Connectivity

Broadband market developments in the EU

Europe's Digital Progress
Report 2016

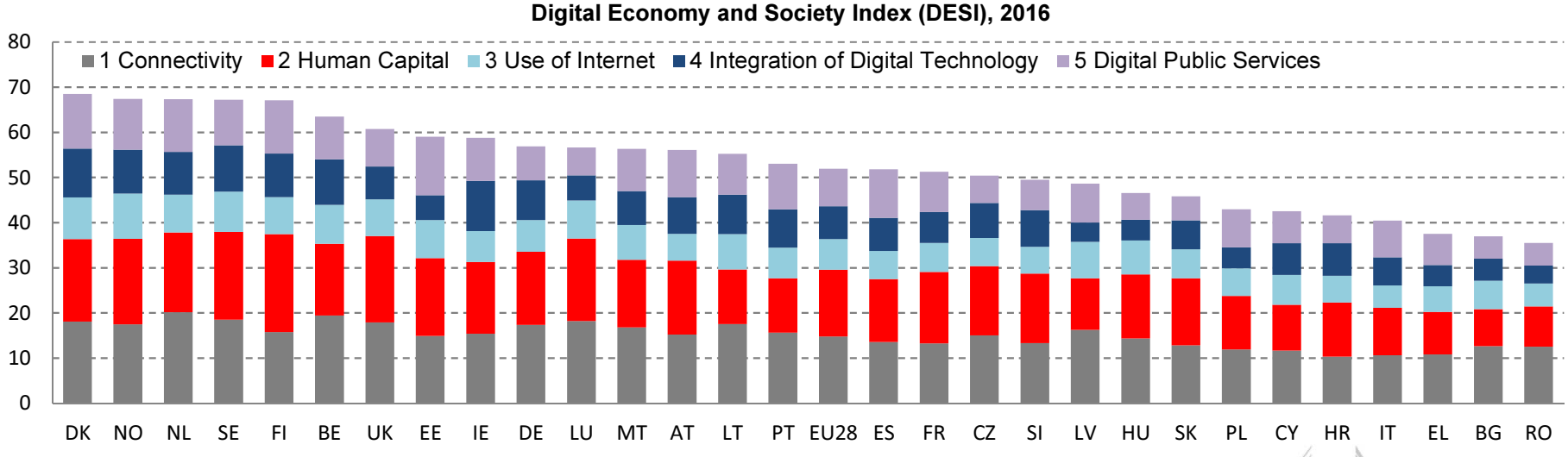
The digital economy and society index (DESI) is a composite index that summarises relevant indicators on Europe's digital performance and tracks the progress of EU Member States in digital competitiveness.

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

Romania, Bulgaria, Greece and Italy have the least advanced economies in the EU.

The five dimensions of the DESI

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



Source: European Commission, Digital Scoreboard

As for Connectivity, the highest score was registered by the Netherlands followed by Belgium and Sweden. Croatia, Italy, Greece and Cyprus had the weakest performance in this indicator.

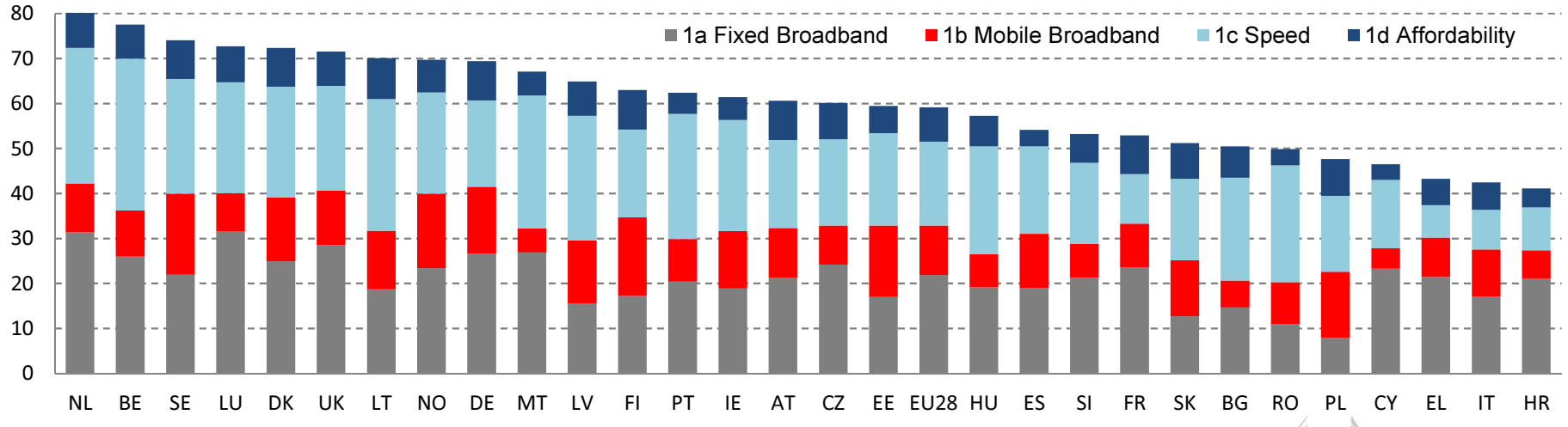
The Connectivity dimension looks at both the demand and the supply side of fixed and mobile broadband. Under fixed broadband it assesses the availability as well as the take-up of basic and high-speed next-generation access (NGA) broadband and also considers the affordability of retail offers. On mobile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

On the fixed side, Luxembourg, the Netherlands and the UK are the strongest, and Poland, Romania, Slovakia and Bulgaria the weakest. NGA subscriptions are particularly advanced in Belgium, Romania, the Netherlands and Lithuania.

As for mobile broadband, the Nordic countries (Finland, Sweden and Denmark) lead along with Estonia, while the lowest figures were registered by Hungary, Greece and Portugal.

Connectivity Indicators in DESI 2016	EU-28
1a1 Fixed BB Coverage % households	97 % (June 2015)
1a2 Fixed BB Take-up % households	72 % (2015)
1b1 Mobile BB Take-up Subscribers per 100 people	75 (June 2015)
1b2 Spectrum % of the target for spectrum to be harmonised at EU level	69 % (December 2015)
1c1 NGA Coverage % households, out of all households	71 % (June 2015)
1c2 Subscriptions to Fast BB % of subscriptions >= 30Mbps, out of fixed BB subscriptions	30 % (June 2015)
1d1 Fixed BB Price % individual gross income spent for the cheapest standalone Fixed Broadband subscription (lower values are better)	1.3 % (Access cost: 2015; Income: 2014)

Digital Economy and Society Index (DESI), Connectivity, 2016



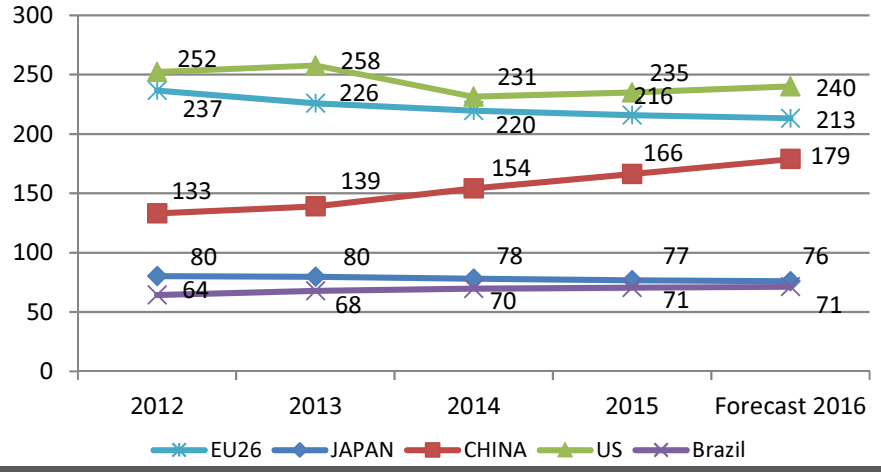
Source: European Commission, Digital Agenda Scoreboard

Total telecom services revenues have declined by 10 % in Europe since 2012. EU telecom CAPEX has slightly increased in the same period.

Telecom operators in Europe generated less revenue than the US operators. Revenues went down from EUR 237 bn in 2012 to EUR 213 bn in 2016 (forecasted) in Europe. At the same time, the US also reduced its figures from EUR 252 bn to EUR 240 bn, surpassing Europe despite its smaller population. There have been large increases in emerging markets, especially in China, where there is still relatively low take-up of telecom services.

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).

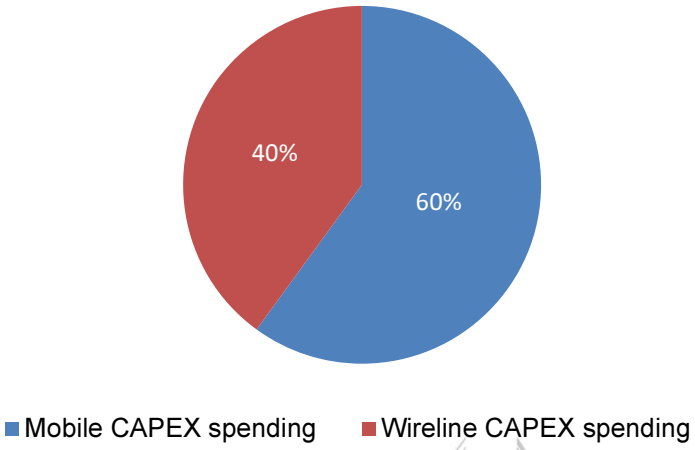
Total telecommunication services revenues per region, billion EUR, 2012-2016



CAPEX figures remained stable over the last four years even though NGA coverage increased from 54 % to 71 %.

Mobile CAPEX spending represented 60 % of total spending

Share of fixed and mobile CAPEX in Europe, 2015



Source: 2015 EITO in collaboration with IDC.

Mobile voice and fixed voice revenues have decreased by over 25 % since 2012. Mobile data grew by 10 %, and will represent over a quarter of total telecom revenues at EU level in 2016.

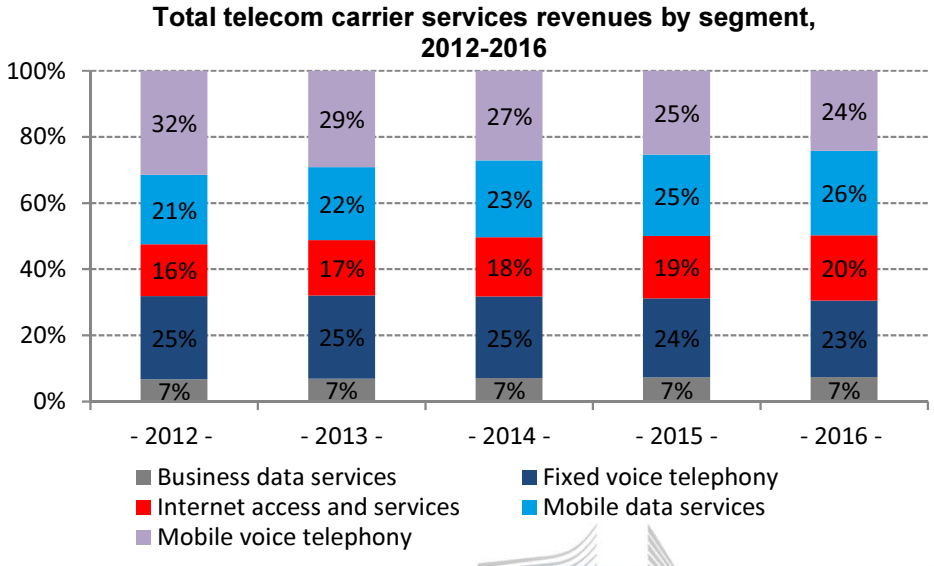
The revenues of the telecommunications sector went down by 10 % between 2012 and 2016 (forecasted figure).

Telecommunications revenues (carrier services) by segment showed, how voice services (both fixed and mobile) lost importance. Fixed voice decreased by 17.2 %, while mobile by 30.8 %. Fixed and mobile voice services made up 57 % of total telecom revenues in 2012, but will only represent 47 % in 2016.

Revenue growth rates 2012-2016	
Telecom carrier services	-10.0 %
Business data services	-0.8 %
Fixed voice telephony	-17.2 %
Internet access and services	13.1 %
Mobile data services	9.9 %
Mobile voice telephony	-30.8 %

By contrast, the growth in mobile data services (9.9 % between 2012 and 2016) is remarkable. Mobile data will represent over one quarter of total market revenue (26 %) in 2016. The growth in mobile data services could not, however, compensate for the major decline in voice.

Revenue from fixed internet access went up by 13.1 % since 2012, whereas business data services decreased by almost 1 % between 2012 and the forecasted figure for 2016, representing solely 7 % of total telecom revenue.



Source: *2015 EITO in collaboration with IDC*

In 2015, telecom operators continued to show significant interest in M&A in Europe, but cross-border mergers remain elusive. Mobile network owning operators continue to push for in-market consolidation.

Merger & acquisition (M&A) activity continued to be significant over the past year with several high value deals. Telecom operators showed a willingness to spend over EUR 45 bn* in 2015 in Europe to buy other *telco* or content companies. This is significant when compared to revenues of around EUR 216 bn in 2015**. Also, it does not include two proposed mobile joint ventures in Denmark and Italy.

* Based on reported values of the following acquisitions that were completed and/or negotiated and/or in the process of regulatory review in 2015: Liberty Global / controlling stake in De Vijver Media (Belgium — completed in 2015); Telia Sonera/Tele2 Norway (completed in 2015); Altice/PT Telekom (Portugal-completed in 2015), Orange/Jazztel (Spain — completed in 2015); Telefonica/DTS (Spain, completed in 2015), BT/EE (UK — completed in 2016), Hutchison/Telefonica UK (UK — blocked by the Commission in 2016); Liberty Global /Base (Belgium, cleared by the Commission in 2016); Altice/Bouygues (France-reportedly abandoned)

* * See slide 4

Truly cross-border mergers still seem to be elusive. In 2015 the main trend was still in-market consolidation or diversification in the same market.

Following acquisitions in Austria (2012), Ireland and Germany (2014), mobile companies continue to press for in-market consolidation in markets with four network-owning operators. This includes three large markets where four operators are still present. In the UK, Hutchison proposed to acquire Telefonica's UK subsidiary, O2. In Italy, Hutchison and Vimpelcom proposed to pool their mobile business in a joint venture. In France, Bouygues Telecom was first courted by Altice (Numericable) and then by Orange.

Acquisitions by fixed operators seem to be driven to a significant extent by convergence, but can also lead to stronger fixed networks.

The highest value telecom deal agreed in 2015 was to create a leading fixed-mobile operator in the UK: the incumbent fixed operator in the UK agreed to buy the largest mobile operator, Everything Everywhere, a joint venture between Deutsche Telekom and Orange.

Liberty Global's acquisition of mobile operator Base in Belgium is another example of a large fixed operator buying its own mobile network.

The two acquisitions suggest that owning a mobile network is an advantage for a fixed operator, which is worth investing in even if the operator is already present in mobile as a virtual operator (and, in the case of Liberty Global in Belgium, had achieved a significant share of the market as a virtual operator).

Liberty Global's acquisition of two popular TV channels in Belgium and Telefonica's acquisition of leading pay-TV provider CanalPlus in Spain show the advantages for telco operators to own business providing content.

The Orange/Jazztel merger in Spain also led to a stronger converged player, combining Orange's mobile network with a combined fixed network of Orange and Jazztel. The Altice/PT Portugal deal saw Altice practically "swap" (as a result of the remedies) its cable company for the largest converged operator in Portugal.

Based on European and national regulatory reviews of mergers, in-market consolidation continued to raise competition concerns. The combination of fixed and mobile networks was not considered problematic for competition, unlike the combination of fixed network operators with content providers.

Mergers **leading to in-market consolidation** continued to raise competition concerns and all but one of these mergers required an in-depth review. The Commission cleared the Orange/Jazztel merger and the Altice/PT Portugal merger subject only to remedies, including the divestment of fixed network assets. The Commission did not consider the remedies offered in the four to three MNO mobile mergers in Denmark and the UK as sufficient. These mergers did not go ahead. The Telia Sonera/Tele2 merger in Norway, which combined two of the three MNOs in the country, was cleared by the Norwegian competition authority subject to the divestment of network assets to allow the entry of a new MNO.

As for '**convergence mergers**' no competition concerns were raised by competition authorities due to the combination of fixed and mobile businesses per se. The BT/EE acquisition was cleared unconditionally by the UK competition authority. While competition concerns were raised in the case of Liberty Global's acquisition of MNO Base in Belgium, these were due to Liberty Global being in direct competition as an MVNO with Base in the Belgian mobile market. The Commission, however, approved the acquisition subject to remedies that allow at the same time a primarily media company in Belgium to become a full MVNO.

The acquisition of important content by telco operators with significant market positions raised concerns both in Belgium and in Spain. These were alleviated by remedies to ensure continued access to such content by rival telco operators.

Broadband coverage: Basic broadband is available to everyone in the EU, while fixed technologies cover 97 %. Next generation access (NGA) covers 71 %, up from 68 % six months ago. Deployment of 4G mobile continued to increase sharply. Rural coverage remains significantly lower, especially in NGA.

Basic broadband is available to all in the EU, when considering all major technologies (xDSL, cable, fibre to the premises (FTTP), WiMax, HSPA, LTE and Satellite). Fixed and fixed-wireless technologies cover 97 % of EU homes.

NGA technologies (VDSL, Cable Docsis 3.0 and FTTP) capable of delivering at least 30 Mbps download are available to 71 %.

4G mobile (LTE) coverage increased by seven percentage points and reached 86 %.

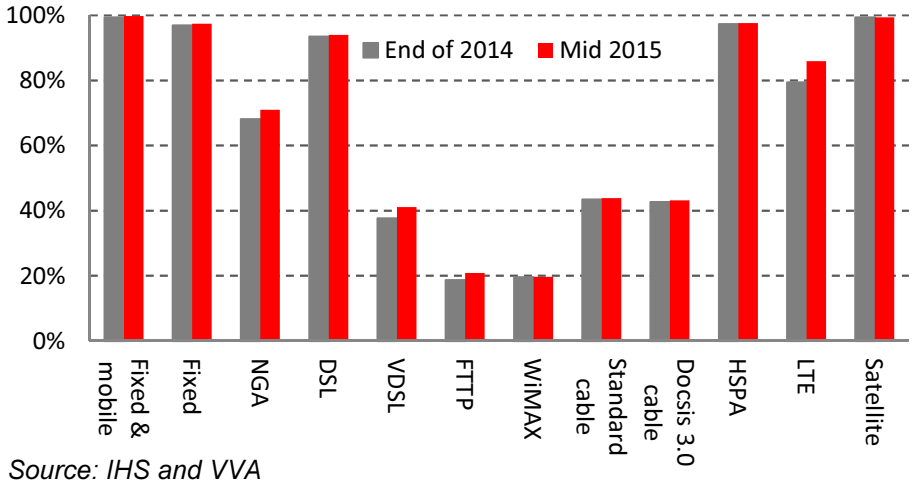
Coverage in rural areas is substantially lower for fixed technologies (91 %), and especially for NGA (28 %).

Our Target

Basic broadband for all by 2013: 100 % in 2015

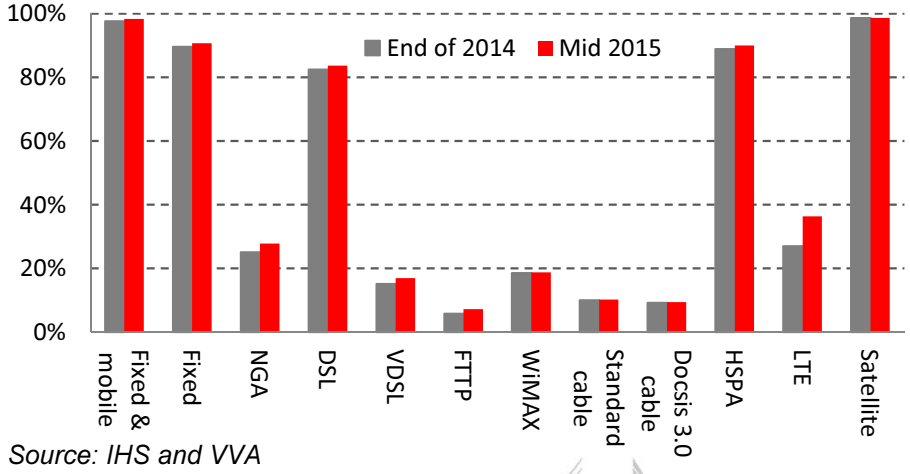
Fast broadband (>30Mbps) for all by 2020: 71 % in 2015

Total coverage by technology at EU level, Dec 2014 to Jun 2015



Source: IHS and VVA

Rural coverage by technology at EU level, Dec 2014 to Jun 2015



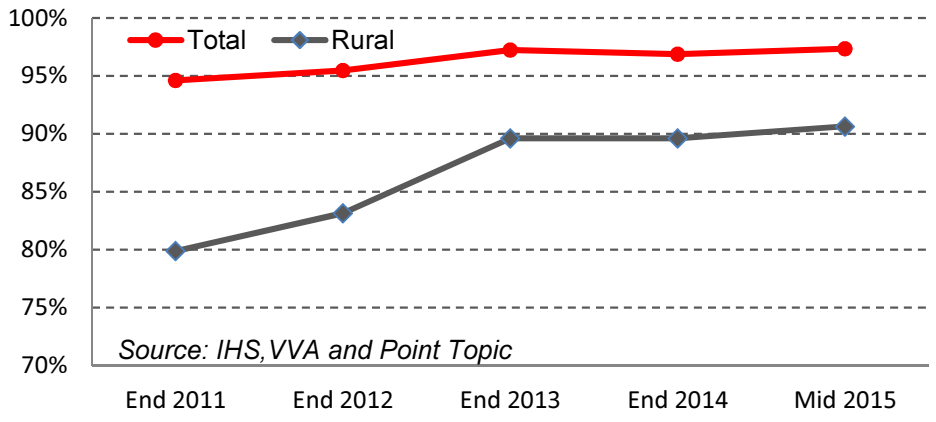
Source: IHS and VVA

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

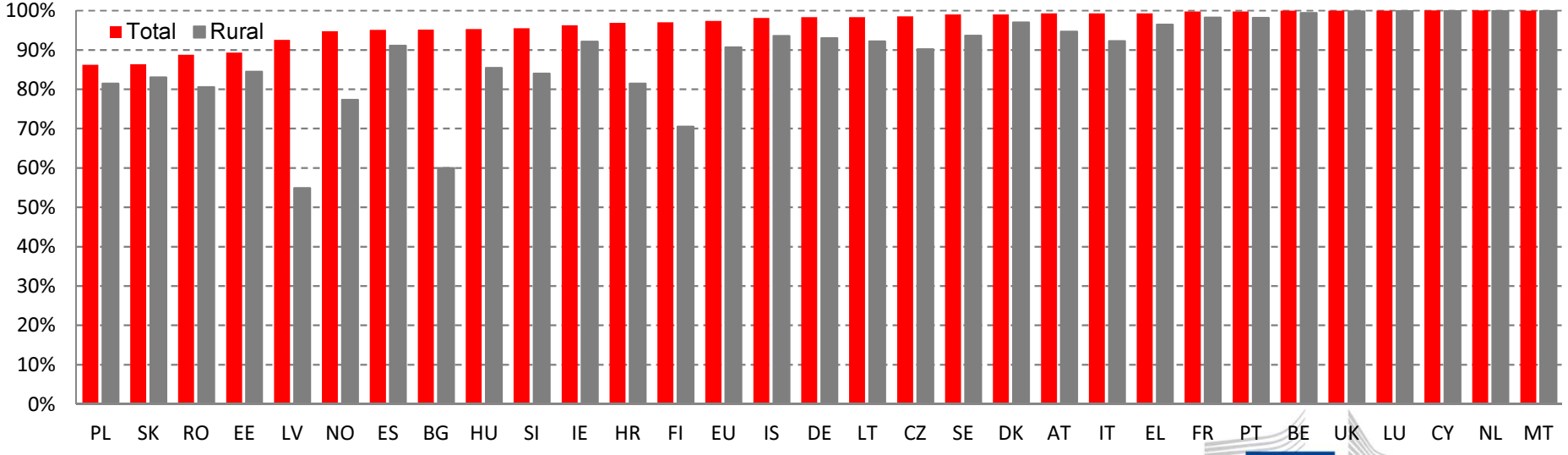
Primary internet access at home is provided mainly by fixed technologies. Among these technologies, xDSL has the largest footprint (94 %) followed by cable (44 %) and WiMAX (20 %). Fixed coverage is the highest in the Member States with well-developed DSL infrastructures, and is over 90% in all but four Member States.

Overall coverage of fixed broadband has only marginally increased since 2011, but rural coverage improved by 11 percentage points. Developments have slowed down, as Member States rather focus on NGA and wireless technologies.

Fixed broadband coverage in the EU, 2011-2015



Fixed broadband coverage, June 2015



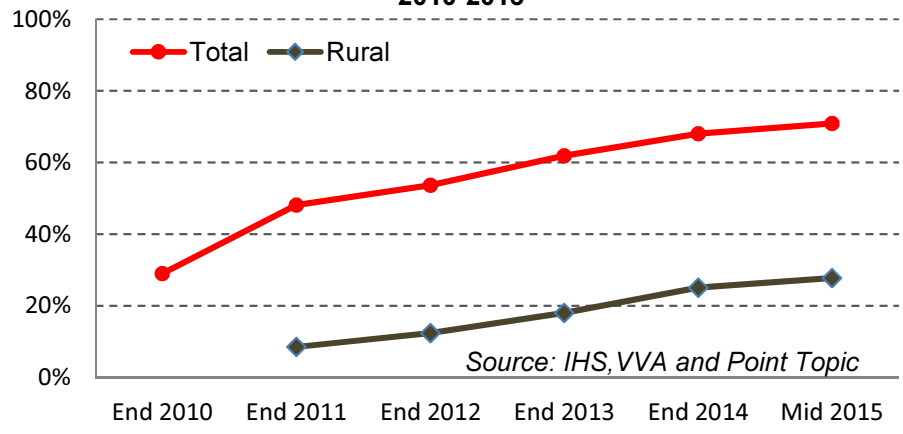
Source: IHS and VVA

Coverage of next generation access (NGA) technologies continued to increase and reached 71 %. NGA deployments still focus mainly on urban areas, while only 28 % of rural homes are covered.

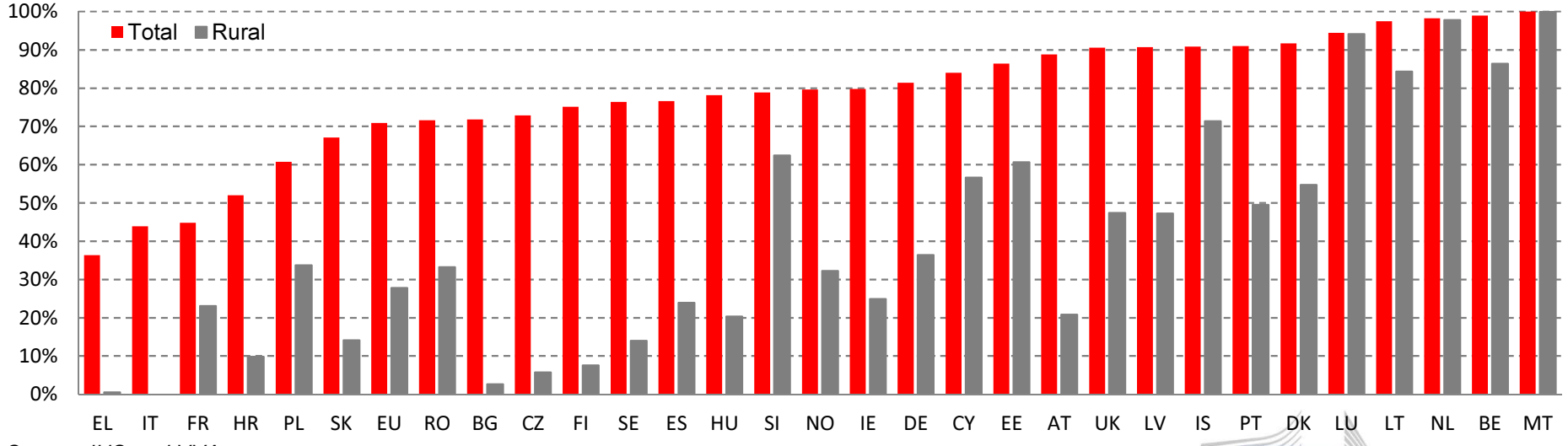
For the purpose of this report, next generation access includes VDSL, Cable Docsis 3.0 and FTTP. By mid-2015, Cable Docsis 3.0 had the largest NGA coverage at 44 %, followed by VDSL (41 %) and FTTP (21 %). Most of the upgrades in European cable networks had taken place by 2011, while VDSL coverage doubled in the last four years. There was remarkable progress also in FTTP growing from 10 % in 2011 to 21 % in 2015, but FTTP coverage is still low.

NGA networks are still very much limited to urban areas: only 28 % of rural homes are covered, mainly by VDSL.

Next generation access (NGA) broadband coverage in the EU, 2010-2015



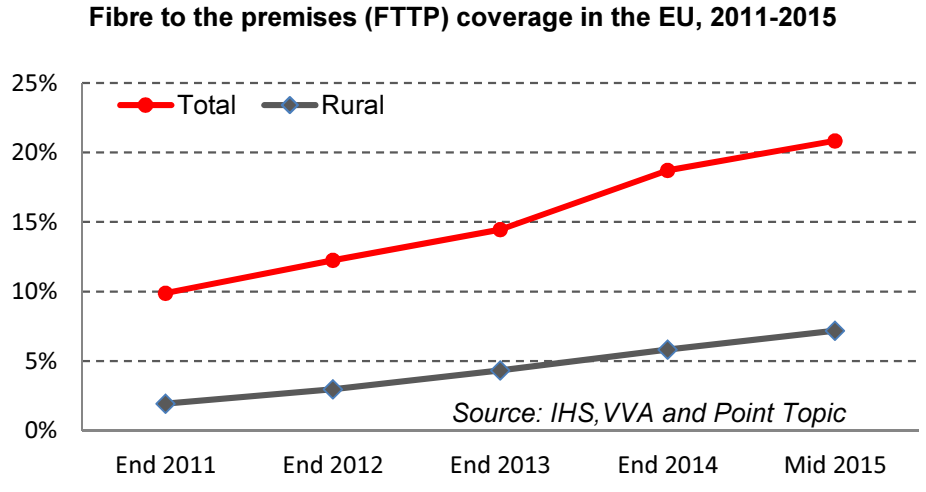
Next generation access (FTTP, VDSL and Docsis 3.0 cable) coverage, June 2015

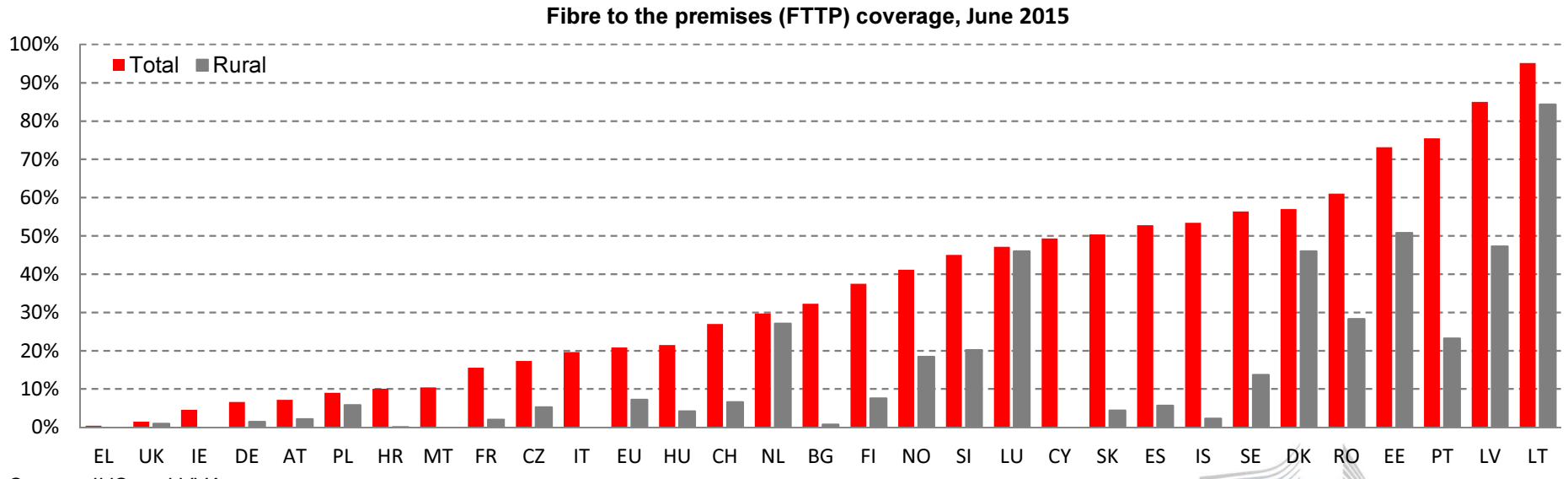


Source: IHS and VVA

Coverage of fibre to the premises (FTTP) grew from 10 % in 2011 to 21 % in 2015, while it remains a primarily urban technology. Lithuania, Latvia, Portugal and Estonia are the leaders in FTTP in Europe.

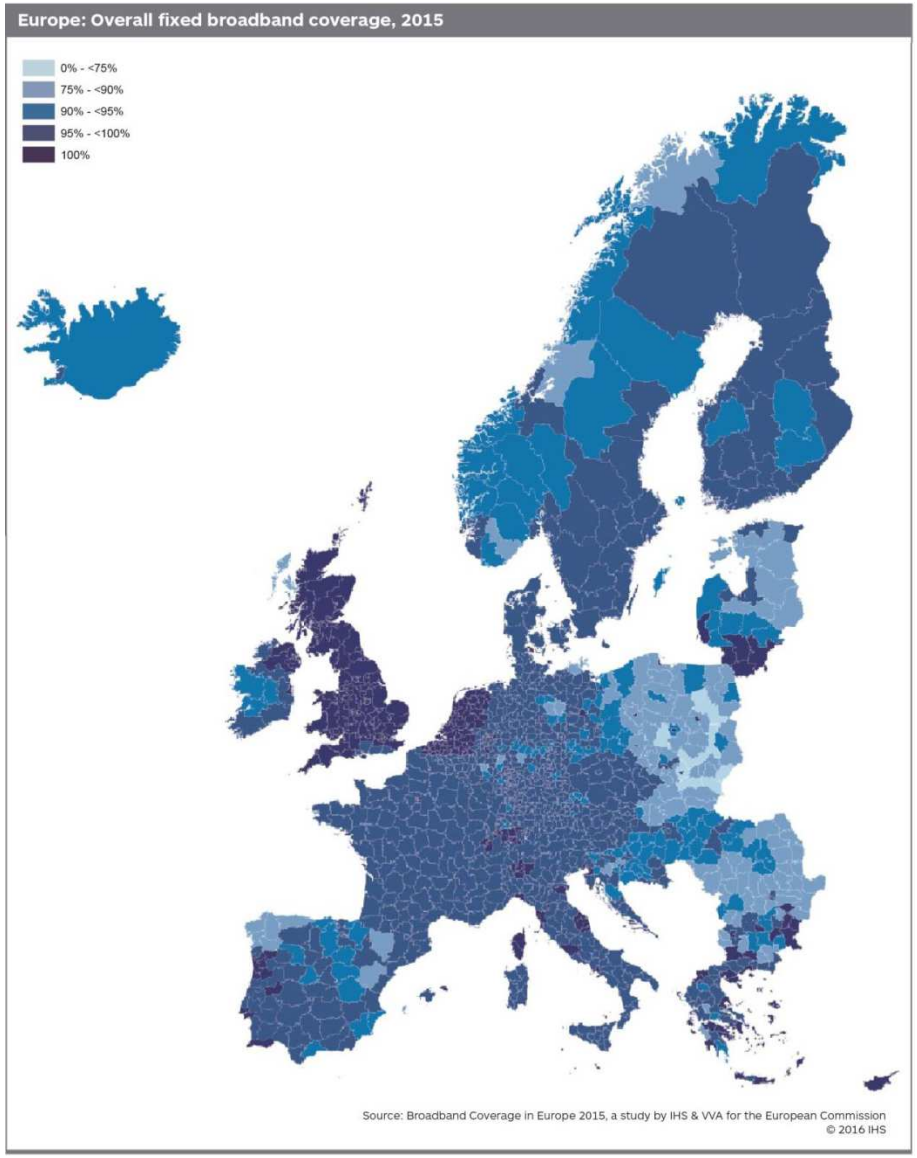
FTTP is catching up in Europe, as coverage for homes more than doubled since 2011. However, the FTTP footprint is still significantly lower than that of cable Docsis 3.0 and VDSL. In Estonia, Portugal, Latvia and Lithuania more than two thirds of homes can already subscribe to FTTP services, while in Greece, the UK, Ireland, Germany, Austria and Poland only less than 10 % can do so. FTTP services are available mainly in urban areas with the exception of Lithuania, Latvia, Estonia, Denmark and Luxembourg, where more than one in three rural homes can also have access to it.

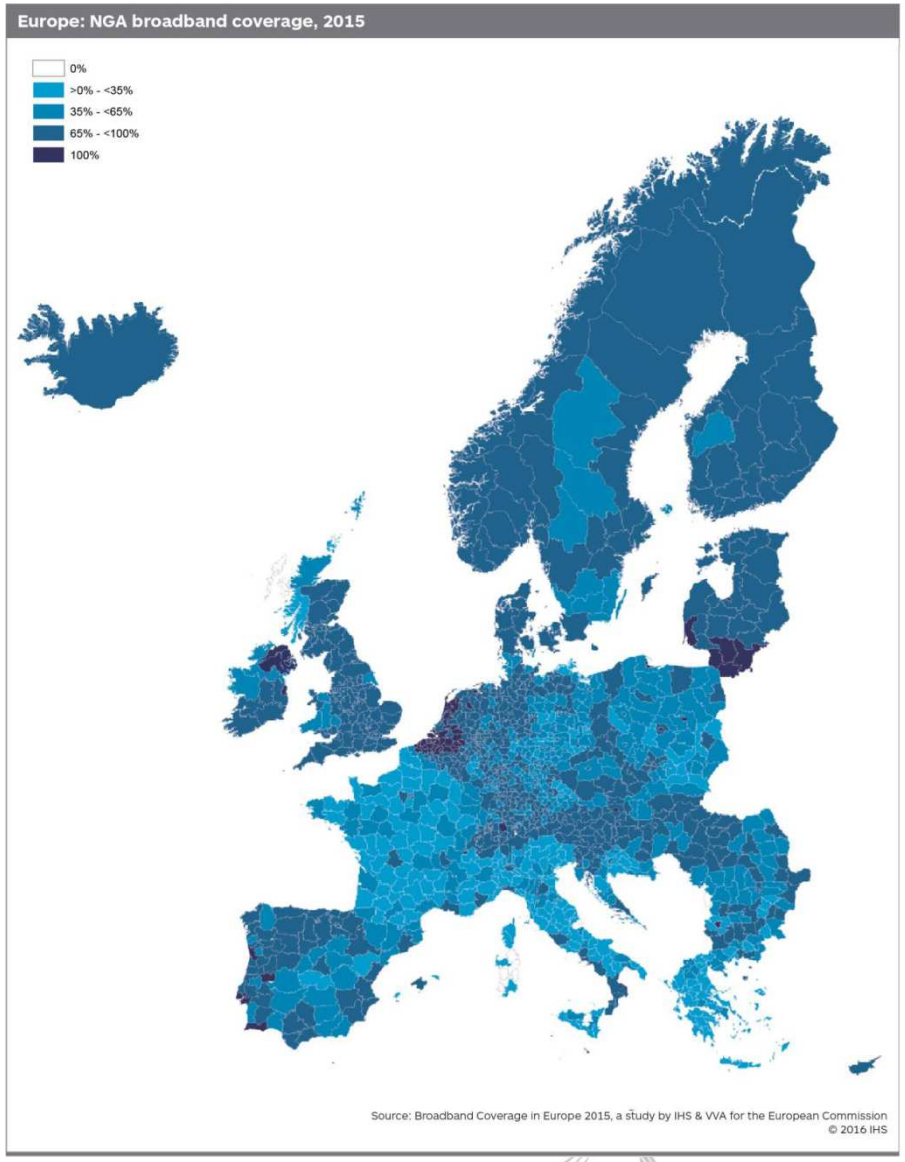




Source: IHS and VVA

Overall fixed broadband and NGA broadband coverage by region.





Source: IHS and VVA

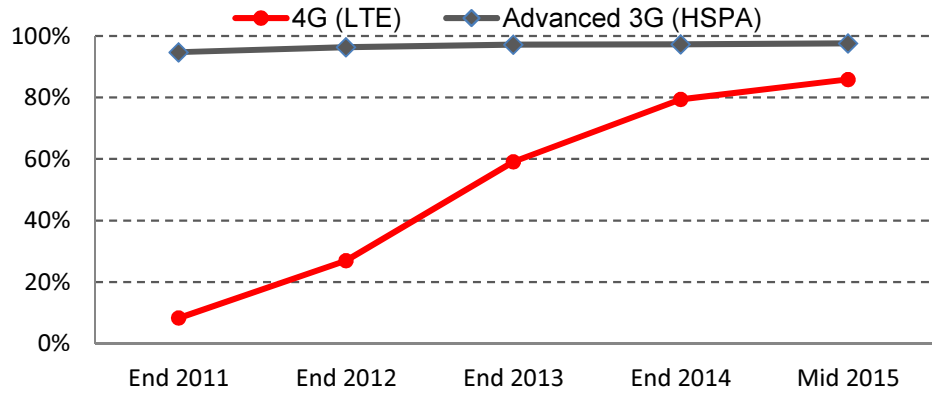
4G mobile broadband availability reached 86 %, up from 27 % in 2012. 4G has been commercially launched in all Member States.

In 2015, deployment of 4G (LTE) continued: coverage went up from 79 % of homes to 86 % in six months. Nevertheless, 4G coverage is still substantially below that of 3G (HSPA). As of October 2015, 80 % of Mobile Network Operators in the EU offered 4G services on LTE networks.

LTE is most widely developed in the Netherlands, Sweden and Denmark, while commercial 4G services were launched only last year in Bulgaria.

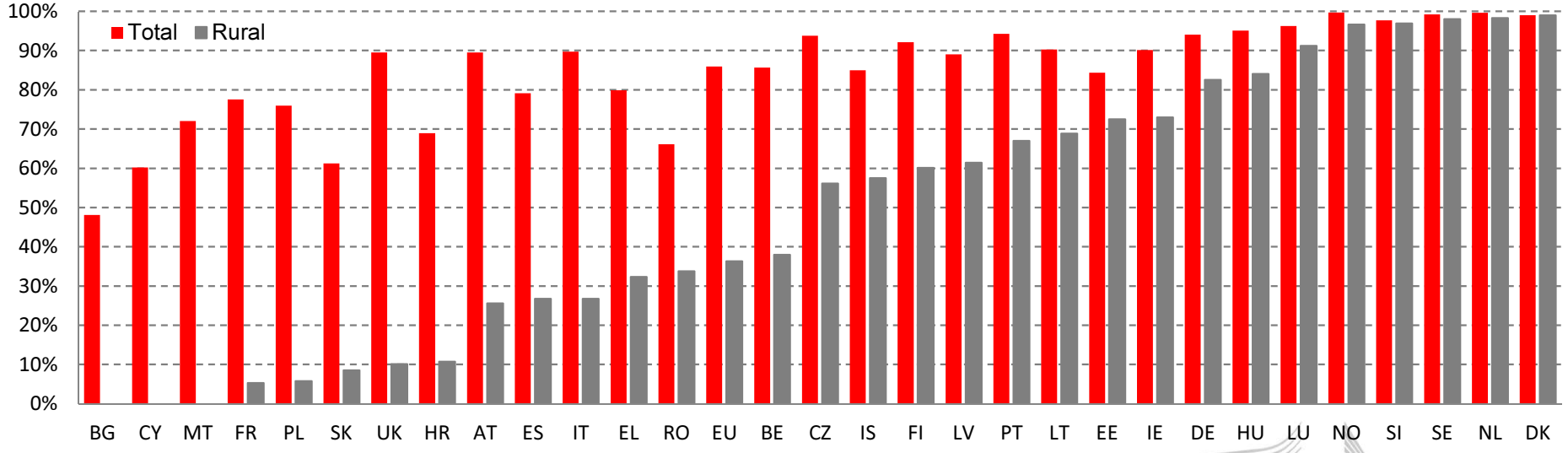
LTE deployment has focused so far mainly in urban areas, as only 36 % of rural homes are covered. However, in 14 Member States, LTE is also already available in the majority of rural homes, with very high rates in Denmark, Sweden, Slovenia, Luxembourg and the Netherlands.

Mobile broadband coverage in the EU, 2011-2015



Source: IHS,VVA and Point Topic

4G (LTE) coverage, June 2015



Source: IHS and VVA

Broadband coverage by speed: 97% of European homes have access to at least 2 Mbps broadband, 68% to 30 Mbps.

Everyone in the EU can have access to broadband services, when considering fixed, mobile and also satellite technologies. These technologies normally provide more than 2 Mbps, but speed goes below this threshold for an estimated 3% of homes in Europe.

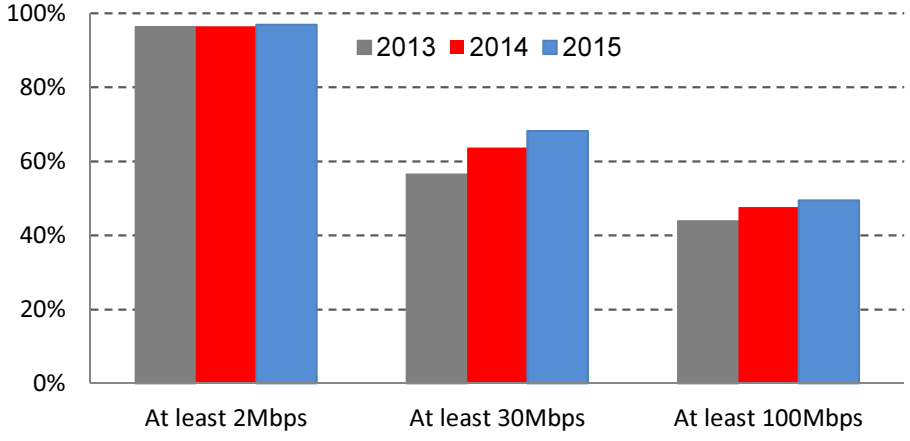
30 Mbps is available to 68 %, just below the NGA coverage of 71 %. At least 30Mbps broadband speed can be delivered through VDSL (but not for all connections), Cable Docsis 3.0, FTTP and to a lesser extent through LTE. It is assumed that Cable Docsis 3.0 and FTTP can deliver at least 30Mbps on their entire footprint.

The majority of VDSL connected homes connected homes can also access 30 Mbps, while actual speeds on LTE networks are typically below this level.

100 Mbps or more is available to around one in two EU homes, delivered either on FTTP or Cable Docsis 3.0 networks.

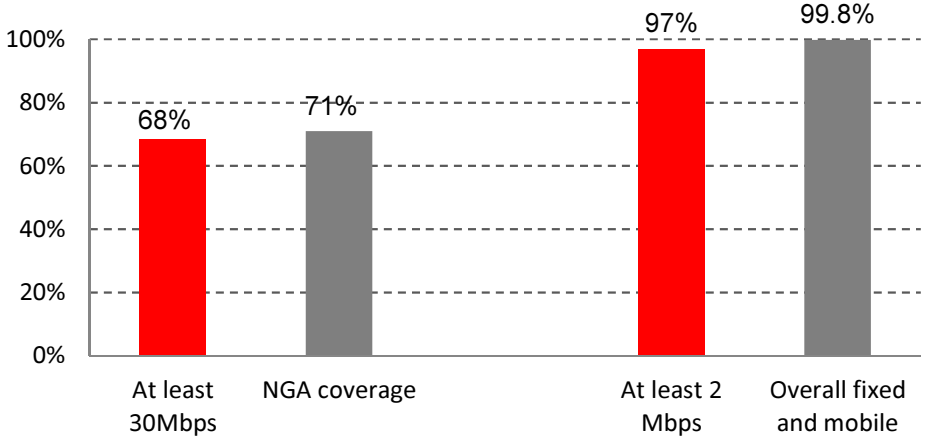
Speed definition: *actual download speeds are assessed, which users can typically reach most of the time during peak hours.*

Broadband coverage by speed at EU level, 2013-2015



Source: IHS and VVA

Broadband coverage by speed and technology, June 2015



Source: IHS and VVA

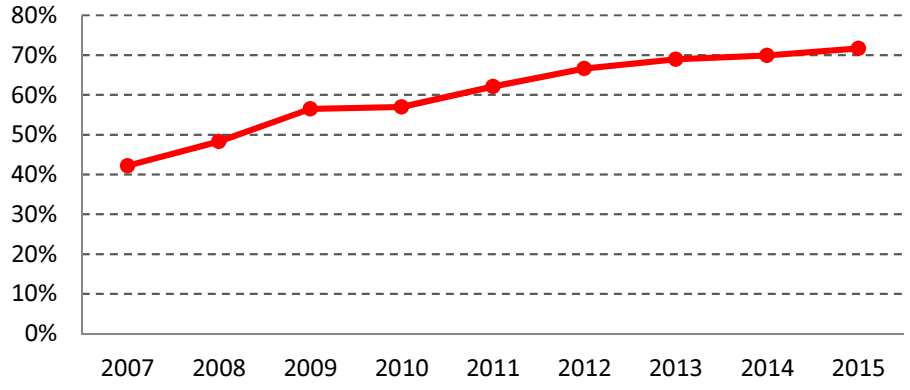
72 % of EU homes had a fixed broadband subscription in 2015. Luxembourg, the Netherlands and the UK registered the highest figures in the EU, while Italy, Bulgaria and Poland had the lowest take-up rates.

Although fixed broadband is available to 97 % of EU homes, 28 % of them do not have a subscription. Growth in take-up was very strong until 2009, but then slowed down in the last few years. This is partially due to fixed-mobile substitution (see slide 34).

At Member State level, take-up rates ranged from only 53 % in Italy to 94 % in Luxembourg.

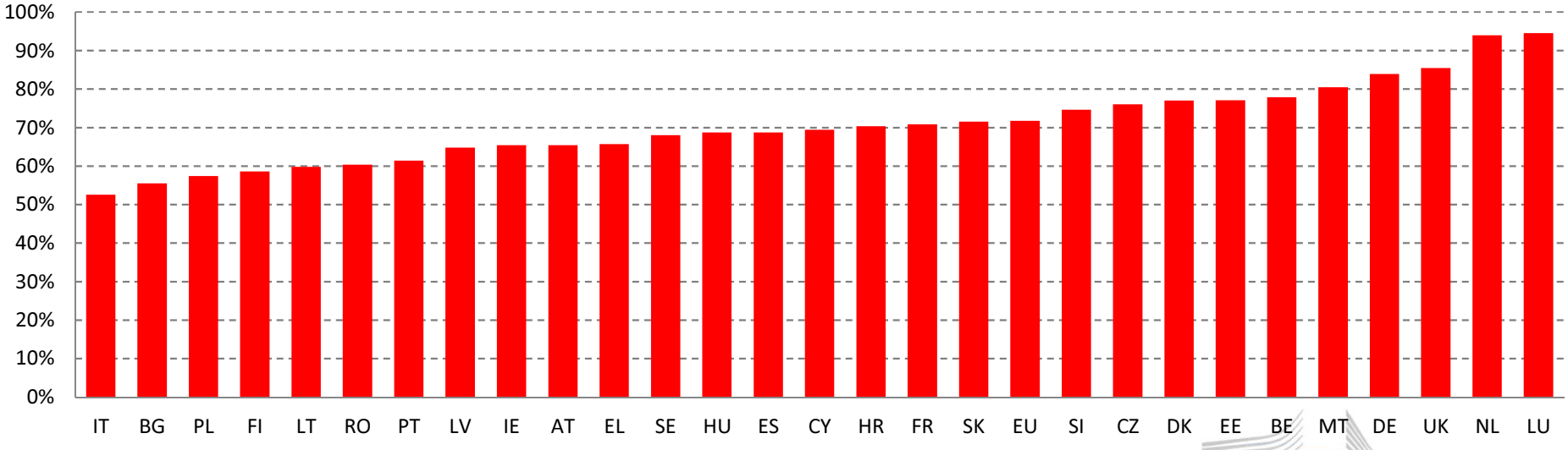
* Note: Penetration figures include also mobile subscriptions until 2009.

Households with a fixed broadband subscription, 2007 – 2015*



Source: Eurostat

Households with a fixed broadband subscription, 2015



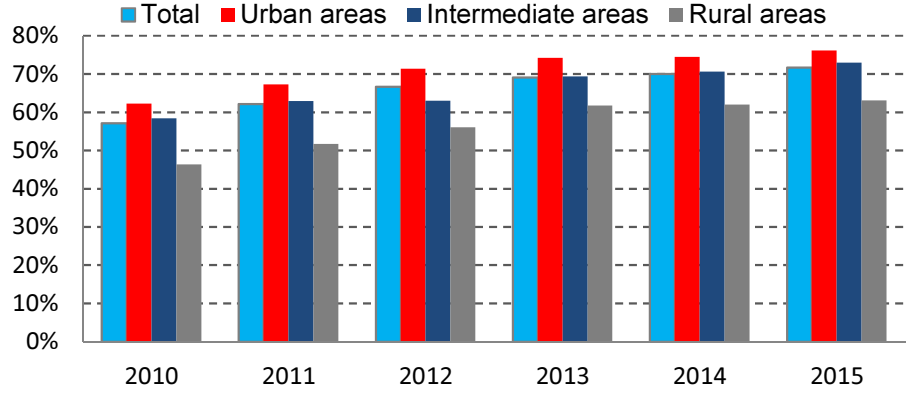
Source: Eurostat

63 % of rural homes had a fixed broadband subscription across the EU in 2015. Luxembourg, the Netherlands, the UK and Germany registered the highest figures, while in six Member States, less than half of the homes subscribed.

There is a substantial gap between rural and national penetration rates, although the gap became smaller over the last five years (from 11 percentage points in 2010 to 9 percentage points in 2015).

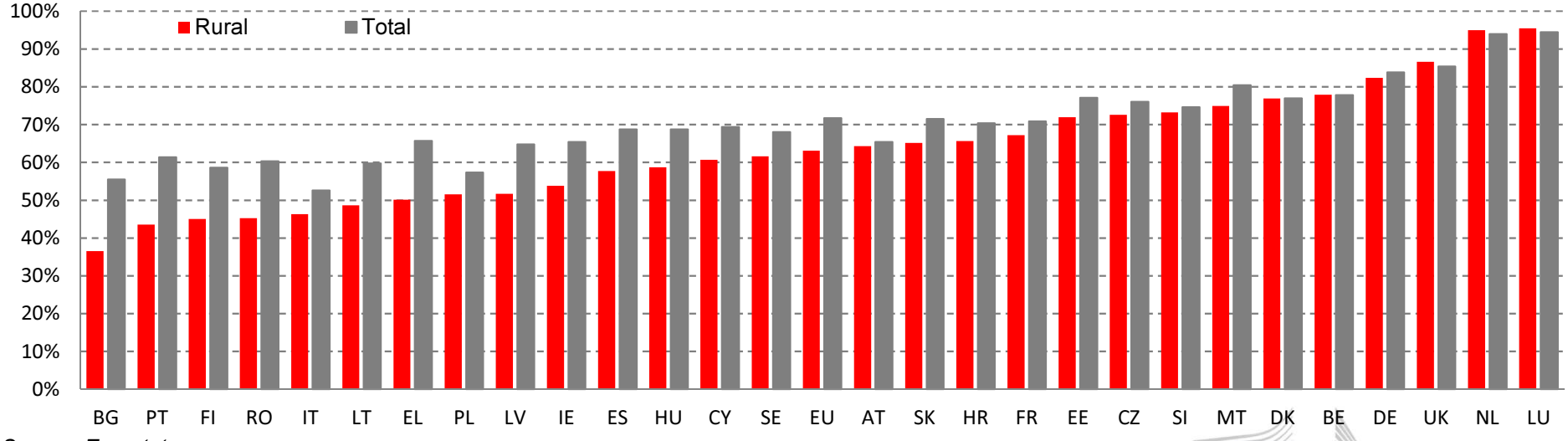
In Luxembourg, Germany, the UK, Belgium, Denmark, Austria and Slovenia, rural and national penetration rates are almost identical. However, in Portugal, Greece, Romania and Bulgaria, where rural take-up is the lowest in Europe, there are significant gaps of 15-18 percentage points compared to the national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

Households having a fixed broadband connection per area at EU level, 2010-2015



Source: Eurostat

Household fixed broadband penetration rural/total, 2015

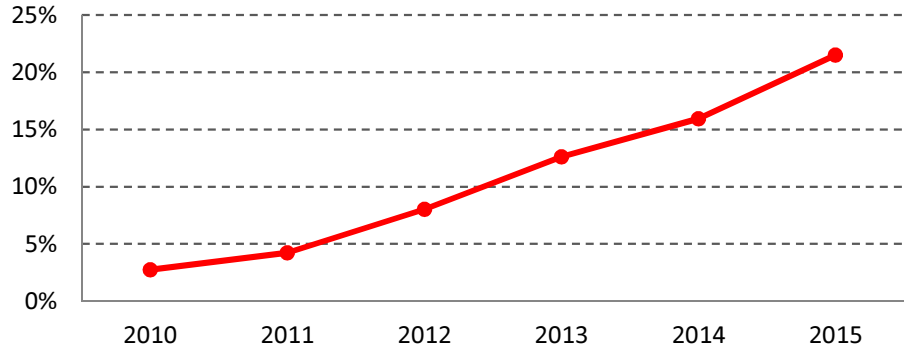


Source: Eurostat

22 % of European homes subscribe to fast broadband access of at least 30 Mbps. There has been a significant increase since 2010. Belgium, the Netherlands and Malta are the leaders in Europe in fast broadband take-up.

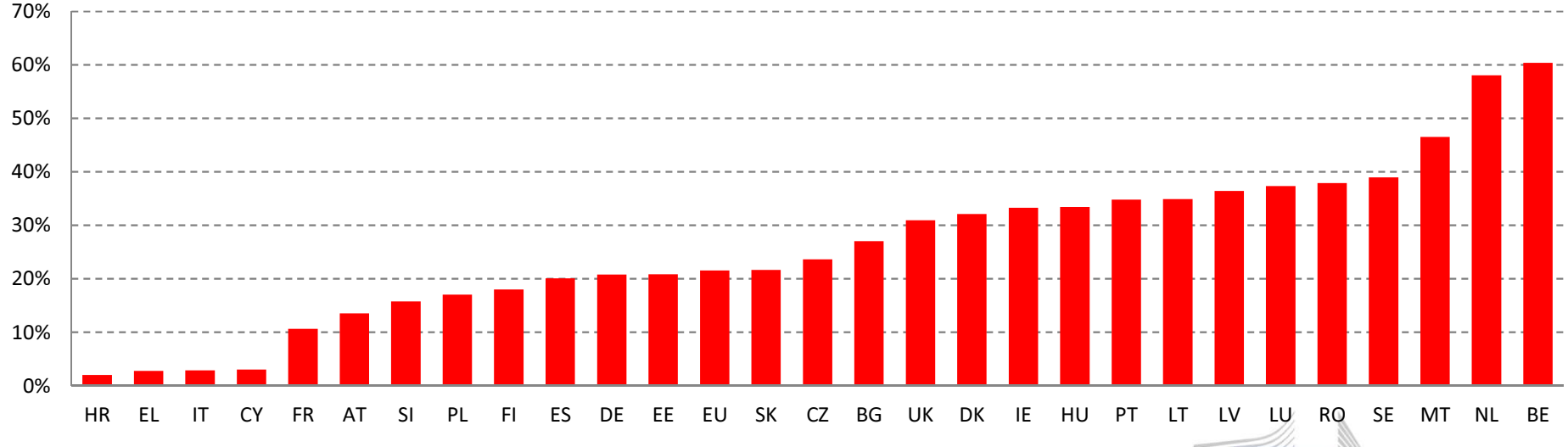
There has been a sharp upward trend in the take-up of fast broadband in the EU since 2010, triggered also by continuous deployment of infrastructure. Most cable subscriptions were migrated to high-speed plans, and high-speed VDSL and fibre services are also catching up. In Belgium and the Netherlands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

Percentage of households with a fast broadband (at least 30Mbps) subscription at EU level, 2010-2015



Source: Communications Committee and Eurostat

Fast broadband (at least 30Mbps) household penetration, July 2015

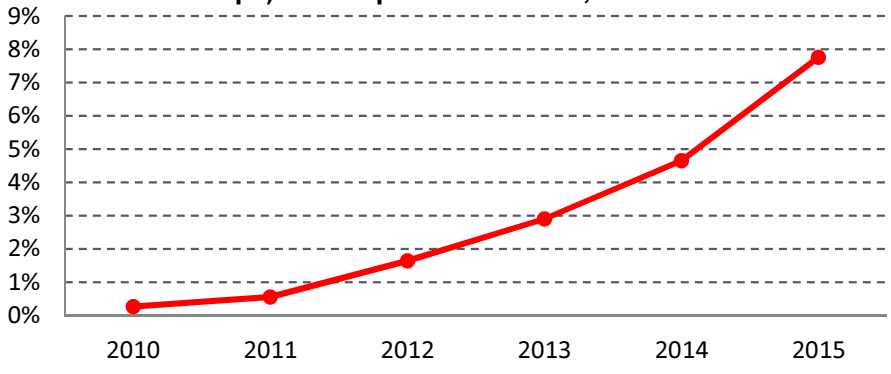


Source: Communications Committee

An estimated 8 % of European homes subscribe to ultrafast broadband (at least 100 Mbps), up from 0.3 % five years ago. Romania, Sweden and Latvia are the most advanced in ultrafast broadband adoption.

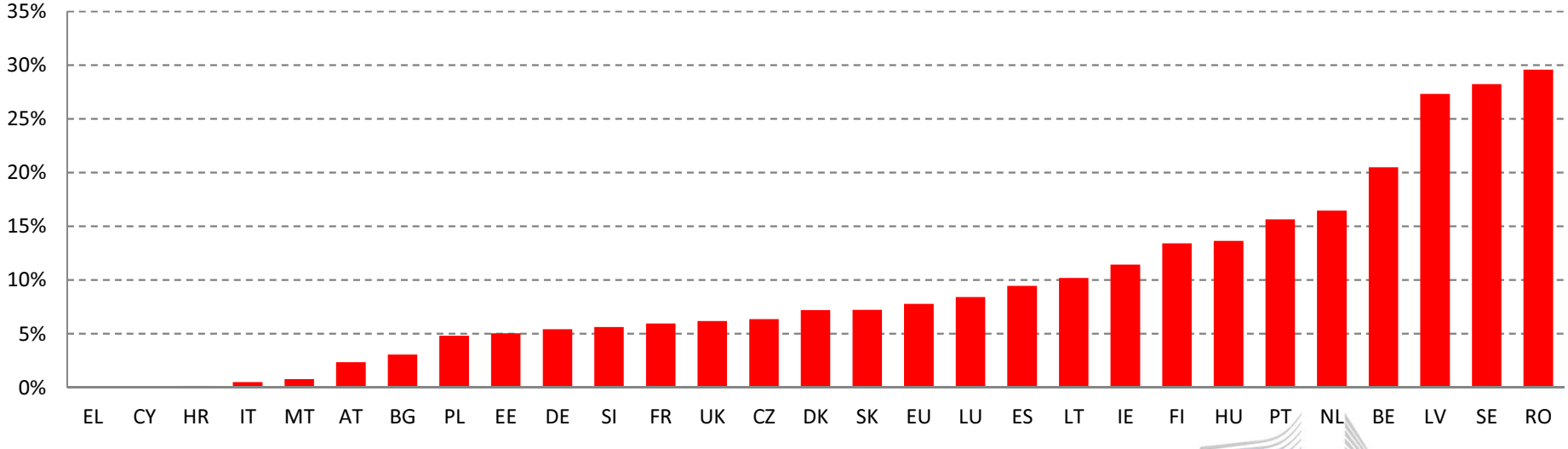
The Digital Agenda for Europe set the objective that at least 50 % of homes should subscribe to ultrafast broadband by 2020. From June 2015, 49 % of homes are covered by networks capable of providing 100 Mbps. As service offerings are emerging, take-up is growing sharply. The penetration is the highest in Romania, Sweden and Latvia. These three Member States have a high coverage of FTTP. In Greece, Italy and Croatia take-up is low mainly due to the lack of superfast infrastructure, while in Cyprus and Malta, where the infrastructure is available for many homes, still mainly lower speed offers are purchased.

Percentage of households with an ultrafast broadband (at least 100Mbps) subscription at EU level, 2010-2015



Source: Communications Committee and Eurostat

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

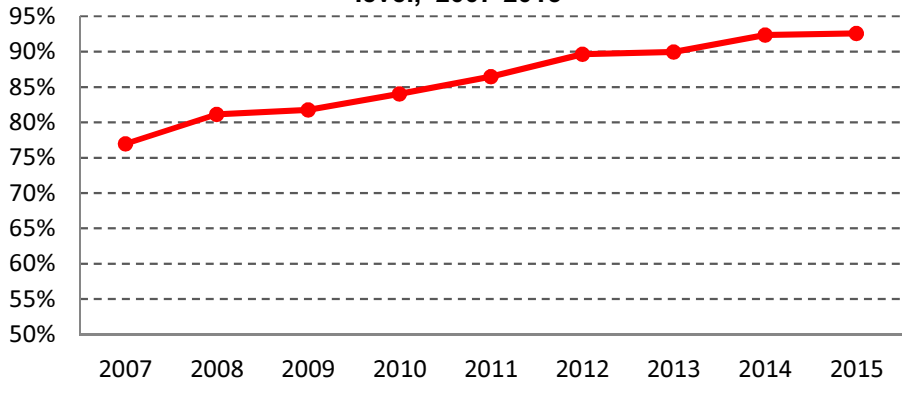


Source: Communications Committee and Eurostat

At EU level, 93 % of companies have a fixed broadband subscription. While almost all large companies use broadband, 8 % of small enterprises are not yet connected.

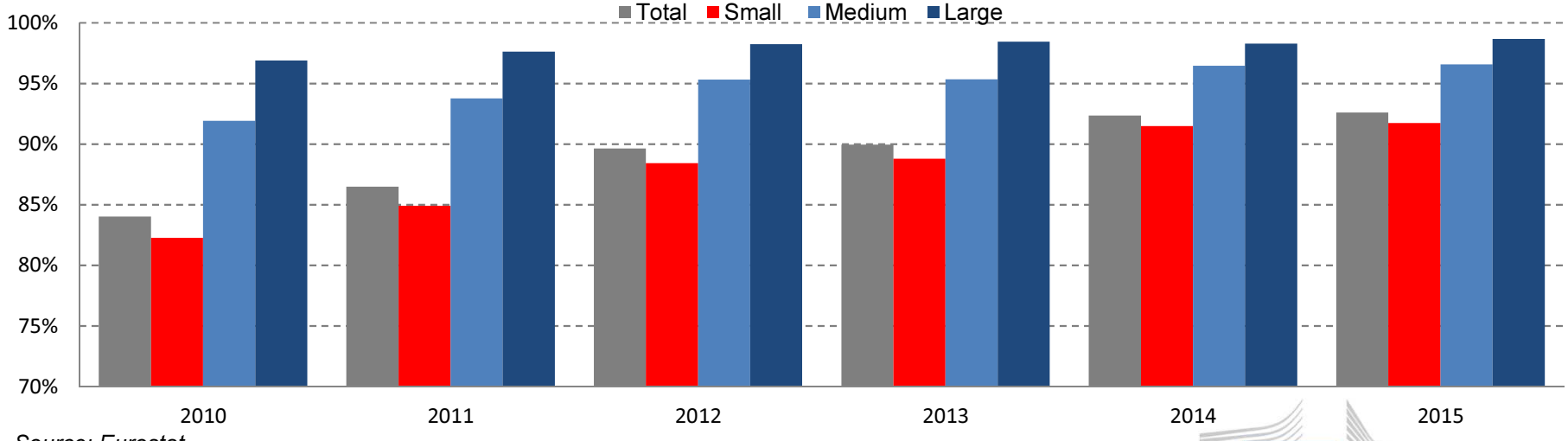
Enterprise connectivity went up from 84 % in 2010 to 93 % in 2015. Almost all large enterprises had a broadband subscription already in 2010, while there was a significant increase in the adoption of broadband in small and medium enterprises in the last five years. In medium-sized enterprises, the take-up rate grew from 92 % in 2010 to 97 % in 2015. At the same time, there was a 10 percentage point increase in penetration among small enterprises, but still 8% of small companies remain unconnected.

Percentage of enterprises having a fixed broadband connection at EU level, 2007-2015



Source: Eurostat

Percentage of enterprises having a fixed broadband connection, by enterprise size at EU level, 2010-2015



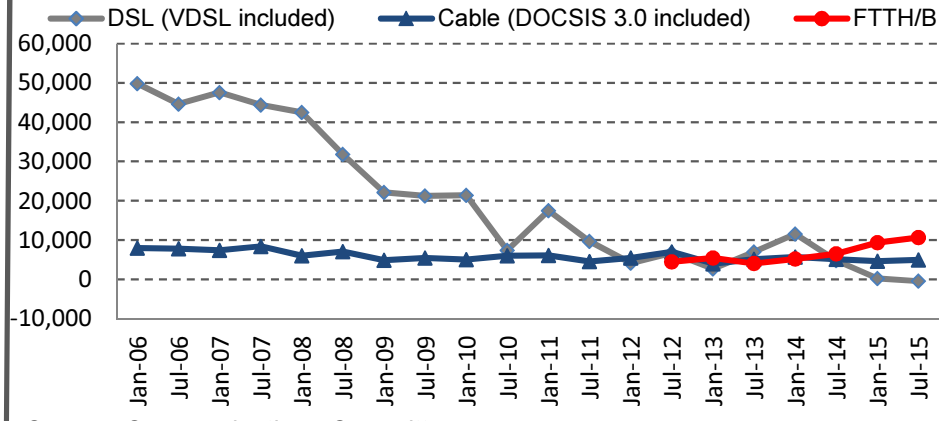
Source: Eurostat

69 % of subscriptions are xDSL, although xDSL is slightly losing market share. Cable is second with 19 % of the market. Fibre to the Home/Building is emerging.

Although DSL is still the most widely used fixed broadband technology, its market share declined from 80 % in 2009 to 69 % in 2015. The main challenger — cable — increased slightly its share during the same time period, but most of the gains were posted by alternative technologies, especially FTTH/B.

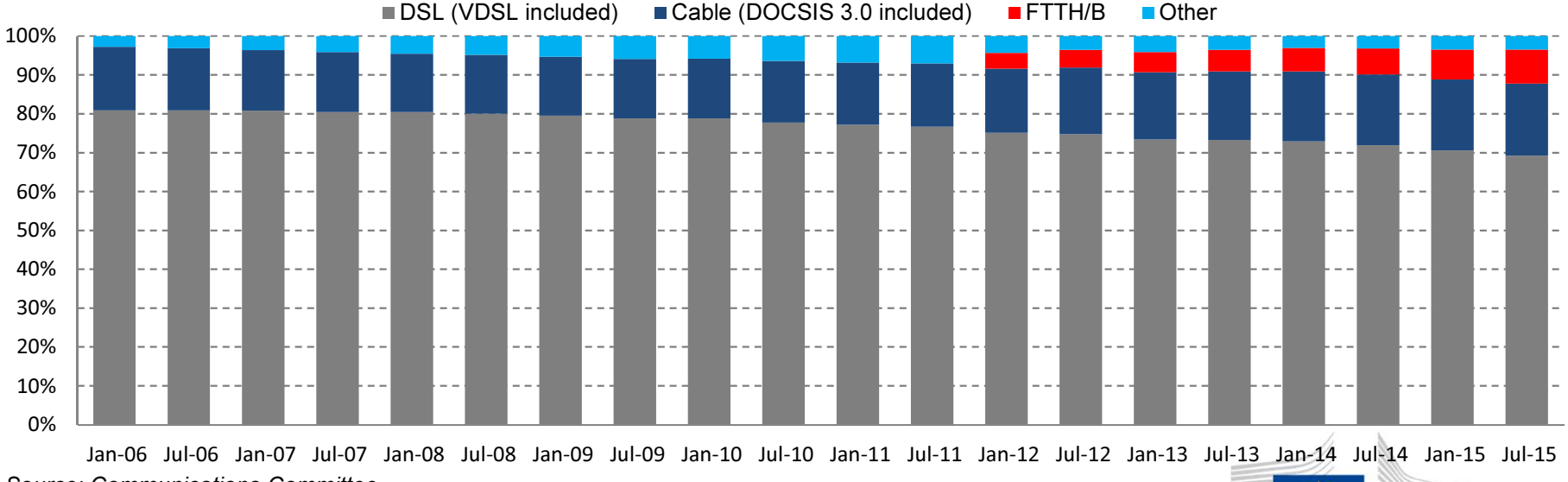
Nevertheless, DSL continues to be predominant, and its market share can be strengthened thanks to the increasing VDSL coverage.

Fixed broadband net adds by technology at EU level, 2006-2015



Source: Communications Committee

Fixed broadband subscriptions — technology market shares at EU level, January 2006 to July 2015

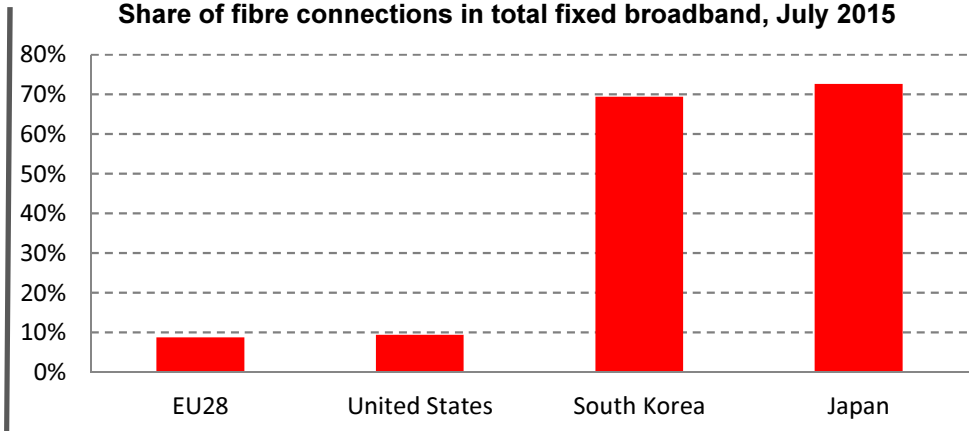


Source: Communications Committee

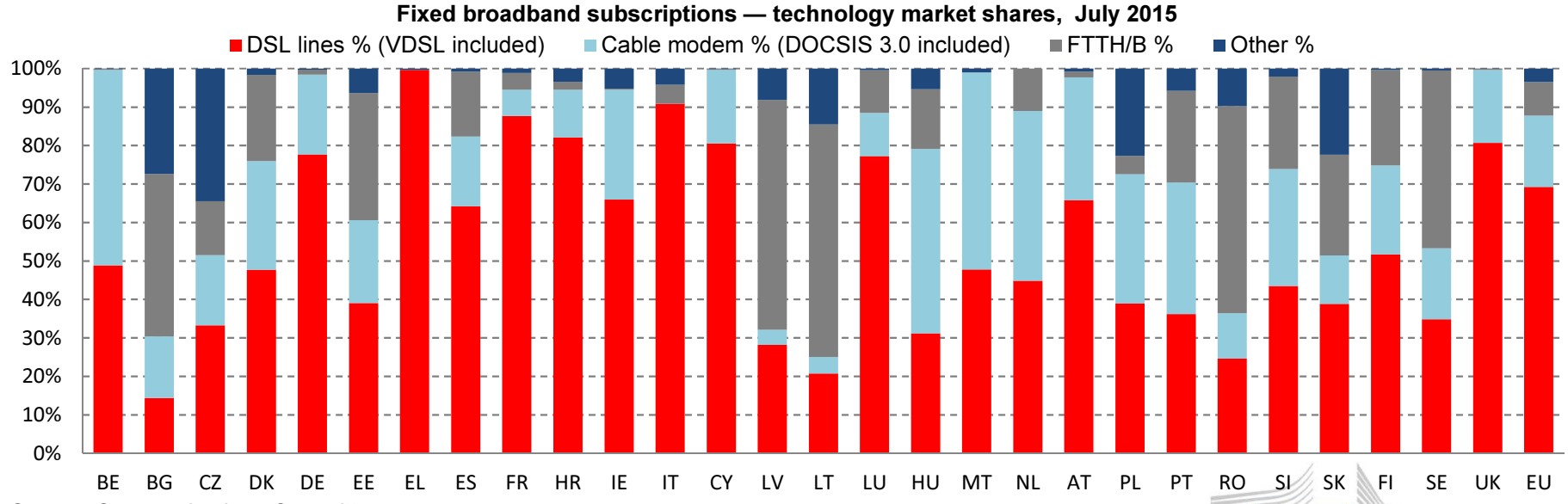
xDSL is particularly important in Greece and Italy, and has the lowest market share in Bulgaria, Lithuania and Romania. Cable has a very high market share in Belgium, Hungary, Malta and the Netherlands. FTTH/B is the most widely used technology in Lithuania, Latvia, Romania, Bulgaria and Sweden.

The share of xDSL ranges from 14 % 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 9 % of EU broadband subscriptions up from 7 % a year ago. In these technologies, Europe is still very much lagging behind South Korea and Japan.



Source: OECD and Communications Committee



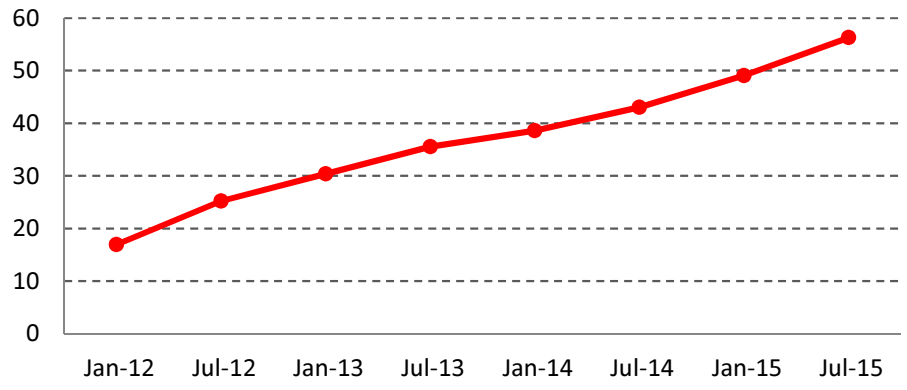
Source: Communications Committee

NGA subscriptions went up sharply by 21 million in the last two years, but only 35 % of all subscriptions are NGA. In Belgium and Romania, over 70 % of fixed broadband subscriptions are NGA, while the same ratio is less than 10 % in Greece, Cyprus and Italy.

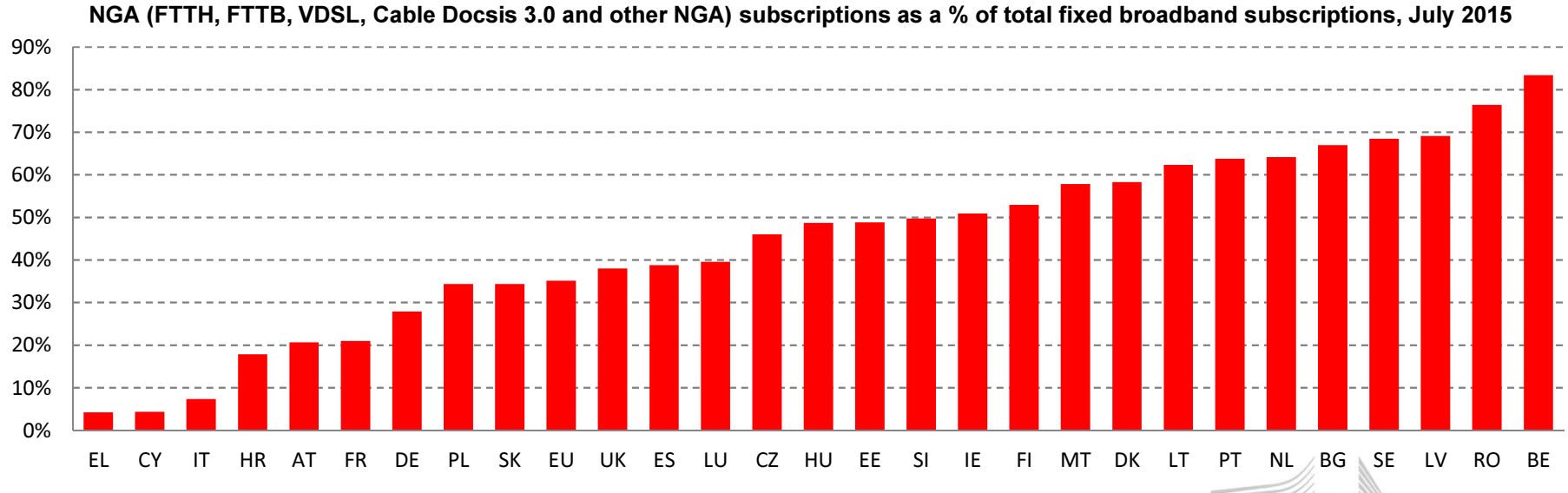
Next Generation Access accounts for 35% of all EU fixed broadband subscriptions. The increase in NGA was mainly attributed to cable. 84 % of cable subscriptions have been upgraded to DOCSIS 3.0.

In the last 12 months, VDSL grew by 6.8 million, FTTH/B by 3.6 million and Cable Docsis 3.0 by 2.7 million.

The majority of broadband subscriptions are NGA in Belgium, Romania, Bulgaria, Latvia, the Netherlands, Sweden, Portugal, Lithuania, Malta, Denmark, Finland and Ireland. At the same time, Cyprus, Greece and Italy are very much lagging behind all other Member States.



Source: Communications Committee

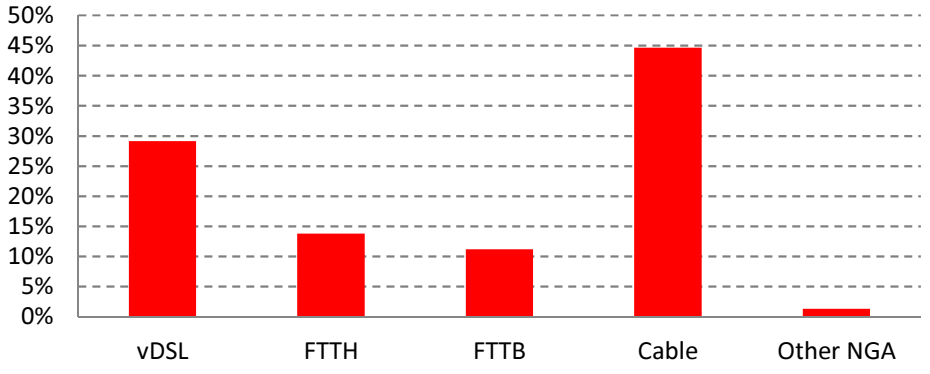


Source: Communications Committee

Cable Docsis 3.0 is currently the most widespread NGA technology in the EU both in coverage and take-up. VDSL subscriptions went up by 33% in the last six months.

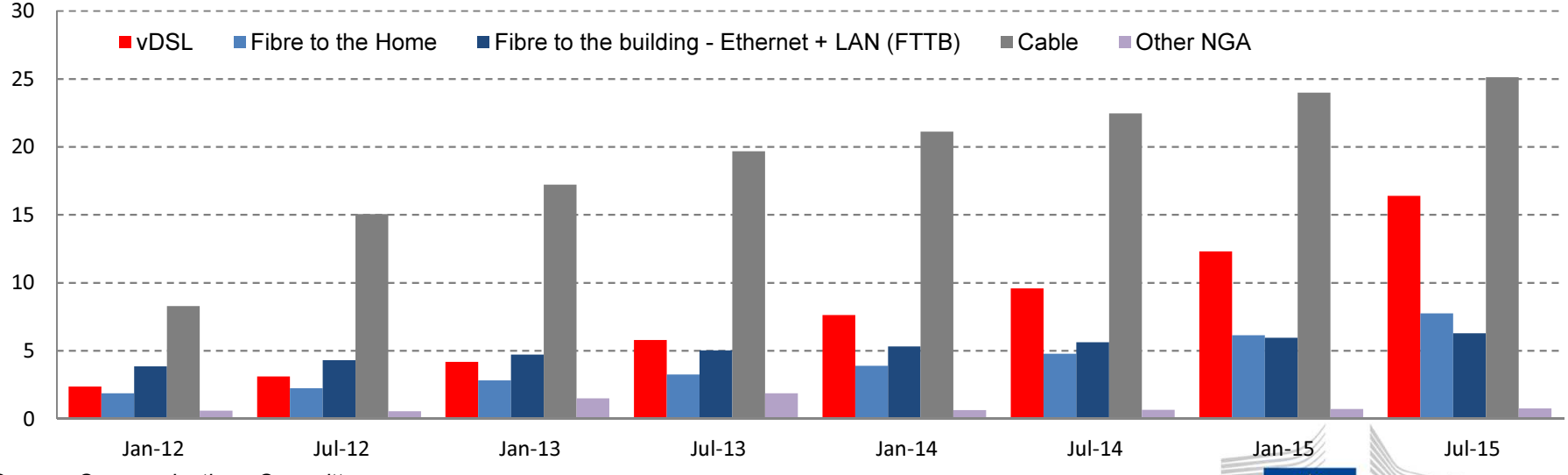
45 % of NGA subscriptions are Docsis 3.0, which is remarkable since cable broadband in total represents only 19 % of all EU fixed broadband subscriptions. While almost all the cable networks have been upgraded to NGA, only 44 % of xDSL network is VDSL-enabled. Nevertheless, VDSL coverage went up by 9 % and the number of subscriptions by 33 % in the last six months. FTTH and FTTB have a 14 % and 11 % share in total NGA subscriptions, respectively.

Share of different NGA technologies in total NGA subscriptions at EU level, July 2015



Source: Communications Committee

NGA subscriptions (millions) by technology at EU level, January 2012 to July 2015

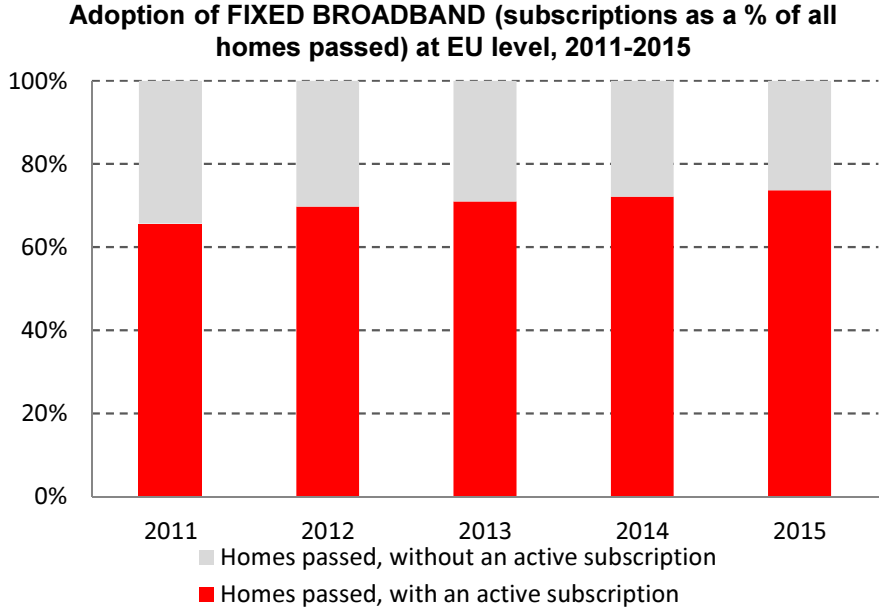


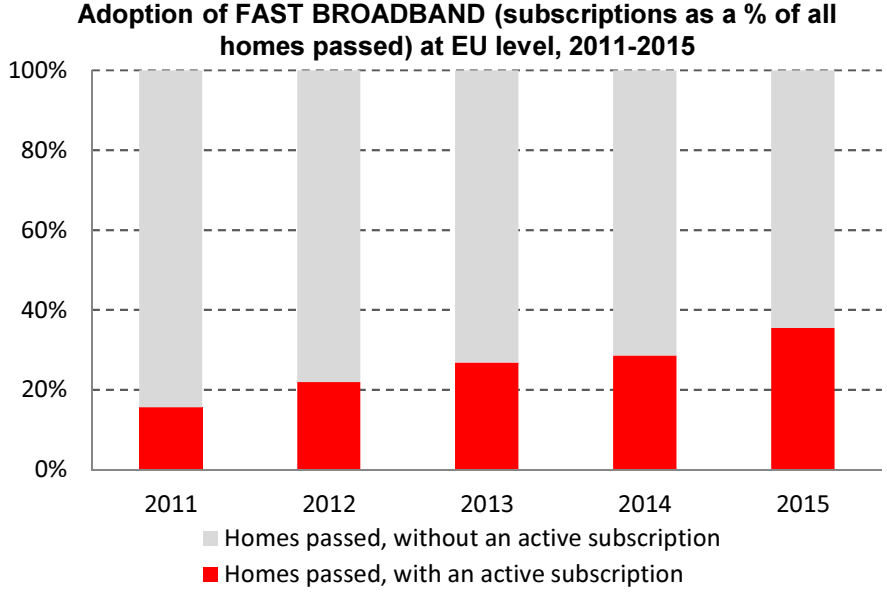
Source: Communications Committee

Fast broadband is available to 71 % of European homes, 35 % of these homes *(which equals to 25% of all European homes)* already subscribe.

Overall, fixed broadband (of at least basic quality) is available to 97 % of European homes, and 72 % subscribe meaning that more than three quarters of homes covered by a fixed technology have an active subscription. While overall fixed broadband coverage is close to be ubiquitous, the increase in subscriptions is slowly reaching saturation.

By contrast, for fast broadband technologies (capable of providing 30Mbps and above) both the coverage and the take-up are increasing. Demand is catching up with ongoing deployment, as the active versus all homes passed ratio went up from 16 % in 2011 to 35 % in 2015.





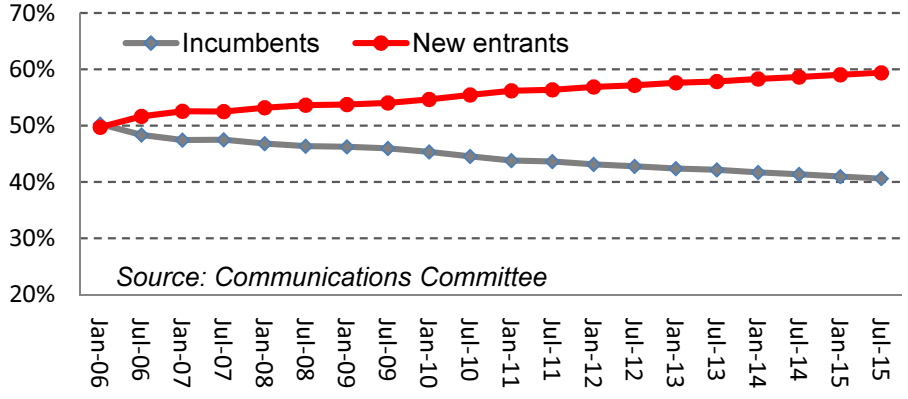
Source: Commission services based on the Communications Committee, Eurostat and IHS & VVA

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

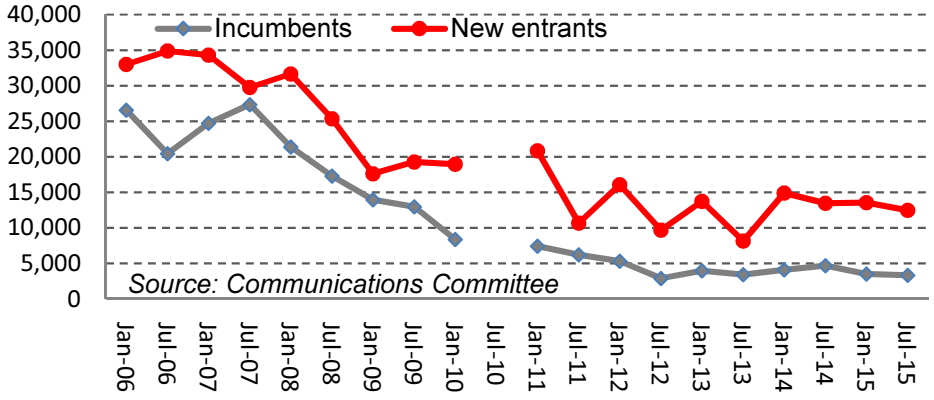
Incumbent operators are market leaders in almost all Member States, although their market share is decreasing. During the last 10 years, new entrant operators always posted higher net gains then the incumbents. In the last six months, new entrants yielded 79 % of the total net gain in the market. This, however, could not result in a significant change in the overall market share of new entrants because of the low growth rate of the total market.*

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

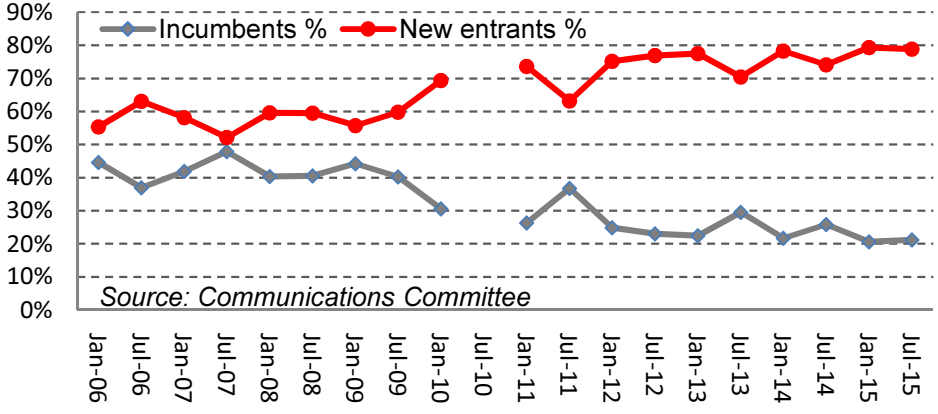
Fixed broadband subscriptions - operator market shares at EU level (% of subscriptions), January 2006 to July 2015



Fixed broadband subscriptions growth per day by operator at EU level, January 2006 to July 2015



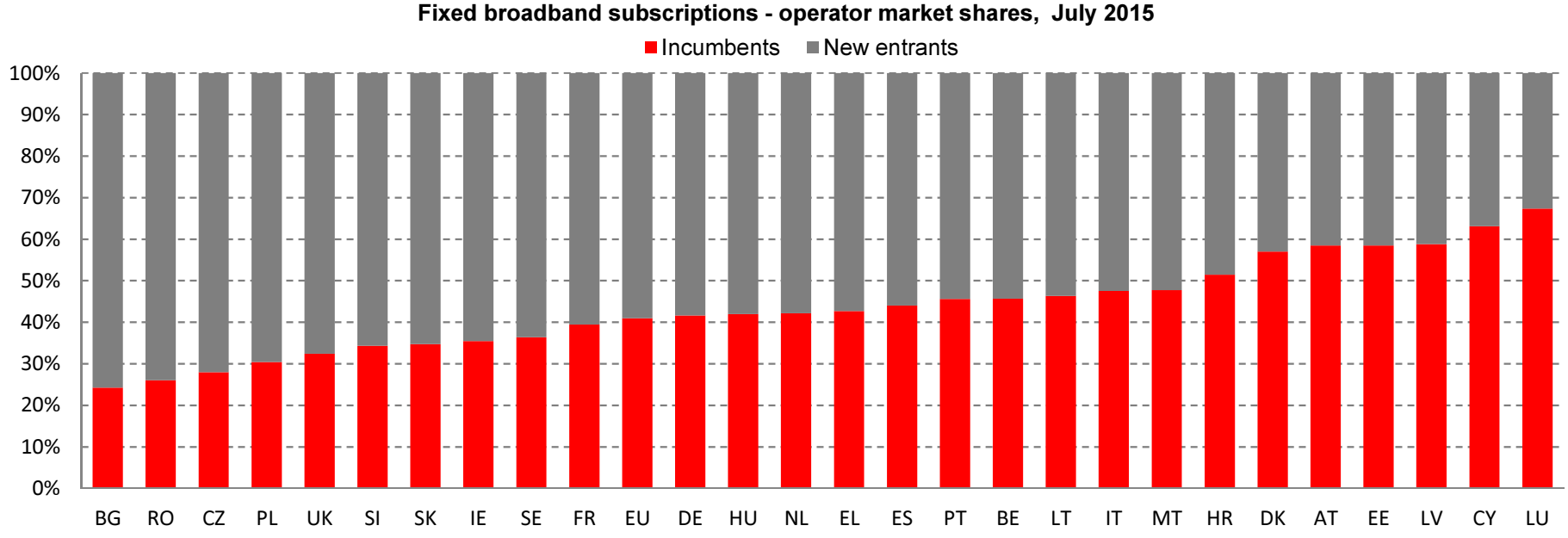
Fixed broadband subscriptions growth per day by operator at EU level, January 2006 to July 2015



Market share of incumbents show very large differences across Europe. In 7 out of the 28 Member States, more than half of the subscriptions are provided by incumbent operators.

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

Incumbents have the highest subscription market share in Luxembourg and Cyprus, where the small market size may favour concentration. Incumbents are the weakest in Europe in four Member States: Bulgaria, Romania, the Czech Republic and Poland. In all these four Member States, most of the subscribers use technologies other than xDSL.

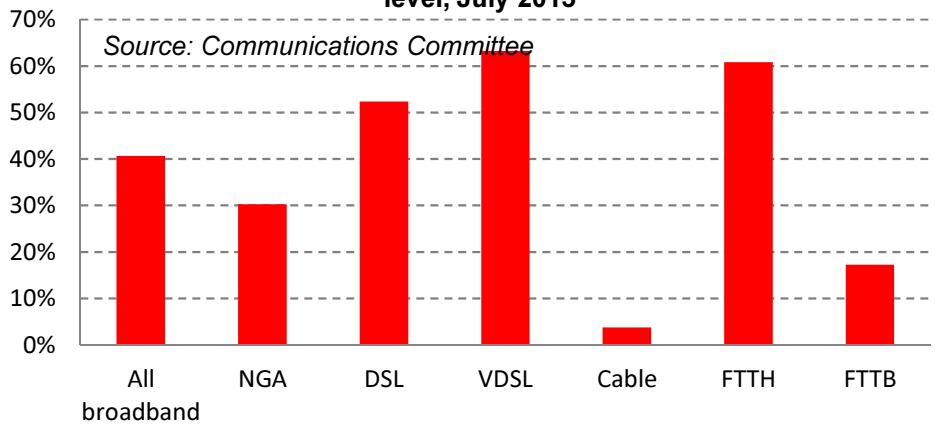


Source: Communications Committee

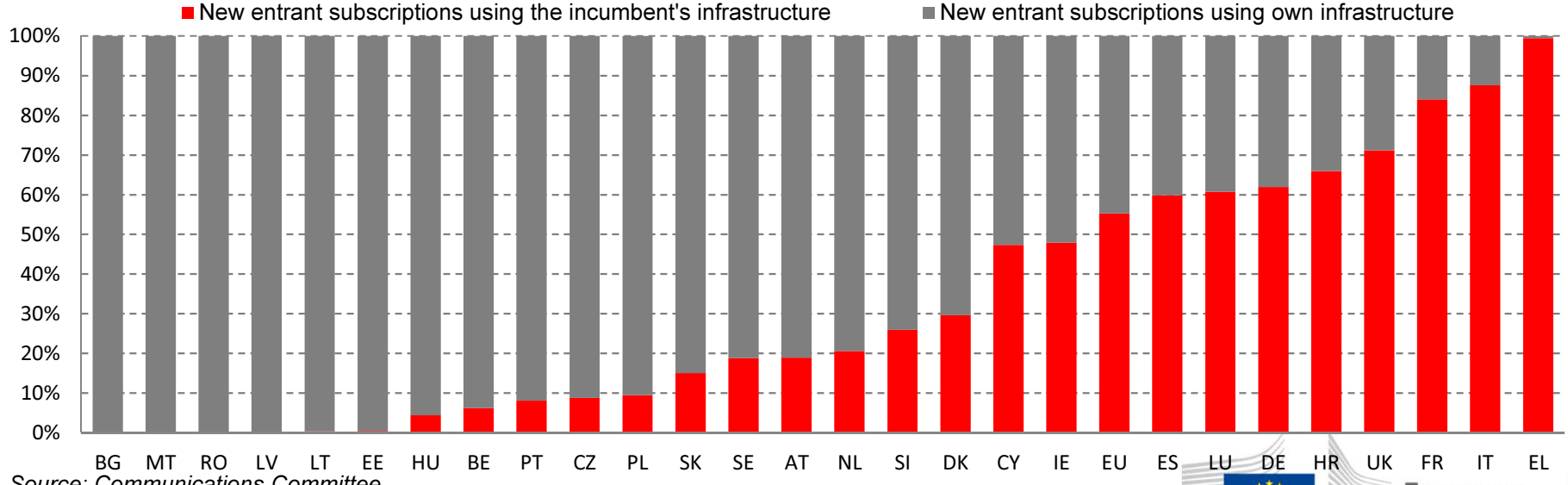
In the DSL market, unbundling reduced the dominance of incumbents, but in VDSL incumbents hold 63 % of subscriptions. Nevertheless, NGA is provided mainly by new entrants because of the high share of cable.

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

Incumbent's market share by technology (% of subscriptions) at EU level, July 2015



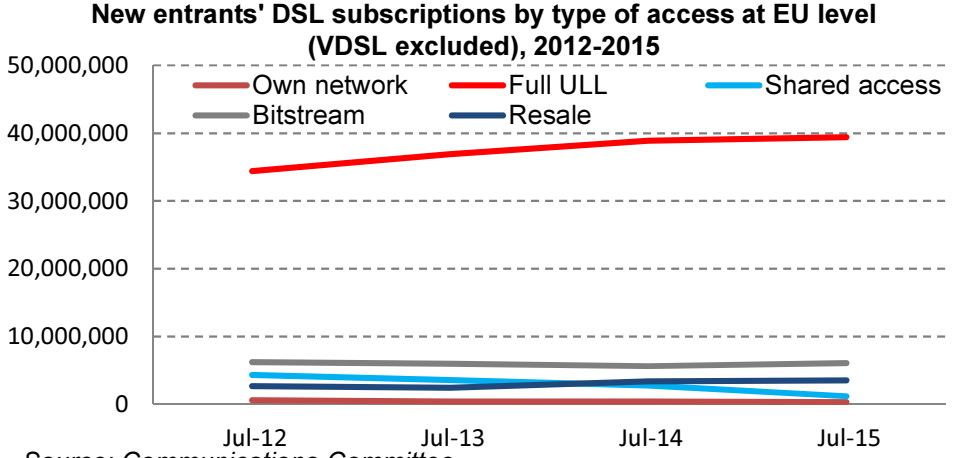
New entrants' subscriptions - using own infrastructure or the incumbent's network, July 2015



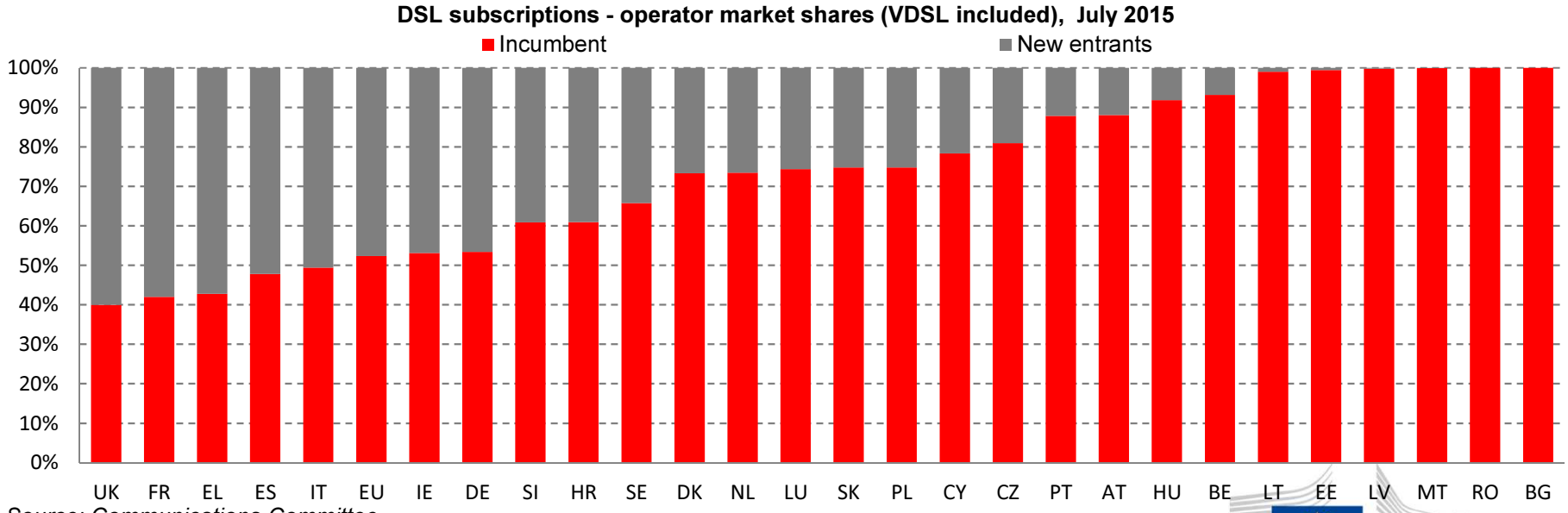
Source: Communications Committee

52 % of DSL subscriptions belong to incumbents. New entrants mainly use Local Loop Unbundling to sell DSL. In six Member States, the new entrants' presence in the DSL market is marginal.

In Bulgaria, Romania, Latvia, Malta, Estonia and Lithuania, there is virtually no competition in the DSL market. These Member States, however, have strong platform competition. At the same time, in the UK, Greece, France, Italy and Spain, new entrants account for the majority of xDSL subscriptions. In all these Member States, the vast majority of new entrants' DSL subscriptions are provided through Local Loop Unbundling, but in Italy bitstream is also important.



Source: Communications Committee

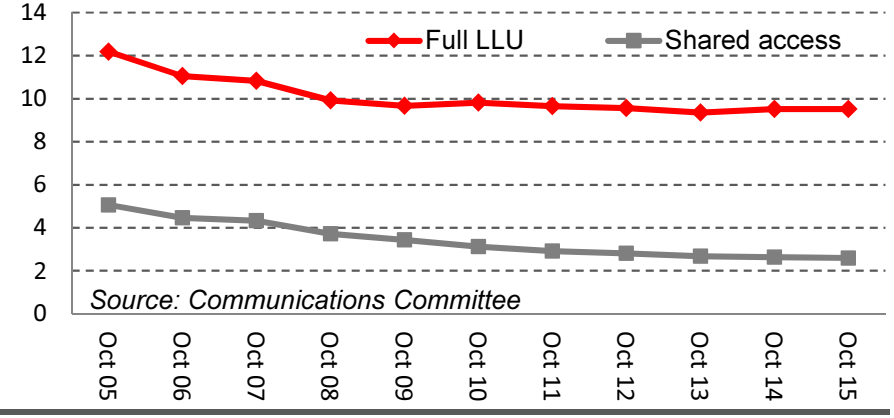


Source: Communications Committee

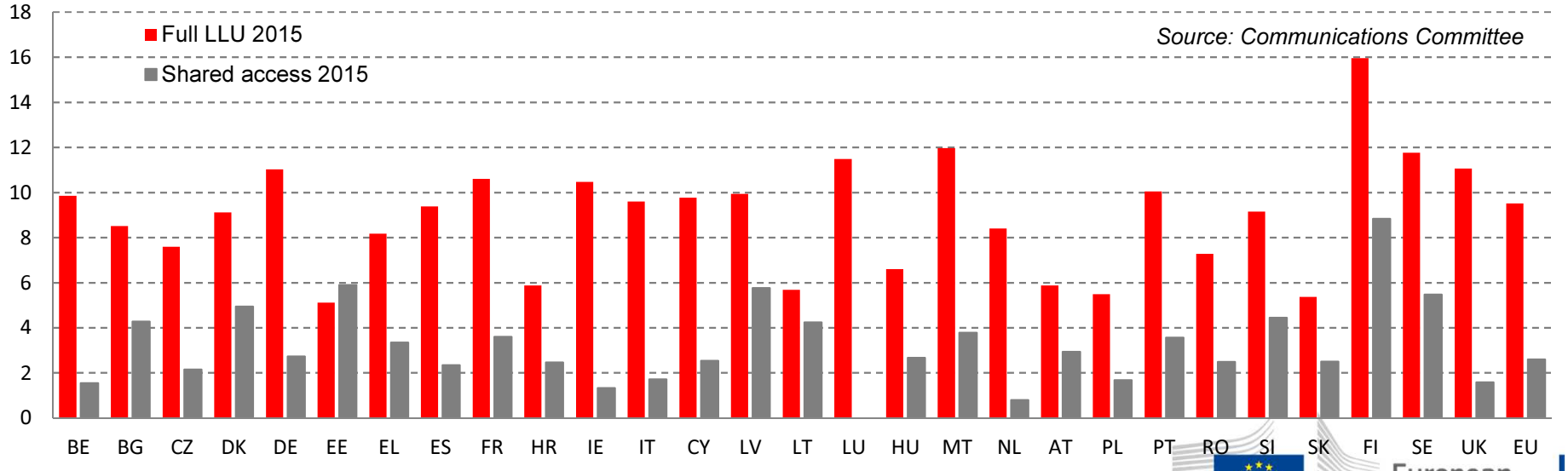
Wholesale charges of Local Loop Unbundling went down by 22% for full access since 2005, but has been broadly stable since 2008.

Regulated wholesale charges giving access for new entrants to the local loop are important to effective competition in the xDSL market. The monthly average total cost (calculated as the monthly rental plus the one time connection charge distributed over a three year period) stood at EUR 9.5 for full access (provision of both voice and broadband) and at EUR 2.6 for shared access (provision of broadband only) as of October 2015.

Local Loop Unbundling monthly average total cost (EUR) at EU level, 2005-2015



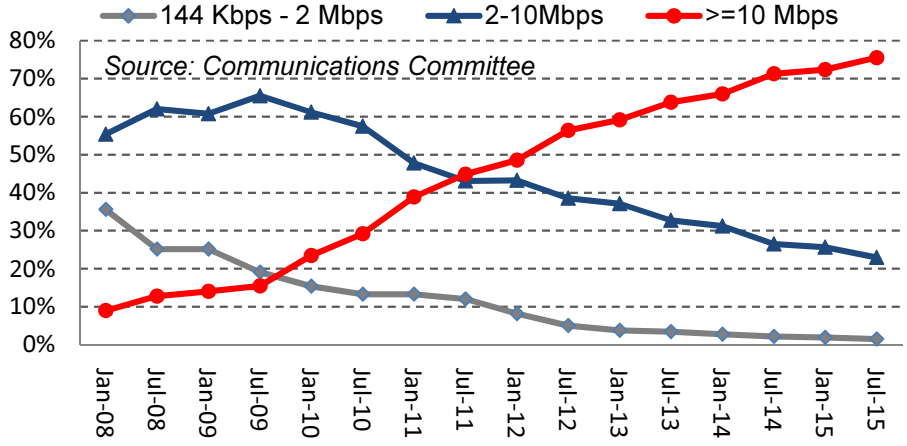
Local Loop Unbundling monthly average total cost (EUR), October 2015



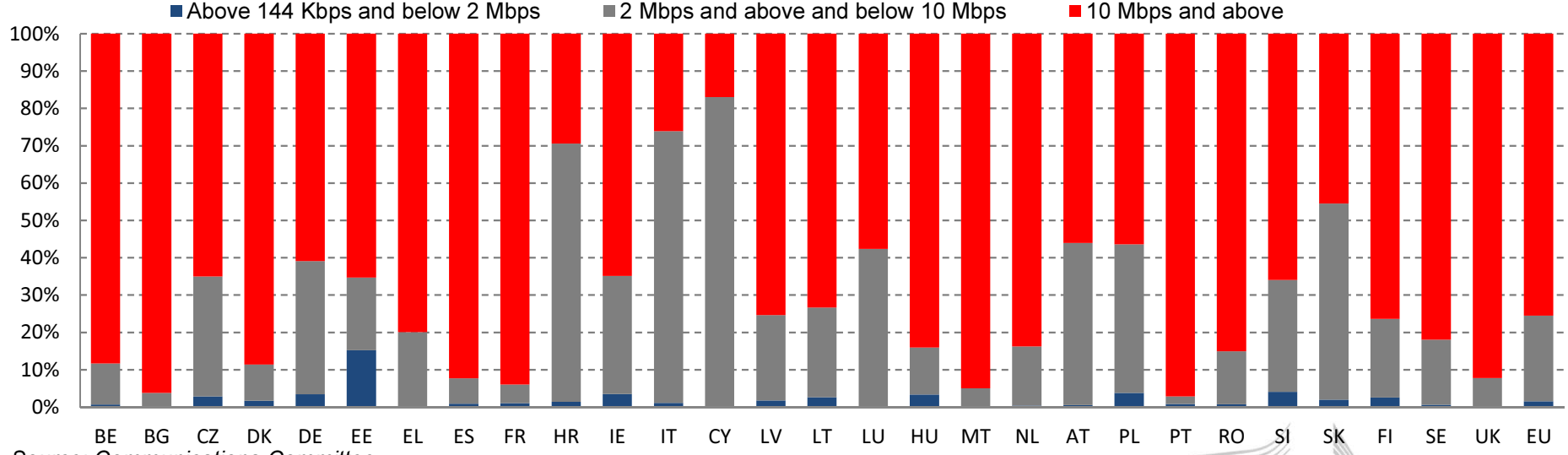
Fixed broadband speeds: over 75 % of subscriptions are at least 10Mbps. <2Mbps is marginal (1.5 %).

Low speed fixed broadband subscriptions are becoming marginal: only 1.5 % of all subscriptions have less than 2 Mbps advertised download speed as opposed to 36 % eight years ago. At least 10 Mbps applies to more than 75 % of subscriptions, up from 9 % in 2008. However, broadband connections are still slow in Italy, Croatia and Cyprus, where less than one third of subscriptions are at least 10 Mbps. In Estonia, a relatively large proportion of subscriptions (15 %) are still below 2 Mbps.

Fixed broadband subscriptions by headline speed at EU level, 2008-2015



Fixed broadband subscriptions by headline speed, July 2015



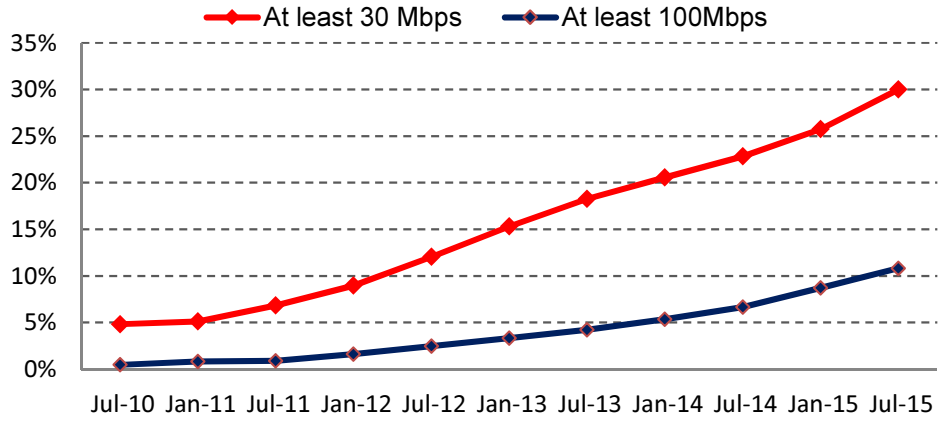
Source: Communications Committee

Fast and ultrafast broadband subscriptions grew by 36 % in 12 months. In Belgium, Latvia and Romania, the majority of subscriptions are at least 30 Mbps. Ultrafast (at least 100 Mbps) is most widespread in Belgium and Romania.

Despite the growth in fast and ultrafast subscriptions, they are still rare in the EU. In January 2015, only slightly more than one in four subscriptions were at least 30 Mbps and only 9 % were at least 100 Mbps.

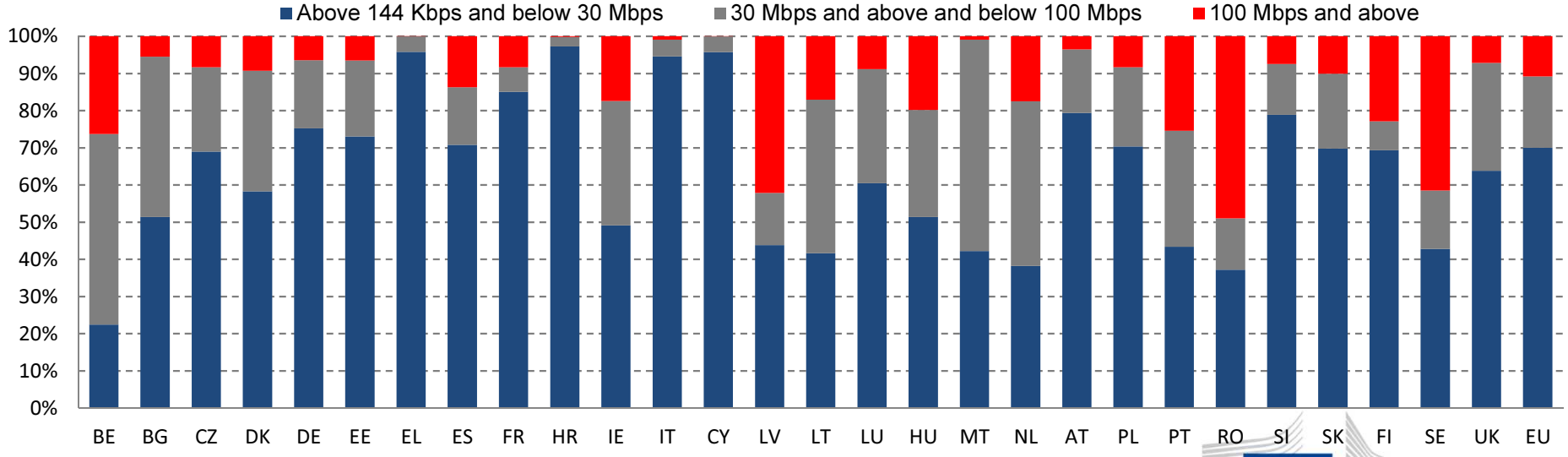
In Belgium, Romania, Malta, Latvia, Portugal, Lithuania, Ireland, the Netherlands and Sweden, already more than 50 % are already at least 30 Mbps, while the same ratio is less than 10 % in Italy, Greece, Cyprus and Croatia. In ultrafast (at least 100 Mbps), Sweden, Latvia and Romania are the most advanced with more than 40 % of subscriptions.

Fixed broadband subscriptions by headline speed at EU level, 2008-2015



Source: Communications Committee

Fixed broadband subscriptions by headline speed, July 2015



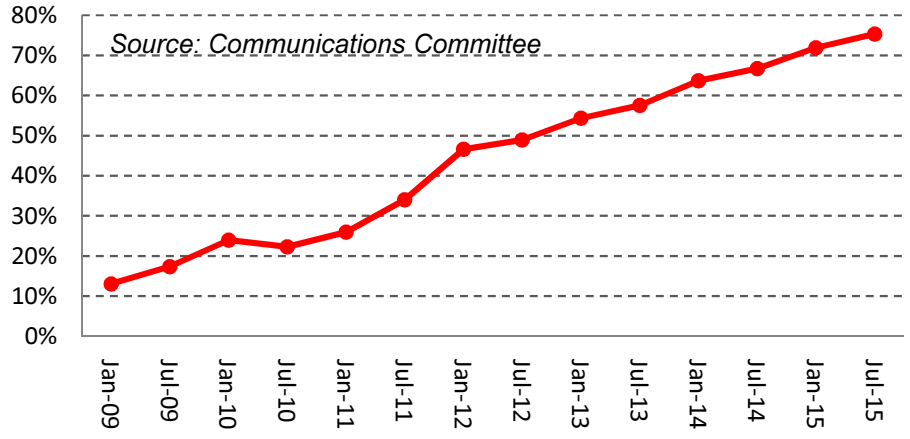
Source: Communications Committee

There are 75 active mobile broadband SIM cards per 100 people in the EU, up from 34 four years ago. The growth was linear over the last three years with over 40 million new subscriptions added every year.

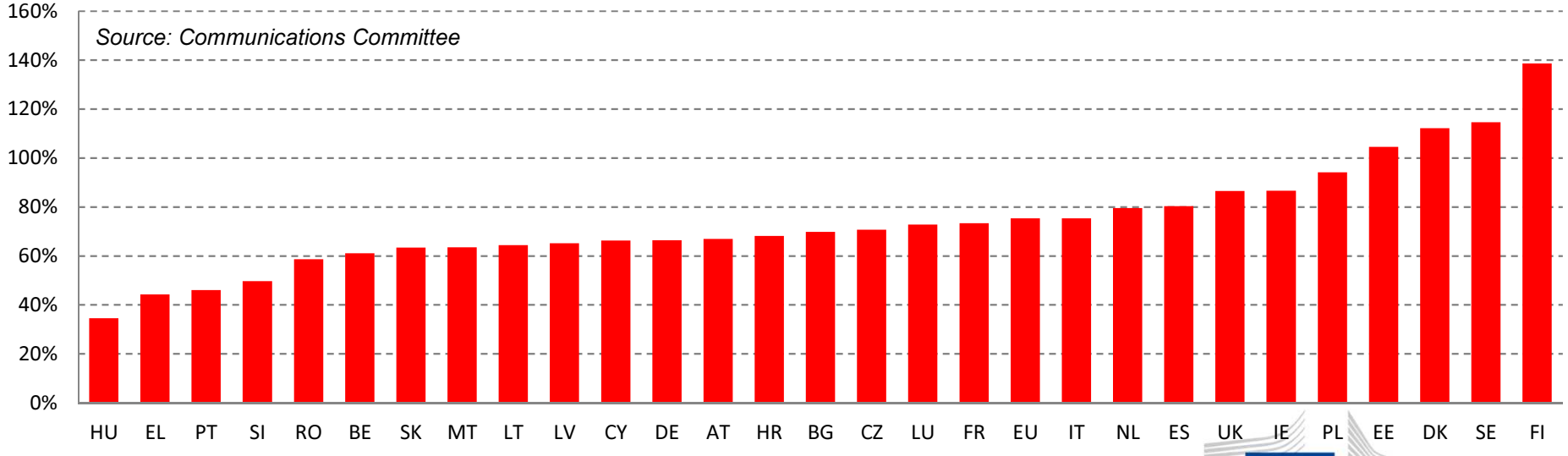
Mobile broadband represents a fast growing segment of the broadband market. More than 60 % of all active mobile SIM cards use mobile broadband.

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

Mobile broadband penetration at EU level, January 2009 to July 2015



Mobile broadband penetration - all active users as a % of population, July 2015

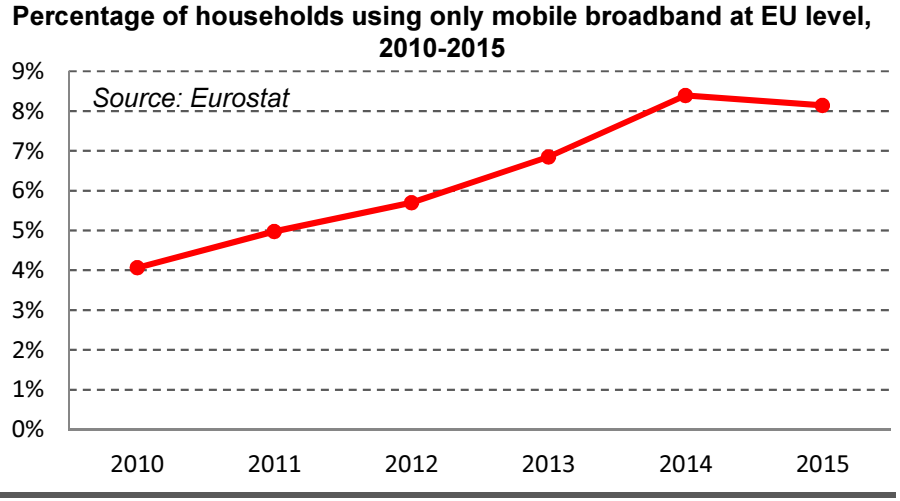


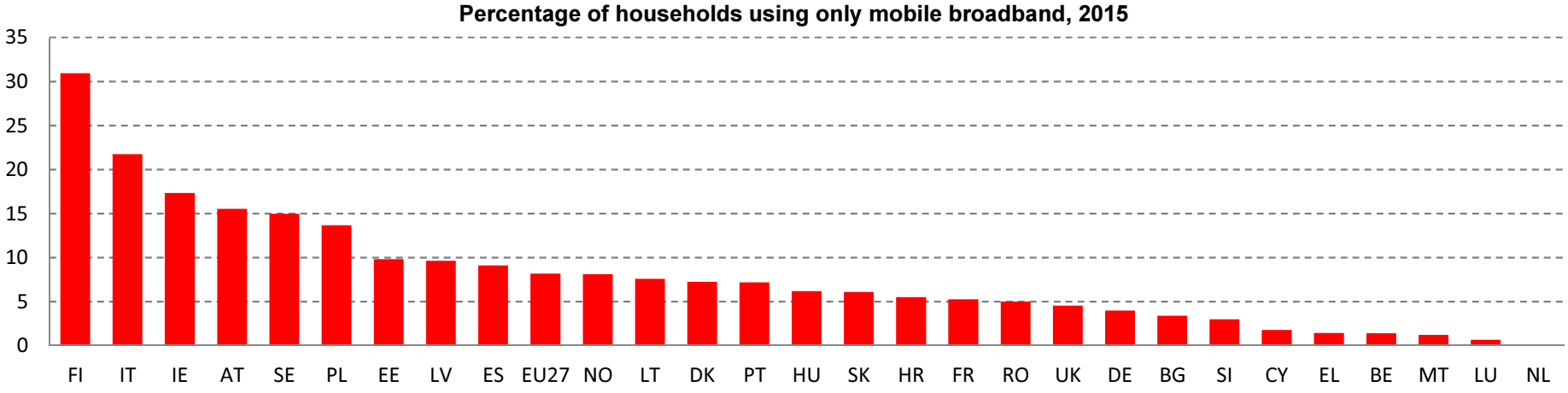
Mobile broadband is still mainly complementary to fixed broadband. In 2015, 8.1 % of EU homes accessed the internet only through mobile technologies. Finland and Italy were leaders in mobile access to internet with 31 % and 22 % of homes using it in 2015.

Europeans access the internet primarily with fixed technologies at home. However, there are a growing number of homes with only mobile internet use. The percentage of homes with purely mobile broadband access went up from 4.2 % in 2010 to 8.1 % in 2015. This indicates that mobile broadband is still mainly complementary to fixed broadband, but not a substitution product.

The Netherlands was the Member State with the lowest figure at less than 0.5 %.

By contrast, Finland and Italy were leaders in mobile access to internet with 30.9 % and 21.7 % of homes in 2015.





Source: Eurostat

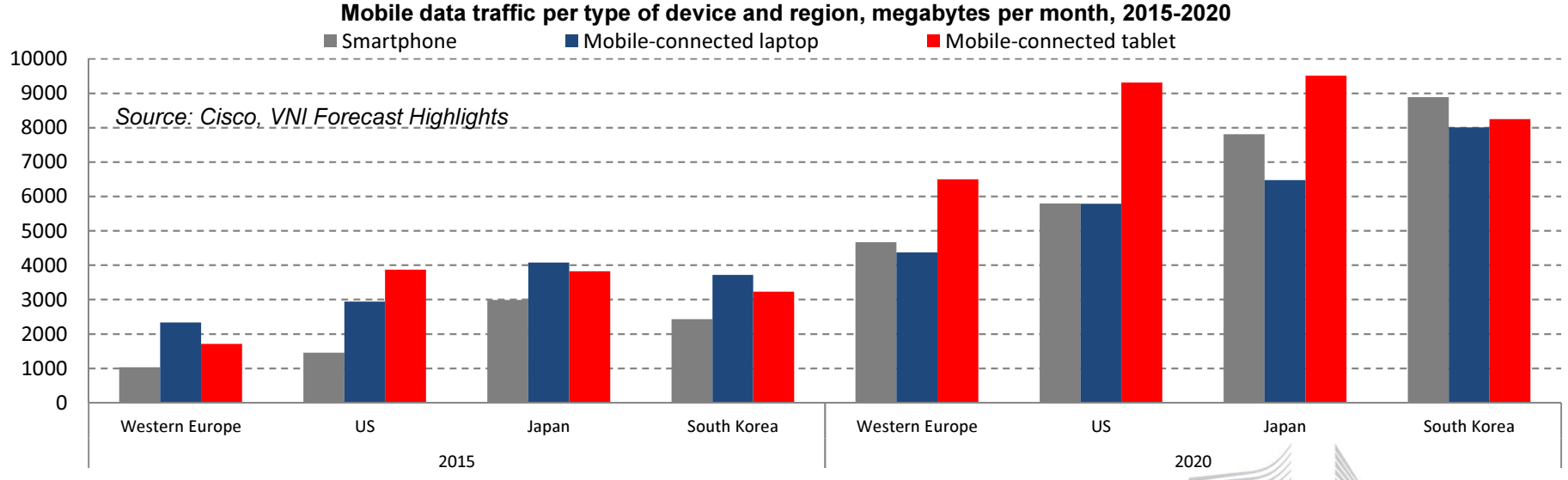
Mobile broadband traffic: Tablets are expected to be the touchstone for mobile data traffic in 2020, exceeding smartphones and laptops in average usage. Mobile data traffic in 2020 is expected to be six times higher than in 2015.

Mobile data traffic in western Europe is expected to grow by six fold from 2015 until 2020, which represents a higher growth compared to the US (x6), South Korea (x5) and Japan (x4). Indeed, mobile data traffic will grow two times faster than fixed IP traffic from 2015 to 2020.

The average smartphone user in western Europe will generate 4.6 GB of mobile data traffic per month in 2020, up by 353 % from 2015. Laptop users will generate 4.4 GB and tablet users more than 6 GB.

Tablet devices in Europe will overtake mobile-connected laptops and smartphones in total data traffic. Currently, in western Europe, tablets represent 33 % of total mobile traffic. In 2020, their share will be 42 %, while in South-Korea and Japan tablets will weigh less than 40 % of total mobile traffic.

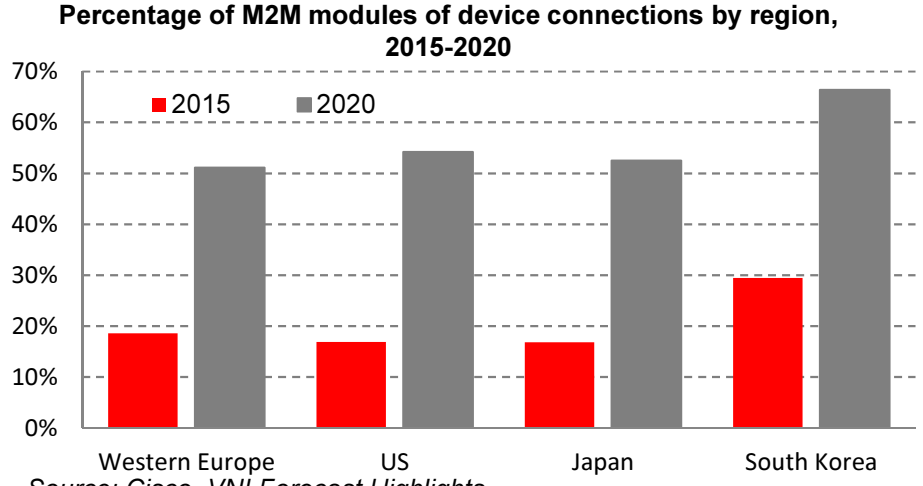
As for the US, tablets will represent 44 % of total mobile traffic by 2020, with 9 GB per month per user, as opposed to 6 GB in the EU.



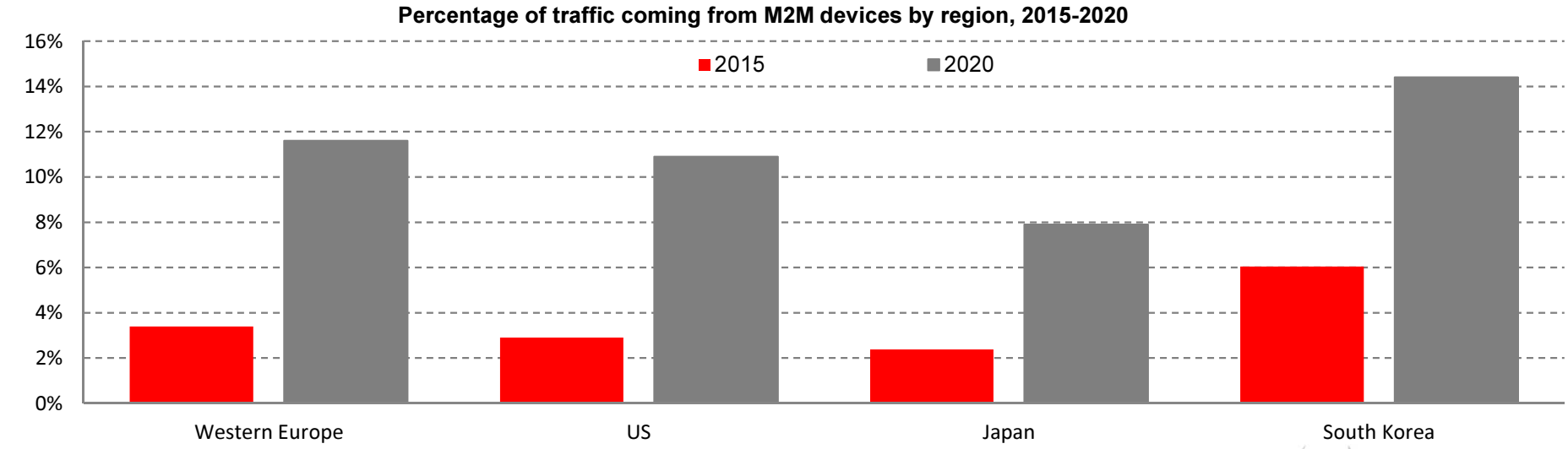
Machine-to-machine communications: In western Europe, M2M modules currently generate 3 % of total mobile data traffic. By 2020, this figure will go up to 11.6 %, while M2M modules will represent more than half of the total connected mobile devices in western Europe.

M2M communications on mobile networks will continue to increase rapidly both in terms of traffic and the number of devices. M2M currently represents 19 % of all connected mobile devices. This ratio is forecasted to go up to 51 % by 2020 in western Europe. M2M traffic will also expand, but will still take a relatively low share of total traffic on mobile networks (12 %).

The US and Japan will show similar figures, while in South Korea both traffic and the number of M2M devices will be significantly higher proportionally.



Source: Cisco, VNI Forecast Highlights



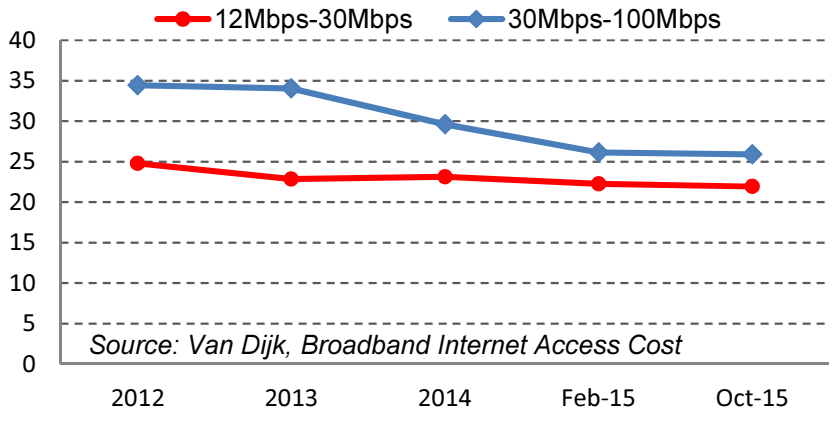
Source: Cisco, VNI Forecast Highlights

Prices* of high speed broadband access tend to decrease over time but remain dispersed across Member States.

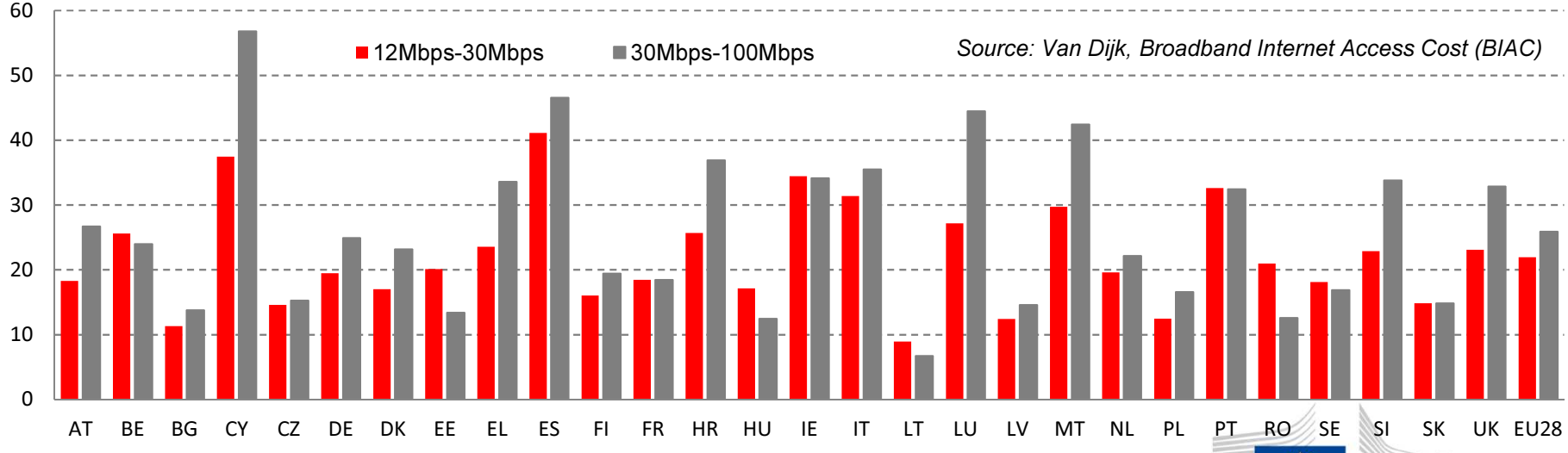
Broadband access prices remained dispersed across Europe: the minimum prices (calculated on Purchasing Power Parity) vary between EUR 6 and EUR 56 for a standalone offer with a download speed between 30 and 100 Mbps. The minimum prices were the lowest in Lithuania (EUR 6), Hungary (EUR 12) and Romania (EUR 13) and the highest in Cyprus (EUR 56), Spain (EUR 46) and Luxembourg (EUR 44). In Greece, Cyprus and Italy fast broadband (at least 30 Mbps) is still rare, representing less than 10 % of all subscriptions. The minimum price of standalone offers of 30 to 100 Mbps decreased from EUR 34 in 2012 to EUR 26 in 2015.

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

Broadband retail prices (EUR PPP) – standalone offers at EU level, 2012-2016



Fixed broadband retail prices (EUR PPP) - standalone offers at EU level, October 2015

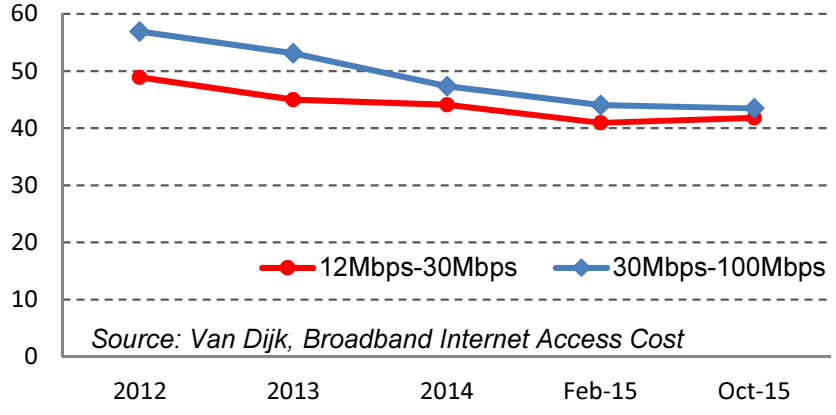


Prices* of triple play bundles including high-speed broadband access, fixed telephony and television went down by 24 % since 2012.

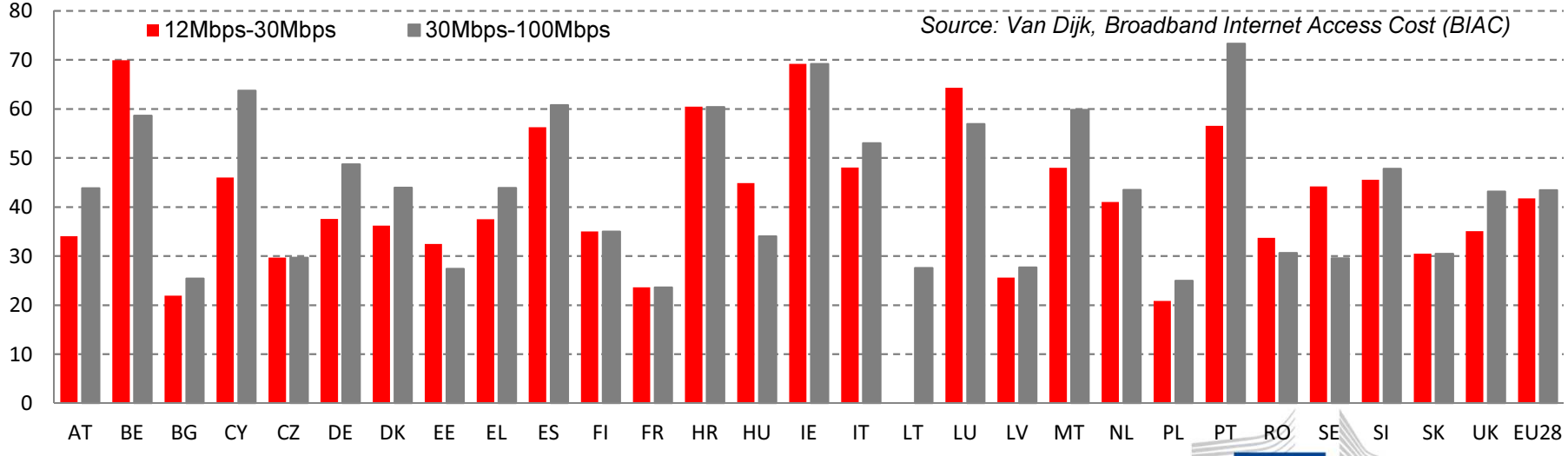
The minimum prices for triple play bundles including broadband access (with a download speed between 30 and 100 Mbps), fixed telephony and television vary between EUR 24 and EUR 73 in the EU. The minimum price was the lowest in France (EUR 24), Poland (EUR 24) and Bulgaria (EUR 25) and the highest in Portugal (EUR 73), Ireland (EUR 69), Cyprus (EUR 64) and Spain (EUR 61). Prices decrease over time, with the EU average going down from EUR 57 in 2012 to EUR 43 in October 2015.

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

Broadband retail prices (EUR PPP) – bundles including broadband, fixed telephony and television at EU level, 2012-2016



Fixed broadband retail prices (EUR PPP) - bundles including broadband, fixed telephony and television, October 2015



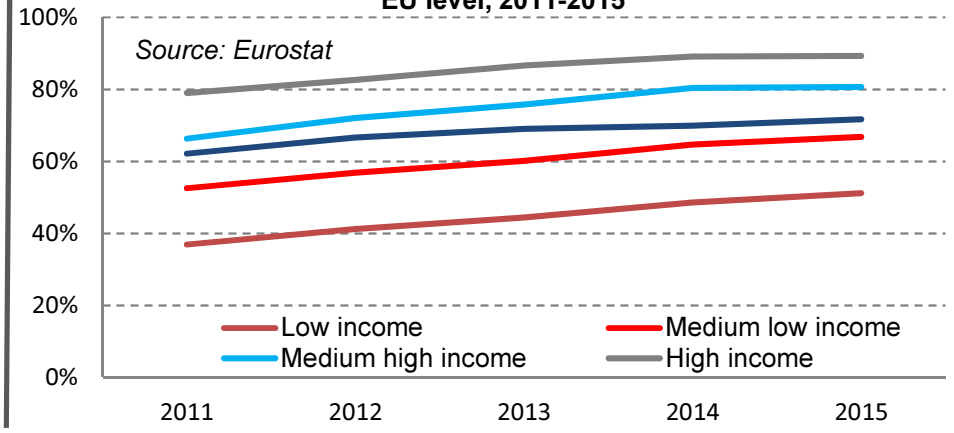
Broadband take-up tends to be lower in Member States where the cost of broadband access accounts for a higher share of income, but the correlation is not strong. The lowest income quartile of the EU population has a significantly lower take-up rate.

Considering overall take-up, European average is 72 % of homes with Luxembourg, the Netherlands at the highest positions and Italy, Bulgaria and Poland lagging behind.

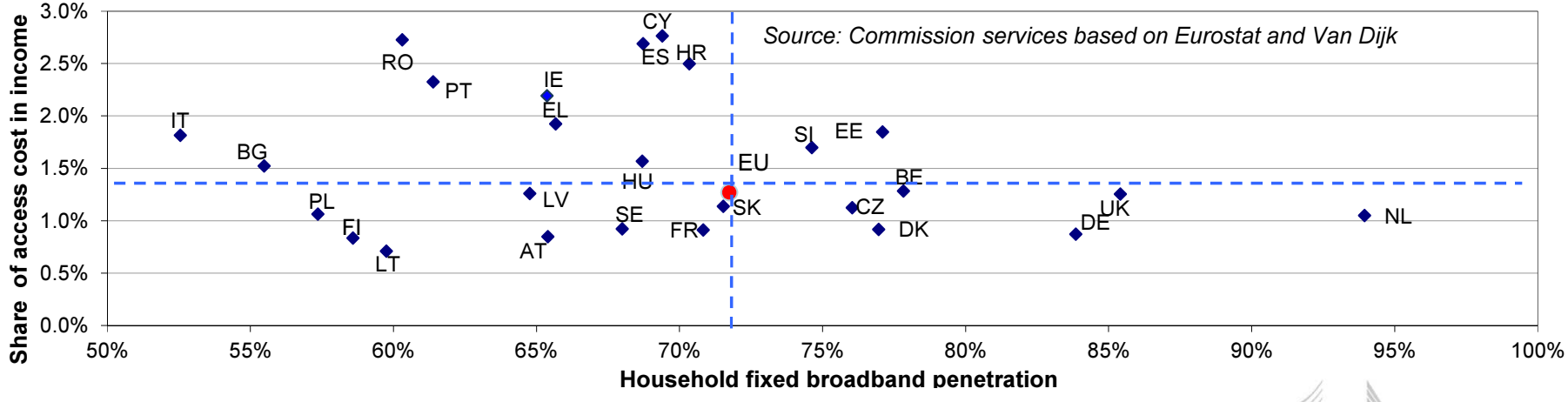
Statistics show that income plays an important role in subscription rates. The lowest income quartile has only 51 % take-up of fixed broadband as opposed to 89 % in the highest income quartile.

The lag in the lowest income quartile when compared with the national average is evident in Bulgaria, Romania, Hungary, Slovenia, Lithuania, Czech Republic, Croatia, Spain and Slovakia.

Fixed broadband household penetration by income quartiles at EU level, 2011-2015



Household fixed broadband penetration and share of broadband access cost (standalone 12-30Mbps donwload) in disposable income, 2015



Data not available for Luxembourg and Malta.

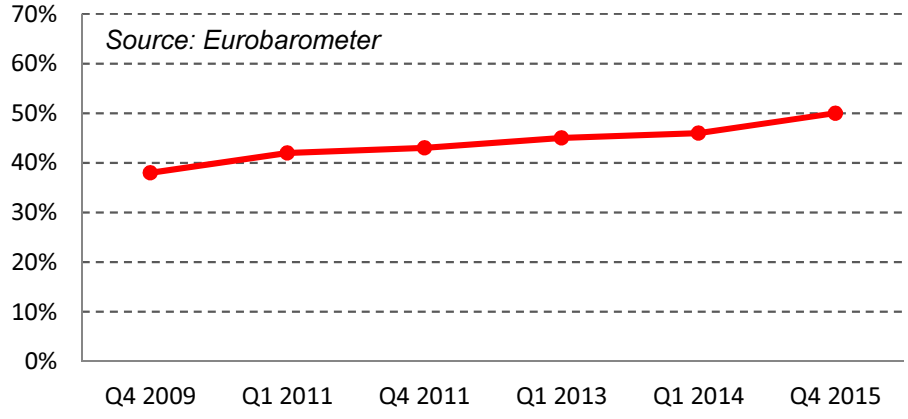
Half of all EU households subscribed to bundled communications services in 2015. 80 % of bundles include internet access. Fixed telephony + internet is the most popular type of bundle.

50% of all EU households purchase bundled communications services, up from 38% six years ago.

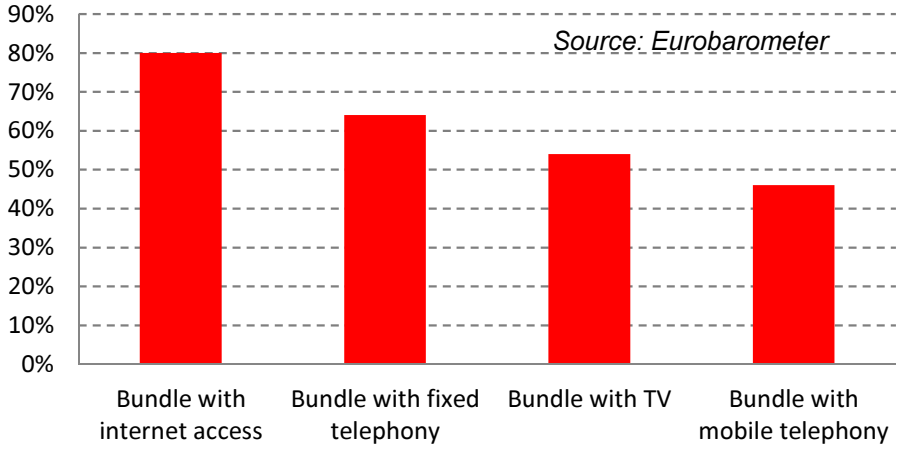
The most popular bundle is fixed telephony + Internet followed by `triple play`: fixed telephony + internet + TV.

Internet access (either fixed or mobile) is present in 80 % of all service bundles, fixed telephony in 64 %, TV in 54 % and mobile telephony in 46 %.

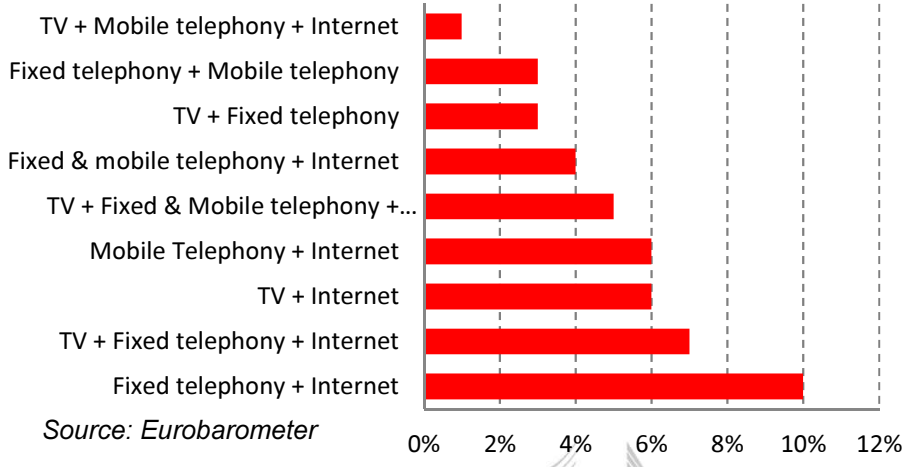
Percentage of households subscribing to bundled services at EU level, 2009-2015



Popularity of different services in bundles at EU level, 2015



Popularity of different bundles (% homes with subscriptions) at EU level, 2015



Almost all Member States are late in transposing the Cost Reduction Directive (Directive 2014/61/EU) (1/2).

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

- facilitating access to physical infrastructures of all network operators (i.e. telecom operators, as well as energy, or other utilities);
- improving coordination of civil engineering works;
- providing transparency of permit granting procedures; and
- equipping and accessing buildings with in house physical infrastructure (e.g. mini-ducts) capable of hosting high-speed networks.

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

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

As of 31 March 2016, only one Member State (Italy) has notified complete transposition of the Directive. Eight Member States (Denmark, Spain, Lithuania, Austria, Poland, Slovenia, Slovakia and the United Kingdom) have notified partial transposition of the Directive, while the 19 remaining Member States have not notified any transposition measure so far. Delays in transposing and applying the measures provided in the Directive may limit opportunities to reduce deployment costs and exploit synergies, which is particularly important in those areas where NGA coverage is lagging behind or upgrades of networks are needed.

Almost all Member States are late in transposing the Cost Reduction Directive (Directive 2014/61/EU) (2/2).

Consequently, the Commission on 23 March 2016 sent letters of formal notice to all 27 Member States who have not yet notified complete transposition of the Directive (except Italy). The letter of formal notice is the first step of an infringement procedure, which can lead to the referral of the Member State to the Court of Justice of the European Union. Information about national measures transposing the Directive is available here and ongoing infringement proceedings here.

MS	Status	Stage
BE		LFN
BG		LFN
CZ		LFN
DK		LFN
DE		LFN
EE		LFN
HR		LFN
IE		LFN
EL		LFN
ES		LFN
FR		LFN
IT		
CY		LFN
LV		LFN
LT		LFN
LU		LFN
HU		LFN
MT		LFN
NL		LFN
AT		LFN
PL		LFN
PT		LFN
RO		LFN
SI		LFN
SK		LFN
FI		LFN
SE		LFN
UK		LFN
	19 8 1	

Following the adoption of the 2014 Recommendation on relevant markets, liberalisation of telecom markets has progressed across the EU.

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

The table shows an overview of markets which are still subject to ex ante regulation (red colour), have already been fully or partially deregulated (green/yellow colour), as well as the rounds of market analysis carried out since the adoption of the Regulatory Framework back in 2002. The 2014 Recommendation on relevant markets excluded from regulation two fixed telecoms markets and redefined two other markets in order to reflect market and technology developments. For markets not included in the Recommendation, ex ante regulation can be imposed only if a market analysis shows that the market does not tend towards effective competition.

Since the adoption of the 2014 Recommendation, the Commission observes the systematic liberalisation of non-regulated fixed telecoms markets across the EU. This trend confirms the Commission's assumption that those markets tend towards effective competition in the Member States. Most markets outside the scope of the Recommendation which are still regulated have only been reviewed once or twice since the entry into force of the Regulatory Framework and market regulation may no longer be suited to the effective competitive dynamics developed since the last round. Therefore ensuring a timely review of market analysis is key to align market regulation with technological and market developments.*

* Note: See Annex 1

More EU harmonised spectrum available across Member States underpins future spectrum needs within the EU, while assignment in national markets differs (1/2).

Following the adoption in May 2015 of Commission Implementing Decision (EU) 2015/750, harmonising the 1.5 GHz band, the total amount of spectrum harmonised at EU level for wireless broadband use reached 1030 MHz during the reporting year. The authorisation process for this band was already completed by three Member States.

Moreover, with a view to reaching the radio spectrum policy programme (RSPP) 1200 MHZ target of EU-harmonised spectrum, the Commission in April 2016 adopted Implementing Decision (EU) 2016/687 harmonising the technical conditions of use of the 700 MHz band (already assigned by France and Germany).

The 800 MHz band (the 'digital dividend') is currently assigned in 25 Member States, 8 of which had been granted a derogation from the original deadline under Article 6(4) of the RSPP. Three Member States have not yet assigned and/or made available the 800 MHz band. While Cyprus and Malta have asked for an extension of the derogations they had been granted, Bulgaria benefits from the exception under Article 1(3) RSPP.

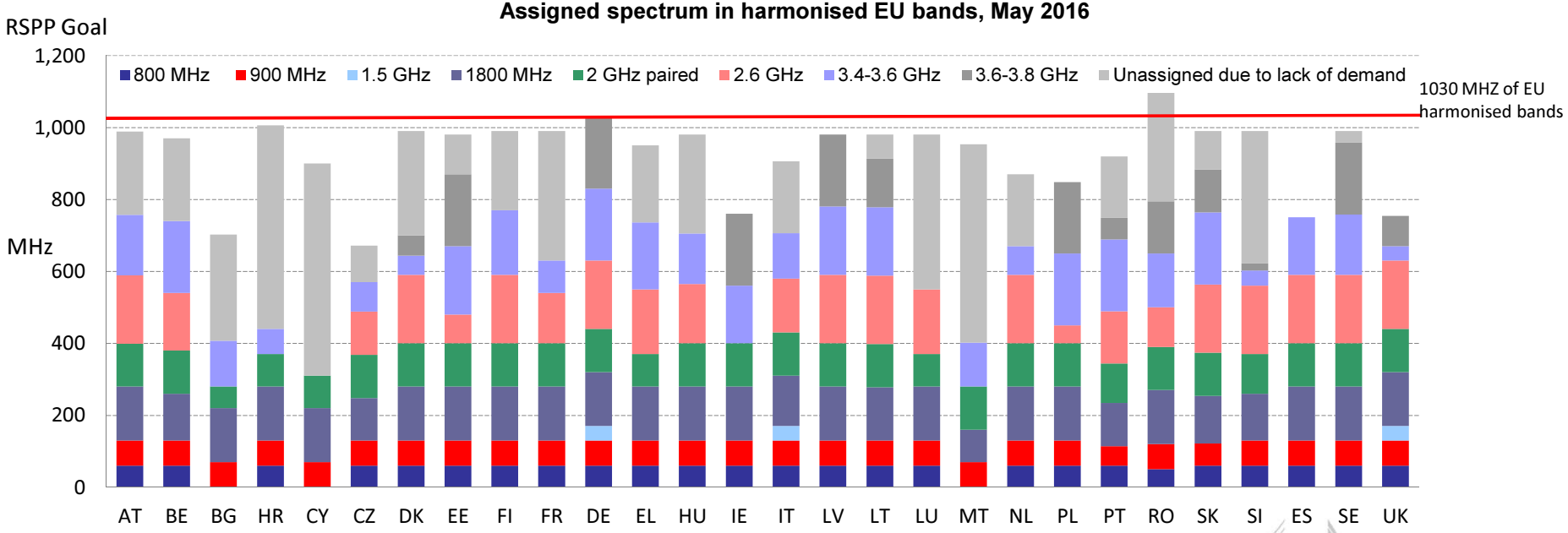
More EU harmonised spectrum available across Member States underpins future spectrum needs within the EU, while assignment in national markets differs (2/2).

When excluding the recently harmonised 1.5 GHz and 700 MHz bands, a 2 percentage points (from 69 to 71 %) increase in the EU-harmonised spectrum assigned on average across Member States for wireless broadband use can be reported since last year. Nevertheless, an average 30 % of harmonised spectrum still remains unassigned.

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

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

Assigned spectrum in harmonised EU bands, May 2016



Source: Commission services

Note: Assigned spectrum include guard bands

Broadband Targets: Overview of national broadband plans (1/4)

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

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

Content-wise, all Member States' NBPs focus on reaching minimum download speeds — in most cases in terms of coverage (availability of commercial offer on a given territory) and sometimes also penetration (actual take-up in the form of internet access subscriptions). In contrast, emphasis on upload data rates is rather exceptional (e.g. Denmark, 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 conducted consultations on their draft national broadband plans. These include for instance the Czech Republic ('Digital Czech Republic'), France ('National Programme for Very High Speed Broadband') and the Slovak Republic ('National Strategy for Broadband Access in the Slovak Republic).*

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

Broadband Targets: Overview of national broadband plans (2/4)

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

• 17 Member States are fully aligned to the DAE-2020 targets (Bulgaria, Croatia, Cyprus, Czech Republic, Greece, Hungary, Ireland, Italy, Latvia, Lithuania, Malta, Netherlands, Poland, Portugal, Romania, Slovakia and Spain);

• 8 Member States have an ambitious target on one or more of the parameters (coverage, take-up) — for instance aiming at Gigabit or 100 Mbps coverage for over 80 % of their population by 2020 — which, if reached, will help them achieve or even supersede all the DAE targets (Austria, Belgium, Denmark, Estonia, France, Luxembourg, Slovenia, Sweden); and

• 3 Member States pursue only a coverage dimension but with an earlier timeline and/or choose a quite distinct metric — that makes them difficult to assess against the DAE targets (Finland, Germany, United Kingdom).

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

Broadband Targets: Overview of national broadband plans (3/4)

MS	NBP-Targets	MS	NBP-Targets
Austria	99 % coverage with 100 Mbps by 2020	Italy	100 % coverage with 30 Mbps by 2020. 50 % HH penetration of 100Mbps services by 2020
Belgium	50 % HH penetration with 1 Gbps by 2020	Latvia	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Bulgaria	100 % coverage with 30 Mbps by 2020. 50 % of households and 80 % of businesses subscribing >100 Mbps by 2020	Lithuania	100 % coverage with 30 Mbps by 2020. 50 % penetration with 100 Mbps by 2020
Croatia	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020	Luxembourg	100 % coverage with 1 Gbps downstream and 500 Mbps upstream by 2020
Cyprus	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020	Malta	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Czech Republic	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 MBps service by 2020	Netherlands	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Denmark	100 % coverage with 100 Mbps download and 30 Mbps upload by 2020	Poland	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Estonia	100 % coverage with 30 Mbps by 2020. 60 % HH penetration with 100 Mbps by 2020	Portugal	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Finland	99 % of all permanent residences and offices should be located within 2 km of an optic fibre network or cable network that enables connections of 100 Mbps by 2019	Romania	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
France	100 % coverage with 100 Mbps by 2022	Slovakia	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020.
Greece	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps by 2020	Slovenia	98 % coverage with 100 Mbps, 2% coverage 30 Mbps by 2020.
Germany	100 % coverage with 50 Mbps by 2018	Spain	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020
Hungary	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020	Sweden	90 % coverage with 100 Mbps by 2020
Ireland	100 % coverage with 30 Mbps by 2020. 50 % HH penetration with 100 Mbps service by 2020, expecting upstream bandwidth around 17 to 21 Mbps.	United Kingdom	95 % coverage with 24 Mbps by 2017

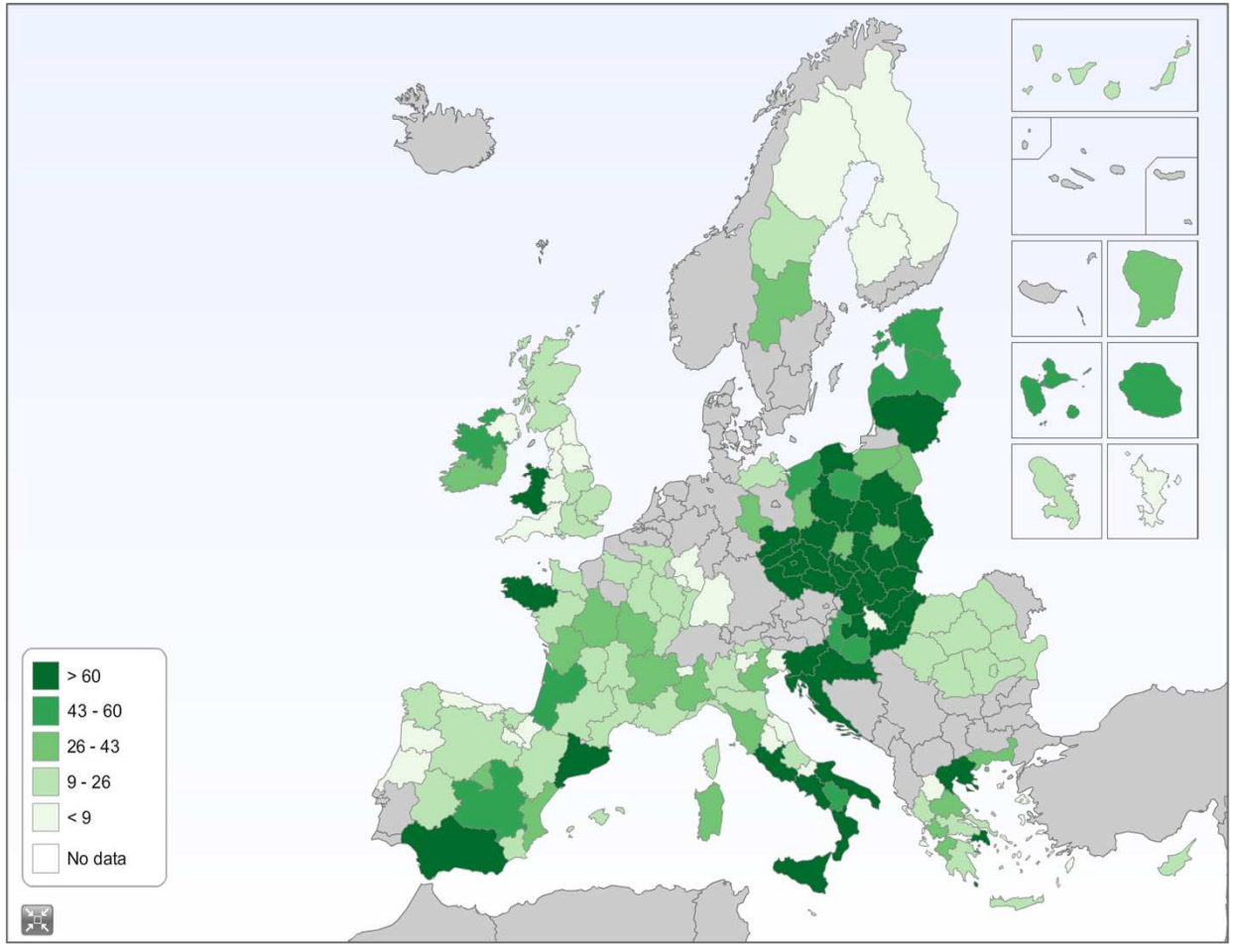
Source: Atene KOM: Study on National Broadband Plans in the EU (SMART 2014/0077) – draft/ongoing.

Broadband Targets: Overview of national broadband plans (4/4)

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

Countries like Poland and Italy plan to invest more than a EUR 1 billion of ERDF each; France, the Czech Republic, Spain and Hungary are in a range of EUR 700 million to EUR 400 million of ERDF each; Croatia, Greece and Slovakia between EUR 400 million and EUR 200 million of ERDF each. The administrative capacity to maximise the leverage effect on public (national or regional) and private co-funding (notably through the use of financial instruments) will be key to support projects rolling out the next generation of broadband networks.

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



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

ANNEX 1 - Article 7 cases as of 31/03/2016

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

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

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

Source: Commission services

Human Capital:
Digital inclusion and skills

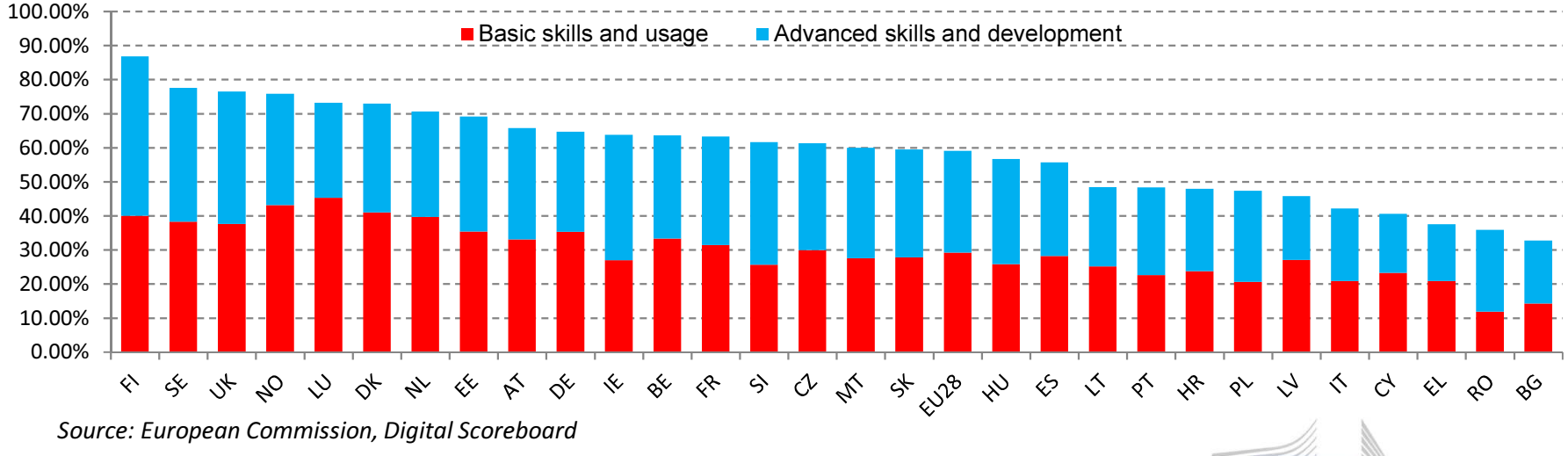
For the Human Capital dimension of the Digital Economy and Society Index (DESI), the highest scores were achieved by Finland, Sweden, the United Kingdom and Luxembourg. Romania, Bulgaria, Greece, Cyprus and Italy had the lowest scores.

The Human Capital dimension covers (a) 'basic skills and usage' and (b) 'advanced skills and development'. 'Basic skills and usage' comprises indicators of whether people use the internet and of whether they have basic digital skills. 'Advanced skills and development' comprises indicators on ICT specialist employment and on graduates in STEM (science, technology and mathematics). LU, DK, FI, NL and SE score highest for basic skills and usage, while FI, SE, the UK and IE score best for advanced skills and development. RO, BU, EL, CY and IT rank lowest overall on the Human Capital dimension.

Indicators included in the Human Capital dimension of the DESI 2016

	EU 28
2a1 Internet Users % individuals (aged 16-74)	76% (2015)
2a2 Basic Digital Skills % individuals (aged 16-74)	55% (2015)
2b1 ICT Specialists % employed individuals	3.7% (2014)
2b2 STEM Graduates Graduates in STEM per 1000 individuals (aged 20 to 29)	18 (2013)

DESI 2016, Human Capital dimension, by country

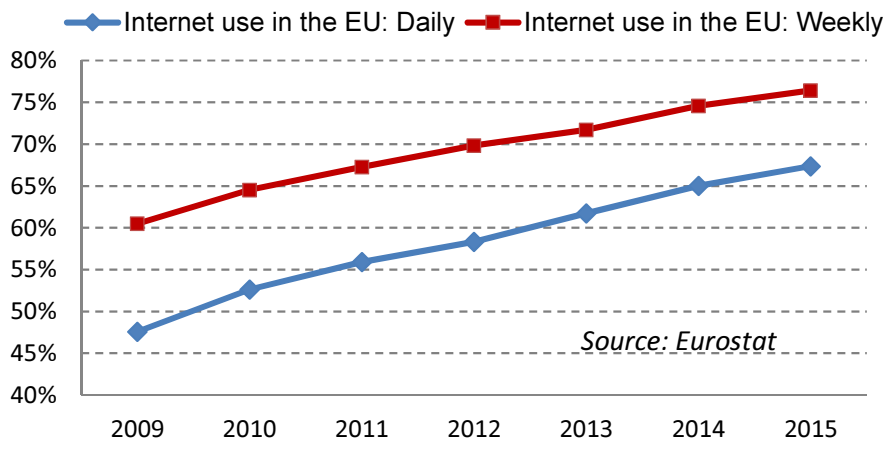


Source: European Commission, Digital Scoreboard

76 % of EU citizens go online weekly, and 67 % daily. 63 % of disadvantaged people use the internet weekly. The old (53 %) and low educated (55 %) are furthest behind.

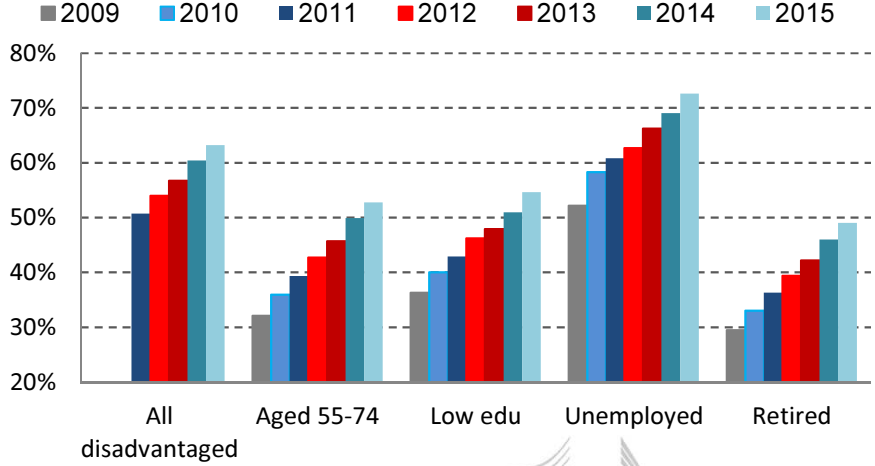
The percentage of internet users in the population continues to increase; 76 % of the EU population use the internet at least weekly (2015). For most people, internet use is a daily activity: 67 % of EU citizens reported using it daily in 2015. Use by disadvantaged people also rose to 63 % in 2015. These rates are higher than the targets for this year in the Digital Agenda, which were already reached last year. While the steady increase in regular internet use is positive, based on past trends we can still only expect regular use by 90 % of the population by 2024.

Daily and weekly use of internet in the EU (% of population)



Among different categories of disadvantaged people, while the unemployed have a rate of internet use similar to that of the EU average, the rates for the older population (53 %), the low educated (55 %) and the retired or inactive (49 %) remains around 20 percentage points or more lower. In particular, age and education levels are strong determinants of internet usage. Digital inclusion policies should focus on these groups.

Figure 2.4: Weekly use of internet by disadvantaged people

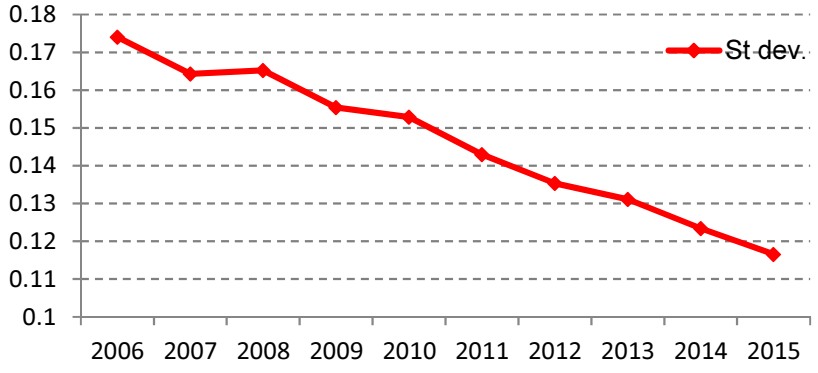


Source: Eurostat

Rates of weekly internet use across the EU Member States remain quite dispersed, but there has been significant catch-up over time.

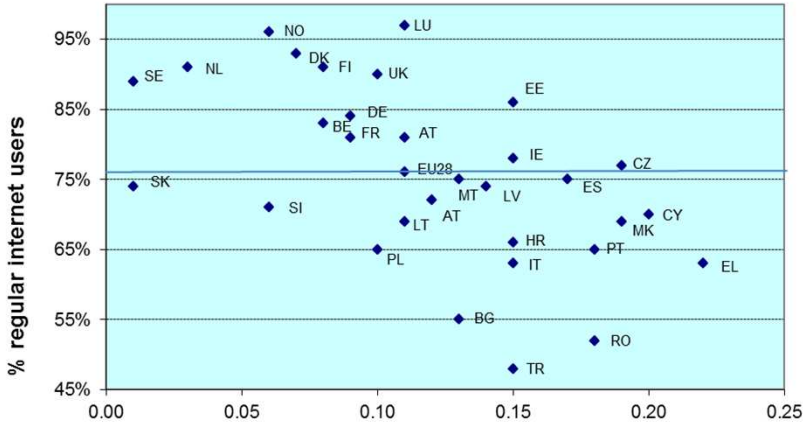
Across Europe, rates of weekly internet use remain dispersed and the rankings of countries with the highest and lowest rates have changed very little over time. The highest rates of weekly internet use are found in the Nordic countries, Luxembourg, the Netherlands and the United Kingdom, where rates are around 90 % or more. At the other end of the scale, in countries with the lowest rates of weekly internet use in the EU(RO, BG), around half of the population does not use the internet on a weekly basis.

Figure 2.5: Standard deviation of weekly internet use across EU 2006-2015



Source: Commission services based on Eurostat

Figure 2.6: Progress in regular internet use 2010-2015

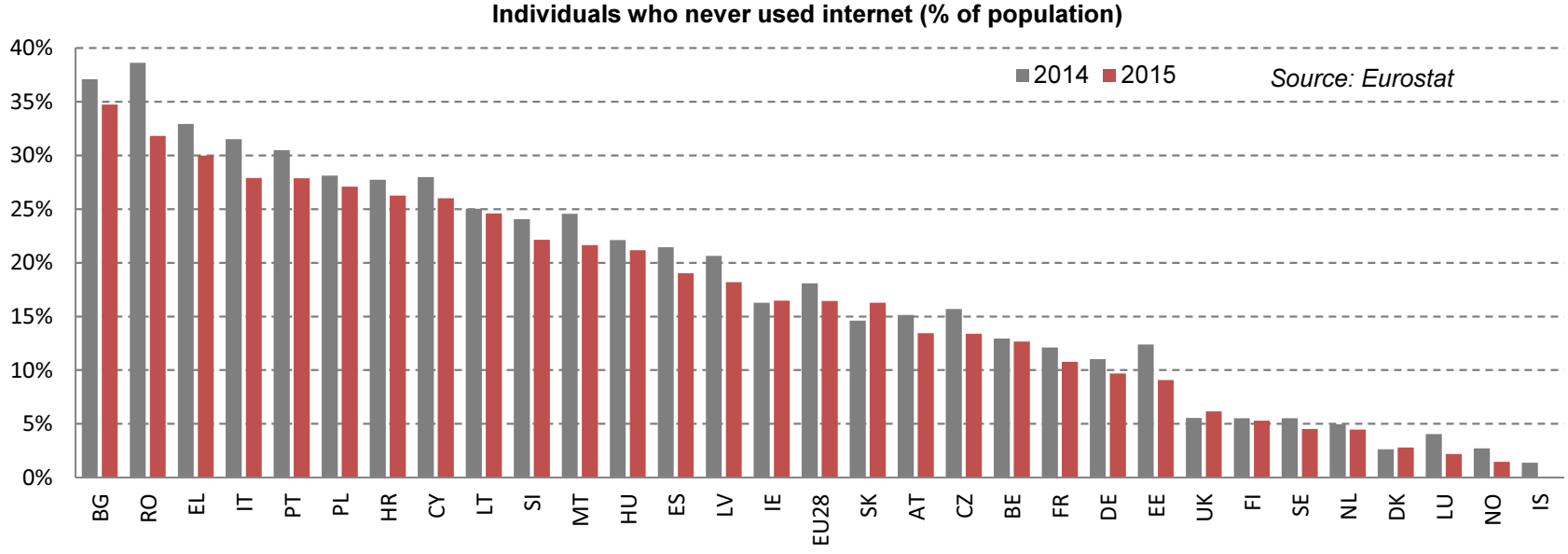


Source: Eurostat

Nevertheless, there has also been significant catch-up with, generally speaking, larger increases in the rates of weekly use in countries with the most catching up to do. In particular, from 2010 to 2015 regular use of internet by Greek citizens rose by over 20 percentage points. Cyprus, the Czech Republic, Portugal, Romania and the Former Republic of Macedonia have also seen similar rises. Other lagging countries such as Spain, Italy and Croatia have also made significant improvements. All of these countries now have rates above 60 %. While figures for Romania (+18 percentage points) and Bulgaria (+13 percentage points) have also risen, their very low starting position mean that they remain substantially below the EU average.

The number of non-internet users continues its gradual downward trend and big improvements have been made in some countries with large rates of non-users. However 16 % of the EU population has still never used the internet.

In the EU, the share of non-internet users in total population fell marginally in 2015, to 16 % from 18 % a year earlier. Nearly all Member States made some improvement in reducing rates of non-users. The biggest improvements were made in Romania (-7 percentage points) and Italy (-4 percentage points). Above average reductions were also made in Greece, Portugal, Malta and Estonia (-3 percentage points each). Taking a longer view, Romania (-25 percentage points) and Greece (-23 percentage points) are the countries that have made the most progress in reducing non-use of the internet by their citizens over the past 5 years; followed by Cyprus (-19 percentage points), Portugal (-18 percentage points), Bulgaria (-17 percentage points) and Croatia (-16 percentage points). However, a number of countries still need to do more to reduce their relatively high shares of non-internet users in total population. Furthermore, Slovenia (22 %; -6 percentage points) and Poland (27 %; -8 percentage points) stand out in 2015 as countries with above average rates of non-users and relatively slow progress in reducing them since 2010.

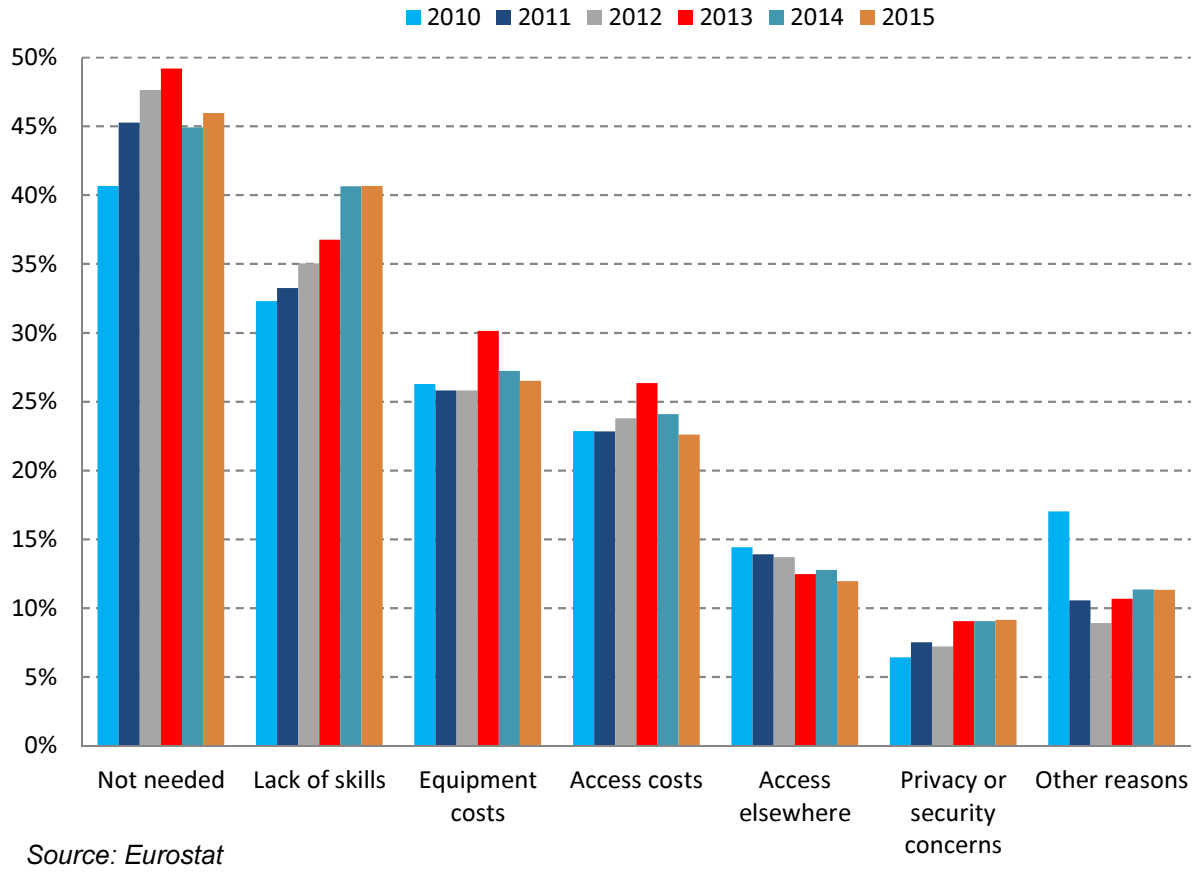


The biggest barriers to internet access at home in the EU are lack of need, insufficient skills and cost barriers. In particular, lack of skills has increased in importance as a reason over time.

The most important reasons for households not having internet access are that it is not needed (46 %), they lack the skills (41 %) or the equipment (27 %) or access (23 %) costs are too high. In particular, lack of skills has gained substantially in importance over time (+9 percentage points since 2010). Lack of need has also increased as a reason but has declined somewhat since 2013. While a relatively less cited reason, concerns about privacy and security (+3 percentage points since 2010) have also risen.

Looking at **different household types**, cost factors are substantially more important reasons for not having internet access at home among households with children (61 %) and those on low incomes (42 %).

Barriers to internet access at home in the EU28 (% households without internet access)



Source: Eurostat

In 2015 45 % of the EU population had an insufficient level of digital skills. 21 % had none at all, as they did not use the internet.

According to the **Digital Skills Indicator***, a composite indicator based on the EU digital competence framework for citizens**, 21 % of the EU population can be considered as having no digital skills (2015) as they are not using the internet. This figure ranges from 3 % in Luxembourg to 44 % in Bulgaria and Romania. In eight countries (PT, PL, HR, CY, IT, EL, BG and RO) 30 % or more of the population have no digital skills. In Italy, with its large population, this equates to almost 18 million people without digital skills; in Poland it means around 12 million.

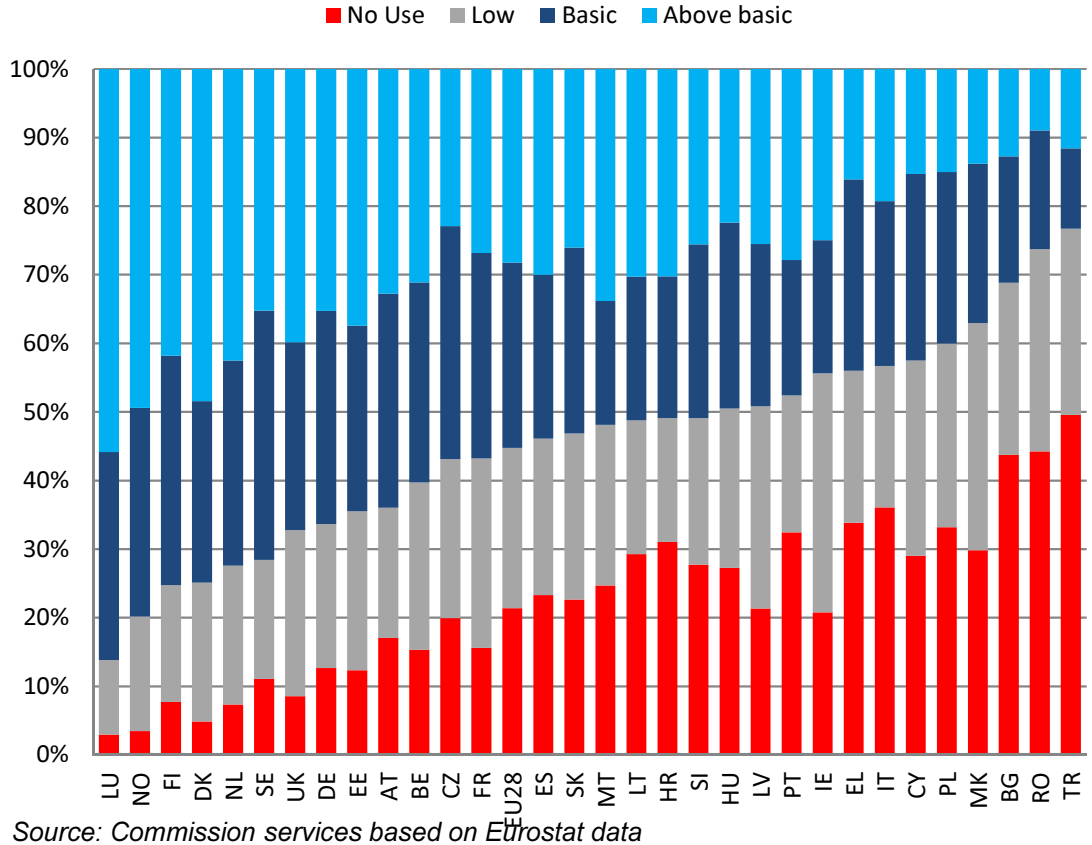
Considering that to function effectively in a digital society an individual needs more than low level skills (e.g. only being able to send emails)***, 45 % of the EU population can be considered as insufficiently digitally skilled (having either low or no digital skills or not using the internet). Seventeen Member States have rates higher than this. In Romania (74 %) most of the population does not have the skills they need to function effectively in the digital world.

* http://ec.europa.eu/newsroom/dae/document.cfm?action=display& doc_id=9979 .

** EU Digital Competence framework for citizens (DigComp) was developed by the Joint Research Centre's Institute for Prospective Technologies Studies on behalf of DG Employment, Social Affairs and Inclusion. For more information, see https://ec.europa.eu/jrc/en/digcomp/.

*** A 'low skilled' individual is someone who has carried out activities from only one of the four digital competence domains included in the index (information, communication, content creation or problem-solving). To qualify as having 'basic skills', an individual has to have 'basic skills' in at least one domain, and 'no use' in none. To be classified 'above basic', the individual has to score above basic in each of the four domains.

Digital skills in the EU, NO, MK and TR, 2015
(% individuals with above basic, basic and low digital skills and no internet use)



Source: Commission services based on Eurostat data

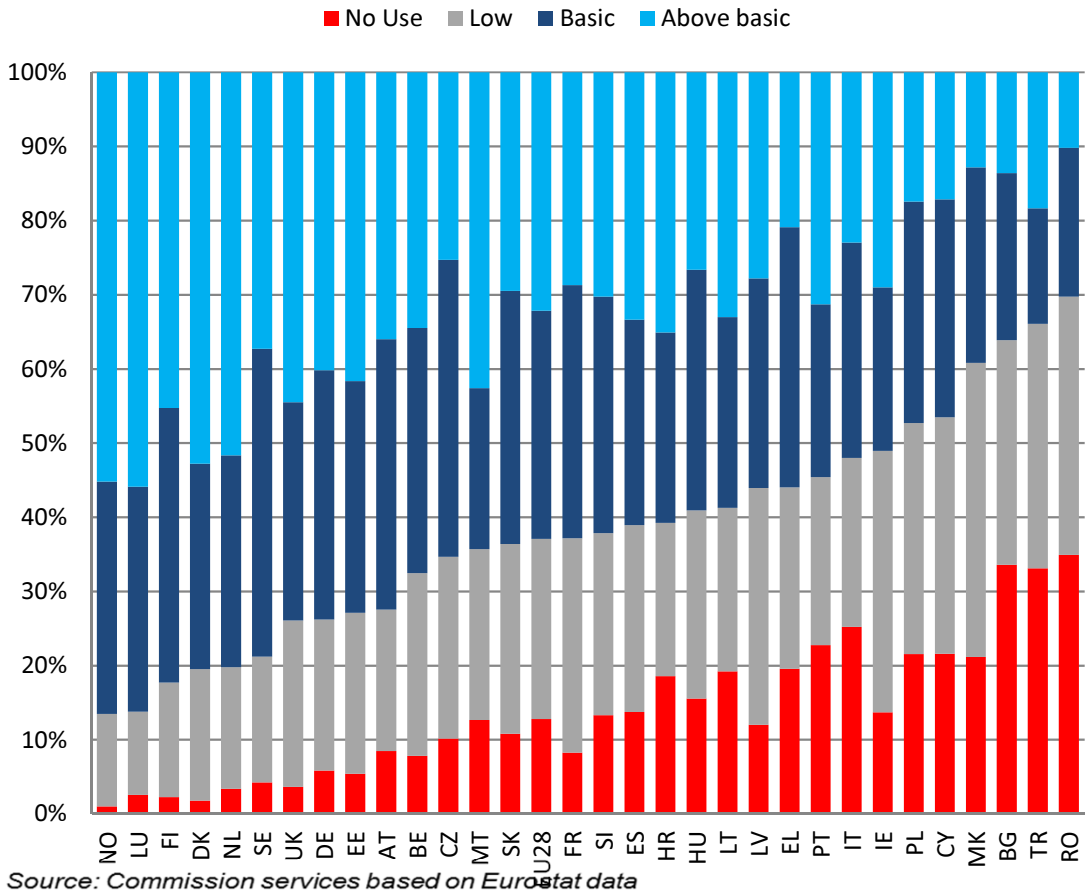
European Commission

In 2015 37 % of the EU labour force had an insufficient level of digital skills.13 % had no digital skills at all, as they did not use the internet.

Rates of **digital skills among the labour force** are on average higher than for the average population in the EU. Only 13 % of the EU labour force has no digital skills (most not using the internet). However, in some Member States rates are still relatively high. In seven countries (EL, CY, PL, PT, IT, BG and RO) rates are at or above 20 % of the labour force. In Romania and Bulgaria more than a third of the labour force has no digital skills.

If we also add to this the percentage of the labour force who have only a low level of skill, 37 % of the EU labour force can be considered to be insufficiently digitally skilled. In 15 Member States (FR, SI, ES, HR, HU, LT, LV, EL, PT, IT, IE, PL, CY, BG and RO) the percentage is higher. In Bulgaria (64 %) and Romania (70 %) it is most of the labour force.

Digital skills of the labour force, 2015 (% labour force with above basic, basic and low digital skills and no internet use)



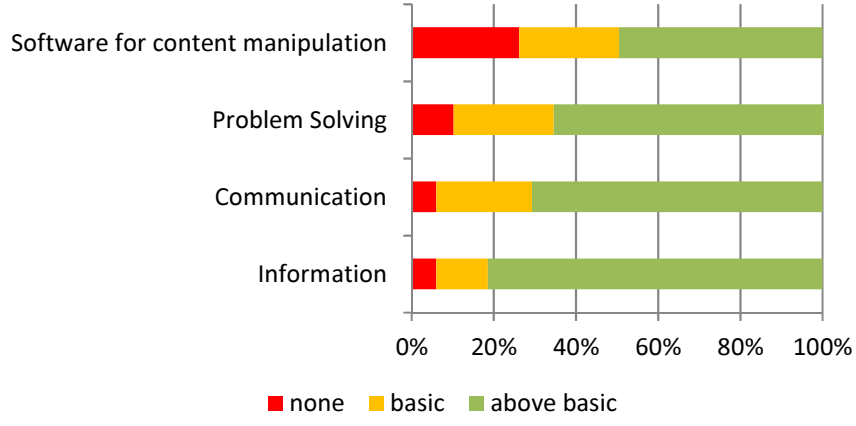
Source: Commission services based on Eurostat data

Internet users in the EU most lack the digital skills needed to use basic software tools which are increasingly seen as indispensable in the workplace and beyond

Among the four digital competence domains assessed in the digital skills indicator*, internet users in the EU most lack the digital skills needed to create and manipulate commonly used basic software tools. While only 6 % of internet users in the EU report not having carried out any of the commination or information activities and only 10 % any of the problem-solving tasks, 26 % have not used any of the more common basic software for the manipulation of text, data, photos or videos. This group of internet users, ranging from 9 % (LU) to 49 % (RO), it can be considered, are at an increasing disadvantage in the labour market, as more and more jobs require these types of skills.

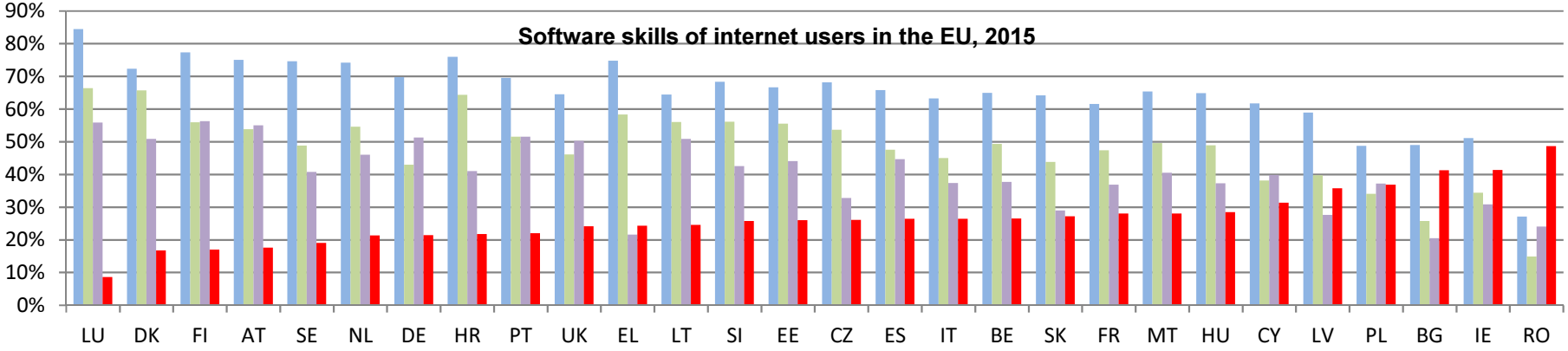
*These are: information, communication, software, and problem-solving (the fifth domain, security, is not assessed, for lack of suitable indicators). In each domain, a set of activities is used to determine whether individuals have the skills or do not have the skills and in some cases (where information is available on the variety or complexity of the task) whether the level of skills is 'above average'.

Digital skills in the EU by digital competence domain, 2015 (% of internet users)



Source: Commission services based on Eurostat data

Software skills of internet users in the EU, 2015



Source: Commission services based on Eurostat data

EU digital citizens are not always able to protect themselves, their data and their privacy.

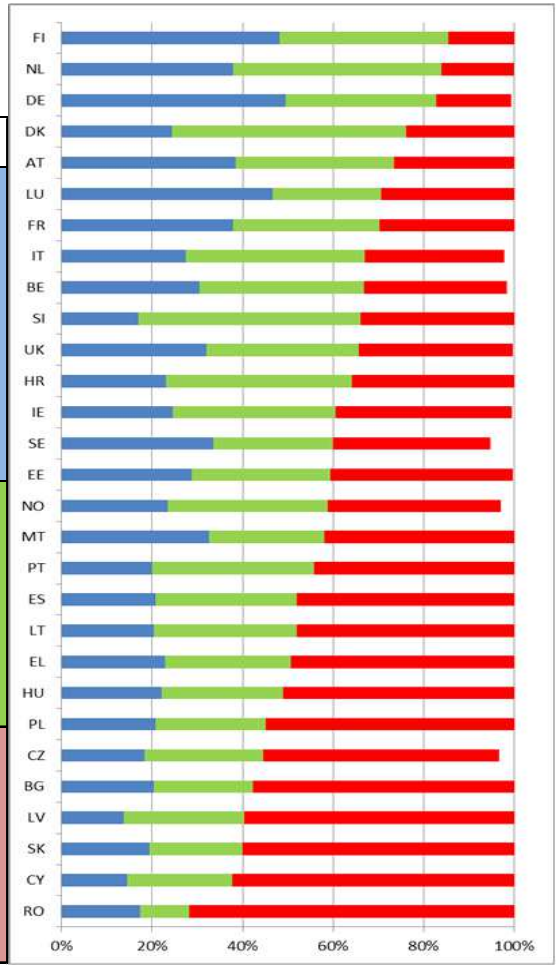
Cookies are largely used by almost all web-services with different purposes, but still more than one third of European internet users (35 %) do not know they can be used to trace their online movements.

Among the remaining, more aware, internet users, only half has taken action to prevent or limit cookies by changing browser parameters.

There seems to be greatest awareness in countries with more advanced and longer use of ICT technologies. There are some national particularities, like Germans being very protective of their privacy, and DK, SI and NL internet users, despite different degrees of awareness, taking little action against cookies.

Security and privacy skills (knowledge and management of cookies) of internet users, 2015

		EU28
Internet users who know that cookies can be used to trace movements of people on the internet	and have ever changed the settings in their internet browser to prevent or limit them	32%
	but have NOT changed the settings in their internet browser	33%
Internet users who don't know that cookies can be used to trace movements of people on the internet		35%



Over the last decade, employment of ICT specialists has grown by 2.9 million in the EU. By contrast, total employment has not improved and has been falling since the onset of the crisis in 2008.

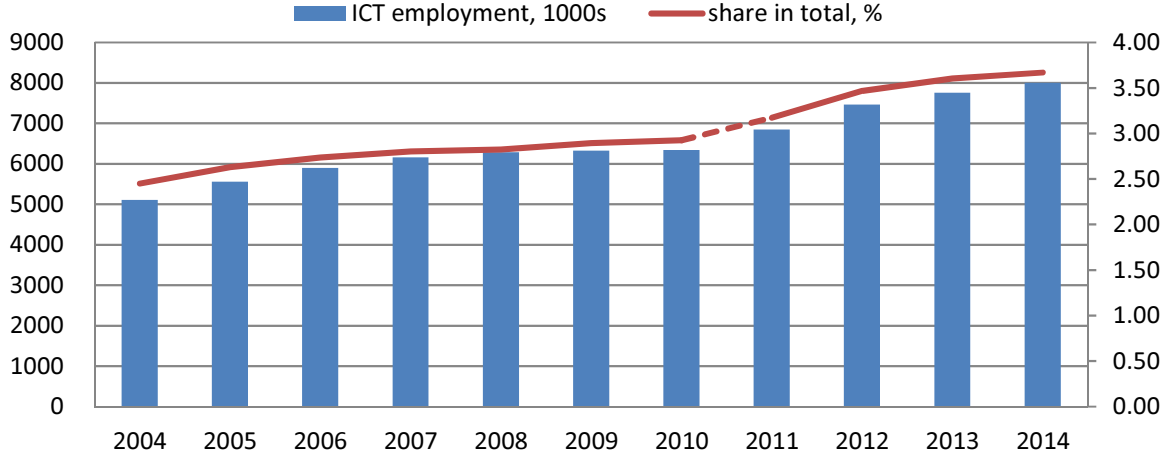
Over the period 2004-2014* employment of ICT specialists in the EU-28 grew significantly by 2.9 million; from around 5.1 million in 2004 to 8 million in 2014. This resulted in an increase in the share of ICT employment in total employment from 2.5 % to 3.7 %. ICT employment growth averaged over 4 % a year (allowing for the break in the series in 2010-2011). By contrast, the average growth rate of total employment was 0.4 % a year. Overall employment fell almost continuously following the onset of the economic and financial crisis in 2008 and has only begun to increase once more since 2014.**

All EU countries have seen a big increase in ICT specialist employment in the last 10 years. The largest employment gains were made in the big Member States, DE (765 000), FR (417 000), ES (269 000), PL (182 000) and the UK (162 000).

However, growth in ICT specialist employment has been very substantial in many smaller countries. The Member States with the highest rates of ICT specialist employment in total employment are FI (6.7 %), SE (6 %), LU (5 %), NL (5 %), EE (5 %) and the UK (4.9 %).

The UK employs the largest number of ICT specialists in absolute terms (1.49 million); however, Germany is rapidly catching up (1.47 million), having doubled its ICT employment in the last 10 years. The biggest employment gains have been made outside the ICT sector and in the ICT services sector.

Employment of ICT specialists in the EU in absolute terms and as a share of total employment, 2004-2014



Source: Eurostat

*Since this period included the break in series due to the update of ISCO to its latest version, the figures referring to the dynamics of ICT specialists' employment need to be interpreted with caution.

**http://ec.europa.eu/eurostat/statistics-explained/index.php/File:Employment_rate,_age_group_15_%E2%80%9364,_2004%E2%80%9314_(%25)_YB16.png.

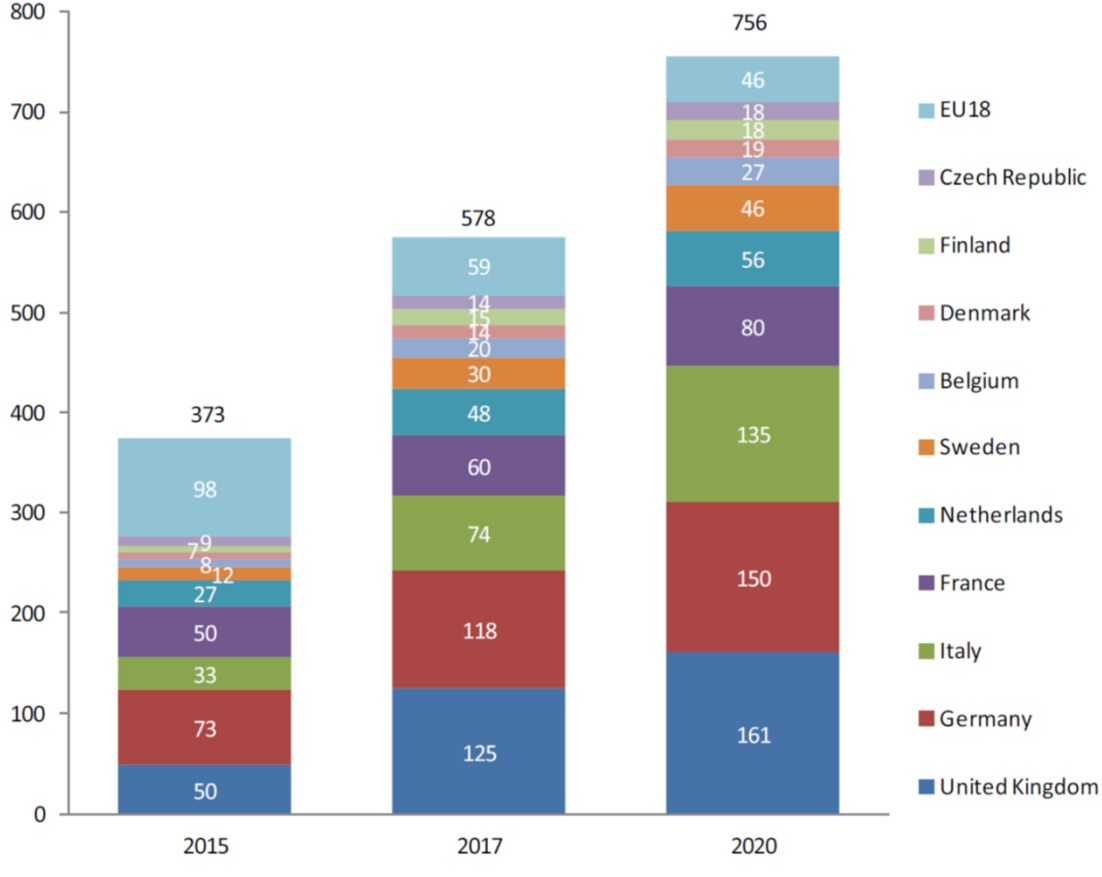
The EU has a growing deficit of ICT professional skills, forecast to reach 756 000 by 2020.

Despite the strong rise in employment of ICT professionals in the EU over the past decade, the **employment potential of ICT is underexploited**. Evidence shows that there is a growing gap emerging between the demand for and supply of ICT specialists in Europe. The latest forecasts suggest the gap could double over the next five years: from 373 000 in 2015 to 756 000 by 2020.*

Currently the largest ICT professional skills gap is to be found in **Germany, followed by the UK and France**. These skills gaps are expected to grow substantially up to 2020, especially in the **UK, Germany, Italy and France**; largely due to insufficient production of ICT graduates to keep up with strongly increasing demand for ICT professionals in these countries.

*http://eskills-lead.eu/fileadmin/LEAD/Working_Paper_-_Supply_demand_forecast_2015_a.pdf

E-Skills Vacancies Estimate – Main forecast scenario: Distribution of vacancies per country ('000s)



Source: Empirica (November 2015)

The Commission's Grand Coalition for Digital Jobs initiative and the 13 national coalitions have led to the training of an estimated over 2 million people since the initiative's launch in 2013.

The European Commission is addressing lacking digital skills in Europe with its **Grand Coalition for Digital Jobs** initiative.* This multi-stakeholder initiative has so far attracted around 60 pledges, from over 100 stakeholders, to undertake concrete actions to reduce digital skills gaps in Europe. Actions are grouped around five themes: training and matching for digital jobs (29), certification (6), innovative learning and teaching (11), mobility (1) and awareness raising (12). It has also lead to the setting of national coalitions in 13 countries (BE, BG, CY, EL, IT, LT, LU, LV, MT, PL, PT, RO, UK), with more to come. There are also active local coalitions in a number of regions around Europe.

*https://ec.europa.eu/digital-single-market/en/grand-coalition-digital-jobs

To help set up national and local coalitions in the EU Member States, the Commission has produced a 'toolkit' providing useful information and outlining the essential ingredients for a successful coalition.**

It is estimated that these actions and initiatives have led to the **training of over 2 million people in digital skills** since the launch of the coalition in 2013. Ongoing and recent new pledges and initiatives will lead to the training of millions more. Progress on the pledges of the Grand Coalition is self-reported by pledgers on the Grand Coalition Pledge Tracker.***

**https://ec.europa.eu/digital-single-market/sites/digital-agenda/files/toolkit_for_national_and_local_coalitions_5.pdf

***http://www.linkedpolicies.eu/pledge/

Use of Internet

Use of Internet Services by Citizens in the EU

Digital Agenda Scoreboard
2016

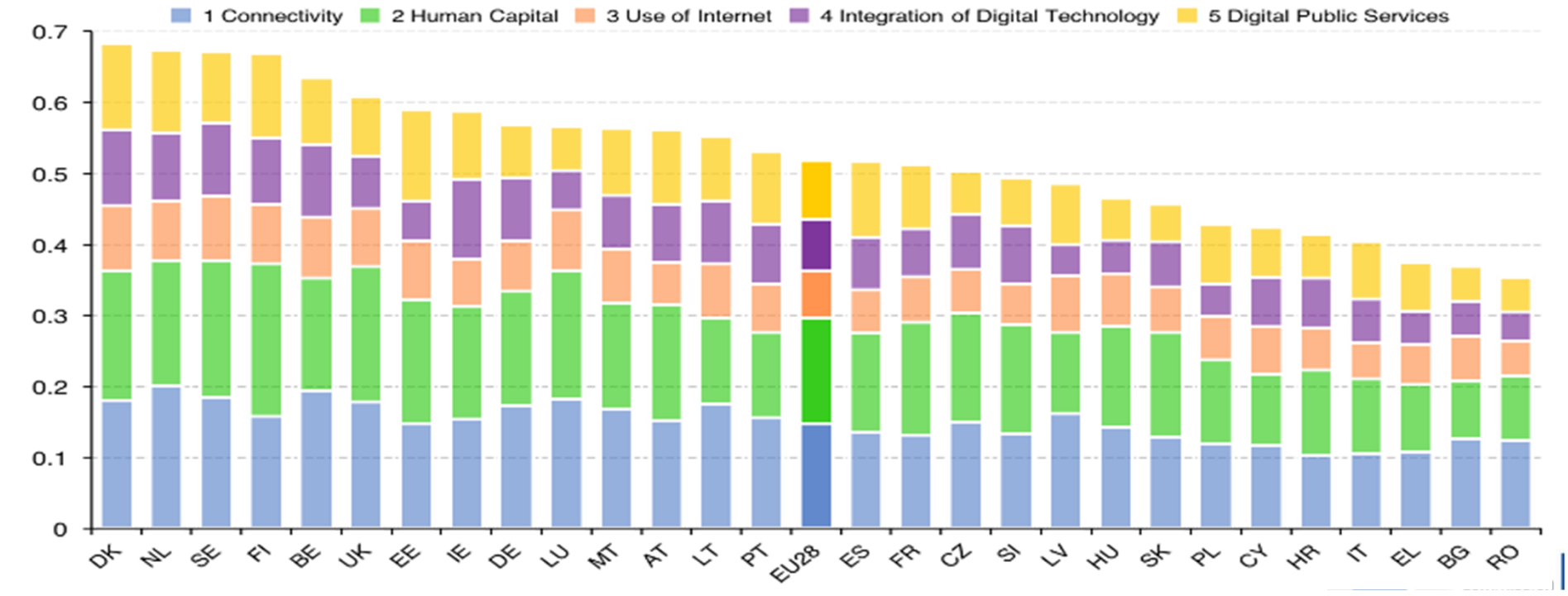
The Digital Economy and Society Index (DESI) is a composite index that summarises relevant indicators on Europe's digital performance and tracks the evolution of EU Member States in digital competitiveness.

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

Romania, Bulgaria, Greece and Italy are at the bottom of the list.

The five dimensions of the DESI

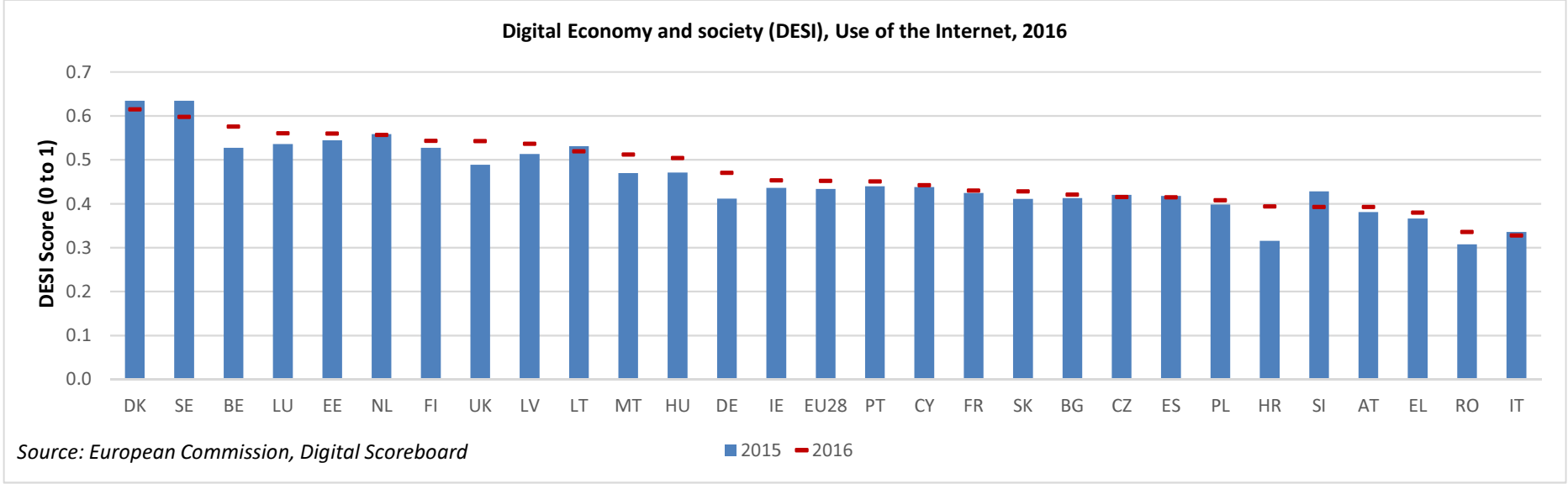
1 Connectivity	Fixed Broadband, Mobile Broadband, Broadband speed, and Affordability
2 Human Capital	Basic Skills and Usage, Advanced skills and Development
3 Use of Internet	Content, Communication and Transactions on line
4 Integration of Digital Technology	Business digitization and eCommerce
5 Digital Public Services	eGovernment



Use of Internet by EU citizens.

People in the EU engage in a **range of online activities** — they consume content, communicate, shop, use online banking services and much more. Such activities are captured in DESI dimension 3, on internet use. Denmark, Sweden and Belgium have the most active internet users, followed by Estonia, the Netherlands and Finland. However, **Croatia, Germany and the UK showed the biggest increase** in the DESI score. Denmark overtook Sweden to take first place. At the same time, both these countries actually saw a small decrease in their DESI score for Use of Internet. Croatia increased and climbed from 27th to 23rd position. Italy saw a small decrease and was overtaken by Romania and Croatia.

DESI – Use of Internet indicators	
News (% individuals aged 16-74)	68% (2015)
Music, videos and games (% individuals aged 16-74)	49% (2014)
Video on demand (% households that have a TV)	41% (2014)
Video calls (% individuals aged 16-74)	37% (2015)
Social networks (% individuals aged 16-74)	63% (2015)
Banking (% individuals aged 16-74)	57% (2015)
Shopping (% individuals aged 16-74)	65% (2015)



Source: European Commission, Digital Scoreboard

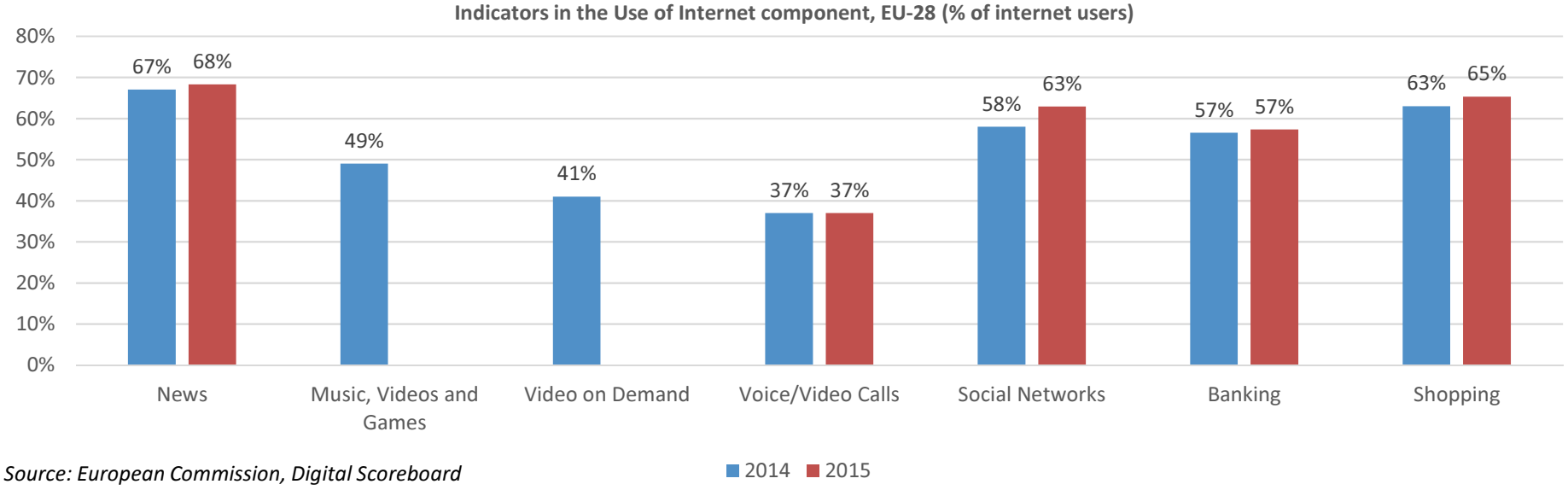
Overall slowdown in growth of online activities.

Between 2014 and 2015, progress in the different activities used as indicators in the Use of Internet dimension has been slow. The **biggest increase** was observed in the percentage of internet users active on social networks — 5 percentage points. All other indicators showed small or no increase at all for the European average. The Video on demand and Music, Videos and Games indicators were not collected in 2015.

Internet users in the EU are active in **obtaining content** online, with two thirds reporting reading news online in 2015 and nearly half downloading music, videos and games in 2014.

EU households are also using the internet to watch televised entertainment, both via video on demand and via IPTV.

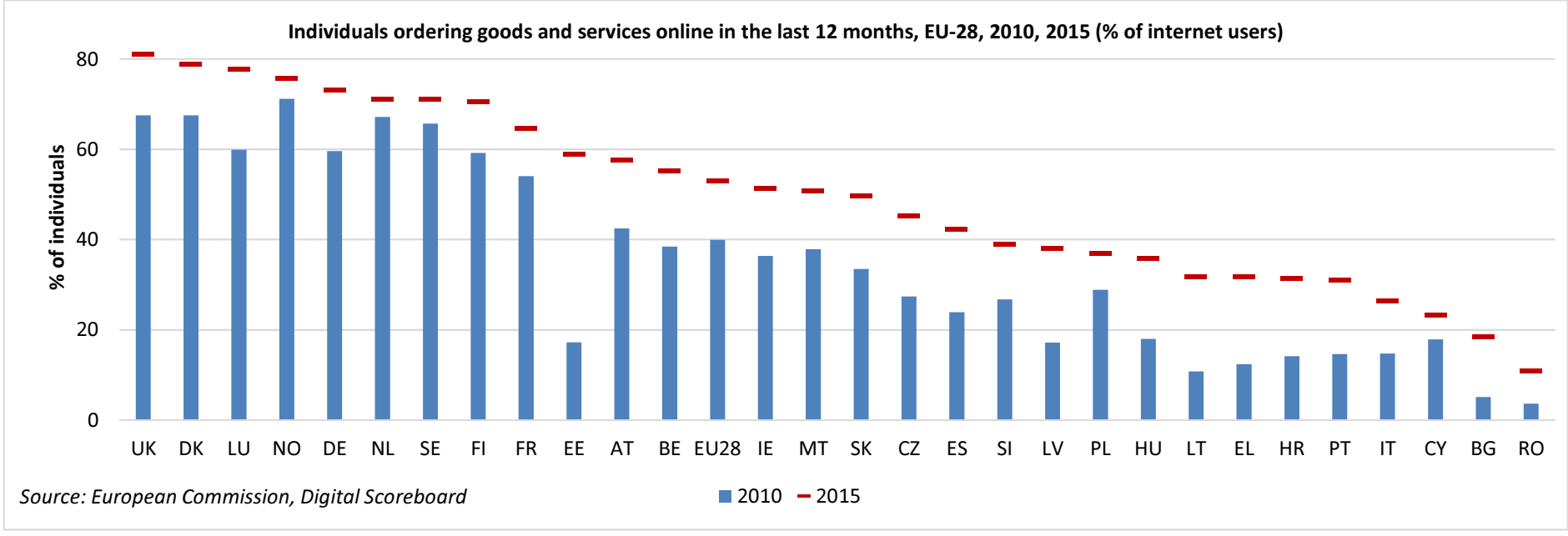
EU citizens also use the internet for **communication**. More than one third of internet users place calls (video or audio) over the internet, and 63 % interact using social networks. For **online transactions**, users are keen on doing their banking activities online (57 %) and close to two thirds of them reported to have shopped online during 2014.



Source: European Commission, Digital Scoreboard

eCommerce: Individuals ordering goods and services online.

Over the last five years, the number of European citizens ordering goods and services online has increased by 13 percentage points, to 53 %. As with many other online activities, e-commerce is higher among younger and higher educated people. These groups also had higher growth over the last five years so other groups are not yet catching up. Countries where online shopping among citizens was less common in 2010 have seen higher growth rates over the last 5 years than the ones at already high levels. Still, even where levels were high in 2010, there has been an increase in the number of people shopping online. The big increase for Estonia is due to a change in methodology.

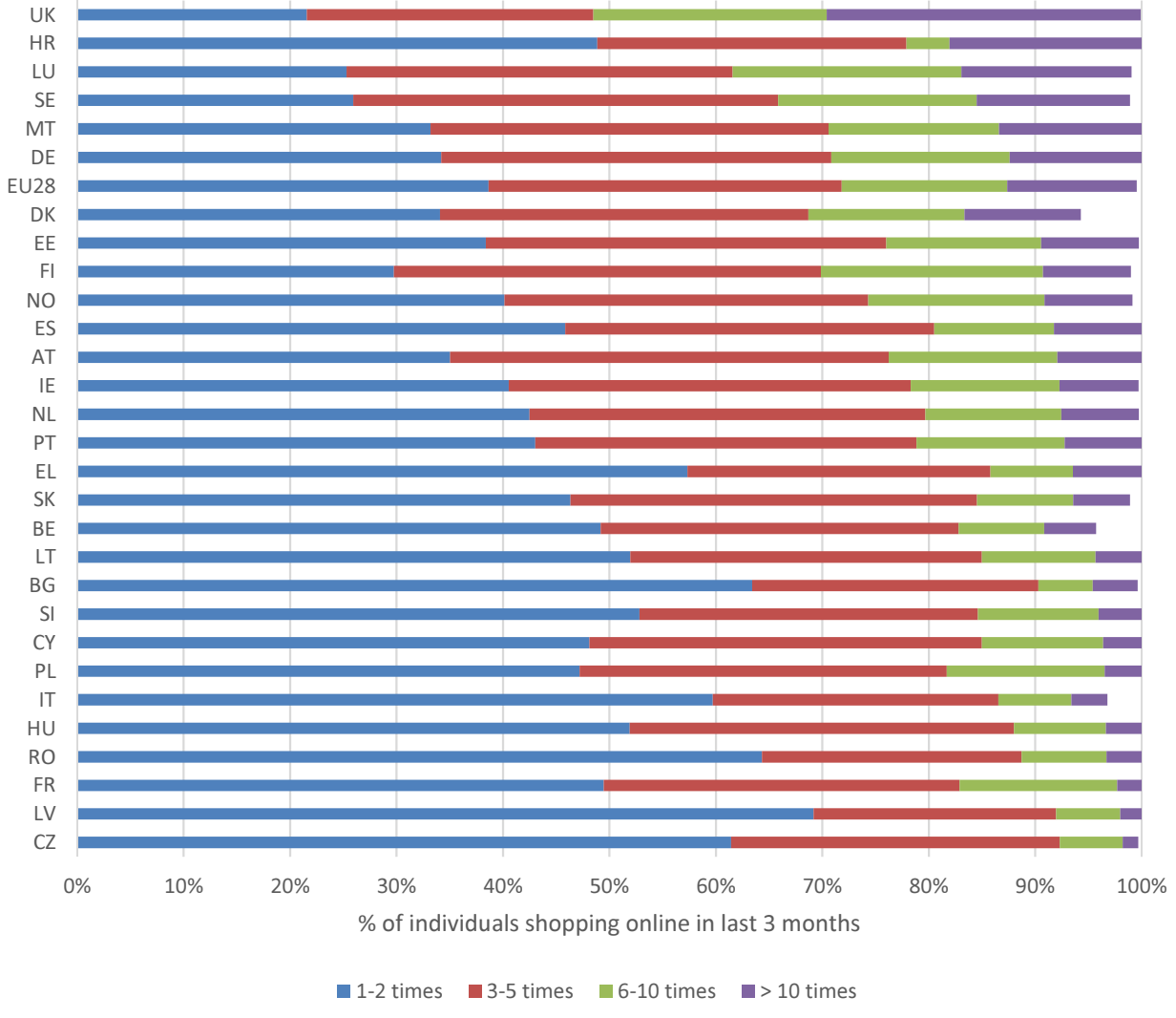


There has been a a small increase in the number of online purchases over the Internet since 2009.

Most people (72%) did between 1 and 5 purchases/orders online over last three months at the time of the survey. Only 12% said that they did more than 10 purchases. The UK has the highest share of frequent online shoppers with 29% making more than 10 purchases, while in Latvia and the Czech Republic the figures are only 1 and 2% respectively. There has been small changes since 2009 and only few online shoppers do more frequent purchases today. In 2015, on average 39% of the online shoppers spent less than 100€, 40% spent 100-499€ and 19% spent more than 500€ online over the last three months. There has only been small changes in the money spent since 2009 as well.

Source: Commission services based on Eurostat data

Frequency of online purchases/orders online in the last 3 months, EU-28, 2015
(% of internet users buying online in last 3 months)



eCommerce: Barriers and problems.

People who did not buy anything online within the previous year most commonly said that they "preferred to shop in person, like to see the product, choose shops out of loyalty or act from force of habit". This reason was given by 75 % of the non-online shoppers. Payment security concerns were a reason for 27 %, although only 3 % of e-shoppers encountered problems with fraud. Lack of trust — concerns about receiving or returning goods and complaints/redress — was given as reason not to shop by 19 %, although only 4 % of e-shoppers actually encountered problems that complaints and redress were difficult or no satisfactory response was received upon complaint.

Most common problems encountered while buying online, EU-28, 2015 (% e-shoppers)	share
Speed of delivery longer than indicated	16%
Technical failure	12%
Wrong or damaged good/services	8%
Difficulties finding information concerning guarantees, other legal rights	5%
Complaints and redress were difficult or no satisfactory response received after complaint	4%

Most common reasons for not buying online, EU-28, 2015 (% people who did not buy in the last 12 months)	share
Prefer to shop in person, they like to see product, loyalty to shops or force of habit	75%
Payment security concerns	27%
Trust concerns about receiving or returning goods, complaint / redress concerns	19%
Lack the necessary skills	18%
Don't have a payment card	13%

Source: Eurostat

eCommerce: Barriers and problems.

In 2015 70 % of online shoppers encountered no problems when buying goods or services online. Among those that did encounter problems, speed of delivery was the most common, given by 16 %. The 2015 DSM survey of online consumers ('Identifying the main cross border obstacles of the Digital Single Market and where they matter most', GfK for the European Commission, September 2015)

also revealed that for the 31 % of respondents who reported having had at least one problem with online purchases over the previous 12 months, the most common problem was with delivery (17 %: long delivery time). A series of problems with the product followed, such as its being of lower quality than advertised (15 %), being defective or the wrong product (14 % and 13 % respectively), or the product not being received at all (13 %).

The survey showed that the main consumer concerns about purchasing products online domestically were linked to: data protection and payment security (30 % of respondents were concerned that personal data may be misused and 26 % that payment details might be stolen) and consumer rights (fear of receiving wrong or damaged products (26 %), not finding it easy to replace or repair a faulty product (25 %) and not finding it easy to return a product they did not like and be reimbursed (22 %).

Internet users face a number of security threats online.

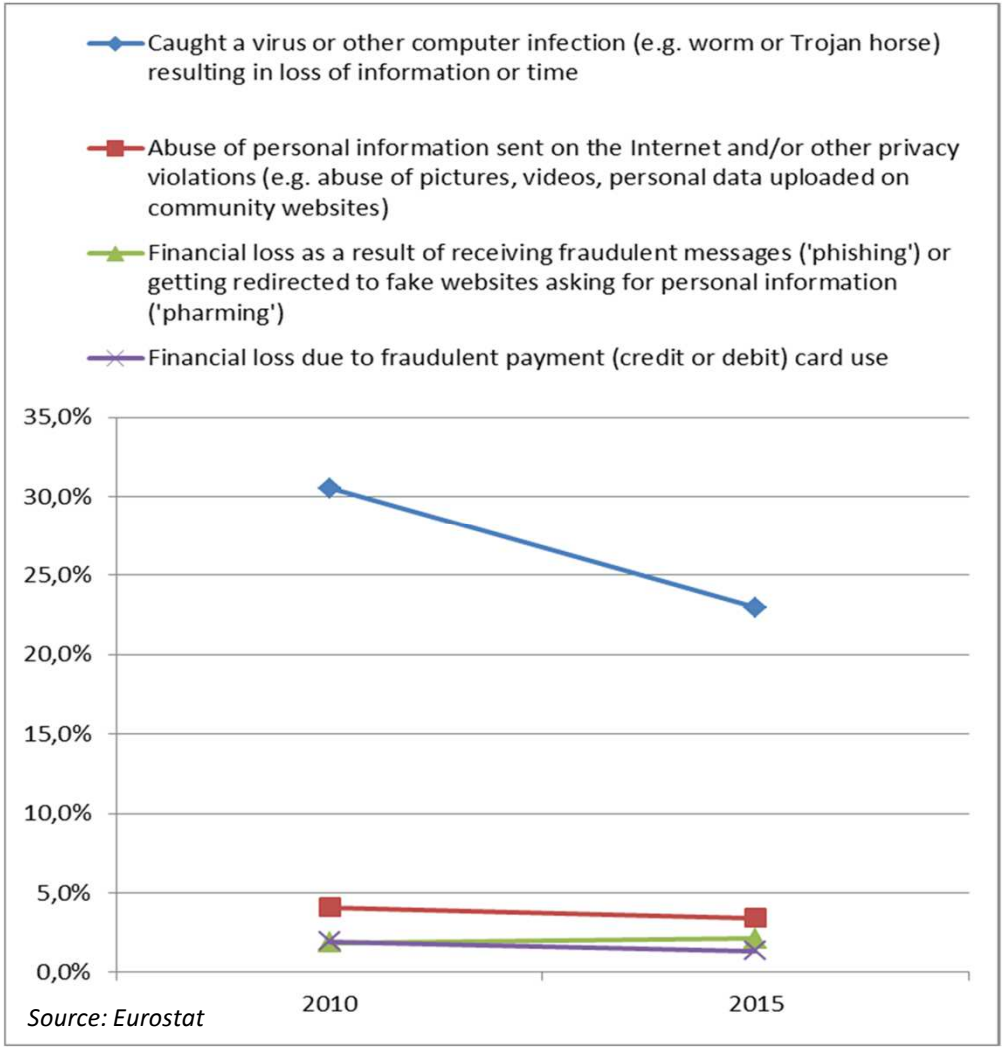
Internet users encounter a variety of security problems. For four of them we can see if the environment has changed in the last five years.

Over the period 2010-2015, the percentage of internet users experiencing any of the four security problems fell by 10 percentage points to 24 %. This was mainly due to fewer cases of damaging virus infections, at least those recognised by users.

Financial losses and abuse of personal information are rarer, but their gravity for victims can be important. They still happen, so it is natural that news of such cases raises concerns even among people who are not directly affected.

New forms of security threats have also appeared that are not yet monitored, like catfishing, ransomware and identity theft (see ENISA Threat Landscape 2015)

Individuals experiencing security problems online, EU-28, 2015 (% of internet users)

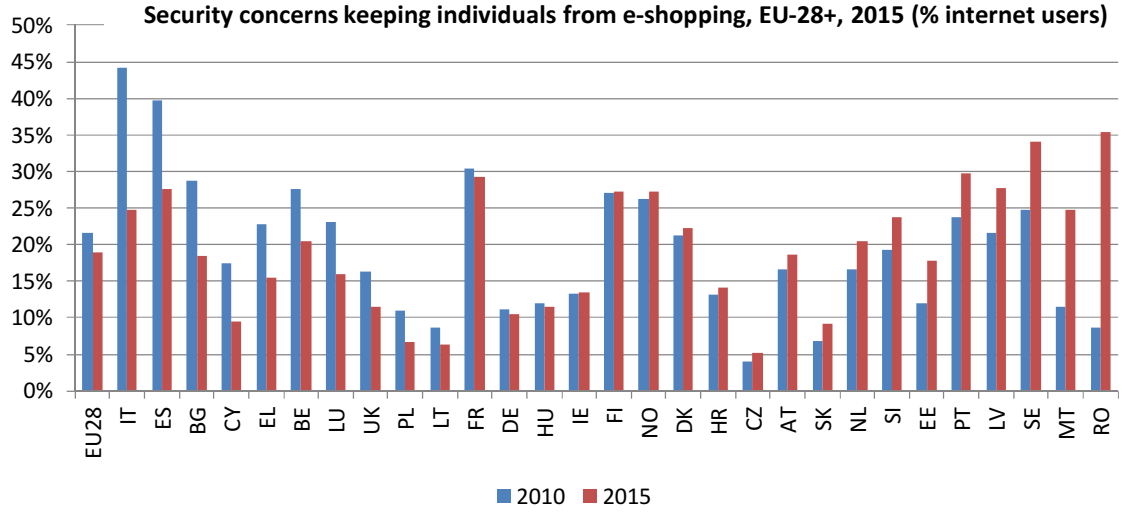


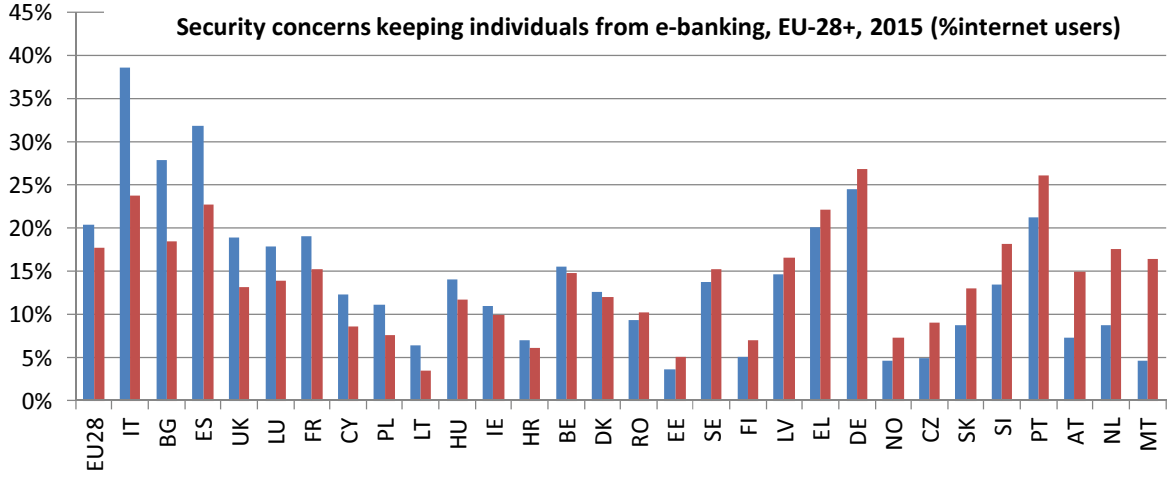
Source: Eurostat

Security concerns continue to keep 1/5 of internet users away from online transactions (e-commerce and e-banking).

Over last five years, the share of internet users declaring that security concerns have limited or kept them away from basic online transactions has fallen somewhat, to just under 20 %. Such slow progress is challenging the construction of a true digital single market at EU level, However the situation varies greatly between EU Member States. Some, among the more reticent to trust online transactions, have made substantial progress: IT, ES, and BG. The left side of the charts below shows those countries with better progress since 2010.

DK, FR, FI, and NO experienced trust problems with e-commerce above the EU average, with no progress in the last five years. Mistrust in RO, MT, SE, LV and PT has risen sharply and is above the EU average (right side of the charts). MT, AT and NL seem to have seen a large drop in trust in online banking services.





Source: Eurostat

In some countries security concerns are keeping internet users away from e-commerce, while in others, they inspire more selective defensive behaviour.

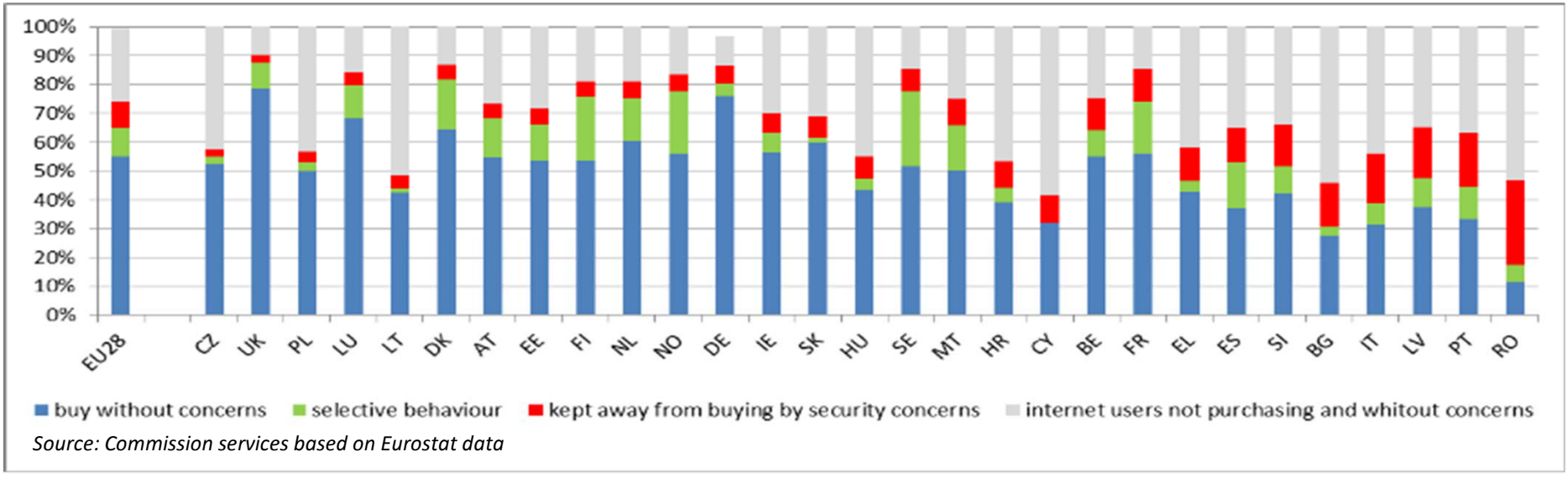
Internet users can be divided into four groups, according to whether they have purchased online (yes/no), and whether security concerns limited or kept them away from e-commerce (yes/no).

At EU level, 9 % of internet users (red segment) are completely deterred from buying online by their concerns. It is an important issue to address to develop the Digital Single Market, and in countries like PT and RO it involves 20 % or more persons.

For another 10 % of EU internet users (green segment), security concerns seem to simply limit shopping online. The phenomenon could be interpreted as depending on internet users' capacity to distinguish which websites do or do not deserve trust, and in which situations, such as when using public wifi, it is preferable not to conduct money transactions.

The countries where this selective defensive behaviour seems more developed are: SE, NO, FI, FR, DK, MT, ES and NL.

Security concerns and their impact on eCommerce, EU-28+, 2015 (% internet users)

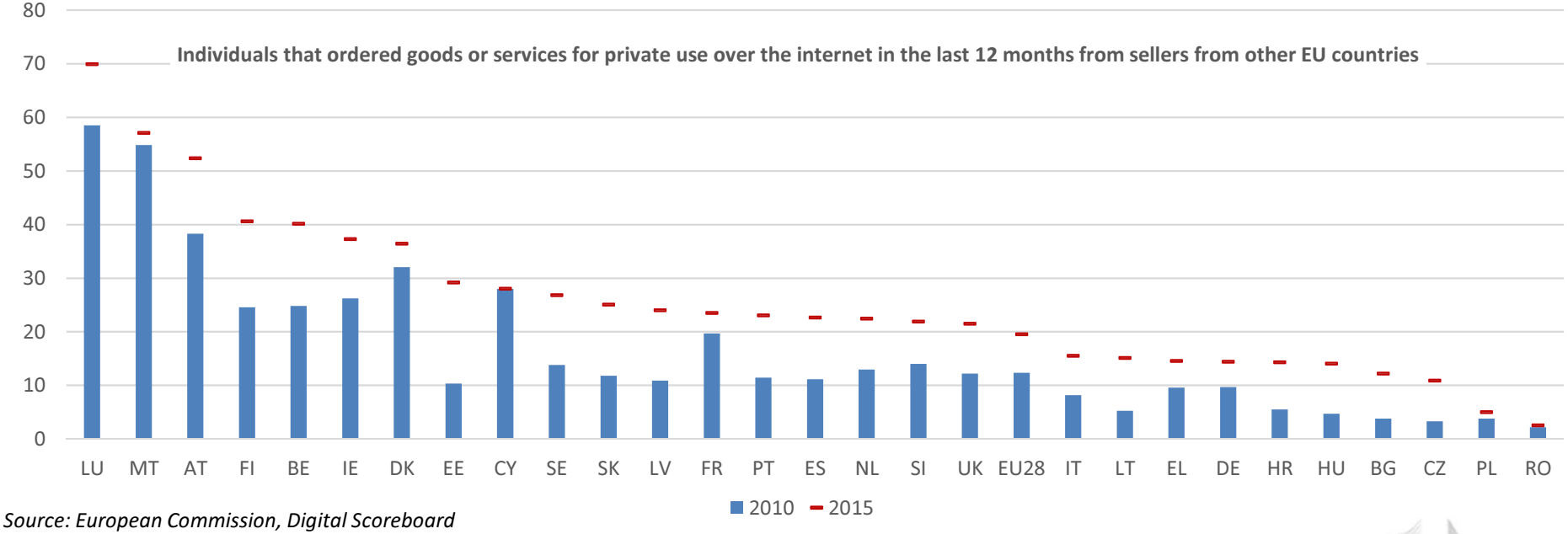


Source: Commission services based on Eurostat data

eCommerce: Individuals ordering cross-border goods or services online.

While 53 % of citizens shop online, only 16 % engage in cross-border eCommerce. While cross-border online shopping is advancing, it is doing so rather slowly, having increased 7 percentage points over the last five years. The differences between Member States are quite big, ranging from Luxembourg, at 68 %, to Romania with under 2 % of people shopping online with sellers from other EU countries.

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



Source: European Commission, Digital Scoreboard

European Commission

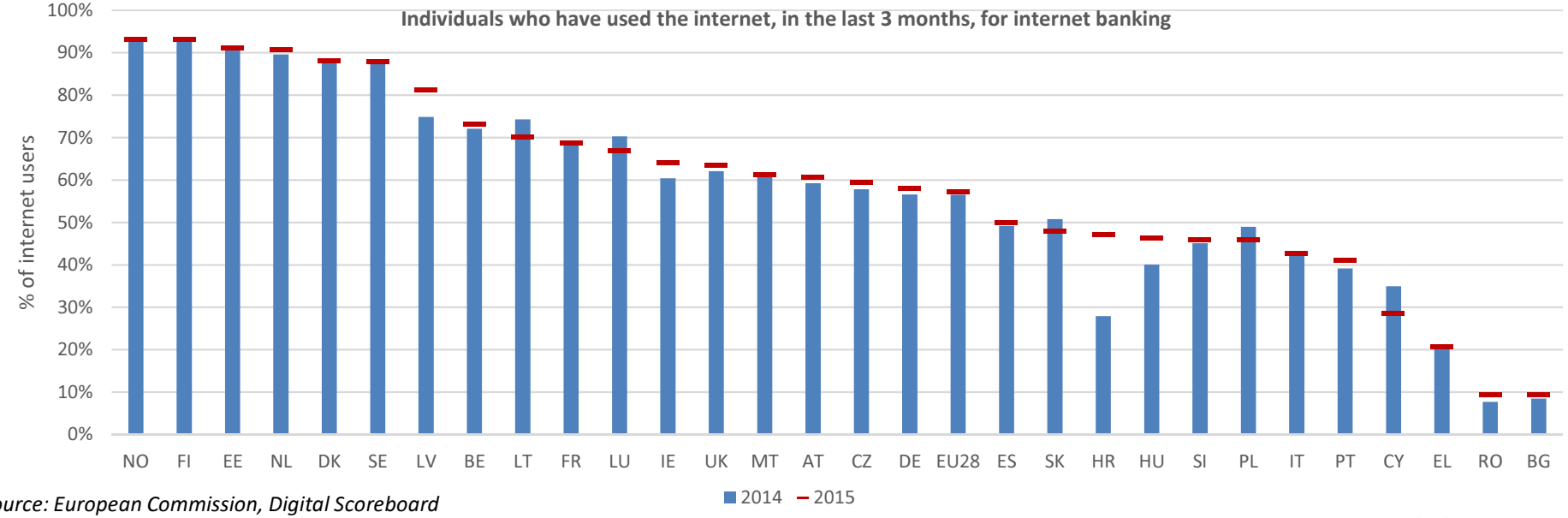
More than half of EU Internet users use online banking.

Online banking is a common activity among internet users. **More than half** of internet users in the EU **transact with their bank online**.

High shares of internet users doing online banking are recorded in **Finland (93 %), Estonia and the Netherlands (91 % each)** for 2015. The differences between Member States are big, with **Bulgaria (9 %)** and **Romania (10 %)** having the lowest figures.

Concerning progress in the EU overall, **from 2010 to 2015 the percentage** of internet users doing online banking **increased slightly** from 52 % to 57 %. Between 2014 and 2015 there was no change.

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



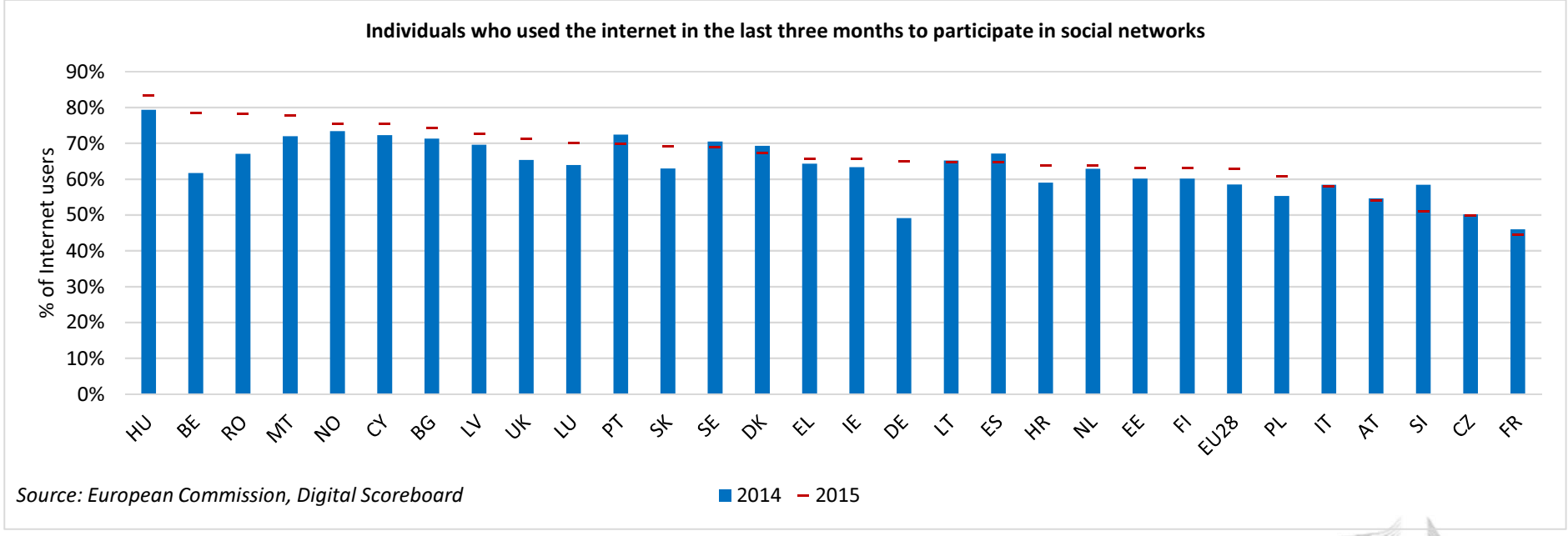
Source: European Commission, Digital Scoreboard

Participation in social networks online is still increasing.

Social networks have been around for some time and is a common and popular activity among internet users. In 2015, 63 % of internet users participated in social networks. Among 16- to 24-year-olds, the rate of users is close to saturation at 90 %, while the older age groups still see growth in the number of users. Participation in social networks online is an activity with a high frequency of use and all groups see growth in time spent on social networks. While Facebook is the dominant platform, there are several different choices. The higher the age, the more dominant Facebook is as the choice of network. Among younger people, other services are more frequently used.

The country with the biggest proportion of internet users on social networks is Hungary, with 83 %. Belgium, Malta and Romania follow with 78 % of users each.

Most European countries saw an increase in the number of social network users between 2014 and 2015. Belgium and Germany had big increases of 16 or 17 percentage points. Some countries saw small declines. France has the lowest share of users and has not seen any increase over the last four years. This was also the situation in Germany until a sudden increase in 2015.

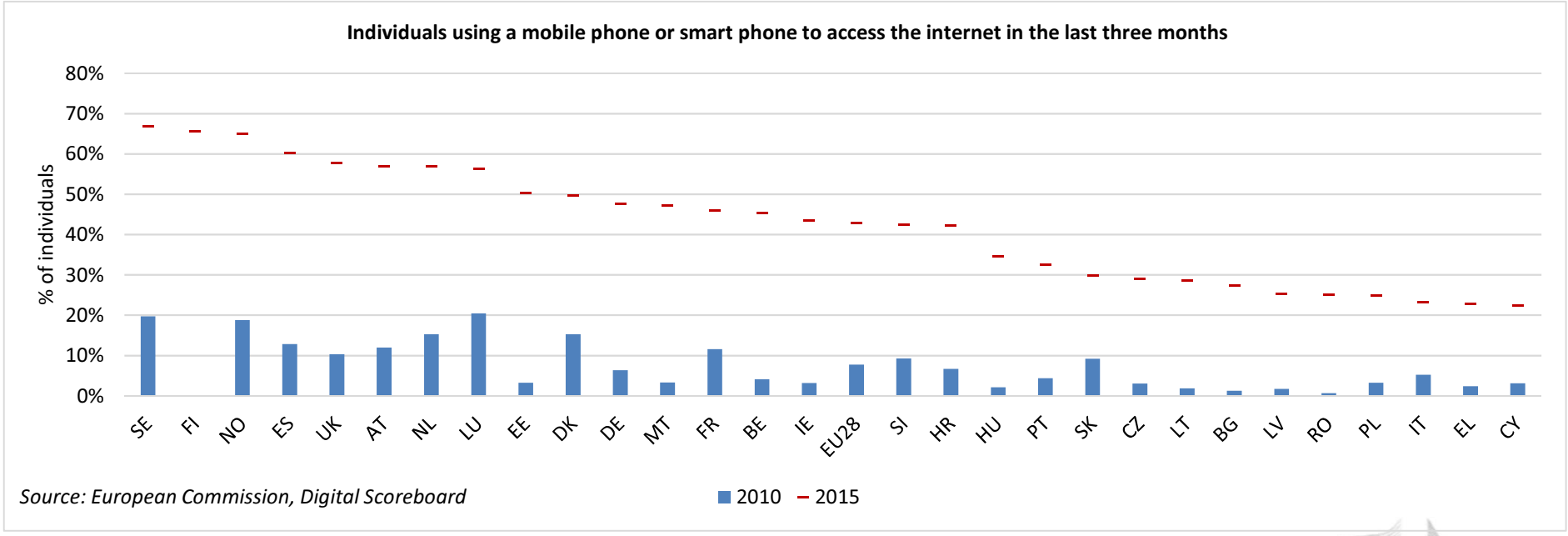


Source: European Commission, Digital Scoreboard

The internet becomes mobile.

Mobile use of the internet in Europe really started to take off around 2010. Today 43 % of the population (aged 16-74 years) use their mobile phone to access the internet when they are away from home or work. Mobile internet increases the opportunity to access online services. Some countries like Finland and Sweden have seen steep growth over the last five years and are approaching 70 % of users. Yet, these countries still have high rates of growth.

If growth in use continues, mobile devices could be expected to overtake computers as the primary tool for accessing services and content online. There is of course a correlation between internet use in general and the use of internet on a mobile phone. Still, some countries have a higher rate of mobile users among their internet users than others. In Spain, 80 % of internet users are mobile, while in Cyprus the number is only 32 %.



Source: European Commission, Digital Scoreboard

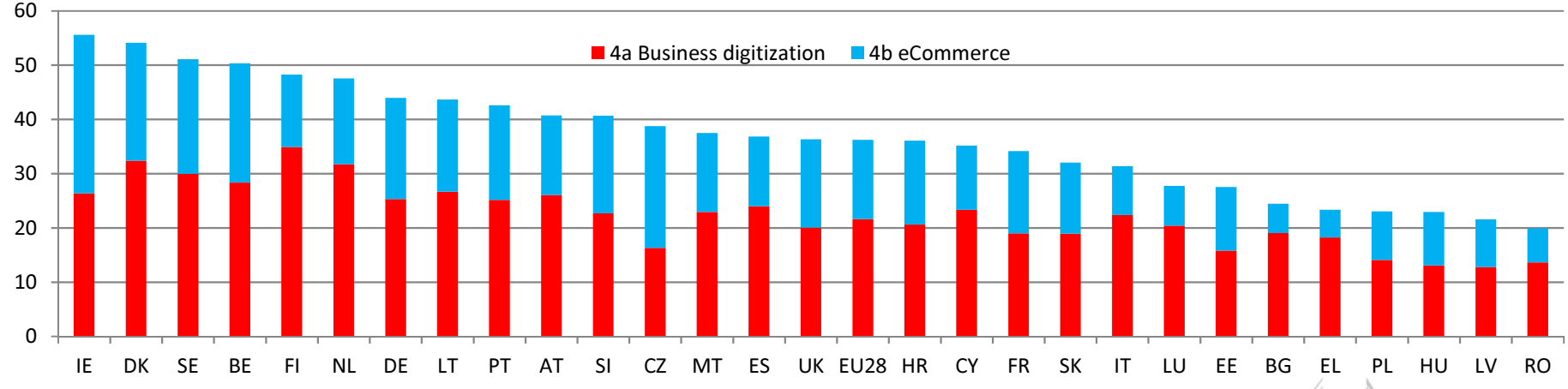
Integration of Digital Technology

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

Integration of Digital Technology covers (a) 'business digitisation' and (b) 'eCommerce'. 'Business digitisation' has five indicators (as % of firms using): electronic information sharing, RFID, social media, eInvoices and cloud solutions. eCommerce has indicators the percentage of small and medium-sized enterprises (SMEs) selling online, eCommerce turnover as a percentage of total turnover of SMEs, and the percentage of SMEs selling online cross-border.

	EU-28
4a1 Electronic Information Sharing % enterprises (no financial sector, 10+ employees)	36 % (2015)
4a2 RFID % enterprises (no financial sector, 10+ employees)	n.a.
4a3 Social Media % enterprises (no financial sector, 10+ employees)	18 % (2015)
4a4 eInvoices % enterprises (no financial sector, 10+ employees)	n.a.
4a5 Cloud % enterprises (no financial sector, 10+ employees)	n.a.
4b1 SMEs Selling Online % SMEs (no financial sector, 10-249 employees)	16 % (2015)
4b2 eCommerce Turnover % turnover of SMEs (no financial sector, 10-249 employees)	9.4 % (2015)
4b3 Selling Online Cross-border % SMEs (no financial sector, 10-249 employees)	7.5 % (2015)

DESI 2016, Integration of Digital Technology dimension, by country



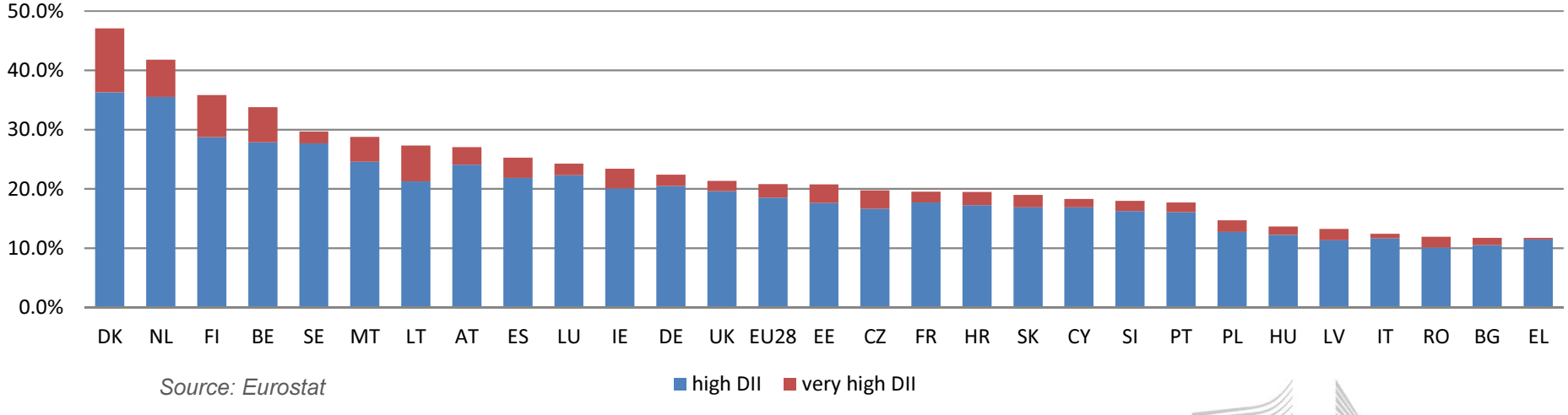
Source: European Commission, Digital Scoreboard

Only one company out of five in the EU-28 is highly digitised, but the situation across countries is varied: from one out of two in Denmark to one out of nine in Greece and Bulgaria.

The Digital Intensity Index (DII) is a micro-based index that measures the availability to the firm of 12 different digital technologies: the internet for at least 50 % of employed persons, recourse to ICT specialists, fast broadband (30 Mbps or above), mobile internet devices for at least 20 % of employed persons, website, a website with sophisticated functions, social media, ERP, CRM, electronic sharing of supply chain management information, eCommerce turnover accounting for over 1 % of total turnover, business-to-consumer (B2C) web sales of over 10 % of total web sales. The value for the index therefore ranges from 0 to 12.

Only in five EU countries is the percentage of firms with a very high DII (i.e. possessing at least 10 out of the 12 monitored digital technologies) above 5 %: DK, NL, FI, BE and LT. In the first four countries at least one third of firms also have a high or very high DII (i.e. firms have at least 7 out of the 12 monitored digital technologies). In IT, RO, BG and EL, less than one firm out of eight has invested heavily in digital technologies (i.e. has a high DII).

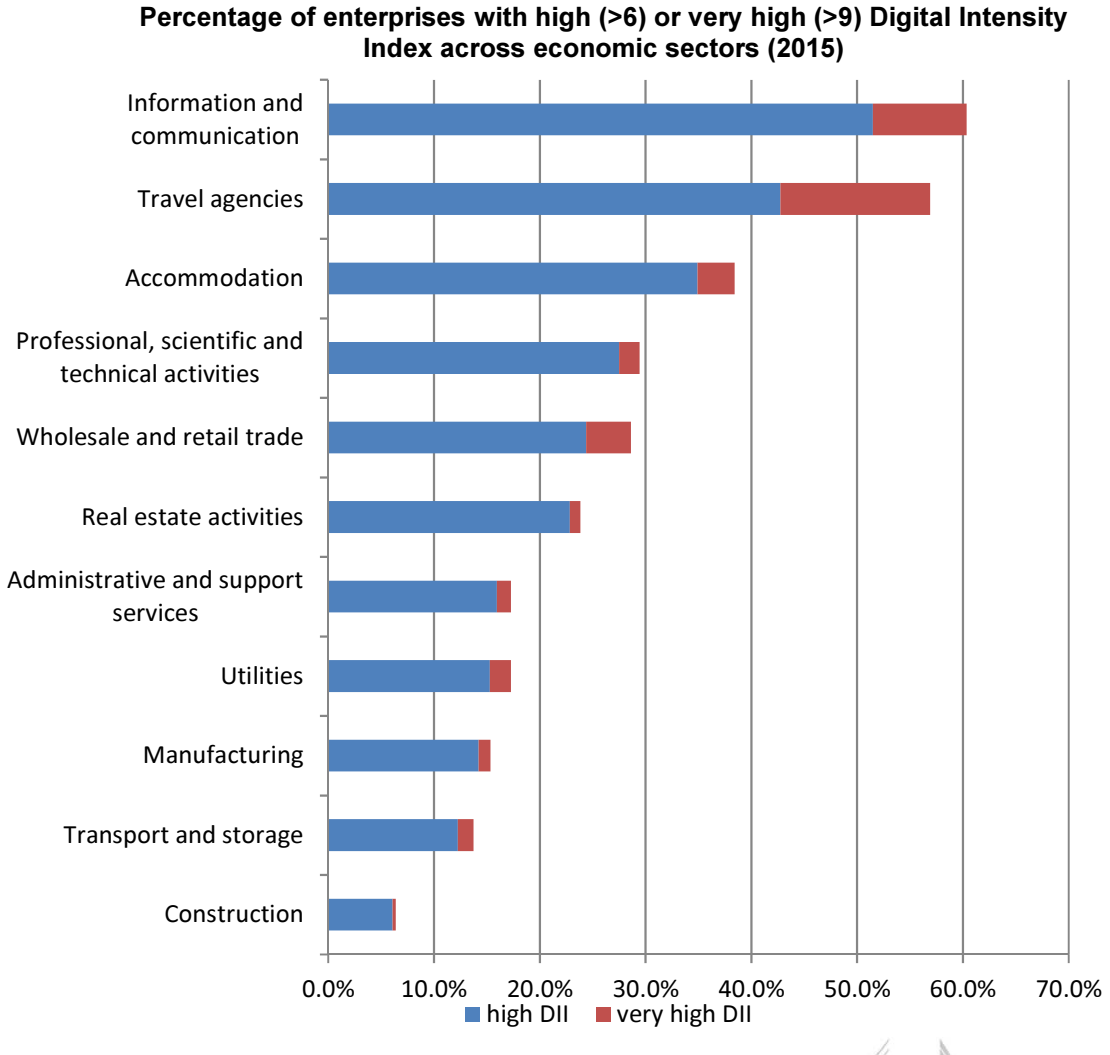
Percentage of enterprises with a high (>6) or very high (>9) Digital Intensity Index across EU countries (2015)



Source: Eurostat

In some economic sectors* digital business models are clearly visible (e.g. travel agencies, accommodation) while other sectors have strictly analog business models (e.g. construction).

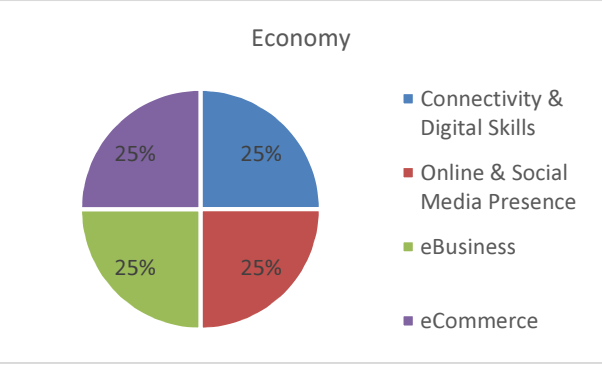
It was expected that businesses in the information and communication services sector would have high levels of digitisation (60 %). However, the extent to which some sectors have been transformed by the emergence of digital business models is perhaps more surprising. In the travel agency sector, 57 % of businesses are high adopters of digital technologies. In the accommodation sector, 38 %have a high or very high DII. Some sectors are still impervious to digital change: in the construction sector only 6 % of firms have a high or very high DII.

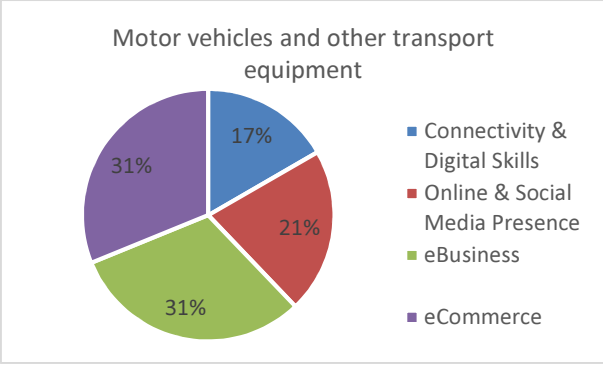


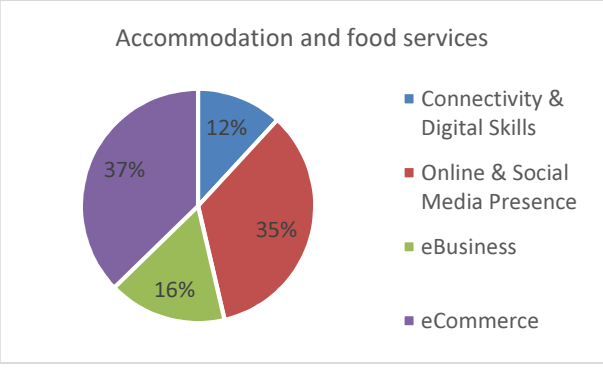
* The surveyed sectors include all the market economy with the exception of financial services, agriculture and mining (i.e. NACE rev 2 sectors 10 to 63 and 68 to 82).

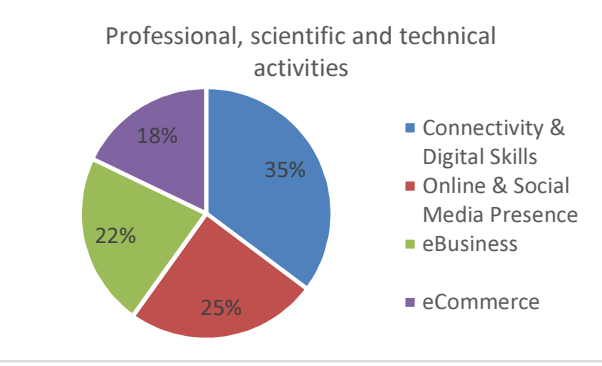
The diversity of digital tools adopted in different economic sectors reflects the diversity of digital business models adopted by their enterprises.

ICT solutions adopted in different economic sectors









Source: European Commission calculations based on Eurostat data

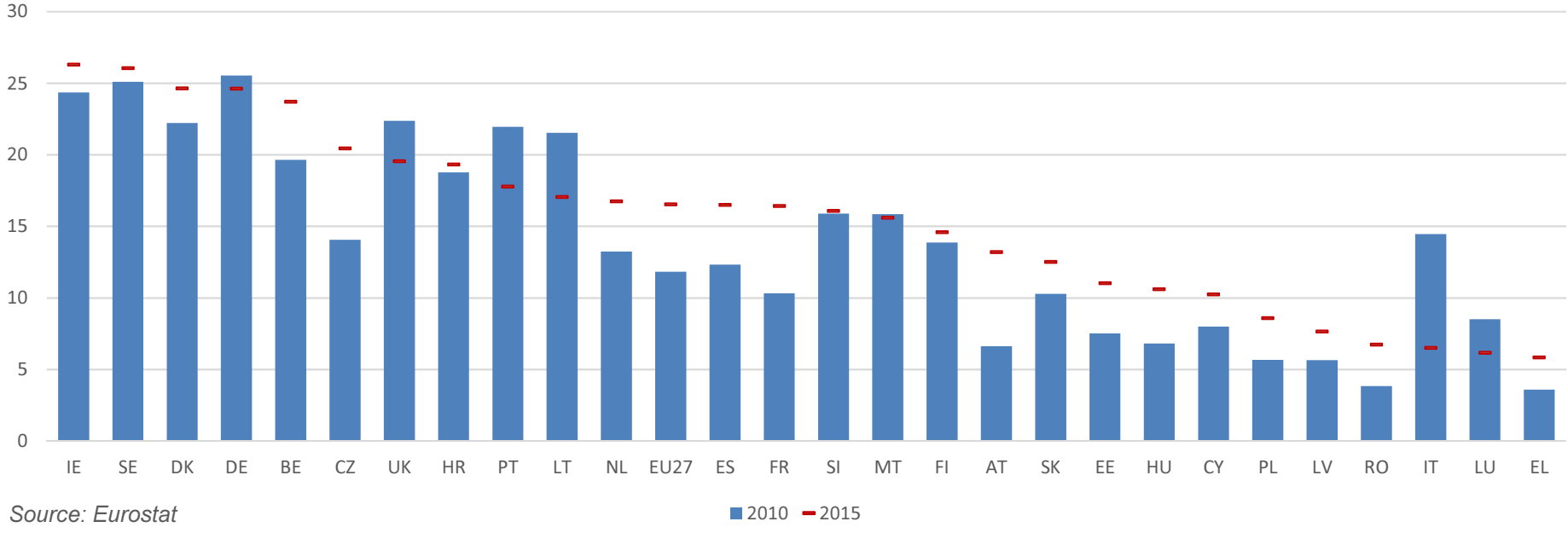
By looking in more detail at the ICT solutions adopted by firms in different sectors we discover differences not only in level but also in composition. For example, businesses that produce motor vehicles and transport equipment invest more heavily in eBusiness (e.g. ERP, CRM) and do more eCommerce than the rest of the economy. On the other hand, businesses in the accommodation and food services sector need to have well-developed websites and social media to remain competitive, and their online sales channel is very important to them. For professional, scientific and technical activities' firms it is very important to have a well-developed broadband infrastructure and lots of connected employees and ICT specialists.

eCommerce – slow progress in digital sales by companies in Europe.

Progress in online sales by European companies is slow. 16.8 % of them sell online, which represents an increase of only 3.5 percentage points over five years. Ireland saw a bigger than average increase and is in the lead.

Large companies are more active, with 38 % selling online. This represents a gain of 7 % points over the last five years. Thus the gap between SMEs and large companies is increasing.

Enterprises using a computer network for sales (at least 1 %) during the previous year (2010 2015)



Source: Eurostat

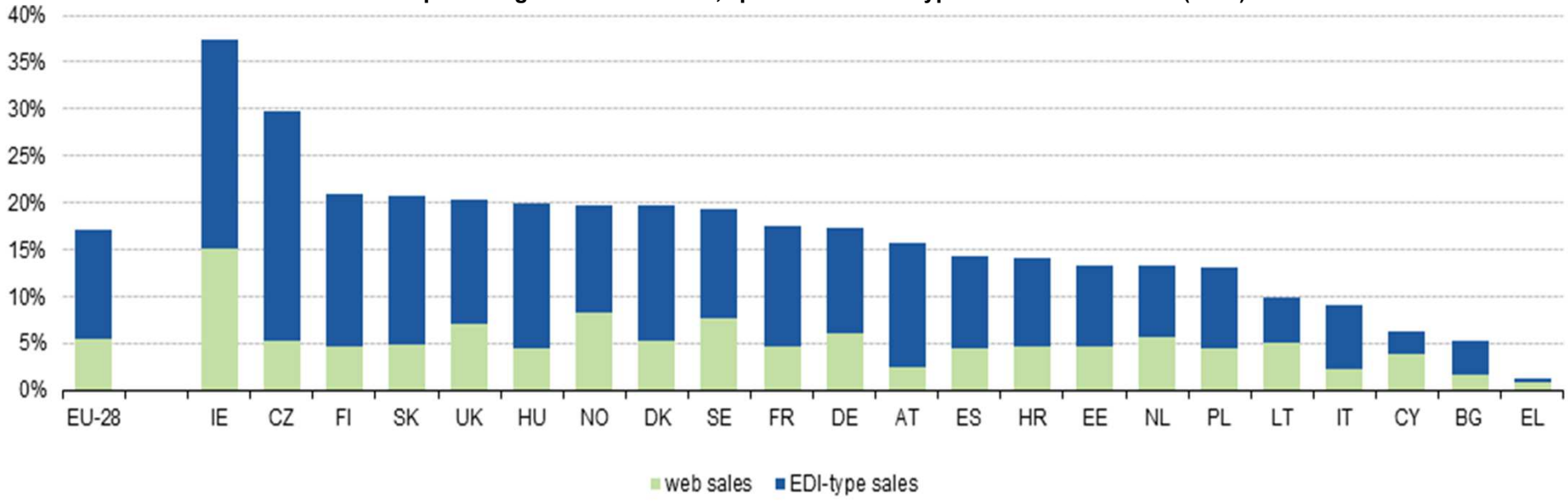
European Commission

Web and EDI as different types of eCommerce.

eCommerce can be broadly divided into two types: web sales and EDI-type sales, according to the way customers place orders for products. In the EU-28, firms made 17 % of their total turnover from e-sales in 2015. Turnover from *EDI-type sales* accounted for 12 % of total turnover, while the turnover from *web sales* accounted for only 5 %. EDI stands for Electronic Data Interchange and it is a standard for the electronic transmission of data suitable for automated processing. It's normally a standard used in B2B transactions to exchange documents such as purchase orders and invoices.

That 5 % was made up of 3 % from e-sales to other enterprises and public authorities and 2 % from e-sales to private consumers. The share of total turnover obtained from *EDI-type sales* ranged from less than 1 % in Greece to 24 % in the Czech Republic and 22 % in Ireland. The share of total turnover from *web sales* ranged from 1 % in Greece to 15 % in Ireland.

Turnover from online sales as percentage of total turnover, split between EDI-type sales and web sales (2015)



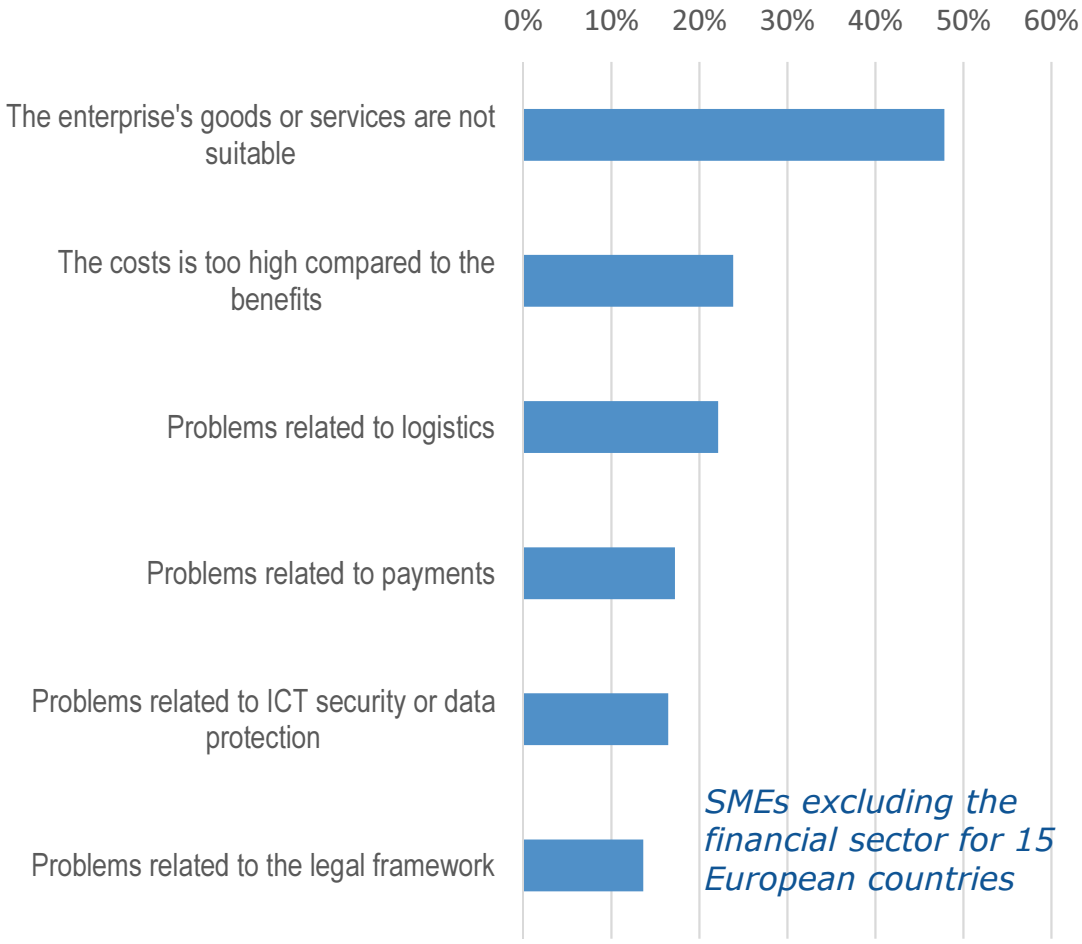
Source: Eurostat

* EDI stands for Electronic Data Interchange and it is a standard for the electronic transmission of data suitable for automated processing. It's normally a standard used in B2B transactions to exchange documents such as purchase orders and invoices.

Obstacles for SMEs to sell on the web.

SMEs (10-249 employees) that do not sell on the web give as their main reason that their products and services are not suitable. This might be reflected by the second most common obstacle: that the cost of investing in web sales is too high compared to the benefits.

In general, SMEs are more concerned about most of the barriers to online sales than large firms. Selling online requires an up-front investment (in money but also in time, e.g. to research legislation) which larger companies can afford more easily.



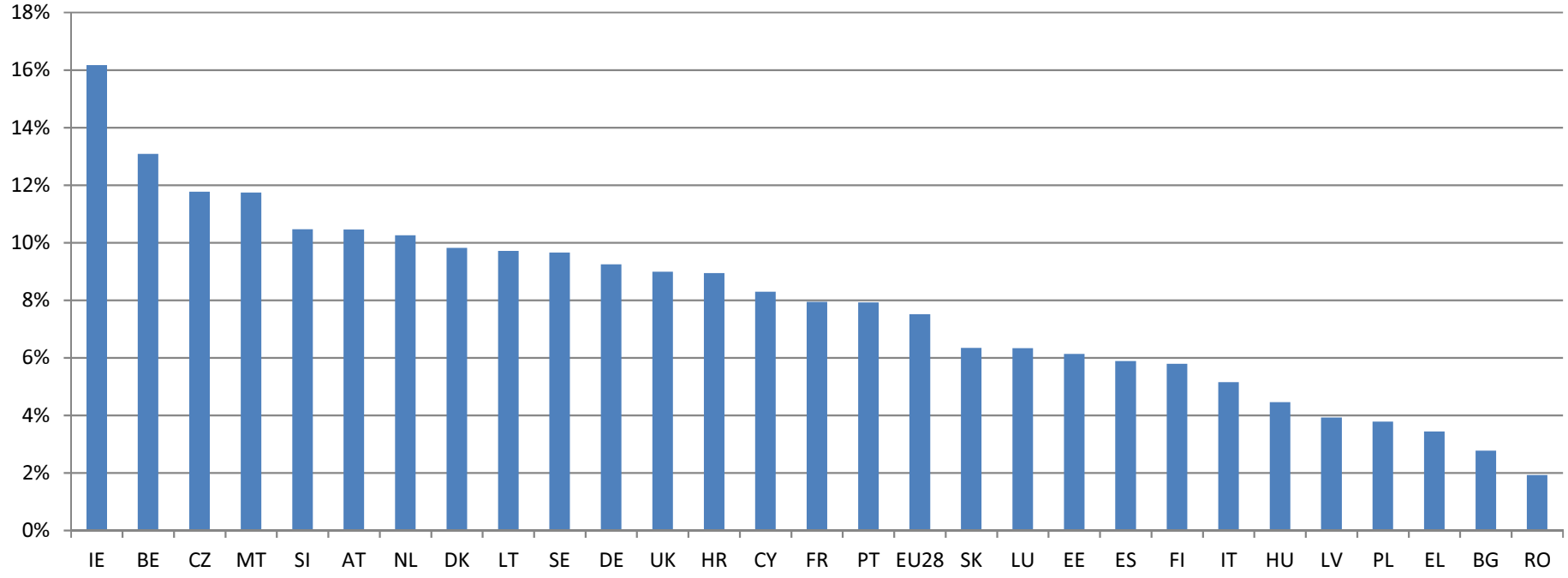
Source: Eurostat

Cross-border eCommerce among SMEs.

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

However, only 7.5 % of European SMEs sell online to other Member States, an increase of 1 percentage point since 2013. At the same time 23 % of large enterprises do so.

SMEs (10-249 persons employed) with electronic sales to other EU countries in the last calendar year (2015)



Source: European Commission, Digital Agenda Scoreboard

EU Enterprises are still not enough prepared to face security risks.

Having a formal security policy is a basic requirement for effectively addressing threats. This was true for 64 % of large firms in 2010, and now 72 %. But 11 % had not reviewed their security plans in the previous two years, so they risk becoming outdated in a quickly changing environment.

SMEs are more rarely equipped with security plans, (nevertheless improving from 24 % to 30 % between 2010 and 2015), but the main difference between them and large business is that they rely mainly on external suppliers to run such specialist functions, justifying recent attention to reinforcing EU industry in this field.

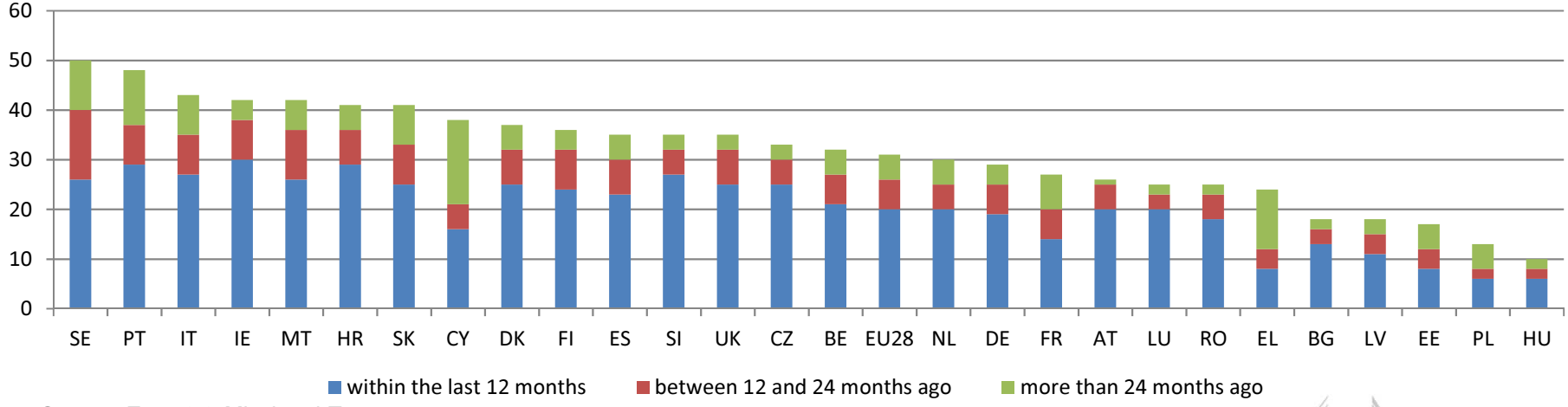
Only 20 % of EU companies have recently updated their security plans.

Percentage of enterprises with a formally defined ICT security policy by size of enterprise (2015) and degree of outsourcing

Enterprises with a formally defined ICT security policy (as of 2015)	Yes	No
Large enterprises (250+)	72.3 %	27.4 %
SMEs (10-249)	30.4 %	65.5 %

If yes, who mainly performs security and data protection ICT specialist functions?	External suppliers	Own employees
Large enterprises (250+)	22.8 %	47.6 %
SMEs (10-249)	17.8 %	11.0 %

Percentage of enterprises with a formally defined ICT security policy by date of latest update (2015)



Source: Eurostat. Missing: LT

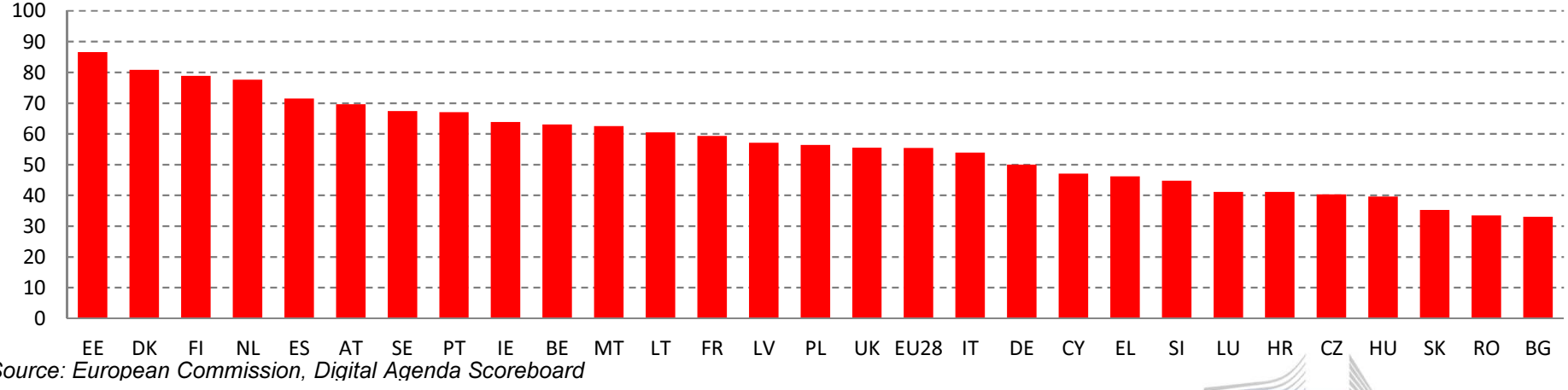
Digital Public Services

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

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

	EU-28 value
5a1 eGovernment Users % individuals (aged 16-74) who used Internet in the last year	32 % (2015)
5a2 Pre-filled Forms Score (0 to 100)	49 % (2015)
5a3 Online Service Completion Score (0 to 100)	81 % (2015)
5a4 Open Data Score (0 to 700)	351 (2015)

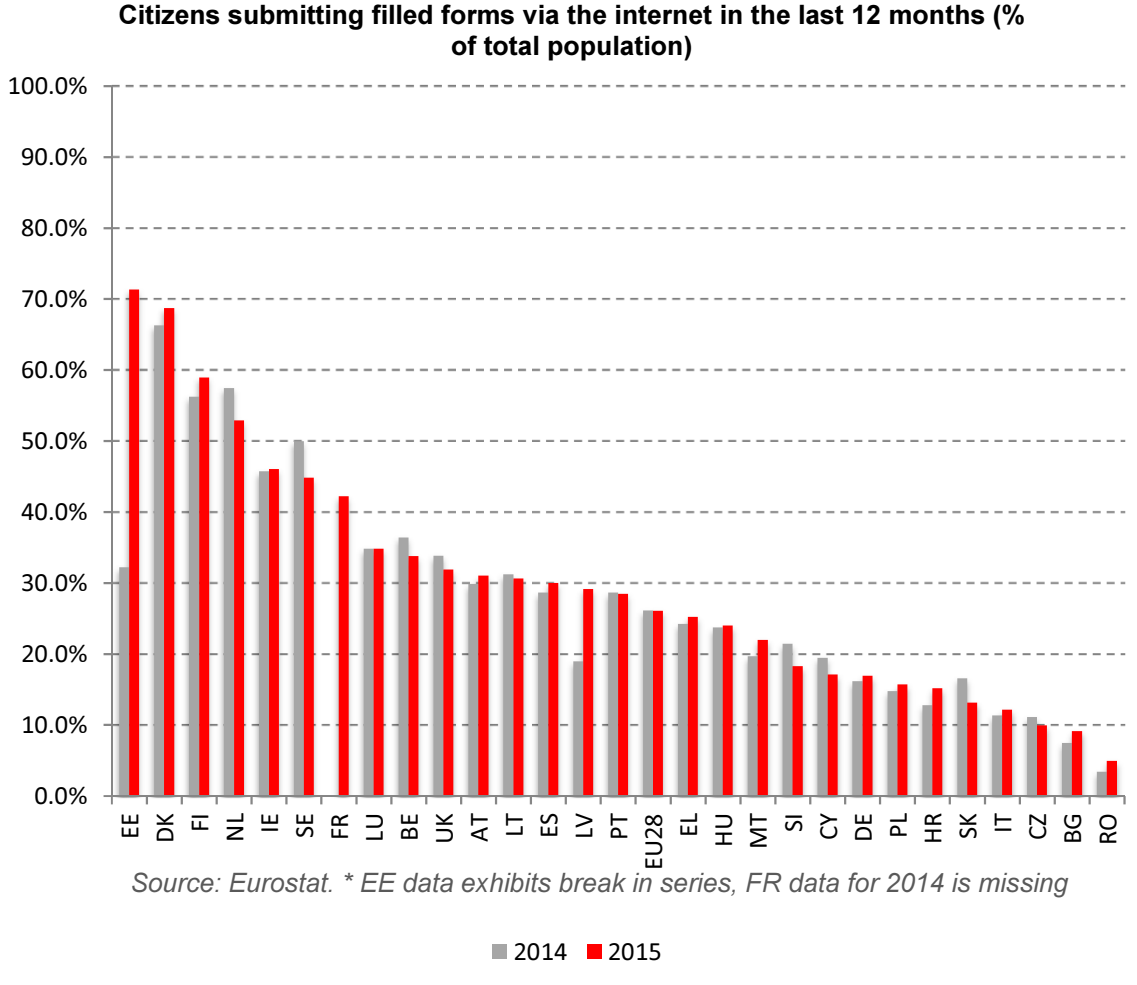
DESI 2016, Digital Public Services dimension, by country



Source: European Commission, Digital Agenda Scoreboard

eGovernment usage has levelled out.

In 2015, **interactive eGovernment services** were used by 26 % of the EU-28 population, the same level as the previous year. Usage increased in 15 out of 28 countries, while in NL, SE, LU, BE, UK, LT, PT, SI, CY, SK, and CZ usage fell or remained the same in 2015 (although NL and SE are close to saturation). In three countries (RO, BG, and CZ) less than a tenth of the population submit completed forms online, with generally little progress in catching up (except for CZ).

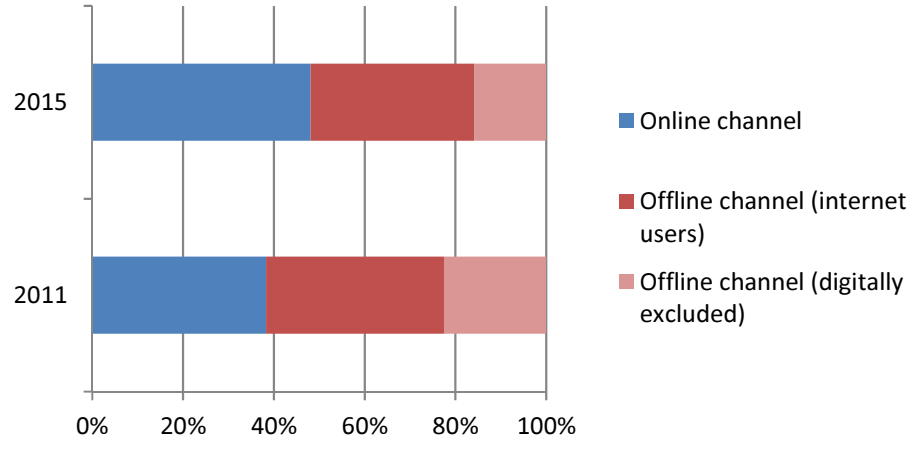


*Source: Eurostat. * EE data exhibits break in series, FR data for 2014 is missing*

Almost half of the population needing public services chooses the online channel. The main reason for non-use is recourse to intermediaries.

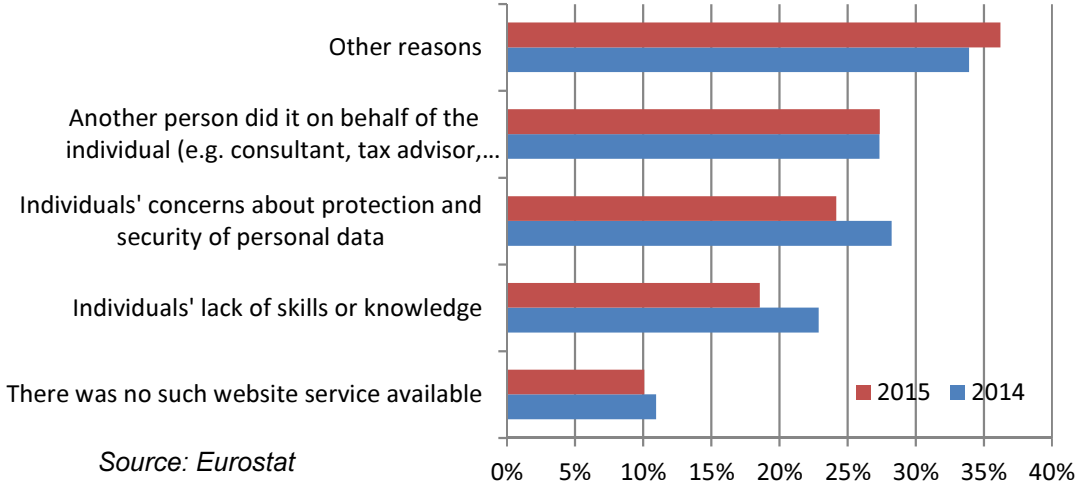
Of people needing to submit forms to the public administrations*, 48 % chose the online channel in 2015, an increase of 10 percentage points from 2011. This is the result of both a fall in the percentage of the digitally excluded (from 23 % to 16 % of the total) and a fall in popularity of offline channels among internet users (by 3 percentage points). However, there is still great untapped potential (52 %) for use of eGovernment services. While this could be addressed in part by increasing digital skills (to increase both internet use and the skills of internet users, see below), some further policies on the supply side may be needed. The percentage of citizens needing to submit forms (for which information is lacking) has been assumed to be analogous to the percentage of internet users needing to submit a form (for which information is available).

eGovernment usage potential (preferred channel for submitting forms to public authorities by citizens)



Source: EUROSTAT

Reasons for not submitting official forms through the online channel (% of Internet users needing to submit official forms)



Source: Eurostat

Personal characteristics are less of a barrier to non-use of the online channel than in 2014: lack of skills or knowledge is down from 23 % to 19 % while concerns about protection and security of personal data are down from 28 % to 24 %. The main specific factor is the use of intermediaries (both professionals and acquaintances), at 27 % of cases (unvaried). These may be used in some cases for convenience and in others for lack of skills. Lack of supply/awareness still accounts for 10 % of cases of non-use. Other reasons account for 36 % of the cases.

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

The measurement of eGovernment supply, some methodological notes.

The supply side of eGovernment is measured through a 'user journey' approach. Researchers pose as ordinary users of eGovernment services in an event that requires some official action (e.g. a marriage). They go through the steps of meeting the relevant administrative requirements using public authority websites and the online channel where possible.

Seven life events are analysed over two years (with data for three complete measurements in 2012-2013, 2013-2014 and 2014-2015) in different areas of government:

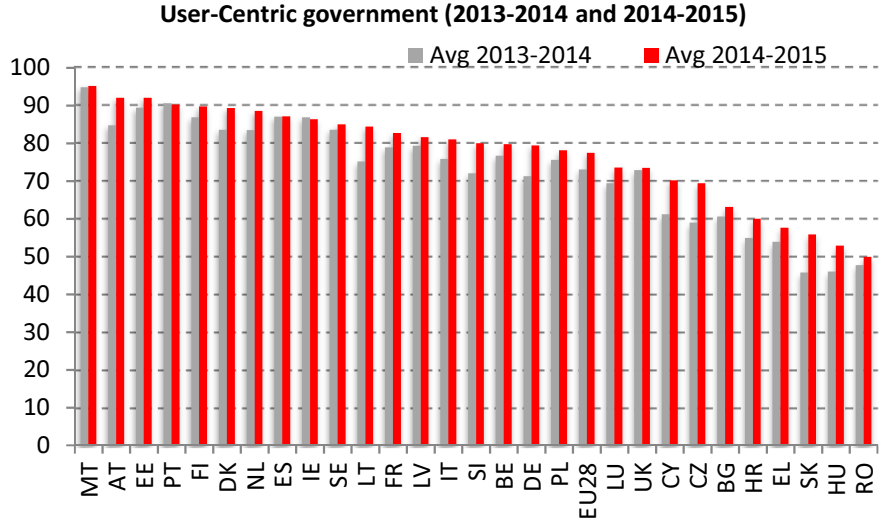
- losing/finding a job
- enrolling at university
- moving
- starting a small claims procedure
- buying/owning a car
- starting a business
- regular business operations

This new method looks at different aspects of service provision, but the two examined here are the following: user-centricity and transparency. The User-Centric eGovernment indicator measures the availability of eGovernment services, their connectedness and their user-friendliness. The Transparent eGovernment indicator measures the online transparency of government in different aspects of online service delivery, treatment of citizens' personal data and the activities of public administrations. Both indicators range from 0 (complete absence of required features) to 100 (all features included).

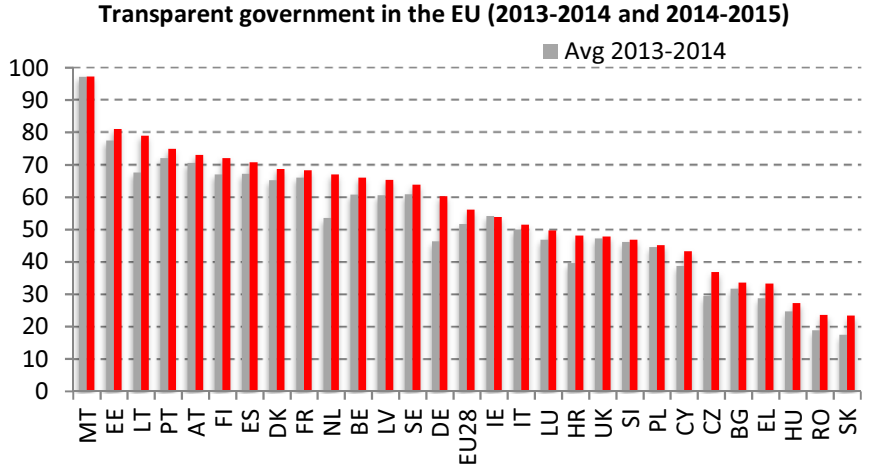
The source for the eGovernment supply data is the eGovernment Benchmark Report (see https://ec.europa.eu/digital-agenda/news-redirect/16475)

There is progress in supplying eGovernment, especially by those catching up. Transparency is increasing for most countries but more is needed to win trust.

Five countries in the EU-28 are very close to having a fully developed digital channel for public services with scores above 90 %: MT, EE, LT, PT and AT. Those at the bottom are catching up, with all countries now scoring 50 or above, with most progress made by SK and CZ.



Source: eGovernment Benchmark Report



Source: eGovernment Benchmark Report

Transparency is an important element for increasing the take-up of online public services, since it helps build citizens' trust in public administrations.

Transparency has improved with respect to the previous year in almost all countries, with average EU-28 progress of 4pp. But more progress is needed to gain users' trust.

THE EU ICT SECTOR AND ITS R&D PERFORMANCE

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 2008-2012. It corresponds to the definition provided by the OECD in 2007.

The **operational definition** of the ICT sector enables an international comparison with non-EU countries over a longer period (2006-2012), as some of these countries do not have the necessary disaggregated information to estimate all the ICT sub-sectors included in the comprehensive definition. The operational definition does not include the following sectors: manufacture of magnetic and optical media (268) and ICT trade industries (465).

Sector analysis

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

Source

Joint Research Centre – Institute for Prospective Technological Studies (JRC-IPTS) calculations and estimates, based on Eurostat, the OECD's structural analysis database (STAN), EU-KLEMS data, and the JRC's PREDICT project.

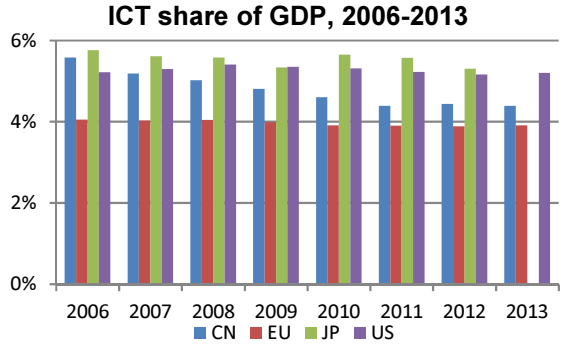
All data contained in these databases come from official sources (e.g. Eurostat, OECD, national statistical institutes). However, there may be some discrepancies with the original sources, e.g. owing to updates of the original data or the use of multiple auxiliary sources and variables.

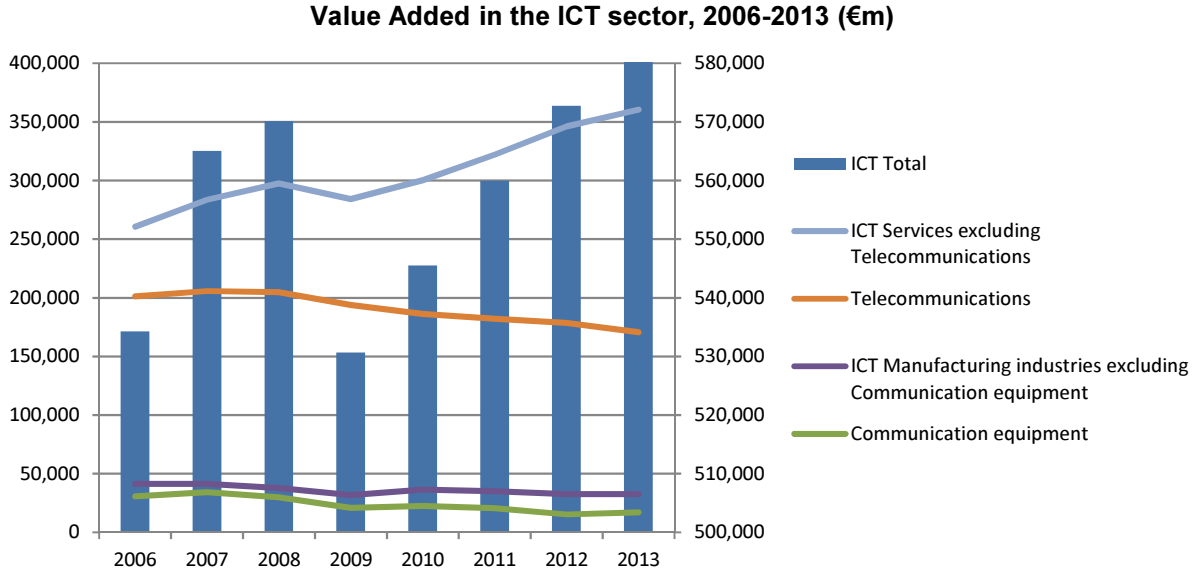
VALUE ADDED IN THE ICT SECTOR
at EU and global level

The ICT sector **value added** amounted to €581 bn in 2013. After a slowdown in 2009, the ICT sector experienced a recovery. A breakdown by sub-sector shows the predominance of ICT services (€531 bn and 91 % of total ICT value added in 2013) over ICT manufacturing industries (€50 bn and 9 % of total ICT value added in 2013). The ICT services sector (excluding telecommunications) is the only one that saw an increase in value added over the medium-term period (2006-2013) up to €360 bn. The communication equipment sector experienced the sharpest decline over the medium-term period (2006-2013). After peaking at €34 bn in 2007, it fell to €17 bn in 2013, indicating structural decline.

Value added in the ICT sector (comprehensive definition*) accounted for 4.3 % of EU GDP in 2013. However, value added in the ICT sector (operational definition*) in the EU (3.9 %) was behind China (4.4 %) and the US (5.2 %) in 2013 (no data for Japan in 2013, but Japan and the US had similar levels in 2012).

** See methodological note.*

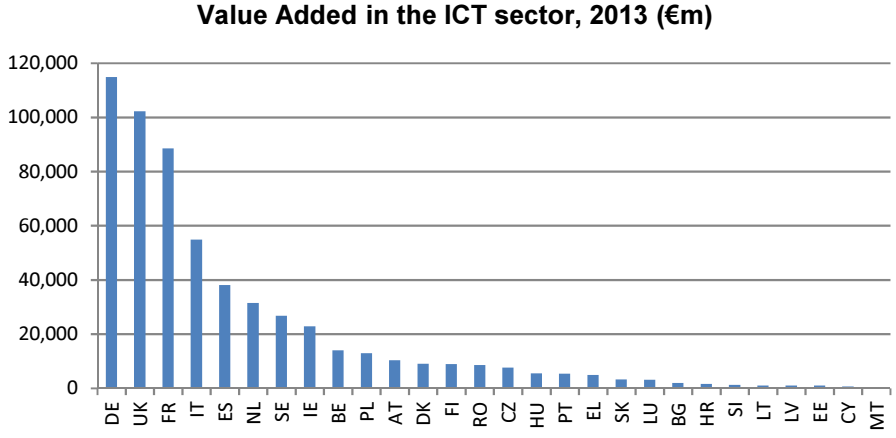


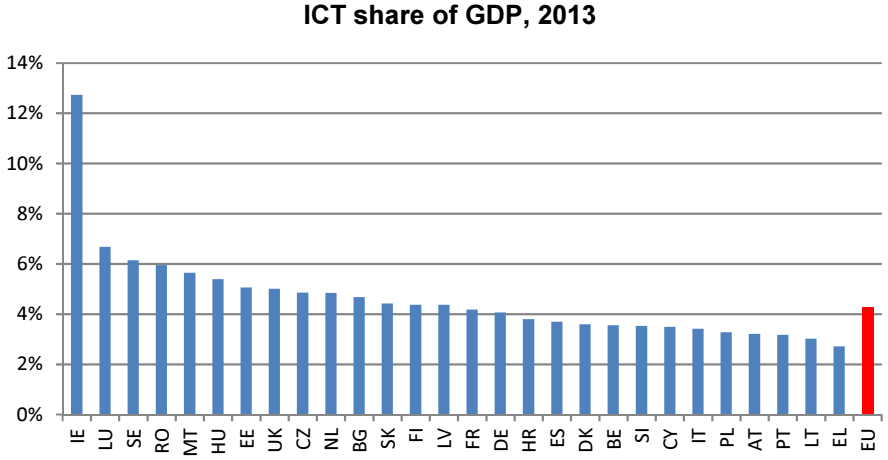


Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

VALUE ADDED IN THE ICT SECTOR
by Member State

Unsurprisingly, the five largest economies were also the **five biggest contributors** to ICT value added in 2013: Germany (€115 bn or 20 %), the United Kingdom (€102 bn or 18 %), France (€88 bn or 15 %), Italy (€55 bn or 9 %) and Spain (€38 bn or 7 %). Together, these five countries represented 69 % of total EU ICT value added in 2013.





Ireland had — by far — the highest ICT share of GDP, with a rate of 12.7 % in 2013, while Greece was lagging behind with less than 3.0 %. After Ireland, countries with the highest share of ICT included Luxembourg (6.7 %) and Sweden (6.1 %). Some eastern Member States (Romania, Hungary, and Estonia) also had a high rate of ICT as a share of GDP. In most other Member States, ICT remained broadly stable as a proportion of GDP over the medium-term period (2006-2013), except in Finland, where the rate fell by 4.2 pp. in 2006-2013.

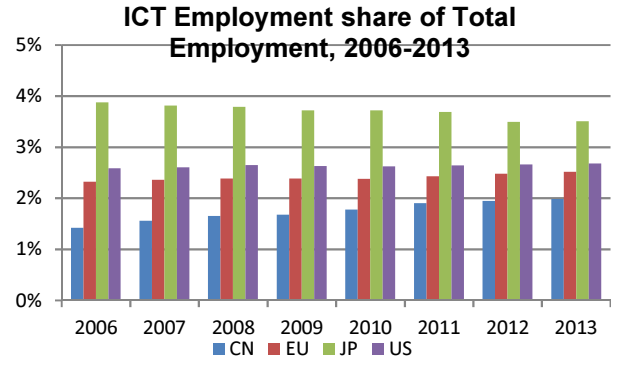
Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

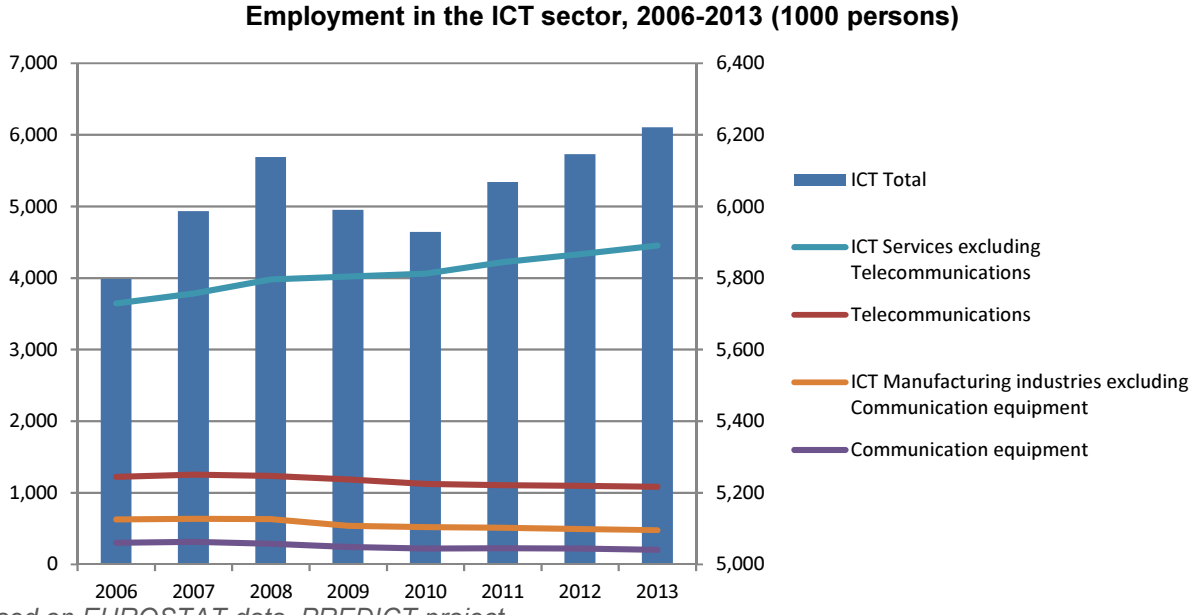
EMPLOYMENT IN THE ICT SECTOR
at EU and global level

The ICT sector **employed** a just over 6.2 m people in 2013, close to its peak of 6.2 m in 2008. The ICT services sector (excluding telecommunications) employed 4.5 m people and accounted for 70 % of total ICT employment in 2013. It is the only sector that recorded a structural increase over the medium-term period (2006-2013). The telecommunications sector employed over 1 m people in 2013, a number which fell over the medium-term period. The ICT manufacturing industries sector (excluding communications equipment) employed 478 000 people in 2013 and this number was falling. The communication equipment sector recorded the sharpest structural decline in 2013, falling to 204 000 people.

Employment in the ICT sector (comprehensive definition*) represented 2.8 % of EU total employment in 2013, remaining stable over the medium-term period. In comparison with the US (2.7 %), the EU (2.5 %) fared better than China (2.0 %), but all three lagged markedly behind Japan (3.5 %) in 2013 (comparable operational definition*)

** See methodological note*

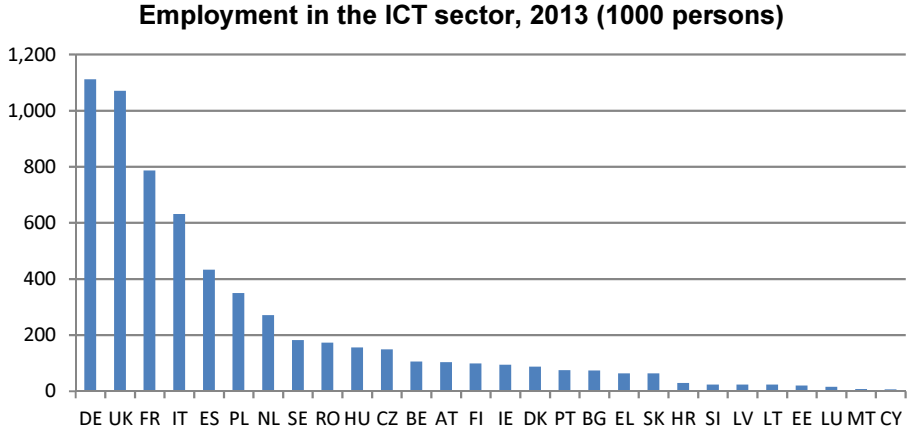


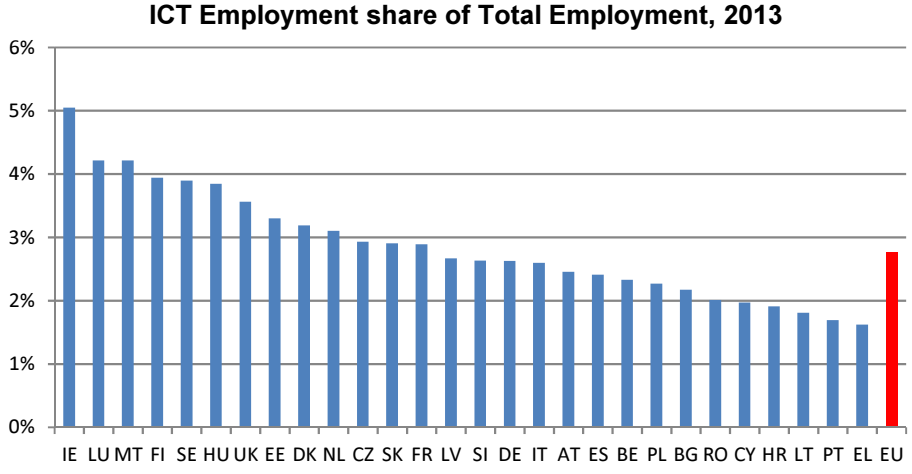


Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

EMPLOYMENT IN THE ICT SECTOR
by Member State

As in the case of value added, the five largest economies were also the **five largest employers** in the ICT sector in 2013: Germany (1.1 m people or 18 %), the United Kingdom (1.1 m people or 17 %), France (0.78 m or 13 %), Italy (0.63 m or 10 %) and Spain (0.43 m or 7 %). Together, the five largest employers represented 65 % of total ICT employment in 2013.





Ireland was in pole position with 5.1 % ICT employment as a share of total employment in 2013, and Greece had the lowest rate of only 1.6 %. Other countries that were performing well include Luxembourg and Malta (4.2 % in 2013). Finland, Sweden and Hungary followed closely behind with rates of between 3.8 % and 3.9 %. Over the medium-term period (2006-2013), the share of ICT employment as a proportion of total employment remained stable in most countries.

Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

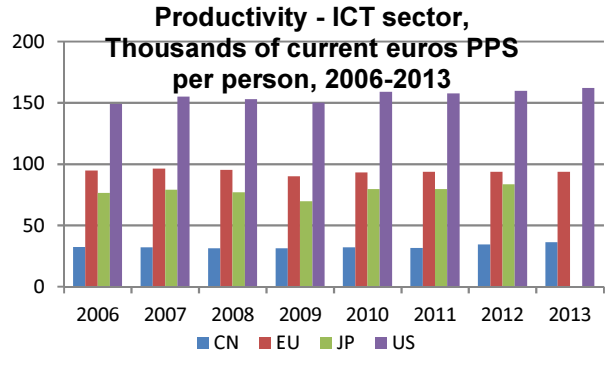
PRODUCTIVITY IN THE ICT SECTOR
at EU and global level

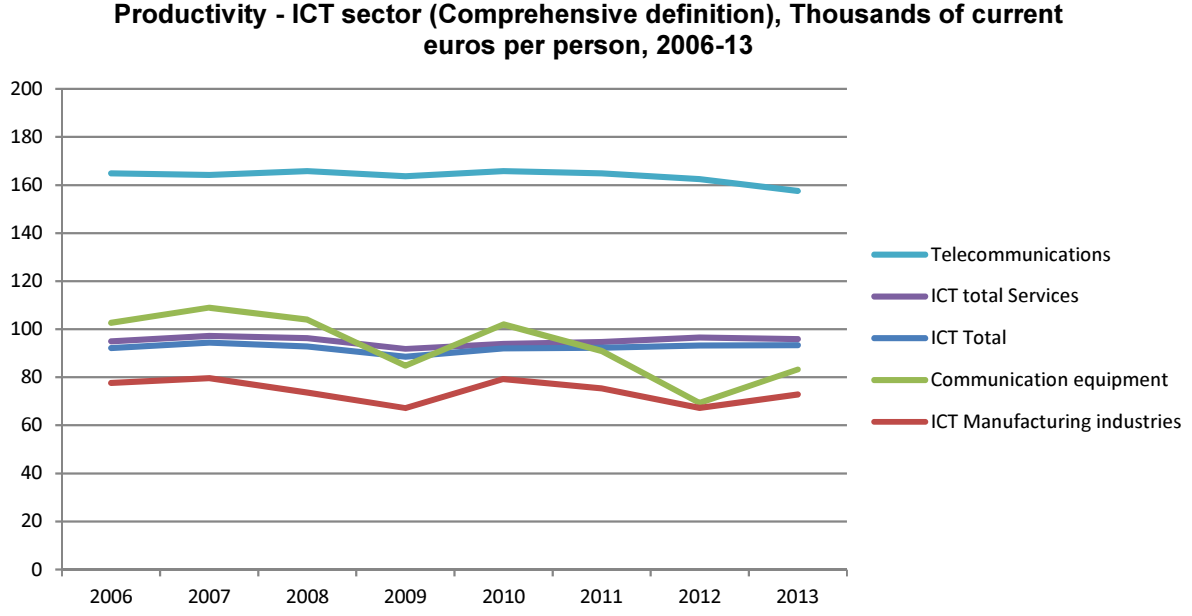
Productivity in the ICT sector (comprehensive definition*) amounted to €93 000 per person in 2013, remaining broadly stable over the medium-term period. In the ICT manufacturing sector, productivity was below average (€73 000 per person in 2013); moreover, it is volatile and pro-cyclical in relation to the business cycle. The communications equipment sector is even more sensitive to the business cycle. Unlike the manufacturing sector, productivity in the ICT services sector as a whole (i.e. services and trade), which stood at €96 000 per person in 2013, is not sensitive to business cycles. Although productivity in the telecommunications sector is very high (at €158 000 per person in 2013), wholesale trade productivity is average (at €92 000 per person in 2013).

** See methodological note.*

Regarding the **productivity** of the ICT sector (operational definition*), the EU is somewhat behind the US (€162 000 per person), but far higher than China (€36 000 per person), which in this respect still an emerging country (no data are available for Japan in 2013, but Japan and the EU had similar ICT productivity levels in 2012).

** See methodological note.*

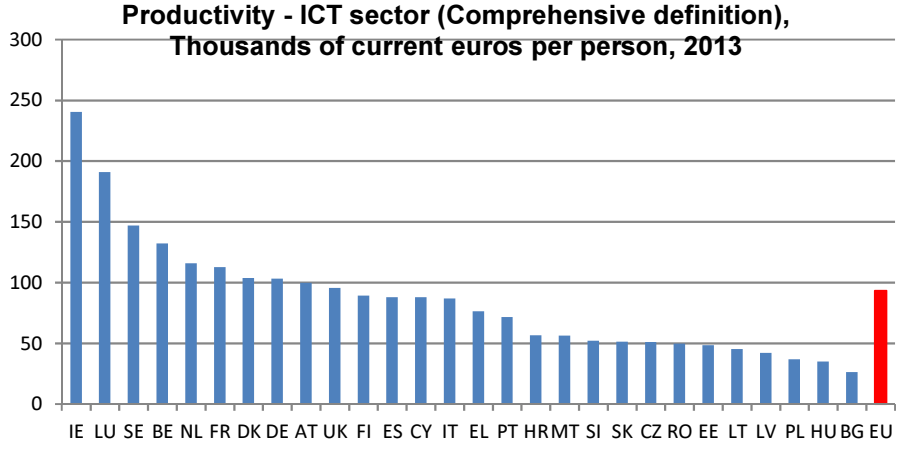


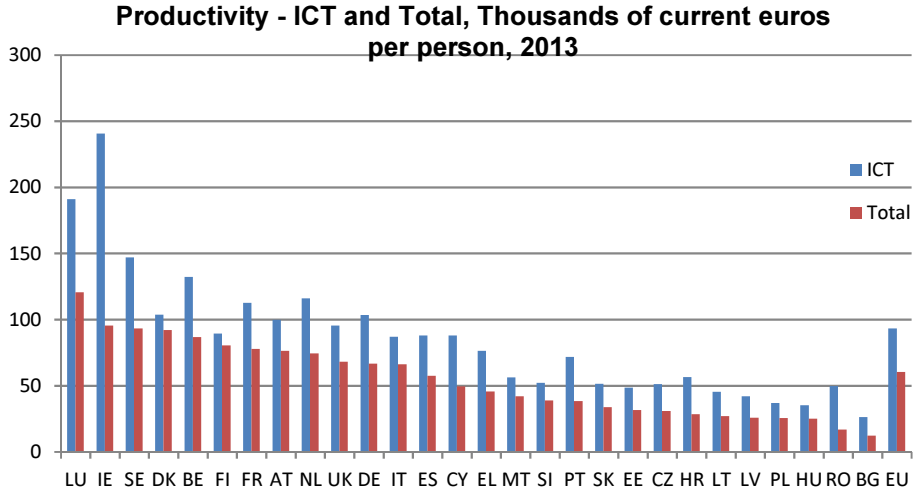


Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

PRODUCTIVITY IN THE ICT SECTOR
by Member State

In terms of **labour productivity** in the ICT sector, Ireland (€240 000 per person), Luxembourg (€191 000 per person) and Sweden (€147 000 per person) led the way in 2013. At the opposite end of the scale were Poland (€37 000 per person), Hungary (€35 000 per person) and Bulgaria (€26 000 per person).





The picture for **labour productivity** in the economy as a whole was broadly similar. Luxembourg (€121 000 per person), Ireland (€95 000 per person) and Sweden (€93 000 per person) were still the best-performing countries, while Hungary (€25 000 per person), Romania (€17 000 per person) and Bulgaria (€12 000 per person) were at the bottom of the table.

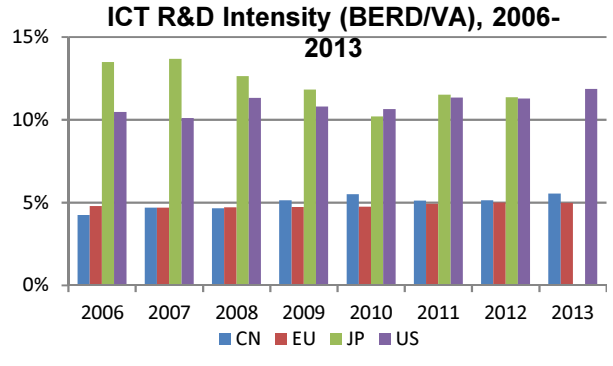
Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

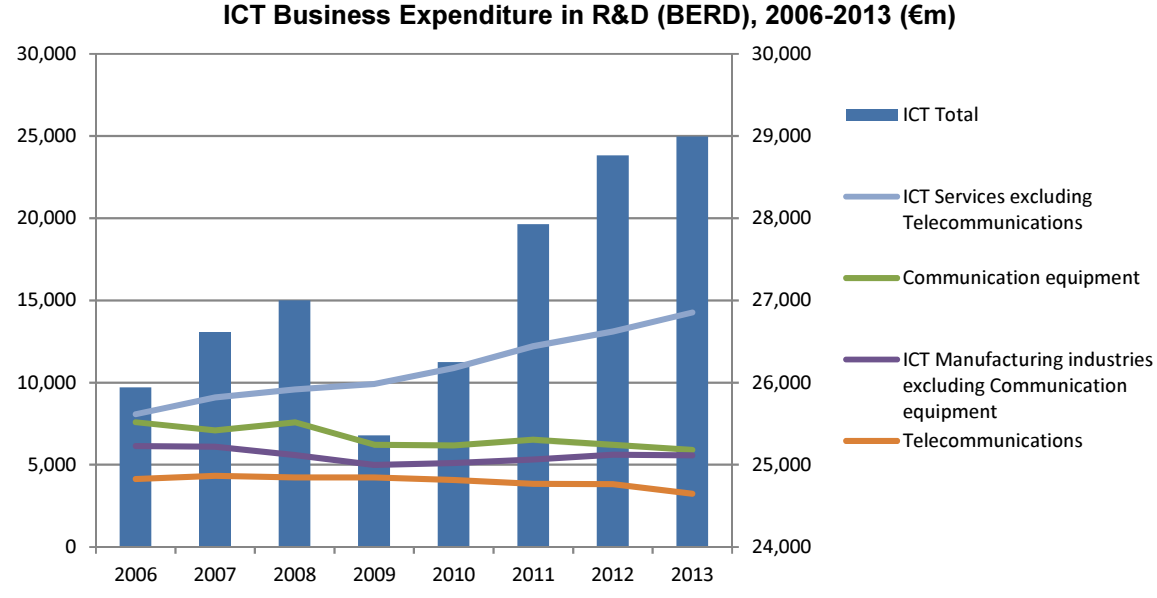
BUSINESS ENTERPRISE R&D (BERD) EXPENDITURE IN THE ICT SECTOR at EU and global level

Business enterprise R&D (BERD) expenditure in the ICT sector amounted to €29 bn in 2013, its highest point over the medium-term period (2006-2013), an improvement on its lowest point of €25 bn reached in 2009. A breakdown by sub-sector reveals a more balanced situation for BERD than for value added – despite accounting for only 9 % of ICT value added, the ICT manufacturing sector was responsible for 40 % of total ICT BERD spending (€11 bn) while the ICT services sector was responsible for 60 % (€18 bn) of ICT BERD spending in 2013. Over the medium-term period (2006-2013), the situation was quite different. The ICT manufacturing sector saw a structural decline (falling by 16 % from 2006 to 2013), whereas the ICT services sector saw a structural increase (rising by 43 % over 2006-2013), particularly in the ICT services sector (excluding telecommunications), which saw an increase of 77 % from 2006 to 2013.

R&D intensity in the ICT sector (comprehensive definition*) amounted to 5.0 % in 2013. Although the EU compares therefore favourably to China (5.5 %), both the EU and China lagged behind the US (11.8 %) in 2013 (comparable operational definition*, no rate available for Japan in 2013, but Japan and the US were at a comparable level in 2012).

** See methodological note.*

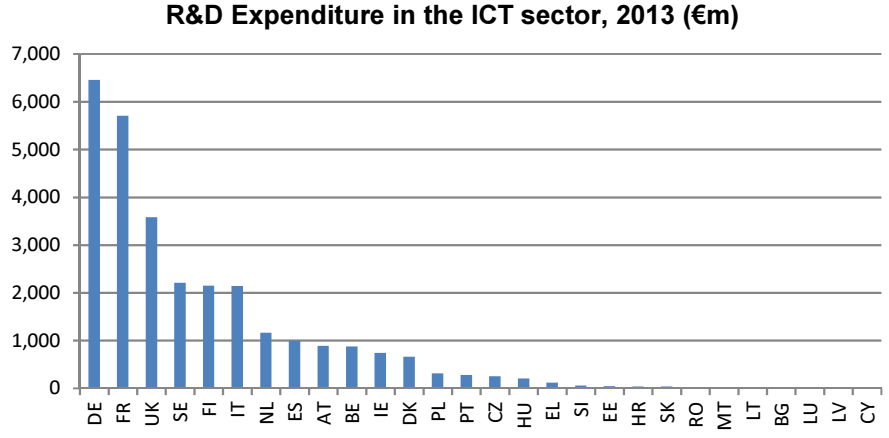


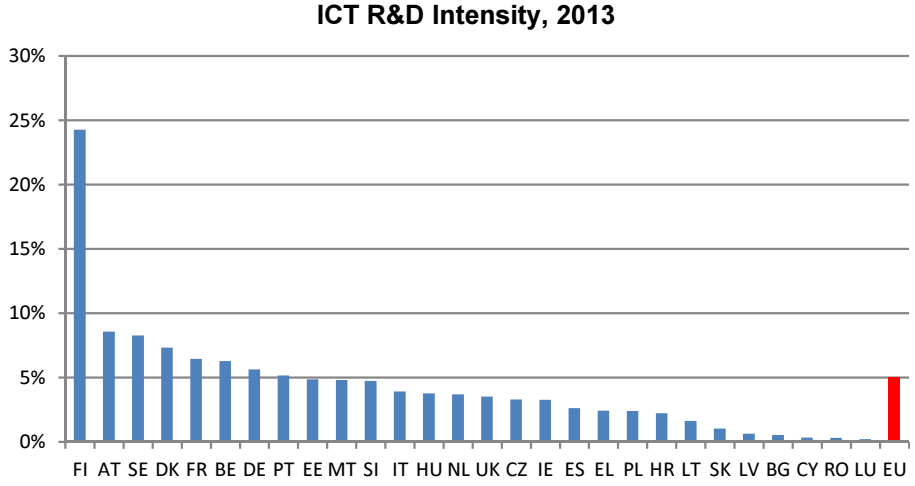


Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

R&D EXPENDITURE IN THE ICT SECTOR by Member State

The **six main contributors** in terms of R&D expenditure in the ICT sector in 2013 were the four largest economies in the EU – Germany (€6.5 bn or 22 %), France (€5.7 bn or 20 %), the United Kingdom (€3.6 bn or 12 %) and Italy (€2.1 bn or 7.4 %), together with two Nordic countries – Sweden (€2.2 bn or 7.6 %) and Finland (€2.1 bn or 7.4 %), confirming the importance of Nordic countries for ICT R&D. Together, the six largest contributors represented 77 % of total ICT R&D expenditure in 2013.





Finland was leading the way in the EU with a 24 % ICT R&D intensity rate in 2013. Luxembourg was the poorest performer with a rate of 0.2 %. Of the Nordic countries, Sweden had a rate of 8.3 % and Denmark had a rate of 7.3 %. Other strong performers include Austria (8.6 %), France (6.4 %), Belgium (6.3 %) and Germany (5.6 %). Over the medium-term period (2006-2013), ICT R&D intensity remained broadly stable with the notable exception of Finland which saw an increase of about 8.2 pp. (from 2013-2016) owing to a sharp decline in its value added (denominator of the rate).

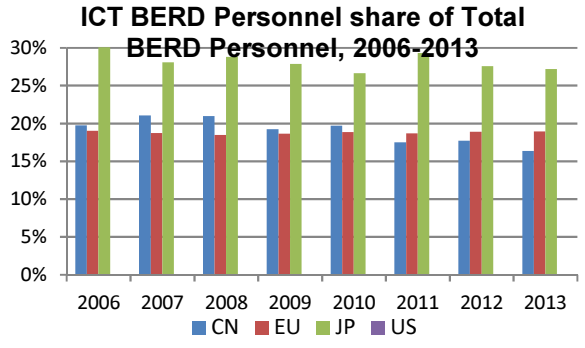
Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

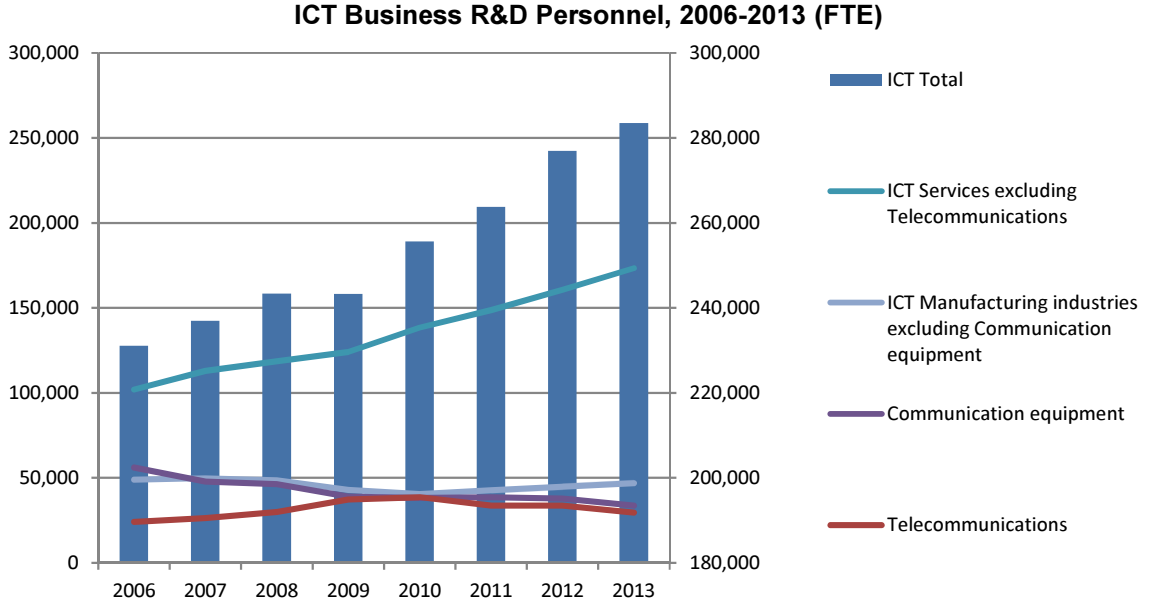
R&D PERSONNEL IN THE ICT SECTOR at EU and global level

R&D personnel in the ICT sector included 284 000 full-time equivalents (FTEs) in 2013, a figure which rose over the medium-term period (2006-2013), recovering after 2009. The ICT services sector (excluding telecommunications) employed 173 000 FTEs in 2013 (61 % 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 47 000 FTEs in 2013, representing a fall over the medium-term (2006-2013) with signs of recovery after 2010. The communication equipment sector was in constant decline. The telecommunications sector employed 29 000 FTEs in 2013 (10 % of R&D personnel in the ICT sector), and was on a downward trend (falling 24 % from its peak of 39 000 FTEs in 2010).

R&D personnel in the ICT sector (comprehensive definition*) made up 19 % of total R&D personnel in 2013, a figure which remained stable over the medium-term period. However, the EU (19 %) and China (16 %) were behind Japan (28 %) in 2013 (comparable operational definition*, no data available for the US but the ICT/total rate for R&D researchers stood at nearly 40 %, compared with 30 % for Japan and 21 % for the EU) and over the medium-term period.

** See methodological note.*

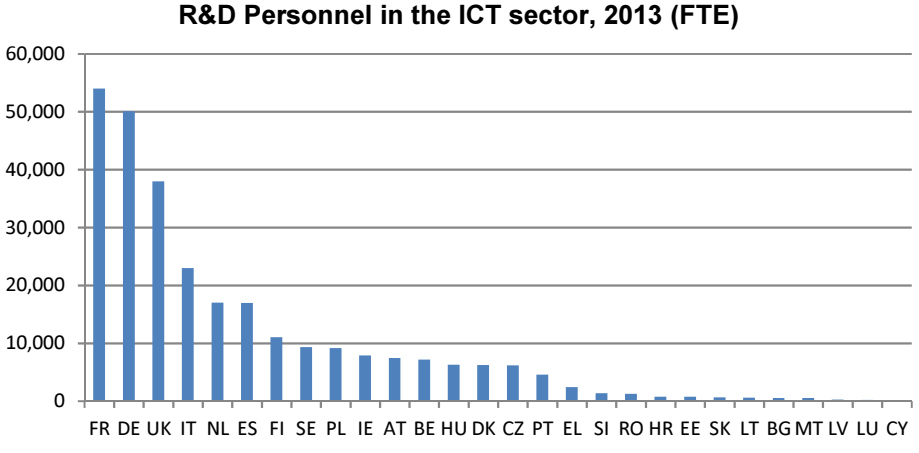


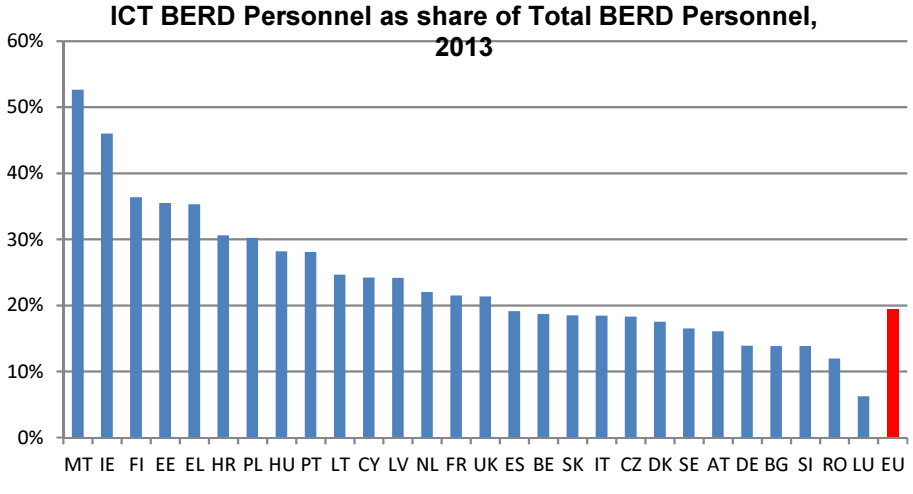


Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

R&D PERSONNEL IN THE ICT SECTOR by Member State

The four largest economies were also the **four biggest employers** of R&D personnel in the ICT sector in 2013 – France (54 000 or 19 %), Germany (50 000 or 18 %), the United Kingdom (38 000 or 13 %) and Italy (23 000 or 8 %). Together, the four biggest employers represented 58 % of total R&D personnel in the ICT sector in 2013.





Malta (53 %) and Ireland (46 %) were the two countries with the highest concentration of R&D personnel in the ICT sector in 2013. Luxembourg had the lowest concentration (less than 10 %).

Other strong performers (with between 35 % and 40 % of R&D personnel in the ICT sector in 2013) were Finland (36 %), Estonia (36 %) and Greece (35 %).

Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

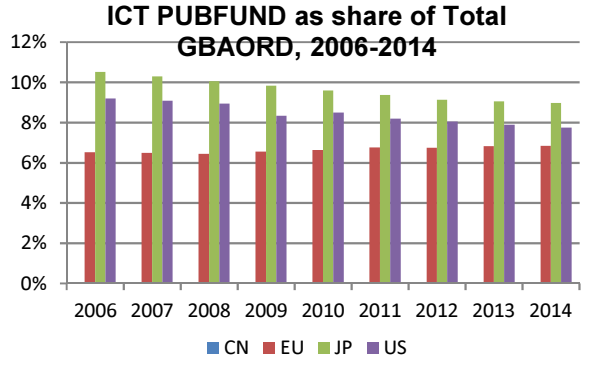
PUBLIC FUNDING ICT R&D EXPENDITURE at EU and global level

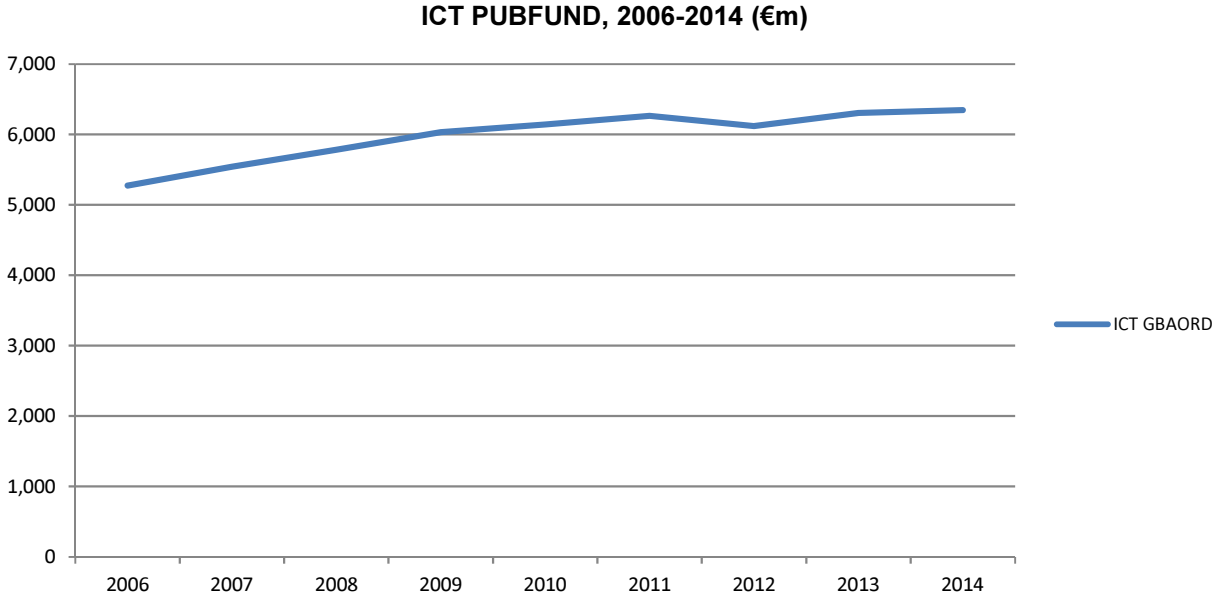
After rising for several years, the estimated level of publicly funded expenditure on ICT R&D in the EU fell in 2012, but recovered in 2013, and by 2014 had exceeded its historical peak of €6.2 bn in 2011, reaching €6.3 bn.

The Digital Agenda target of doubling publicly funded R&D in ICT between 2007 and 2020 requires an annual growth rate of 5.5 % (assuming constant annual growth rate). Estimated public ICT R&D was below the necessary trend line in 2014, with a gap of about 20 %.

In 2014*, ICT **public funding** represented 6.8 % of EU total 'government budget appropriation or outlays for R&D' (GBAORD), a figure which remained broadly stable over the medium-term period.

The EU was lagging behind the US (7.7 %) and Japan (9.0 %), even though both those countries saw some decline in their rates (no data available for China).





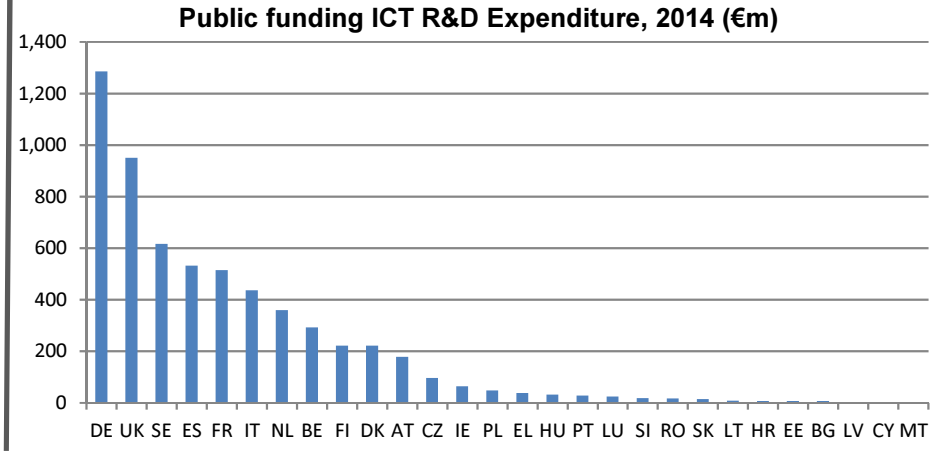
* *Official statistics on public expenditure are available one year before business statistics.*

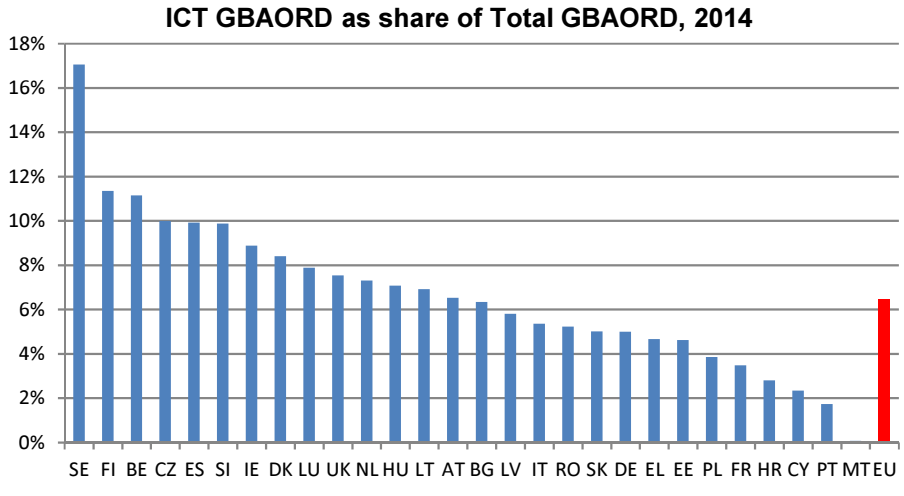
Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

PUBLIC FUNDING ICT R&D EXPENDITURE by Member State

The **five biggest public funders** of R&D in ICT in 2014 were Germany (€1.3 bn or 21 %), followed by the United Kingdom (€0.95 bn or 16 %), Sweden (€0.62 bn or 10 %), Spain (€0.53 bn or 8.8 %) and France (€0.52 bn or 8.5 %).

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





The ranking of ICT GBAORD as a proportion of total GBAORD in 2014 again reveals a strong performance by Nordic countries with Sweden in first place at 17 % and Finland in second place with 11 %.

However, other countries also attribute special importance to ICT in their R&D public spending, such as Belgium (ranked third with 11 %), the Czech Republic (fourth with 10 %) and Slovenia and Spain (in joint fifth position with 9.9 %).

Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

ICT INNOVATION OUTPUT INDICATOR
Methodology

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

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

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

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

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

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

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

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

GOOD: The contribution of the trade balance of high-tech and medium-tech products to the total trade balance.

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

- DYN_{ICT}: employment in fast-growing firms of innovative sectors.

DYN is a measure of fast-growing firms based on the growth in the number of employees (all employees, with no distinction according to education)

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

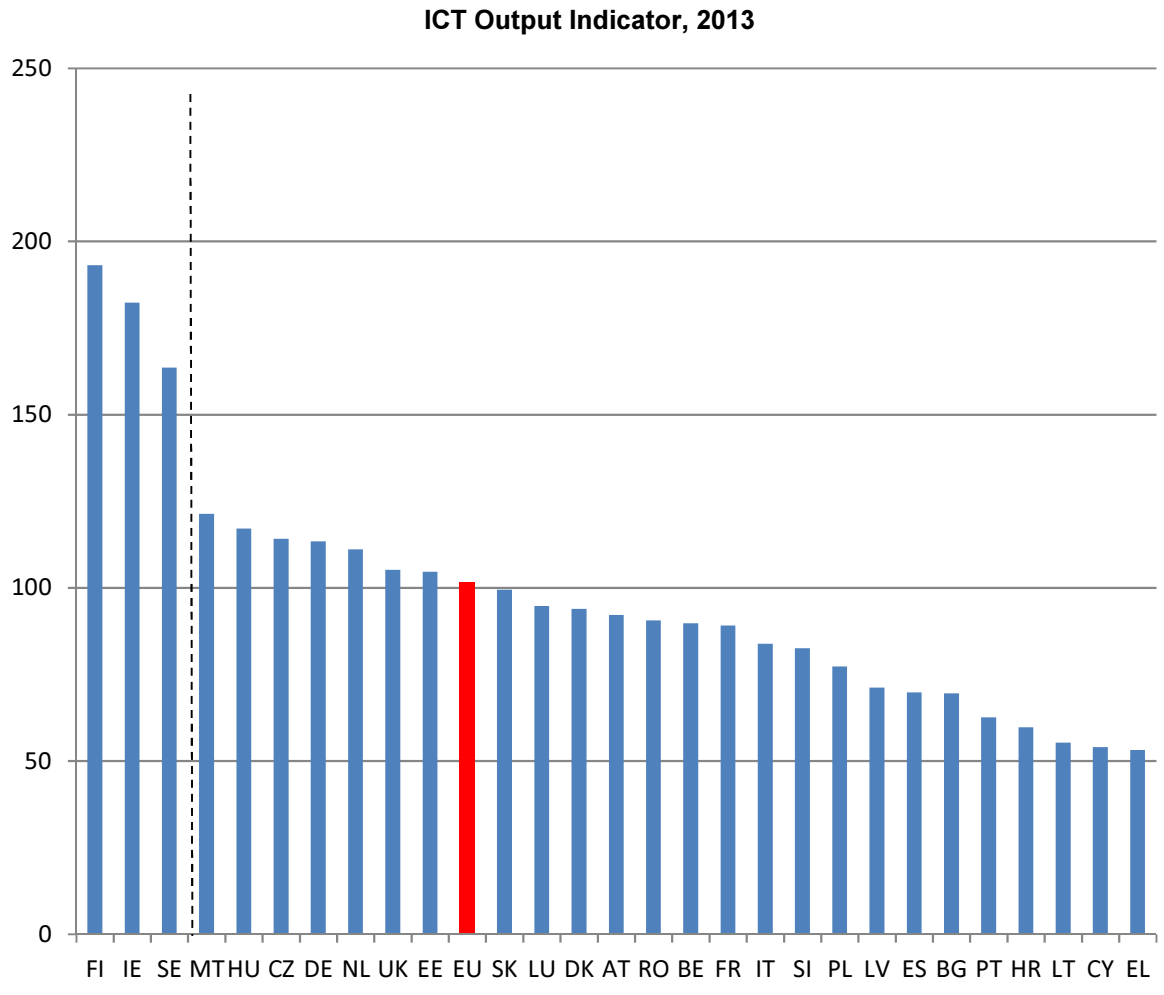
'Developing an indicator of innovation output', Commission Staff Working Document – SWD (2013) 325 final.

ICT INNOVATION OUTPUT INDICATOR
by Member State

A group of three countries takes a significant lead with scores above 150 (the benchmark was been set to equal 100 for Europe in 2011): Finland (193), Ireland (182) and Sweden (164).

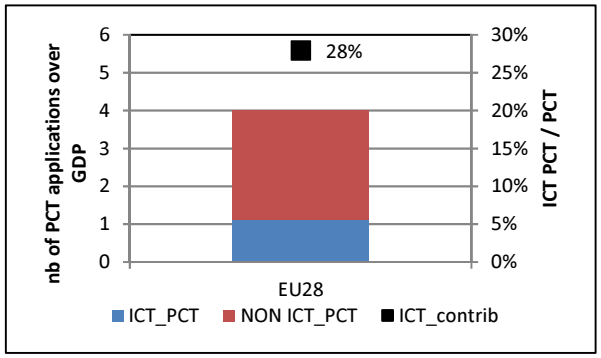
The three top scores in ICT innovation output result from very high ICT contributions in the trade of knowledge-intensive services, above average levels of fast-growing innovative ICT employment for Ireland and remarkable results for ICT patenting in Finland and Sweden.

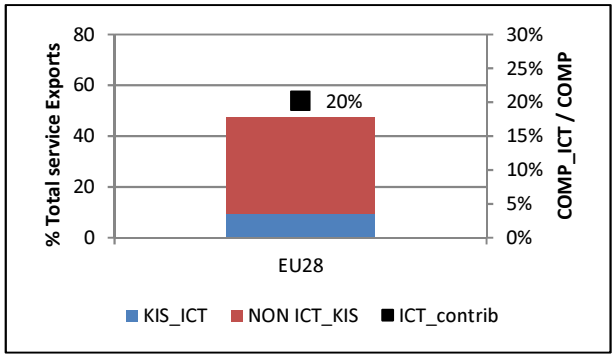
At the lowest end of the scale are Lithuania (with a score of 55), Cyprus (54) and Greece (53).

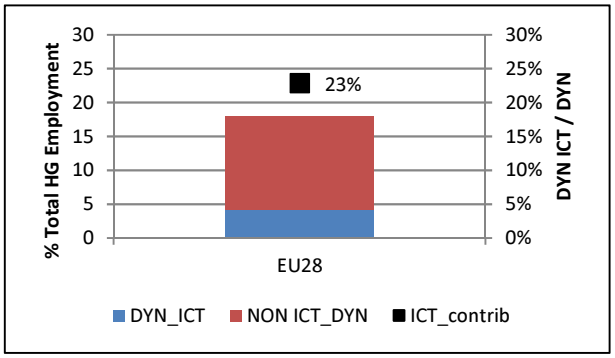


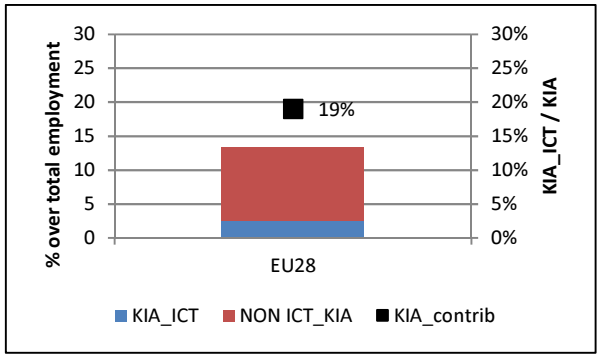
Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

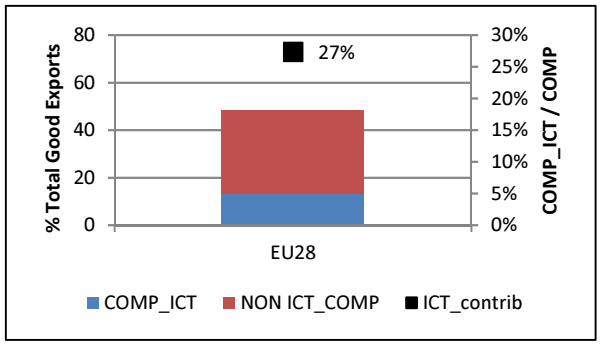
ICT INNOVATION OUTPUT INDICATOR
by Component











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

1. 28 % in technological innovation as measured by patents (PCT_ICT).
2. 19 % in absorption of skills as measured by employment in knowledge-intensive activities (KIA_ICT).
3. 27 % in competitiveness of knowledge goods as measured by exports of medium-high-tech goods (COMP_GOOD_ICT).
4. 20 % in competitiveness of knowledge services as measured by exports of knowledge-intensive services (KIS_ICT).
5. 23 % in innovative firms' dynamics as measured by employment of innovative fast-growing firms (DYN_ICT)