared well too. At the opposite end of the scale were Bulgaria (EUR 27 000 per person), Hungary (EUR 32 000 per person) and Poland (EUR 38 000 per person).

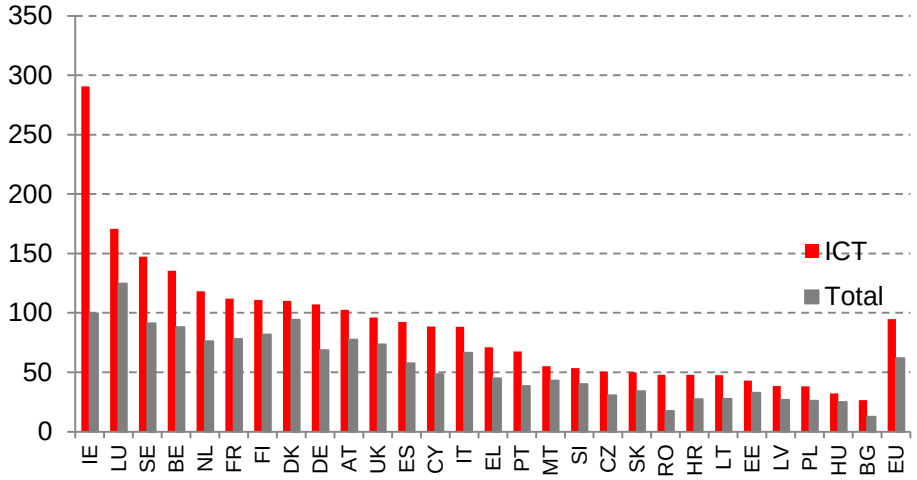
Figure 6.11: Productivity - ICT sector (Comprehensive definition), Thousands of current euros per person, 2014



Source: European Commission, PREDICT database

The picture for labour productivity in the economy as a whole was broadly similar. Luxembourg (EUR 125 000 per person) and Ireland (EUR 100 000 per person) were the best-performing countries, while Bulgaria (EUR 12 000 per person) and Romania (EUR 17 000 per person) were at the bottom of the table.

Figure 6.12: Productivity - ICT and Total, Thousands of current euros per person, 2014

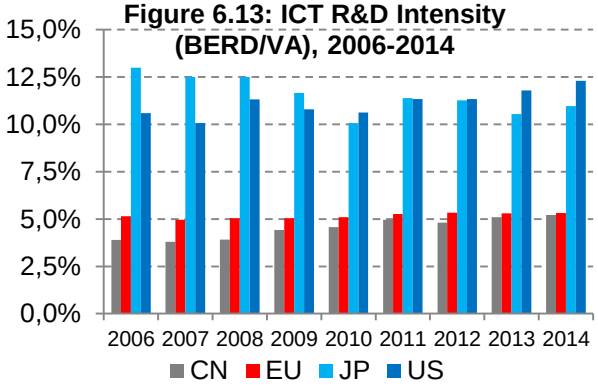


Source: European Commission, PREDICT database

Business Enterprise R&D expenditure (BERD) in the ICT sector amounted to EUR 30 bn in 2014. The ICT services sector was responsible for 62 % (EUR 18 bn) of ICT BERD in 2014. ICT R&D intensity amounted to 5 % in 2014 in the EU, markedly behind the US and Japan.

R&D intensity in the ICT sector (comprehensive definition*) amounted to 5 % in 2014. According to the operational definition* which enables world comparisons, although the EU (5.3 %) compares to China (5.2 %), both the EU and China lagged behind the US (12.3 %) and Japan (11 %) in 2014.

Figure 6.13: ICT R&D Intensity (BERD/VA), 2006-2014

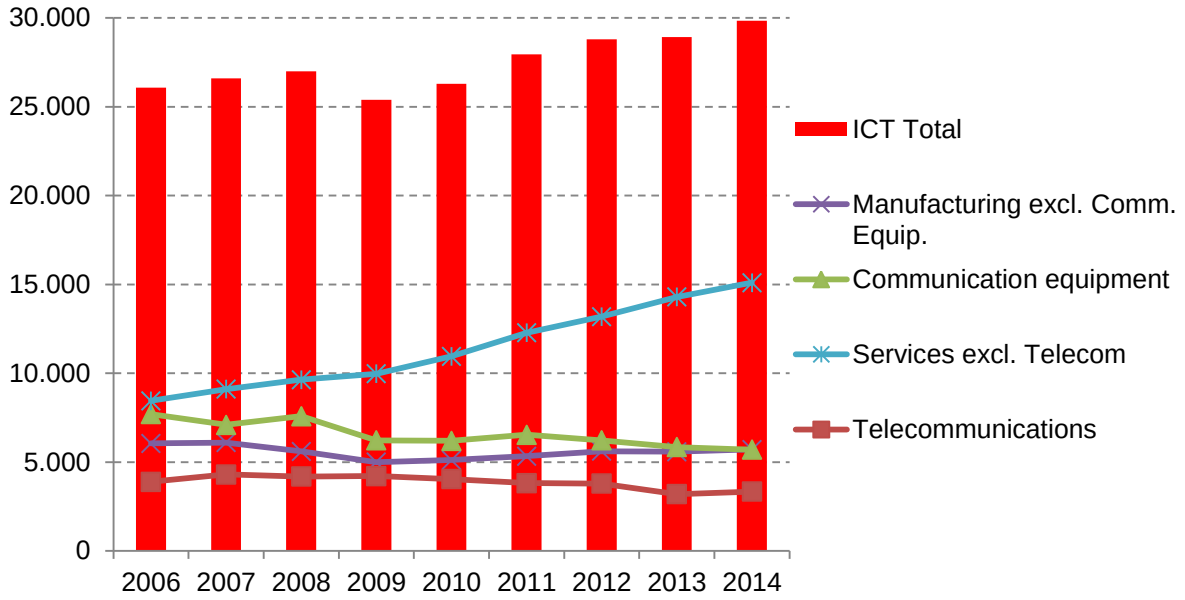


Source: European Commission, PREDICT database

Business Enterprise R&D expenditure (BERD) in the ICT sector amounted to EUR 30 bn in 2014, its highest point over the medium-term period (2006-2014), an improvement on its lowest point of EUR 25 bn reached in 2009. A breakdown by sub-sector reveals a more balanced situation for BERD than for value added – despite accounting for only 9 % of ICT value added, the ICT manufacturing sector was responsible for 38 % of total ICT BERD (EUR 11 bn) while the ICT services sector was responsible for 62 % (EUR 18 bn) of ICT BERD in 2014. Over the medium-term period (2006-2014), the situation was quite different. The ICT manufacturing sector saw a structural decline (falling by 17 % from 2006 to 2014), whereas the ICT services sector saw a structural increase (rising by 49 % over 2006-2014), particularly in the ICT services sector excluding telecoms, which saw an increase of 79 % from 2006 to 2014.

** See methodological note*

Figure 6.14: ICT Business Expenditure in R&D (BERD), 2006-2014 (€mio)

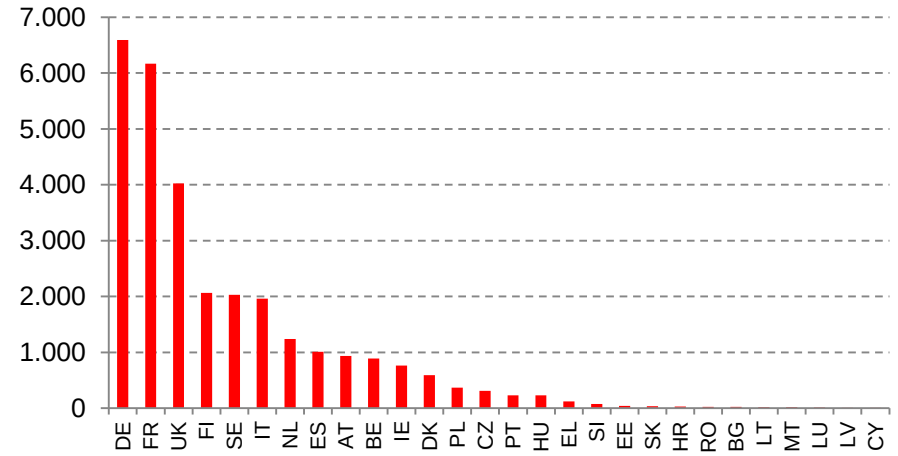


Source: European Commission, PREDICT database

The six main contributors in terms of ICT R&D expenditure in 2014 were the four largest economies in the EU: Germany, France, the United Kingdom and Italy, together with two Nordic countries: Finland and Sweden.

The six main contributors in terms of R&D expenditure in the ICT sector in 2014 were the four largest economies in the EU – Germany (EUR 6.6 bn or 22 %), France (EUR 6.2 bn or 21 %), the United Kingdom (EUR 4.0 bn or 13 %) and Italy (EUR 2.0 bn or 7 %), together with two Nordic countries – Finland (EUR 2.1 bn or 7 %) and Sweden (EUR 2.0 bn or 7 %), confirming the importance of Nordic countries for ICT R&D. Together, the six largest contributors represented 77 % of total ICT Business R&D expenditure in 2014.

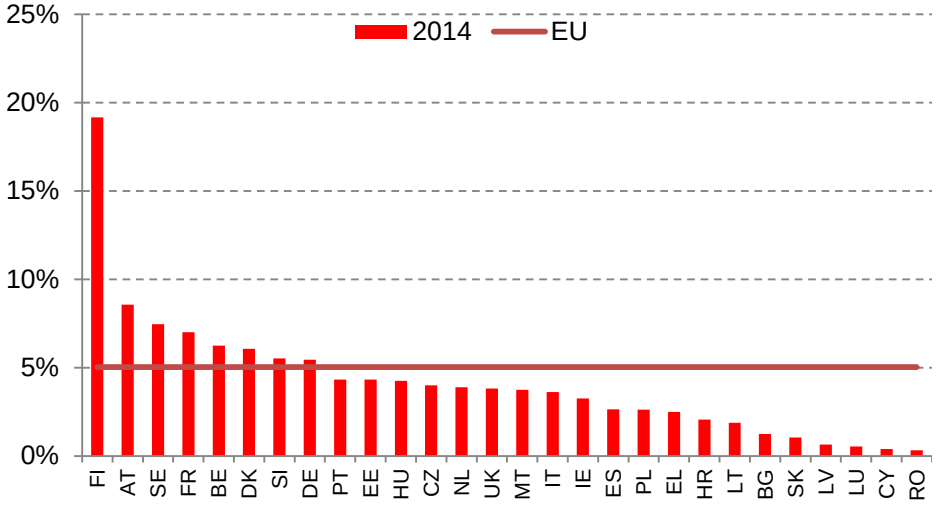
Figure 6.15: R&D Expenditure in the ICT sector, 2014 (€m)



Source: European Commission, PREDICT database

Finland was by far leading the way in the EU with a 19.2 % ICT BERD intensity rate in 2014. Romania was the poorest performer with a rate of 0.3 %. Of the Nordic countries, Sweden had a rate of 7.5 % and Denmark had a rate of 6.1 %. Other strong performers include Austria (8.6 %), France (7 %), and Belgium (6.2 %). Over the medium-term period (2006-2014), ICT R&D intensity remained broadly stable, but some eastern countries (Poland, Hungary, and Lithuania) made significant progress.

Figure 6.16: ICT R&D Intensity (BERD/VA), 2014

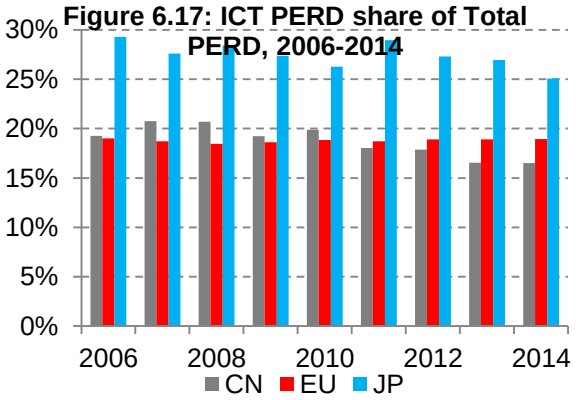


Source: European Commission, PREDICT database

ICT R&D personnel included 292 000 full-time equivalents (FTEs) in 2014. The top employer was the ICT services sector (excluding telecoms), employing 181 000 FTEs in 2014 (62 % of ICT R&D personnel). ICT R&D personnel made up 20 % of total R&D personnel in 2014.

R&D personnel in the ICT sector (comprehensive definition*) made up 20 % of total R&D personnel in 2014, a figure which remained stable over the medium-term period. However, according to the operational definition* which enables world comparisons, the EU (19 %) and China (17 %) were behind Japan (25 %) in 2014 and over the medium-term period (no data available for the US).

Figure 6.17: ICT PERD share of Total PERD, 2006-2014

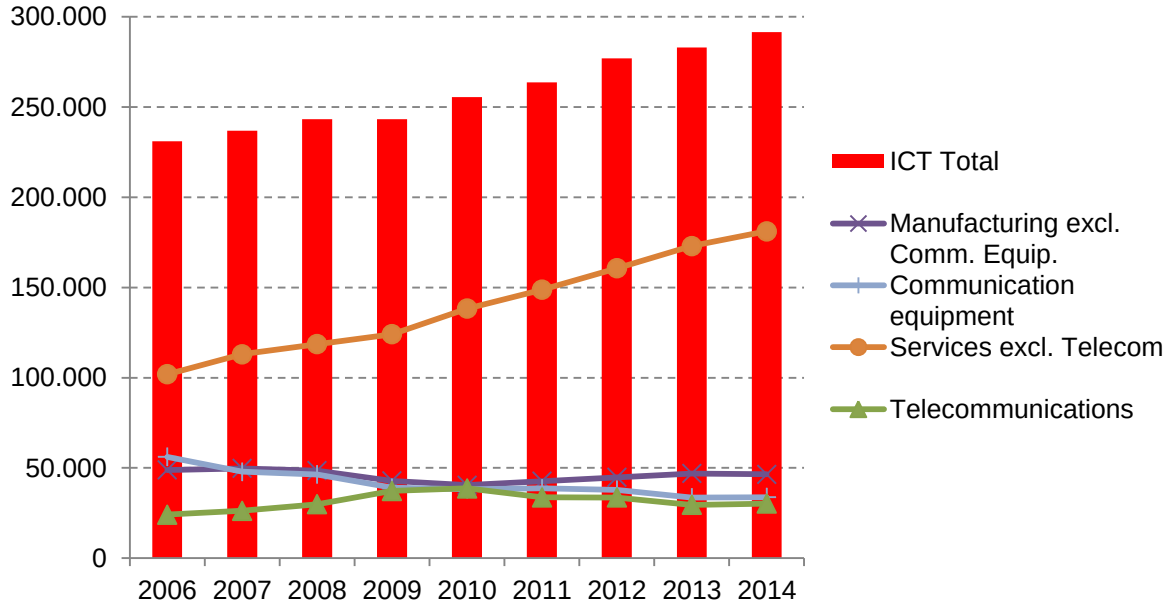


Source: European Commission, PREDICT database

R&D personnel in the ICT sector included 292 000 full-time equivalents (FTEs) in 2014, a figure which rose over the medium-term period (2006-2014), growing faster after 2009. The ICT services sector (excluding telecommunications) employed 181 000 FTEs in 2014 (62 % of R&D personnel in the ICT sector, making it the top employer), with a rising trend. The ICT manufacturing sector (excluding communications equipment) employed 46 000 FTEs in 2014, representing a slight fall over the medium-term (2006-2014) despite signs of recovery after 2010. The communication equipment sector stabilized in 2014. The telecommunications sector employed 30 000 FTEs in 2014 (10 % of R&D personnel in the ICT sector), and was on a downward trend (falling about 22 % from its peak of 39 000 FTEs in 2010).

** See methodological note.*

Figure 6.18: ICT Business R&D Personnel, 2006-2014 (FTE)

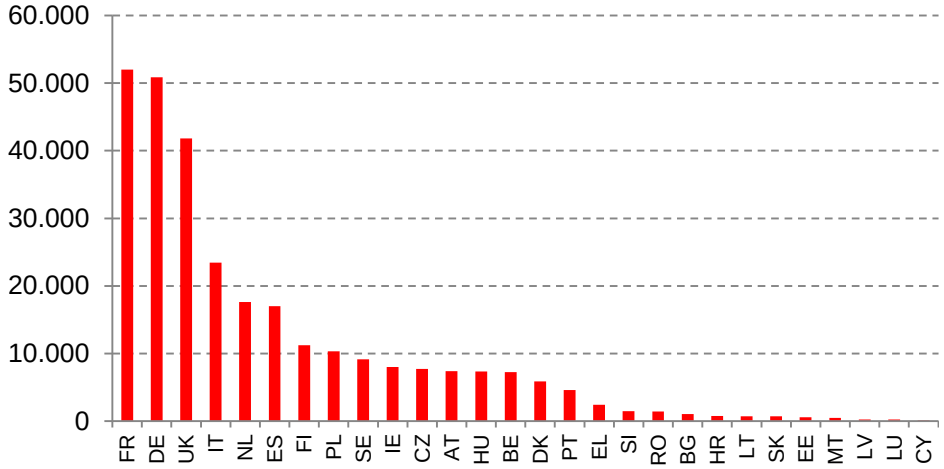


Source: European Commission, PREDICT database

The four largest economies were also the four biggest employers of ICT Business R&D personnel in 2014: France, Germany, the United Kingdom and Italy. Malta and Ireland were the two countries with the highest concentration of ICT Business R&D personnel in 2014.

The four largest economies were also the **four biggest employers** of R&D personnel in the ICT sector in 2014 – France (52 000 or 18 %), Germany (51 000 or 17 %), the United Kingdom (42 000 or 14 %) and Italy (23 000 or 8 %). Together, the four biggest employers represented 58 % of total R&D personnel in the ICT sector in 2014.

Figure 6.19: ICT Business R&D Personnel, 2014 (FTE)

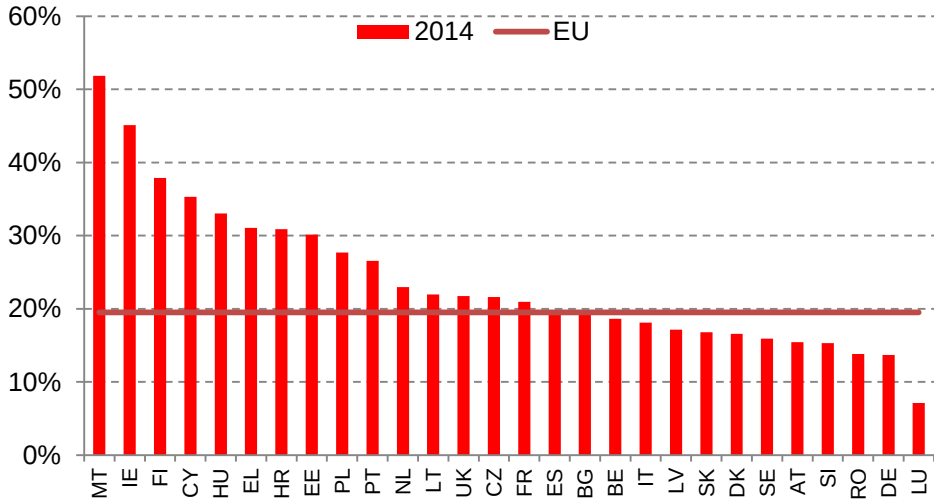


Source: European Commission, PREDICT database

Malta (52 %) and Ireland (45 %) were the two countries with the highest concentration of R&D personnel in the ICT sector in 2014. Luxembourg had the lowest concentration (7 %).

Other strong performers were Finland (38 %), Cyprus (35 %) and Hungary (33 %).

Figure 6.20: ICT PERD as share of Total PERD, 2014

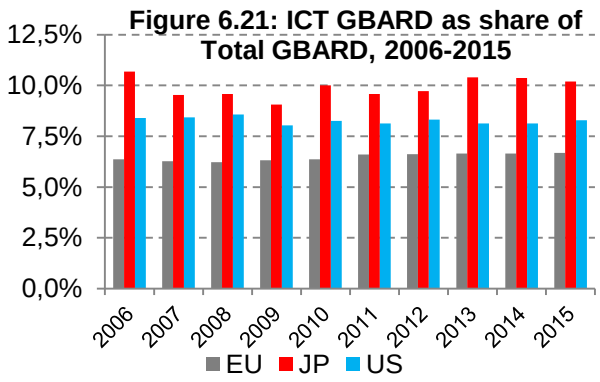


Source: European Commission, PREDICT database

The estimated level of publicly funded expenditure on ICT R&D in the EU reached EUR 6.3 bn in 2015. Estimated public ICT R&D expenditure was more than 20 % below the necessary trend line for doubling publicly funded R&D in ICT between 2007 and 2020.

In 2015*, ICT **public funding** represented 6.7 % of EU total 'government budget allocations for R&D' (GBARD), a figure which remained broadly stable over the medium-term period.

The EU was lagging behind the US (8.3 %) and Japan (10.2 %), a relative position that remained stable over the medium-term period (no data available for China).



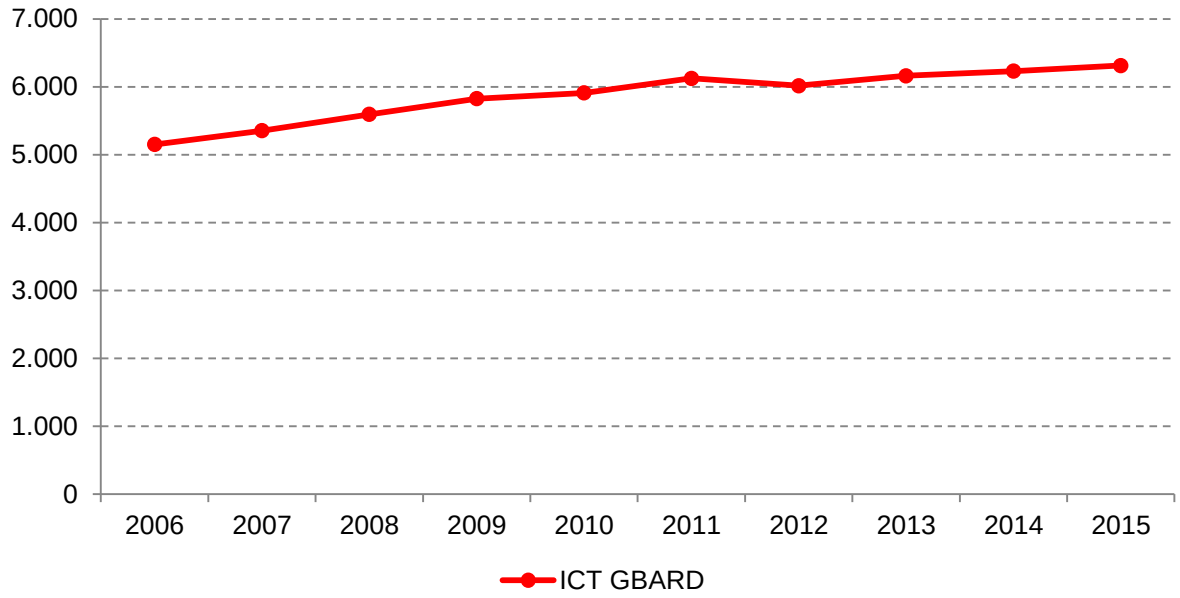
Source: European Commission, PREDICT database

After rising for several years, the estimated level of publicly funded expenditure on ICT R&D in the EU fell in 2012, but recovered in 2013, and by 2015 had exceeded its historical peak of EUR 6.2 bn in 2014, reaching EUR 6.3 bn.

The Digital Agenda target of doubling publicly funded R&D in ICT between 2007 and 2020 requires an annual growth rate of 5.5 % (assuming constant annual growth rate). Estimated public ICT R&D expenditure was below the necessary trend line in 2015, with a gap of more than 20 %.

** Official statistics on public expenditure are available one year before business statistics.*

Figure 6.22: ICT GBARD, 2006-2015 (€m)



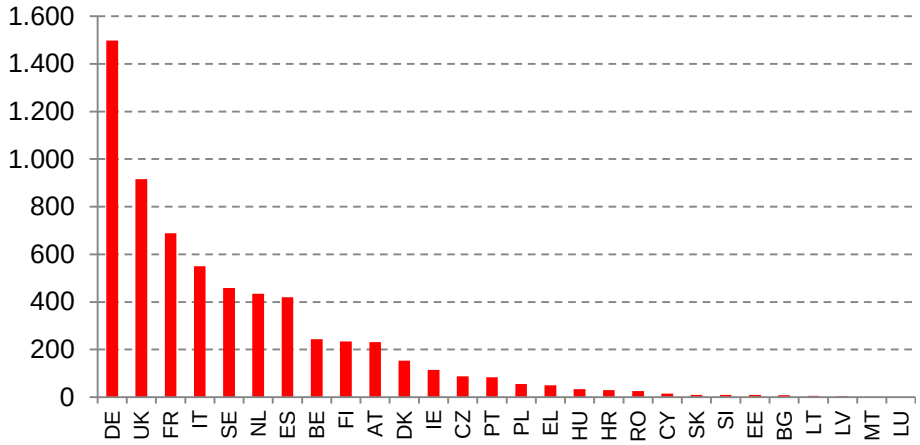
Source: European Commission, PREDICT database

The five biggest public funders of R&D in ICT in 2015 were Germany, followed by the United Kingdom, France, Italy and Sweden. Cyprus was surprisingly leading the way in the EU with a 2.11 % ICT GBARD as a proportion of ICT VA in 2014.

The **five biggest public funders** of R&D in ICT in 2015 were Germany (EUR 1.5 bn or 24 %), followed by the United Kingdom (EUR 915 m or 15 %), France (EUR 689 m or 11 %), Italy (EUR 550 m or 9 %) and Sweden (EUR 458 m or 7 %).

Together, those five countries represented 65 % of total public funding for R&D in ICT.

Figure 6.23: Public funding ICT R&D Expenditure, 2015 (€m)

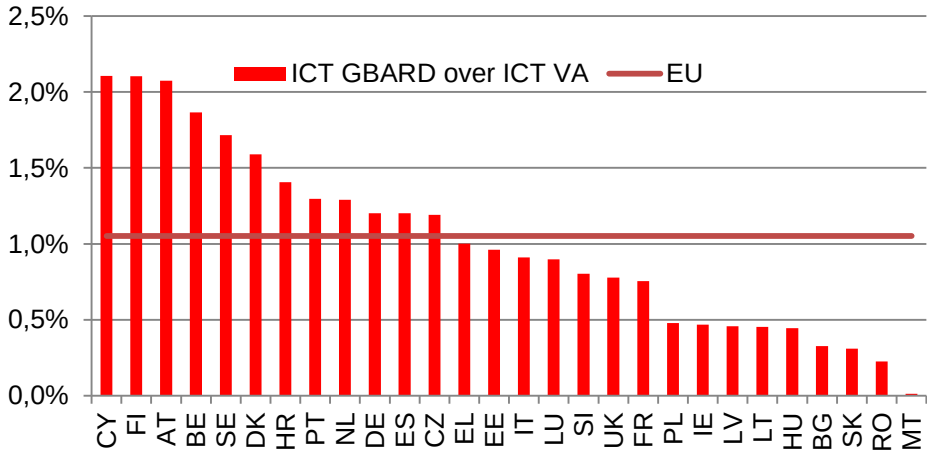


Source: European Commission, PREDICT database

Cyprus was surprisingly leading the way in the EU with a 2.11 % ICT GBARD as a proportion of ICT VA in 2014. Unsurprisingly, the ranking in 2014 again reveals a strong performance by Nordic countries: Finland (2.10 %), Sweden (1.71 %) and Denmark (1.59 %).

However, some other countries also attribute special importance to ICT in their R&D public spending, such as Austria (2.07 %) and Belgium (1.87 %).

Figure 6.24: ICT GBARD share of ICT VA, 2014



Source: European Commission, PREDICT database

A group of three countries takes a significant lead with scores above 150 (the benchmark has been set to equal 100 for Europe in 2011) in the innovation output indicator: Finland (177), Ireland (162) and Sweden (153).

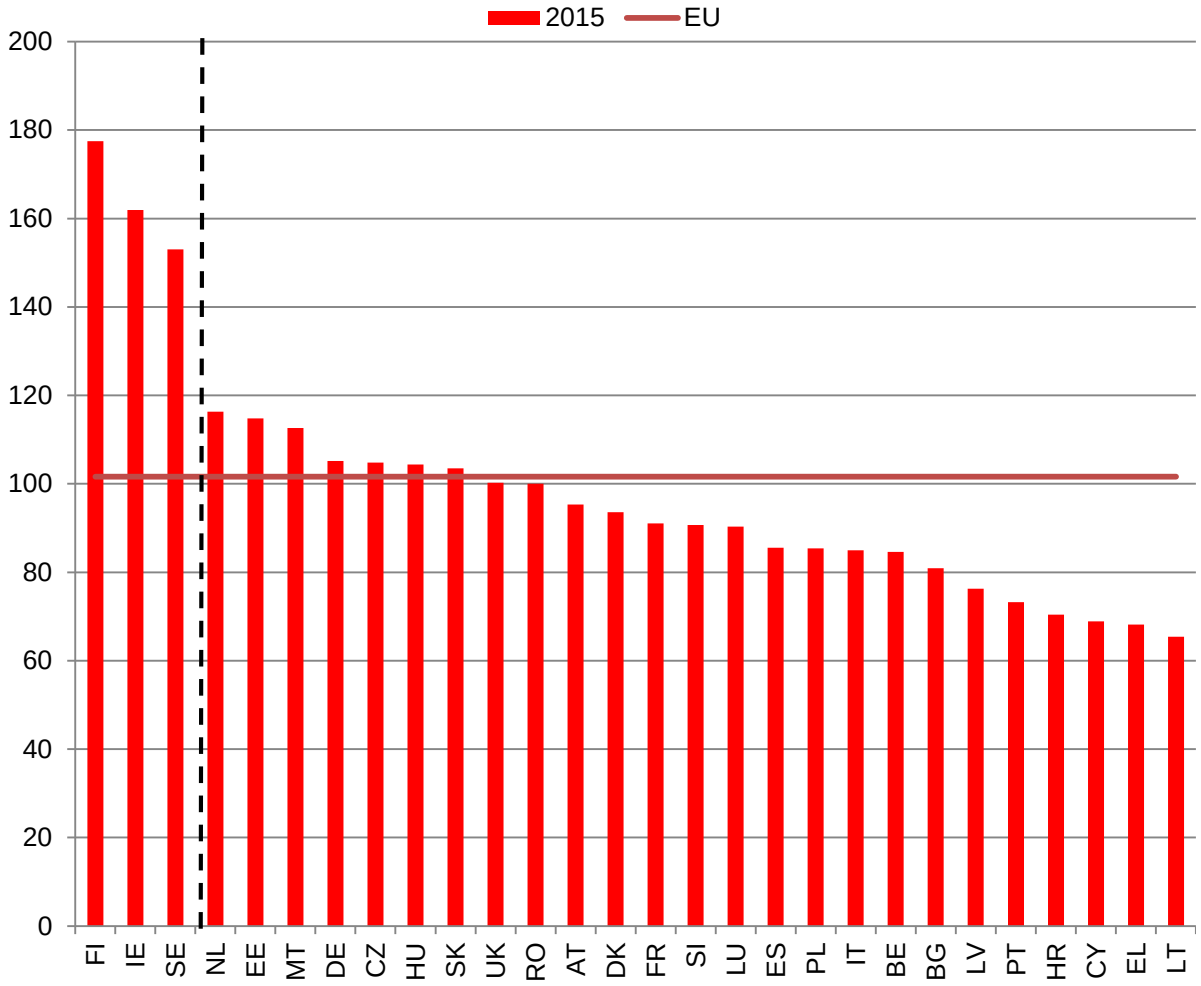
The innovation output indicator is a composite indicator that focuses on four output-oriented innovation measures (see methodological note).

A group of three countries takes a significant lead with scores above 150 (the benchmark has been set to equal 100 for Europe in 2011): Finland (177), Ireland (162) and Sweden (153).

The three top scores in ICT innovation output result from very high ICT contributions in the trade of knowledge-intensive services, above average levels of fast-growing innovative ICT employment for Ireland and remarkable results for ICT patenting in Finland and Sweden.

At the lowest end of the scale are Cyprus (69), Greece (68) and Lithuania (65).

Figure 6.25: ICT Output Indicator, 2015



Source: European Commission, EURIPIDIS database

ICT INNOVATION OUTPUT INDICATOR
by Component

The contribution of ICT has been computed for each underlying component of the innovation output indicator. The ICT contributions for Europe are:

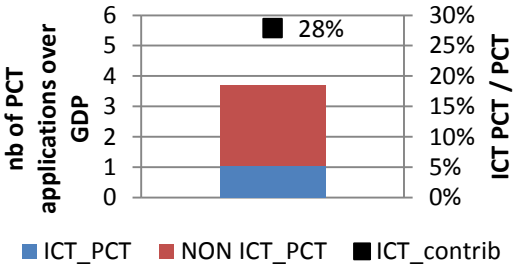
1. 28% in technological innovation as measured by patents (PCT_ICT)

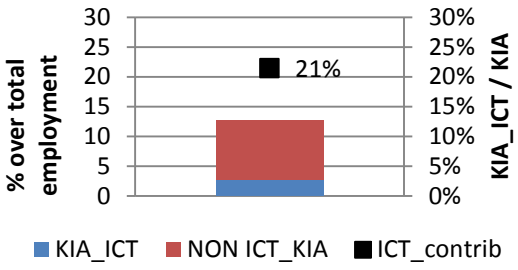
2. 21% in absorption of skills as measured by employment in knowledge intensive activities (KIA_ICT)

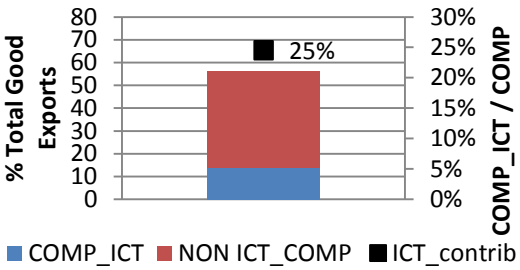
3. 25% in competitiveness of knowledge goods as measured by exports of medium-high tech goods (COMP_GOOD_ICT)

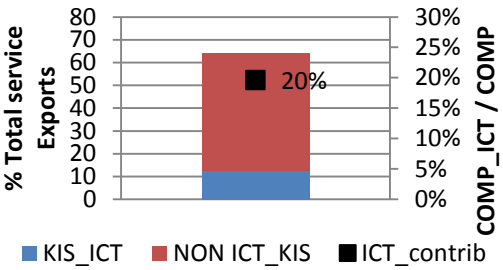
4. 20% in competitiveness of knowledge services as measured by exports of knowledge intensive services (KIS_ICT)

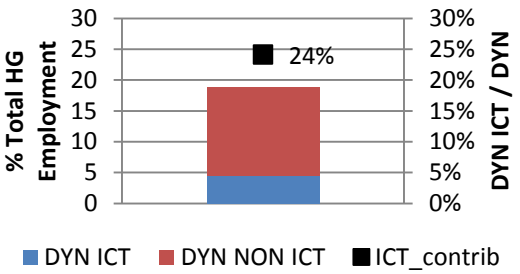
5. 24% in innovative firm's dynamics as measured by average innovativeness scores (employment-weighted) of fast-growing firms (DYN_ICT)











METHODOLOGICAL NOTE

Definition of the ICT sector

In this section, the ICT sector is defined according to the definition provided by the OECD on the basis of the NACE (Statistical Classification of Economic Activities in the European Community) Rev.2 (2008) nomenclature. The ICT sector has 12 sub-sectors:

- ***ICT Manufacturing***

  C261 Manufacture of electronic components and boards
  C262 Manufacture of computers and peripheral equipment
  C263 Manufacture of communication equipment
  C264 Manufacture of consumer electronics
  C268 Manufacture of magnetic and optical media

- ***ICT Services***

  G4651 Wholesale of computers, computer peripheral equipment and software
  G4652 Wholesale of electronic and telecommunications equipment and parts
  J5820 Software publishing
  J61 Telecommunications
  J62 Computer programming, consultancy and related activities
  J631 Data processing, hosting and related activities; web portals
  S951 Repair of computers and communication equipment

Comprehensive vs operational definition

The **comprehensive definition** of the ICT sector applies to EU Member States for the period 2008-2014. It corresponds to the definition provided by the OECD in 2007.

The **operational definition** of the ICT sector enables an international comparison with non-EU countries over a longer period (2006-2014), as some of these countries do not have the necessary disaggregated information to estimate all the ICT sub-sectors included in the comprehensive definition. The operational definition does not include the following sectors: manufacture of magnetic and optical media (268) and ICT trade industries (465).

Sector analysis

In the following section, a sector analysis is made for each indicator. The 12 sub-sectors are aggregated into four sectors: ICT manufacturing (excluding communication equipment), communication equipment, ICT services (excluding telecommunications) and telecommunications.

Source

Joint Research Centre – Dir. B Growth and Innovation (JRC – Dir. B) calculations and estimates, based on Eurostat, the OECD's structural analysis database (STAN), EU-KLEMS data, and the JRC's PREDICT and RISES projects.

All data contained in these databases come from official sources (e.g. Eurostat, OECD, national statistical institutes). However, there may be some discrepancies with the original sources, e.g. owing to updates of the original data or the use of multiple auxiliary sources and variables.

ICT INNOVATION OUTPUT INDICATOR
Methodology

The Innovation output indicator is a composite indicator that focuses on four output-oriented innovation measures (see list)

$$I_{ICT} = w_1 PCT_{ICT} + w_2 KIA_{ICT} + w_3 COMP_{ICT} + w_4 DYN_{ICT}$$

The weights *w1, w2, w3, w4* are the weights of the component indicators, fixed over time and country

The weights are calculated in such a way that the linear correlations between each single component and the final scores of the composite indicator are almost the same (i.e. balanced). Each single weight is different from the other but the correlation coefficients are the same (or very close).

See sources (below) for further details on the methodology.

- PCT_{ICT}: patent applications per billion GDP
- KIA_{ICT}: employment in knowledge-intensive activities in business industries as a % of total employment

  KIA measures the percentage of highly educated (tertiary degree level) employees in each sector (i.e. is a proxy of employees' skills efficiency)

- $COMP_{ICT}$= 0.5*GOOD+0.5*SERV

  GOOD: The share of medium-tech and high-tech products in total goods exports

  SERV: Knowledge-intensive services as a share of the total services exports

- DYN_{ICT}: average (employment-weighted) innovativeness scores of fast-growing firms

  DYN is a measure of fast-growing firms based on the average innovativeness scores of fast-growing enterprises

  Sources: JRC Technical report, how much does ICT contribute to innovation output? An analysis of the ICT component in the innovation output indicator, Annarosa PESOLE, 2015

  "Developing an indicator of innovation output", Commission Staff Working Document- SWD (2013) 325 final.

7. Research and Innovation: ICT projects in Horizon 2020

In its first three years of implementation, Horizon 2020 has allocated EUR4 billion of EU funding to 1 369 projects in the field of ICT, attracting 4 832 organisations.

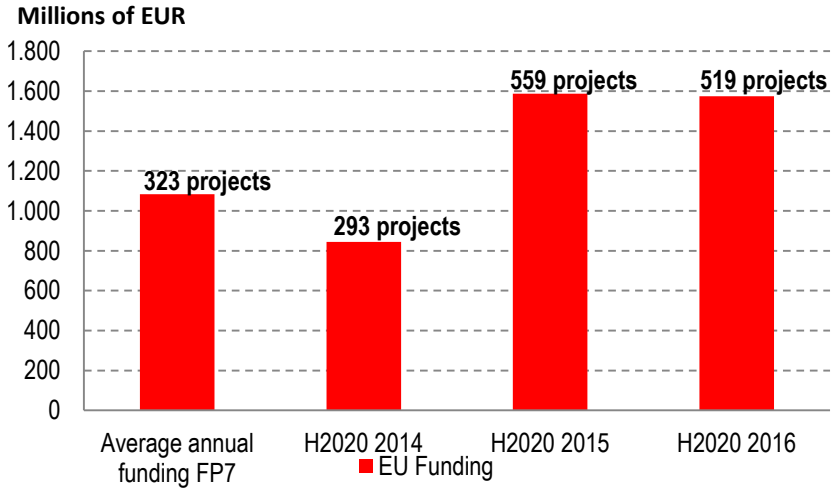
Annual funding has increased compared with the previous Framework Programme, FP7, where average annual funding was EUR 1.08 bn a year. **Leadership in Enabling and Industrial Technologies** (LEIT) **ICT** (including the SME instrument) accounts for the majority of funding (65 %), participations (64 %) and 73 % of projects.

Excellence in science[26] accounts for slightly over one fifth of the budget (22 %) and participations (21 %) and 13 % of projects. **Societal Challenges** (SC) 1,6 and 7 account for 13 % of the budget, 14 % of projects and 15 % of participations.

H2020 has been able to attract **new participants**: about 2 000 organisations (41 %) had not participated in FP7. The vast majority (80 %) of new participants are private entities.

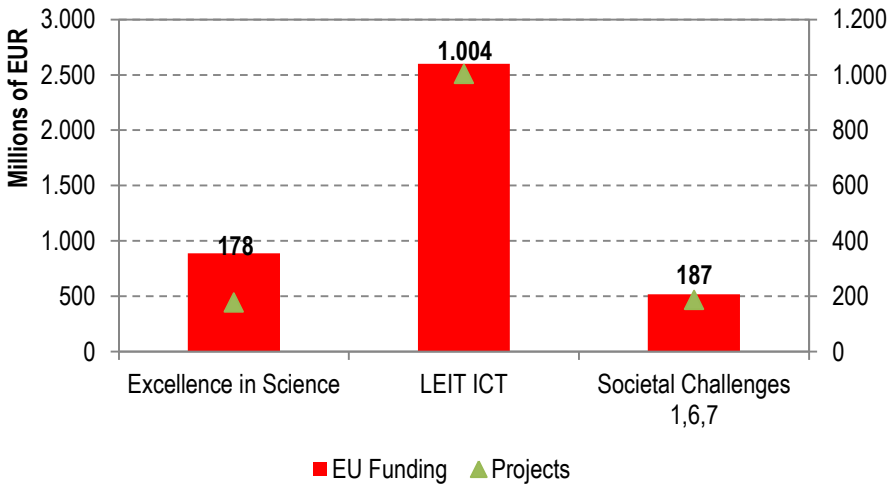
Slightly more than 1 950 SMEs have taken part to H2020 so far, the majority of which (1 086) had not participated in FP7.

Figure 7.1: EU Funding and projects funded, 2014-2016 (H2020) and annual average FP7



[26] eInfrastructures, FET Open, FET Proactive, FET Flagships and High Performance Computing.

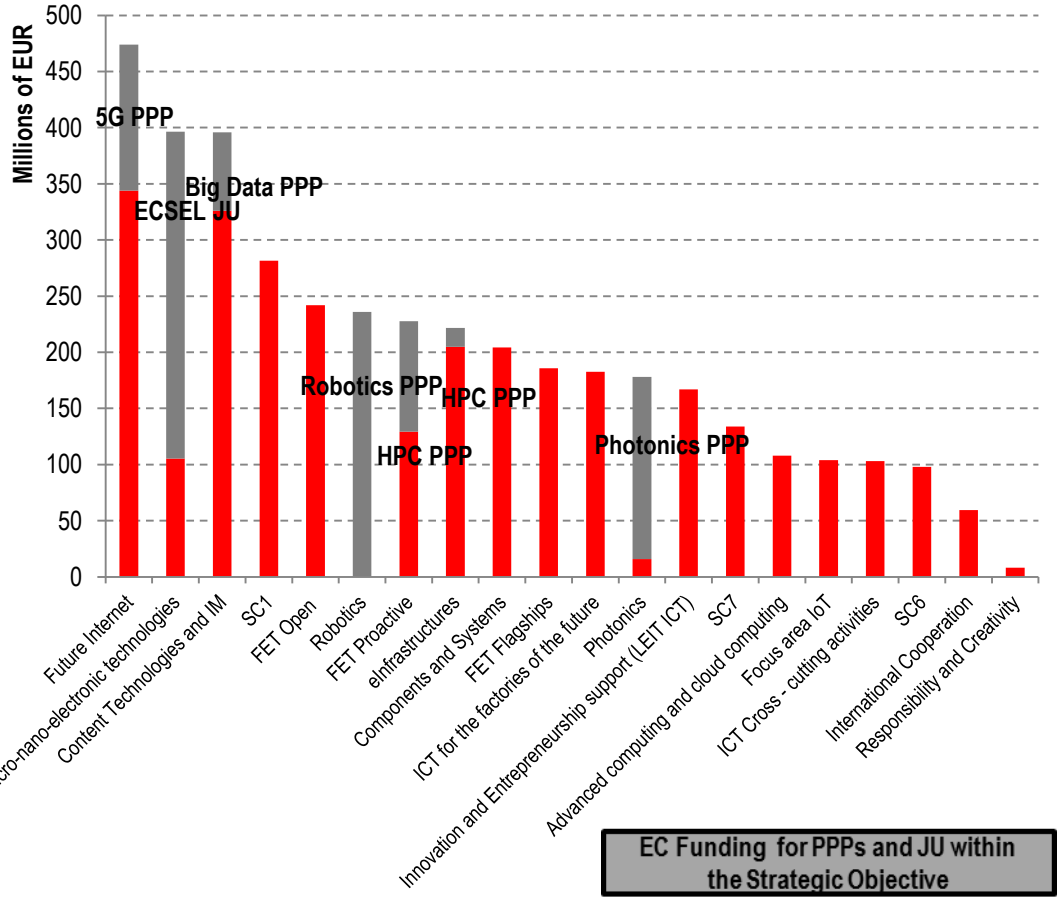
Figure 7.2: EU Funding and projects by Pillar, cumulated values 2014 - 2016



Future Internet and Micro – and Nanoelectronic technologies are the areas that attract the highest number of participants and funding.

Within the Work Programme Area 'Future Internet', the contractual **Private Public Partnership** (cPPP) **for 5G** accounts for EUR 130 m. 'Micro–Nanoelectronic technologies' includes funding for the **Electronic Components and Systems for European Leadership** (**ECSEL**) **Joint Undertaking** of EUR 291 m. Within 'Content Technologies and Information Management', the Big Data cPPP accounts for EUR 70 m, whereas the EU funding to the **Robotics cPPP** amounts to EUR 236 m. The **High Performance Computing** (**HPC**) and **Photonics** cPPPs account for EUR 116 and EUR 162 m, respectively. SC1 on 'Health, demographic change and wellbeing' receives the highest funding among the SCs: EUR 282 m, followed by SC7 on Secure Societies (EUR 134 m). Projects for inclusive, innovative and reflective societies (SC6) receive EUR 98 m. 'FET Open' has total funding of EUR 242 m, FET Proactive and the two Flagships EUR 228 and EUR 128 m respectively.

Figure 7.3: EU funding by Work Programme Area, cumulated values 2014-2016



Source: European Commission, based on CORDA

Research and Innovation Actions are the prevailing type of action.

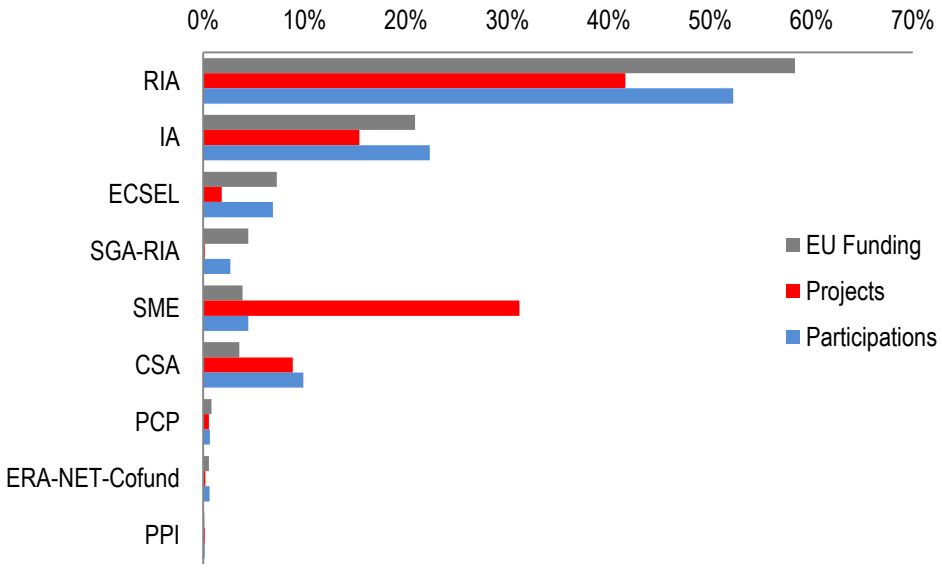
Research and innovation actions account for 58 % of funding, 52 % of participations and 42 % of projects. **Innovation actions** follow, with 21 % of funding, 22 % of participations and 15 % of projects.

Coordination and support actions account for 9 % of projects, 10 % of participations and 4 % of funding.

The **SME instrument** projects (LEIT ICT, SC1 and SC6) account for 31 % of projects, and 4 % of funding and participations.

The three **ERA-NET actions** (in FET Proactive, FET Flagships and Photonics) account for 1 % of funding and participations.

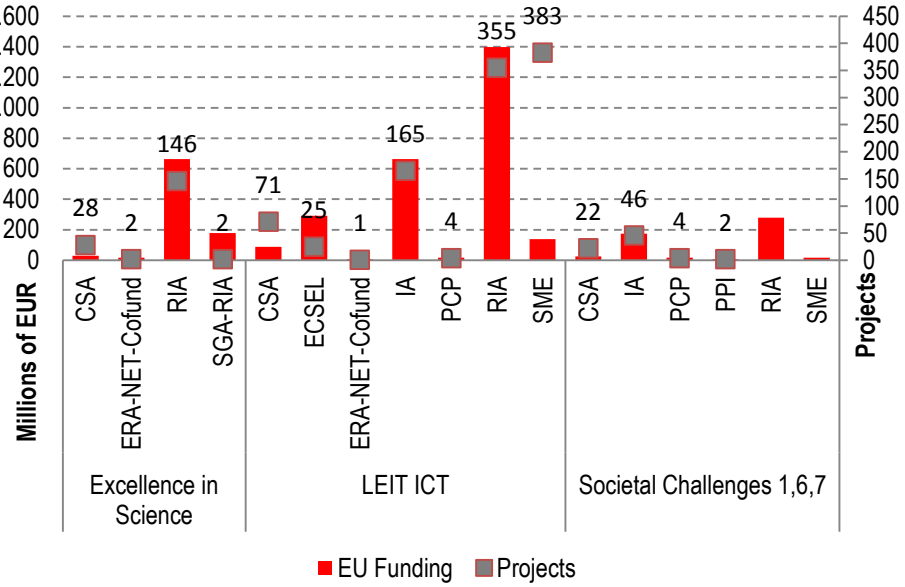
Figure 7.4: EU Funding, projects and participations by type of action, cumulated values 2014-2016



Source: European Commission, based on CORDA

The **average project size** differs by action and pillar: RIAs are projects of EUR 3.9 m in LEIT ICT, EUR 4 m in SCs and EUR 4.5 m in Excellence in Science. The average IA receives EUR 4 m on in LEIT ICT and 3.8 m in SCs. The average size of the CSAs is EUR 1.1 m, whereas Pre-Commercial Procurement (PCP) and Public Procurement for Innovation (PPI) actions are as big as EUR 4.2 m and EUR 2.7 m respectively. The ERA-NET actions account for an average EUR 8.8 m in Excellence in Science and EUR 5.7 m in LEIT ICT.

Figure 7.5: EU Funding and projects by action and Pillar, cumulated values 2014-2016



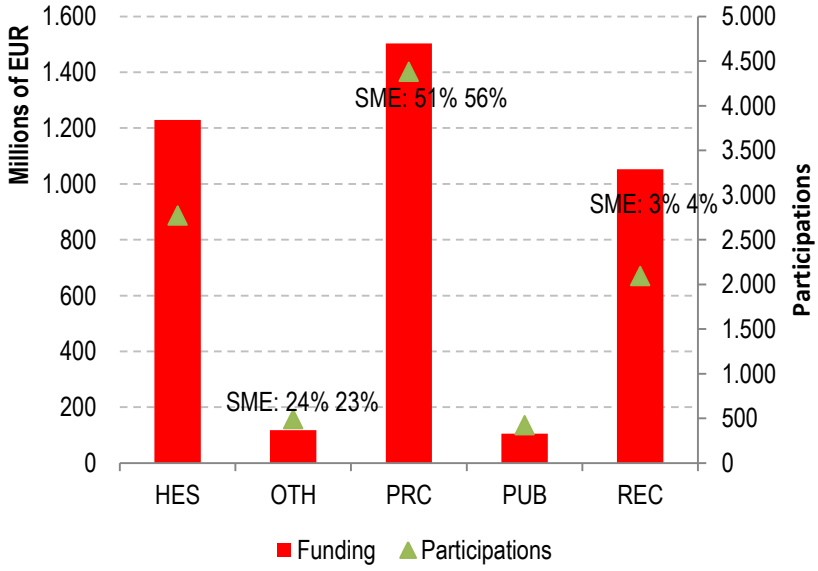
Source: European Commission, based on CORDA

Under H2020 the enterprise sector shows an increase in participation compared with FP7, accounting for 43 % of participations and 38 % of the budget, with 21 % of the budget going to SMEs

Secondary and higher education establishments (HES) and **research organisations** (REC) taken together account for **half of all project participations** (48 %) and receive the **highest funding** (57%). Their relative size has decreased in comparison with FP7, where they accounted for 57 % of participations and 64 % of the budget.

Conversely, there has been an increase in **enterprise participation**, with private organisations (PRC) accounting for 38 % of the budget and 43 % of participations, up from 33 % and 35 %, respectively, under FP7. **Funding for SMEs** has also increased, from 15 % to 21 %, along with the share of SME participations, which has risen from 16 % to 26 %.

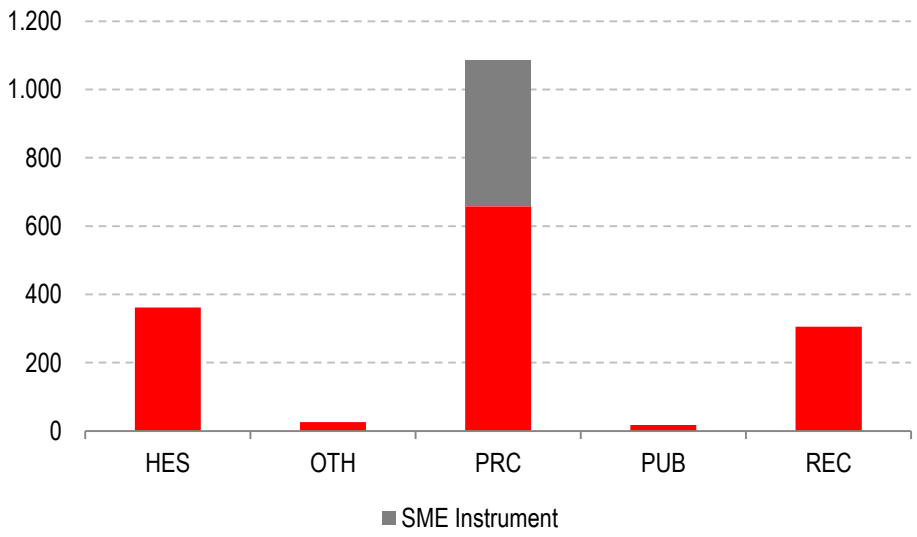
Figure 7.6: Participations and EU funding by type of organisation, cumulated values 2014-2016



Source: European Commission, based on CORDA

HES/REC and **PRC** coordinate 48 % of projects respectively. SMEs coordinate 40 % of projects; this is however influenced by the high number of SME instrument projects. In the other areas, the share of projects coordinated by SMEs is at 9 %, slightly lower than under FP7 (10 %). Large enterprises coordinate a lower share of projects (9 %) compared with 18 % under FP7.

Figure 7.7: Project coordinators by type of organisation, cumulated values 2014-2016



Source: European Commission, based on CORDA

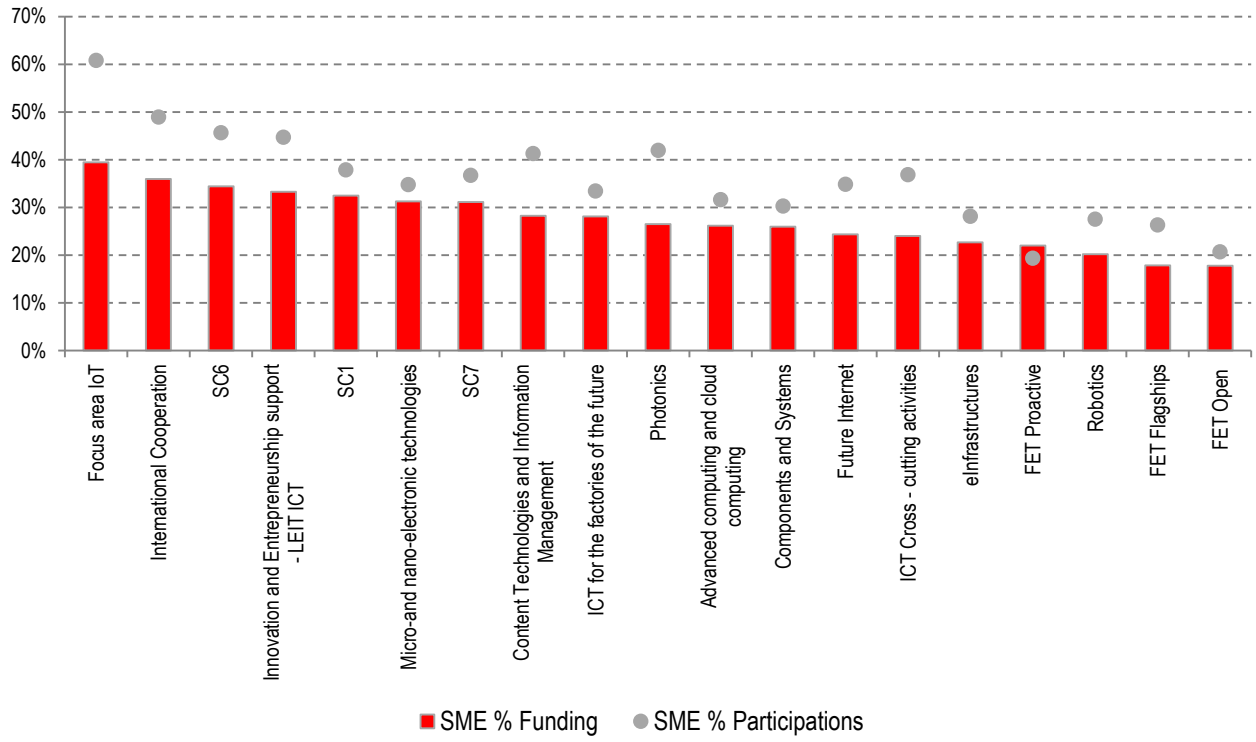
SMEs are especially present in the Work Programme area Focus Area Internet of Things, International Cooperation and Societal Challenge 6

SMEs represent 40 % of participating organisations and their participation varies according to pillar and Work Programme Area. They are very present in the 'Focus Area IoT', in the Societal Challenges and within LEIT ICT in 'Micro-and Nanoelectronic technologies', 'Content Technologies and Information Management' and in 'Factories of the Future'.

The SME Instrument attracted mostly new SMEs: 90% of organisations had not participated in FP7. SMEs are particularly weak in FET, 'Robotics' and 'e-Infrastructures'. As for the public-private-partnerships and the joint undertakings, the presence of SMEs ranges from 11 % in robotics and in HPC, 13 % in ECSEL, to 17 % in 5G, 19 % in Big Data and 25 % in Photonics.

In certain Member States, SMEs account for the large majority of the total funding going to the country – in Estonia the share is 58 %, in Latvia and Slovakia 55 % and in Hungary 44 %.

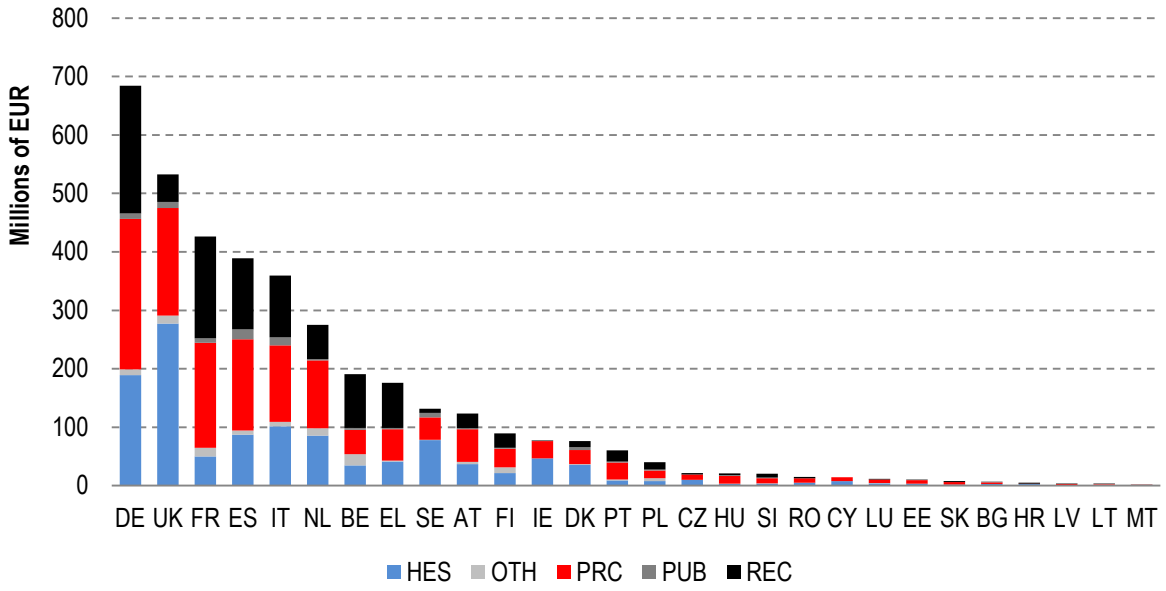
Figure 7.8: Incidence of SMEs by Work Programme Area (as % of total funding and participations), cumulated values 2014-2016



In absolute terms, Germany and the United Kingdom are the biggest recipients of EU funding, but Greece and Cyprus are the countries with the highest funding in relation to the size of their ICT sector

Germany, the United Kingdom, France, Spain and Italy account for 64 % of total EU funding and 62 % of participations in the first three years of H2020. Participants from Spain coordinate 18 % of projects, from Germany 12 % and from Italy 10 %.

Figure 7.9: EU Funding by Member State and type of participant organisation, cumulated values 2014-2016

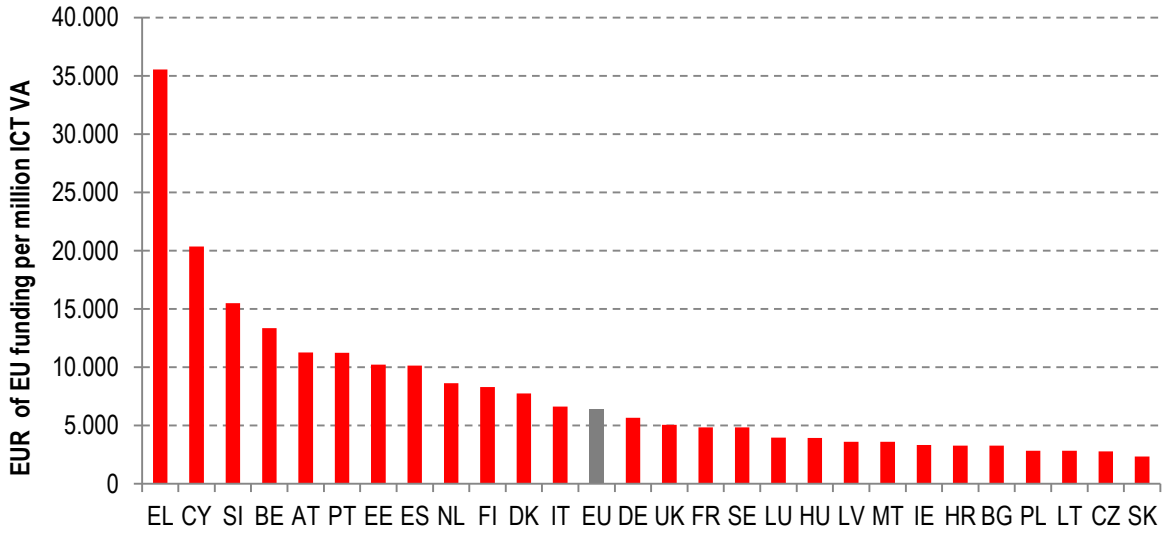


Source: European Commission, based on CORDA

Slovenia, Belgium, Austria and Portugal are also among the Member States with the highest amounts of funding compared to the size of their ICT sector.

When looking at the total funding by country and its distribution among H2020 pillars, in all the countries the majority of funding (out of the total funding for the country) is allocated to LEIT-ICT, ranging from the lowest level at 43 % for Malta, to 80 % for Lithuania. In Hungary and Malta 39 % of funding goes to Excellent Science; Sweden has also 30% of its EU funding in this Pillar. In Luxembourg 37 % of funding is allocated to Societal Challenges, in Romania and Estonia it is 34 %.

Figure 7.10: EU funding by Member State per million of ICT sector Value Added, cumulated values 2014-2016



Source: European Commission, based on CORDA and PREDICT data for ICT Value Added

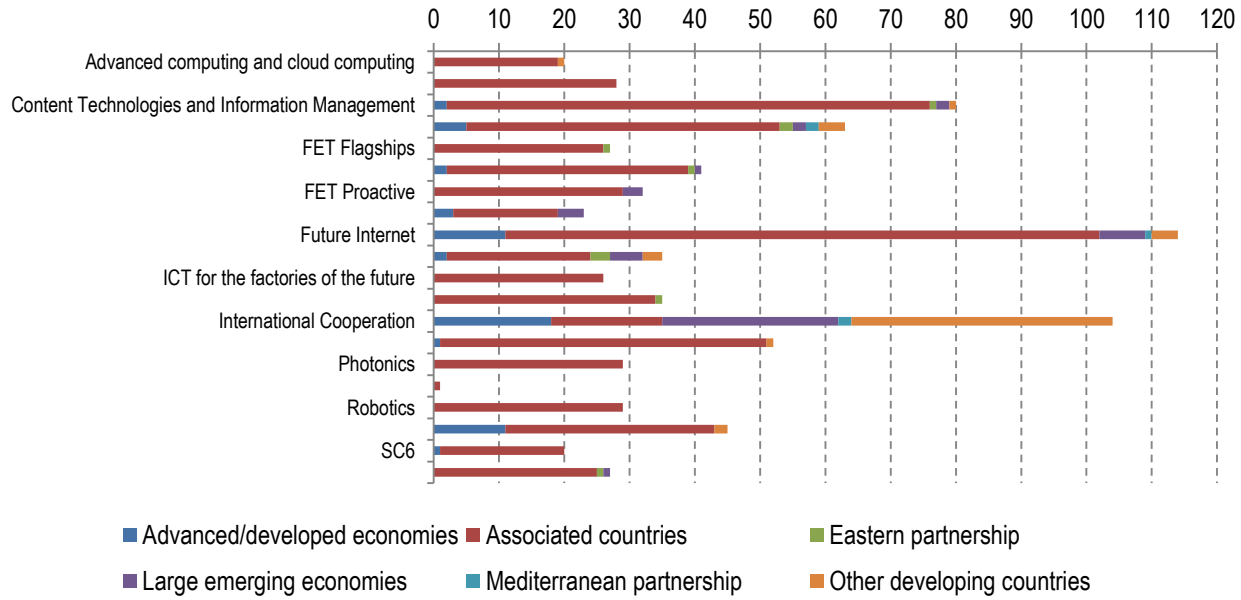
94 % of EU funding for ICT in H2020 is allocated to EU Member States, followed by associated countries. Third countries take part in the Research Programme but with little EU funding

In the first three years of H2020, 460 organisations from 65 non-EU countries participated in 445 ICT projects. About 5.5 % of participations and funding is allocated to associated countries, mainly due to the presence of research-oriented players such as Norway, Israel and Switzerland.

Most of the projects with international participants fall under the Work Programme Area 'Future Internet' (72 projects), 'Content Technologies and Information Management' (45 projects), 'Innovation and Entrepreneurship support' (32 projects) and 'Societal Challenge 1' (31 projects).

Over three years, EUR 17 m of EU funding were allocated to calls with Japan for R&D cooperation in IoT, Future Internet and Robotics; EUR 7 m in projects in IoT and Cloud Computing with Brazil and EUR 6 m with Korea in the areas of Future Internet, IoT and Cloud Computing. EUR 12 m of EU funding were invested in support to policies and international cooperation for eInfrastructures. In 2016, calls for cooperation with China on Future Internet and with Mexico in ICT were launched (EUR 1 m of EU funding each). EUR 12 m of funding were for International partnership building in low and middle income countries.

Figure 7.11: International participation: number of participations by country group and WP Area, cumulated values 2014-2016



Note

This report covers all the projects signed by 31 December 2016.

Annual comparisons are made by considering projects signed by 31 December of the relevant year.

The following Country Groups are used for the international cooperation part:

- Associated countries (art. 7 of H2020 Regulation): Iceland, Norway, Albania, Bosnia and Herzegovina, the former Yugoslav Republic of Macedonia, Montenegro, Serbia, Turkey, Israel, Moldova, Switzerland (partial association: Excellent Science Pillar only), Faroe Islands
- Advanced / developed economies: US, Japan, Canada, Australia, New Zealand, Korea, Singapore
- Large emerging economies: BRICS (with South Africa); Mexico, Indonesia, Nigeria and Turkey (the MINT group), South America (Argentina, Chile, Uruguay, Colombia).
- Eastern Partnership: Ukraine, Belarus, Armenia, Azerbaijan, Georgia
- Mediterranean Partnership: Morocco, Algeria, Tunisia, Libya, Egypt, Lebanon, Jordan, Syria
- Other developing countries: all other Third Countries

Source: the report is based on CORDA data elaborated by the European Commission - DG CONNECT.

The source of data for ICT Value Added is PREDICT.