



# Connectivity

## Broadband market developments in the EU

Digital Economy and Society Index Report 2018  
Connectivity

**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.

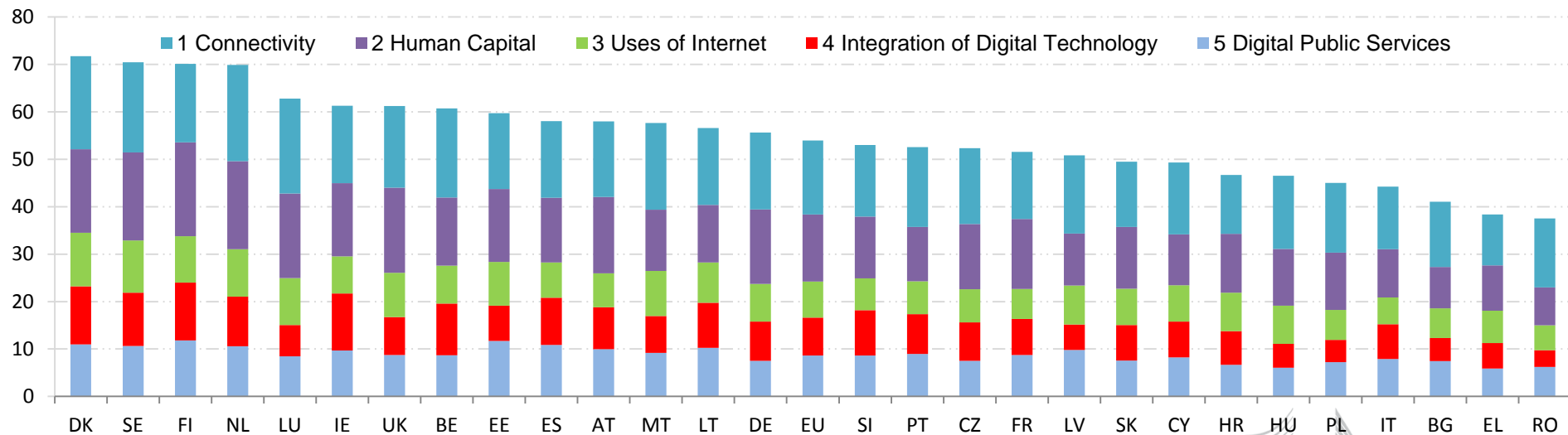
Denmark, Sweden, Finland and the Netherlands have the most advanced digital economies in the EU followed by Luxembourg, Ireland, the UK and Belgium.

Romania, Greece, Bulgaria and Italy have the lowest scores on the index.

### The five dimensions of the DESI

1 Connectivity	Fixed Broadband, Mobile Broadband, Fast and Ultrafast Broadband and Prices
2 Human Capital	Basic Skills and Internet Use, Advanced skills and Development
3 Use of Internet Services	Citizens' use of Content, Communication and Online Transactions
4 Integration of Digital Technology	Business Digitisation and E-commerce
5 Digital Public Services	eGovernment and eHealth

**Digital Economy and Society Index (DESI) 2018**



Source: DESI 2018, European Commission



# For **Connectivity**, the highest score was registered by the Netherlands followed by Luxembourg, Denmark and Sweden. Greece, Croatia and Italy had the weakest performance in this dimension of the DESI.

The connectivity dimension 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, fast (Next Generation Access – NGA providing at least 30 Mbps ) and ultrafast (at least 100 Mbps) broadband and also considers the prices of retail offers. On mobile broadband, the availability of 4G and the take-up of mobile broadband are included. Digital Connectivity is considered as a social right in the EU\*.

A comparative assessment of fixed broadband (basic, fast and ultrafast) shows the Netherlands, Belgium, Luxembourg, Malta and Denmark, as the strongest performers. In contrast, Greece, Poland, Italy and Croatia are shown to be among the weakest performers.

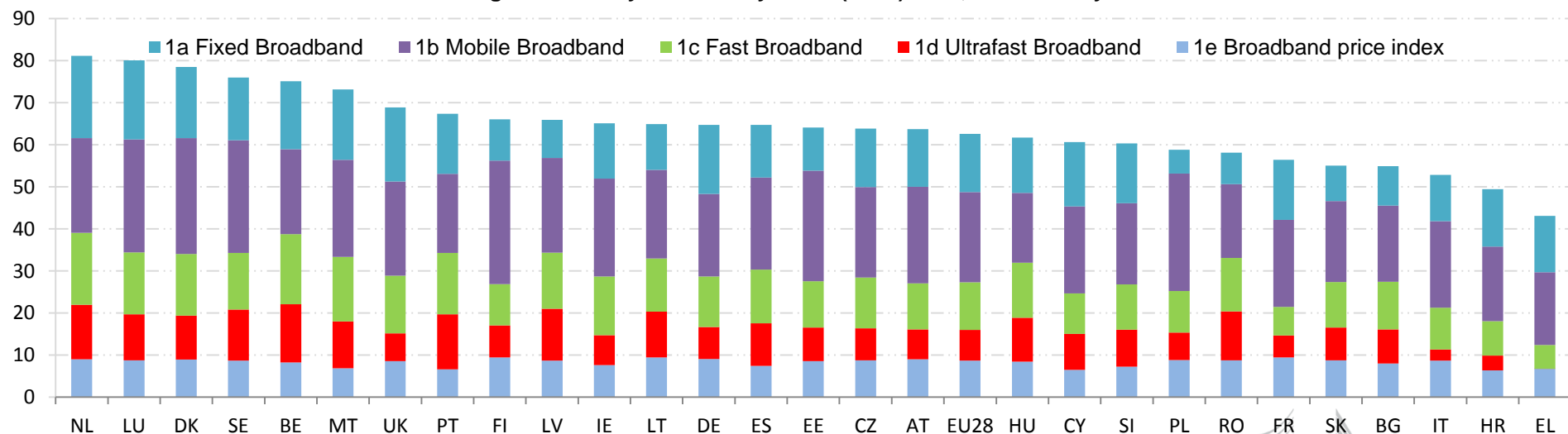
As for mobile broadband, the Nordic countries (Finland, Sweden and Denmark) lead Europe along with Latvia and Poland, while the lowest scores were registered by Hungary, Greece and Romania.

\* <https://composite-indicators.jrc.ec.europa.eu/social-scoreboard/>

## Connectivity indicators in DESI 2018

	EU
<b>1a1 Fixed Broadband Coverage</b>	<b>97%</b>
% households	2017
<b>1a2 Fixed Broadband Take-up</b>	<b>75%</b>
% households	2017
<b>1b1 4G Coverage</b>	<b>91%</b>
% households (average of operators)	2017
<b>1b2 Mobile Broadband Take-up</b>	<b>90</b>
Subscriptions per 100 people	2017
<b>1c1 Fast Broadband (NGA) Coverage</b>	<b>80%</b>
% households covered by VDSL, FTTP or Docsis 3.0	2017
<b>1c2 Fast Broadband Take-up</b>	<b>33%</b>
% homes subscribing to >= 30Mbps	2017
<b>1d1 Ultrafast Broadband Coverage</b>	<b>58%</b>
% households covered by FTTP or Docsis 3.0	2017
<b>1d2 Ultrafast Broadband Take-up</b>	<b>15.4%</b>
% homes subscribing to >= 100Mbps	2017
<b>1e1 Broadband Price Index</b>	<b>87</b>
Score (0 to 100)	2017

Digital Economy and Society Index (DESI) 2018, Connectivity



Source: DESI 2018, European Commission



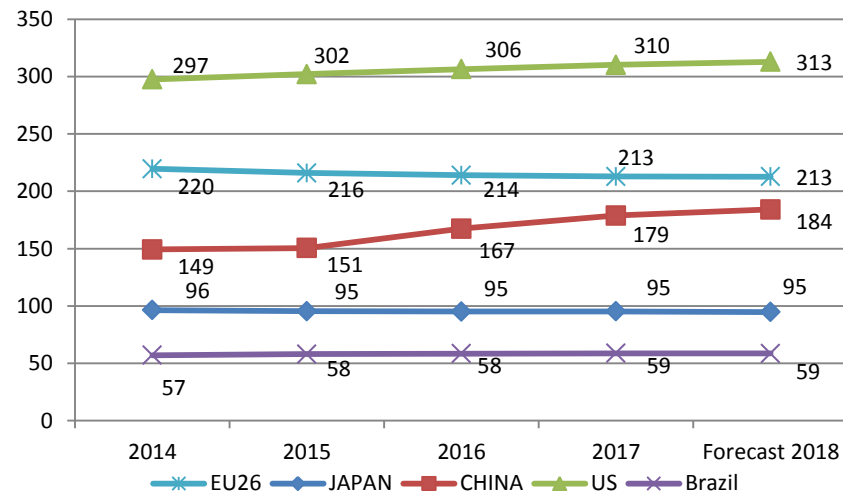
**Total telecom services revenues** have slightly declined (by 3.1 %) in Europe since 2014. **Mobile and fixed voice revenues** have decreased by 16 % since 2014. An increase in **mobile data and internet services** was not enough to offset the major decline in voice services.

Telecom operators in Europe generated less revenue than the US operators. Revenues went slightly down from EUR 220 billion in 2014 to EUR 213 billion in 2017 in Europe. At the same time, the US revenues also slightly increased from EUR 297 billion to EUR 310 billion, despite its smaller population.

China increased its revenues by 23.3 %, from EUR 149 billion in 2014 to EUR 179 billion in 2017.

*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).*

Total Telecommunication revenues per region, billion €, 2014-2018



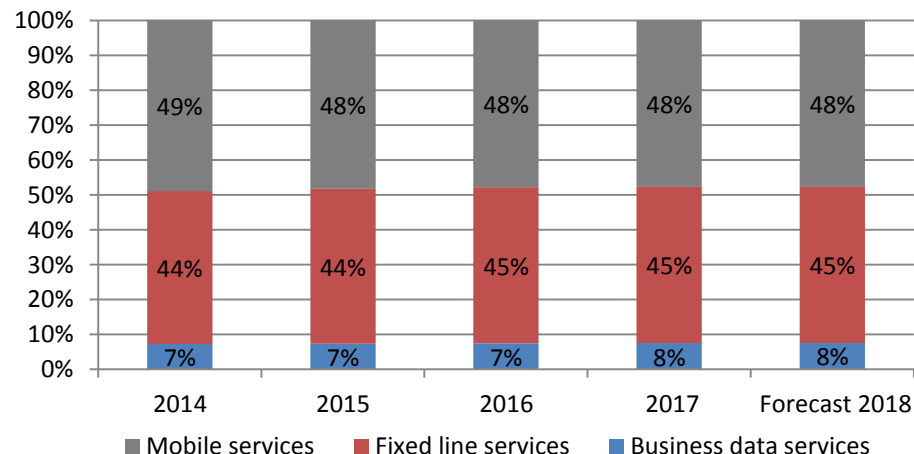
The analysis of telecommunications revenues (carrier services) by segment shows a decline in voice services (both fixed and mobile) revenues. Fixed voice service revenues have fallen by 11.6 % since 2014, compared to 20.4 % for mobile services over the same period (2014 – 2017). Together, fixed and mobile voice services represented 44 % of total telecom revenues in 2017, compared with 51 % in 2014.

Mobile data services represented 27 % of total revenues in 2017, up from 24 % in 2014. The growth in mobile data services could not, however, compensate for the major decline in voice services and overall revenues fall by 3 %.

*\*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). Data is not available for Malta and Cyprus.*

Source: 2017 - 2018 European IT Observatory (EITO) in collaboration with IDC.

Telecom services revenues by segment, EU 26\*, % of total, 2014 - 2018



**Broadband coverage: Fast Broadband** (Next generation access - NGA) covers 80 % of homes, up from 76 % a year ago, while **Ultrafast Broadband** (Fibre to the Premises and Docsis 3.0 cable) is available in 58 %. **4G** mobile is almost universal at 98%. Rural coverage improved substantially in **4G** and NGA technologies.

Basic broadband is available to all homes 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 97 % of EU homes.

Coverage of NGA technologies (VDSL, Cable Docsis 3.0 and FTTP) capable of delivering at least 30 Mbps download reached 80 %, thanks to an increase of 5 percentage points in VDSL and 3 percentage points in FTTP last year.

Rural areas remain challenging, as 8% of homes are not covered by any fixed network, and 53% are not covered by any NGA technology.

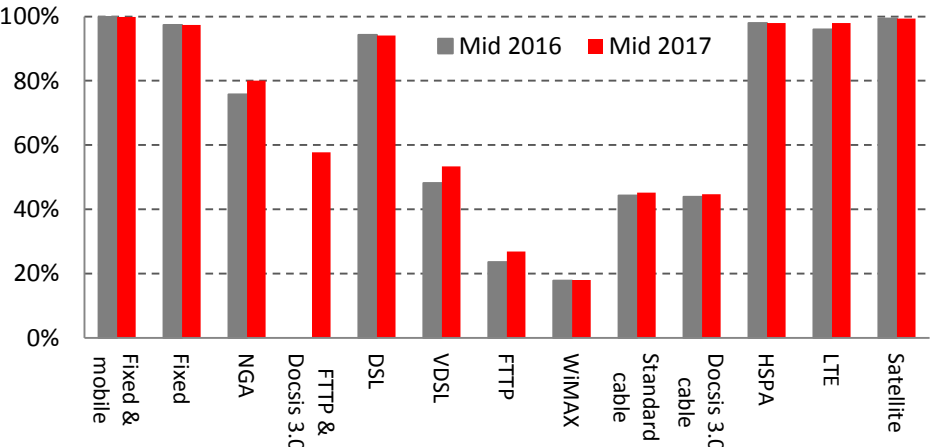
**Our Target under the Digital Agenda for Europe**

Basic broadband for all by 2013: **100 % in 2017**

Fast broadband (>30Mbps) for all by 2020: **80 % in 2017**

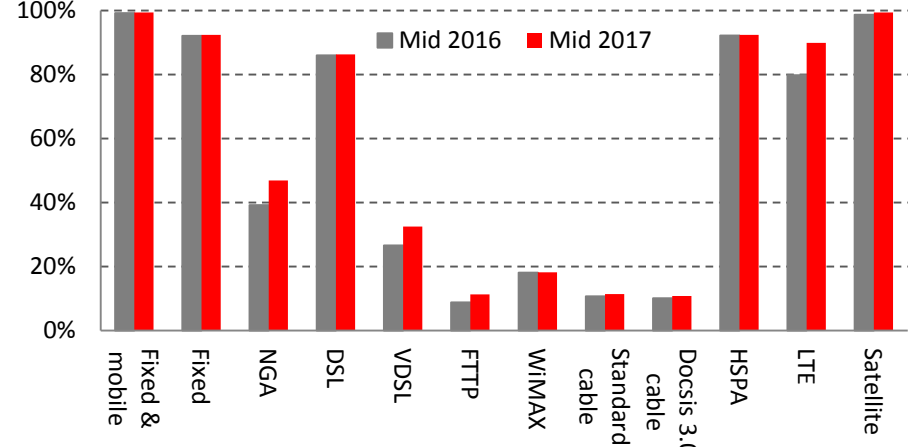


**Total coverage by technology at EU level, 2016-2017**



Source: IHS and Point Topic

**Rural coverage by technology at EU level, 2016-2017**

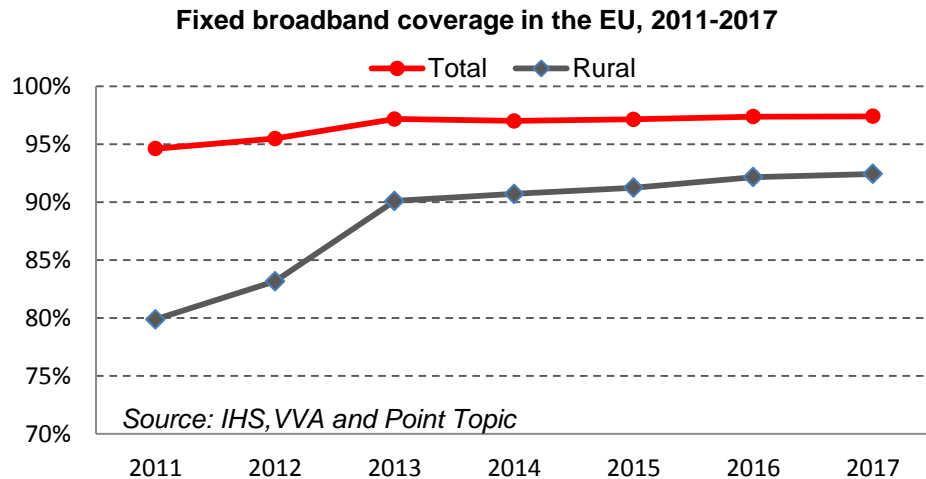


Source: IHS and Point Topic

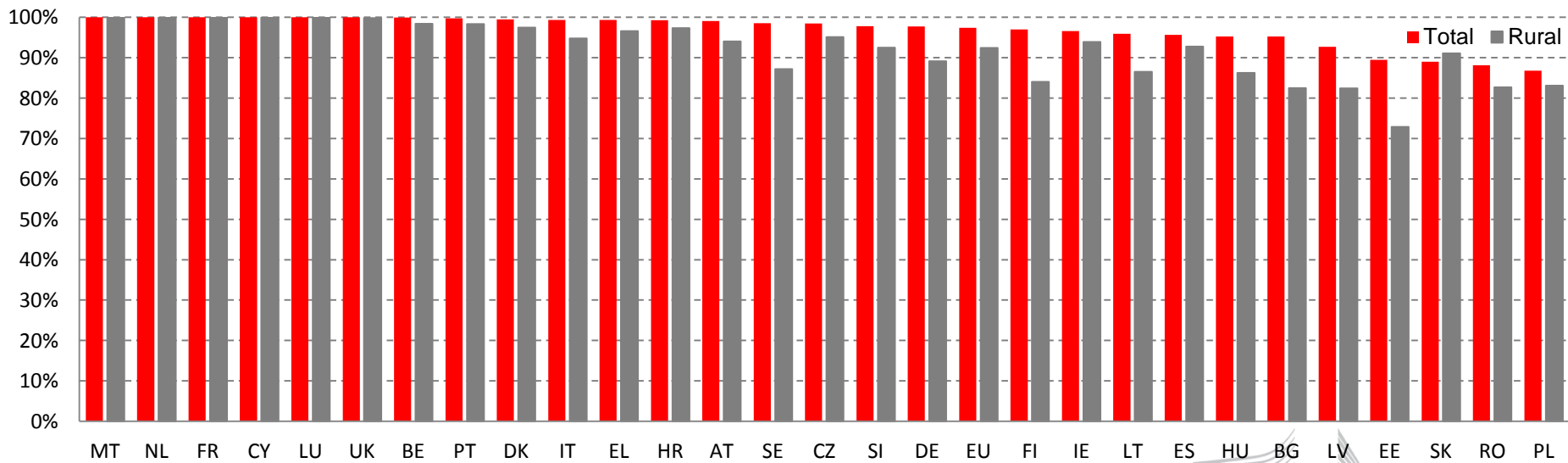
**Coverage of fixed broadband** remained at 97 %. In about half of the Member States more than 99 % of homes are covered. Poland, Romania, Slovakia and Estonia are lagging behind with less than 90 % of homes covered.

Primary internet access at home is provided mainly by fixed technologies. Among these technologies, xDSL has the largest footprint (94 %) followed by cable (45 %) and WiMAX (18 %). Fixed coverage is the highest in the Member States with well-developed DSL infrastructures, and is over 90 % in all but four Member States.

Overall coverage of fixed broadband has only marginally increased since 2011, but rural coverage improved by 12 percentage points. Developments have slowed down, as Member States have diverted their focus to NGA and wireless technologies.



**Fixed broadband coverage, June 2017**



Source: IHS and Point Topic

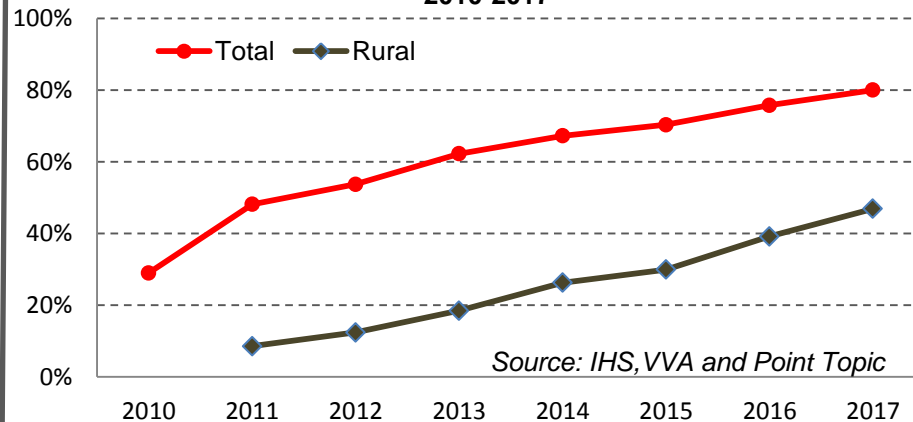


## Coverage of Next Generation Access (NGA) technologies continued to increase and reached 80 %. NGA improved significantly in rural areas, from 39 % to 47 % of homes compared to last year.

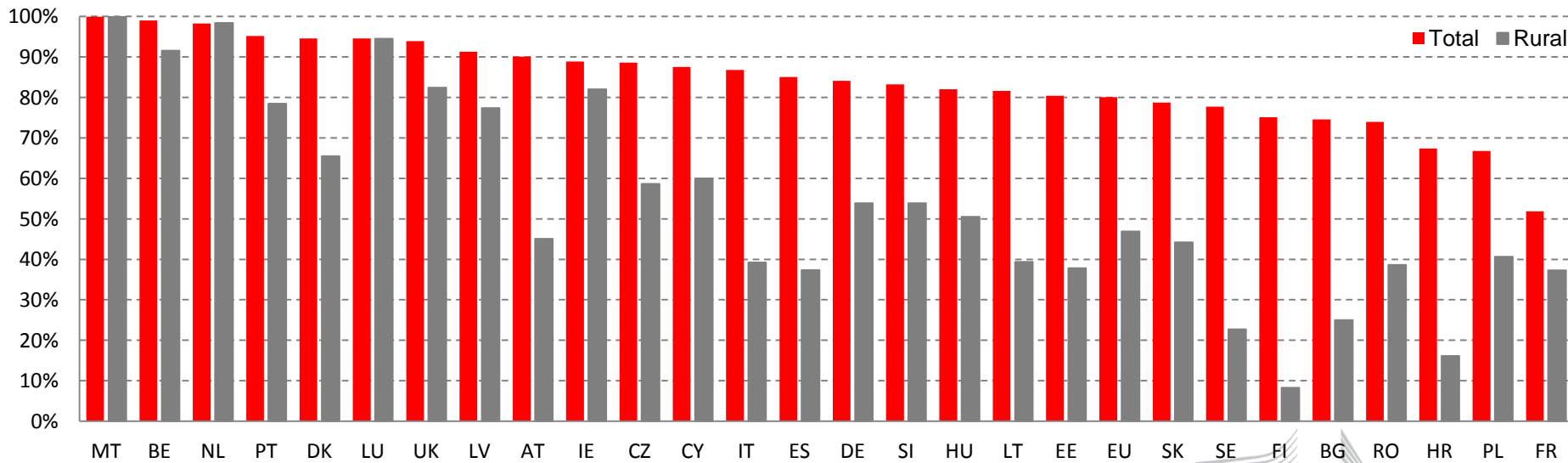
At mid-2017, VDSL had the largest NGA coverage at 53 %, followed by cable (45 %) and FTTP (27 %). While cable coverage only marginally increased last year, VDSL went up by 5 percentage points. There was progress also in FTTP (from 24 % in 2016 to 27 % in 2016), but FTTP coverage is still low.

Rural NGA is still far behind national coverage.

Next Generation Access (NGA) broadband coverage in the EU, 2010-2017



Next Generation Access (FTTP, VDSL and Docsis 3.0 cable) coverage, June 2017



Source: IHS and Point Topic

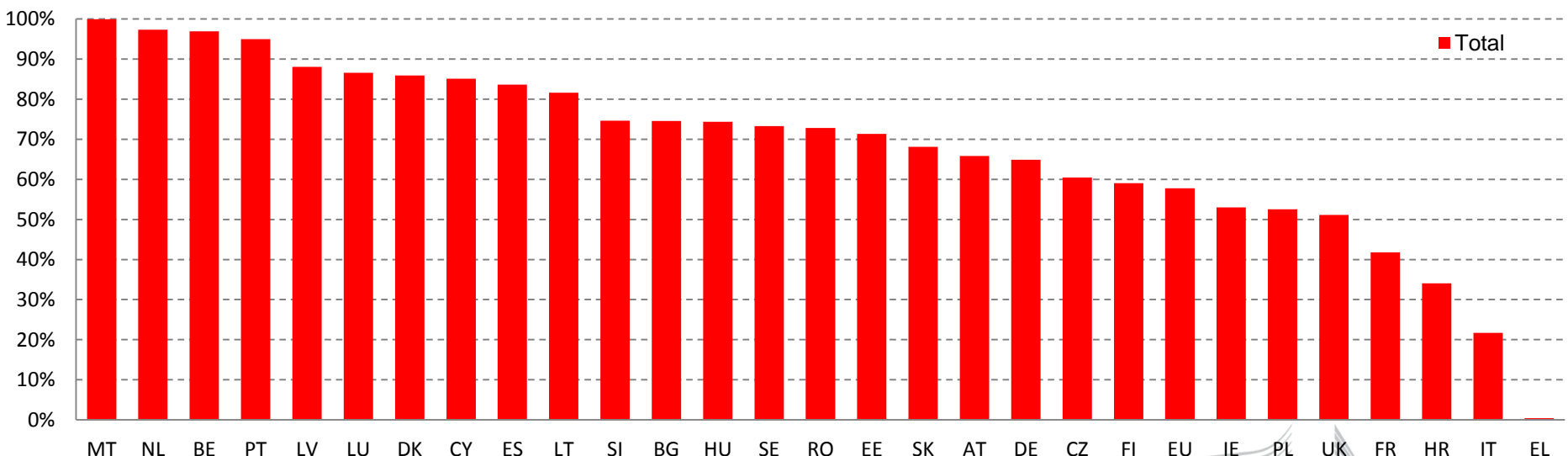
**Ultrafast broadband (FTTP & Cable Docsis 3.0) is available in 57% of European homes. In Malta, the Netherlands, Belgium and Portugal more than 90% of homes have access, while in Greece such networks do not yet exist.**

The Digital Agenda for Europe set a target that by 2020 at least 50 % of European homes should subscribe to ultrafast broadband of at least 100 Mbps. A precondition to achieving this target is the wide availability of ultrafast broadband networks.

Currently, FTTP and Docsis 3.0 cable networks are capable of delivering ultrafast connectivity. Cable covers 45 %, while FTTP covers 27 % of homes. Cable and FTTP networks overlap, and mainly cover urban areas. 57 % of homes have access to at least one of the ultrafast technologies.

Looking at the Member States, the top three countries (Malta, the Netherlands and Belgium) provide ultrafast connectivity mainly through cable, while in Portugal and Latvia (the next two countries in the ranking) FTTP is the more widespread ultrafast technology. At the bottom of the list, Greece has neither FTTP nor cable, while Italy purely has FTTP available in some cities.

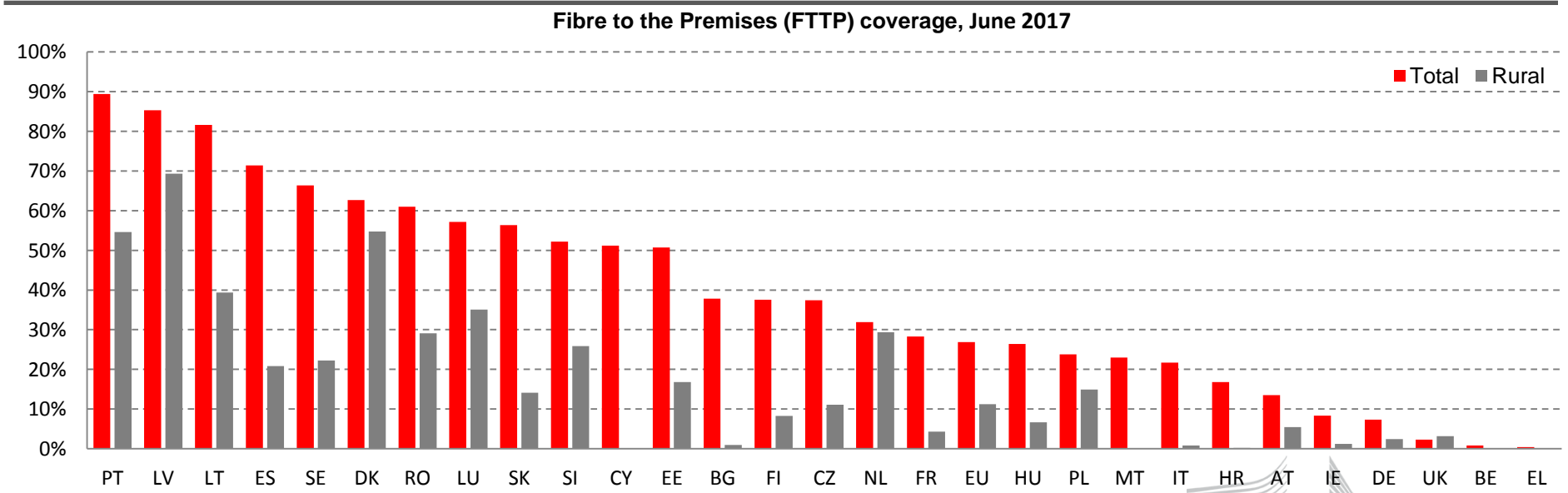
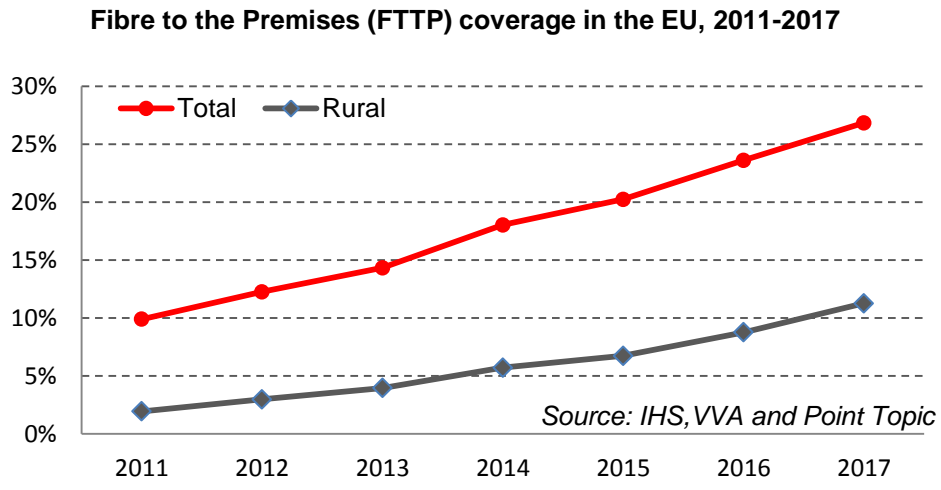
**Ultrafast (FTTP and Cable Docsis 3.0) coverage, June 2017**





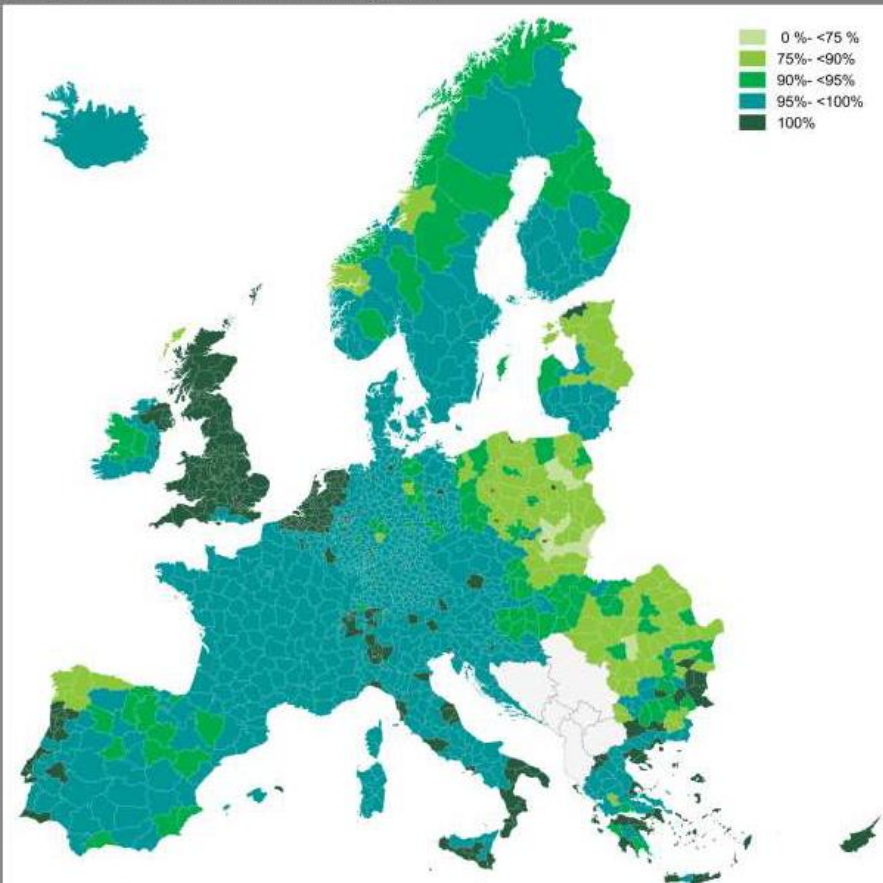
**Coverage of Fibre to the Premises (FTTP) grew from 10 % in 2011 to 27 % in 2017, although it remains a primarily urban technology. Portugal, Latvia, Lithuania and Spain are the leaders in FTTP in Europe.**

FTTP is catching up in Europe, as coverage of homes has more than doubled since 2011. However, the FTTP footprint is still significantly lower than that of cable Docsis 3.0 and VDSL. In Portugal, Latvia, Lithuania and Spain more than 70 % of homes can already subscribe to FTTP services, while in Greece, Belgium, the UK, Germany and Ireland less than 10 % can do so. FTTP increased the most in Spain (8.6 percentage points) and France (7.5 percentage points). FTTP services are available mainly in urban areas with the exception of Portugal, Latvia and Denmark, where more than 50 % of rural homes also have access to it.



# Overall fixed broadband and NGA broadband coverage by region.

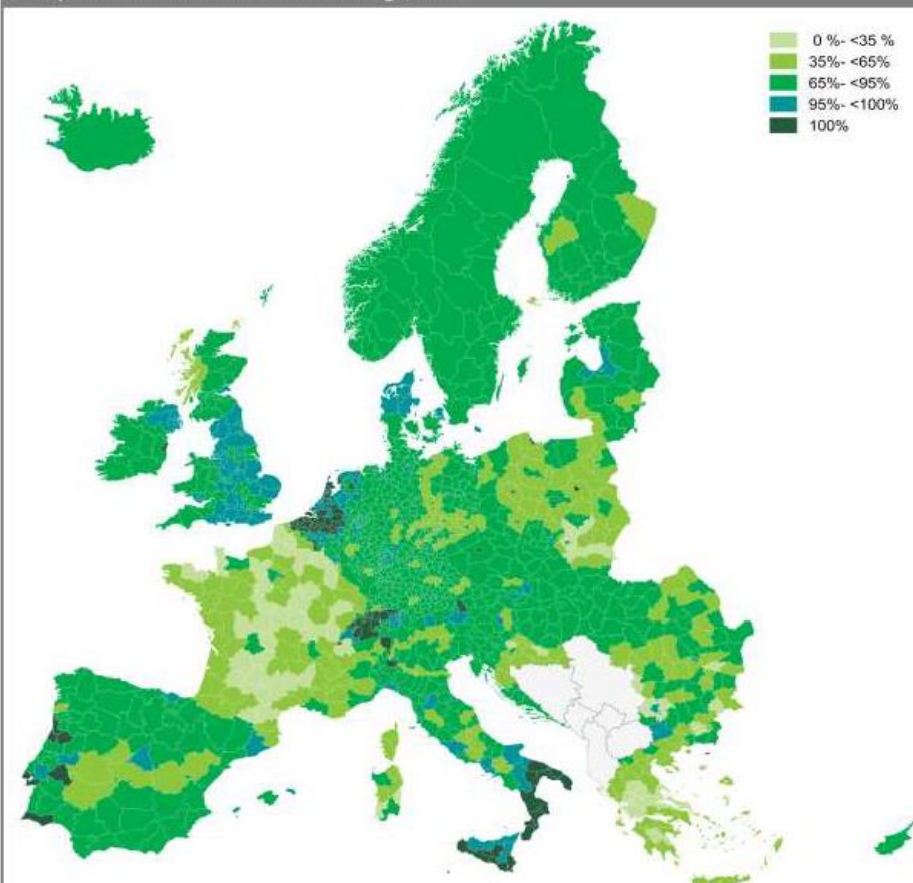
Europe: Overall fixed broadband coverage, 2017



Source: Broadband Coverage in Europe 2017, a study by IHS Markit and Point Topic for the European Commission

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Europe: Overall NGA broadband coverage, 2017



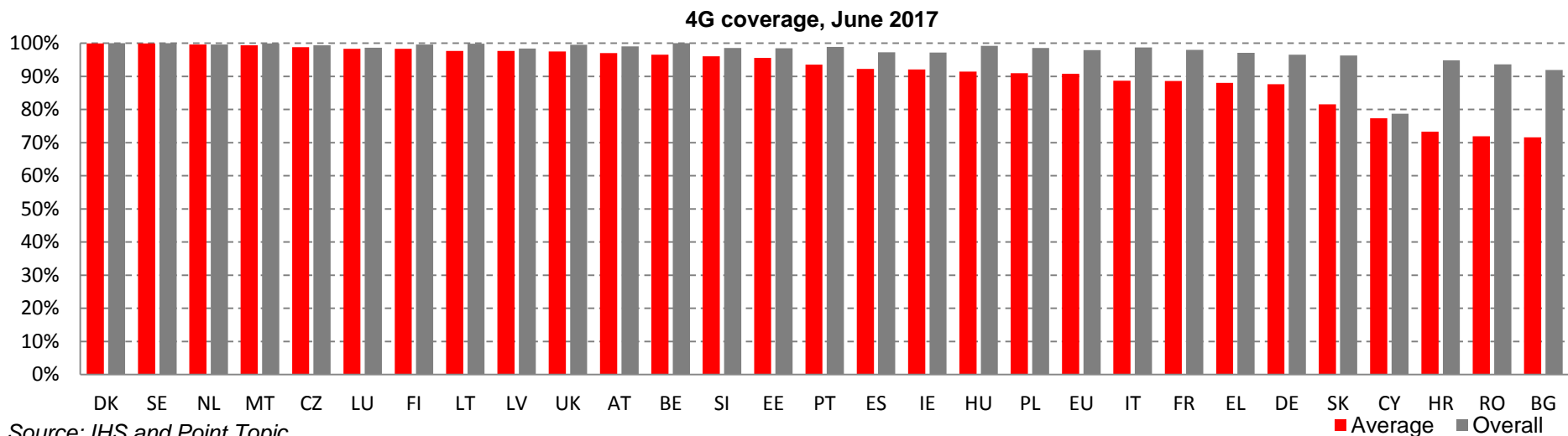
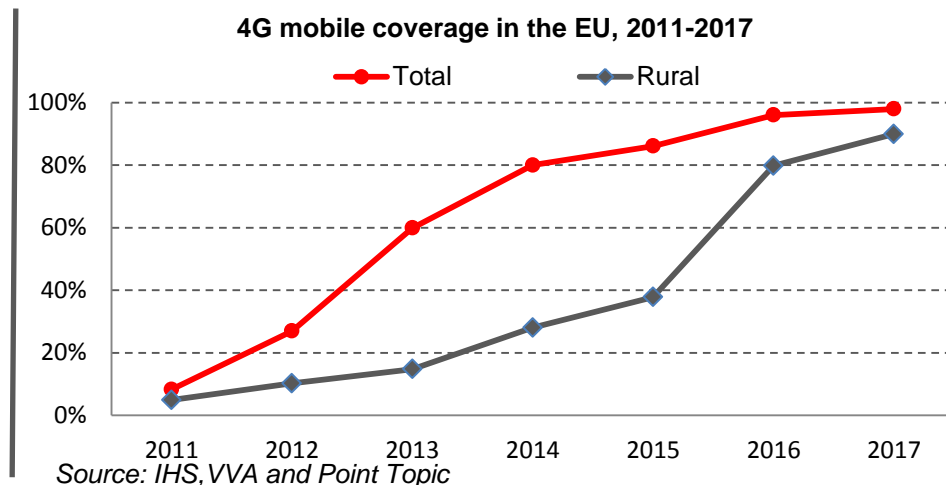
Source: Broadband Coverage in Europe 2017, a study by IHS Markit and Point Topic for the European Commission

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**4G mobile coverage:** 98 % of homes are covered by at least one operator in Europe (overall coverage). Rural coverage went up from 38 % in 2015 to 90 % in 2016. **Average 4G availability\*** stands at 91 %, up from 86 % a year ago.

4G (LTE) is now as widely available as advanced 3G (HSPA) and fixed broadband. 4G expanded mainly in Romania (by 18 percentage points) and Bulgaria (by 15 percentage points) last year.

Average 4G availability (calculated as the average of each operator's coverage) is somewhat below the overall coverage and stands at 91 %.



\* This indicator measures the average of mobile telecom operators' coverage within each country.

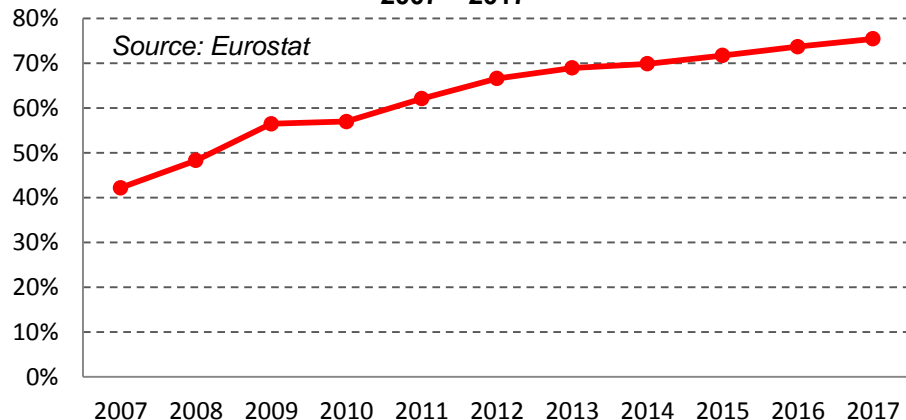
75 % of EU homes had a **fixed broadband subscription** in 2017. The Netherlands, Luxembourg, Germany and the UK registered the highest figures in the EU, while Italy, Finland and Bulgaria had the lowest take-up rates.

Although fixed broadband is available to 97 % of EU homes, 25 % of homes do not have a subscription. Growth in take-up was very strong until 2009, but has slowed down in the last few years, partially due to fixed-mobile substitution.

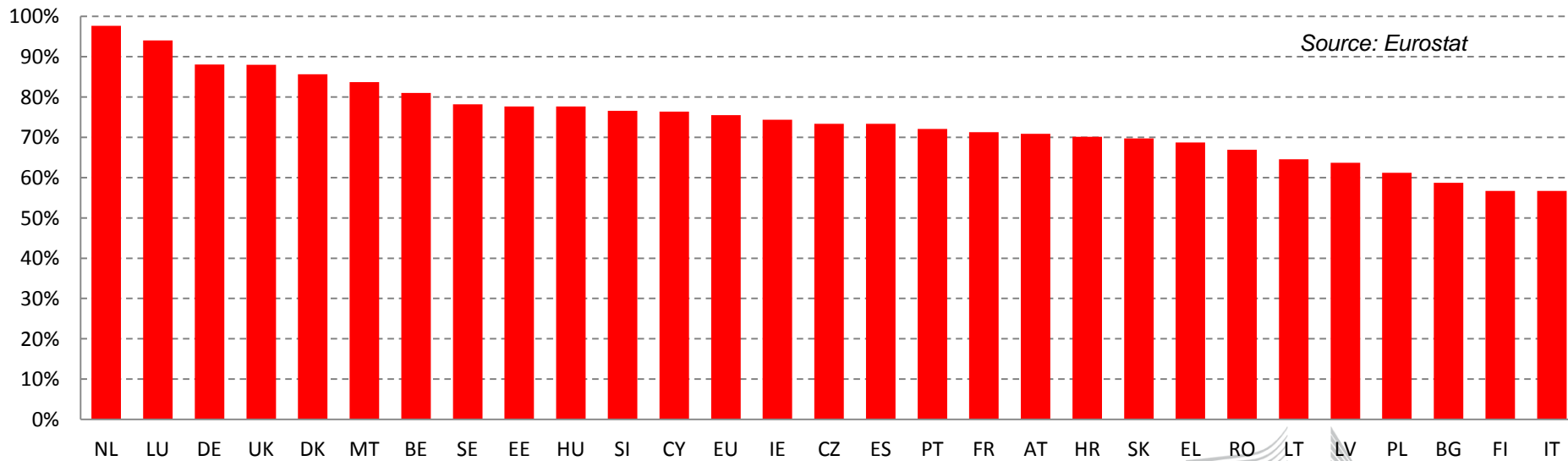
At Member State level, take-up rates ranged from only 57 % in Italy and Finland to 98 % in the Netherlands.

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

Households with a fixed broadband subscription (% of households), 2007 – 2017\*



Households with a fixed broadband subscription (% of households), 2017

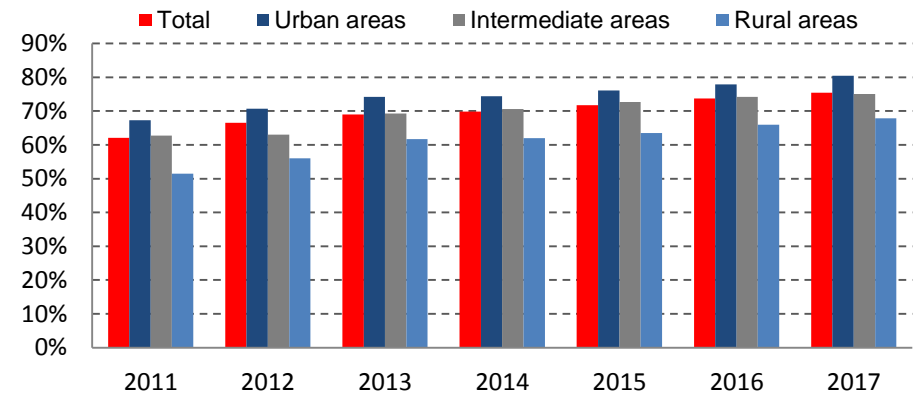


**68 % of rural homes in the EU had a fixed broadband subscription in 2017. The Netherlands, Luxembourg, the UK and Germany registered the highest figures, while in Bulgaria and Finland, less than half of rural homes subscribed.**

There is a substantial gap between rural and national penetration rates. This gap, however, slightly decreased from 10 percentage points in 2011 to 7 percentage points in 2017.

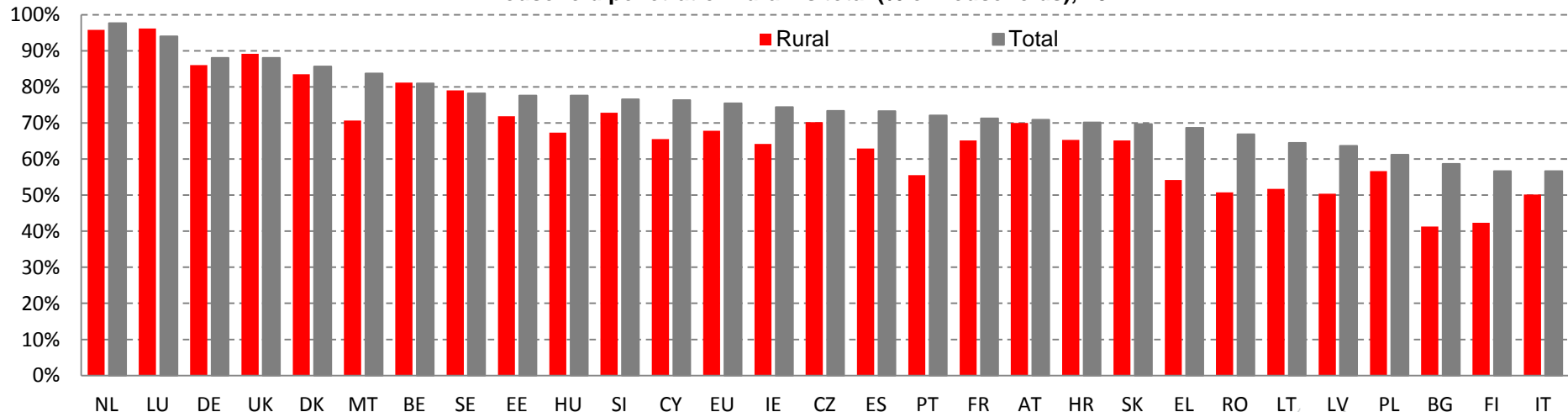
In the Netherlands, Germany, the UK, Belgium, Austria and Sweden, rural and national penetration rates are identical or almost identical. However, in Finland, Bulgaria, Portugal, Romania and Greece, where fixed rural take-up is among the lowest in Europe, there are significant gaps of 15-18 percentage points compared to the national take-up.

Households having a fixed broadband connection per degree of urbanisation at EU level (% of households), 2011 - 2017



Source: Eurostat

Household penetration rural vs total (% of households), 2017

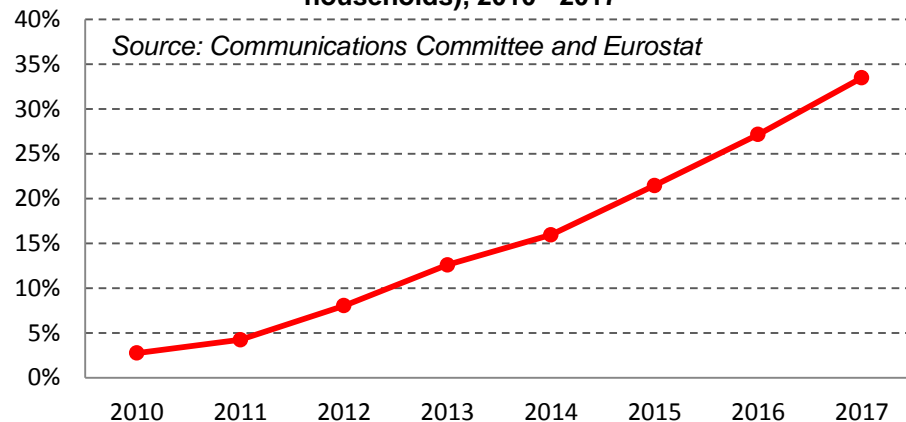


Source: Eurostat

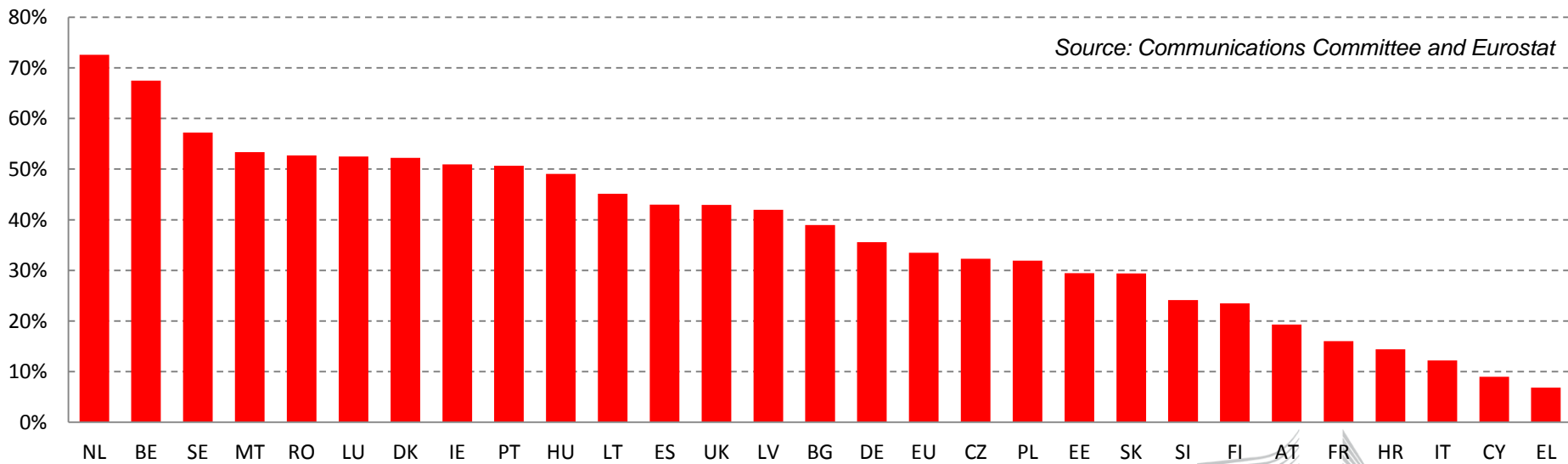
One third of European homes subscribe to **fast broadband access** of at least 30 Mbps. There has been a significant increase since 2010. The Netherlands and Belgium are the leaders in Europe in fast broadband take-up.

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 the Netherlands and Belgium more than two thirds of homes already subscribe to fast broadband, while in Greece, Cyprus and Italy, take-up still remains marginal.

Households with a fast broadband (at least 30Mbps) subscription (% of households), 2010 - 2017



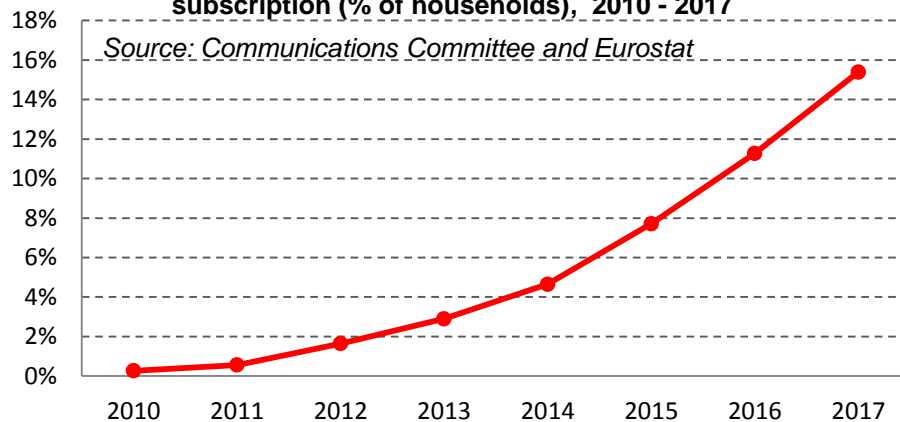
Fast broadband (at least 30Mbps) household penetration (% of households), July 2017



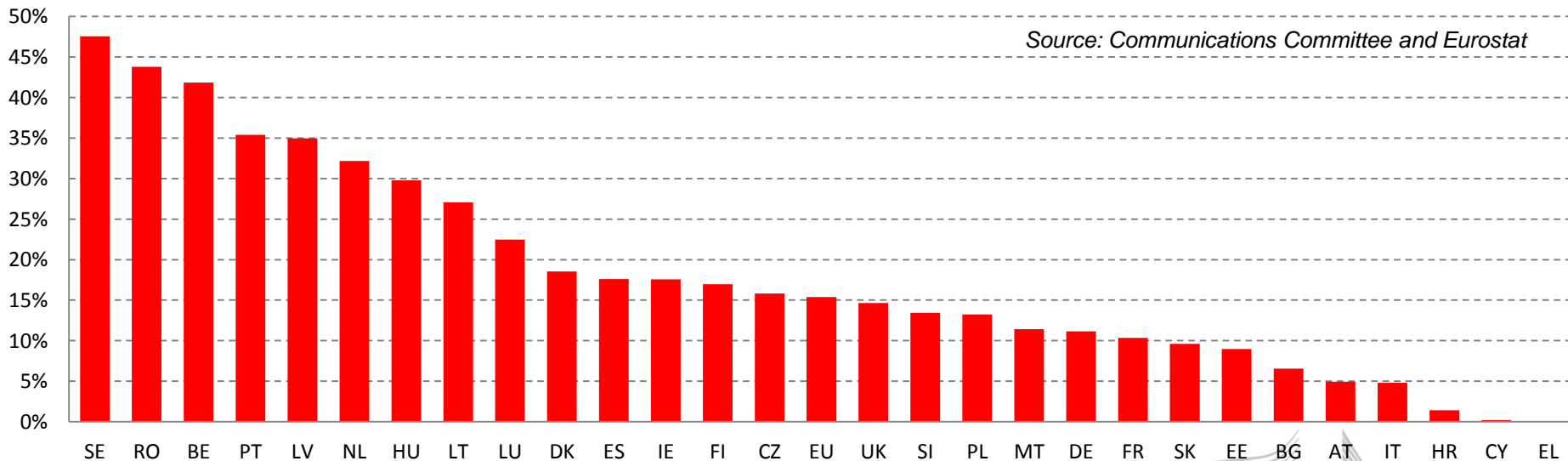
**15 % of European homes currently subscribe to **ultrafast broadband** (at least 100 Mbps), a marked improvement from 0.3 % 7 years ago. Sweden, Romania, Belgium, Portugal and Latvia are the most advanced in ultrafast broadband adoption.**

The Digital Agenda for Europe set the objective that at least 50 % of homes should subscribe to ultrafast broadband by 2020. In June 2017, 58 % of homes were covered by networks capable of providing 100 Mbps. As service offers are emerging, take-up is growing sharply. The penetration is the highest in Sweden, Romania and Belgium with over 40% of homes subscribing to at least 100 Mbps. In Greece, Cyprus and Croatia take-up is very low.

**Households with an ultrafast broadband (at least 100Mbps) subscription (% of households), 2010 - 2017**



**Ultrafast broadband (at least 100Mbps) household penetration (% of households), July 2017**

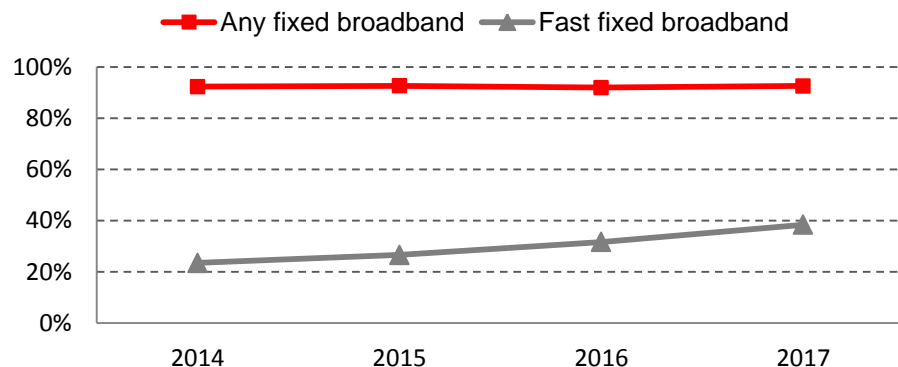




At EU level, 93 % of companies have a **fixed broadband subscription**. However, only 38 % have fast broadband (at least 30Mbps). While almost all large companies use broadband, 8 % of small enterprises are not yet connected.

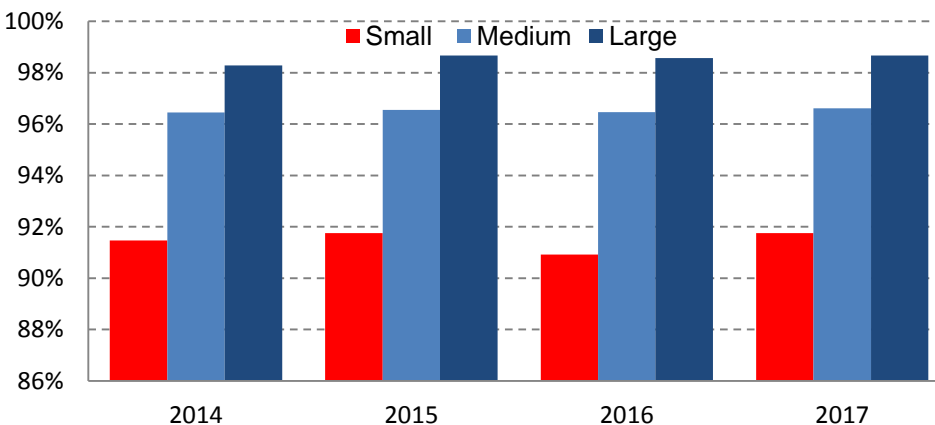
While the vast majority of European businesses use broadband, only 38 % of companies and 33 % of private homes subscribed to fast broadband in 2017. The penetration of fast broadband varies greatly between companies of different size. While 69 % of large companies benefit from broadband speeds of at least 30 Mbps, only 35 % of small enterprises do so. The penetration of fast broadband went up from 24 % to 38 % among all enterprises in 4 years.

Enterprises having a fixed broadband connection at EU level, 2014-2017



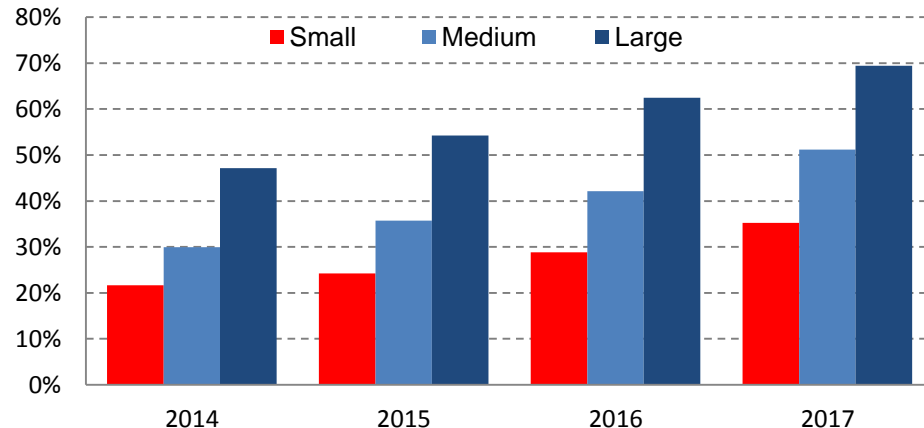
Source: Eurostat

Percentage of enterprises having any fixed broadband connection, by Enterprise size at EU level, 2014 - 2017



Source: Eurostat

Percentage of enterprises having a fast fixed broadband connection, by Enterprise size at EU level, 2014-2017



Source: Eurostat

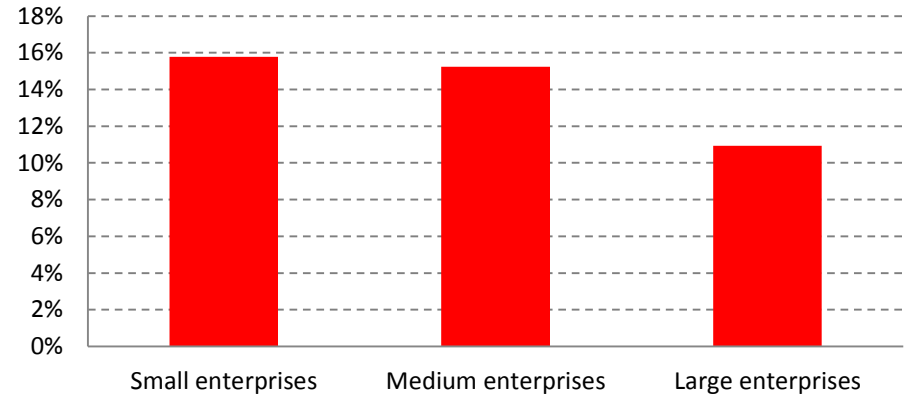


**16 % of European enterprises consider that the speed of their fixed connection is not sufficient for the current needs of the company. Germany, France, Croatia and the UK are the countries where this perception is the highest. Bulgarian, Latvian, Bulgarian, Latvian and Estonian companies are the most satisfied with the speed of their broadband connection.**

Satisfaction with broadband speeds vary greatly in the Member States. Those with the lowest satisfaction rates all have relatively low coverage of FTTP.

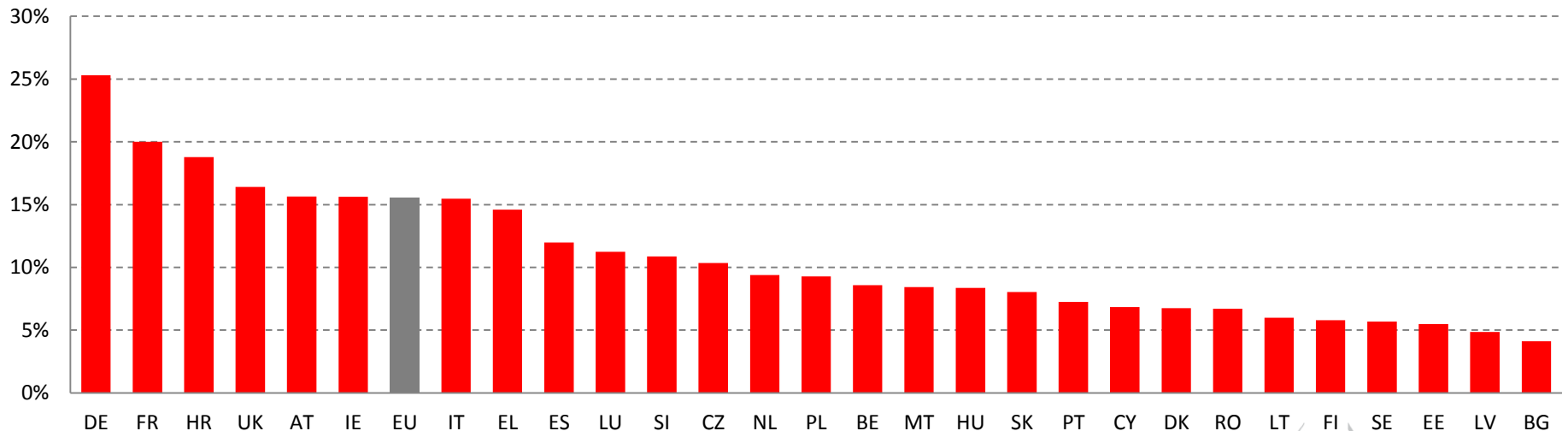
Large companies are generally better served than small ones. While only 11 % of large companies consider that their internet speed is not fast enough, this percentage increases to 16 % in small enterprises.

Enterprises that consider that speed of their fixed internet connection is not sufficient, by Enterprise size at EU level, 2017



Source: Eurostat

Percentage of enterprises that consider that speed of their fixed internet connection is not sufficient, 2017



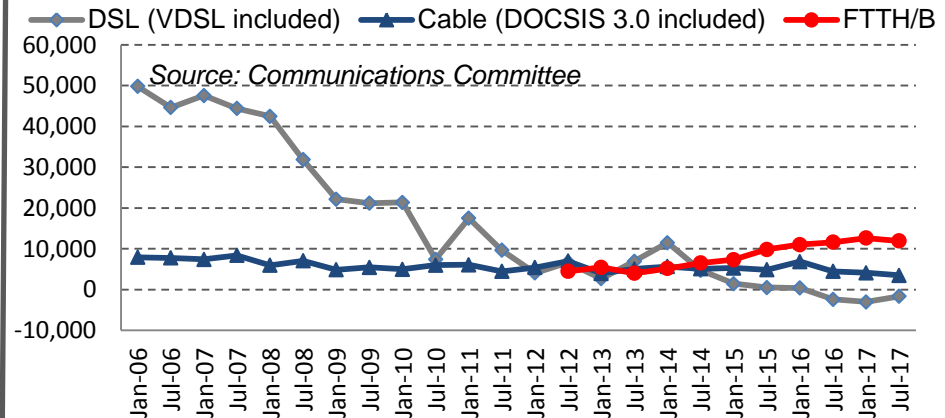
Source: Eurostat

64 % of subscriptions are **xDSL**, although this technology is slightly losing market share. **Cable** is second with 19 % of the market. **Fibre to the Home/Building (FTTH/B)** is the fastest-growing technology.

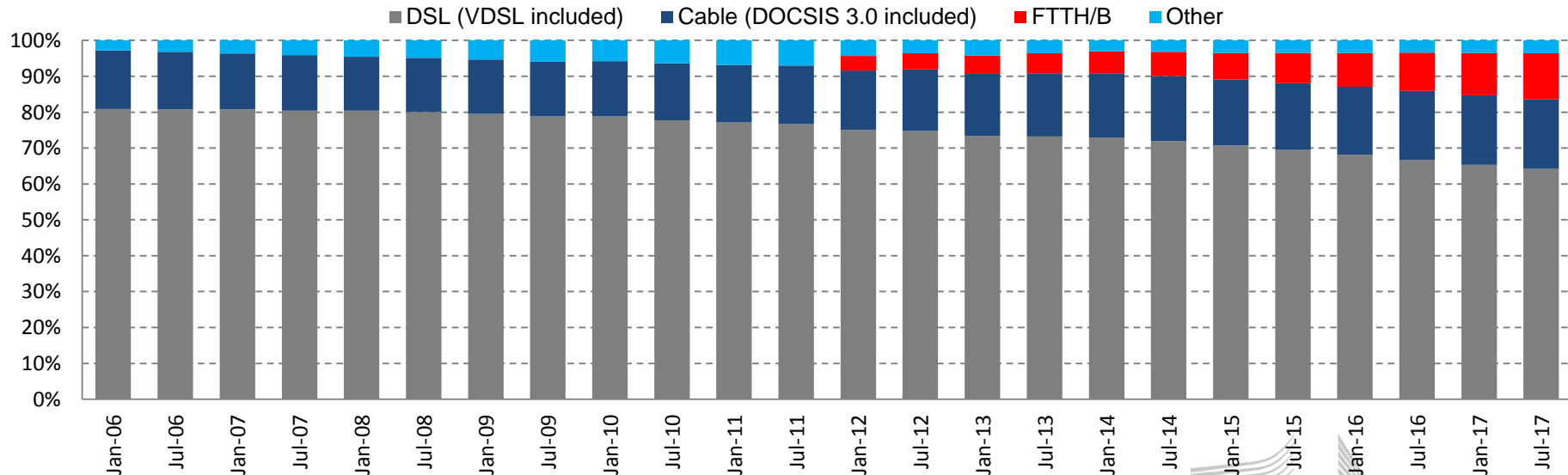
Although DSL is still the most widely used fixed broadband technology, its market share declined from 80 % in 2009 to 64 % in 2016. In the last 18 months, the number of xDSL subscriptions declined despite the growth of VDSL. The main challenger — cable — increased its share slightly during the same time period, but most of the net adds were posted by FTTH/B during the last 3 years.

Nevertheless, DSL continues to be predominant, and its market share can still grow thanks to the increasing VDSL coverage.

Fixed broadband net adds by technology at EU level, 2006-2017



Fixed broadband subscriptions - technology market shares at EU level, January 2006 - July 2017



Source: Communications Committee

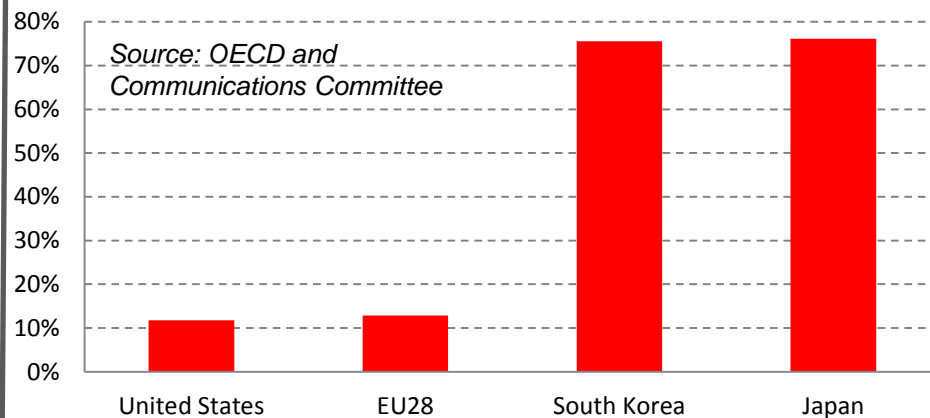


**xDSL** is particularly important in Greece and Italy, and has the lowest market share in Bulgaria, Lithuania and Romania. **Cable** has a very high market share in Belgium, Hungary, Malta and the Netherlands. **FTTH/B** is the most widely used technology in Lithuania, Latvia, Romania, Bulgaria, Portugal,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

The share of xDSL ranges from 11 % 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.

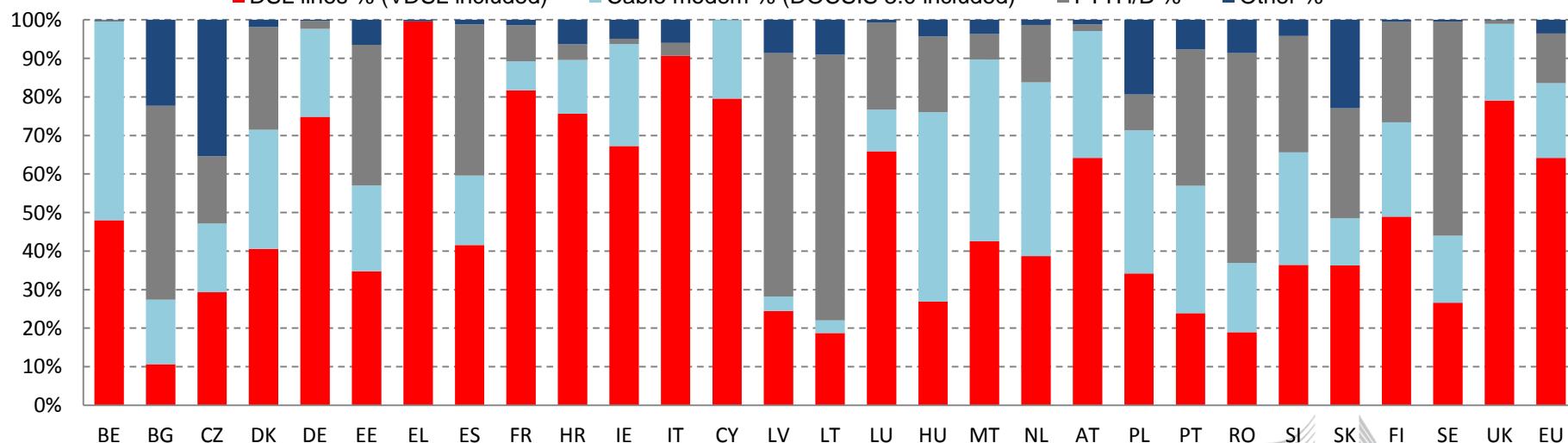
FTTH and FTTB together represent 13 % of EU broadband subscriptions. In these technologies, Europe continues to lag behind global leaders such as South Korea and Japan.

Share of fibre connections in total fixed broadband, July 2017



Fixed broadband subscriptions - technology market shares, July 2017

■ DSL lines % (VDSL included) ■ Cable modem % (DOCSIS 3.0 included) ■ FTTH/B % ■ Other %



Source: Communications Committee



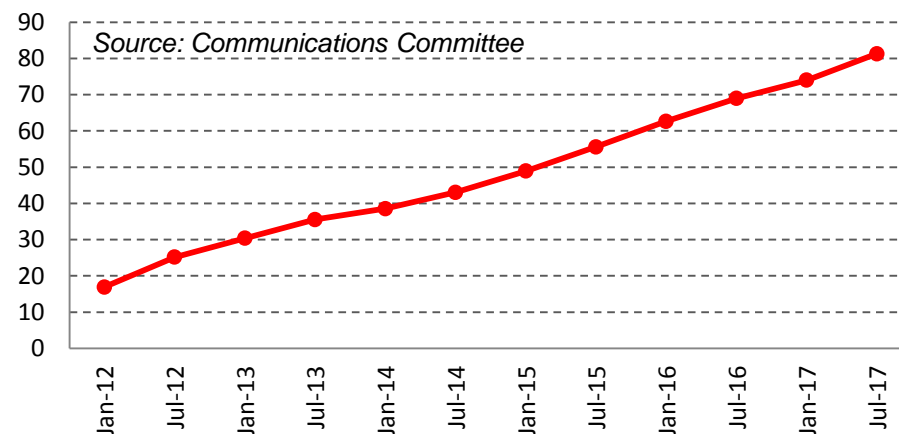
**NGA subscriptions** went up sharply by 26 million in the last 2 years, and just below 50 % of all subscriptions are NGA. In seven Member States, NGA's market share is higher than 75%. By contrast, its take-up remains low in Greece, Cyprus, Italy, France and Austria.

NGA subscriptions have been steadily increasing in the EU since 2012 and currently account for 48 % of all EU fixed broadband subscriptions.

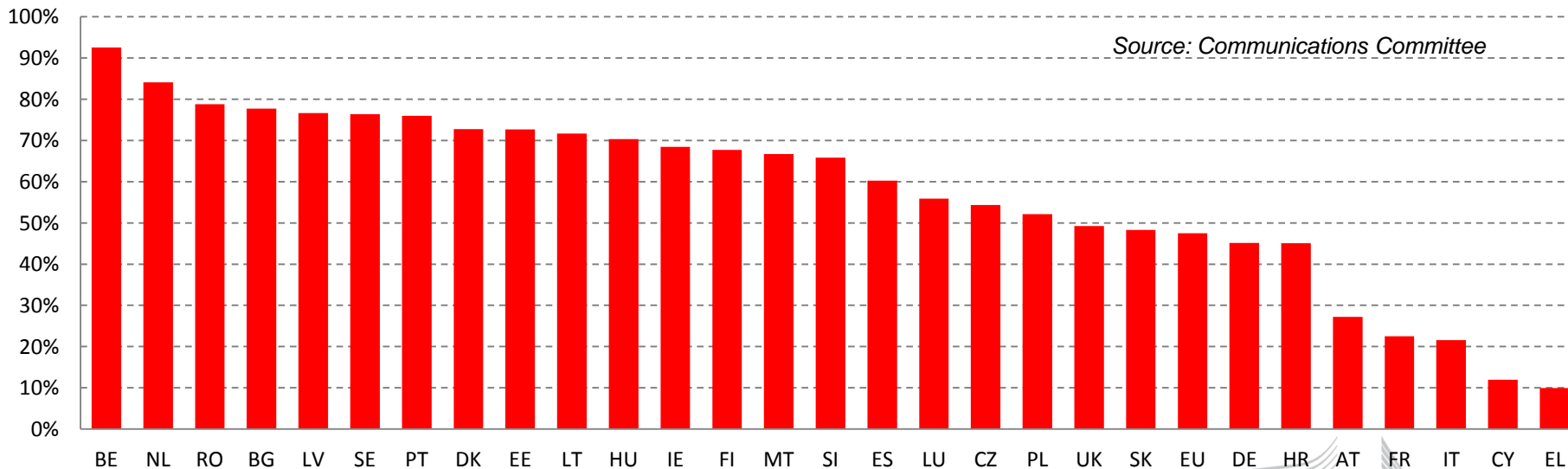
European leaders in NGA take-up are Belgium, and the Netherlands. In these two countries, both VDSL and cable Docsis 3.0 are widely available.

The highest growth in the last 12 months was observed in Estonia (14 percentage points) Germany (11 percentage points).

Evolution of NGA subscriptions (in millions) in the EU, 2012-2017



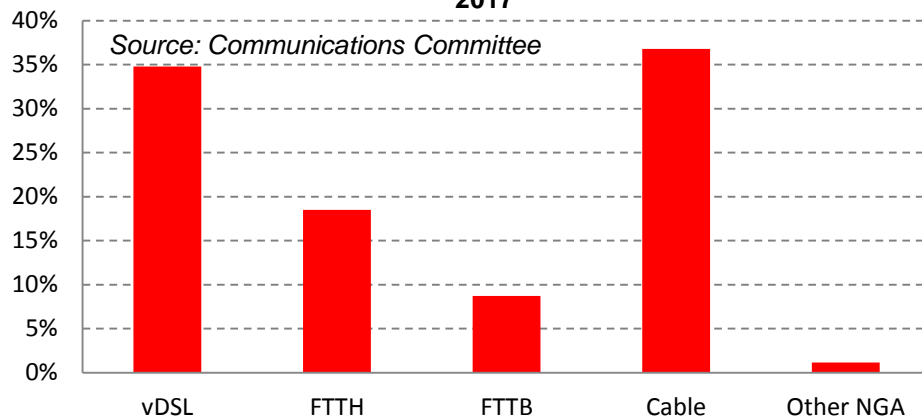
NGA (FTTH, FTTB, VDSL, Cable Docsis 3.0 and other NGA) subscriptions as a % of total fixed broadband subscriptions, July 2017



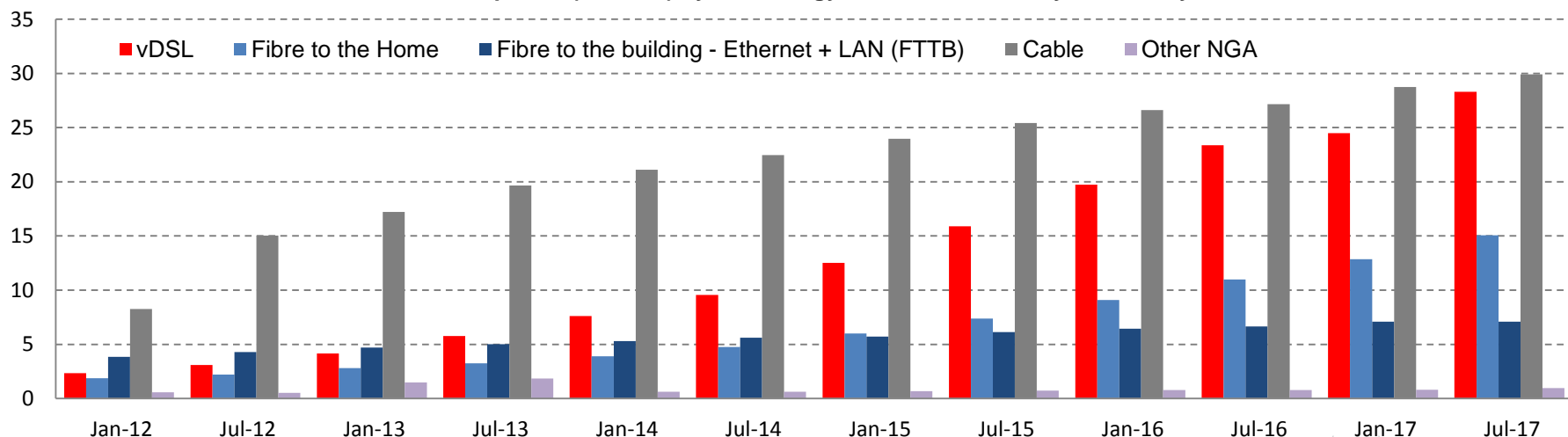
## Cable Docsis 3.0 is currently the most widespread NGA technology in the EU in terms of take-up. VDSL is catching up.

37 % of NGA subscriptions are Docsis 3.0, which is a relatively high figure given that cable broadband in total represents only 19 % of all EU fixed broadband subscriptions. While almost all cable networks have been upgraded to NGA, only 55 % of the xDSL network is VDSL-enabled. Nevertheless, in the last twelve months VDSL coverage went up by 11 % and the number of subscriptions by 21 %. FTTH and FTTB have a 19 % and 9 % share in total NGA subscriptions respectively.

Share of different NGA technologies in total NGA subscriptions, July 2017



NGA subscriptions (millions) by technology at EU level, January 2012 - July 2017



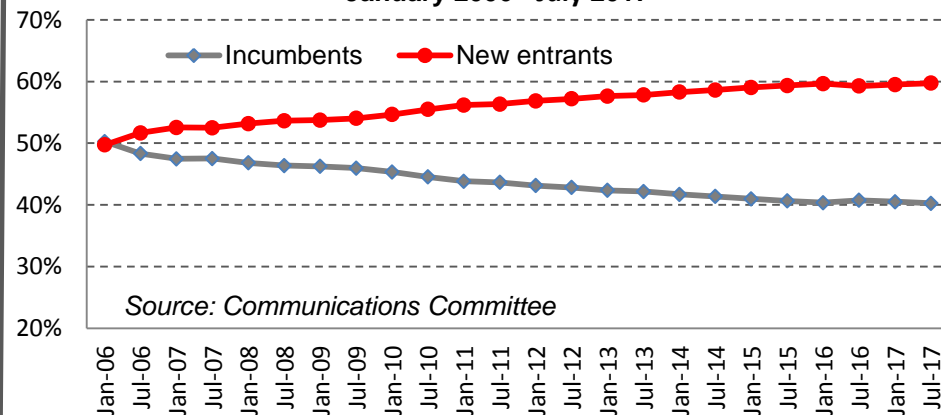
Source: Communications Committee

## Competition in the fixed broadband market: new entrant operators are continuously gaining market share, but incumbents still control 40 % of subscriptions.

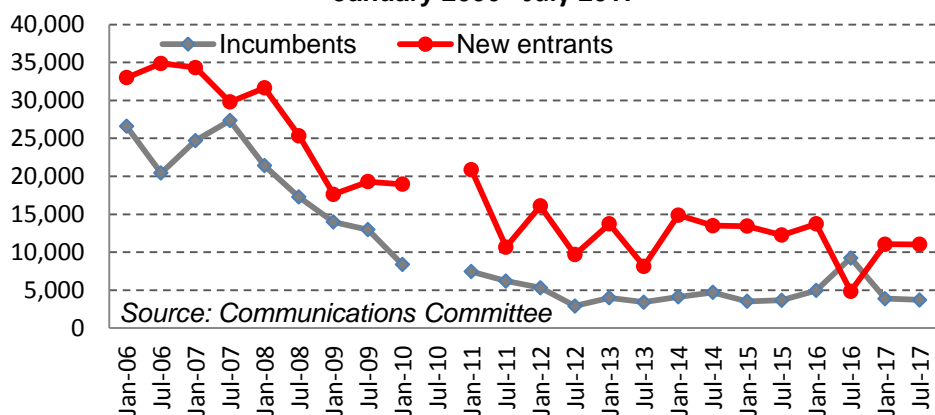
Incumbent operators are market leaders in almost all Member States, although their market share is gradually decreasing. During the last 10 years, new entrant operators have consistently posted higher net gains than the incumbents in each year. Overall, the market share of incumbents in the EU has decreased by 10 percentage points since 2006.\*

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

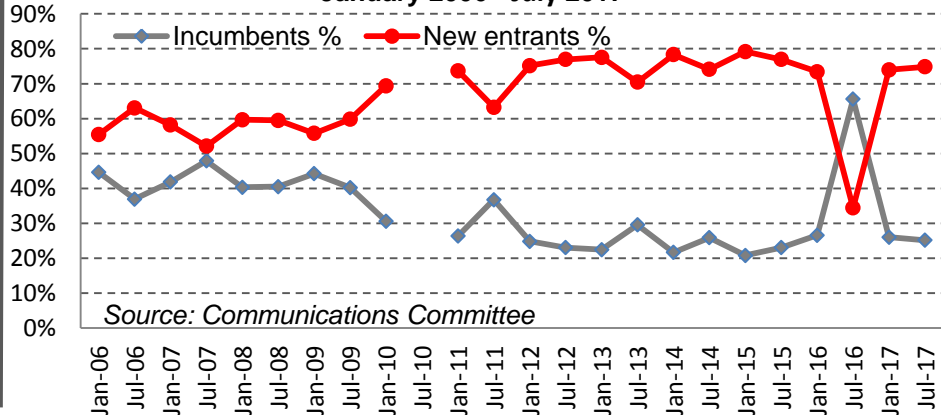
Fixed broadband subscriptions - operator market shares at EU level, January 2006 - July 2017



Fixed broadband subscriptions growth per day by operator at EU level, January 2006 - July 2017



Fixed broadband subscriptions growth - share of operators at EU level, January 2006 - July 2017

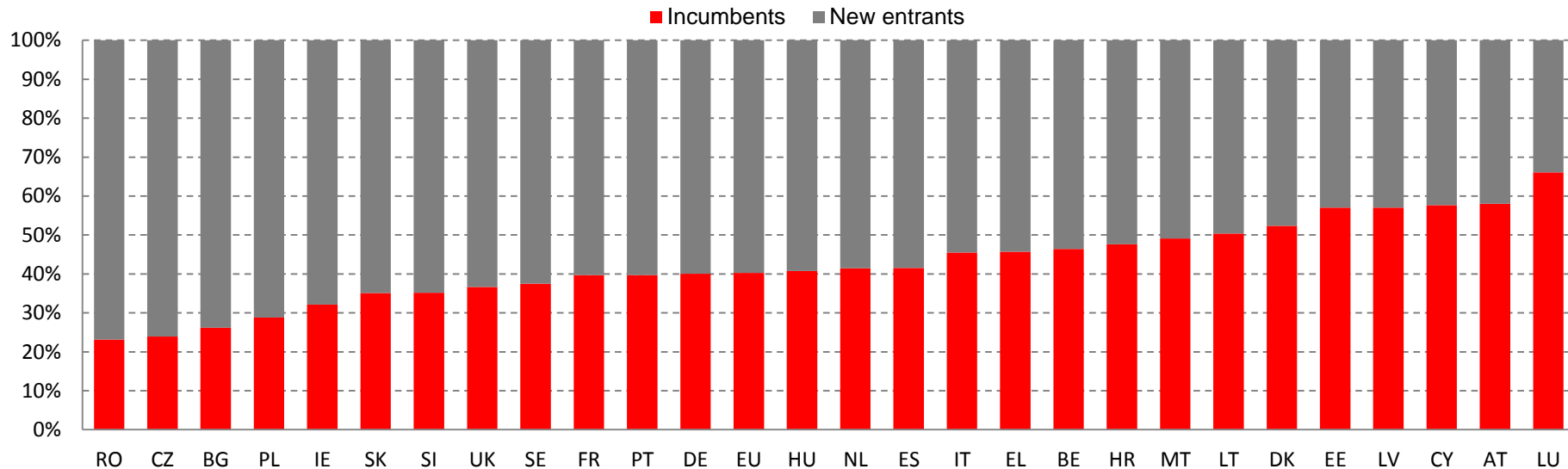


**Market shares of incumbents** show large differences across Europe. In 7 out of the 28 Member States, at least half of the subscriptions are provided by incumbent operators.

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 the incumbent operator in this case).

Incumbents have the highest subscription market share in Luxembourg, Austria and Cyprus. In contrast, incumbents are the weakest in Europe in Romania, the Czech Republic, Bulgaria and Poland. In all these four Member States most subscribers use technologies other than xDSL.

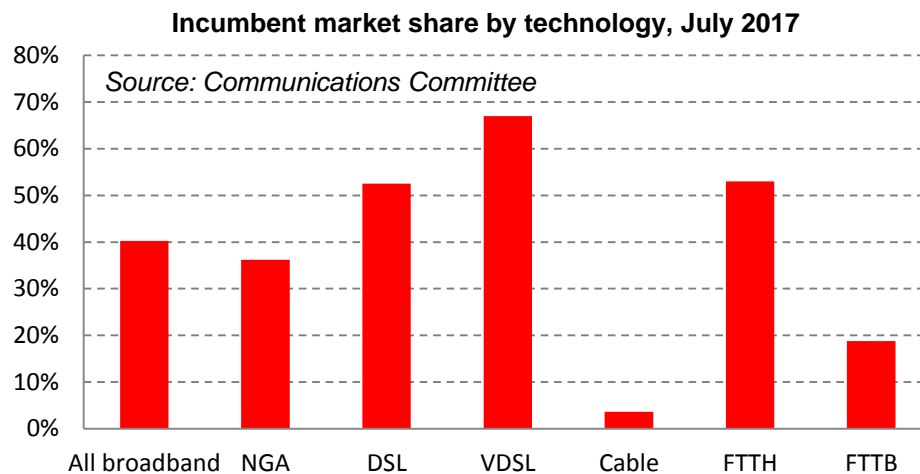
**Fixed broadband subscriptions - operator market shares, July 2017**



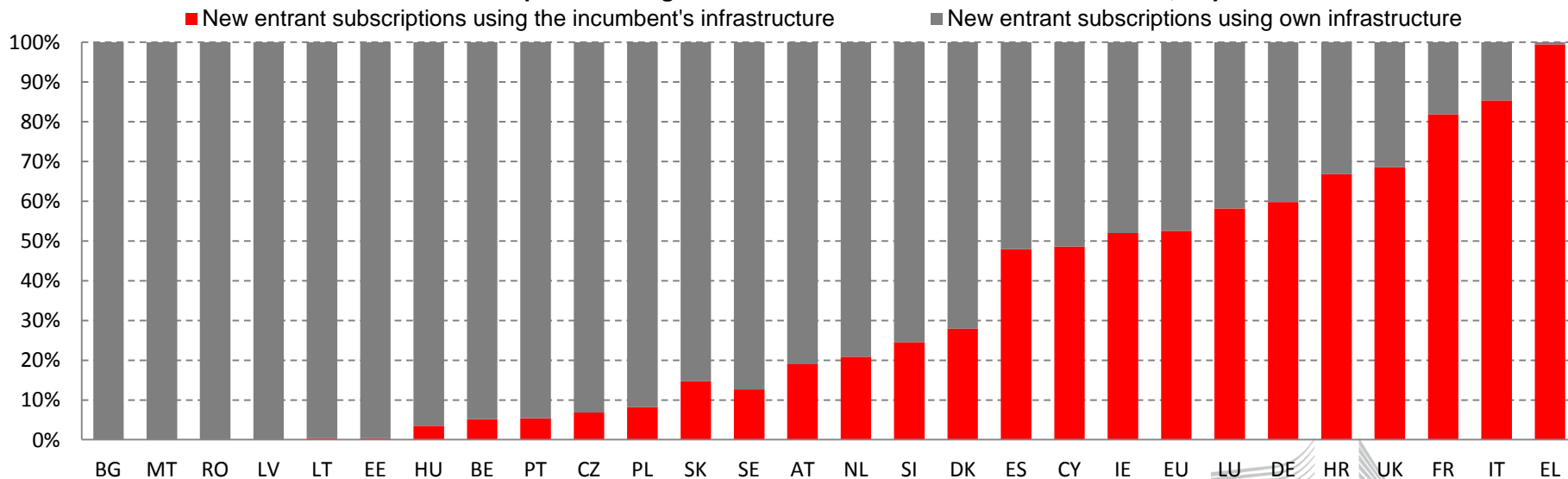
Source: Communications Committee

In the **DSL** market, unbundling reduced the dominance of incumbents, but for **VDSL** incumbents hold 67 % 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 incumbents access network, while in Italy and France over 80 % of subscriptions are DSL. In eastern European Member States, competition is based rather on competing infrastructures. This applies also to Belgium, Malta, Portugal and the Netherlands.



**New entrant subscriptions - using own infrastructure or the incumbent network, July 2017**

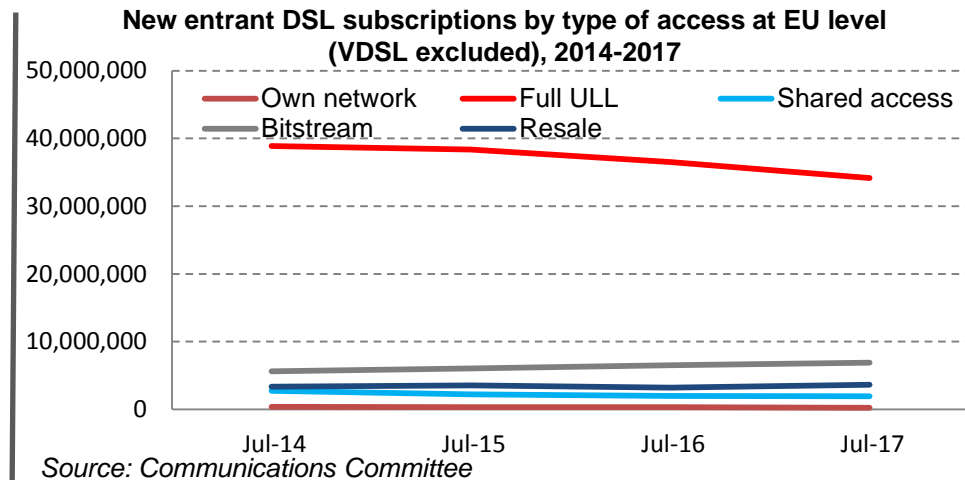


Source: Communications Committee

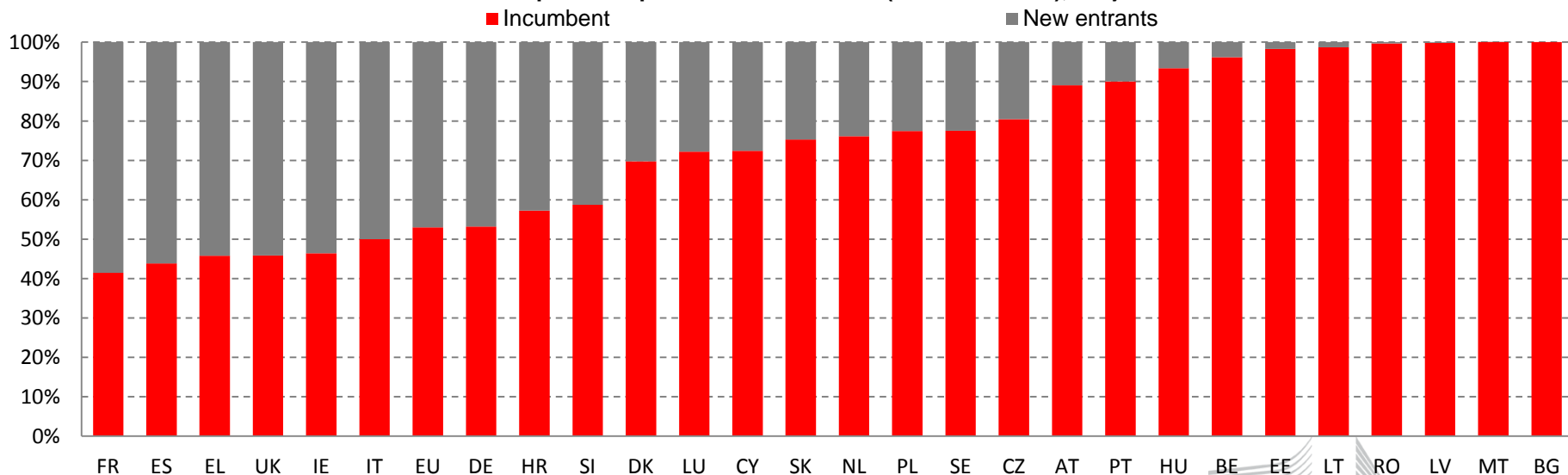


**53 % of DSL subscriptions are with incumbents. New entrants mainly use Local Loop Unbundling to sell DSL. In six Member States, the new entrants presence in the DSL market is marginal.**

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. In France, Greece, the UK, Spain and Ireland new entrants account for the majority of xDSL subscriptions. In all these Member States, competition is strong due to the possibility of entry via DSL subscriptions provided through Local Loop Unbundling.



**DSL subscriptions - operator market shares (VDSL included), July 2017**



**Average connection speeds for fixed broadband range from 7 Mbps to 23 Mbps in Europe. Sweden, Finland, Denmark and the Netherlands are among the top countries in Europe and worldwide.**

South Korea is the world leader in average internet connection speed at 28.6 Mbps, followed by Norway and Sweden at 23.5 and 22.5 Mbps respectively.

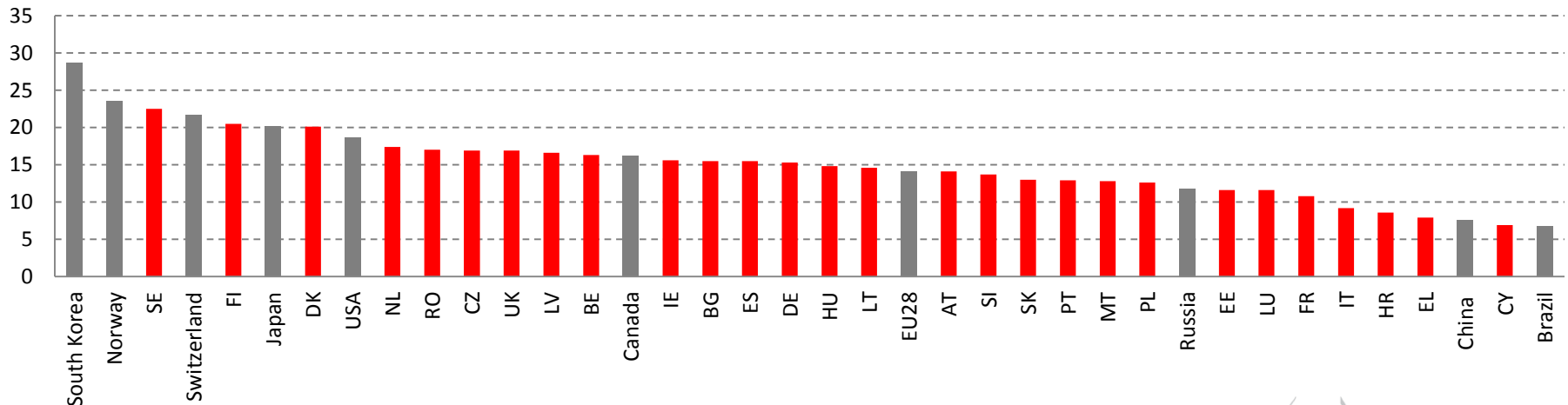
The EU has an average speed of 14.1 Mbps, well below the preceding leading countries, and also Japan (20.2 Mbps), Canada (16.2 Mbps) and the US (18.7 Mbps).

Last year, five Member States had higher speeds than the US. This year only three did.

Among the selected countries, Brazil has the lowest average speed at only 6.8 Mbps, below Cyprus (6.9 Mbps) and China (7.6 Mbps). At European level, the worst performing countries include Cyprus, Greece, Croatia and Italy 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).

The lower speeds in the EU can be explained by relatively low use and/or coverage of FTTH and cable technologies.

**Average connection speed (Mbps) by country, 2017**



Source: Akamai, Q1 -2017

**Average 4G (LTE) download speed** ranges from 20 Mbps to 42 Mbps in Europe. The Netherlands, Hungary, Bulgaria and Denmark are among the top countries in Europe and worldwide.

The Netherlands is among the world leaders in average LTE download speed at 42.1 Mbps, followed by Norway and South Korea at 41.2 and 40.4 Mbps respectively.

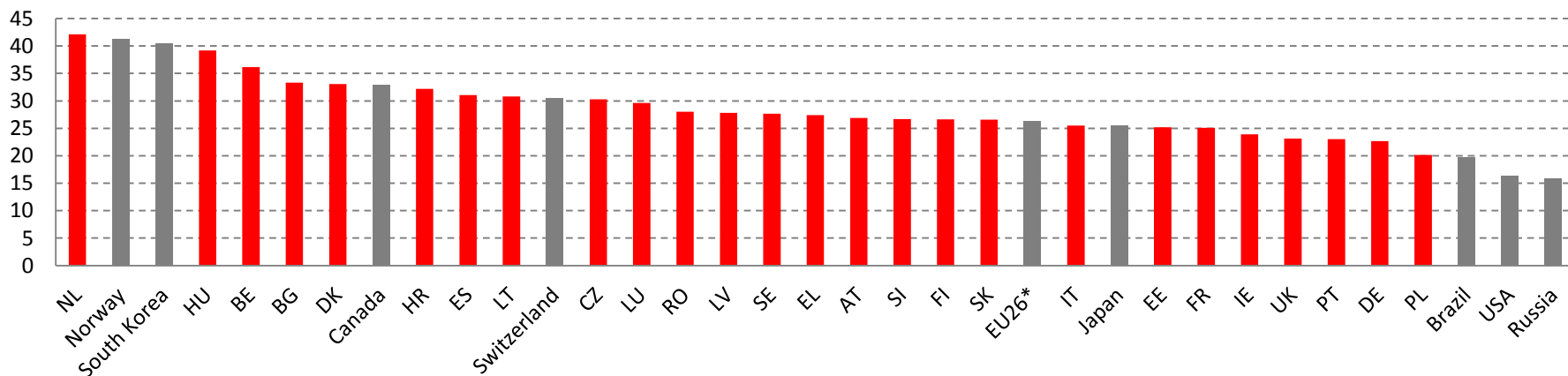
The EU26\* has an average download speed of 26.3 Mbps, which is above Japan (25.4 Mbps), Brazil (19.7 Mbps), the US (16.3 Mbps) and Russia (15.8 Mbps).

All Member States had higher LTE average download speeds than the US.

Among the selected countries, Russia is the country that shows the lowest average download speed at only 15.8 Mbps, below all Member States with reported data. When benchmarking only European countries, Poland, Germany, Portugal, the UK, Ireland, France, Estonia and Italy score below the EU average.

\* Note: No data available for Cyprus and Malta.

**Average LTE download speed (Mbps) by country\*, 2018**

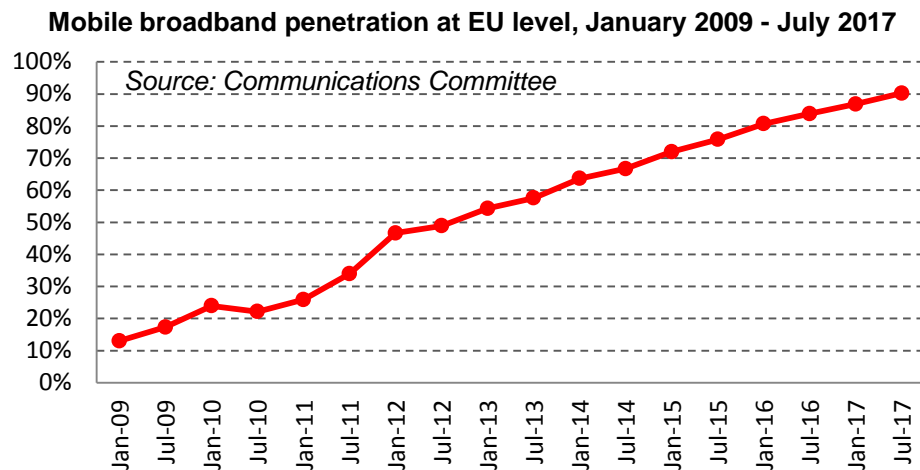


Source: Open Source, February 2018.

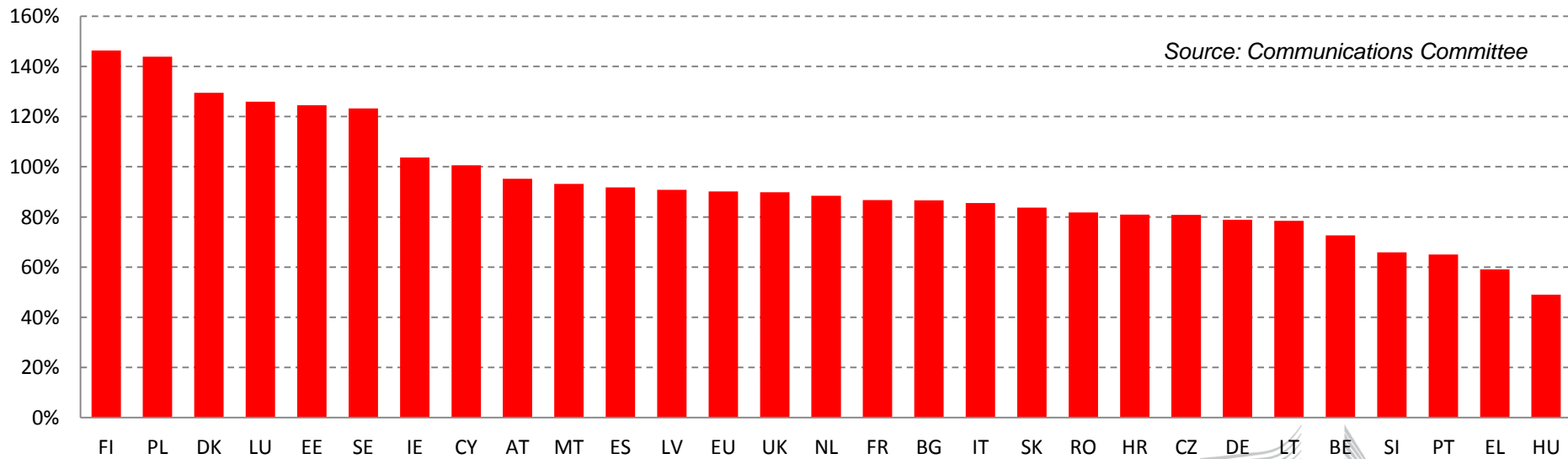
There are 90 active **mobile broadband** SIM cards per 100 people in the EU. The growth was linear over the last 5 years, with over 40 million new subscriptions added every year.

Mobile broadband represents a fast growing segment of the broadband market. About two thirds of all active mobile SIM cards use mobile broadband.

In the Nordic countries and Estonia, Luxembourg and Poland, there are already more than 120 subscriptions per 100 people, while in Hungary and Greece the take-up rate is less than half of that. Most mobile broadband subscriptions are used on smartphones rather than on tablets or notebooks.



**Mobile broadband penetration - all active users as a % of population, July 2017**



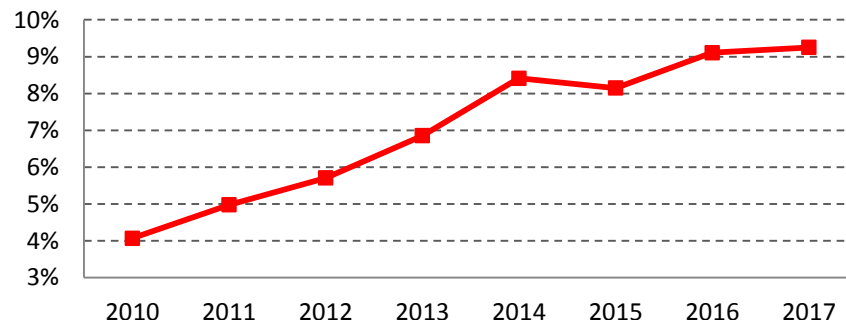
**Mobile broadband** is still mainly complementary to fixed broadband. In 2017, 9.3 % of EU homes accessed the internet only through mobile technologies. Finland and Italy were leaders in mobile internet access at 37% and 23 % of homes.

Europeans access the internet primarily using 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 9.3 % in 2017.

The Netherlands was the Member State with the lowest mobile-only access at less than 0.2 % of homes.

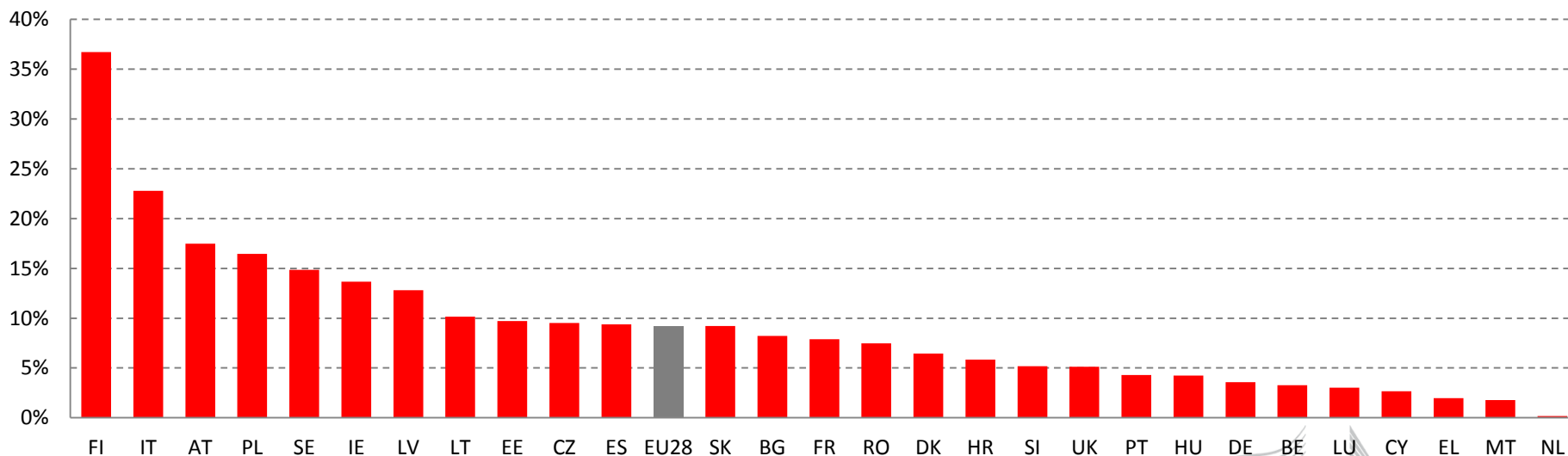
By contrast, in Finland, where fixed broadband take-up has been declining, 37 % of homes rely purely on mobile technologies at home.

Households using only mobile broadband connection at home at EU level (% of households), 2010 - 2017



Source: Eurostat

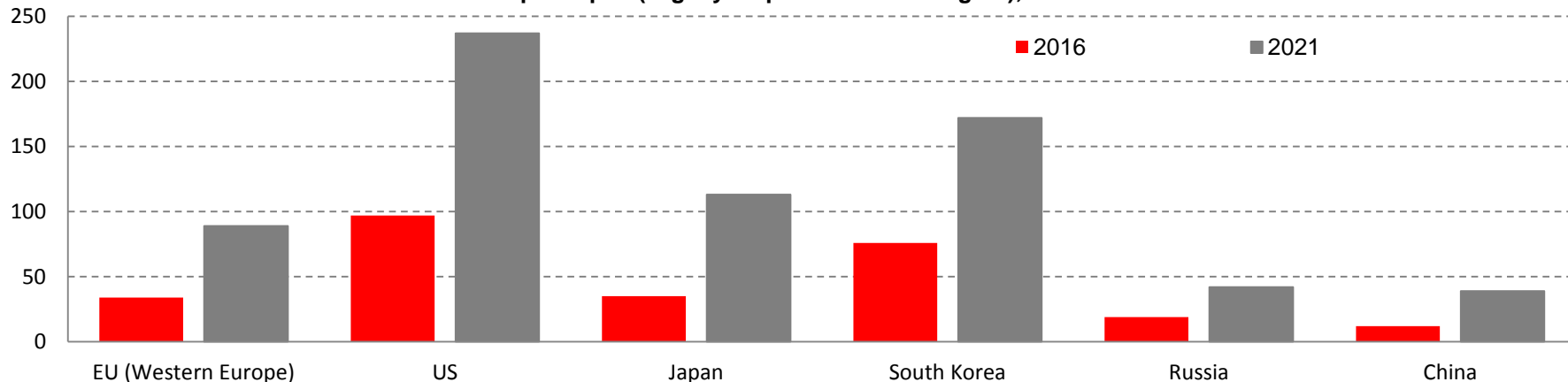
Households using only mobile broadband at home (% of households), 2017



Source: Eurostat

**Internet traffic** per capita in western Europe\* is currently 34 GB per month. By 2021, this figure is estimated to go up to 89 GB, while in the US it will be 237 GB.

IP traffic per capita (Gigabytes per month and region), 2016 - 2021

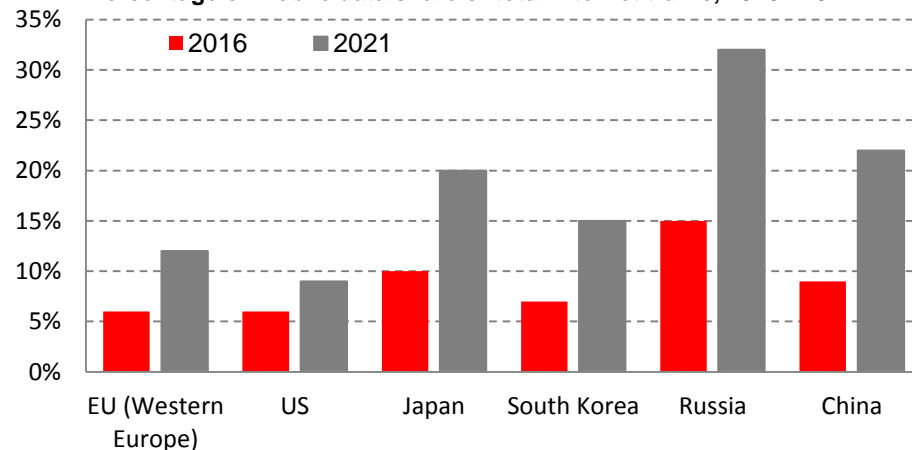


Source: Cisco, VNI Forecast Highlights

Internet traffic per capita in western Europe\* is well below the figures for the US and South Korea.

Mobile data traffic is a fraction of total IP traffic, and this will remain so despite the large increase forecast by Cisco. Mobile data currently represents 6% of European internet traffic, and this ratio is estimated to double by 2021. Nevertheless, the share of mobile traffic will be significantly higher in Japan (20%), China (22%) and Russia (32%). The US, on the other hand, will have only 9% of its internet traffic on mobile networks.

Percentage of mobile data share of total internet traffic, 2016 - 2021



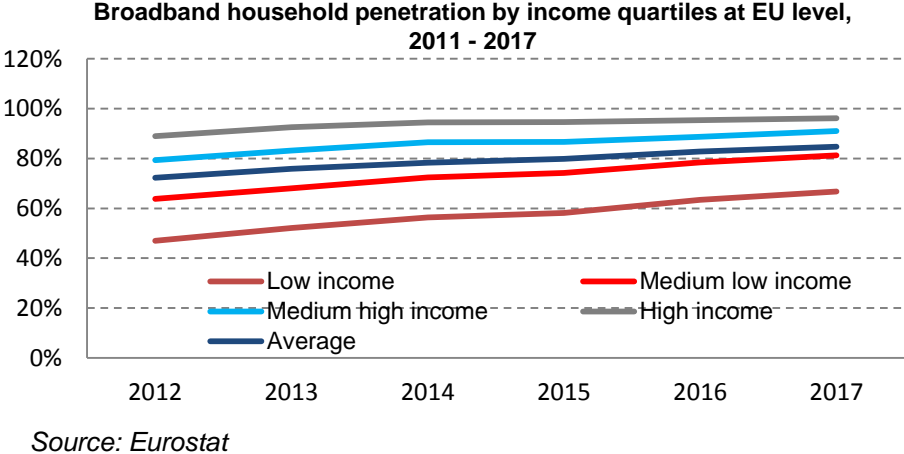
Source: Cisco, VNI Forecast Highlights

\* France, Germany, Italy, Spain, Sweden, the United Kingdom, Denmark, Netherlands, Belgium, Ireland, Norway and Iceland.

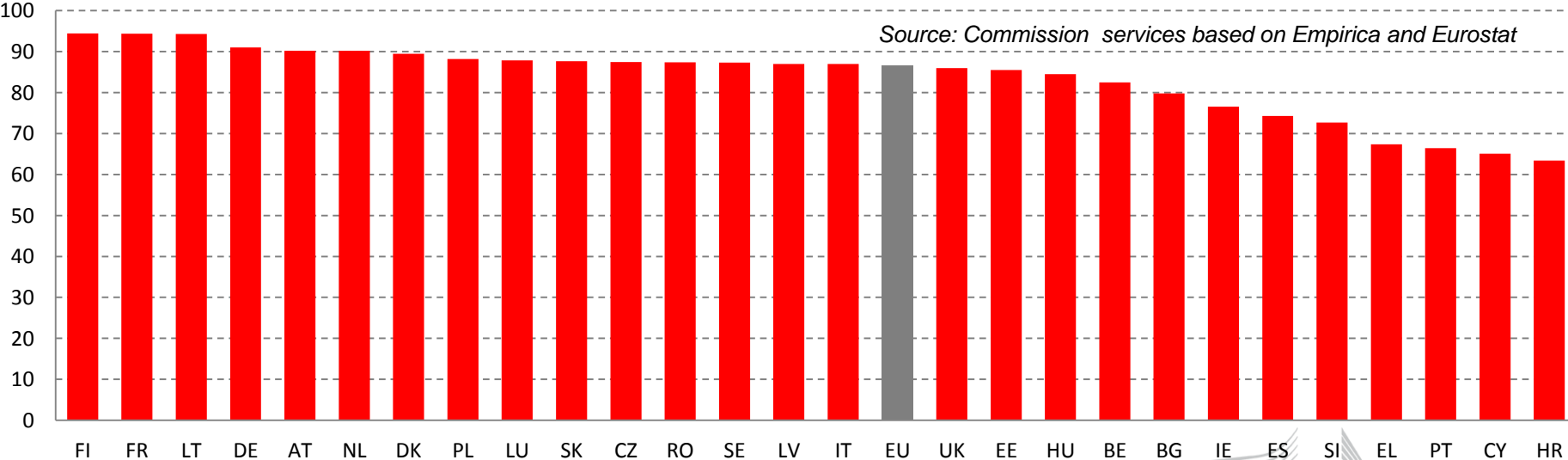
**Broadband take-up** tends to be lower in Member States where the cost of **broadband access** accounts for a higher share of income, but this correlation is not strong. Based on the **Broadband Price Index**, fixed broadband is most affordable in Finland, France and Lithuania.

Income plays an important role in broadband take-up. The lowest income quartile has a take-up rate for fixed broadband of just 67 % as opposed to 96 % in the highest income quartile.

The **Broadband Price Index** is a score\* that measures the prices of twelve representative broadband baskets as a percentage of household income. The baskets include three speed categories (12-30 Mbps, 30-100 Mbps and at least 100 Mbps) and four types of products (standalone internet, internet + TV, internet + fixed telephony and internet + TV + fixed telephony).  
 \* 0 to 100, 100 being the best



**Broadband Price Index, 2017**



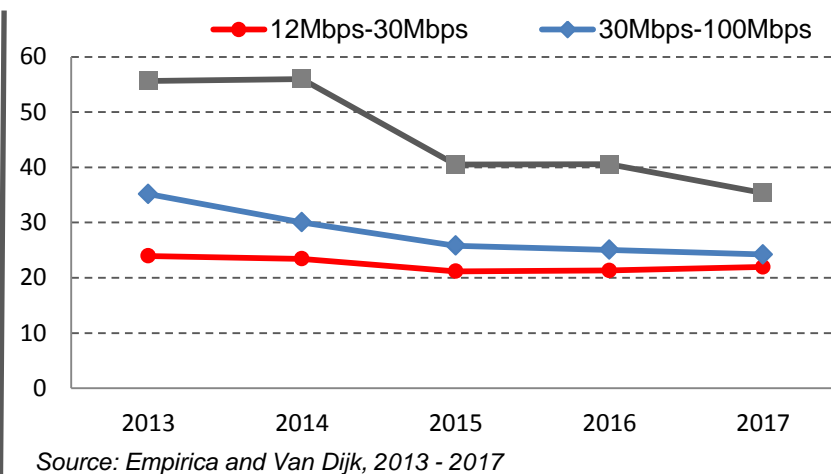
## Prices\* of fast broadband access tend to decrease over time but vary widely between Member States.

Broadband access prices (minimum prices, calculated on Purchasing Power Parity) vary between EUR 8 and EUR 43 for a standalone offers with a minimum download speed of 12 Mbps. The minimum prices were the lowest in Denmark (EUR 7.7), Lithuania (EUR 13) and Romania (EUR 13), while the highest were in Portugal (EUR 43), Ireland (EUR 36.2), Luxembourg (EUR 35), Spain (EUR 33), Slovenia (EUR 33) and Cyprus (EUR 32).

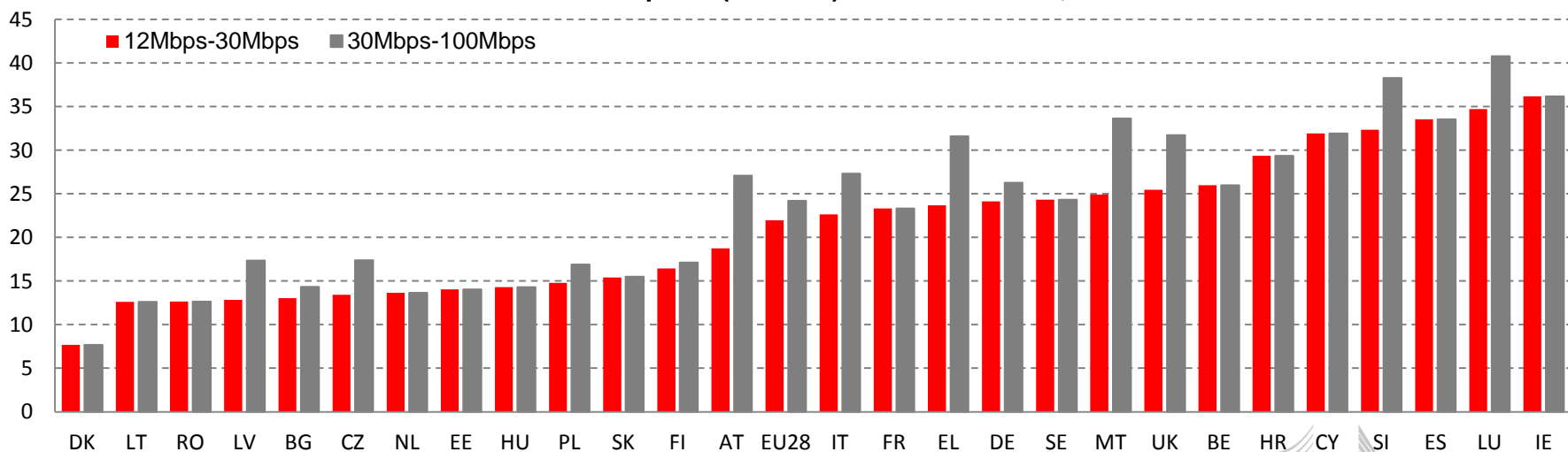
As for offers of at least 100 Mbps, the European average stands at EUR 35 with a substantial decrease from 2016.

\* Based on the least expensive monthly prices available and expressed in euros, adjusted for purchasing power parity, VAT included.

Broadband retail prices (EUR PPP) – Standalone offers, 2013 - 2017



Fixed broadband retail prices (EUR PPP) - Standalone offers, October 2017



Source: Empirica, Fixed Broadband Prices in Europe (2017)



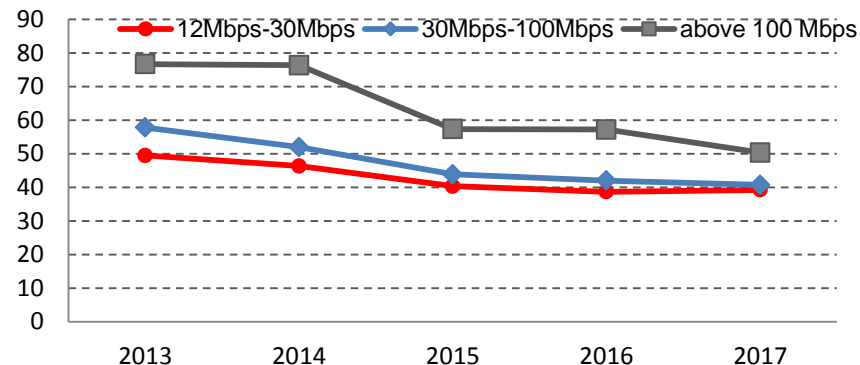
## Prices\* of triple play bundles\*\* including fast broadband access, fixed telephony and television have gone down by 27 % since 2013.

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 13 and EUR 61 in the EU. The lowest prices were recorded in Lithuania (EUR 13), France (EUR 23) and Bulgaria (EUR 28), while the highest were in Belgium (EUR 61), Spain (EUR 56), Ireland (EUR 55), Portugal (EUR 54), Malta (EUR 53) and Denmark (EUR 52).

The EU average prices of at 100 Mbps offers stands at EUR 50 with a decrease of EUR 7 from 2016.

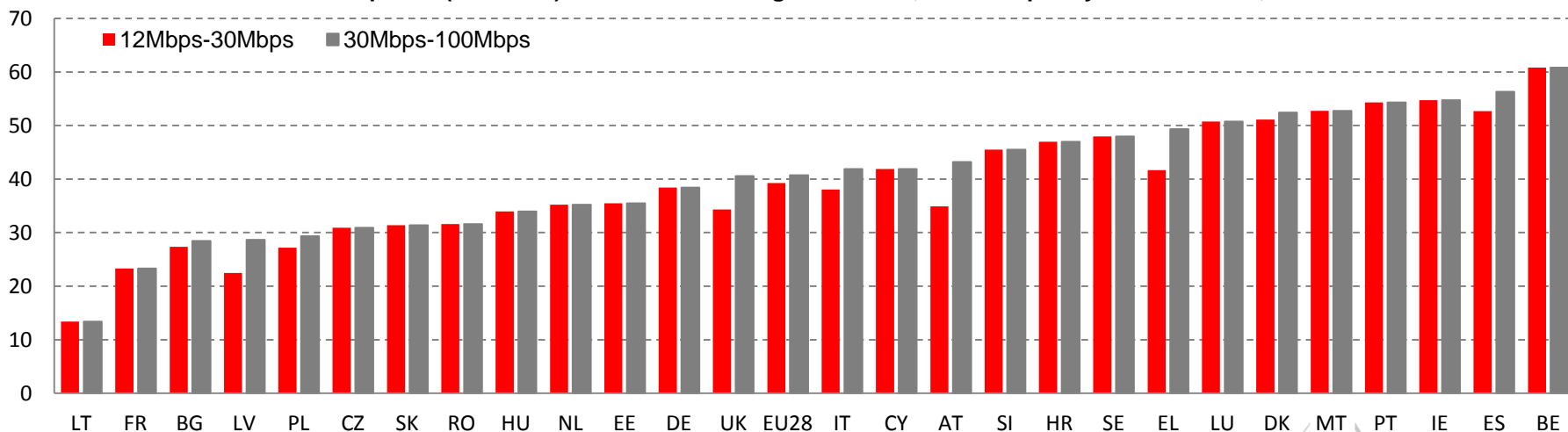
\*Based on the least expensive prices available and expressed in euros, adjusted for purchasing power parity, VAT included. \*\*No data available for Finland.

Broadband retail prices (EUR PPP) – Bundles including broadband, fixed telephony and television, 2013-2017



Source: Empirica and Van Dijk, 2013 to 2017

Broadband retail prices (EUR PPP) - Bundles including broadband, fixed telephony and television, October 2017



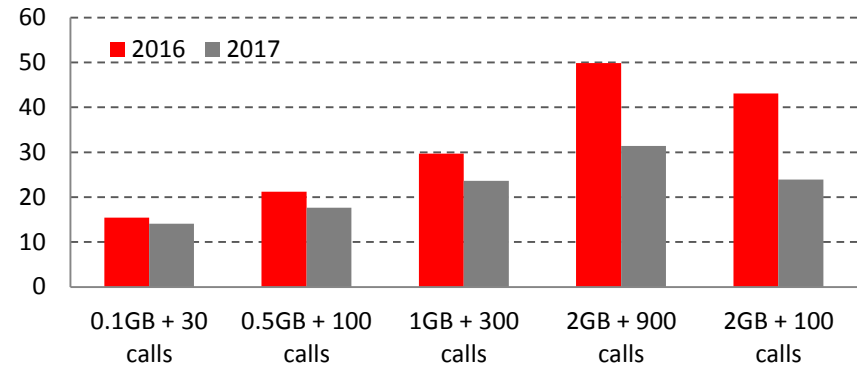
Source: Empirica, Fixed Broadband Prices in Europe (2017)

**Prices of mobile voice and data plans vary greatly across Europe. Prices went down in all consumption baskets, including 2 GB of mobile broadband and 900 voice calls or 100 voice calls went down by 37 % and 44 % respectively from 2016.**

Looking at the usage basket of 300 voice calls and 1GB data, minimum prices range between EUR 9 and EUR 62 with an EU average of EUR 24.

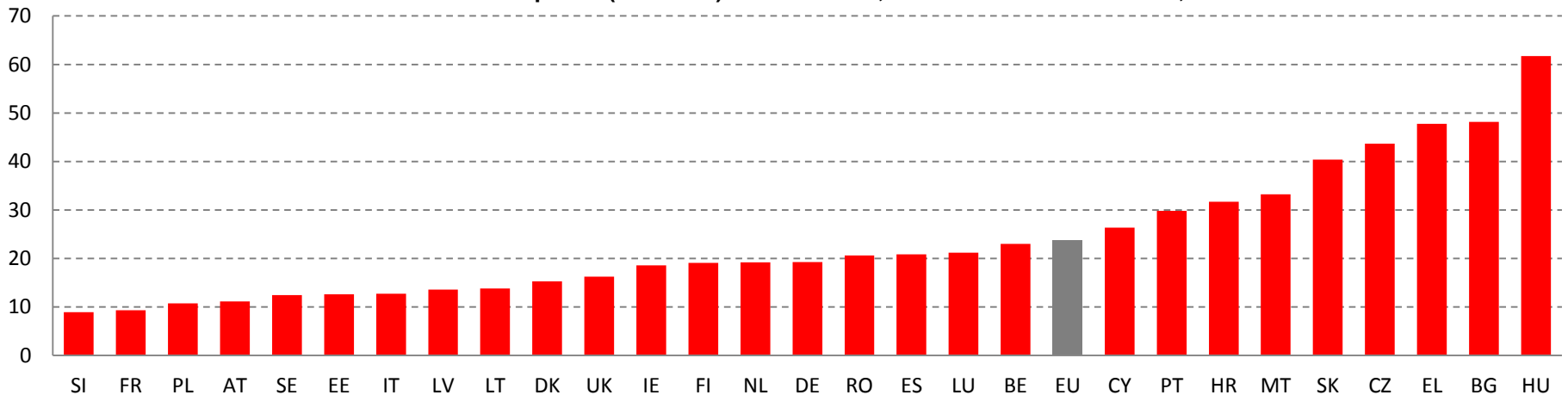
The cheapest countries are Slovenia, France, Poland, Austria, Sweden, Estonia and Italy with minimum prices below EUR 13. By contrast, prices are high in Hungary (EUR 62), Bulgaria (EUR 48) and Greece (EUR 48).

**Mobile broadband prices (EUR PPP) - handset use in the EU, 2016 - 2017**



Source: Van Dijk and Empirica, 2016 and 2017

**Mobile broadband prices (EUR PPP) - handset use, 1GB + 300 calls + 225 SMS, 2017**



Source: Empirica, Mobile Broadband Prices study, February 2017

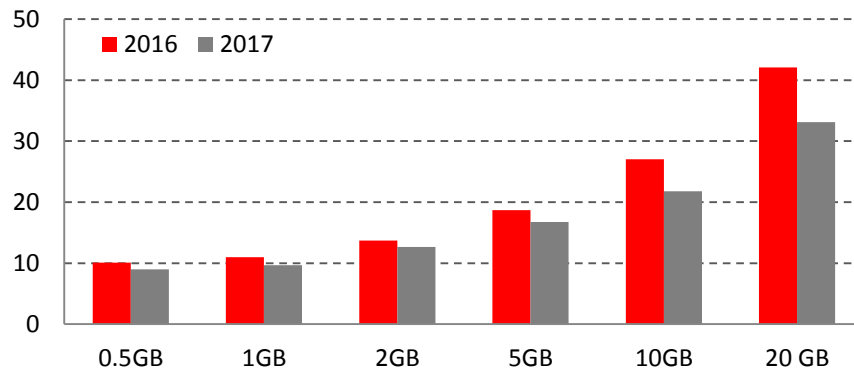
**Prices of mobile broadband** plans for laptops and tablets also show large differences across Europe. On average, prices have decreased for all types of consumption baskets since 2016, ranging between 8 % and 21 %.

Looking at 5GB data-only plans for laptops, minimum prices range between EUR 3.7 and EUR 42. The EU average (EUR 17) is below the price of fixed standalone offers of 12-30 Mbps.

The cheapest countries are Italy, Poland, Sweden, Latvia and Austria, with prices below EUR 10. At the same time, prices are very high in Cyprus (EUR 43).

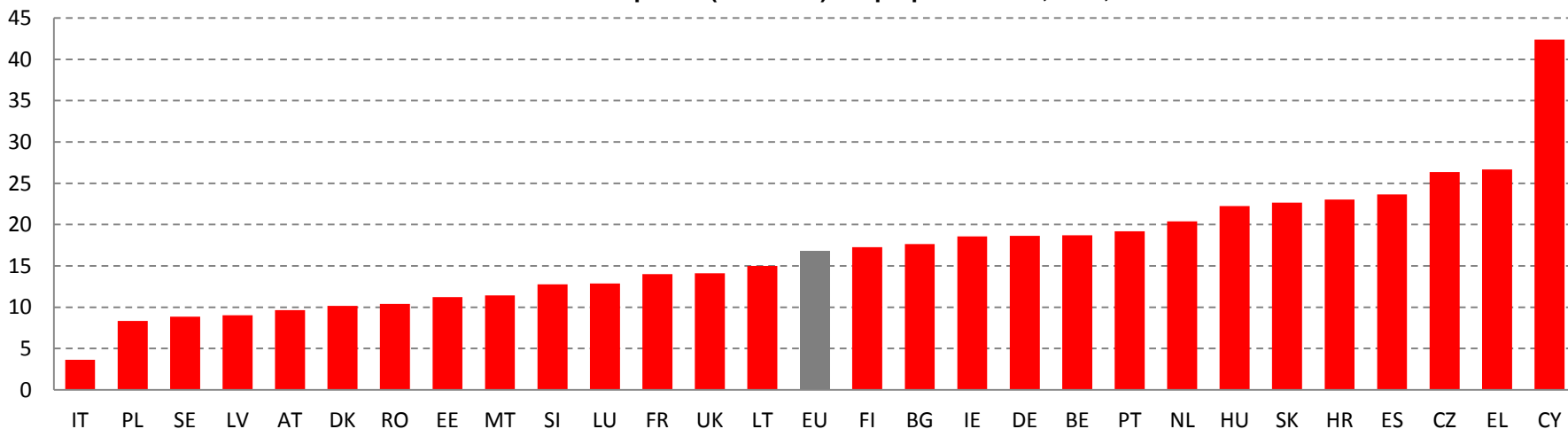
Laptop prices have decreased for all types of consumption baskets since 2016. The largest price drop is registered in the highest consumption basket (20 GB), with a 21 % decrease.

Mobile broadband prices (EUR PPP) – laptop use in the EU, 2016 - 2017



Source: Van Dijk and Empirica, 2016 and 2017

Mobile broadband prices (EUR PPP) – laptop/tablet use, 5GB, 2017



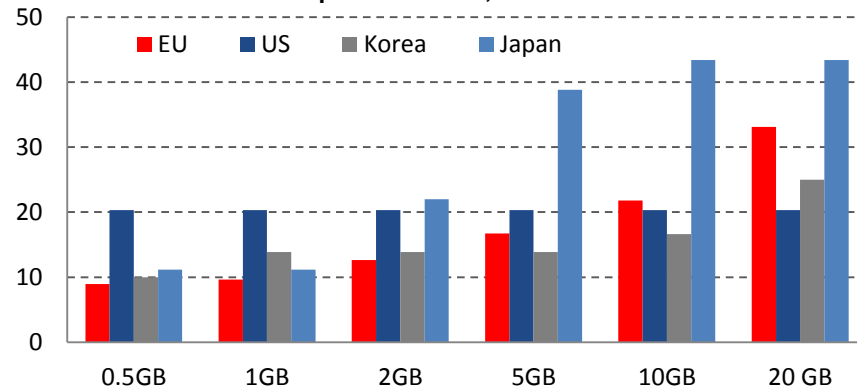
Source: Empirica, Mobile Broadband Prices study, February 2017

## Mobile prices in the world: in comparison with the US, the EU is cheaper for handset usage baskets, and more expensive for high-end data-only (laptop/tablets) packages.

In South Korea and the US, no offers adapted to the lower-usage baskets were found on the market, which is why those two countries might seem overpriced. The least expensive data-only offer in the United States allows up to 23 GB of data, but the maximum download speed is only 2 Mbps.

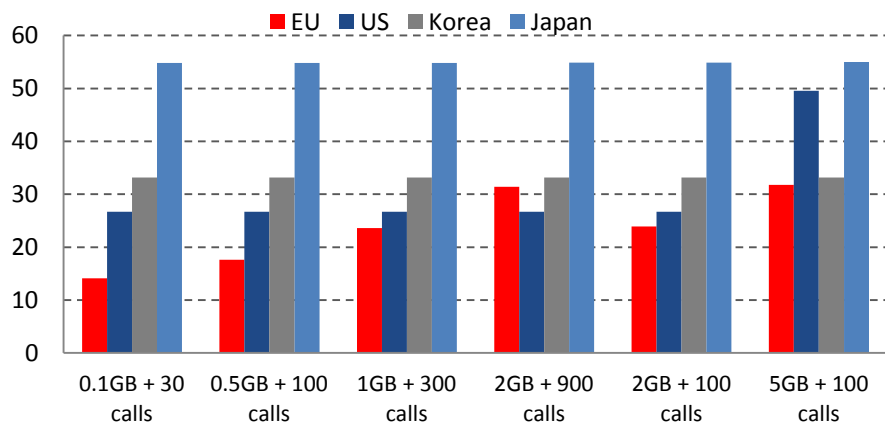
In the case of Japan, prices seem much higher for baskets with 5 GB, 10 GB and 20 GB than the other economies. On average, the EU performs well for lower baskets, but prices are higher than South Korea and the US for high-end baskets (especially 20 GB).

Mobile broadband prices (EUR PPP) - laptop/tablet use in the EU, the US, Japan and Korea, 2017



Source: Empirica, Mobile Broadband Prices study, 2017

Mobile broadband prices (EUR PPP) - handset use in the EU and the US, Japan and Korea, 2017



Source: Empirica, Mobile Broadband Prices study, 2017

Regarding handset use baskets, for those below 2 GB data usage, the US offers flat rates for calls and messages for EUR 26.7 in 2017. Additionally, offers in South Korea include 5 GB for all data consumption.

On average, the EU performs well in all data consumption basket, with much lower prices than South Korea and Japan. When comparing EU and US prices, prices are lower for all baskets, with the exception of the basket with 2 GB data and high intensity of voice calls (900 calls) where average EU prices are above US.

## Telecoms markets: **General trends**

Under the **connectivity objectives for the European gigabit society**, by 2025 all European households need to have access to at least 100 Mbps connectivity (upgradable to Gbps). In addition, gigabit connectivity should be available for all main socioeconomic drivers and all urban areas, while major terrestrial transport paths should have uninterrupted 5G coverage.

In many Member States the **deployment of fibre networks (FTTH/B)** has increased. This is inter alia due to the supporting regulatory measures (e.g. access to ducts), as well as co-investment agreements, commercial wholesale access agreements and mobile network sharing agreements. Very often, however, FTTB/FTTH is almost exclusively deployed in urban areas and in business parks. As regards take-up of very high speed networks (over 100 Mbps), there has often been a difficult early period in most areas where unfamiliar new access services are deployed, before demand picks up.

Most Member States have **national broadband plans** in place that focus (among other things) on reaching minimum download speeds. Some Member States have adjusted their plans to reflect the gigabit objectives.

Many Member States have either: (i) publicly consulted on **5G**-related challenges (e.g. conditions for 5G roll-out, new use cases, technologies and services, new bands) when setting up a national strategy; (ii) have already published a national plan or strategy; or (iii) at least entered such plan or strategy in their government programmes. A few Member States have earmarked investments to promote the development of 5G. Many operators have started or announced 5G trials.

**Effective and impartial governance** of telecoms markets is crucial in fast-changing markets. Still, in some Member States concerns have arisen about the national regulatory authority's independence and regulatory capacity. Both should be ensured and must not be undermined.

The trend towards offering **bundled services and fixed-mobile convergence** continues and in many Member States has even increased significantly. Offers consisting of two or three services are the most frequent bundles. Often it is difficult for new customers to obtain services as a single offer. Moreover, access to (premium) content has become a clear competitive advantage in many markets.

## More **EU-harmonised spectrum** underpins future spectrum needs within the EU, while assignment varies between national markets (1/2).

Following the adoption 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 amounts to 1 090 MHz.

Member States are required to authorise the 700 MHz band by 2020, unless there are justified reasons for delaying it until mid-2022 at the latest. The authorisation process has already been completed in three Member States (Finland, France and Germany).

All Member States but one have met the first milestone set out in the Decision, which is to finalise cross-border coordination with other Member States by 31 December 2017. This is a major success for roadmap-based migration across Europe, which is embedded in EU legislation with a binding end date for assignment.

\* A limited list of justified reasons is set out in the Annex to the Decision of the European Parliament and the Council on the use of the 470-790 MHz band in the Union.

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 Radio Spectrum Policy Programme (RSPP). Two Member States have not yet assigned and/or made available the 800 MHz band: while Malta resumed the assignment process after the withdrawal of a proposed merger between two of the three mobile operators, Bulgaria still invokes the exception under Article 1(3) RSPP due to incumbent military use.

Moreover, with a view to reaching the target of 1 200 MHz harmonised for wireless broadband set by the 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 additional 50 MHz\*\*.

\*\* The adoption of a harmonisation decision on the 1.5 GHz extension bands is ongoing at the time of writing. Once such Commission Implementing Decision will enter into force, the total amount of spectrum harmonised for wireless broadband will go up to 1140 MHz.

## More **EU-harmonised spectrum** underpins future spectrum needs within the EU, while assignment varies between national markets (2/2).

A slight increase, in absolute terms, in the amount of EU-harmonised spectrum assigned on average across Member States for wireless broadband use can be reported since 2016. As far as the assignment of the 700 MHz band is concerned, most of the Member States are taking the necessary measures to meet the 2020 deadline.

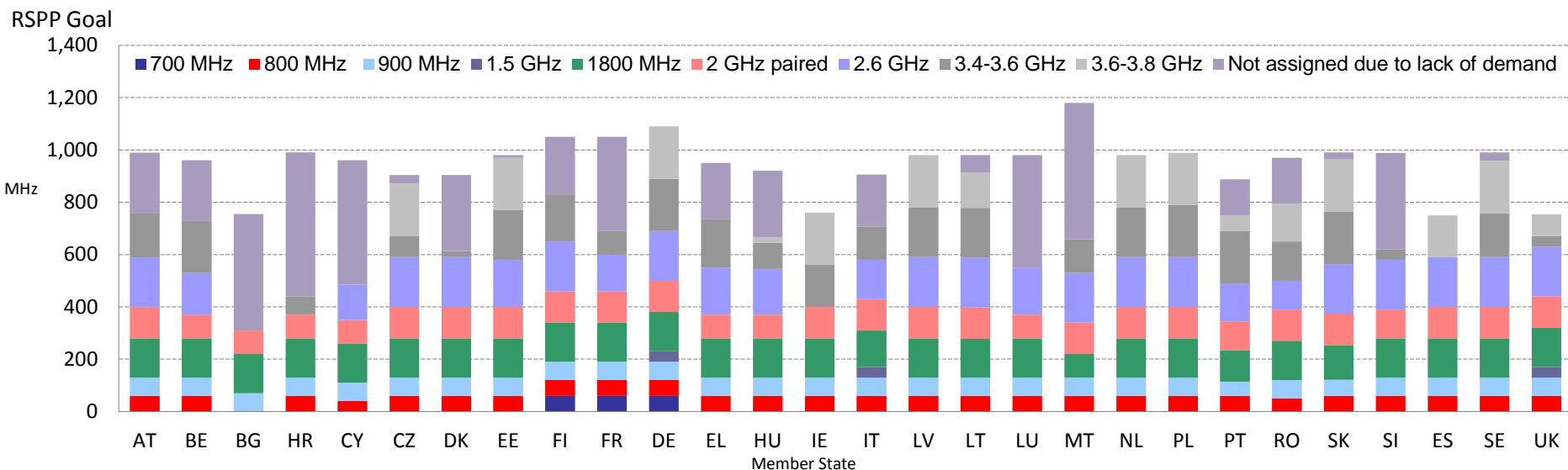
Bands above 1 GHz have the potential for additional capacity. While these remained partly unassigned in many Member States, they will play an even larger role in the deployment of 5G services.

Lack of assignment may be due to different reasons depending on the circumstances in each Member State. These include: delays in making the spectrum available and in the carrying out of assignment procedures, lack of market interest and use for defence purposes.

However, several Member States are currently preparing to assign the 3.6 GHz band. This is particularly important, as the 3.6 GHz band was identified at EU level as one of what are called the 5G pioneer bands.

In this context, and in view of the possible derogations and exceptions applicable to different bands, lack of assignment does not necessarily mean non-compliance with EU law.

**Assigned spectrum in harmonised EU bands, end of February 2018**



Note: Assigned spectrum include guard bands

## The Commission has sent warnings to several Member States **not carrying out the analysis of the relevant telecom markets on time.**

National regulatory authorities must carry out an analysis of telecom markets susceptible to regulation every 3 years (Article 16(6)(a) of the Framework Directive).

As markets evolve and competition develops, regulatory remedies imposed in the past need to be adjusted or even removed to adapt to the developing market conditions.

In the European Electronic Communications Code, the Commission has proposed to extend the market review cycle to 5 years (instead of 3) to achieve a better balance between adequacy and appropriateness of regulation — on the one hand — and the legal certainty and stability of regulation — on the other.

In October 2017, the Commission sent letters of formal notice to seven Member States where the delays were even over 5 years: the countries concerned were Belgium, Spain, Ireland, Hungary, Slovenia, Poland and Romania\*.

The markets in question include not only key broadband markets as listed in the 2014 Recommendation on relevant markets for the purpose of ex ante regulation in the electronic communications sector but also 'older' markets removed from the list and which are still regulated in some Member States on the basis of very outdated market analyses.

\* Spain and Slovenia have notified the corresponding market reviews in early 2018.



# State of play of relevant markets reviews notified under **Article 7 cases** as of 1 January 2018

	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	5	5	4	4	4	3	2	4	3	4	1	2	1	3
Belgium	2	3	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			
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	4	4	3	4	4	2	2	2	1	2	1	1	1	2
Denmark	4	4	4	4	4	3	3	2	2	1	1	2	1	1	1	1
Estonia	3	4	4	4	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	5	5	5	5	3	5	5	1	1	1	1	2	1	2	W	4
Germany	5	5	3	3	2	3	3	2	1	2	1	2	2	1	1	3
Greece	3	4	4	4	2	3	2	3	1	3	1	2	3	2	1	1
Hungary	3	5	4	4	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	2	3	4	3	4	3	3	2	1	1	1
Lithuania	4	3	3	3	2	1	3	3	2	3	2	1	2	2	1	6
Luxemburg	3	4	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	5	5	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	3
Portugal	2	2	3	3	3	2	2	2	2	2	2	1	1	3		2
Romania	3	3	2	1	1	2	2	1	1	1	1		2			2
Slovakia	4	4	3	3	3	4	4	2	2	2	2	2	2	1	1	2
Slovenia	2	5	4	4	2	3	3	2	1	1	1	2	3	1	3	3
Spain	3	4	3	3	3	4	3	2	2	2	2	2	2	4	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	5	4	2	2	2	2	4	2	4	1	2

Source: Commission services

## Development of national broadband plans

Most Member States have gradually adopted national broadband plans (NBPs) 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 by at least 50 % of European households. The plans are devised to integrate all relevant aspects of an effective broadband policy and resources, enabling policy makers and public authorities to properly plan any necessary public action in the telecommunications sector.

A large majority of Member States have started implementing their NBPs, albeit covering various time periods ranging from 2017 to 2022. Some NBPs are integrated within broader strategic approaches, while others are documents specifically dedicated to broadband deployment. In some countries, there are multiple official documents drafted by different national authorities, specifying aspects related to such broadband developments.

In accordance with the connectivity objectives for the gigabit society, by 2025 all European households, whether rural or urban, need to have access to internet connectivity offering a downlink of at least 100 Mbps (upgradable to Gbps). Only very few NBPs have so far been adjusted to reflect those objectives.

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. in Denmark, Luxembourg 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 NBPs. These include the Czech Republic ('Digital Czech Republic'), France ('National Programme for Very High Speed Broadband') and Slovakia ('National Strategy for Broadband Access in the Slovak Republic')\*.

Some Member States (e.g. Sweden, the UK, France, Spain, Germany and Austria) have already started to adapt the targets of their NBPs 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"](#).

\* OECD countries which ran public consultation procedures before drafting their NBPs are: Canada ('Improving Canada's Digital Advantage'), Ireland ('Next Generation Broadband'), Japan ('Path of light'), and the US ('Connecting America: The National Broadband Plan').

## Broadband targets in national broadband plans

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

- 11 Member States have set more ambitious objectives in their NBPs than the DAE-2020 targets (Austria, Belgium, Bulgaria, Denmark, Estonia, Finland, Germany, Hungary, Luxembourg, Slovenia and Sweden);
- 14 Member States' NBP objectives 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 have partly less ambitious objectives in their NBPs than the DAE-2020 targets (France, Romania and the UK) as regards at least one parameter (e.g. speed, end date).

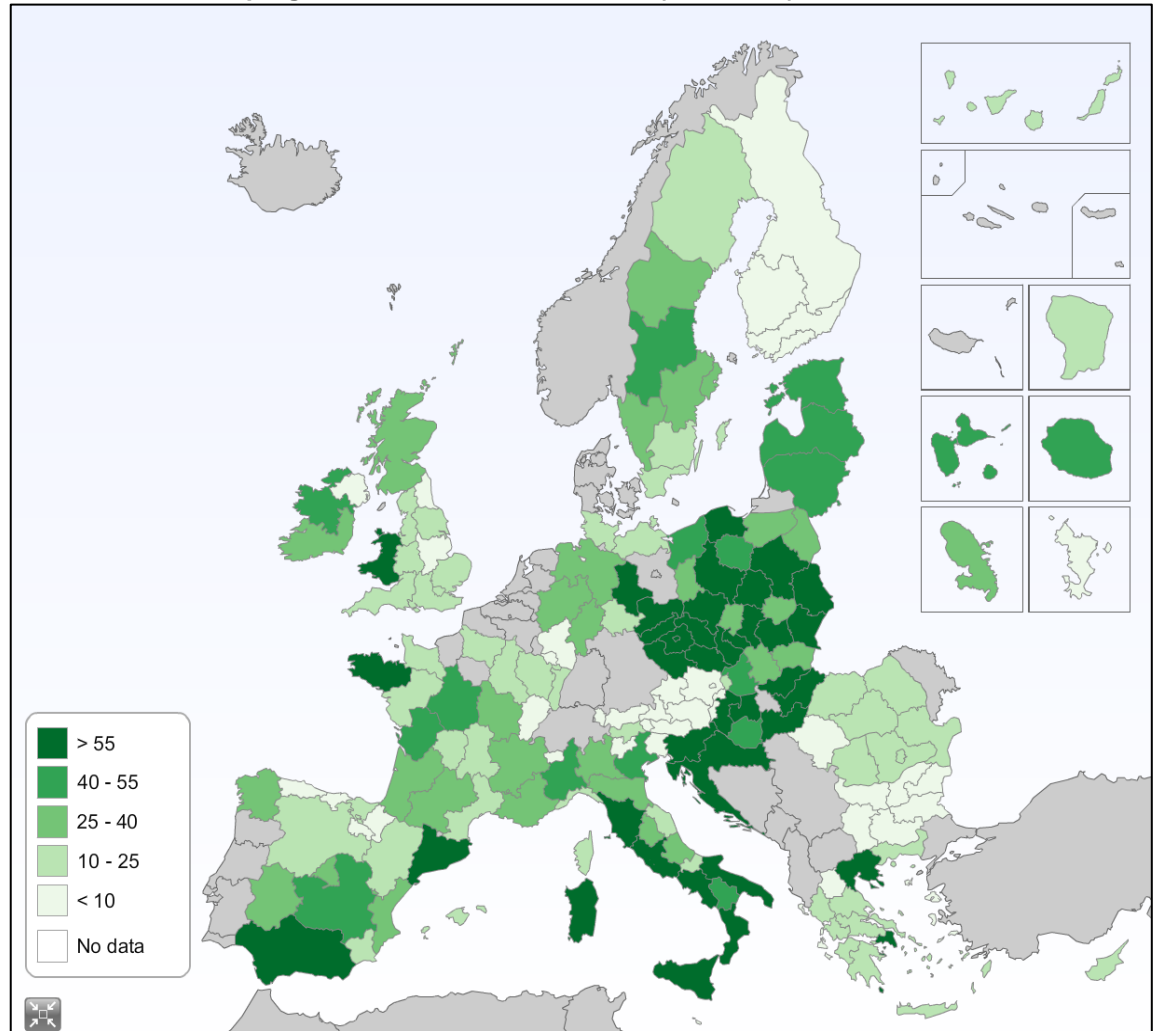
Declared broadband targets in NBPs are, first and foremost, intended as a guide. Their practical feasibility and actual success will depend on the use of appropriate means including legal measures and financial resources. Therefore, it is important that Member States have the necessary resources and tools in place, rather than merely policy targets, to facilitate the actual roll-out of broadband infrastructure on their territories.

To facilitate the exchange of best practice between Member States on adapting their NBPs to the gigabit targets for 2025, in 2017 the Commission set up a Communications Committee working group on 5G. The working group should also identify common elements and best practices which can potentially become part of the revised NBPs.

## Funding national broadband plans

In a number of cases, Member States decided to make extensive use of the European Investment and Structural Funds (ESIFs) for a total programmed amount of over EUR 6 billion by 2020. Member States' use focused particularly on the European Regional Development Fund (Poland and Italy more than EUR 1 billion) and the European Agricultural Fund for Rural Development (Italy EUR 273 million, Germany EUR 223 million and Sweden EUR 157 million). The roll-out of broadband projects remains challenging in many Member States and in specific regions, partly due to the lack of appropriate administrative capacity (e.g. for state aid notification, technological choices and business models). The Commission is working closely with Member States that envisage reallocating substantial parts of their initial programming from broadband measures to other sectors. To prevent reprogramming of this kind, in particular in rural areas, and to help improve technical assistance, the Commission has asked Member States to set up technically competent broadband competence offices and has put in place a broadband rural action plan. In addition, financial instruments including the ESIFs and the forthcoming Connecting Europe Broadband Fund are intended to maximise the leverage of public funding dedicated to the roll-out of the next generation of broadband networks.

ERDF and EAFRD programmed funds on broadband (2014-2020) — total EUR 6 071 million



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

## 5G Observatory - progress towards 5G market introduction

### 5G trials

- More than **80 pre-commercial 5G trials and pilots** launched in Europe as part of the industry's [5G trial roadmap](#)
- **Seventeen Trial Cities appointed**: Amsterdam, Barcelona, Bari, Berlin, Espoo, L'Aquila, London, Madrid, Malaga, Matera, Milan, Oulu, Patras, Prato, Stockholm, Tallinn and Turin
- **Five "digital cross-border corridors"** established inter alia accommodating live tests of 5G for [Cooperative Connected and Automated Mobility](#)

### 5G Spectrum plans

- **5G pioneer bands identified** in Europe (700 MHz, 3.6 GHz and 26 GHz)
- [Common roadmap](#) for the availability of spectrum adopted by Member States
- **Consultations on spectrum assignments** launched by a first set of Member States (e.g. Austria, Denmark, Italy, Germany, France, Finland, Portugal, Sweden, UK)

Three Member States have published national 5G roadmaps (Germany, Sweden, and the UK) and 3 have launched a public consultation (France, Poland, Spain):

- National calendars for key milestones set by the government,
- Measures to stimulate investments in 5G infrastructures such as: reducing the cost of deploying small cells; wide-ranging support to 5G trials,
- Promoting partnerships between the telecom sector and vertical industries,
- Foster public services as a lead user for early 5G deployment.

More information is available on the [European 5G Observatory](#), which has been set up by the Commission to provide qualitative and quantitative information on

- Actual and expected market developments,
- Initiatives and preparatory actions taken by private and public actors in the area of 5G.

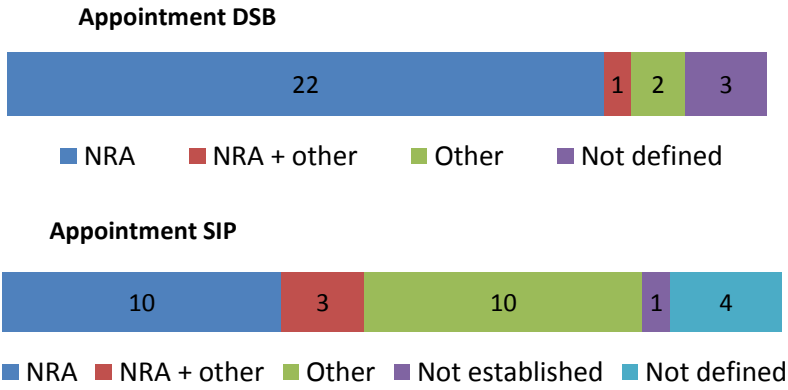
# Member States' implementation of the **Broadband Cost Reduction Directive** (Directive 2014/61/EU) (1/2).

Directive 2014/61/EU (**the Broadband Cost Reduction Directive**) aims to facilitate and incentivise the roll-out of high-speed electronic communications networks by: (i) promoting the joint use of existing physical infrastructure; and (ii) enabling synergies across sectors for a more efficient deployment of new physical infrastructure. The overall aim is for high-speed networks to be rolled out at a lower cost. Member States had until 1 January 2016 to transpose the Directive into national law. After significant time lags, most Member States have achieved this. The case against Belgium is still pending before the Court of Justice.

The fact that most Member States were late in transposing the Directive and have only recently achieved its full implementation means that transposition measures are only slowly starting to produce results. More tangible results can nevertheless be seen in those countries that had pre-existing legislation in place and that partially went well beyond certain requirements of the Directive (such as on mapping and in-house equipment).

The Directive also requires Member States to appoint one or more independent dispute settlement bodies ('DSBs') and one or more bodies to act as single information point ('SIP').

## Tasks laid down in the Broadband Cost Reduction Directive appointed to NRAs in the EU



Source: Body of European Regulators for Electronic Communications (BEREC)



## Member States' implementation of the **Broadband Cost Reduction Directive** (Directive 2014/61/EU) (2/2).

The tasks of the **dispute settlement body** were allocated to the national regulatory authority or partially to the NRA in most of the Member States and to other organisations only in two Member States.

In several countries, the NRA already had tasks to fulfil as DSB before the entry into force of the Broadband Cost Reduction Directive. An increase in the number of disputes can be observed since the application of the Directive. The most important challenges the NRAs have faced as DSB so far relate to: (i) setting the price for access to existing physical infrastructure; (ii) the appropriation of costs for coordination of civil works and: (iii) (un)justified refusal of access to existing physical infrastructure.

In several Member States, NRAs have also started developing rules or guidelines on dispute settlement (e.g. the process the NRA is likely to follow in resolving disputes). These may enhance legal certainty and overcome the general reluctance of the stakeholders involved.

The tasks of the single information point were allocated to the NRA (or partially to the NRA) in 14 Member States. In 10 Member States other organisations are in charge of performing this function: in most cases this is a ministry.

The Directive provides for the possibility to require all public-sector bodies to make minimum information they are holding on existing physical infrastructure available via the SIP. Several Member States have imposed such an obligation on public-sector bodies and some Member States have also obliged other organisations, for instance network operators, to make available information via the SIP.

The main challenges NRAs were faced with as SIP relate to collecting the data and the information which has to be provided, and on how to incentivise those who have to provide information to meet this obligation.

Long delays in permit granting, in particular for mobile network roll-out, also still pose a challenge in many Member States.



## Widespread use of **roam like at home** across Member States since 15 June 2017 (1/2).

Since 15 June 2017, mobile operators in the EU/EEA are not allowed to levy any roaming surcharges for any fair usage of roaming services by their customers ('roam like at home', RLAH), except in a few cases duly authorised by national regulators to avoid any increase in domestic prices (see below on sustainability derogations).

We observe broadly successful implementation of the new roaming rules, overall consumer satisfaction and a considerable rise in travellers' roaming data consumption, as well as substantial increases in roaming voice calls since 15 June 2017. According to the last BEREC International Roaming Benchmark Report, despite the introduction of RLAH, the average retail revenue per user slightly increased in most Member States in Q3 2017 (first RLAH quarter) compared to Q2 2017.

NRAs have the responsibility to monitor and enforce EU roaming rules in the Member States. It is therefore necessary that all Member States have equipped them with the appropriate powers to penalise non-compliance with the rules.

According to the last BEREC International Roaming Benchmark Report, more than 95 % of EU/EEA subscribers are roaming-enabled. Almost 90 % of them benefit from RLAH. Less than 9 % are on an alternative roaming tariffs.

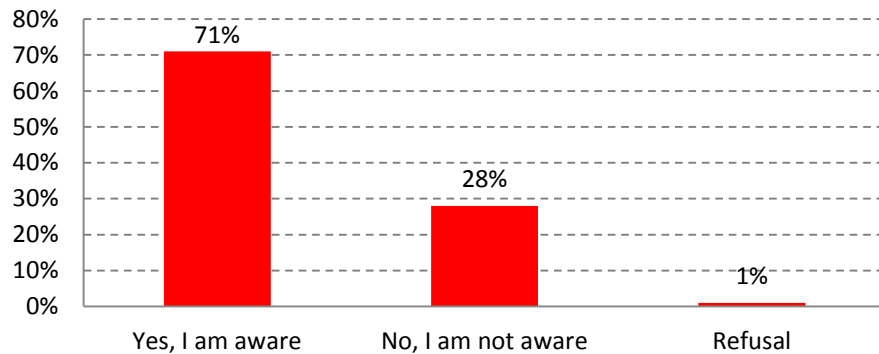
Sustainability derogations have been granted by national regulators to operators falling in categories which were foreseen to be likely candidates for the derogation, i.e. some mobile virtual network operators in several Member States and some mobile network operators in some of the very low-data-price Member States with high roaming imbalances and/or low revenues per user (Estonia, Lithuania, Finland). Even in the latter countries, more than 70 % of subscribers benefit from RLAH. In total, less than 2 % of EU/EEA subscribers are subject to a small roaming surcharge due to a derogation (RLAH+).

According to the last BEREC International Roaming Benchmark Report, on average in the EU/EEA roaming traffic was multiplied by 5.3 and 2.4 respectively for data and voice in Q3 2017 compared to Q3 2016. The increase in outbound roaming traffic was particularly high for operators in Poland, Romania, Latvia, Bulgaria, Croatia and Slovenia.



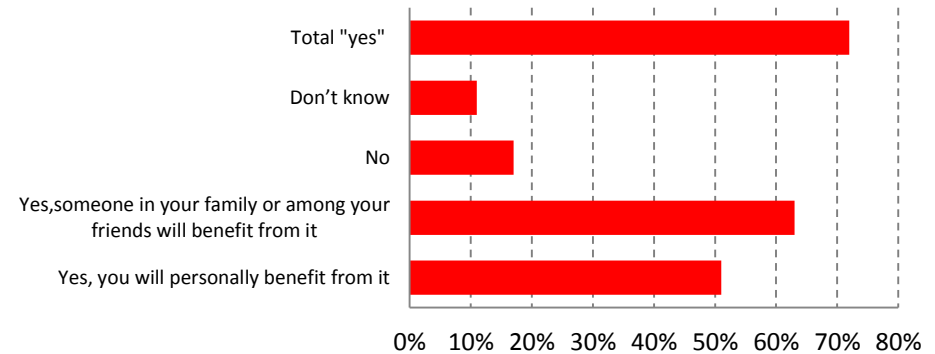
# Widespread use of **roam like at home** across Member States since 15 June 2017 (2/2).

% of EU citizens that are aware that since 15th June 2017 EU residents can use their mobile phone while travelling in the EU and pay the same as they would at home, 2017



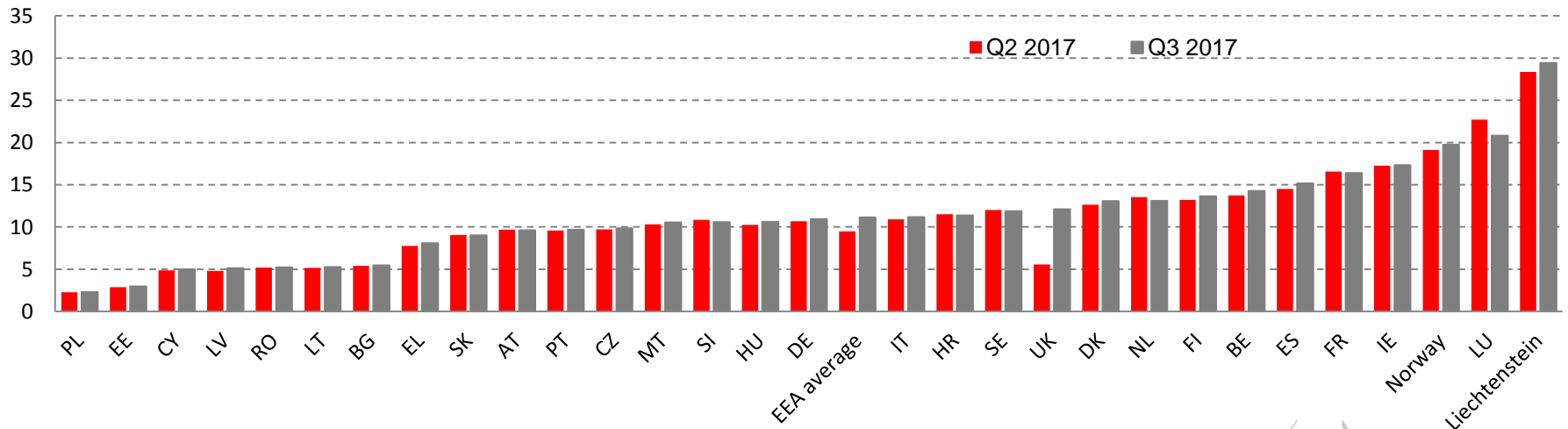
Source: Flash Eurobarometer 454

Do you think that you or someone in your family or among your friends will benefit from the end of roaming charges for the use of mobile phones abroad in the EU (multiple answers)? % of total answer, 2017



Source: Flash Eurobarometer 454

## Domestic mobile service - monthly retail revenue per subscriber (ARRPU) - prepaid + postpaid, Q2-2017 - Q3-2017



Source: 20th BEREC International Roaming Benchmark Report (March 2018)



# Member States' implementation of the **net neutrality rules** (Regulation (EU) 2015/2120) (1/2).

Under the EU net neutrality rules, Europeans must have access to the online content and services they wish, regardless of where this content originates from or is stored. These rights are established by directly applicable EU legislation and cannot be changed by mere administrative decision.

Specific BEREC guidelines and close cooperation between NRAs, BEREC and the Commission contribute to a consistent application of the rules throughout the EU.

## Net neutrality issues

Many NRAs have started to analyse individual commercial offers emerging on the market on a case-by-case basis. Several NRAs launched investigations regarding zero-rating services and assessed them according to the BEREC guidelines. Some NRAs (e.g. in Germany, Hungary, Italy, Sweden, [Portugal]) found that the investigated zero-rating practice was in breach of Regulation 2015/2120, because it was accompanied by unlawful traffic management practices.

Several NRAs (e.g. in Belgium, Estonia and Latvia) found that the investigated zero-rating practice was compliant with the Regulation.

The business models on zero-rating services adopted by many EU operators have been generally open, without discriminating between specific content providers in a given category.

Other practices relevant from a net neutrality perspective were also identified: blocking of ports, availability of private IP addresses, video on demand as a specialised service, altering/routing of traffic, different treatment of traffic, use of deep packet inspection, free choice of modems and interruption of IP connections.

## Net neutrality annual Reports

Under Article 5 of Regulation (EU) 2015/2120 national regulatory authorities are required to publish annual reports on their monitoring and findings and to share these reports with the Commission. The annual country reports on open internet from national regulators covering 2017 are available at:

<https://ec.europa.eu/digital-single-market/en/news/annual-country-reports-open-internet-national-regulators-2017>

# Member States' implementation of the **net neutrality rules** (Regulation (EU) 2015/2120) (2/2).

## Net neutrality penalties

Article 6 of Regulation (EU) 2015/2120 stipulates that 'Member States shall lay down the rules on penalties applicable to infringements of Articles 3, 4 and 5'. The deadline to notify the Commission of these rules and measures was 30 April 2016.

By mid-February 2018 the Commission had received notifications in this regard from 22 Member States.

Penalties are in place in another three Member States (Croatia, Czech Republic, Italy), but these were not notified to the Commission.

In three Member States (Austria, Ireland and Portugal) there are as yet no penalties related to net neutrality.

## Sanctioning power of NRAs

Most NRAs (e.g. in Belgium, Germany, Denmark, Finland, France, Greece, Hungary, Italy, Luxembourg, Latvia, Malta, Poland, Slovenia, Sweden, Slovakia and the UK) can impose such fines and penalty payments directly. There are only a few exceptions (e.g. Ireland).

## Transparency measures

Several NRAs have adopted measures on the transparency obligations set out in the Regulation (for example: in Germany, Hungary and Lithuania)

The EETT in Greece is currently preparing a decision with more specific requirements for the implementation of Regulation (EU) 2015/2120. The decision will include requirements on the estimation of speeds, zero-rating and information transparency.

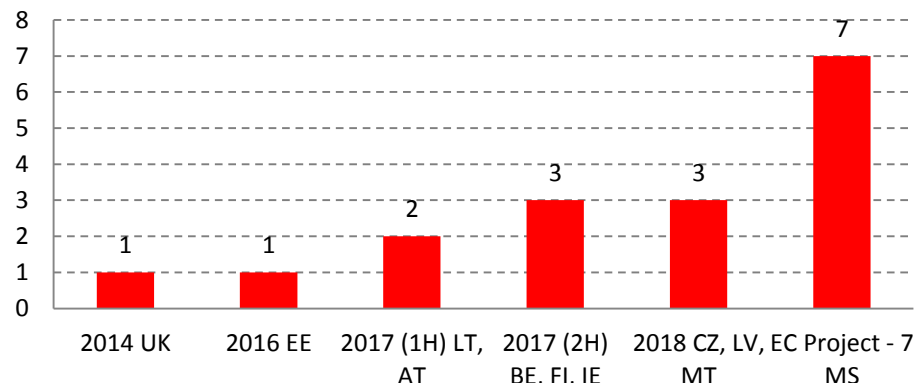
ANACOM in Portugal is considering preparing in 2018 some recommendations or communications to operators in order to support or improve implementation of the transparency measures in Article 4.

# Emergency Communications and the single European emergency number 112.

## Main findings based on the 2018 report on the implementation of the European emergency number 112:

- The advanced mobile location (AML) handset-based caller location solution was launched in Belgium, Finland and Ireland, raising the number of AML countries to seven. Currently AML is deployed in Austria, Belgium, Estonia, Finland, Ireland, Lithuania and the UK. To boost the take-up of AML for the benefit of the public and emergency services, the European Commission launched in September 2017 a project to deploy AML in a further seven Member States in the next 2 years. AML provides an accuracy well below 100 m, which makes it possible to provide emergency assistance in good time.

## AML deployment and accessibility solutions for disabled end-users



Source: EC - Implementation of the European emergency number 112

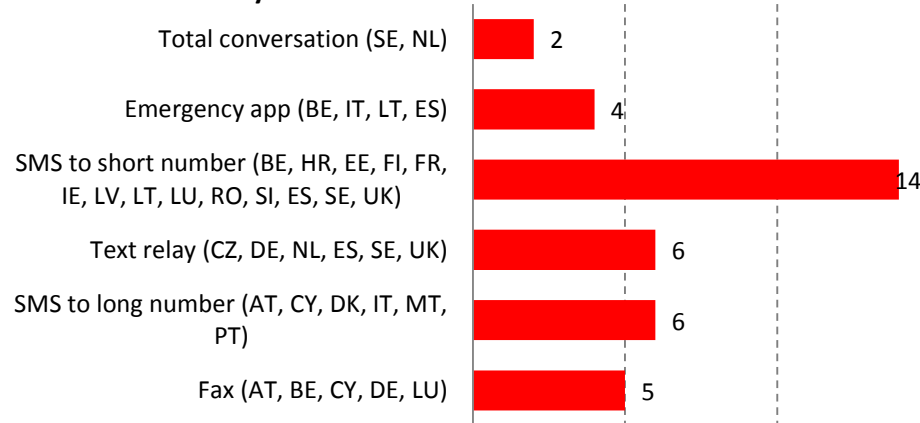
- In the reporting period AML was available only on phones with an Android operating system. As of spring 2018, Apple will also support AML as of the next update of iOS.

- 24 Member States reported implementing an alternative access to emergency services for users with disabilities. SMS to a long or short number is implemented in 20 Member States. User location for alternative means of access is available in only 10 Member States.

- According to the latest Eurobarometer e-communications household survey, almost half of EU citizens (49 %) identified 112 as the single number to call throughout the EU. This is a 1pp. increase since 2015 and 7pps since 2014.

The Commission services are looking into the matter of the timely provision of caller location information and accessibility solutions for people with disabilities in several Member States.

## AML accessibility solutions for disabled end-users



Source: EC - Implementation of the European emergency number 112



# Human Capital

## Digital Inclusion and Skills

Digital Economy and Society Index Report 2018  
Human Capital

**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.

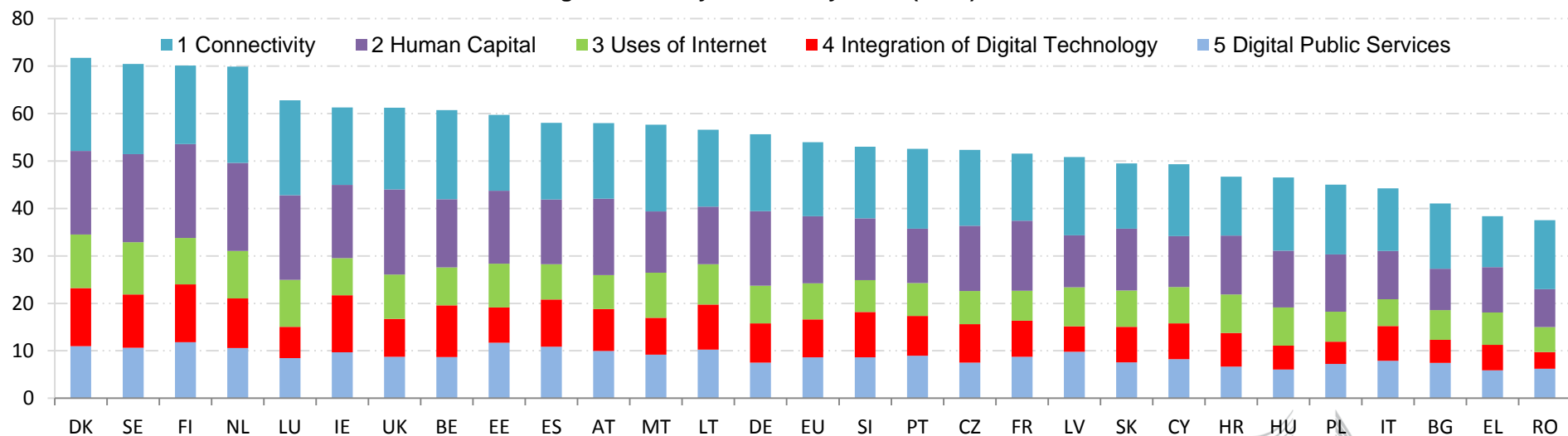
Denmark, Sweden, Finland and the Netherlands have the most advanced digital economies in the EU followed by Luxembourg, Ireland, the UK and Belgium.

Romania, Greece, Bulgaria and Italy have the lowest scores on the index.

### The five dimensions of the DESI

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

**Digital Economy and Society Index (DESI) 2018**

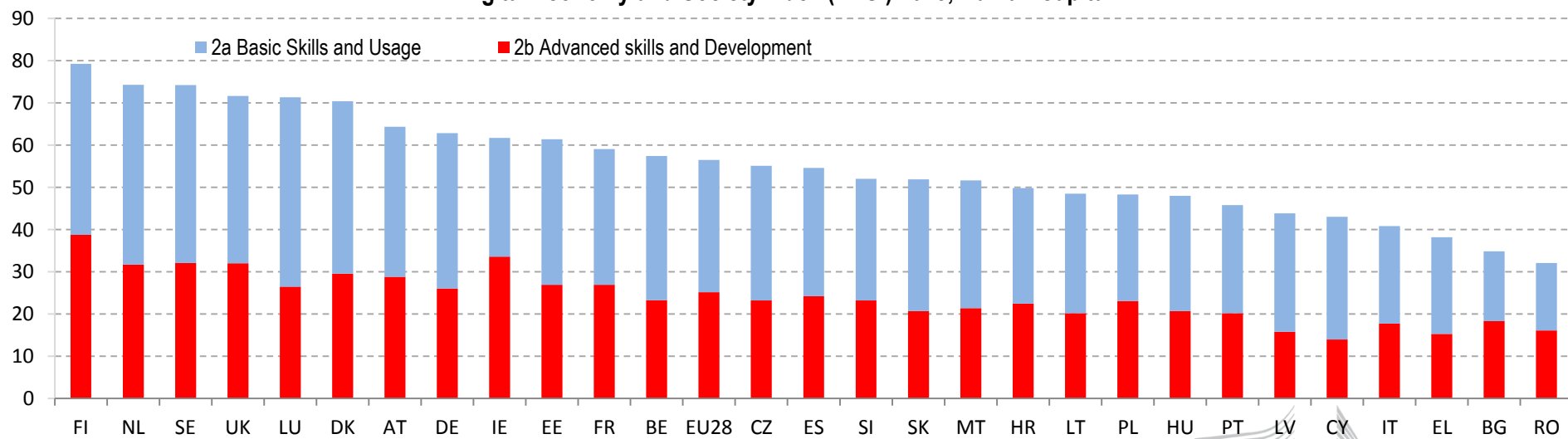


In the **Human Capital dimension of DESI 2018**, Finland, the Netherlands, Sweden, the United Kingdom, Luxembourg and Denmark obtained the highest scores. Romania, Bulgaria, Greece and Italy had the lowest ones.

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 as per the Digital Skills Indicator). The latter includes indicators on ICT specialist employment and graduates in STEM (Science, Technology Engineering and Mathematics) disciplines. According to 2017 data, the Netherlands, Sweden and Luxembourg are the top performers in basic skills and usage; Finland, Ireland, Sweden and the UK had the highest scores in advanced skills and development. Romania, Bulgaria, Greece and Italy rank lowest overall on DESI's Human Capital dimension.

	EU 28
<b>2a1 Internet Users</b>	<b>81%</b>
% individuals	2017
<b>2a2 Basic Digital Skills</b>	<b>57%</b>
% individuals	2017
<b>2b1 ICT Specialists</b>	<b>3.7%</b>
% total employment	2016
<b>2b2 STEM Graduates</b>	<b>19.1</b>
Graduates in STEM per 1000 individuals (aged 20 to 29)	2015

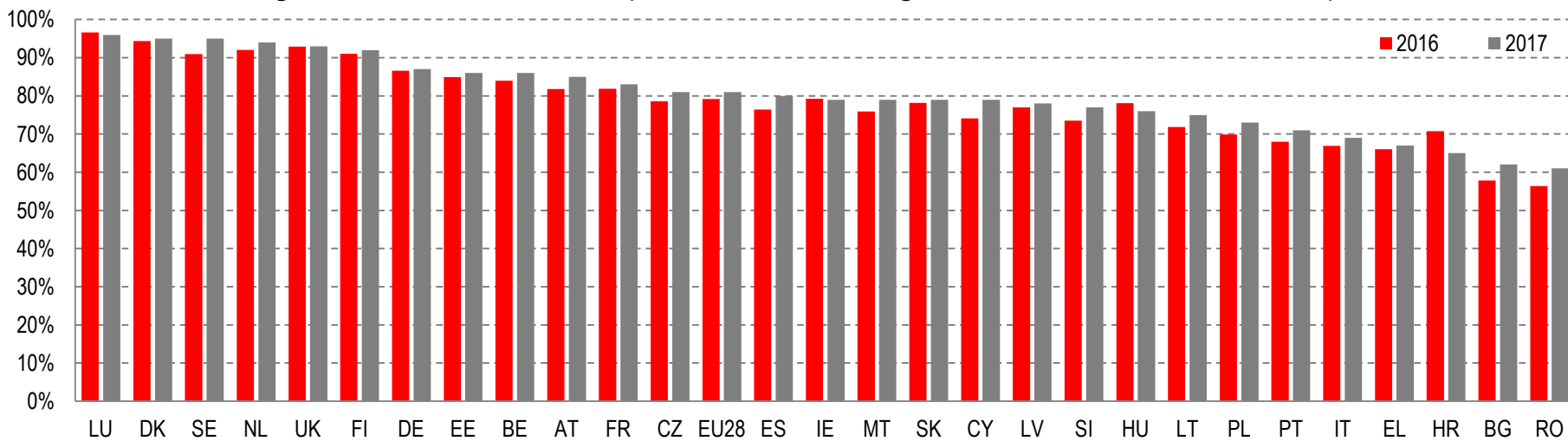
Digital Economy and Society Index (DESI) 2018, Human Capital



The differences in **regular internet use** shrank further in 2017. However, in some Member States, over a third of the population still does not go online on a regular basis.

In Member States such as **Luxembourg, Denmark, Sweden and the Netherlands**, the vast majority of the population uses the internet at least once a week. Those countries in the process of **catching up** with top-performing Member States, such as **Austria, Belgium, Germany and Estonia**, saw further improvements in this respect in 2017. **Cyprus, Spain and Slovenia** also made significant progress and now stand very close to the EU average. Noteworthy increases were likewise recorded in both **Romania (+5pp. compared with 2016)** and **Bulgaria (+4pp.)**, although 39% and 38% of their respective populations still do not go on line on a regular basis. Both Member States are also among those with the largest increases in their rates of regular internet use over the period 2010-2017, together with **Cyprus (+29pp.)**, **Greece (+26pp.)**, the **Czech Republic (+23pp.)**, **Spain (+22pp.)** and **Italy (+21pp.)**.

Regular Internet use in the EU (% of individuals using the internet at least once a week)



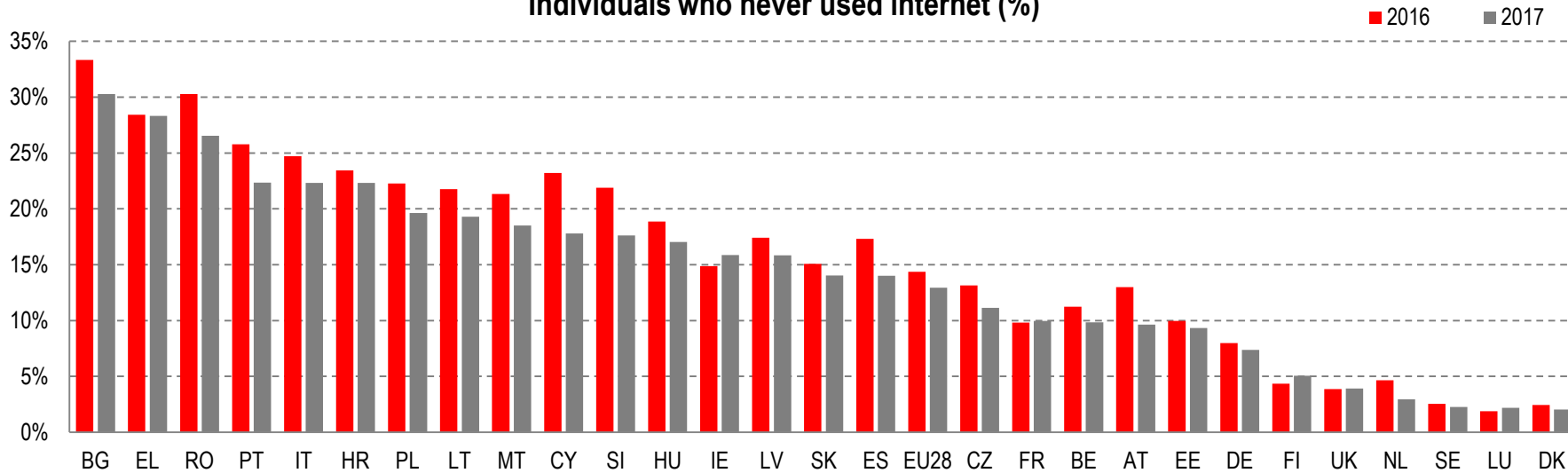
Source: Eurostat



The **share of people in the EU who have never gone online** decreased again in 2017, although the current share of 13 % warrants further efforts. Despite convergent trends, large disparities remain across Member States.

The share of EU citizens not using the Internet fell in nearly all Member States in 2017. On average, it decreased by 1 pp. in 2017 (to 13 %) compared to a year earlier. Proportionally, the Members States featuring the largest reductions were **Cyprus**, where the share of people aged 16-74 who have never used the internet shrank by 5 pp., **Slovenia** and **Romania** (both -4 pp.). Austria, Bulgaria, Poland, Portugal and Spain also made good progress in this respect (-3 pp.) The Member States where the share of non-internet users fell the most between 2010 and 2017 are Romania (-31 pp.), Cyprus (-27 pp.), Greece (-24 pp.), and Portugal (-23 pp.).

Individuals who never used internet (%)



Source: Eurostat

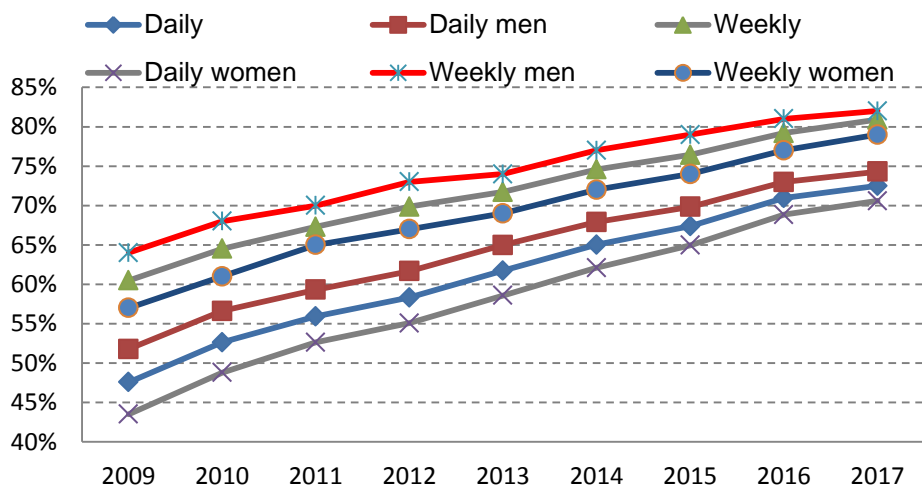
**81 % of EU citizens go online at least weekly and 72 % do so every day. A gender gap persists but it is narrowing. Despite ongoing improvements, particularly in some Member States, the elderly and those with low education levels or on low incomes continue to be at risk of digital exclusion.**

In 2017, 81% of Europeans used the internet at least weekly and about 72 % daily or almost, compared, respectively, with 79 % and 71 % a year earlier.

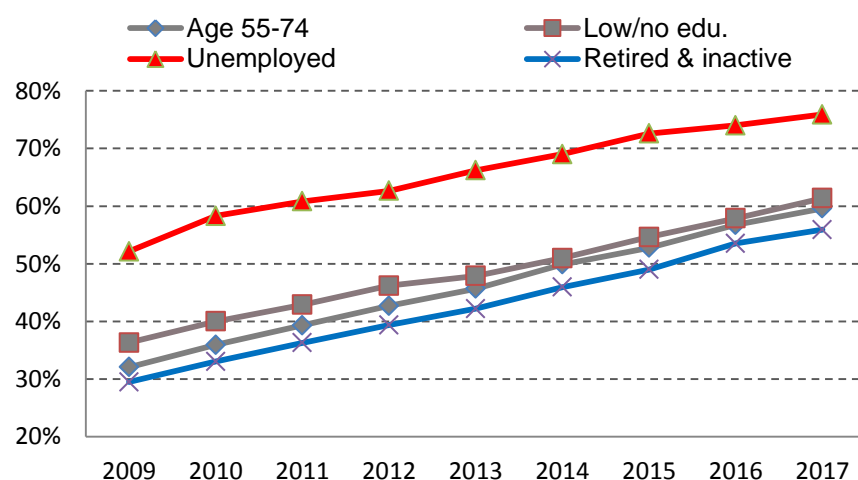
Proportionately, men use the internet more than women (at least weekly: 82 % vs. 79 %; daily or almost: 74 % vs. 71 %), although the difference is narrowing (at least weekly: from 5 pp. in 2015 to 3 pp. in 2017).

People with low education levels or on low incomes, as well as the elderly and the retired or inactive tend to be comparatively less active internet users: although internet use rates among these groups are increasing, within each of them, about 4 in 10 people do not use the internet regularly. This means that digital exclusion risks are particularly high for people from these groups.

Daily and weekly use of internet in the EU, 2017 (% of individuals)



Weekly internet use in 2017, selected pop. groups (% of individuals)

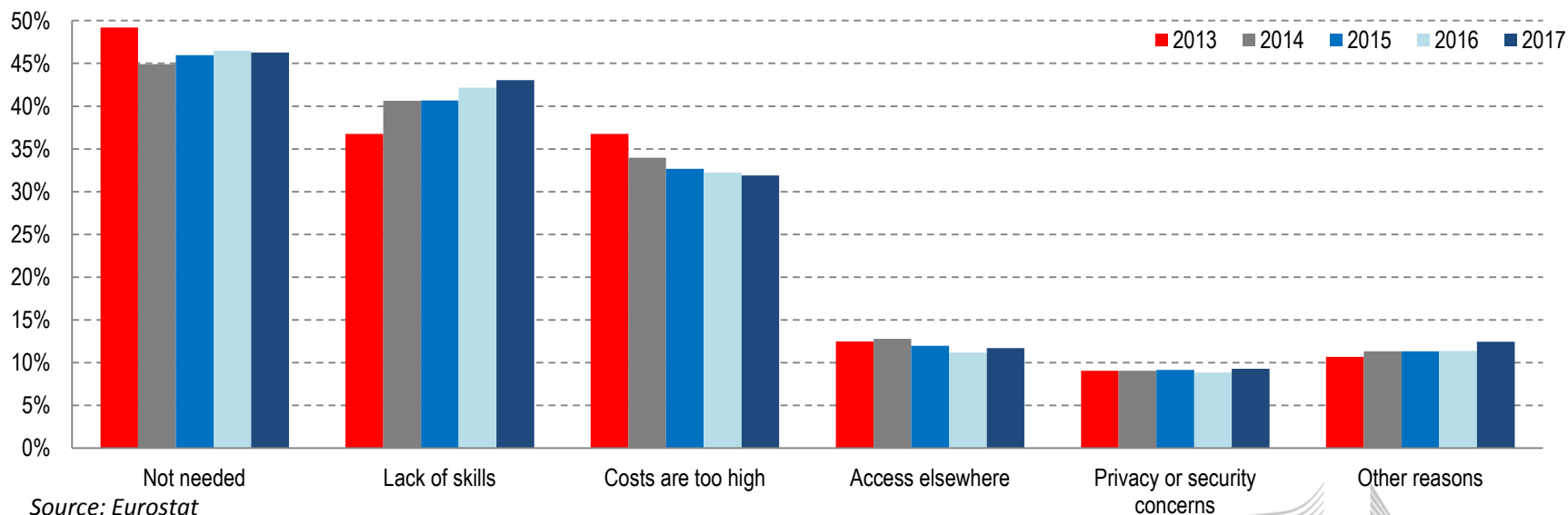


Source: Eurostat

**Lack of need or interest, insufficient skills and cost-related barriers continue to be the most common reasons given by households for not having internet access at home. 2017 data confirm the growing importance of digital skills in the fight against digital exclusion.**

The three main reasons evoked by households for not having internet access remain, respectively, the **lack of need or interest** (46 % of households without internet access in 2017), **insufficient skills** (43 %) and **high access and equipment costs** (32 %). The deterring effect of each of these factors varies significantly in strength across Member States. For example, only 8 % of Danish households without internet access mentioned costs as a barrier but as many as 57 % did so in Croatia and Hungary. **Lack of relevant skills remains by far the fastest-growing factor deterring households from having internet access at home** (+11 pp. since 2010) and, to the extent that it **limits awareness of potential benefits from digitisation**, may also be among the reasons behind the large numbers of European households still claiming that they do not have internet access at home because they do not need it.

**Barriers to internet access at home in the EU, 2017 (% households without internet access)**

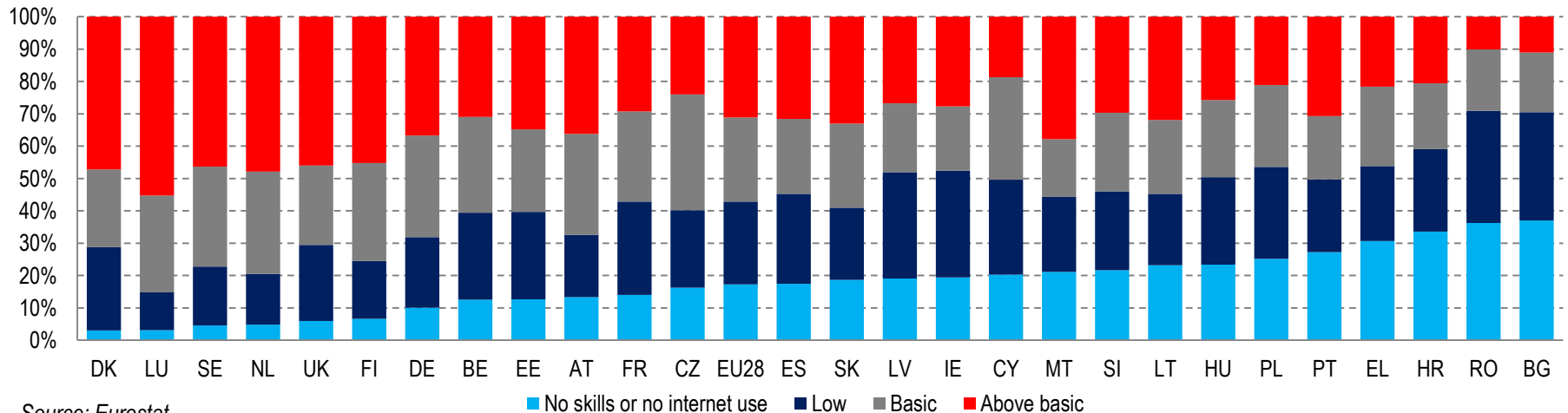


In 2017, 43 % of the EU population had an insufficient level of **digital skills**. 17 % had none at all, as they did not use the internet or barely did so.

According to the **Digital Skills Indicator**, a composite indicator based on the Digital Competence Framework for Citizens\*, 17 % of the EU population had no digital skills in 2017, the main reason being that they did not use the internet or did so only seldom. This represents an improvement (i.e. decrease) of 2 pp. compared to 2016. The share of EU citizens without basic digital skills, in turn, went down by 1 pp. (to 43 %). However, these figures imply serious risks of digital exclusion in a context of rapid digitisation. There are **proportionally more men than women with at least basic digital skills** (respectively, 60 % and 55 %). In addition, only about 31 % of people with low education levels or no education have at least basic digital skills. This figure is also significantly lower among those living in rural areas (49 %), who tend to be relatively older, than for their city-dwelling counterparts (63 %).

There are still **major disparities across Member States**. The share of people with at least basic digital skills ranges from 29 % in Bulgaria and Romania (despite noticeable progress in both these countries in 2017) to 85 % in Luxembourg and 79 % in the Netherlands.

**Digital skills of the EU population, 2017 (% of individuals, by skills level)\*\***



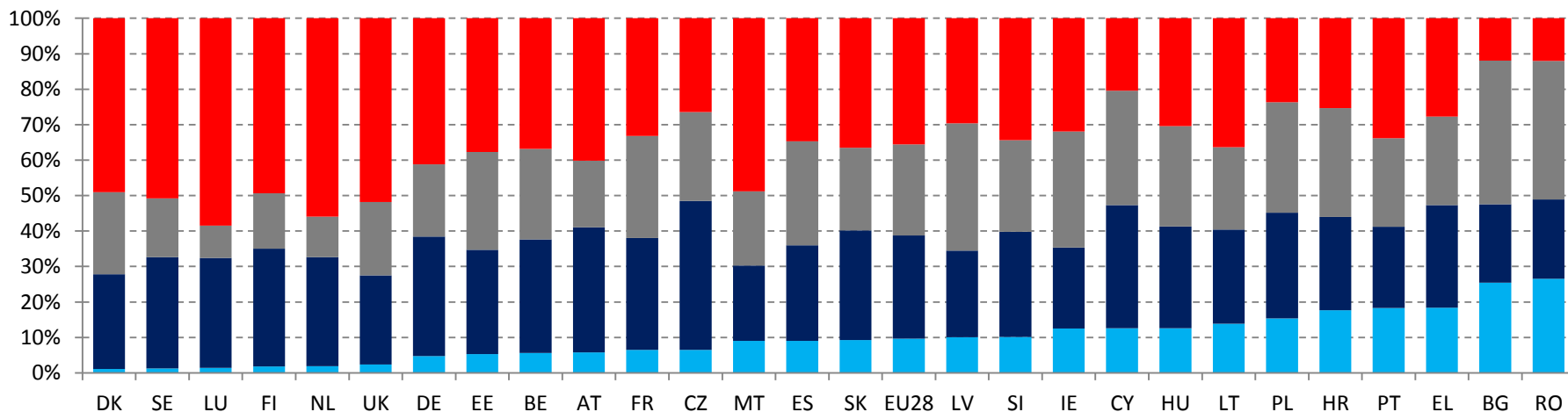
Source: Eurostat

\*More details at: <https://ec.europa.eu/jrc/digcomp>. \*\*To be classified as *low skilled*, an individual has to have carried out activities from only one of the four Digital Competence dimensions considered (information, communication, content-creation and problem-solving). *Basic skills* means that an individual has *basic skills* in at least one dimension, but *no skills* in none. To be classified as *above basic*, the individual has to score *above basic* in all dimensions. Data not available for Italy.

In 2017, 10 % of the **EU labour force** had no **digital skills**, mostly because they did not use the internet. 35 % did not have at least basic digital skills, which are now required in most jobs.

The share of the EU's active labour force (employed and unemployed) that can be considered to have **no digital skills** (essentially because they do not use the internet or do so only seldom) went from 11 % in 2016 to 10 % in 2017. This share is much higher in Member States like Romania (26 %), Bulgaria (25 %) and Portugal (18 %), although they are among those showing the largest improvements in this respect compared to last year's figures. Conversely, a very large proportion of the labour force (between 82 % and 89 %) in Member States such as Luxembourg, the Netherlands, Finland and Sweden has at least basic digital skills, and half of it or more have above basic skills. Digital skills are of critical importance not only for **accessing the labour market** but also for being able to **harness the benefits** of transformation currently underway. Bridging this gap, as well as **addressing digital skills deficits** in certain segments of the labour force, such as older cohorts or blue-collar workers, will thus be essential to bring about an inclusive digital economy and society.

Digital skills of the EU labour force, 2017 (% individuals, by skills level)\*



Source: Eurostat

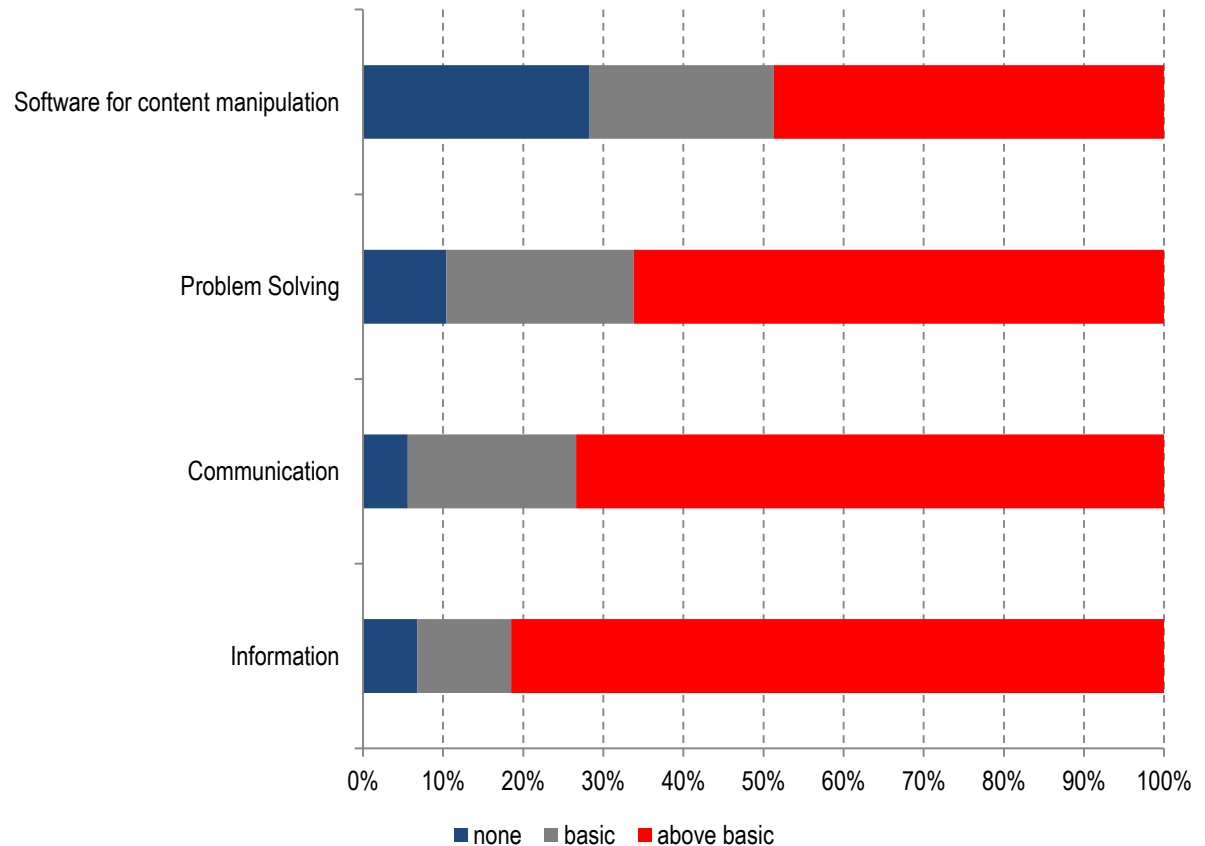
■ No skills or no internet use ■ Basic ■ Low ■ Above basic

\* Data not available for Italy

# The share of the EU's internet users without **software-related skills (28 %)** remained stable in 2017

Advanced digital skills are becoming a prerequisite for entry into many jobs\* and have a wide range of applications, even beyond domains where they are needed for core tasks. Across competence dimensions, the **largest skills deficit**, both among the active labour force and the population at large, relates to the **use of software for content manipulation**. Almost one in three internet users in the EU has no skills in this area (i.e. they declared to not to have 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). This share is particularly large in Member States like Bulgaria, Romania (about 51 % of internet users) as well as Latvia (40 %) and Ireland (39 % down from 44 % in 2016). Conversely, in others like Luxembourg, Portugal, the UK and the Netherlands, a large majority of internet users has above basic software skills (69 %, 58 % -both- and 57 % respectively). By type of activity, only about 7 % and 30 % of EU internet users had, respectively, **written code** and used **spreadsheet advanced functions**. In contrast, 82 % and 73 % can be considered to have above basic skills in, respectively the **information** and **communication** dimensions.

Digital skills, by competence dimension and level, 2017 (% of internet users)



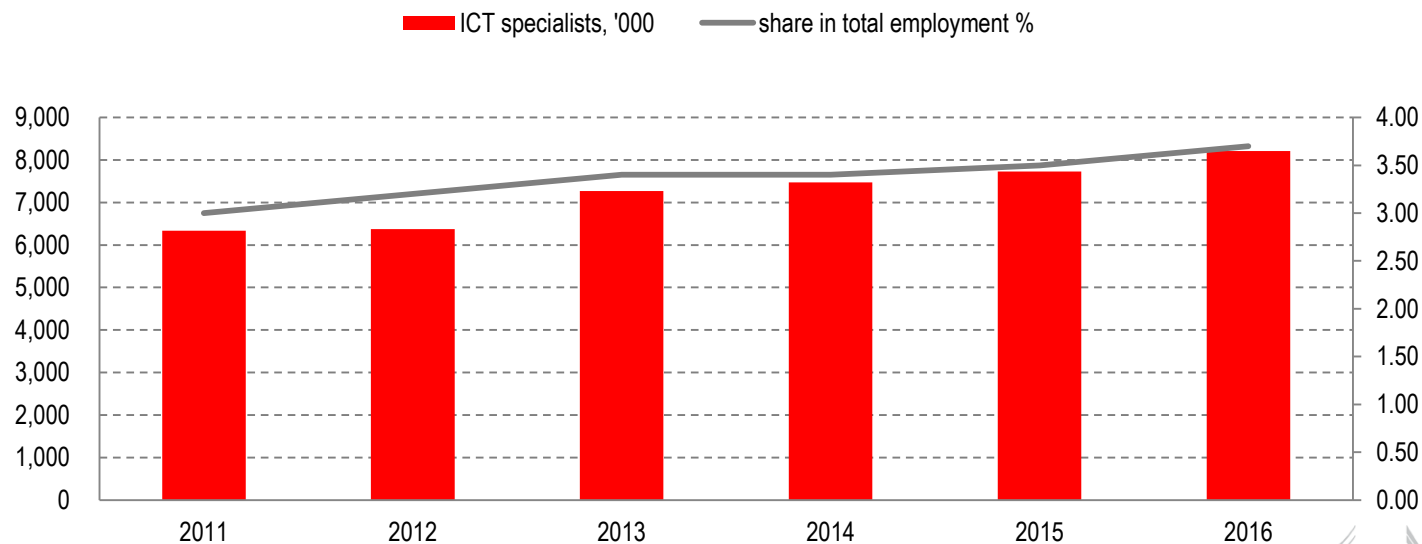
Source: Eurostat

\*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** in the EU grew by 500,000 between 2015 and 2016 to reach 8.2 million workers. However, the employment potential of specialised ICT skills remains underexploited.

8.2 million persons were employed as Information and Communication Technologies (ICT) specialists in the EU in 2016. This amounts to about 3.7 % of total employment. These figures represent an improvement compared with a year earlier (7.7 million and 3.5 % of employment), thus confirming the positive trends observed in recent years (between 2011 and 2016, the number of ICT specialists grew by 1.8 million and their share in total employment went from 3.0 % to 3.7 %). 83 % of all ICT specialists employed in the EU in 2016 were men, and nearly 62 % had at least tertiary education. The Member States employing the most ICT specialists were the UK (1.6 million), Germany (1.5 million) and France (1.0 million). The highest shares of ICT specialists in total employment were recorded in Finland (6.6 %) and Sweden (6.3 %) and Estonia (5.3 %); the lowest in Greece (1.4 %), Romania (2.0 %), Cyprus and Latvia (both 2.2 %). In 2016, 1 in 5 enterprises in the EU employed ICT specialists and nearly 1 in 10 (9 %) recruited or tried to recruit ICT specialists. However, 41 % of enterprises which recruited or tried to recruit them had difficulties in filling vacancies. Despite the positive evolution in recent years, the **gap between demand and supply of ICT specialists in the EU is expected to widen further** and, as suggested also by the growing numbers of vacancies, the employment potential of specialised ICT skills remains underexploited.

## Employment of ICT specialists in the EU, 2011-2016



Source: Eurostat

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.

At the end of 2016, the Commission launched the **Digital Skills and Jobs Coalition**, which brings together Member States and stakeholders from the private and public sectors to **develop a large digital talent pool and ensure that Europe's citizens and labour force are equipped with adequate digital skills**. By means of pledging action and identifying and sharing best practices that can be replicated and scaled up, the Coalition's activities have so far benefited several million citizens, with over 3.7 million trainings in digital skills provided, more than a million digital skills certifications, 4,500 events having reached over a million people and more than 9,000 job placements and internships offered.

The Commission monitors progress annually as part of the DESI. 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 90 pledges have been made by enterprises, education providers and NGOs committing to reduce digital skills gaps by taking actions such as training courses, matching for digital jobs, certification and awareness raising. **18 National Coalitions** for Digital Skills and Jobs have also been launched in Member States.



The **Digital Opportunity Traineeship** has been launched to help young people improve their digital skills and consider a career in the digital sector. This pilot initiative provides cross-border traineeships to 6,000 students and recent graduates of all disciplines so they get hands-on digital experience in fields demanded by the market. In June 2017, the European conference on IT professionalism\* focused on the development of a European Framework for the IT profession building on the European e-Competence Framework (e-CF) for IT professionals\*, a new version of which will be presented in 2019.

\* <http://ictprofessionalism.eu>

\*\* <http://www.ecompetences.eu>





# Use of Internet Services

Digital Economy and Society Index Report 2018  
Use of Internet Services

**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.

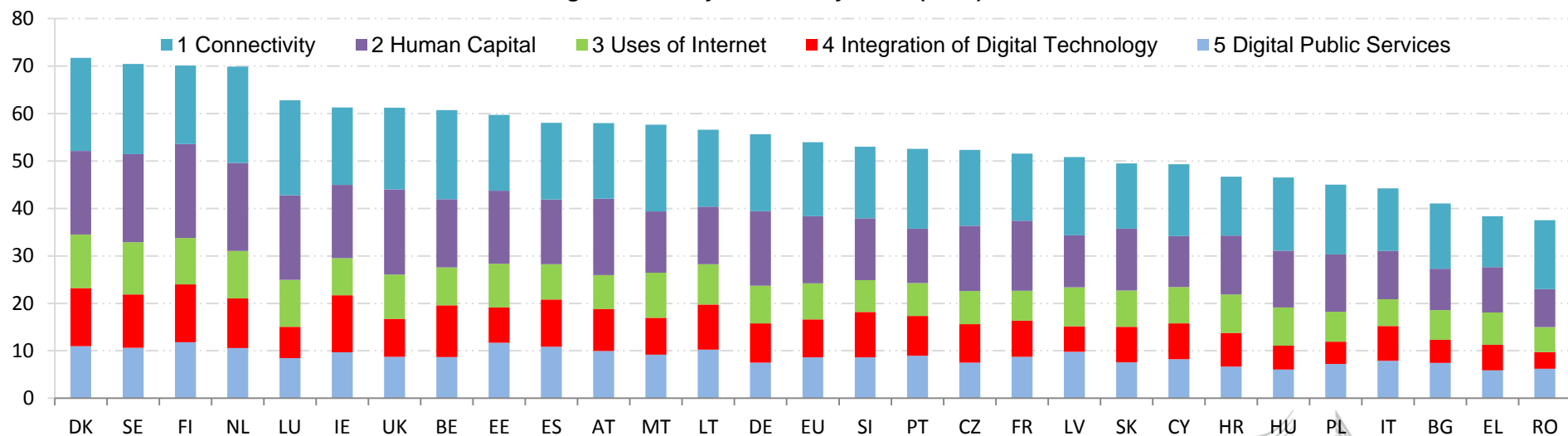
Denmark, Sweden, Finland and the Netherlands have the most advanced digital economies in the EU followed by Luxembourg, Ireland, the UK and Belgium.

Romania, Greece, Bulgaria and Italy have the lowest scores on the index.

### The five dimensions of the DESI

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

**Digital Economy and Society Index (DESI) 2018**

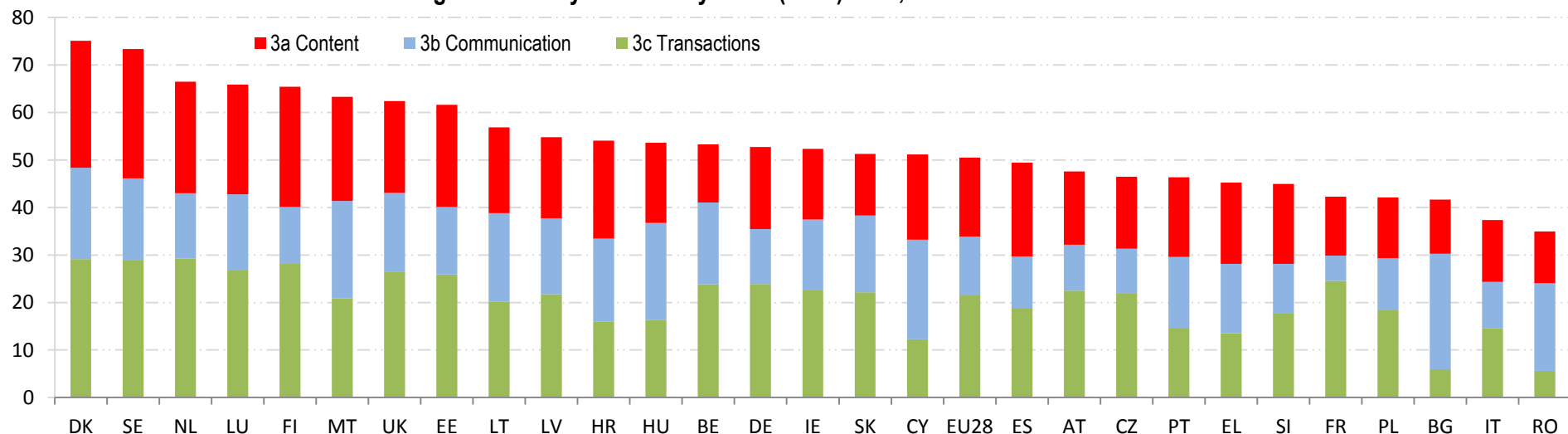


## Large disparities across EU Member States remain in terms of **use of Internet services**.

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's **Use of Internet Services** dimension. Denmark, Sweden, the Netherlands and Luxemburg have the most active internet users, followed by Finland, Malta, the UK and Estonia. Romania, Bulgaria and Italy are, in turn, the least active.

**Romania** is the Member State having registered the **largest improvement** in this dimension compared with the previous edition (nearly 6 pp.). Germany, Malta, Ireland and the Netherlands also made significant progress.

Digital Economy and Society Index (DESI) 2018, Use of internet Services

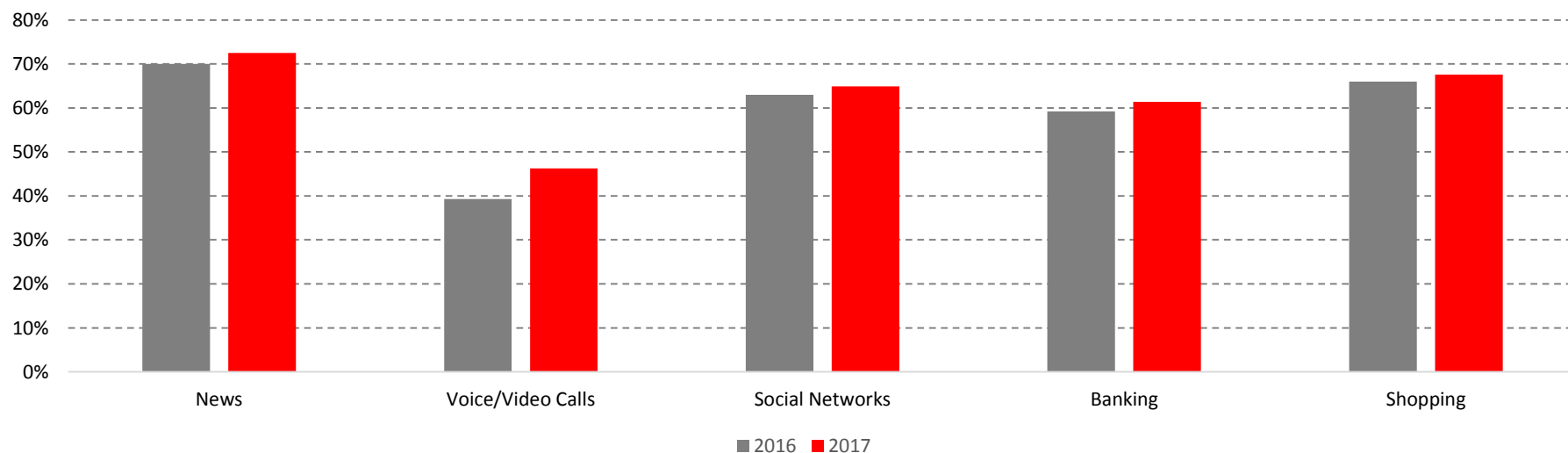


Source: DESI 2018, European Commission

## Growth in the **use of online services** is generally slow, although the use of the internet for voice or video calls picked up significantly in 2017

As in the previous edition of DESI, annual variation in the different activities considered in the Use of Internet Services dimension has been limited. Indeed, **moderate increases** were observed in the percentage of internet users **reading news online, participating in social networks, shopping online and using internet banking** (about 2 pp. each). The largest increase relates to **use of the internet for voice or video calls**, where the share of internet users went from **39 % in 2016 to 46 % in 2017**.

Use of Internet Services in the EU, 2016-2017, selected indicators (% of internet users)



Source: Eurostat

## Participation in online social networks increased moderately in the EU in 2017, to reach 65% of internet users.

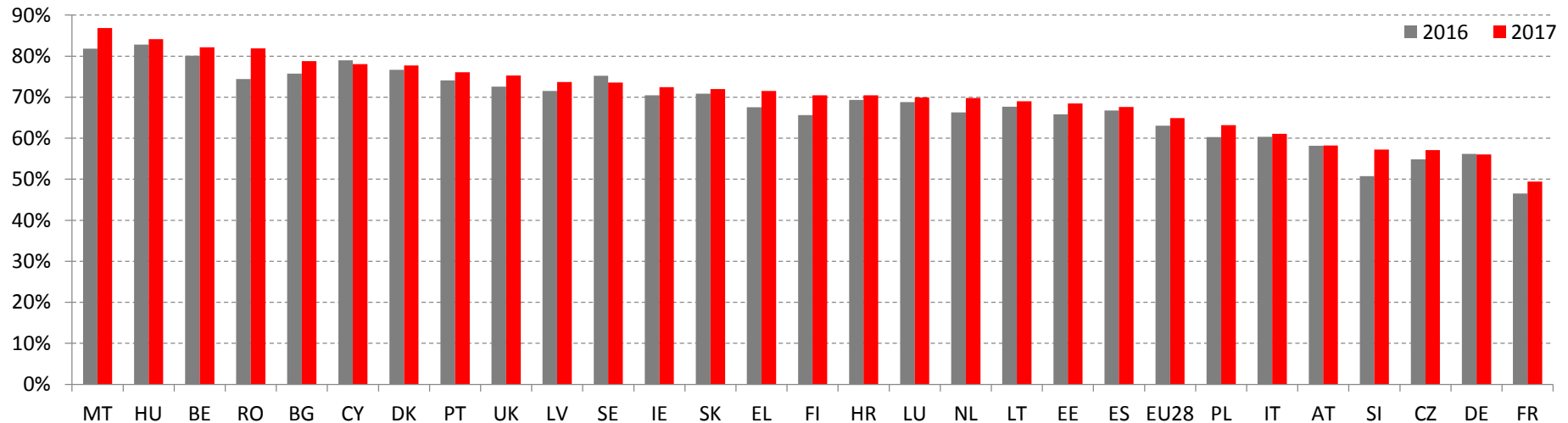
In 2017, **65 % of internet users participated in social networks**, that is a 2 pp. increase compared with 2016 levels. Among **16- to 24-year-olds**, the share of users participating in social networks neared **90 %**, whereas this figure was of 68 % and 40 % for the 25-54 and 55-74 cohorts respectively (both 2 pp. annual increase).

The country with the **largest proportion of internet users on social networks** was **Malta (87 %)**, followed by Hungary (84 %), Belgium and Romania (both 82 %).

The **largest increases** in the share of internet users participating in social networks between 2016 and 2017 were registered in **Romania (8 pp.)** and **Slovenia (7 pp.)**, followed by Malta (5 pp.) and Finland (4 pp.).

**France** had the **lowest share of users (49 %)**, followed by Germany (56 %), the Czech Republic and Slovenia (both 57 %).

Use of the internet to participate in social networks , 2016-2017 (% of internet users in previous 3 months)



Source: Eurostat

# The upward trend in **eCommerce** continued in 2017, with about 68% of EU internet users now shopping online.

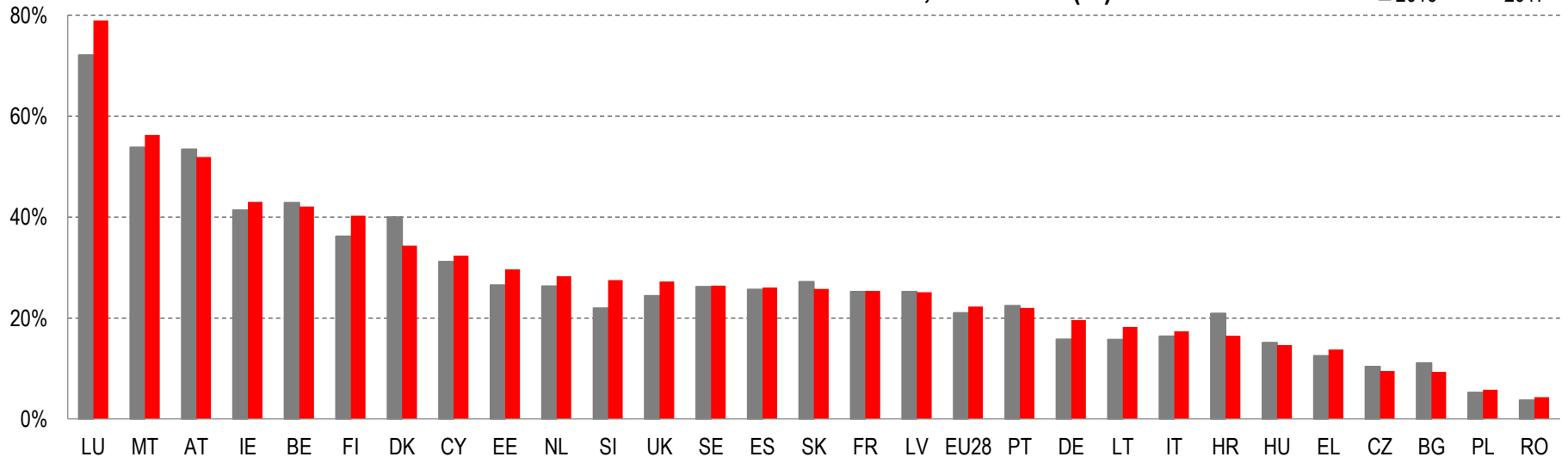
Since 2010, the **proportion of internet users ordering goods and services online** (over the previous 12 month period) **has increased by 12 pp.**, to 68 % in 2017. As with many other online activities, **eCommerce is higher among younger, higher educated and employed people**. These groups also had higher growth in recent years.

**eCommerce intensity varies greatly across EU Member States.** In 2017, 86 % of internet users in the UK shopped online compared to only 23 % in Romania (up from 18 % a year earlier). The largest annual increase in the proportion of internet users engaging in eCommerce took place in the Czech Republic (8 pp.), followed by Romania, Lithuania and Spain.

About 70 % of online shoppers reported not to have encountered any problem when making online purchases. The most **frequently reported problems** relate to **longer than expected delivery times** (17 %), **technical impediments** (11 %) and receiving **wrong or damaged goods/services** (9 %).

As to those internet users who **did not buy online**, the most cited reason (69 % of internet users) was a **preference for shopping in person**, either to see the products beforehand, out of loyalty to shops or by force of habit. Concerns regarding **privacy or security** when paying online, **lack of skills or knowledge** and about **receiving or returning goods** were mentioned, in turn, by 25 %, 19 % and 16 % of internet users respectively.

**Internet users who ordered goods or services for private use over the internet in the last 12 months from sellers from other EU countries, 2016-2017 (%)**



Source: Eurostat

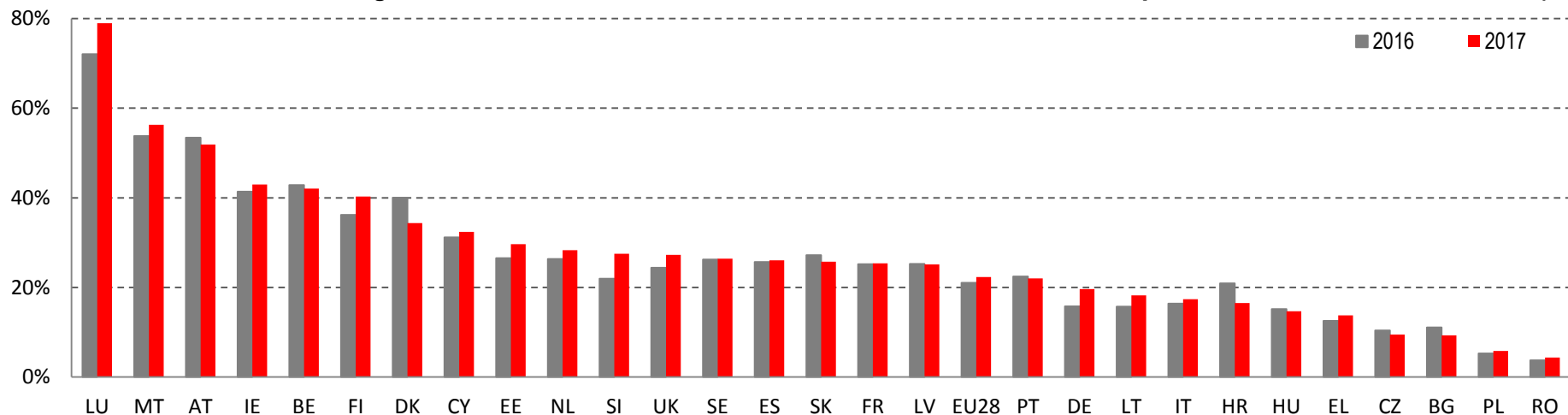
Although most EU internet users engage in **online shopping**, only about 22% of them ordered **goods or services from other Member States** online in 2017, which suggests the existence of important barriers.

In 2017, although 68 % of internet users in the EU shopped online, only 22 % engaged in cross-border eCommerce (1 pp. more than a year earlier). While cross-border online shopping is advancing, it is doing so rather slowly, having increased 10 pp. since 2010. Among online shoppers, 33 % made online purchases from sellers in other EU countries and 23 % from sellers in non-EU countries in 2017, compared, respectively, with 25 % and 13 % in 2012.

Among online shoppers who made purchases from sellers outside their own country, 80 % bought physical goods such as electronics, clothes, toys, food and groceries and books, whereas fewer of them purchased travel, accommodation or holiday arrangements (34 %) or products downloaded or accessed from websites or apps (25 %).

The extent of cross-border eCommerce differs substantially between Member States, as it ranges from 4 % of internet users in Romania to 79 % in Luxembourg. Buying from other EU Member States is influenced by a number of factors including country size and language. For example, Luxembourg, Malta and Austria, which have relatively small home markets and language connections with other large European countries, exhibit higher shares of cross-border eCommerce.

Internet users who ordered goods or services online from other EU Member States in the previous 12 months, 2016-2017 (%)



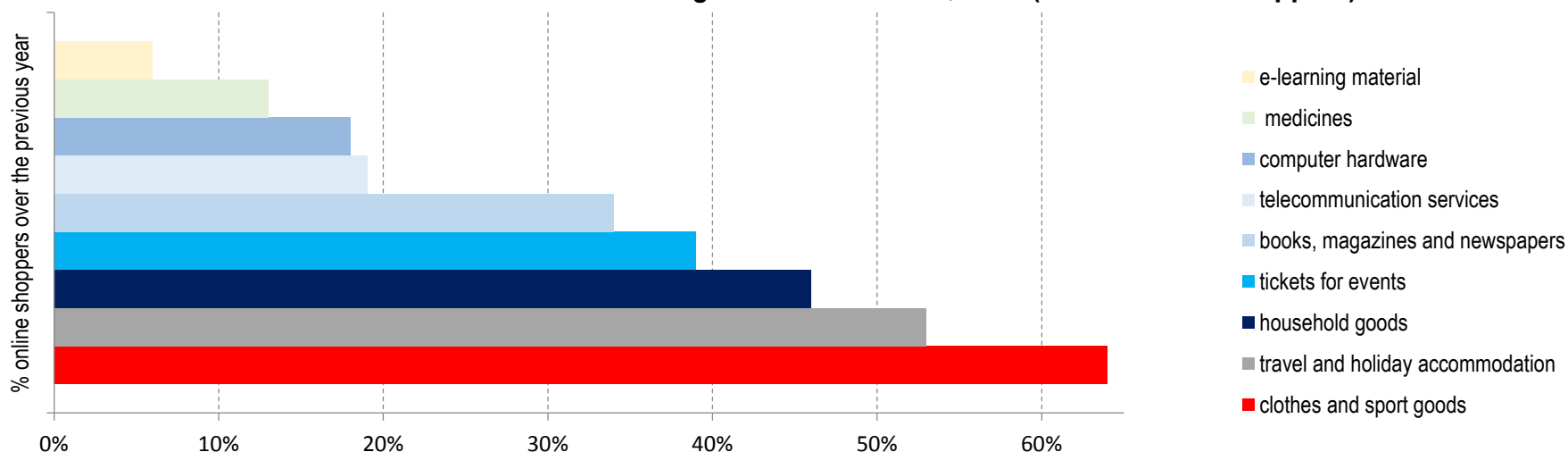
Source: Eurostat

## The goods and services most frequently bought online in 2017 were clothes and sport goods, followed by, accommodation services and household goods.

In 2017, the most popular categories of goods and services purchased online in the EU were **clothes and sport goods** (64 % of online buyers), **travel and holiday accommodation** (53 %), **household goods** (46 %), **tickets for events** (39 %) and **books, magazines and newspapers** (34 %). By age group, online shoppers aged **16-24** and **25-54** favoured clothes and sports goods in their online purchases (71 % and 67 % respectively); **55-74** year-olds, travel and holiday accommodation (57 %).

About **40 %** of online shoppers declared to have spent between **EUR 100 and EUR 499** on online purchases over the previous three-month period. Those aged **16-24** made, on average, **smaller online purchases** (less than EUR 100) than their older counterparts. People aged **25-54**, in turn, tend to make **more frequent purchases**: 17 % of online shoppers in this group had bought online 6-10 times and 16 % even more often.

Goods and services bought online in the EU, 2017 (in % of online shoppers)



Source: Eurostat

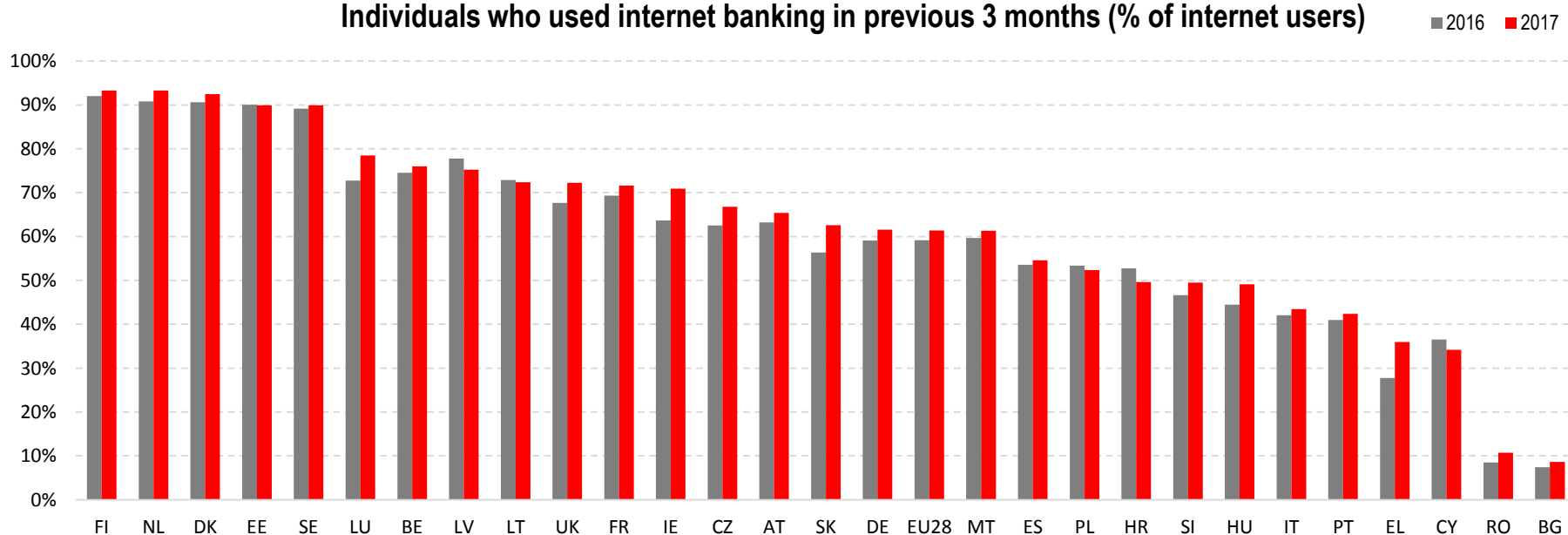


## 61 % of EU Internet users used **online banking in 2017**, although a large majority of them still does not do so in a number of Member States.

Online banking is a relatively common activity among internet users in the EU. **61 % of internet users in the EU used internet banking 2017, a 2 pp. annual increase from 2016.**

High shares of internet users doing online banking were recorded in **Finland and the Netherlands (both 93 %), Denmark (92 %), Estonia and Sweden (both 90 %)** in 2017. **Large differences remain across Member States**, with Bulgaria (9 %) and Romania (11 %) having the lowest shares of internet users engaging in online banking despite improvements observed over the past year. 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**. Over the period **2010 to 2017**, the percentage of internet users doing online banking grew from 52 % to 61 %.

Individuals who used internet banking in previous 3 months (% of internet users)



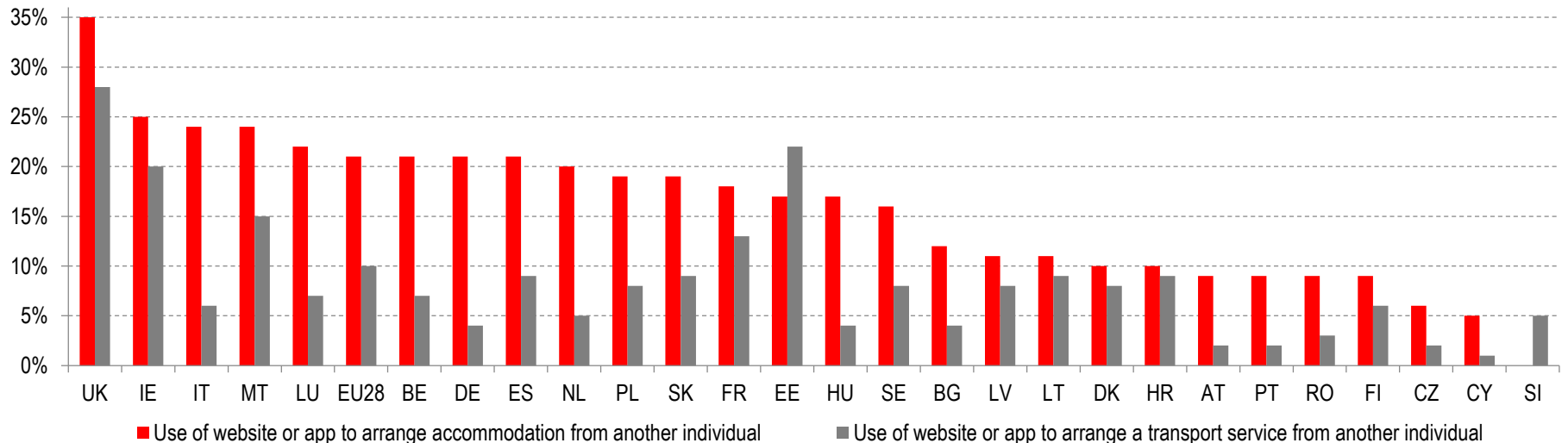
Source: Eurostat

About one-fifth of internet users in the EU used websites or apps to arrange accommodation services from other individuals in 2017; about 10 % used them to arrange transport services from other individuals.

On average, 21 % of internet users in the EU used websites or apps to arrange accommodation from other individuals in 2017, in most cases by means of dedicated platforms. By Member State, this figure ranges from over 35 % in the UK to 6 % in the Czech Republic and 5% in Cyprus. About 10 % of EU internet users in the EU, in turn, used websites or apps to arrange transport services from other individuals. Again, large differences exist across Member States. Institutional, legal and market-related aspects partly explain such disparities.

Internet users with high education levels are considerably more active in this respect: for both transport and accommodation, the share is more than threefold for this category compared to the low-or-no-education group.

Use of websites or apps to arrange transport or accommodation from other individuals, previous 12 months, 2017 (% internet users)\*



Source: Eurostat

\*Data not available for Greece



# Integration of Digital Technology

Digital Economy and Society Index Report 2018  
Integration of Digital Technologies

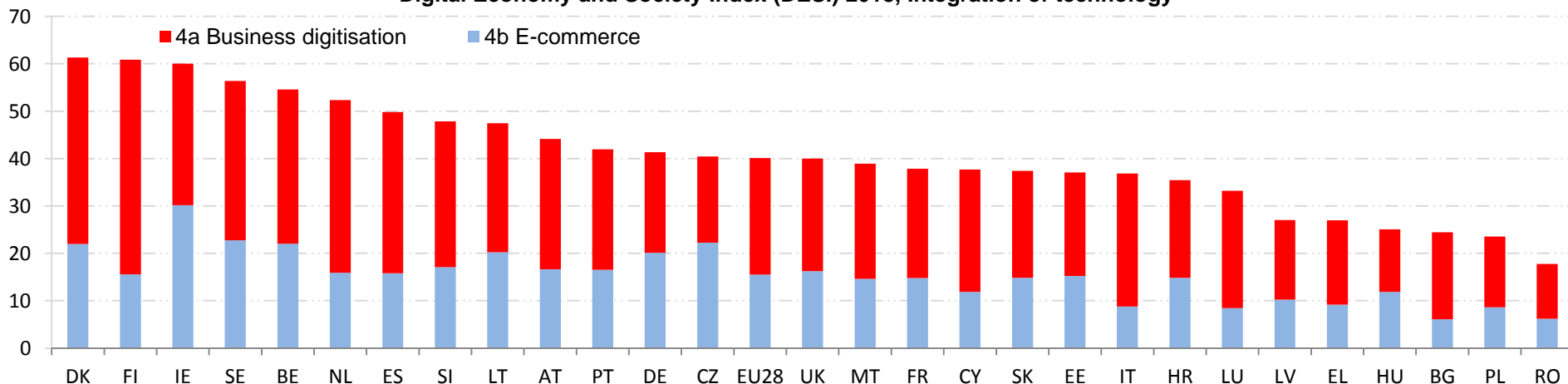
# On **Integration of digital technology**, Denmark scored highest, followed by Finland, Ireland and Sweden. Romania, Poland, Bulgaria and Hungary scored lowest.

**Integration of digital technology** covers (a) 'business digitisation' and (b) 'e-commerce'. 'Business digitisation' has five indicators (as % of firms using): electronic information sharing, Radio Frequency Identification (RFID), social media, e-invoices and cloud solutions. E-commerce has three indicators: the percentage of small and medium-sized enterprises (SMEs) selling online, e-commerce turnover as a percentage of total turnover of SMEs; and the percentage of SMEs selling online cross-border.

Northern countries continue to be leading in the integration of digital technologies.

EU 28	Value 2018	Value 2017
<b>4a1 Electronic Information Sharing</b> % enterprises	<b>34%</b> 2017	<b>NA</b> 2015
<b>4a2 RFID</b> % enterprises	<b>4.2%</b> ↑ 2017	<b>3.9%</b> 2014
<b>4a3 Social Media</b> % enterprises	<b>21%</b> ↑ 2017	<b>20%</b> 2016
<b>4a4 e-invoices</b> % enterprises	<b>NA</b> 2017	<b>17.7%</b> 2016
<b>4a5 Cloud</b> % enterprises	<b>NA</b> 2017	<b>13.5%</b> 2016
<b>4b1 SMEs Selling Online</b> % SMEs	<b>17.2%</b> → 2017	<b>17.2%</b> 2016
<b>4b2 E-commerce Turnover</b> % SME turnover	<b>10.3%</b> ↑ 2017	<b>9.4%</b> 2016
<b>4b3 Selling Online Cross-border</b> % SMEs	<b>8.4%</b> ↑ 2017	<b>7.5%</b> 2015

**Digital Economy and Society Index (DESI) 2018, Integration of technology**



Source: European Commission services based on Eurostat data

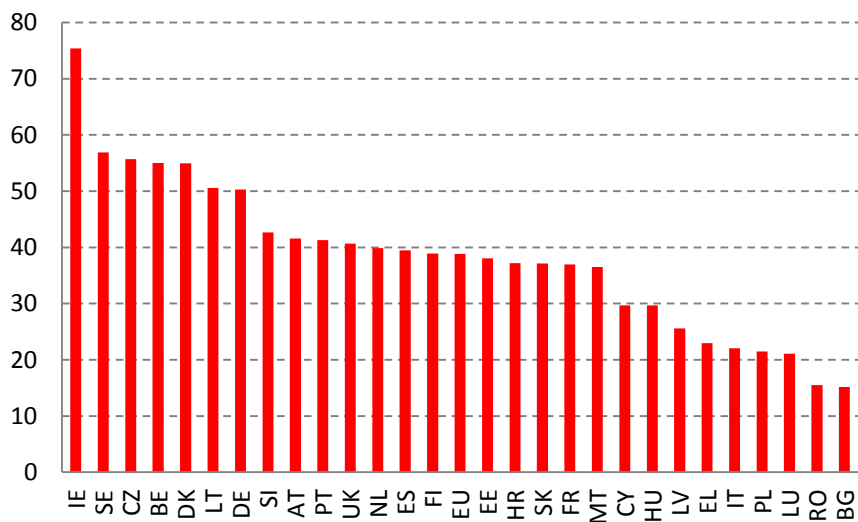
# The opportunities of **e-commerce** have been largely exploited by Ireland, Sweden and the Czech Republic whereas the adoption of **eBusiness** technologies is larger in Finland, Denmark and the Netherlands

Enterprises are, to a similar extent, implementing both eBusiness and e-commerce solutions. When analysing the relative shares, e-commerce is the main driver of digitisation for the Czech Republic, while Italy, Bulgaria, Finland and Luxemburg are mainly investing in eBusiness.

SMEs in Ireland over-perform in all the e-commerce dimensions considered in the indicator. 29.5 % of Irish SMEs are selling online (more than half of them are selling cross-border). This helps them to generate nearly a quarter of their turnover (22.9 %).

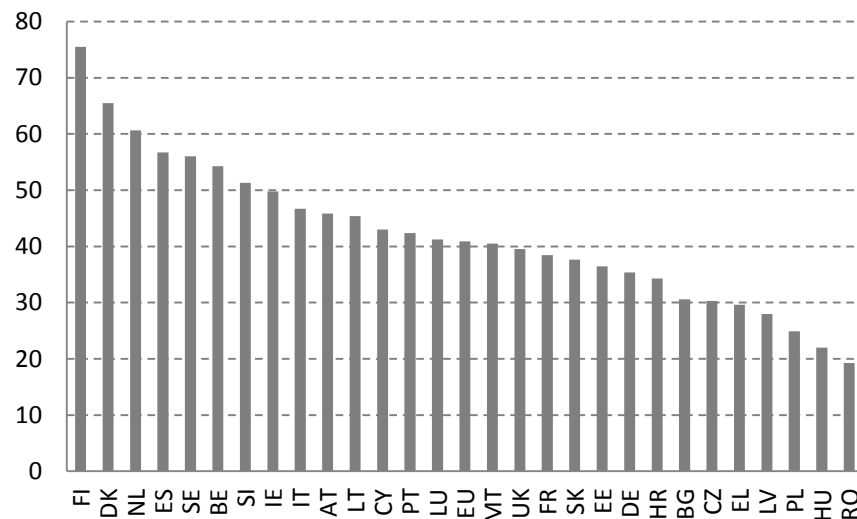
More than half of the businesses in Belgium have implemented an electronic information sharing system (54 %). The adoption of RFID in Bulgaria (9.2 %) is more than the double of the EU average. 42.4 % of the United Kingdom enterprises are active on social media while 31.7 % of the Spanish companies make use of eInvoices. Cloud services turn out to be adopted by almost half of the enterprises in Finland (48.4 %).

**DESI 2018 - E-commerce index**



Source: European Commission services based on Eurostat data

**DESI 2018 - Business digitization index**



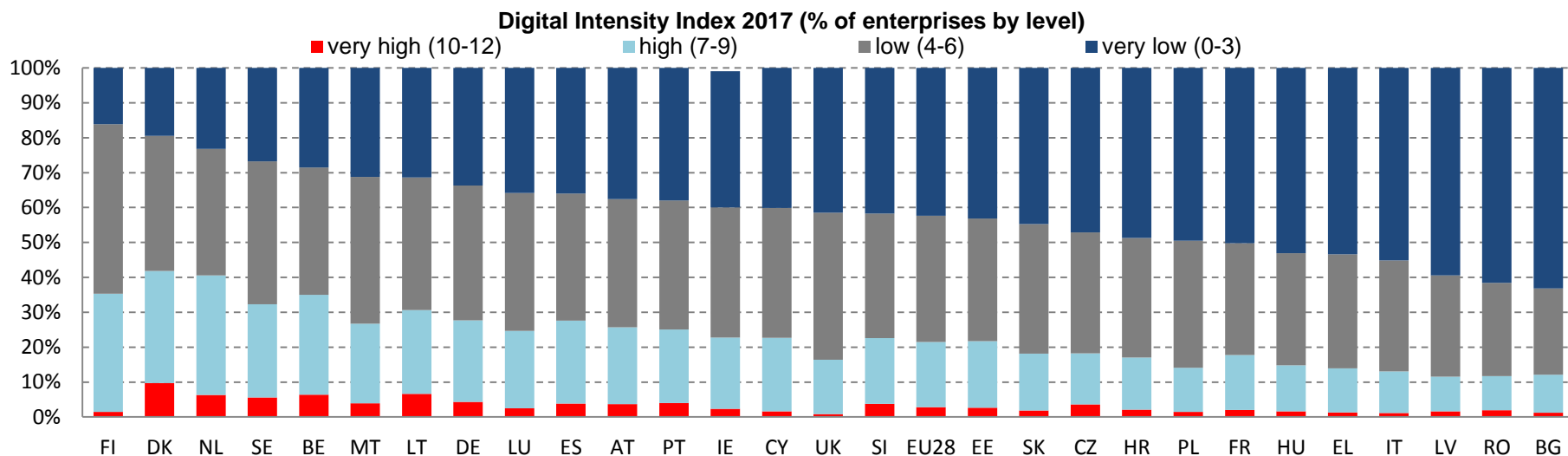
Source: European Commission services based on Eurostat data

Only **a fifth of companies** in the EU-28 are **highly digitised**, but the situation across countries is varied: while **40 %** of companies in Denmark and the Netherlands are highly digitised, in Bulgaria and Romania it is **1 in 10**.

The Digital Intensity Index (DII) measures the availability at firm level of 12 different digital technologies: internet for at least 50 % of persons employed, recourse to ICT specialists; fast broadband (30 Mbps or above); mobile internet devices for at least 20 % of persons employed; a website or homepage; a website with sophisticated functions; social media, sharing supply chain management data electronically; the use of Enterprise Resource Planning (ERP) software packages; the use of Customer Relationship Management (CRM); e-commerce web sales 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.

Denmark is the only country in the EU where the percentage of firms with a very high DII (i.e. possessing at least 10 out of the 12 monitored digital technologies) is close to 10% .

By contrast, in some countries such as Bulgaria, Romania, Latvia, Italy, Greece, Hungary and France, the majority of businesses (more than 50%) have not yet invested heavily in digital technologies (i.e. have a very low DII), often having just a simple website and a few computers.



Source: Eurostat

## Digital transformation of European businesses is driven by fast broadband connections, social media and mobile applications.

The table below shows the degree of penetration and speed of adoption of the different technologies monitored by the DII. Large companies are more digital than SMEs. While some dimensions seem to be reaching saturation (e.g. having a simple website), at least for large companies, for most there is still room for improvement.

Key indicators tracking digitisation processes	Year	% of EU28 enterprises		Variation 2017-2015 (pp)	
		Large	SMEs	Large	SMEs
Having a <b>web site</b> or homepage	2017	94%	76%	0	2
Website has some <b>interactive functionalities</b>	2017	74%	58%	2	3
Use any <b>social media</b>	2017	72%	47%	9	8
>50% of the persons employed <b>use computers &amp; Internet</b>	2017	50%	40%	3	2
Fastest <b>broadband</b> connection is at least 30 Mb/s	2017	69%	37%	15	12
Have <b>ERP</b> software package to share information	2017	76%	33%	Not comparable with 2015	
Use Customer Relationship Management ( <b>CRM</b> )	2017	62%	32%	0	1
>20% of workers with <b>portable devices</b> for business use	2017	38%	32%	7	5
Employ <b>ICT specialist</b>		75%	18%	-3	-1
<b>Selling</b> online (at least 1% of turnover)	2017	39%	17%	1	1
Share electronically <b>supply chain</b> management data	2017	47%	17%	-1	1
Exploit <b>B2C eCommerce</b>	2017	9%	7%	1	1

Source: European Commission services based on Eurostat data

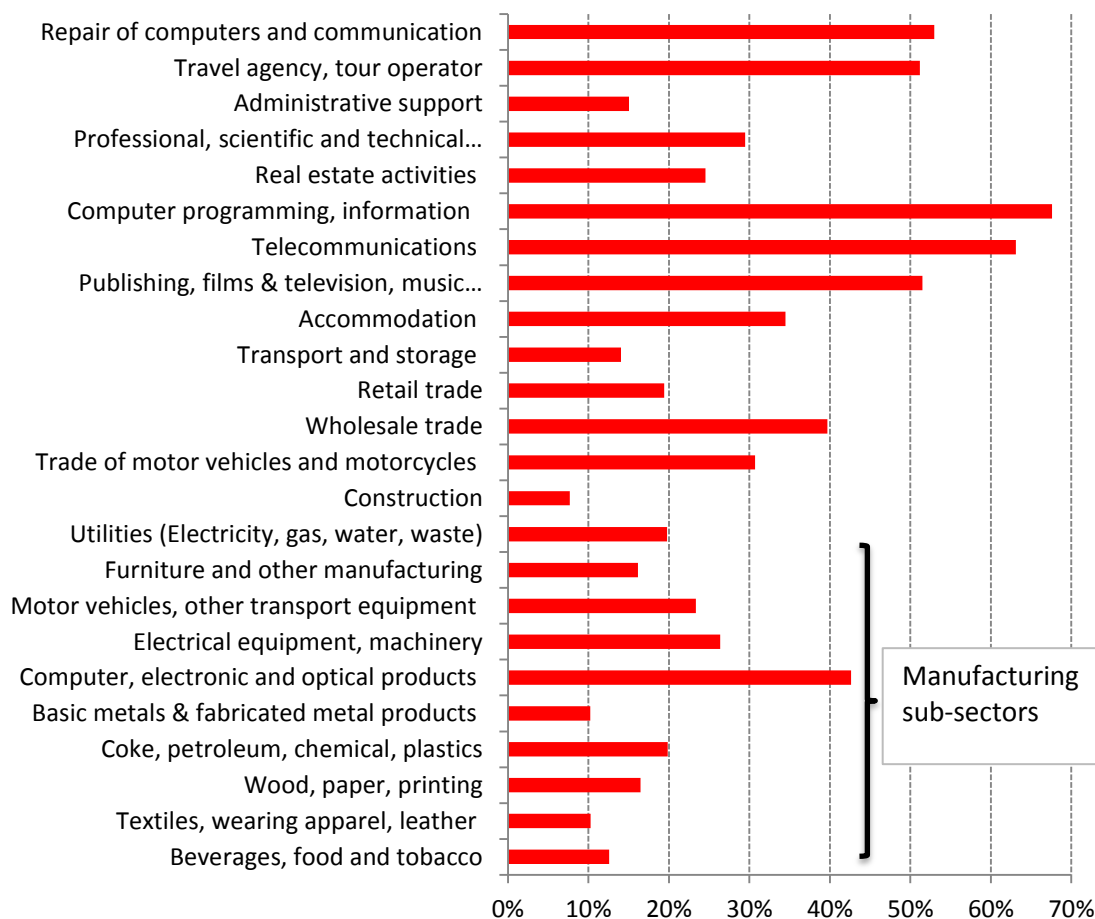
## The digitisation of economic sectors is progressing at different speeds, according to their own specific needs and starting points.

As 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 'Repairs of computers and communication', as well as travel agencies and the media sectors are also highly digitised.

Some sectors are still impervious to digital changes: for example, in the construction sector only 7.7 % of the enterprises have a high or very high DII.

The distribution of the DII by economic activity is similar across EU countries. Denmark, The Netherlands, Finland and Sweden are over performing in many of the sectors. Some positive exceptions of higher digitisation exist in the 'accommodation' sector (Malta, Lithuania, Slovenia, Spain, Estonia, Portugal and Croatia), 'professional scientific and technical activities' (Belgium, Malta and Lithuania), real estate (Cyprus and Spain) and 'transport and storage' (Cyprus)

**Enterprises with high or very high digital intensity index by economic activity, EU, 2017**  
(% enterprises)



Source: European Commission services based on Eurostat data

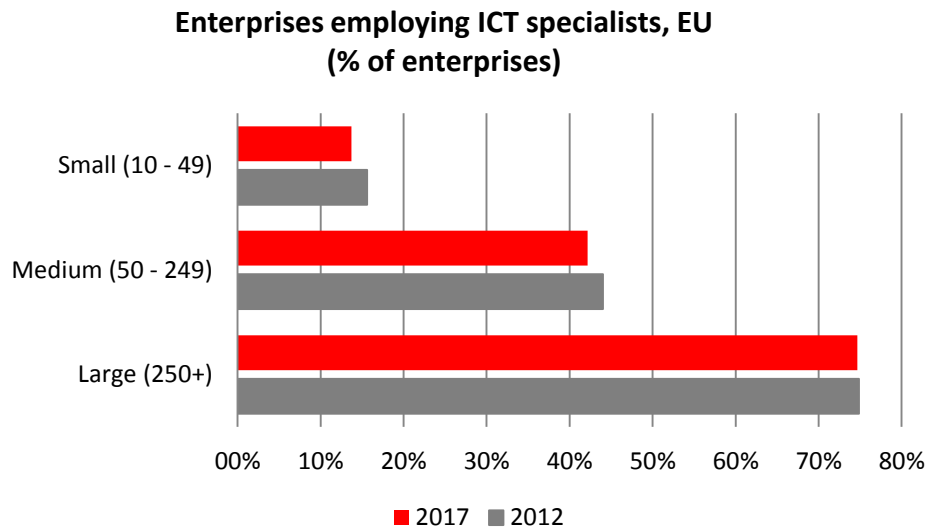


**Size** is a major factor enabling companies to digital transform. **SMEs** are closing the gap with large companies but there are a lot of opportunities still to be exploited.

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

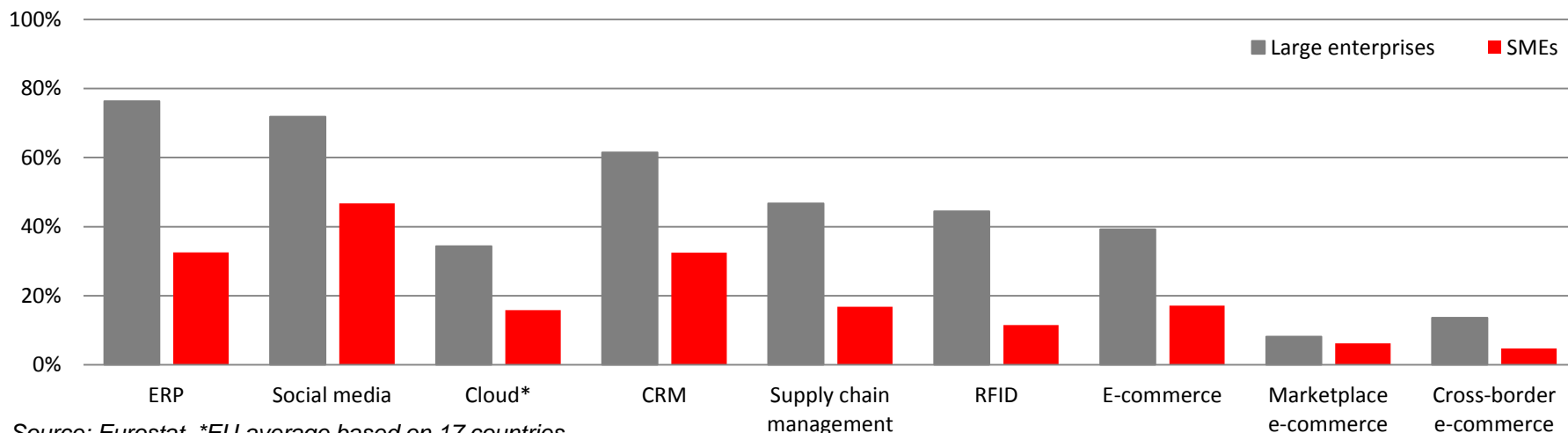
The result is that data sharing infrastructure such as ERP is much more common in large companies. SMEs are relatively active on social media (47 %) and, to a limited extent, they try to exploit e-commerce possibilities by selling through marketplaces.

Nevertheless, there are a lot of technological opportunities still to be exploited by SMEs such as cross-border e-commerce, cloud services and automation.



Source: Eurostat

**Adoption of digital technologies, EU, 2017 (% enterprises)**

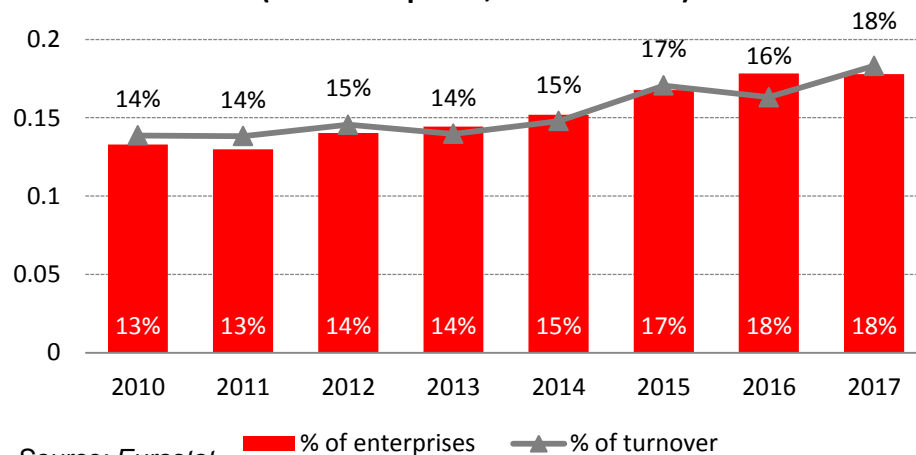


Source: Eurostat. \*EU average based on 17 countries

## E-commerce: slow progress in electronic sales by companies. one out of five made electronic sales. Larger enterprises are better at exploiting the possibilities of e-commerce

One out of five enterprises in the EU-28 made electronic sales. The percentage of turnover on e-sales amounted to 18 % of the total turnover of companies with 10 or more persons employed. In the EU-28, during the period 2010-2017, the percentage of companies that had e-sales increased by 5 pps and the companies' turnover realised from e-sales increased by 4 pps.

Trends in e-commerce, EU  
(% of enterprises, % of turnover)



Source: Eurostat

E-sales and turnover from e-sales, by firm size, EU, 2010 - 2017  
(% of enterprises, % of turnover)

	Enterprise with e-sales (turnover >1%) (%)			Turnover from e-commerce (%)		
	2010	2014	2017	2010	2014	2017
All enterprises	13.3%	15.2%	17.8%	13.9%	14.8%	18.3%
Large (250+)	31.3%	35.3%	39.3%	19.1%	20.2%	25.7%
Medium (50-249)	19.8%	22.0%	25.5%	11.3%	11.1%	13.0%
Small (10-49)	11.6%	13.4%	15.8%	4.9%	5.8%	7.4%

The share of companies conducting e-sales and the turnover from e-sales varies significantly according to size.

The share of small enterprises making e-sales (15.8 %) is less than half compared to the share of the large ones (39.3 %). Even more striking is that the share of the e-sales' turnover on the total turnover by small enterprises (7.4 %) is less than a third of the share generated by the large ones (25.7 %).

25.5 % of medium sized enterprises made e-sales, corresponding to 13 % of total turnover in this size class.

Source: Eurostat

# Different types of e-commerce: **Web and EDI-type**

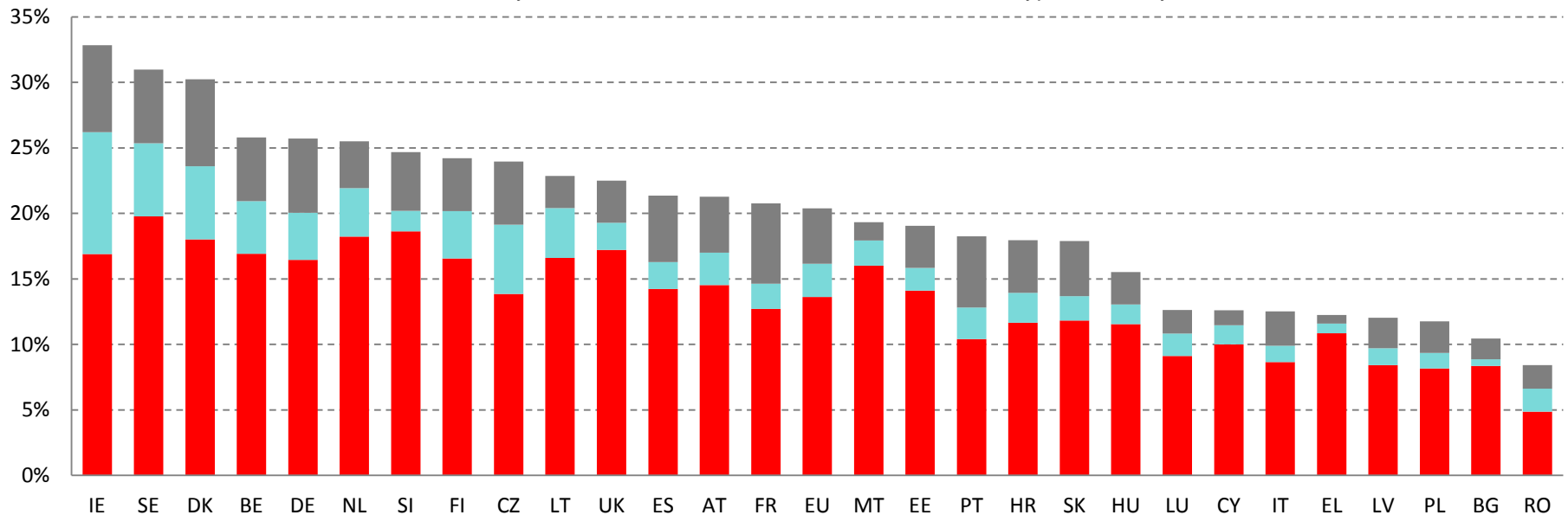
E-commerce can be broadly divided into two types: web sales and EDI-type sales referring to the way customers place orders for the products that they wish to purchase; companies may offer one or both options to their clients. The Electronic Data Interchange (EDI) type is the interchange of data between information systems, through a dedicated channel and in a defined standard so as not to require human intervention except in exceptional cases.

Among the EU-28, the percentage of enterprises making e-sales (web or EDI type) ranged from 8 % in Romania to 33 % in Ireland, closely followed by Sweden (31 %).

Web sales, made through the enterprise own website or through third parties one (including marketplace), is by far the most common option for e-sales. At EU level around 14 % of the enterprises are selling through a website, 2 % are exploiting both channels while slightly more than 4 % is making use of EDI-type sales.

**E-sales broken down by web sales and EDI-type sales, 2017 (% enterprises)**

■ web sales only      ■ both      ■ EDI-type sales only



Source: Eurostat

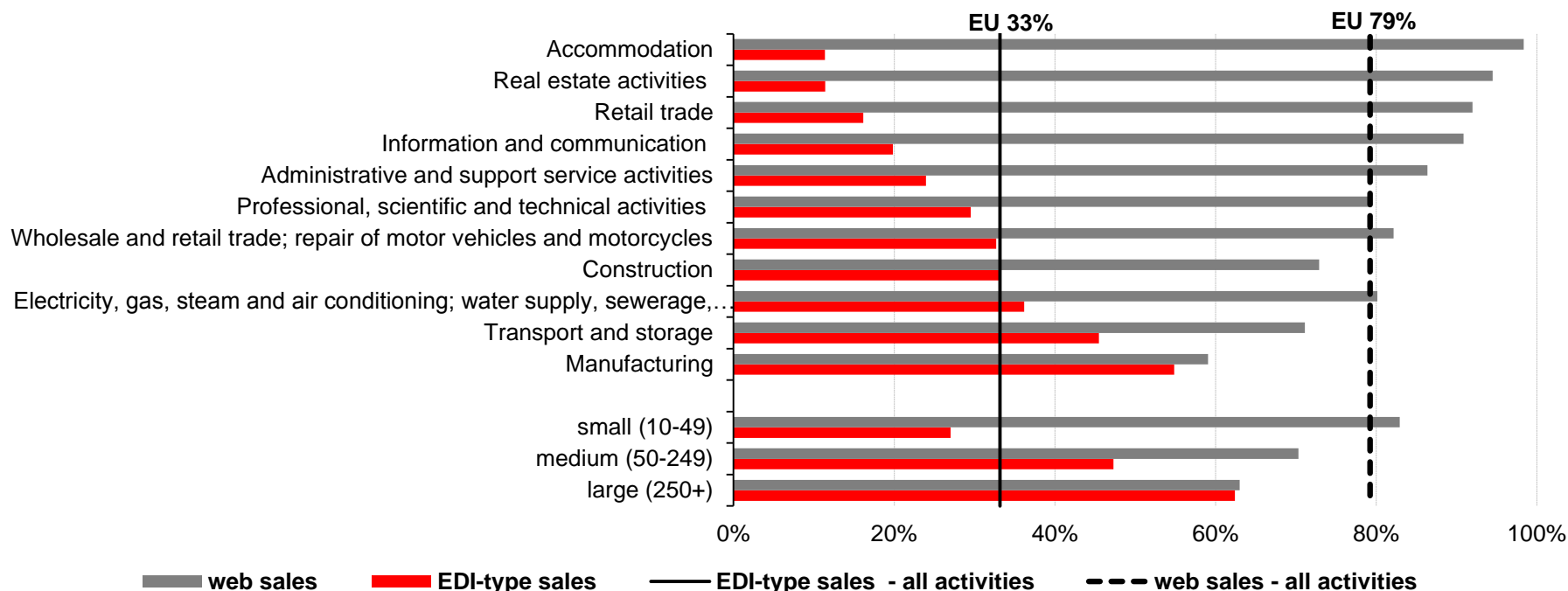
## Almost all enterprises making e-sales in the 'accommodation' branch received orders via a website. Large enterprises use web sales and EDI-type sales to the same extent

Companies received their orders in most cases via websites or apps independently of the economic activity (close to 100 % businesses in the 'accommodation' sector).

Orders received via EDI-type messages are reported by more than half of 'manufacturing' companies making e-sales, followed by companies in the 'transport and storage' sector (46 %).

When analysing e-sales by enterprise dimension, it becomes evident that large companies are using web sales and EDI-type sales to the same degree. The small enterprises making e-sales are mainly relying on web sales (83 % of enterprises) while the percentage reduces to 63 % for large enterprises that received orders via websites.

E-sales broken down by web and EDI-type sales, by economic activity and size, EU, 2017, (% enterprises with e-sales)



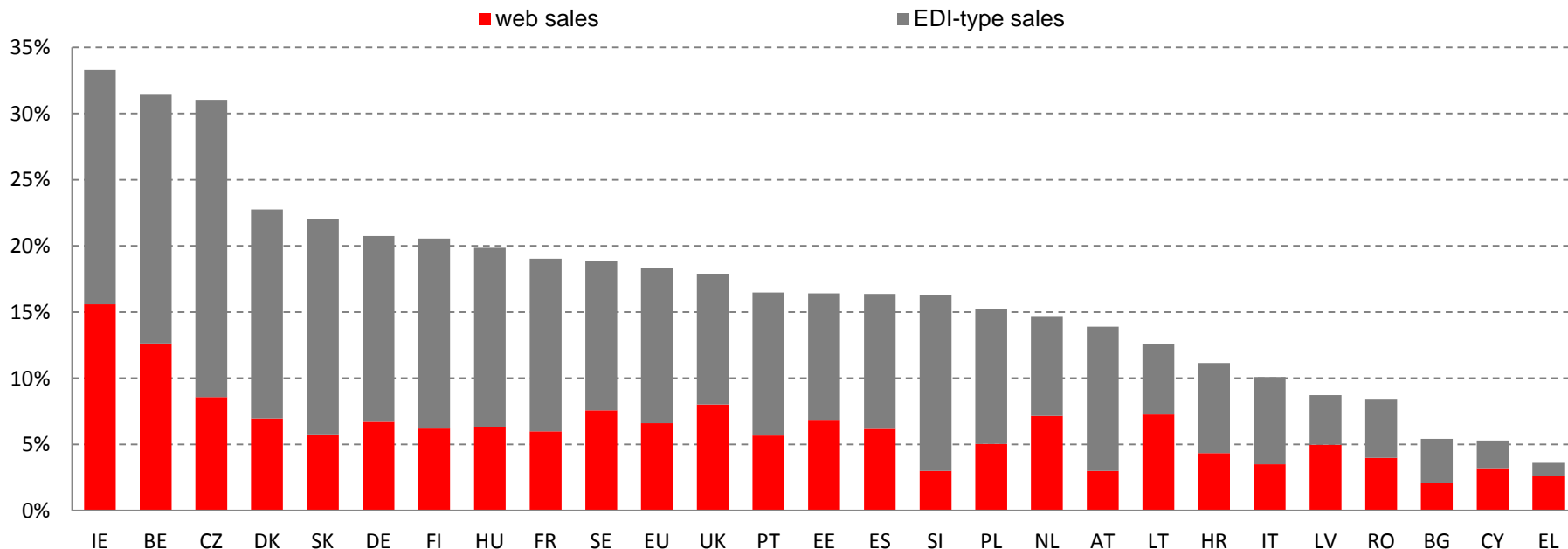
Source: Eurostat

## The share of turnover from EDI-type sales is greater than that from web sales.

Among all Member States, the percentage of turnover from e-sales ranged from 4 % in Greece to 33 % in Ireland. In the EU28, the turnover from EDI-type sales was 12 % of total turnover, while the turnover from web sales was only 7 %. 4 % of this turnover from web sales is mainly generated (4% out of this 7%) by e-sales to other businesses and public authorities (B2BG), while 3 % came from e-sales to private consumers (B2C).

The share of the total turnover from EDI-type sales as well as that from web sales is very diverse across countries. The share from EDI-type sales ranged from less than 1 % in Greece to 22 % in the Czech Republic while the share of total turnover from web sales ranged from 2 % in Bulgaria to 16 % in Ireland.

Turnover from e-sales broken down by web and EDI-type sales, 2017 (% total turnover)



Source: Eurostat

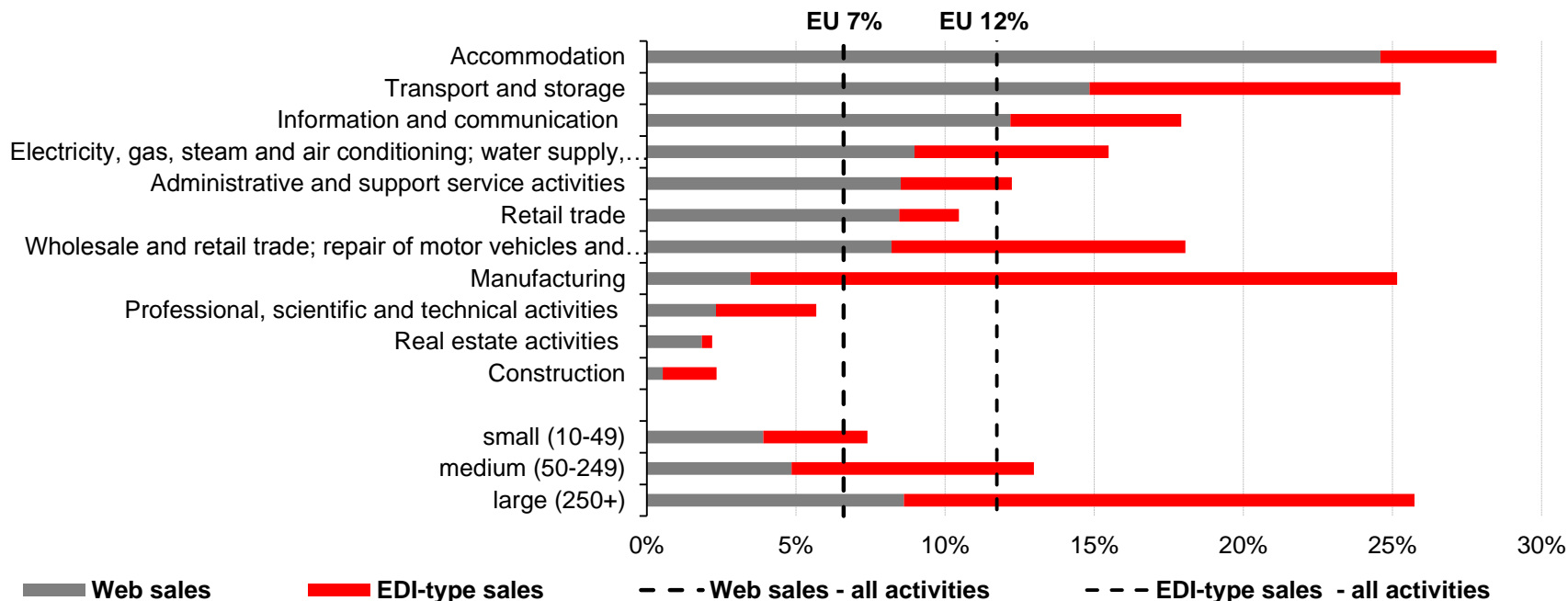
## Large enterprises mainly rely on ICT and standards that integrate EDI-type sales within their business processes.

Large enterprises, with 250 persons employed or more, reported the highest share of turnover from e-sales (26 %), most of it from EDI-type sales (17 %).

As already underlined, small enterprises are lagging behind larger companies in terms of share of turnover from e-sales (7.4 %) which is derived in equal parts from EDI-type sales and web sales.

Businesses in the 'accommodation' sector reported the highest share of total turnover from e-sales (29 %), followed by those in the 'transport and storage' and 'manufacturing' (25 % each). However, businesses in 'accommodation' gained most of their turnover from web sales (25 %), while those in 'manufacturing' gained it from EDI-type sales (22 %). Businesses in 'transport and storage' gained more turnover from web sales (15 %) than from EDI-type sales (10 %).

Turnover from e-sales broken down by web and EDI-type sales, by economic activity and size, EU, 2017, (% total turnover)



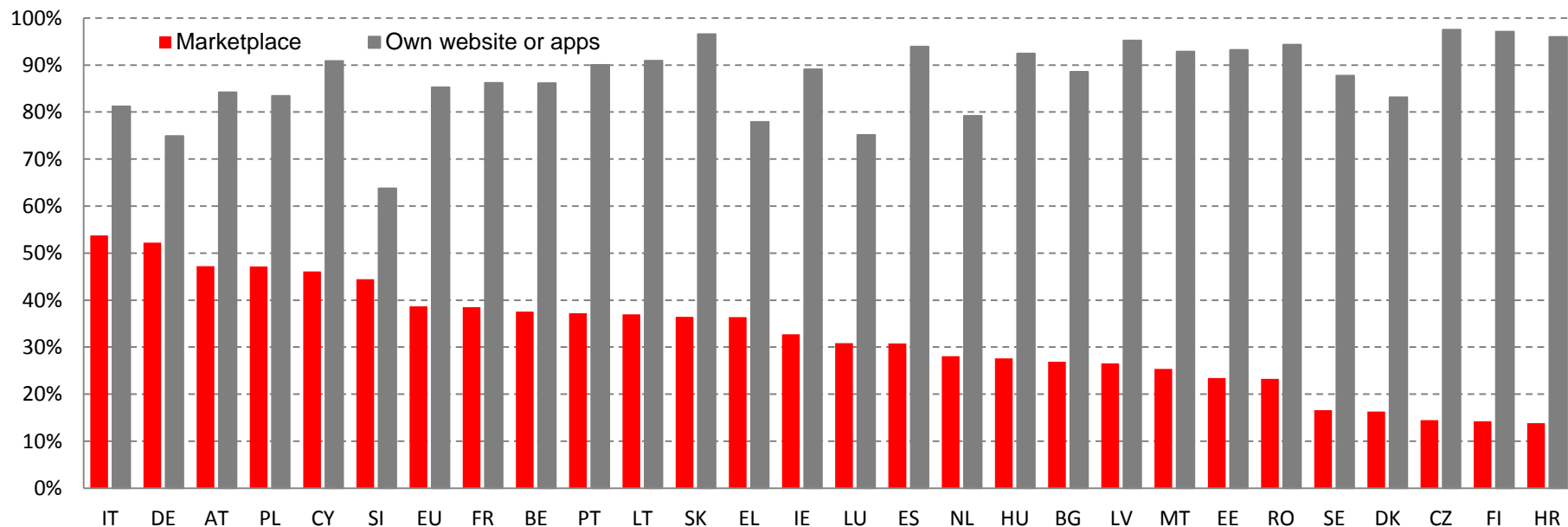
Source: Eurostat

## Businesses are starting to be active on marketplaces

Looking further into web sales, it is of some interest to disentangle web sales made through a marketplace, available on external websites, from those done through company's own website. E-commerce marketplaces and general online platforms may facilitate economic growth by enabling sellers to access new markets and reach new customers at lower cost. This option has been exploited by 39 % of EU level enterprises with web sales (against 85 % of EU enterprises using their own website).

The Czech Republic (98 %), Finland and Slovakia (both 97 %) reported the highest percentages of enterprises with web sales via own sites. The lowest was registered in Slovenia (64 %). At the same time, companies in the Czech Republic, Finland and Croatia have the lowest percentages of web sales via marketplaces (14 % each). Selling online via marketplaces was the most common option in Italy (54 %) and Germany (52 %).

Web sales broken down by own website or apps and marketplace, 2017 (% enterprises with web sales)



Source: Eurostat

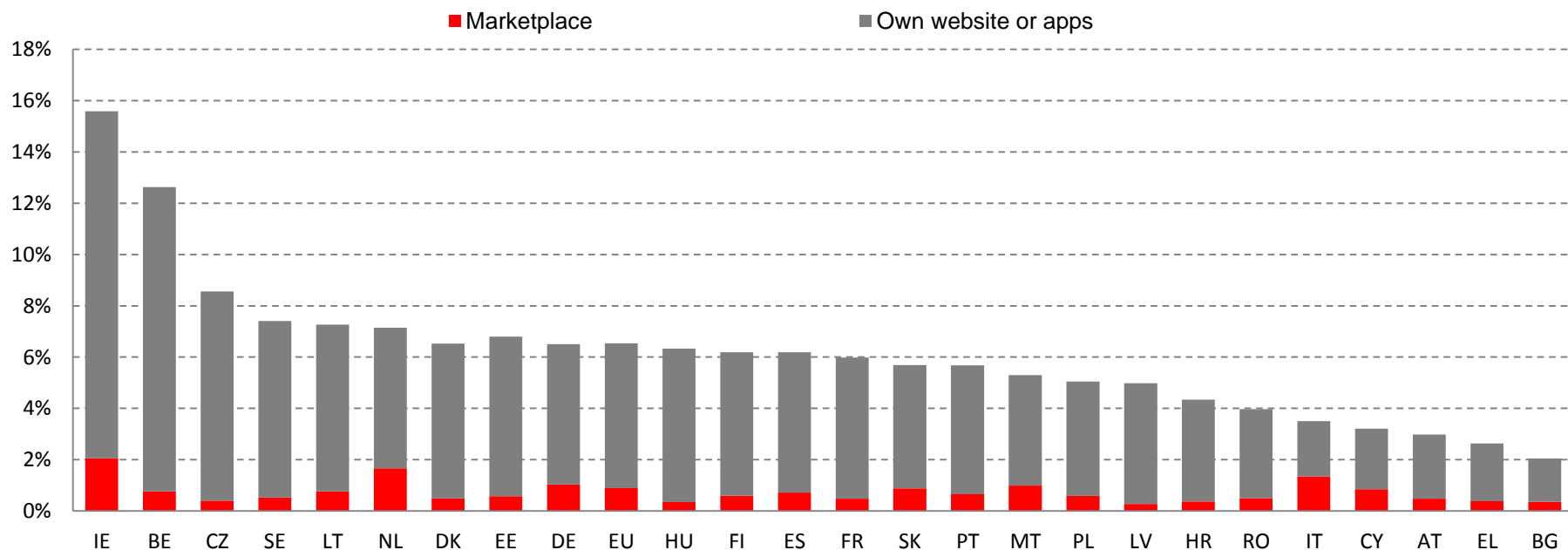
## The share of turnover from web sales via companies' **own website** is greater than that from web sales via **marketplaces**

As already underlined, in the EU-28, companies gained 7 % of their total turnover from web sales. 85 % of it (equal to 6 % of total turnover) was gained from web sales via own website or apps and only 15% (equal to 1 %) from sales via online marketplaces.

The highest share of turnover (over the total turnover of the firm) from selling via the marketplace was gained in Ireland and the Netherlands around 2 %).

When looking at the composition of the turnover, Italian companies gained half of their turnover generated through web sales into marketplaces.

Turnover from web sales broken down by own website or apps and marketplace, 2017 (% total turnover)



Source: Eurostat

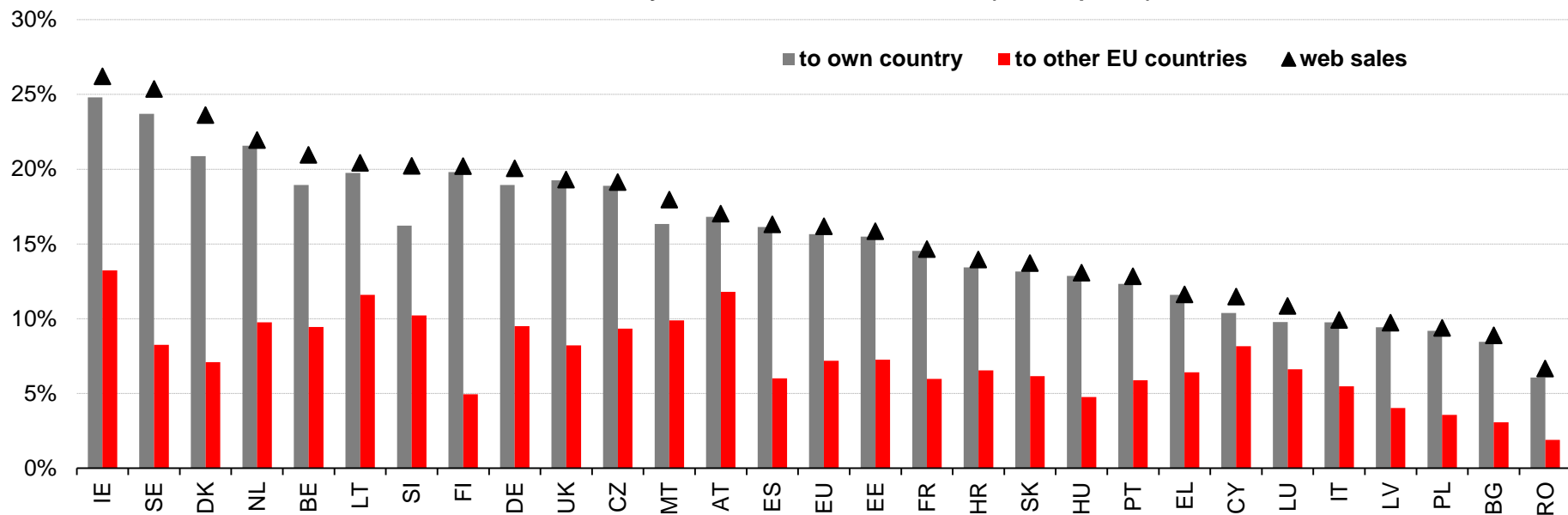


# Companies are not fully exploiting **cross-border e-commerce**

Businesses benefit from cross-border e-commerce by exploiting economies of scale which reduce costs, increase efficiency and promote competitiveness, and by improving total factor productivity. In many cases, without these economies of scale an on-line business may not be viable at all. This could be especially significant for SMEs that remain confined to a small home market with high production costs.

In the EU-28, only 7 % of enterprises made web sales to customers in other EU countries, while almost all enterprises with web sales (16 %) reported that they sold in their own country. The largest proportions of EU companies with web sales to other EU countries were recorded in Ireland (13 %), followed by Austria and Lithuania (both 12 %). Romania (2 %) and Bulgaria (3 %) are the two countries with the lowest share of web sales to customers in other EU countries.

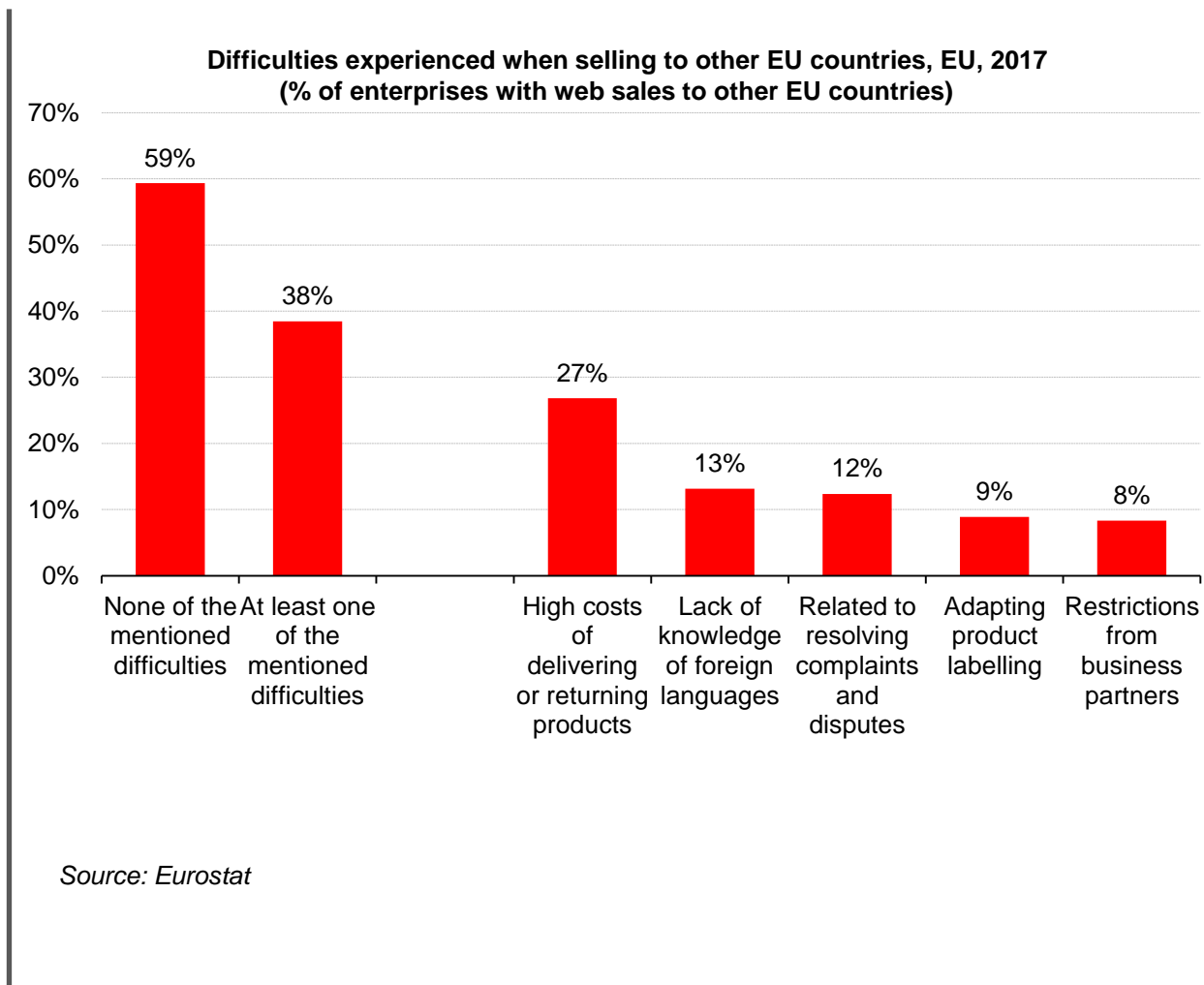
Web sales to own country and other EU countries, 2017 (% enterprises)



Source: Eurostat

## Obstacles to eCommerce with other EU countries

The majority (59 %) of EU companies that received orders via a website or via apps had no difficulties when selling to customers in other EU Member States. However, almost 4 in 10 (38 %) reported obstacles that were mainly related to economic factors, such as the high costs of delivering or returning products (27 %). Other aspects such as linguistic and judicial reasons were also significant. The lack of knowledge of foreign languages and problems related to resolving complaints and disputes were also highlighted, respectively, by 13% and 12% of the enterprises selling online to other EU countries.





# Digital Public Services

Digital Economy and Society Index Report 2018  
Digital Public Services

**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.

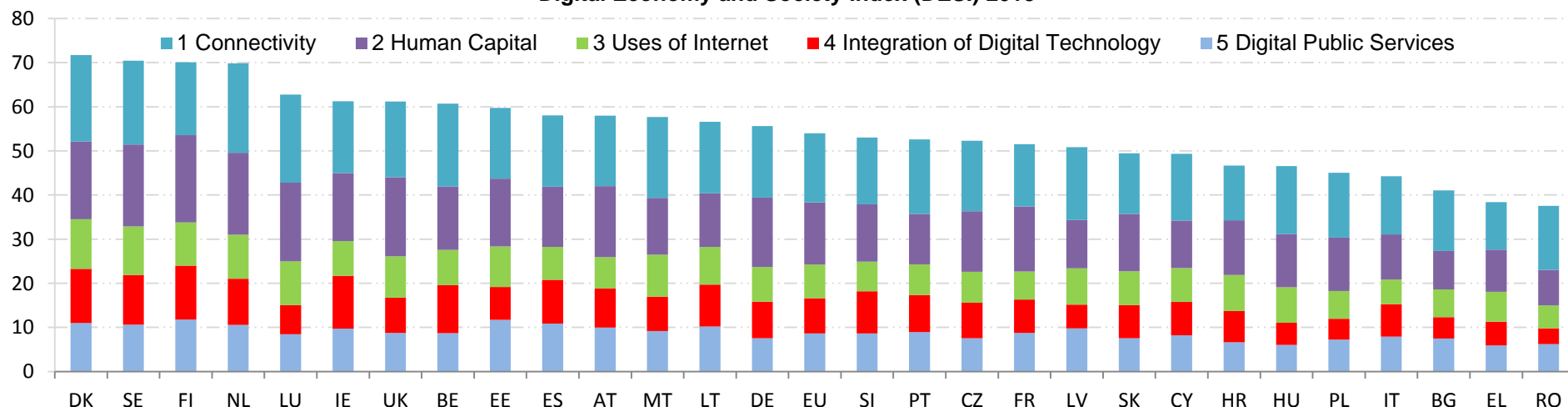
Denmark, Sweden, Finland and the Netherlands have the most advanced digital economies in the EU followed by Luxembourg, Estonia, the UK and Ireland.

Romania, Greece, Bulgaria and Italy have the lowest scores on the index.

### The five dimensions of the DESI

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

**Digital Economy and Society Index (DESI) 2018**



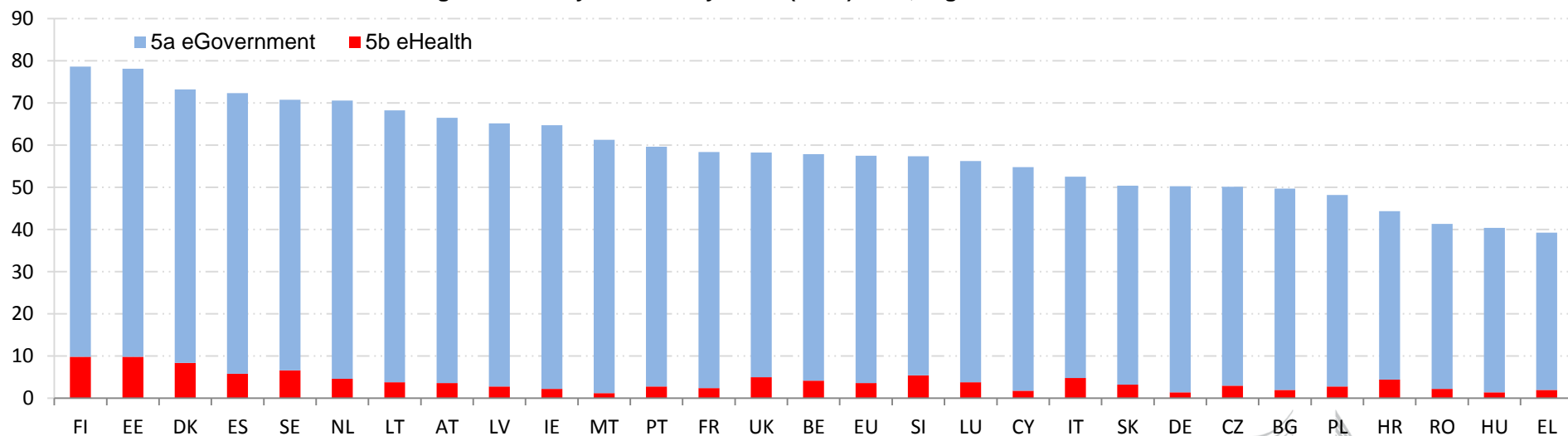
# In digital public services, Finland has the highest score, followed by Estonia, Denmark and Spain. Greece, Hungary and Romania have the lowest scores.

The digital public services dimension consists of six indicators: the eGovernment users measured as a percentage of those internet users who need to submit forms to the public administration (the **eGovernment users** indicator); the extent to which data that is already known to the public administration is pre-filled in forms presented to the user (the **pre-filled forms** indicator); the extent to which the various steps in dealing with the public administration can be performed completely online (the **online service completion** indicator); the degree to which public services for businesses are interoperable and cross-border (the **digital public services for businesses** indicator); the government's commitment to open data (the **open data** indicator); and the percentage of people who used health and care services provided online without having to go to a hospital or doctors surgery (the **eHealth services** indicator).

## Digital Public Services Indicators in DESI 2018

Indicator	EU 28 value
<b>5a1 eGovernment Users</b> % internet users needing to submit forms	<b>58%</b> 2017
<b>5a2 Pre-filled Forms</b> Score (0 to 100)	<b>53</b> 2017
<b>5a3 Online Service Completion</b> Score (0 to 100)	<b>84</b> 2017
<b>5a4 Digital Public Services for Businesses</b> Score (0 to 100) - including domestic and cross-border	<b>83</b> 2017
<b>5a5 Open Data</b> % of maximum score	<b>73%</b> 2017
<b>5b1 eHealth Services</b> % individuals	<b>18%</b>

Digital Economy and Society Index (DESI) 2018, Digital Public Services

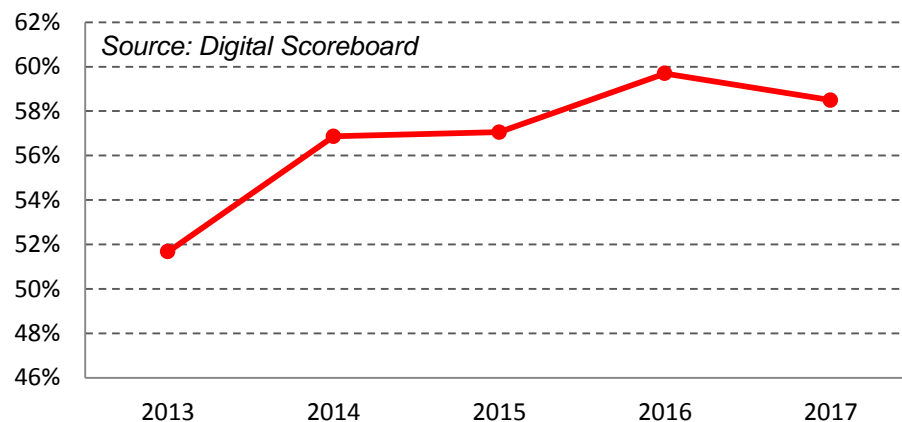


## eGovernment Users: 58% of EU citizens who need public services choose to go online.

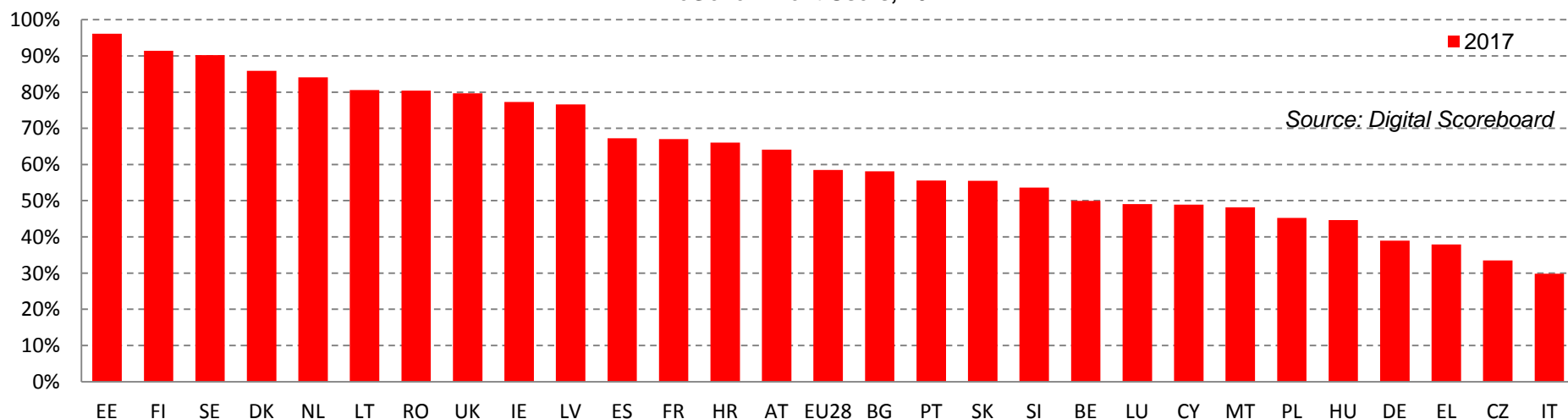
The extent to which e-services reduce the time spend in public administrations **encourage citizens to use them**. Indicatively, Estonia, Finland, Sweden, Denmark, the Netherlands and Lithuania are performing very well, with more than 80% of internet users who need to submit forms to the public administration choosing governmental portals. 14 Member States are above the EU average (58.5%), while Italy, the Czech Republic, Greece and Germany perform below 40%.

Compared to recent years, the upward trend from 2015 to 2017 **stopped in 2017** with a fall of 1 percentage point.

eGovernment Users 2013-2017

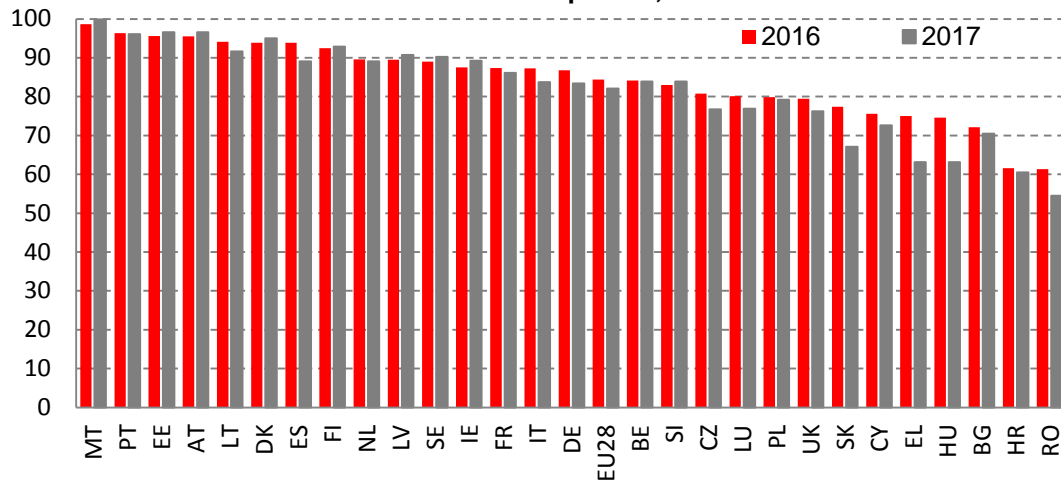


eGovernment Users, 2017



## The provision of government services online is progressing, especially in Member States that are lagging behind.

Online Service Completion, 2016-2017



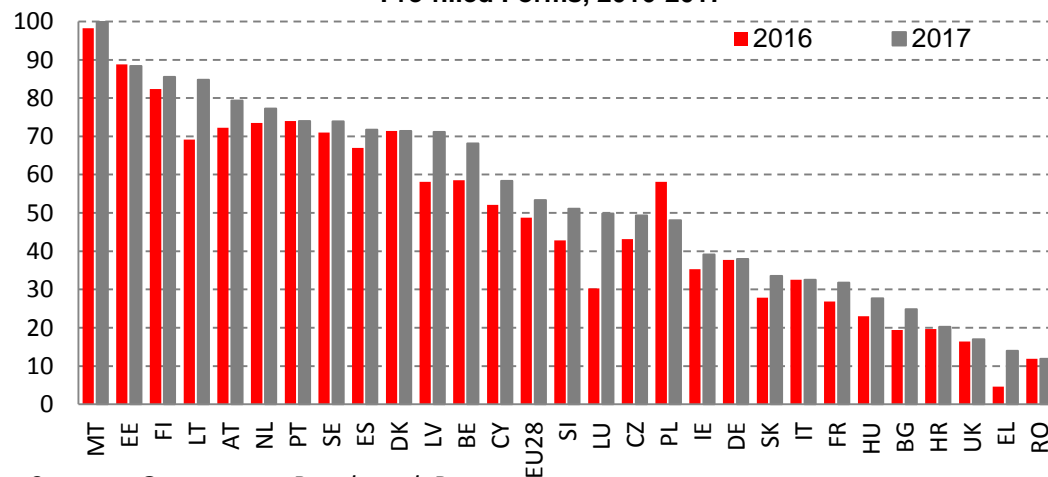
Online service completion refers to the share of administrative steps related to major life events (birth of a child, new residence, etc.) that can be done online.

The countries that perform the best are Malta, Portugal, Estonia, Austria, Lithuania, Denmark, Spain and Finland with over 90 points (out of 100). However, Romania, Croatia, Bulgaria and Hungary have low scores.

Source: eGovernment Benchmark Report

The use of inter-connected registers so users can avoid having to re-submit data is not yet widespread. Pre-filled forms are available, but in the majority of Member States, the amount of data available in public services' online forms is not satisfactory. Member States are working towards improving the provision of pre-filled forms, noting a small increase compared to 2016, with Malta, Estonia, Finland and Latvia leading.

Pre-filled Forms, 2016-2017



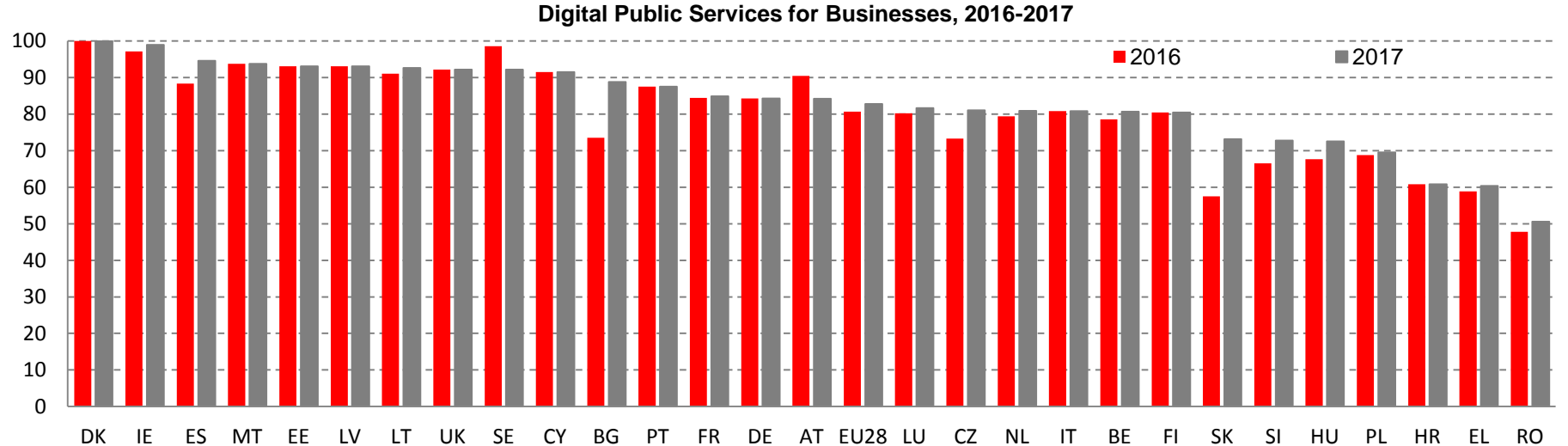
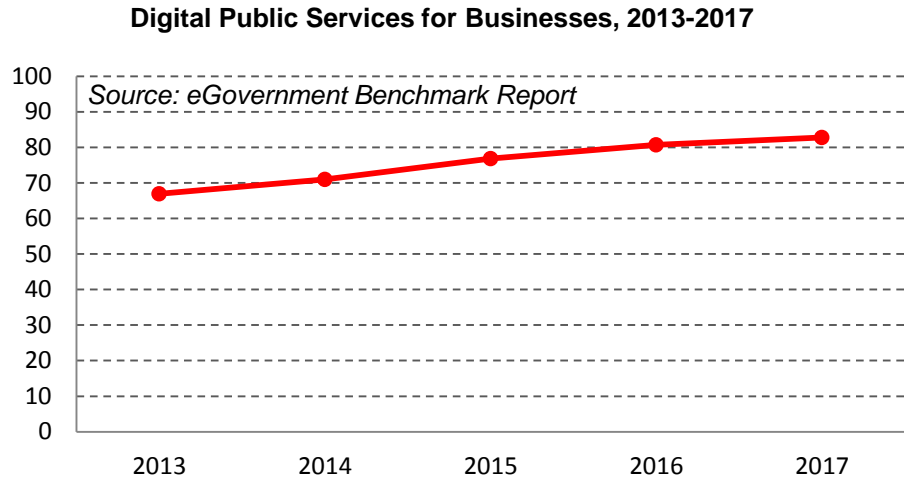
Source: eGovernment Benchmark Report

# The provision of digital public services for businesses is progressively improving.

The indicator broadly reflects the share of public services needed for starting a business and for conducting regular business operations that are available online for domestic as well as for foreign users. Services provided through a portal receive a higher score, while services which provide only information (but have to be completed offline) receive a lower score.

10 Member States (Denmark, Ireland, Spain, Malta, Estonia, Latvia, Lithuania, the United Kingdom, Sweden and Cyprus) score more than 90 points (out of 100), while the EU average is 82. On the other hand, Croatia, Greece and Romania underperform.

Indicatively, the progress recorded in the period 2013-2017 is 23,5%.



Source: eGovernment Benchmark Report



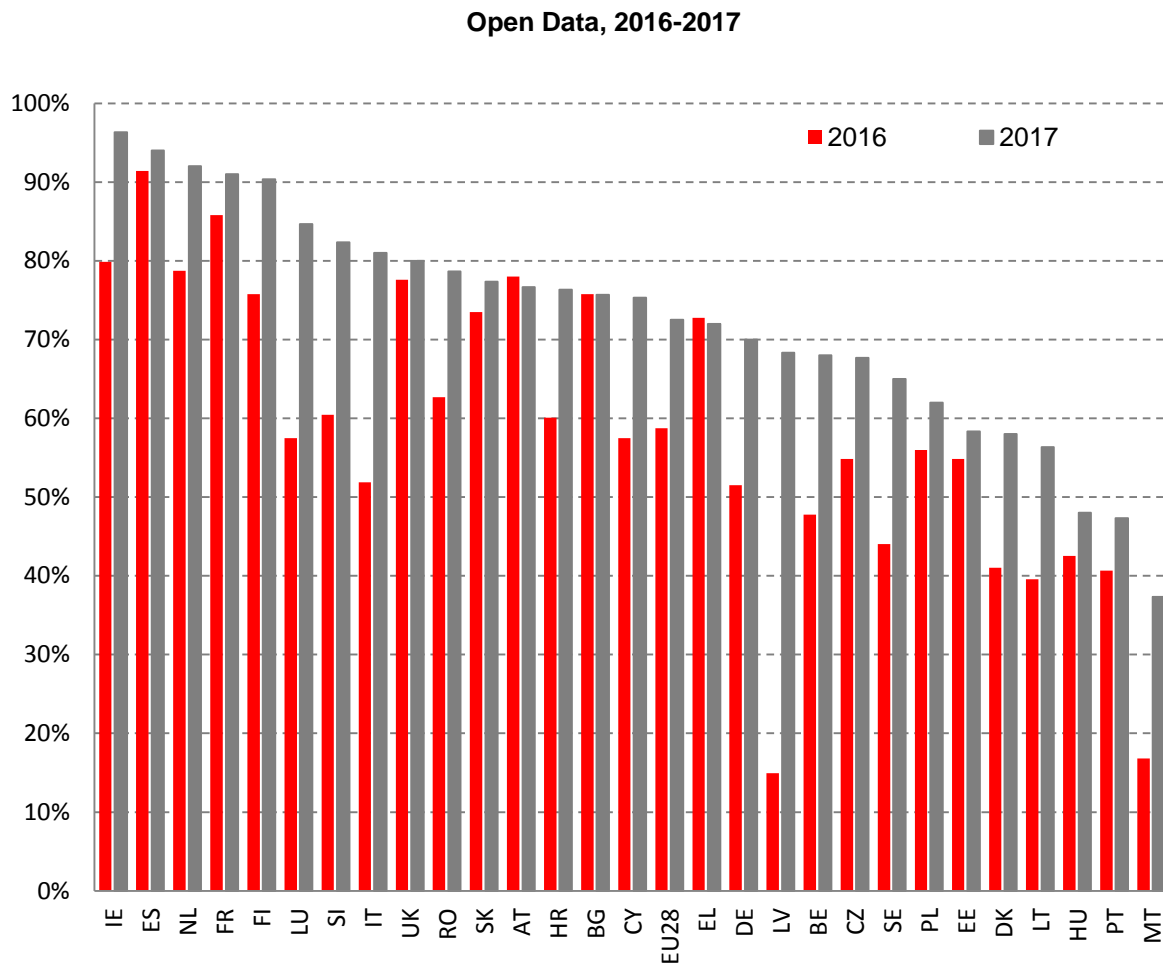
## Open data: More and more Member States make data available for reuse and analysis

The level of maturity of open data is based on two indicators:

- **Open data readiness:** this assesses to what extent countries have an open data policy in place, licensing norms, and the extent of national coordination regarding guidelines and setting common approaches.
- **Portal maturity:** assesses the portal's usability regarding the availability of functionalities, the overall re-usability of data such as machine readability and accessibility of datasets, as well as the spread of data across domains.

All Member States have improved their score, with Ireland, Spain, the Netherlands, France and Finland exceeding 90% on the index.

Latvia and Malta showed the most significant progress. In 2017, Latvia progressed by 350% and Malta by 120% compared to 2016.



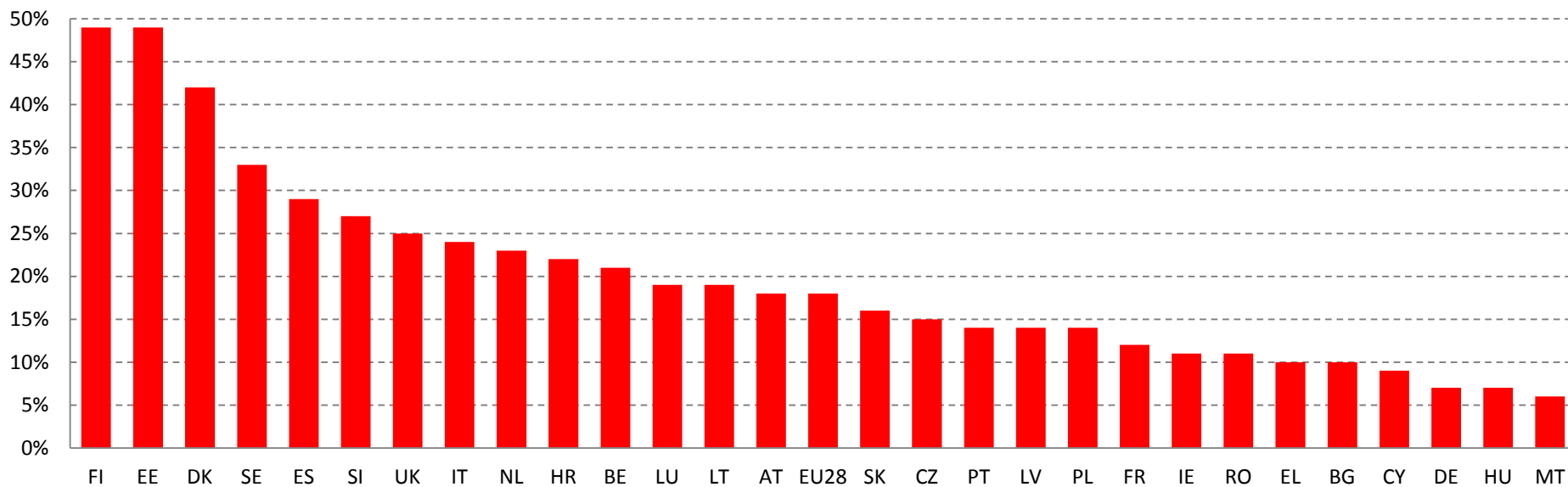
Source: European Data Portal

## eHealth services: Less than one in five EU citizens have used health and care services provided online.

In the last 12 months, only 18 % (EU average) of EU citizens have used health and care services provided online without having to go to a hospital or a doctors surgery (for example, by getting a prescription or a consultation online). Almost 50 % of Finnish and Estonian citizens use eHealth services, while in Denmark the percentage is slightly lower (42 %).

According to Eurobarometer, 52 % of all citizens would like online access to their medical and health records. EU citizens are much more willing to share data on their health and wellbeing with doctors and healthcare professionals (65 %) than with companies (14 %) or with public authorities even if anonymised and for research purposes (21 %).

eHealth Services, 2017



Source: Eurobarometer, Special Eurobarometer 460: Attitudes towards the impact of digitisation and automation on daily life, 2017



# The EU ICT Sector and its R&D Performance

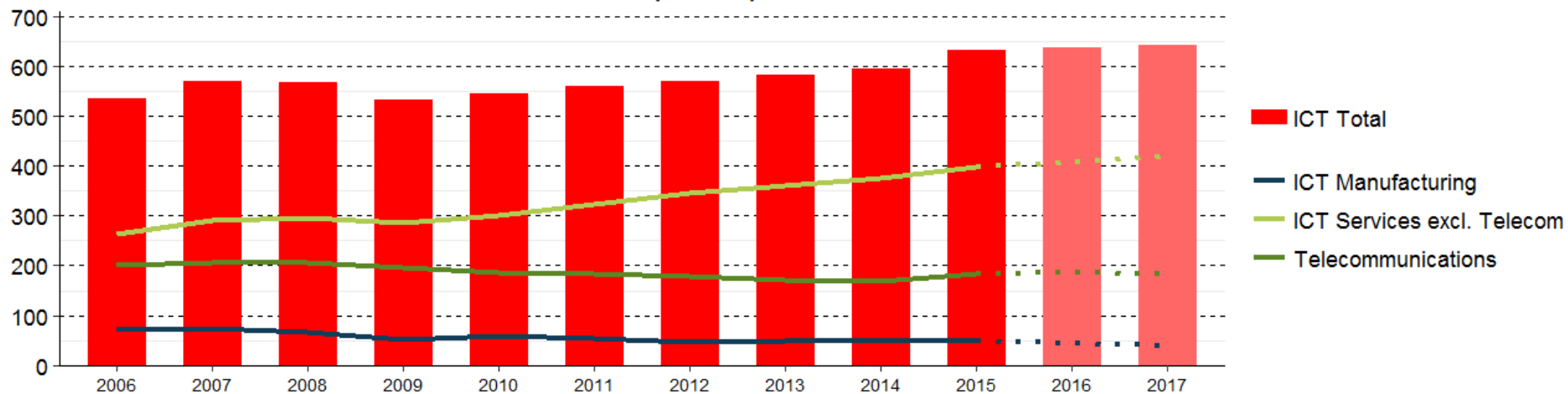
Digital Economy and Society Index Report 2018  
The EU ICT sector and its R&D performance

The ICT sector **value added** amounted to EUR 632 billion in 2015. ICT services represented 92 % of total ICT sector **value added**. ICT services (excluding telecoms) were the dominant sector and the only one to be expanding.

The EU ICT sector value added amounted to EUR 632 billion in 2015, having recovered after a slowdown in 2009. A breakdown by sub-sector shows the predominance of ICT services (EUR 582 billion and 92 % of total ICT sector value added in 2015) over ICT manufacturing industries (EUR 50 billion and 8 % of total ICT sector value added in 2015).

The ICT services sector (excluding telecommunications) is the only one that saw an increase in value added over the medium-term period (2006-2015) up to EUR 398 billion. Over the same period, the communication equipment sector experienced the sharpest decline: after peaking at EUR 32 billion in 2007, it fell to EUR 13 billion in 2015 (historical low over the considered period).

**ICT sector Value Added in the EU  
2006-2017 (bn EUR)**



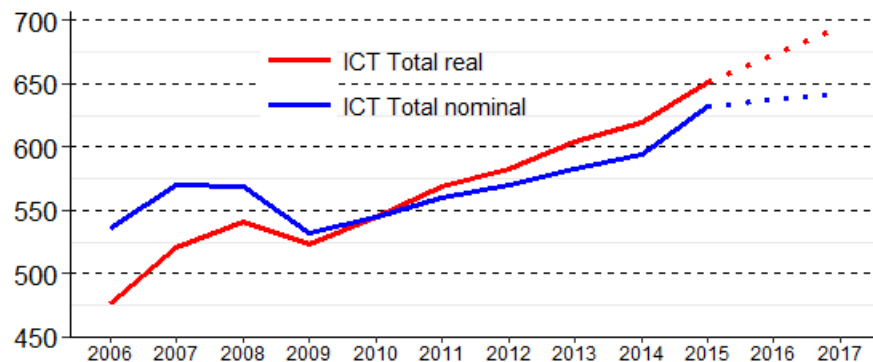
Note: Values for the years 2016 and 2017 are nowcasted data.

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

The **value added** of the ICT sector grew much faster than the rest of the economy in real terms. At global level, the share of the ICT sector **value added** in EU's GDP is lagging behind the main competitors (Japan, United States, China).

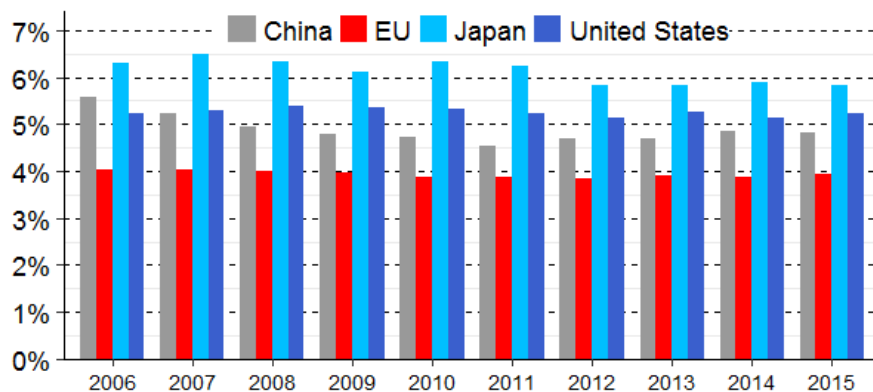
Although the value added of the ICT sector increased by 18 % in nominal terms (in line with GDP: + 21 %), it increased by 37 % in real terms over the period 2006-2015 (well above of the GDP: + 7 %).

**ICT sector Value Added in the EU, nominal and deflated 2006-2017 (bn EUR)**



Note: Values for the years 2016 and 2017 are nowcasted data.

**ICT sector share of GDP Worldwide comparisons, 2006-2015**



Value added in the ICT sector accounted for 4.3 % of EU GDP in 2015 (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 (5.8 %), the US (5.2 %), and China (4.8 %) in 2015.

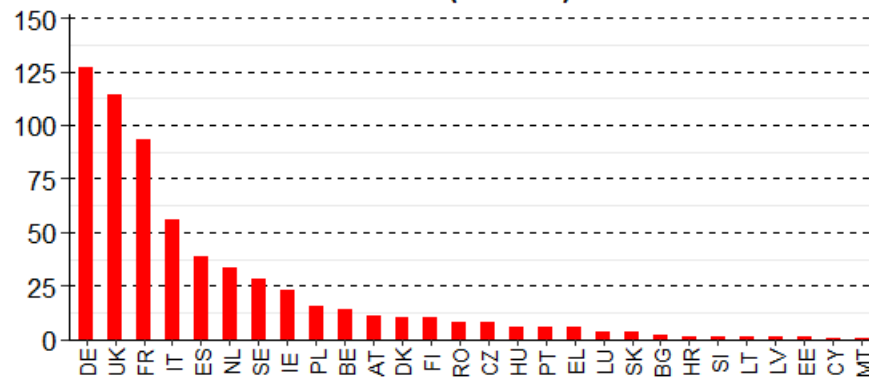
\* See methodological note.

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

The EU's five largest economies (Germany, the United Kingdom, France, Italy, and Spain) were the five biggest contributors to ICT sector value added in 2015. However, Ireland, a medium-sized country, has by far the highest ICT sector share of GDP (11.6 % in 2014, latest data available).

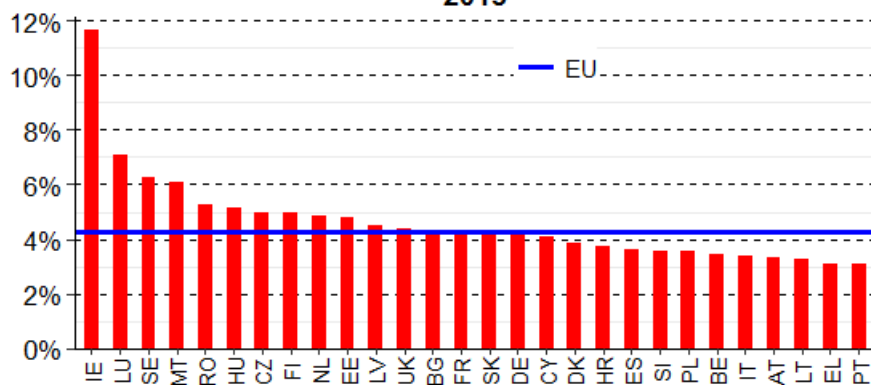
Unsurprisingly, the EU's five largest economies were also the five biggest contributors to ICT sector value added in 2015: Germany (EUR 127 billion or 20 %), the United Kingdom (EUR 115 billion or 18 %), France (EUR 94 billion or 15 %), Italy (EUR 56 billion or 9 %), and Spain (EUR 39 billion or 6 %). Together, these five countries represented 68 % of total EU ICT sector value added in 2015.

Value Added in the ICT sector in the EU 2015 (bn EUR)



Note: Data for Ireland refers to 2014.

ICT sector share of GDP in the EU 2015



Note: Data for Ireland refers to 2014.

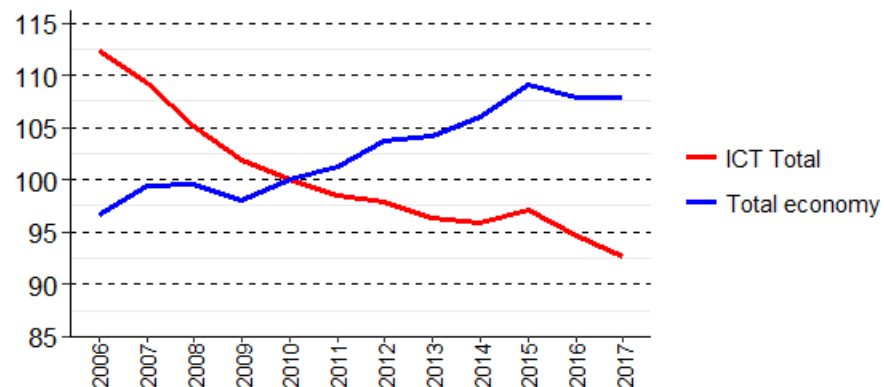
Ireland had by far the highest ICT sector share of GDP, with a rate of 11.6 % in 2014 (latest data available), while Portugal and Greece were lagging behind with a mere 3.1 %. After Ireland, countries with the highest share of ICT sector included Luxembourg (7.1 %) and Sweden (6.3 %). Some eastern Member States (Romania, Hungary, and the Czech Republic) also had a high rate (5 % or higher) of ICT sector as a share of GDP. In most other Member States, ICT sector remained broadly stable as a proportion of GDP over the medium-term period (2006-2015), except in Ireland where the rate increased by 3.7 pps and in Finland where the rate fell by 3.3 pps.

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

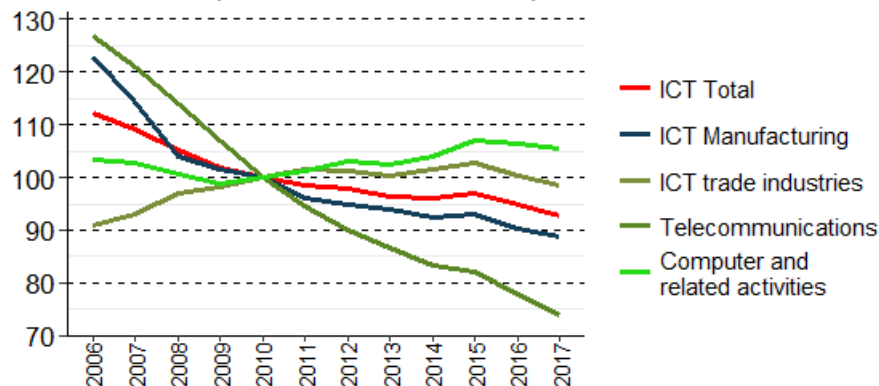
Unlike the general economy, the ICT sector saw a drop in **prices** over the medium term. The telecommunications sub-sector experienced the largest decline.

Prices in the ICT sector fell by 14 % over the medium term (2006-2015), while the general price level increased by 13 % over the same period. This highlights the particular nature of the prices of products in the ICT sector.

**Price Index, ICT sector and GDP  
2006-2017 (Index base 2010 = 100)**



**Price Index, ICT by subsector  
2006-2017 (Index base 2010 = 100)**



However, an analysis by sector shows a contrasting situation: while some sectors experienced a dramatic drop in prices (telecommunications: - 35 %, ICT manufacturing industries: - 24 %), other sectors saw a moderate increase (the ICT trade industry: + 13 %) or even a stagnation (computers and related activities: + 4 %) over the medium term (2006-2015). In addition, prices in the ICT sector stabilised somewhat towards the end of the period (2013-2015), which may indicate a form of normalisation.

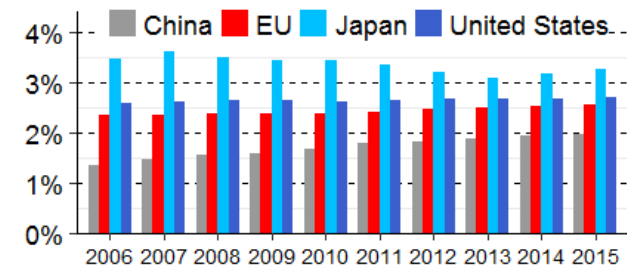
Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

The ICT sector **employed 6.4 m people in 2015**. The **main employer** was the ICT services sector (excluding telecommunications) with 4.7 m people in 2015. The share of **employment** in the ICT sector relative to total employment was **2.8 % in Europe in 2015**.

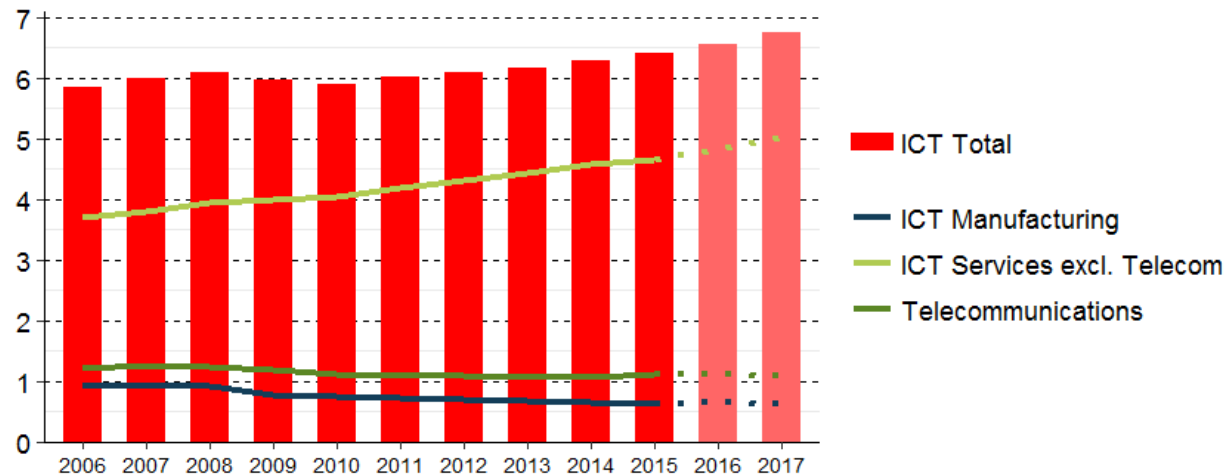
The ICT sector employed 6.4 million people in 2015, the highest in the observed period. The ICT services sector (excluding telecommunications) employed 4.7 million people and accounted for 73 % of total ICT employment in 2015. It is the only sector that recorded a structural increase (of 26 %) over the medium-term period (2006-2015). The telecommunications sector employed 1.1 million people in 2015, a number which fell over the medium-term period by 9 %. The ICT manufacturing industries sector (excluding communication equipment) employed 477 000 people in 2015, a drop of 26 % since 2006. The communication equipment sector recorded the sharpest structural decline in 2015, falling to 160 000 people (- 43 %).

Employment in the ICT sector represented 2.8 % of EU total employment in 2015 (comprehensive definition), having remained stable over the medium-term period. According to the operational definition which enables world comparisons, as with the US (2.7 %), the EU (2.5 %) fared better than China (2.0 %), but all three lagged markedly behind Japan (3.2 %) in 2015.

**ICT sector share of Total Employment Worldwide comparisons, 2006-2015**



**ICT sector Employment in the EU 2006-2017 (million persons)**



Note: Values for the years 2016 and 2017 are nowcasted data.

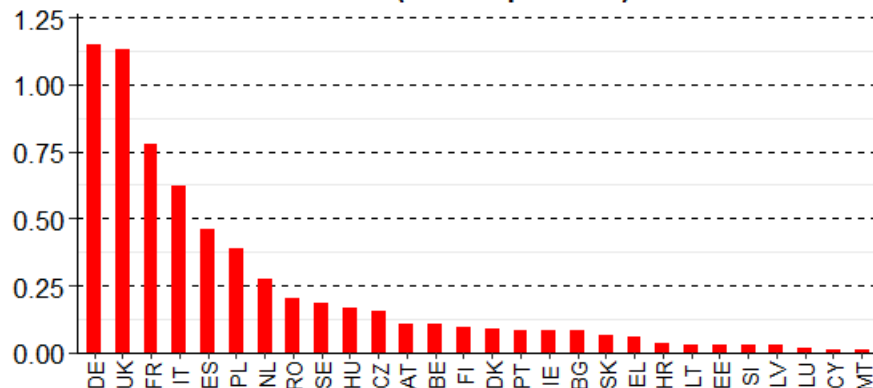
Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project



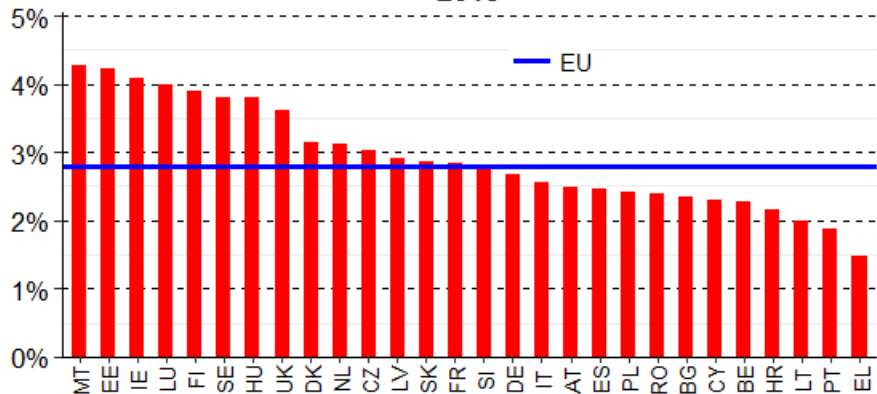
The EU's five largest economies (Germany, the United Kingdom, France, Italy, and Spain) were the five biggest **employers** in the EU's ICT sector in 2015. However, small countries like Malta and Estonia had the highest rate of ICT sector **employment** as a share of **total employment** in 2015.

As in the case of value added, the EU's five largest economies were also the five largest employers in the EU's ICT sector in 2015: Germany (over 1.2 million people or 18 %), the United Kingdom (1.1 million people or 18 %), France (777 000 people or 12 %), Italy (624 000 people or 10 %), and Spain (458 000 people or 7 %). Together, the five largest employers represented 65 % of total ICT sector employment in 2015.

Employment in the ICT sector in the EU  
2015 (million persons)



ICT sector share of Total Employment in the EU  
2015



Malta was in pole position with 4.3 % of ICT sector employment as a share of total employment in 2015, and Greece had the lowest rate of only 1.5 %. Other countries that were performing well in 2015 included Estonia (4.2 %) and Ireland (4.1 %). Luxembourg, Sweden, and Finland followed closely behind with rates just below 4 %. Over the medium-term period (2006-2015), the share of ICT sector employment as a proportion of total employment remained stable in most countries, but small countries like Estonia and Latvia made significant progress, increasing by more than 1 pp.

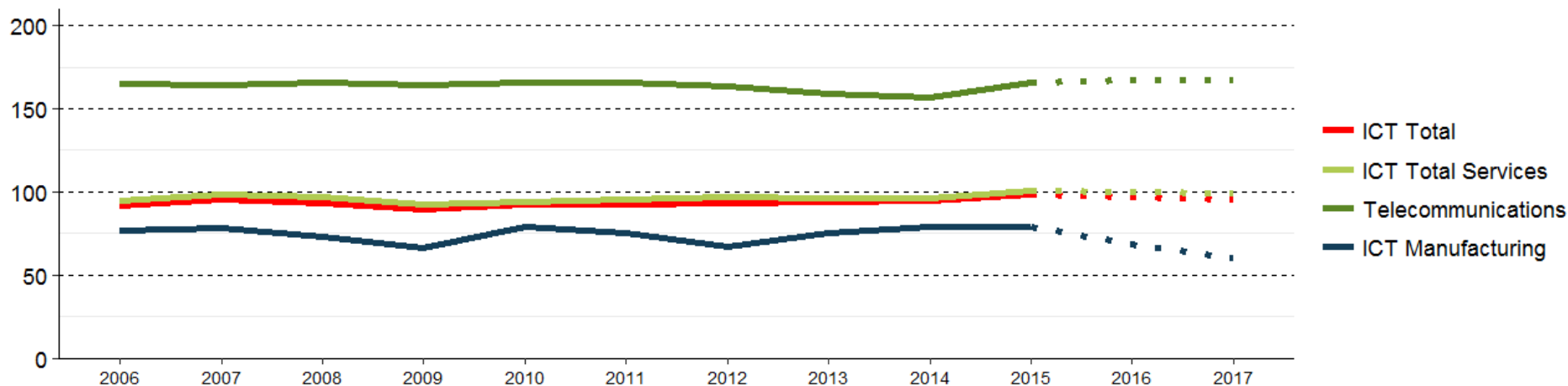
Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

**Productivity** in the ICT sector amounted to EUR 99 000 per person in 2015. **Productivity** in the telecommunications sector is by far the highest.

Productivity in the ICT sector (comprehensive definition) amounted to EUR 99 000 per person in 2015, remaining broadly stable over the medium-term period (2006-2015). In the ICT manufacturing sector, productivity was below average (EUR 79 000 per person in 2015); 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 ICT manufacturing sector, productivity in the ICT services sector as a whole (i.e. services and trade), which stood at EUR 101 000 per person in 2015, is not sensitive to business cycles. Productivity in the telecommunications sector is by far the highest (at EUR 166 000 per person in 2015).

**ICT sector Labour Productivity in the EU  
2006-2015 (thousand EUR per person)**



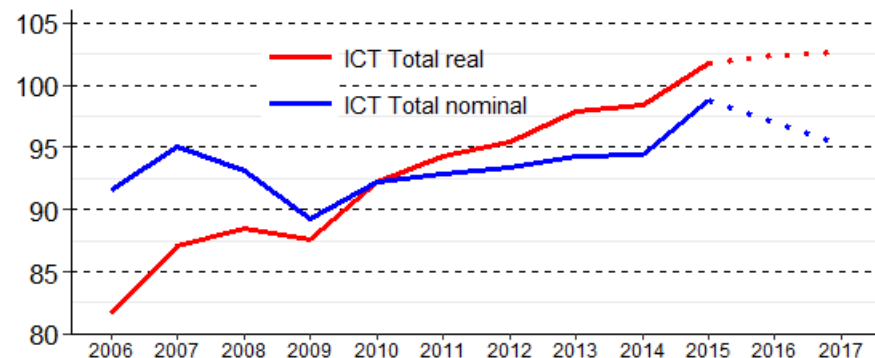
Note: Values for the years 2016 and 2017 are nowcasted data.

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

The ICT sector had a higher **productivity** (in nominal terms) and was growing faster (in real terms) over the period 2006-2015. At global level, as regards **productivity** in the ICT sector, the EU compares with Japan but lagged markedly behind the US.

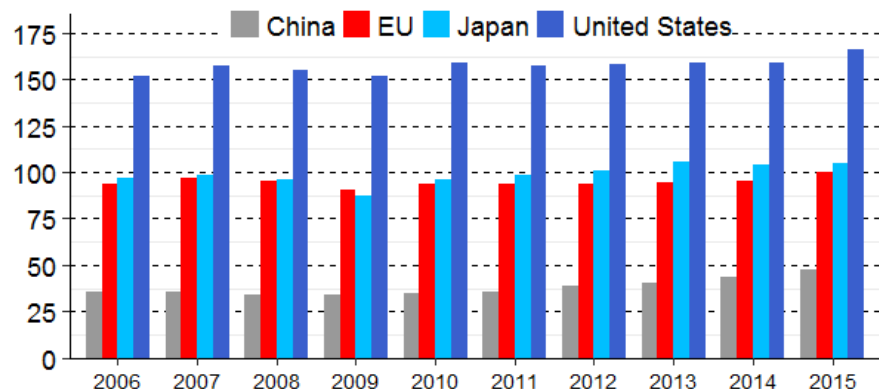
While the productivity of the ICT sector seemed to grow at a higher level than the rest of the economy (EUR 99 000 per person vs. EUR 65 000 per person in 2015) but less quickly in nominal terms (+ 8 % vs. + 18 % over the period 2006-2015), the growth was faster for the ICT sector than for the general economy in real terms (+ 25 % vs. + 5 % over the period 2006-2015).

ICT sector Labour Productivity in the EU, nominal and defl 2006-2017 (thousand EUR per person)



Note: Values for the years 2016 and 2017 are nowcasted data.

ICT sector Labour Productivity Worldwide comparisons, 2006-2015 (1000 EUR PPS per person)



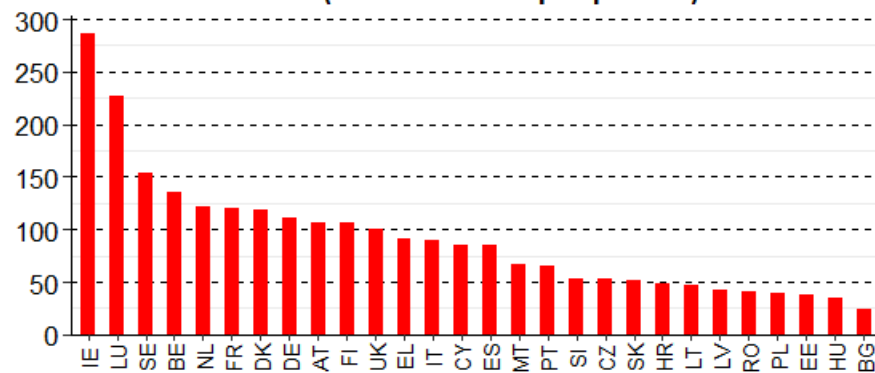
Regarding the productivity of the ICT sector (according to the operational definition which enables world comparisons), the EU (EUR purchasing power standard 100 000 per person) is markedly behind the US (EUR purchasing power standard 166 000 per person), in line with Japan (EUR purchasing power standard 105 000 per person), but far higher than China (EUR purchasing power standard 47 000 per person), which in this respect is still an emerging country.

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

As for **labour productivity**, the highest score was registered by Ireland followed by Luxembourg, Sweden and Belgium. Bulgaria, Hungary, and Estonia had the weakest performance.

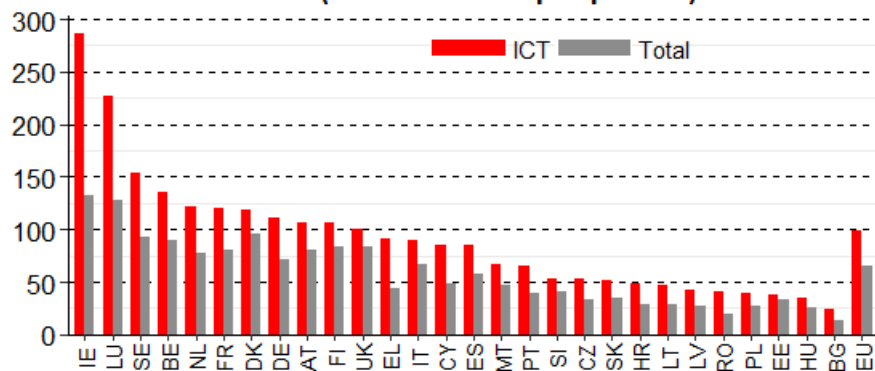
In terms of labour productivity in the ICT sector, Ireland (EUR 286 000 per person) by far led the way in 2014 (latest data available), but Luxembourg (EUR 227 000 per person) and Sweden (EUR 154 000 per person) also fared well in 2015. At the opposite end of the scale were Bulgaria (EUR 24 000 per person), Hungary (EUR 35 000 per person), and Estonia (EUR 37 000 per person).

**Productivity in the ICT sector in the EU  
2015 (thousand EUR per person)**



Note: Data for Ireland refers to 2014.

**Productivity - ICT sector and Total in the EU  
2015 (thousand EUR per person)**



Note: Data for Ireland refers to 2014.

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

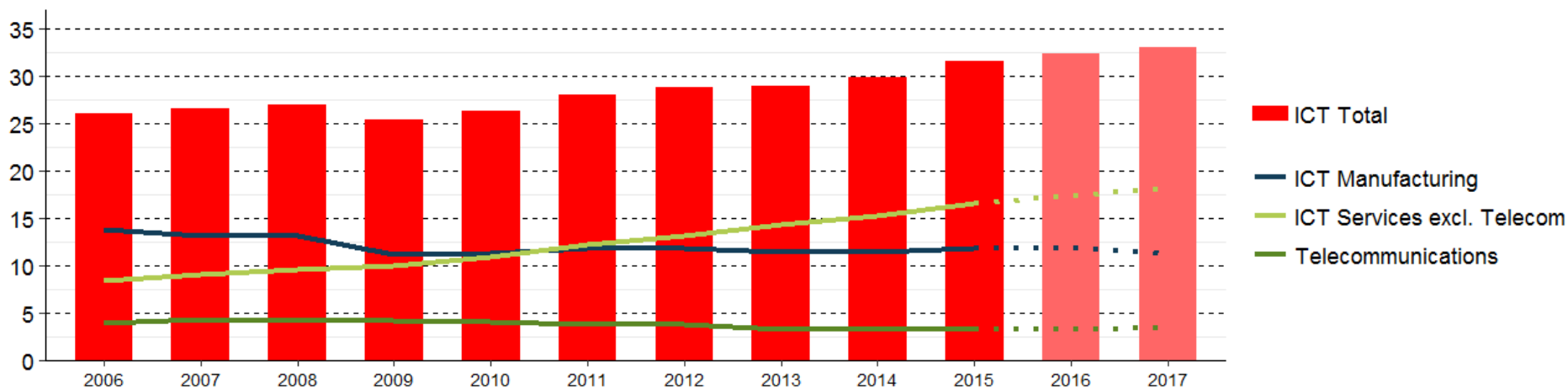
The picture for labour productivity in the economy as a whole was broadly similar. Ireland (EUR 132 000 per person) and Luxembourg (EUR 128 000 per person) were the best-performing countries, while Bulgaria (EUR 13 000 per person) and Romania (EUR 19 000 per person) were at the bottom of the table.

**R&D expenditure by business companies (BERD) in the ICT sector amounted to EUR 32 billion in 2015. The ICT services sector was responsible for 63 % (EUR 20 billion) of ICT BERD in 2015.**

R&D expenditure by business companies (BERD) in the ICT sector amounted to EUR 32 billion in 2015, its highest point over the medium-term period (2006-2015), an improvement on its lowest point of EUR 25 billion in 2009. A breakdown by sub-sector reveals a more balanced situation for BERD than for value added – despite accounting for only 8 % of ICT sector value added, the ICT manufacturing sector was responsible for 37 % of total ICT BERD (EUR 12 billion) while the ICT services sector was responsible for 63 % (EUR 20 billion) of ICT BERD in 2015.

Over the medium-term period (2006-2015), the situation was quite different. The ICT manufacturing sector saw a structural decline (falling by 14 % from 2006 to 2015), whereas the ICT services sector saw a structural increase (rising by 60 % over 2006-2015), particularly in the ICT services sector excluding telecoms, which saw an increase of 95 % from 2006 to 2015.

**ICT sector Business Expenditure in R&D (BERD) in the EU  
2006-2017 (bn EUR)**



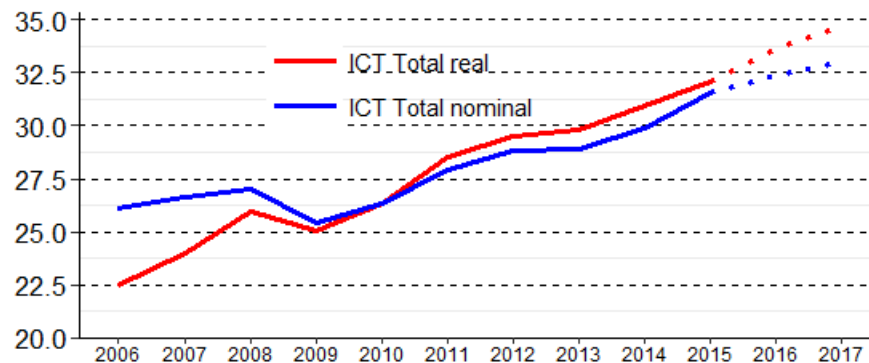
Note: Values for the years 2016 and 2017 are nowcasted data.

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

**R&D expenditure (in real terms) by business companies in the ICT sector grew faster than in the general economy. ICT R&D intensity amounted to 5 % in 2015 in the EU, markedly behind the US and Japan. It remained stable around 4.9 % over the period 2006-2015.**

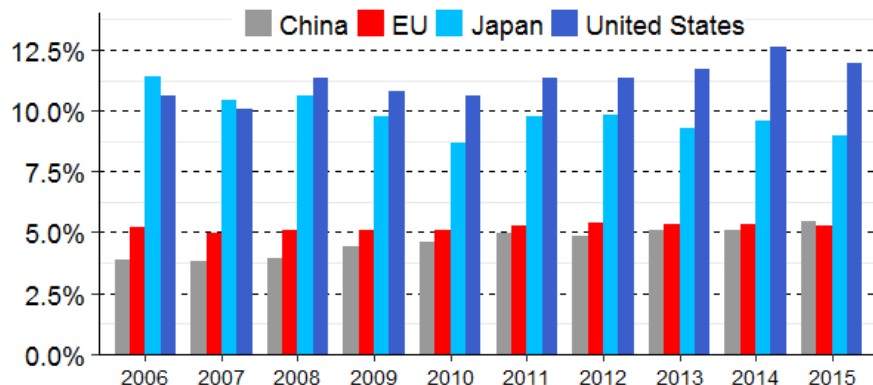
In real terms, R&D expenditure by business companies in the ICT sector grew faster than in the general economy (+ 42 % vs. + 25 % over the period 2006-2015).

**ICT sector BERD in the EU, nominal and deflated 2006-2017 (bn EUR)**



Note: Values for the years 2016 and 2017 are nowcasted data.

**ICT sector R&D Intensity (ICT BERD/ICT VA) Worldwide comparisons, 2006-2015**



R&D intensity in the ICT sector (comprehensive definition) amounted to 5.0 % in 2015. It remained stable around 4.9 % over the period 2006-2015. According to the operational definition which enables world comparisons, despite China (5.5 %) slightly surpassing the EU (5.2 %) for the first time, both the EU and China lagged behind the US (12.0 %) and Japan (9.0 %) in 2015.

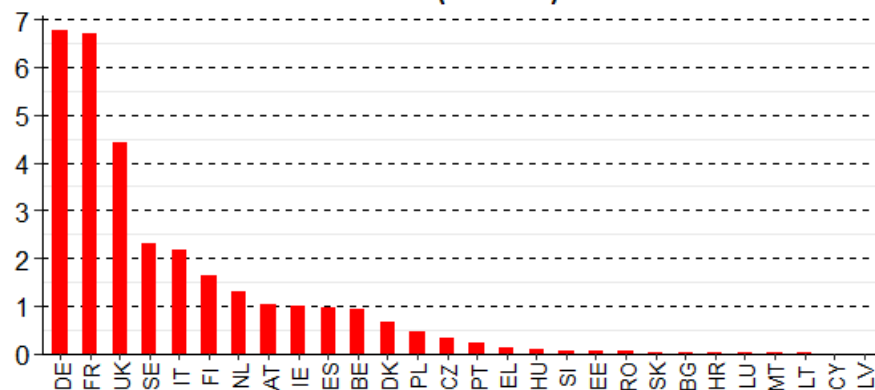
\* See methodological note.

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

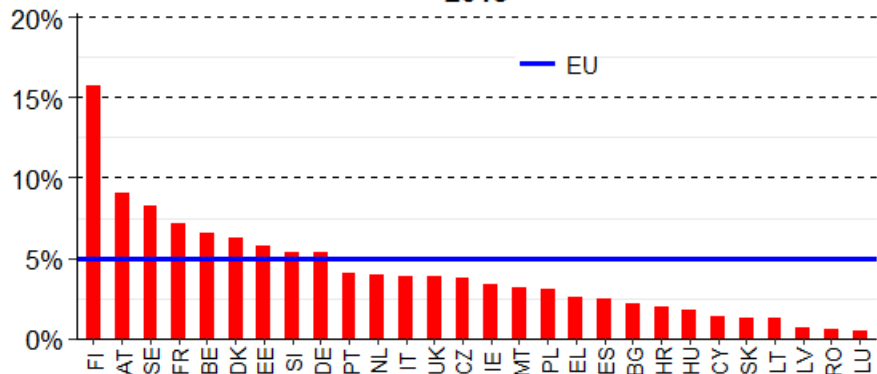
The EU's six main contributors in terms of R&D expenditure by business companies in the ICT sector in 2015 were the EU's four largest economies: Germany, France, the United Kingdom, and Italy, together with two Nordic countries: Sweden and Finland.

The EU's six main contributors in terms of R&D expenditure by business companies in the ICT sector in 2015 were the four largest economies in the EU – Germany (EUR 6.8 billion or 21 %), France (EUR 6.7 billion or 21 %), the United Kingdom (EUR 4.4 billion or 14 %), and Italy (EUR 2.3 billion or 7 %), together with two Nordic countries – Sweden (EUR 2.3 billion or 7 %) and Finland (EUR 1.6 billion or 5 %), confirming the importance of Nordic countries for ICT R&D. Together, the six largest contributors represented 76 % of total ICT Business R&D expenditure in 2015.

R&D expenditure in the ICT sector in the EU 2015 (bn EUR)



ICT sector R&D Intensity (BERD/VA) in the EU 2015



Note: Data for Ireland refers to 2014.

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

Finland was by far leading the way in the EU with a 15.7 % ICT BERD intensity rate in 2015. Of the Nordic countries, Sweden had a rate of 8.2 % and Denmark had a rate of 6.3 %. Other strong performers include Austria (9.0 %), France (7.2 %), and Belgium (6.6 %). Over the medium-term period (2006-2015), ICT R&D intensity remained broadly stable, but some eastern countries (Poland, Slovakia, and Lithuania) made significant progress.



**R&D personnel in the ICT sector** included 303 000 full-time equivalents (FTEs) in 2015. The top employer was the ICT services sector (excluding telecoms), employing 191 000 FTEs in 2015 (63 % of ICT R&D personnel). **R&D personnel in the ICT sector** made up 19 % of total R&D personnel in 2015.

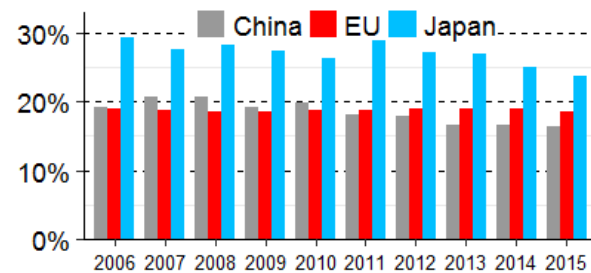
R&D personnel in the ICT sector included 303 000 full-time equivalents (FTEs) in 2015, a figure which rose over the medium-term period (2006-2015), growing faster after 2009. The ICT services sector (excluding telecommunications) employed 191 000 FTEs in 2015 (62 % of R&D personnel in the ICT sector, making it the top employer), with a rising trend. The ICT manufacturing sector (excluding communications equipment) employed 46 000 FTEs in 2015, representing a slight fall over the medium-term (2006-2015) despite signs of recovery after 2010. The communication equipment sector recovered in 2015. The telecommunications sector employed 28 000 FTEs in 2015 (9 % of R&D personnel in the ICT sector), and was on a downward trend (falling about 29 % from its peak of 39 000 FTEs in 2010).

\* See methodological note

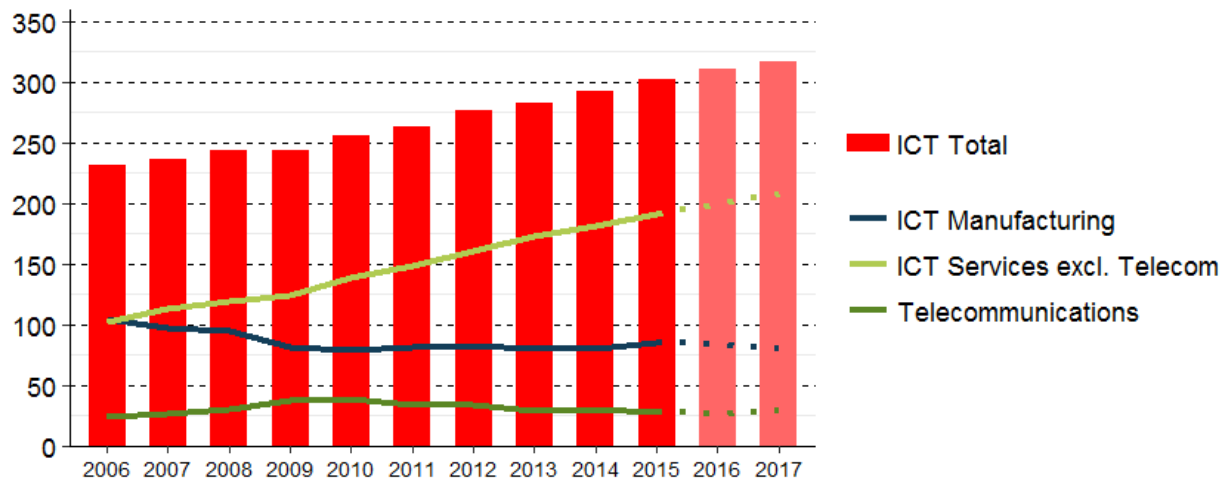
Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

R&D personnel in the ICT sector (comprehensive definition\*) made up 19 % of total R&D personnel in 2015, 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 (16 %) were behind Japan (24 %) in 2015 and over the medium-term period (no data available for the US).

**ICT sector share of Total PERD Worldwide comparisons, 2006-2015**



**ICT sector Business R&D Personnel in the EU 2006-2017 (thousand Full Time Equivalent)**



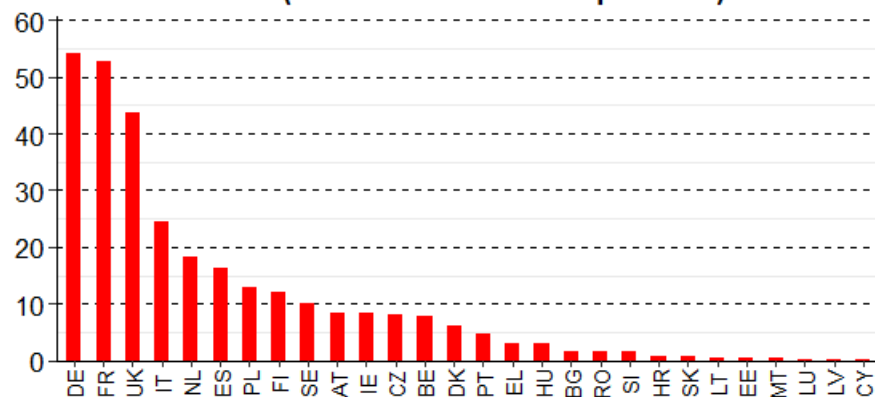
Note: Values for the years 2016 and 2017 are nowcasted data.



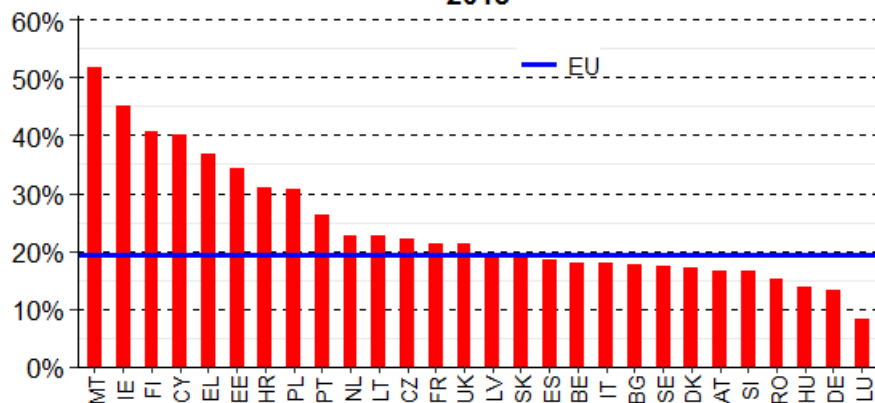
The EU's four largest economies were also the four biggest **employers of R&D personnel** in the ICT sector in 2015: France, Germany, the United Kingdom, and Italy. Malta and Ireland were the two countries with the highest concentration of **R&D personnel in the ICT sector** in 2015.

The EU's four largest economies were also the four biggest employers of R&D personnel in the ICT sector in 2015 – Germany (54 000 or 18 %), France (53 000 or 17 %), the United Kingdom (44 000 or 14 %), and Italy (24 000 or 8 %). Together, the four biggest employers represented 58 % of total R&D personnel in the ICT sector in 2015.

ICT sector Business R&D Personnel in the EU 2015 (thousand Full Time Equivalent)



ICT sector share of Total PERD in the EU 2015



Malta (52 %) and Ireland (45 %) were the two countries with the highest concentration of R&D personnel in the ICT sector in 2015. Luxembourg had the lowest concentration (7 %).

Other strong performers were Finland (41 %), Cyprus (40 %), and Greece (37 %).

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

The estimated level of **publicly funded expenditure on R&D in the ICT sector** in the EU reached EUR 6.4 billion in 2016. Estimated **public R&D expenditure in the ICT sector** was more than 25 % below the necessary trend line for doubling **publicly funded R&D in the ICT sector** between 2007 and 2020.

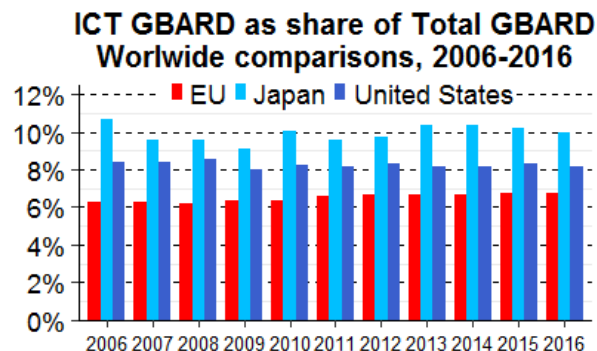
After rising for several years, the estimated level of publicly funded expenditure on R&D in the ICT sector in the EU fell in 2012, but recovered in 2013, and has stabilized since 2015 at its historical peak, reaching EUR 6.4 billion in 2015 and 2016.

The digital agenda target of doubling publicly funded R&D in the ICT sector between 2007 and 2020 requires an annual growth rate of 5.5 % (assuming constant annual growth rate). Estimated public R&D expenditure in the ICT sector was below the necessary trend line in 2016, with a gap of more than 25 %.

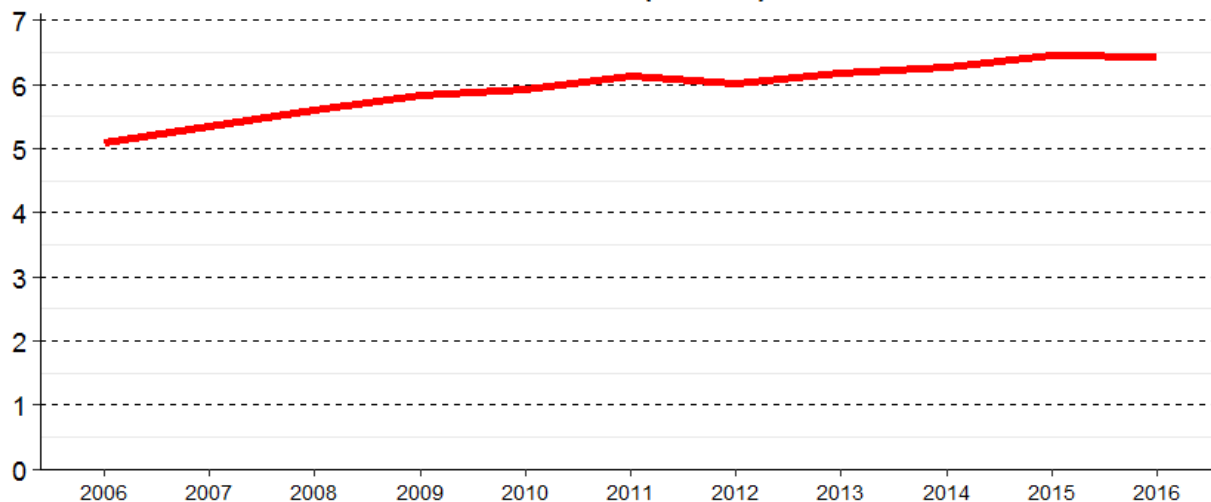
In 2016\*, public funding of R&D in the ICT sector represented 6.8 % of EU total 'government budget allocations for R&D' (GBARD), a figure which remained broadly stable over the medium-term period.

The EU was lagging behind the US (8.2 %) and Japan (10.0 %), a relative position that remained stable over the medium-term period (no data available for China).

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



**Public funding of ICT R&D (ICT GBARD) in the EU 2006-2016 (bn EUR)**



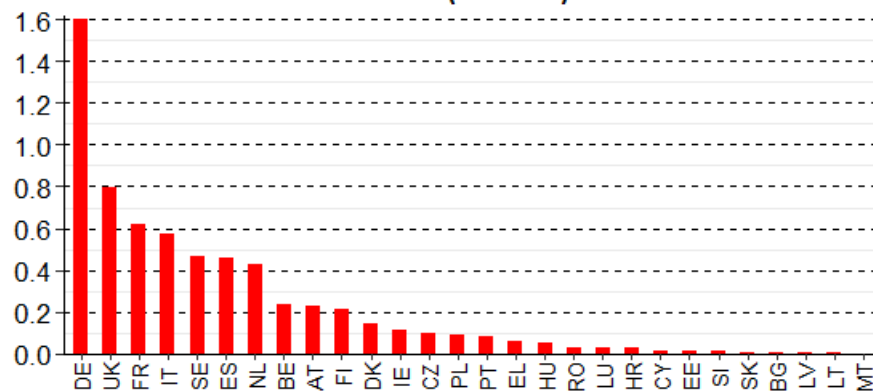
Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

The EU's five biggest public funders of R&D in the ICT sector in 2016 were Germany, the United Kingdom, France, Italy, and Sweden. Surprisingly, Cyprus was leading the way in the EU with the highest rate of GBARD in the ICT sector as a share of total GBARD in 2016.

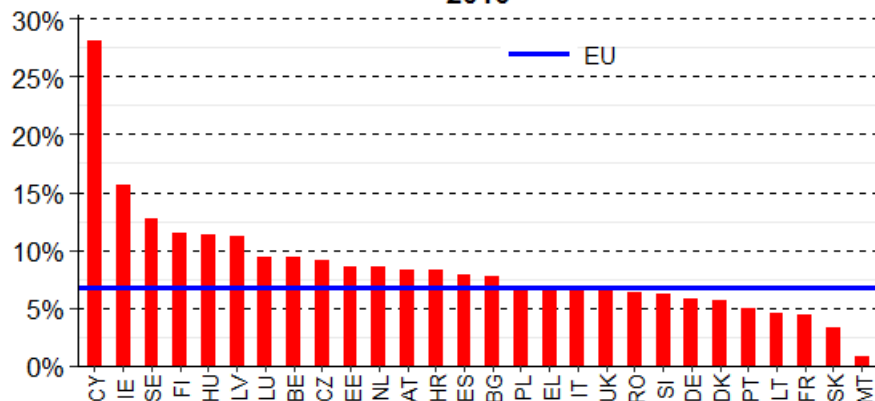
The EU's five biggest public funders of R&D in the ICT sector in 2016 were Germany (EUR 1.6 billion or 25 %), followed by the United Kingdom (EUR 799 million or 12 %), France (EUR 620 million or 10 %), Italy (EUR 577 million or 9 %), and Sweden (EUR 462 million or 7 %).

Together, those five countries represented 63 % of total public funding for R&D in the ICT sector.

Public funding of ICT R&D (ICT GBARD) in the EU 2016 (bn EUR)



ICT GBARD share of Total GBARD in the EU 2016



Cyprus was surprisingly leading the way in the EU with the highest rate (28.1 %) of GBARD in the ICT sector as a proportion of total GBARD in 2016. Unsurprisingly, the ranking in 2016 again reveals a strong performance by Ireland (15.6 %) and Nordic countries: Sweden (12.7 %) and Finland (11.5 %).

However, some other countries also attribute special importance to the ICT sector in their R&D public spending, such as Hungary and Latvia (both 11.3 %).

Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project



# 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

## METHODOLOGICAL NOTE

### Comprehensive vs operational definition

The **comprehensive definition** of the ICT sector applies to EU Member States for the period 2008-2015. It corresponds to the definition provided by the OECD in 2007.

The operational definition of the ICT sector enables the EU to be compared with non-EU countries over a longer period (2006-2015), 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 previous 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 other national sources, from the JRC's PREDICT project.

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. due to updates of the original data or the use of multiple auxiliary sources and variables.



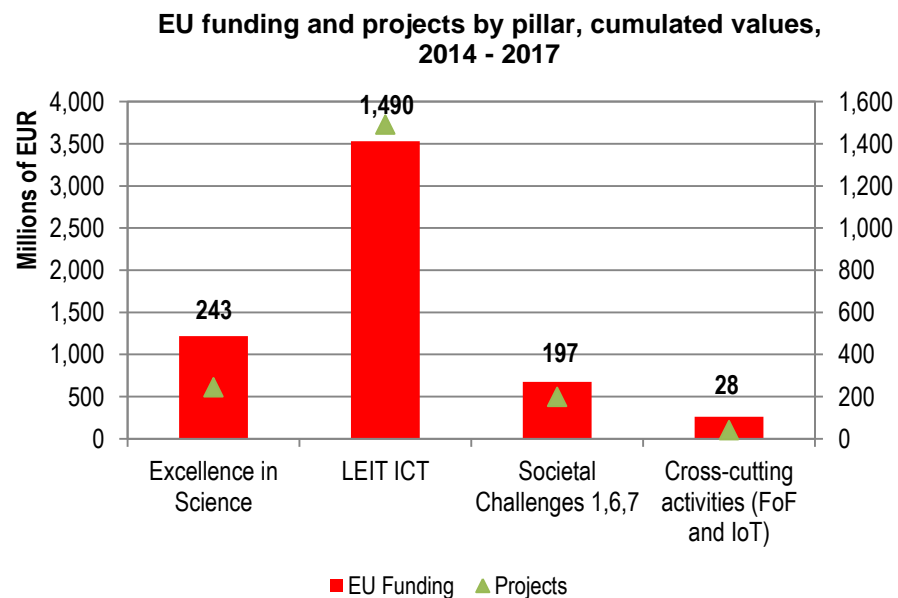
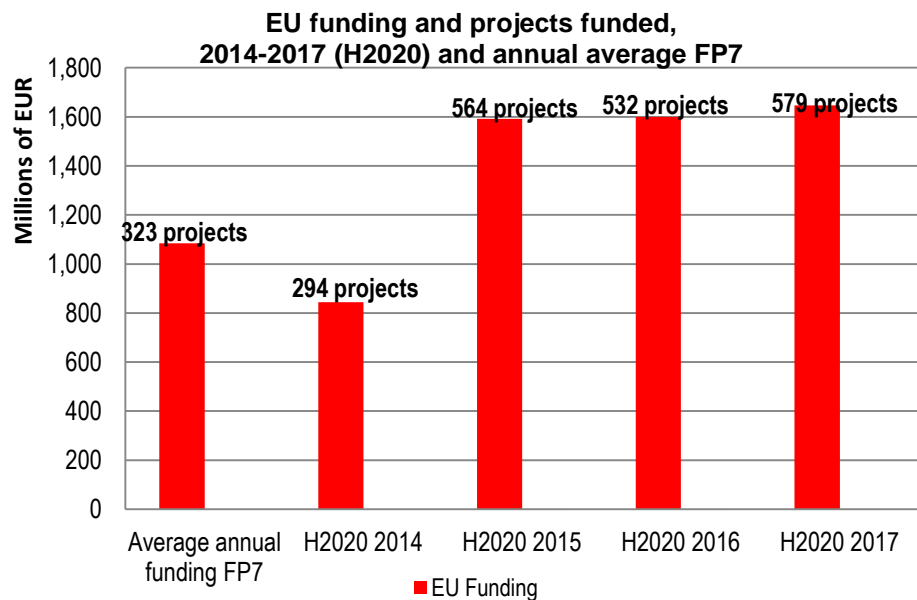
# Research and Innovation: ICT projects in Horizon 2020

In its first four years, **Horizon 2020 (H2020)** has allocated EUR 5.7 billion of EU funding to 1 969 projects in the field of ICT, attracting 6 250 organisations.

Annual funding has increased compared with the previous framework programme, FP7, where the average annual funding was EUR 1.08 billion a year. Leadership in enabling and **industrial technologies (LEIT) ICT** (including the SME instrument) accounts for the majority of funding (62 %), participations (63 %) and 76 % of projects.

**Excellence in science** (e-infrastructures, future emerging technologies (FET) open, FET proactive, FET flagships) accounts for slightly over one fifth of the budget (21 %), 19 % of participations and 12 % of projects. **Societal challenges** (SC) 1, 6 and 7 account for 12 % of the budget, 10 % of projects and 14 % of participations.

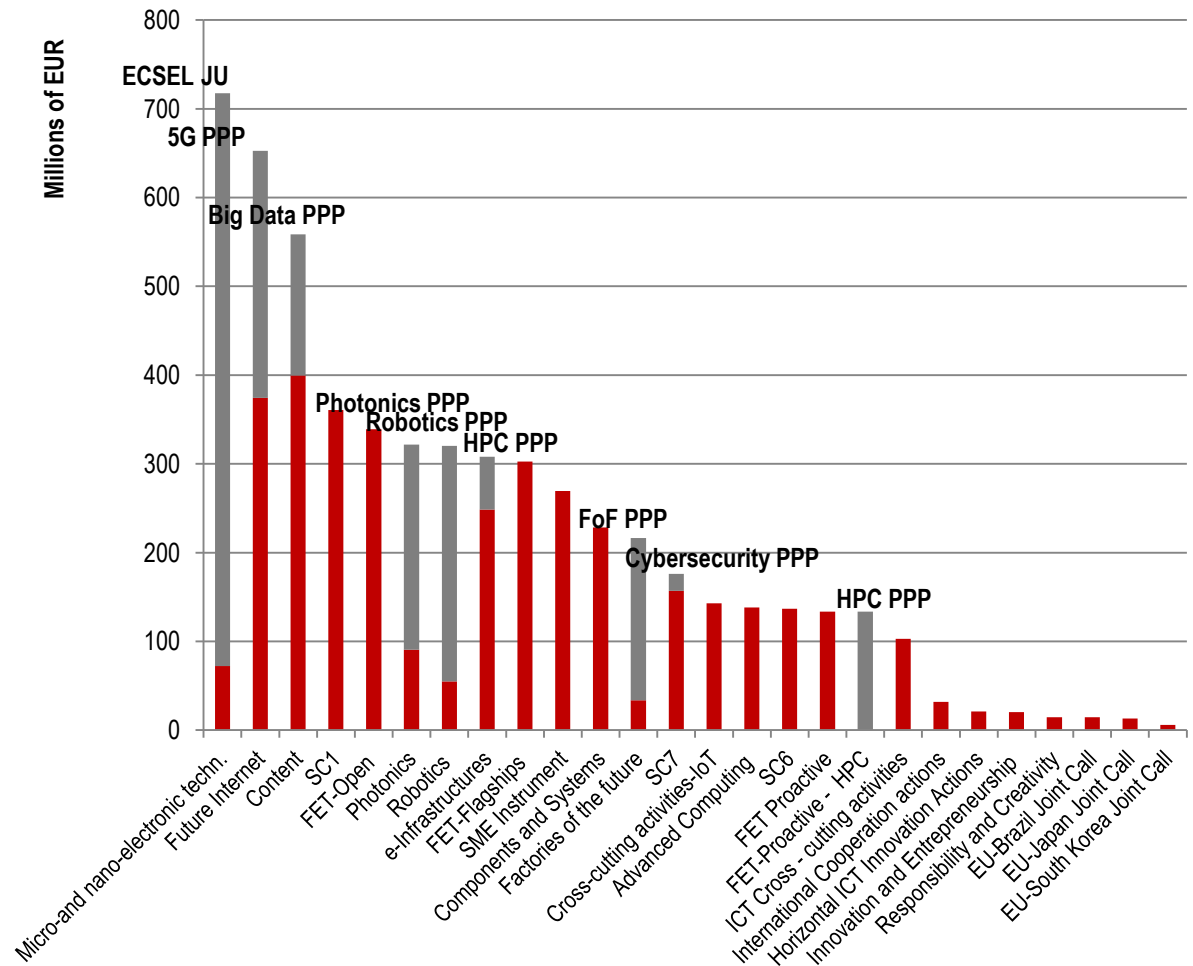
The number of **participants** has also increased compared with FP7, whereby on average 1 830 legal entities took part every year. 48 % of participants are new compared to FP7, and of these, the vast majority (80 %) are private for-profit organisations. So far H2020 has been able to attract 1 674 **new SMEs**.



# Micro- and nano-electronic technologies and future networks and internet are the areas that attract the highest number of participants and funding.

- The area of 'micro- and nano-electronic technologies' includes funding of EUR 645 million for the electronic components and systems for european leadership (ECSEL) joint undertaking.
- Within the strategic objective 'future networks and internet', the contractual private public partnership (cPPP) for 5G accounts for EUR 278 million.
- Within 'content technologies and information management', the big data cPPP account for EUR 159 million, whereas the EU funding to the robotics cPPP amounts to EUR 266 million.
- The cPPPs high performance computing (HPC) and photonics account for EUR 134 million and EUR 231 million, respectively.
- SC1 on 'health, demographic change and wellbeing' receives the highest funding among the SCs: EUR 361 million, followed by SC7 on secure societies (EUR 176 million).
- Projects for inclusive, innovative and reflective societies (SC6) receive EUR 137 million.
- 'FET Open' has total funding of EUR 339 million, FET proactive and the two flagships EUR 134 million and EUR 302 million respectively.

EU funding by Work Programme Area, cumulated values 2014-2017

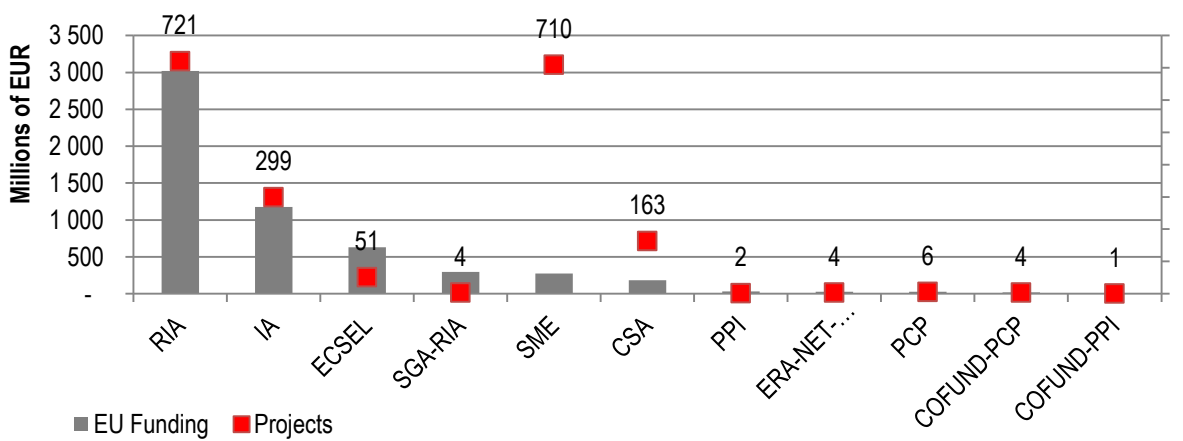


EC Funding for PPPs and JU within the Strategic Objective



The principal types of action are those in the area of **research and innovation**.

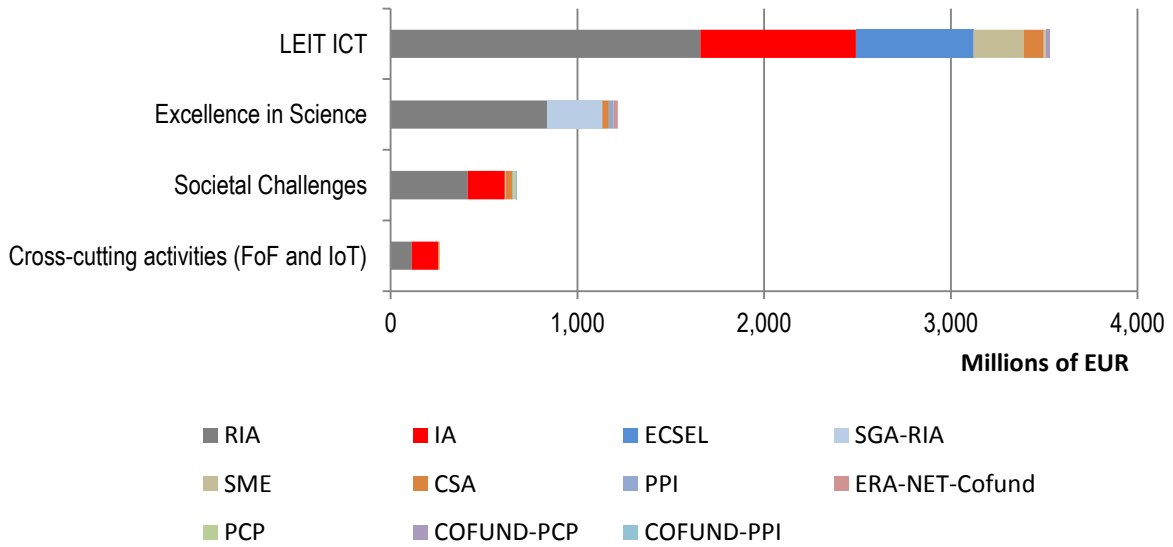
EU funding and projects by type of action, cumulated values, 2014-2017



Research and innovation actions (RIAs) account for 53 % of funding, and 37 % of projects. Innovation actions follow, with 21 % of funding, and 15 % of projects. Coordination and support actions account for 8 % of projects, and 3 % of funding. The **SME instrument projects (LEIT ICT, SC1 and SC6)** account for 36 % of projects, and 5 % of funding. The **three European research area (ERA-NET)** actions (in FET proactive, FET flagships and photonics) account for 0.5 % of funding.

RIAs receive EUR 1 658 million in LEIT ICT, EUR 412 million in SCs and EUR 839 million in excellence in science. Innovation actions (IAs) receive EUR 833 million in LEIT ICT and EUR 200 million in SCs. Coordination and support actions (CSAs) receive EUR 183 million, whereas pre-commercial procurement (PCP) and public procurement for innovation (PPI) actions receive as much as EUR 28 million and EUR 31 million respectively. The ERA-NET actions account for EUR 22 million in Excellence in Science and EUR 6 million in LEIT ICT.

EU funding by type of action and pillar, cumulated values, 2014-2017

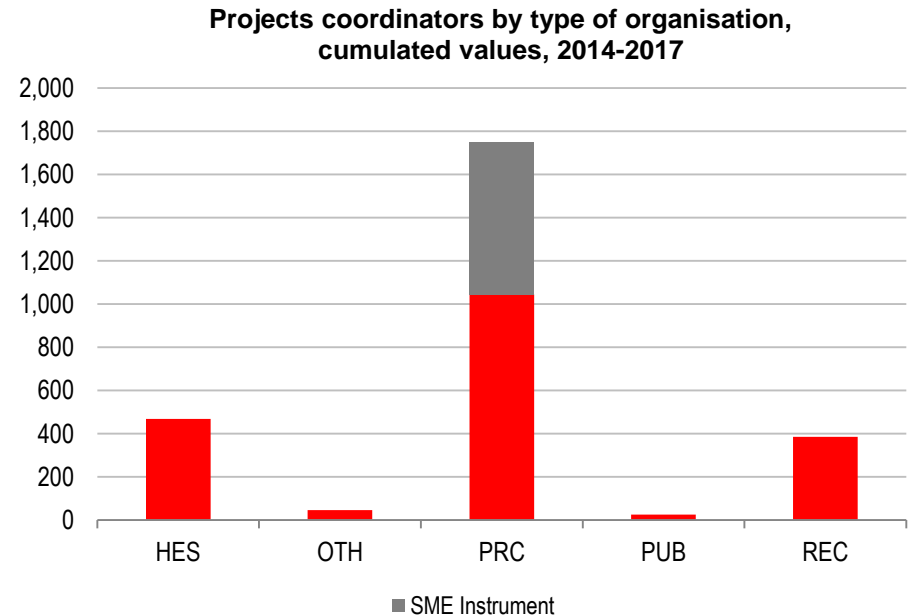
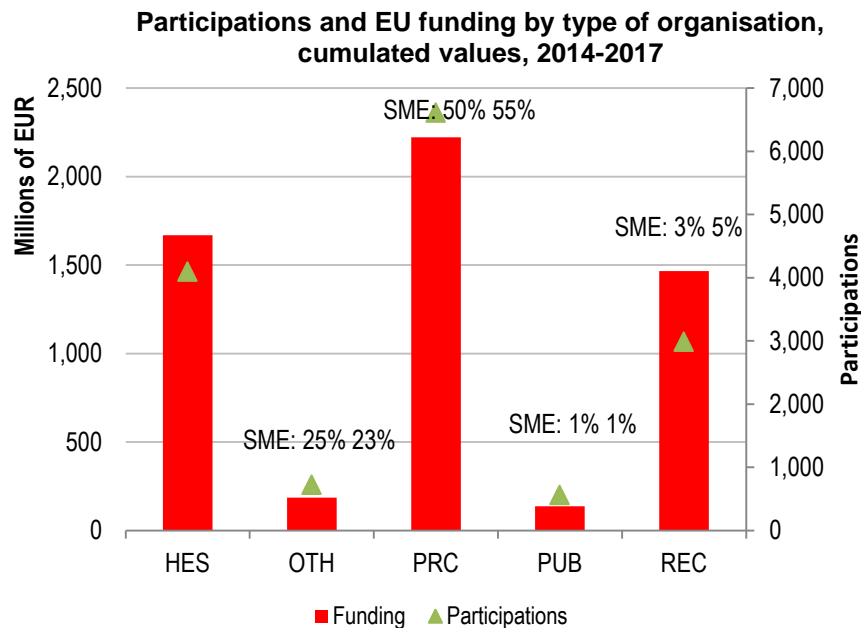


Under H2020 the **business sector** shows an increase in participation compared with FP7, accounting for 44 % of participations and 39 % of the budget, with 21 % of the budget going to SMEs.

Secondary and higher education establishments (HES) and research organisations (REC) taken together account for almost half of all project participations (47 %) and receive the highest funding (55 %). 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 39 % of the budget and 44 % 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 %.

HES/REC and PRC coordinate 43 % and 53 % of the projects. SMEs coordinate 45 % of projects; however, this is 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 companies coordinate a lower share of projects (10 %) than under FP7 (18 %).

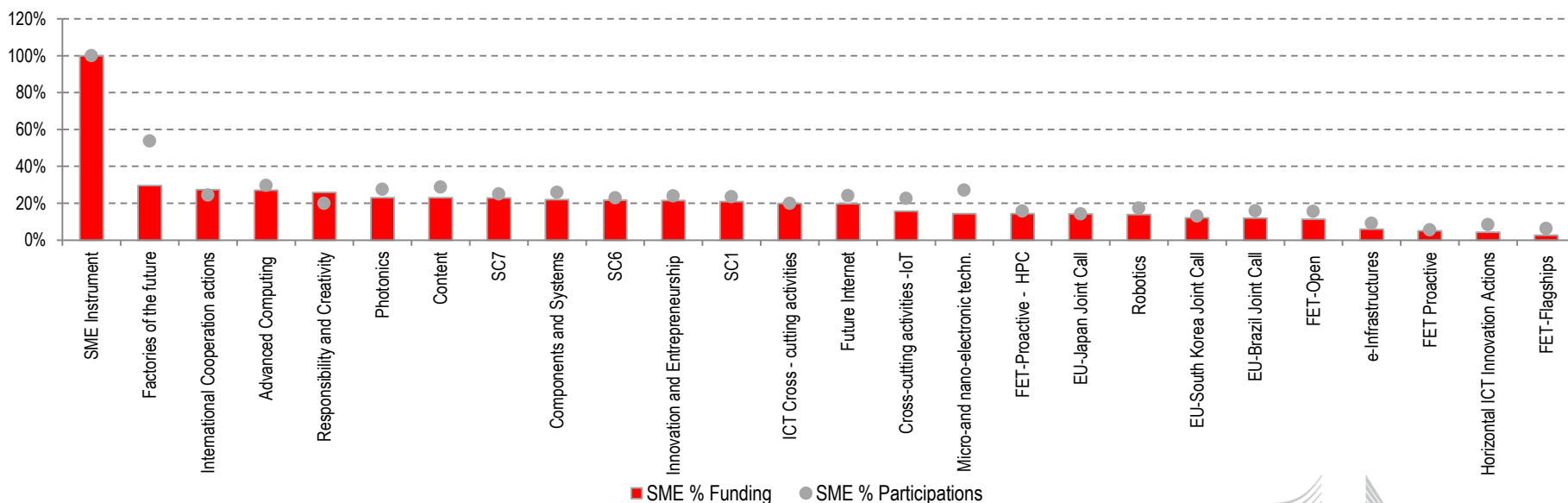


**SMEs** make up more than 25 % of the participating organisations. The **SME instrument** is designed for for-profit SMEs from any sector.

SMEs make up more than 25 % of the participating organisations and their participation varies according to pillar and work programme area. They are strongly present in 'factories of the future', in 'advanced computing', in 'content technologies', in 'photonics', and in 'micro-and nano-electronic technologies'. The **SME instrument** is designed for for-profit SMEs, including young companies and start-ups, from any sector.

As for the public-private-partnerships and the joint undertakings, the presence of SMEs (in terms of funding) ranges from 11 % in robotics, to 12 % in HPC, 14 % in ECSEL, 17 % in cybersecurity, 18 % in big data, 20 % in 5G, 25 % in photonics, 32 % in factories of the future. In certain Member States, SMEs account for the large majority of the total funding going to the country: in Estonia the share is 61 %, in Hungary 51 %, in Cyprus and Lithuania 47 %, and in Bulgaria 45 %.

The involvement of SMEs by work programme area (as a percentage of total funding and participations), cumulated values, 2014-2017



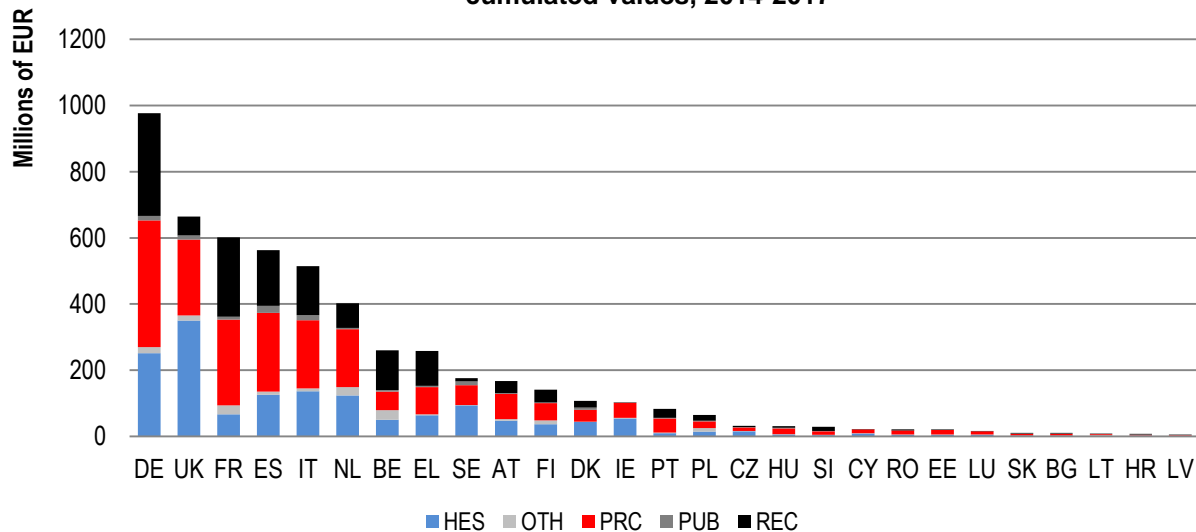
**In absolute terms, Germany and the United Kingdom are the biggest recipients of EU funding, but Greece and Cyprus receive the highest funding in relation to the size of their ICT sector.**

Germany, the United Kingdom, France, Spain and Italy account for 64 % of total EU funding and 62 % of participations in the first four years of H2020. These countries also lead in terms of projects coordinated (61 %), with Spain ranked in first position.

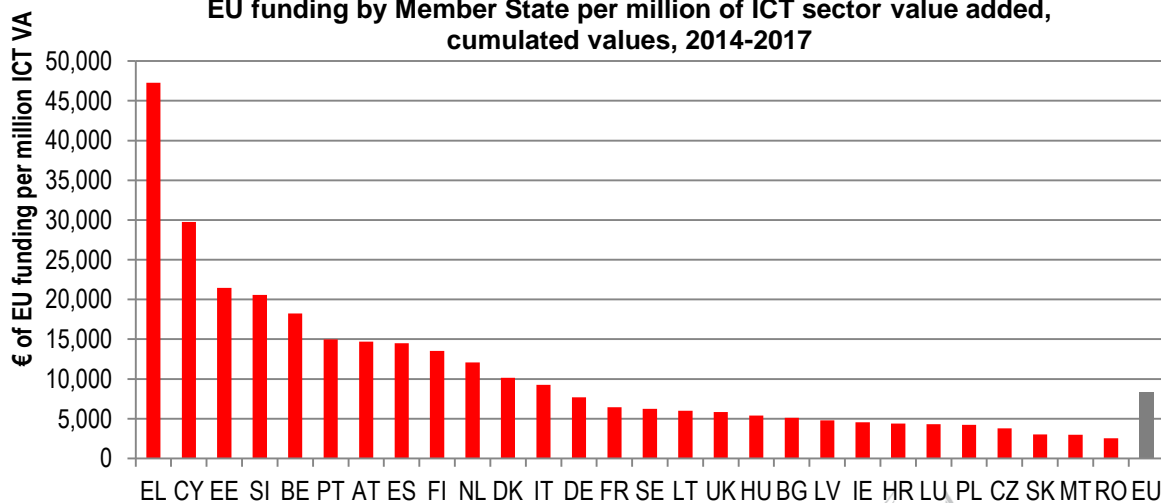
Greece, Cyprus, and Estonia are also among the Member States with the highest amounts of funding compared to the size of their ICT sector.

When looking at the total funding by country and its distribution among H2020 pillars, it is notable that 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 41 % for Malta, to the highest level at 84 % for Lithuania. In Malta, 42 % of funding goes to Excellent Science whereas in Luxembourg this figure is as low as 2 %. In Luxembourg and Romania, 33 % and 30 % respectively of funding is allocated to Societal Challenges.

**EU funding by Member State and type of participant organisation, cumulated values, 2014-2017**



**EU funding by Member State per million of ICT sector value added, cumulated values, 2014-2017**



**95 % of EU funding in H2020 is allocated to EU Member States, followed by associated countries. Third countries take part in H2020 but with little EU funding (1 %).**

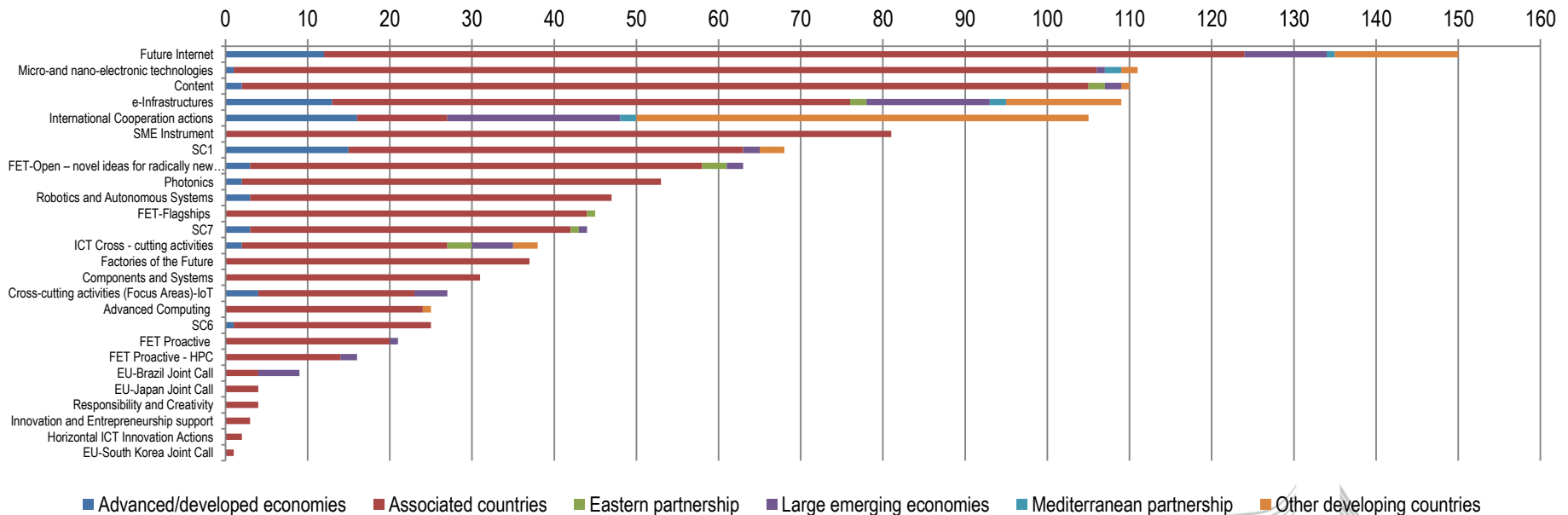
Between 2014 and 2017, 1 229 organisations from countries other than the Member States participated in H2020 projects.

About 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.

The rest of the budget and participations are equally distributed among other third countries.

Most of the projects with international participants fall under the specific objectives ‘future internet’ (150 projects), ‘micro-and nano-electronic technologies’ (111 projects), ‘content’ (110 projects), ‘e-infrastructures’ (109 projects), ‘international cooperation actions’ (105 projects), and ‘SME instrument’ (81 projects).

**International participation: number of participations by country group and work programme area, cumulated values, 2014-2017**



## Notes

This report covers all the projects signed by 31 December 2017.

Annual comparisons are made by taking projects signed by 31 December of the relevant year into account.

### Acronyms for types of organisations:

- PRC: Private for profit companies
- PUB: public bodies (excluding research and education)
- REC: research organisations
- HES: secondary and higher education establishments
- OTH: other entities

### The following Country Groups are used for the chart on international participation:

- 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 (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 DG CONNECT. The source of data for ICT Value Added is PREDICT.