



The EU ICT Sector and its R&D Performance

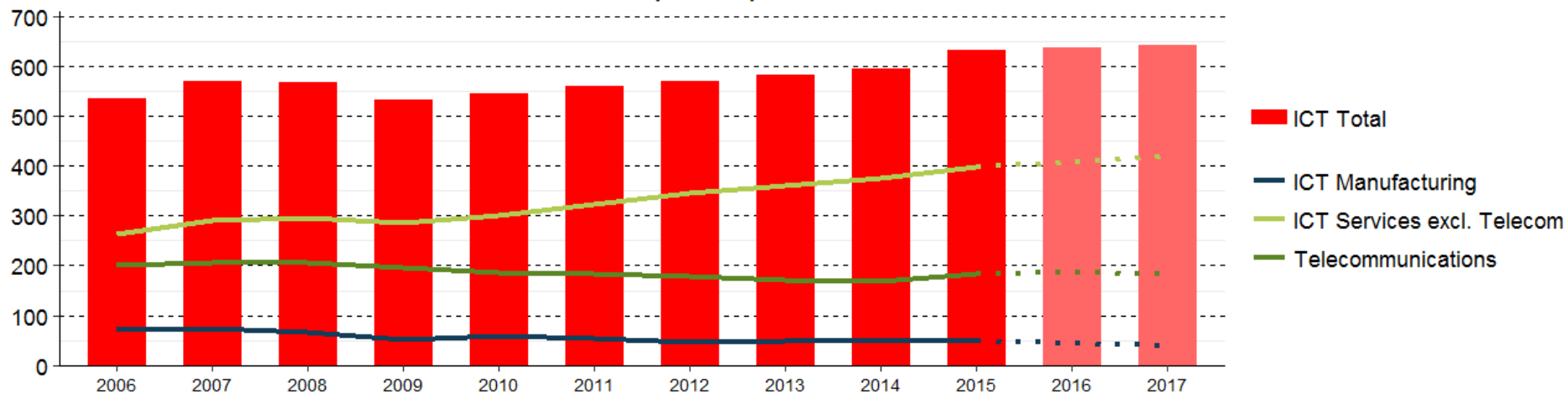
Digital Economy and Society Index Report 2018
The EU ICT sector and its R&D performance

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

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

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

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



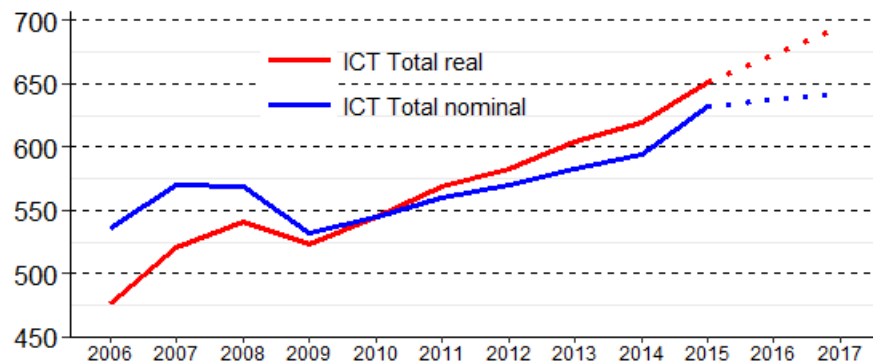
Note: Values for the years 2016 and 2017 are nowcasted data.

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

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

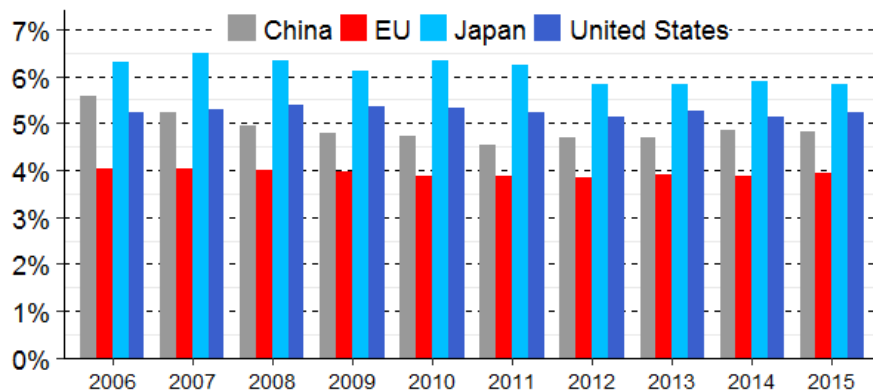
Although the value added of the ICT sector increased by 18 % in nominal terms (in line with GDP: + 21 %), it increased by 37 % in real terms over the period 2006-2015 (well above of the GDP: + 7 %).

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



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

ICT sector share of GDP Worldwide comparisons, 2006-2015



Value added in the ICT sector accounted for 4.3 % of EU GDP in 2015 (comprehensive definition). However, according to the operational definition which enables world comparisons, value added in the ICT sector in the EU (3.9 %) was behind Japan (5.8 %), the US (5.2 %), and China (4.8 %) in 2015.

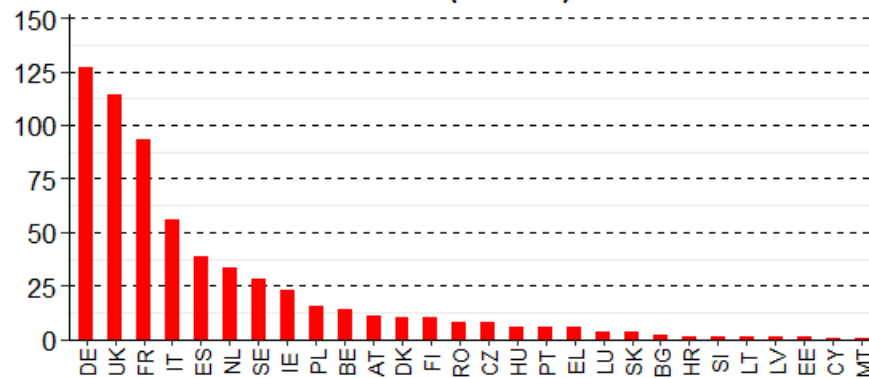
* See methodological note.

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

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

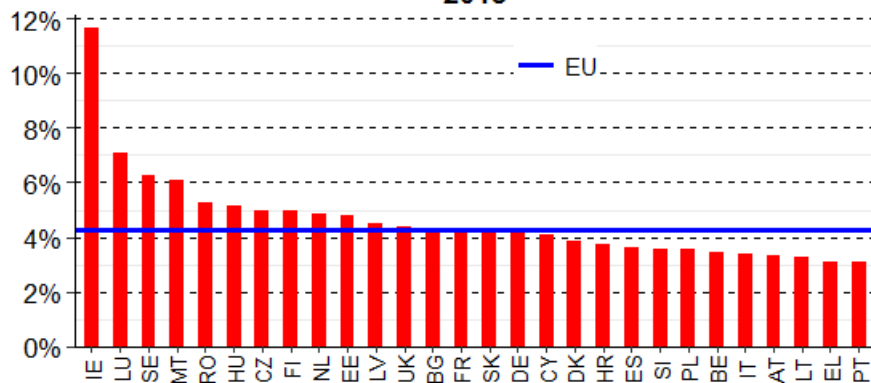
Unsurprisingly, the EU's five largest economies were also the five biggest contributors to ICT sector value added in 2015: Germany (EUR 127 billion or 20 %), the United Kingdom (EUR 115 billion or 18 %), France (EUR 94 billion or 15 %), Italy (EUR 56 billion or 9 %), and Spain (EUR 39 billion or 6 %).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

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



Note: Data for Ireland refers to 2014.

ICT sector share of GDP in the EU 2015



Note: Data for Ireland refers to 2014.

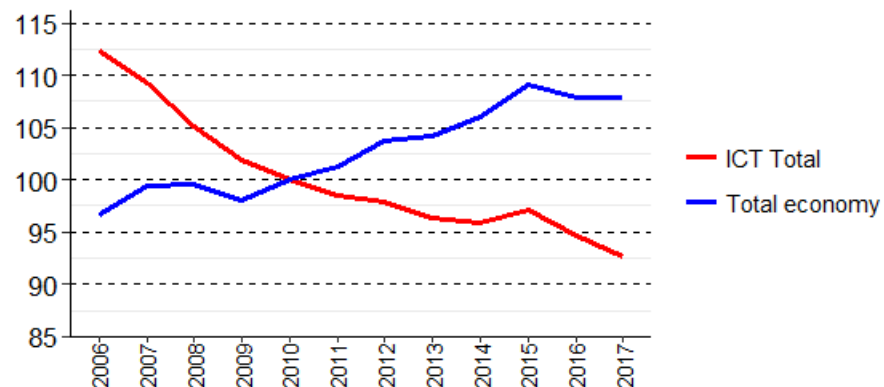
Ireland had by far the highest ICT sector share of GDP, with a rate of 11.6 % in 2014 (latest data available), while Portugal and Greece were lagging behind with a mere 3.1 %. After Ireland, countries with the highest share of ICT sector included Luxembourg (7.1 %) and Sweden (6.3 %). Some eastern Member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

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

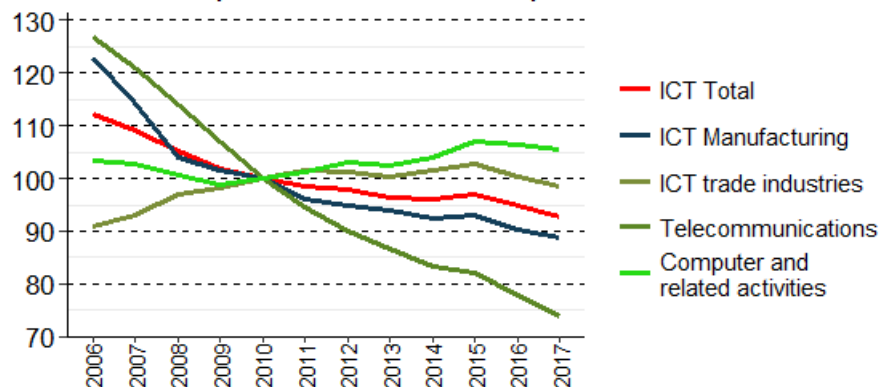
Unlike the general economy, the ICT sector saw a drop in **prices** over the medium term. The telecommunications sub-sector experienced the largest decline.

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

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



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



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

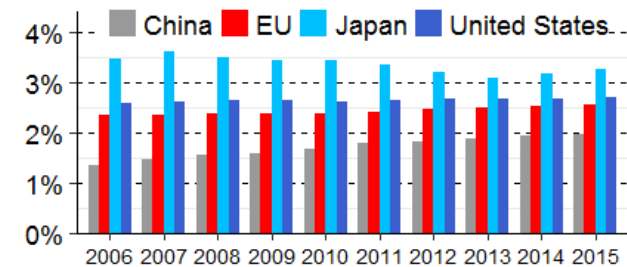
Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

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

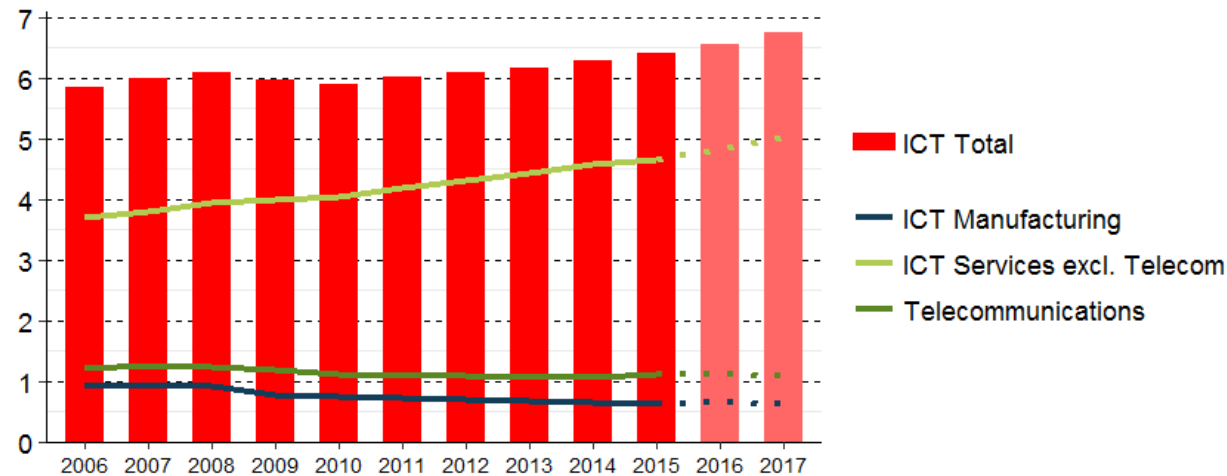
The ICT sector employed 6.4 million people in 2015, the highest in the observed period. The ICT services sector (excluding telecommunications) employed 4.7 million people and accounted for 73 % of total ICT employment in 2015. It is the only sector that recorded a structural increase (of 26 %) over the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

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

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



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



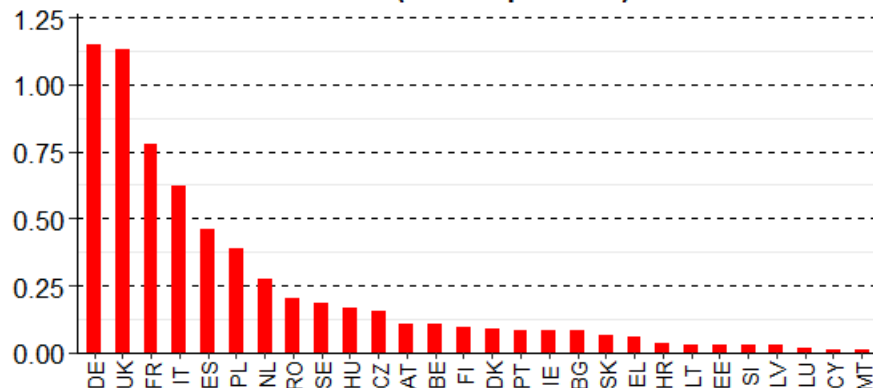
Note: Values for the years 2016 and 2017 are nowcasted data.

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

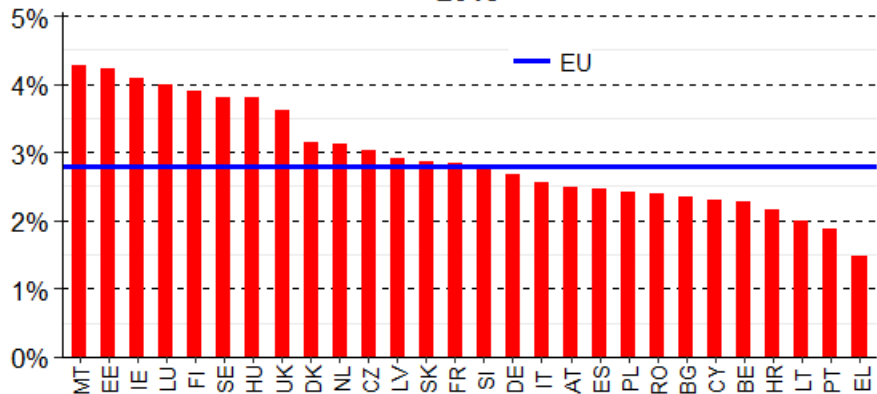
The EU's five largest economies (Germany, the United Kingdom, France, Italy, and Spain) were the five biggest **employers** in the EU's ICT sector in 2015. However, small countries like Malta and Estonia had the highest rate of ICT sector **employment** as a share of **total employment** in 2015.

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

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



ICT sector share of Total Employment in the EU
2015



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

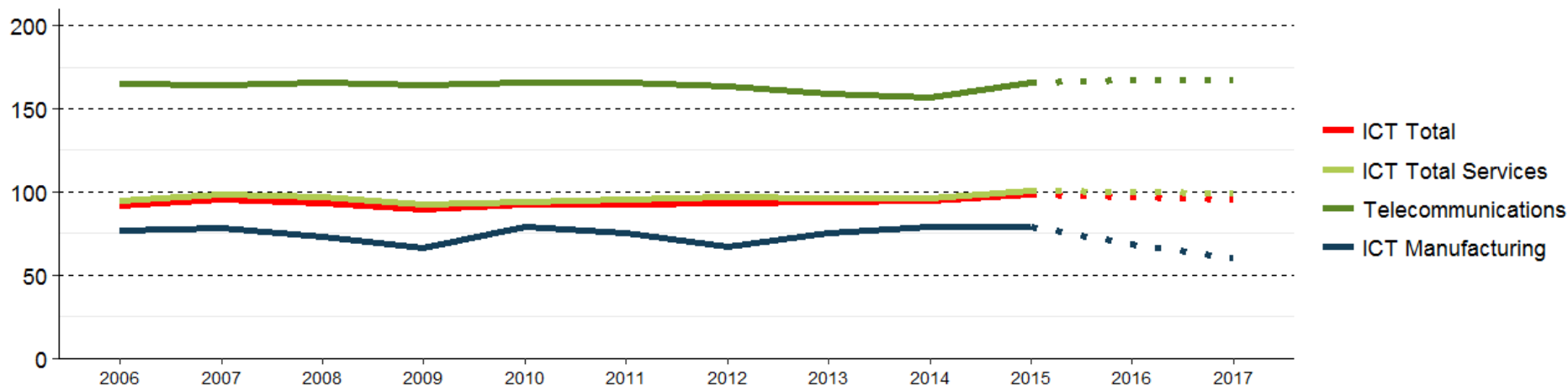
Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

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

Productivity in the ICT sector (comprehensive definition) amounted to EUR 99 000 per person in 2015, remaining broadly stable over the medium-term period (2006-2015). In the ICT manufacturing sector, productivity was below average (EUR 79 000 per person in 2015); moreover, it is volatile and pro-cyclical in relation to the business cycle. The communication equipment sector is even more sensitive to the business cycle.

Unlike the ICT manufacturing sector, productivity in the ICT services sector as a whole (i.e. services and trade), which stood at EUR 101 000 per person in 2015, is not sensitive to business cycles. Productivity in the telecommunications sector is by far the highest (at EUR 166 000 per person in 2015).

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



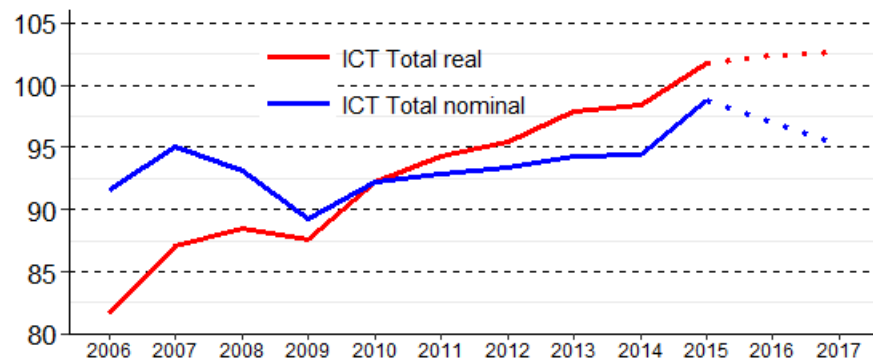
Note: Values for the years 2016 and 2017 are nowcasted data.

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

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

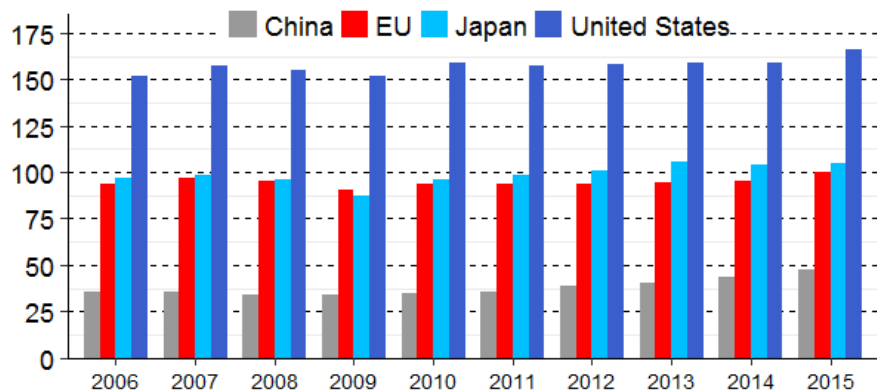
While the productivity of the ICT sector seemed to grow at a higher level than the rest of the economy (EUR 99 000 per person vs. EUR 65 000 per person in 2015) but less quickly in nominal terms (+ 8 % vs. + 18 % over the period 2006-2015), the growth was faster for the ICT sector than for the general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

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



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

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



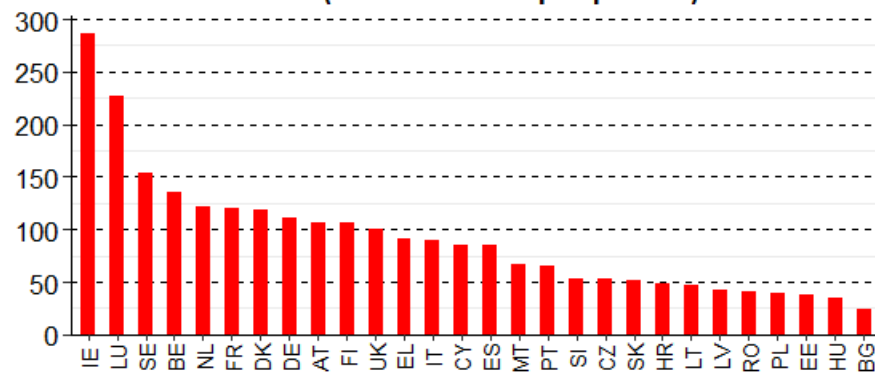
Regarding the productivity of the ICT sector (according to the operational definition which enables world comparisons), the EU (EUR purchasing power standard 100 000 per person) is markedly behind the US (EUR purchasing power standard 166 000 per person), in line with Japan (EUR purchasing power standard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

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

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

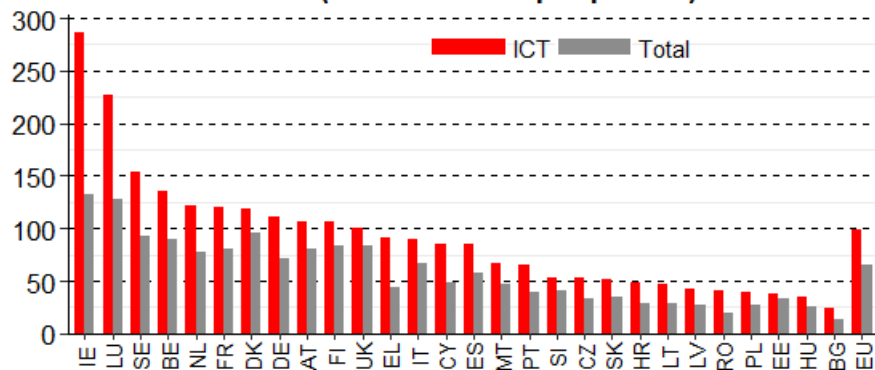
In terms of labour productivity in the ICT sector, Ireland (EUR 286 000 per person) by far led the way in 2014 (latest data available), but Luxembourg (EUR 227 000 per person) and Sweden (EUR 154 000 per person) also fared well in 2015. At the opposite end of the scale were Bulgaria (EUR 24 000 per person),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

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



Note: Data for Ireland refers to 2014.

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



Note: Data for Ireland refers to 2014.

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

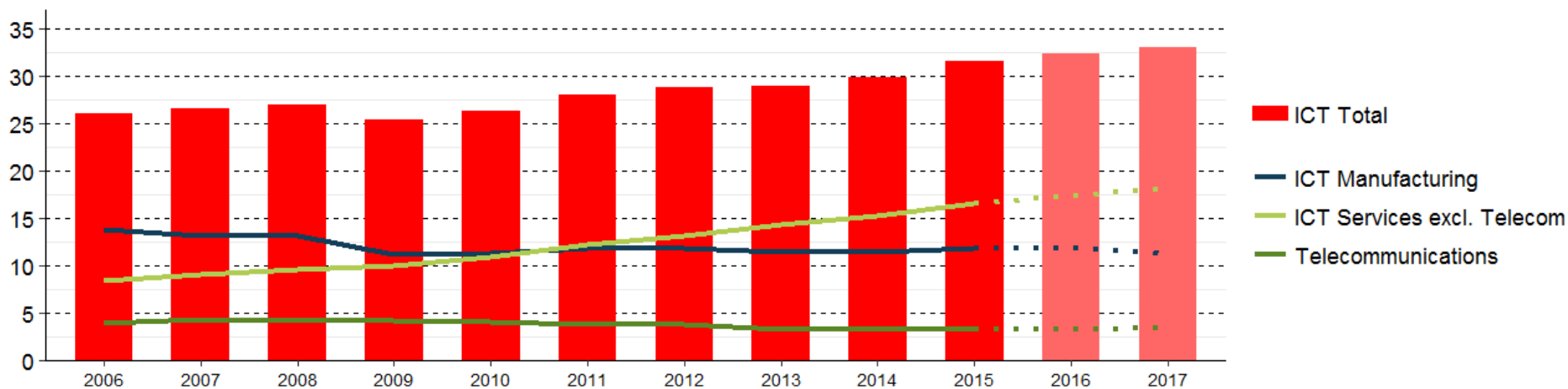
The picture for labour productivity in the economy as a whole was broadly similar. Ireland (EUR 132 000 per person) and Luxembourg (EUR 128 000 per person) were the best-performing countries, while Bulgaria (EUR 13 000 per person) and Romania (EUR 19 000 per person) were at the bottom of the table.

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

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

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

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



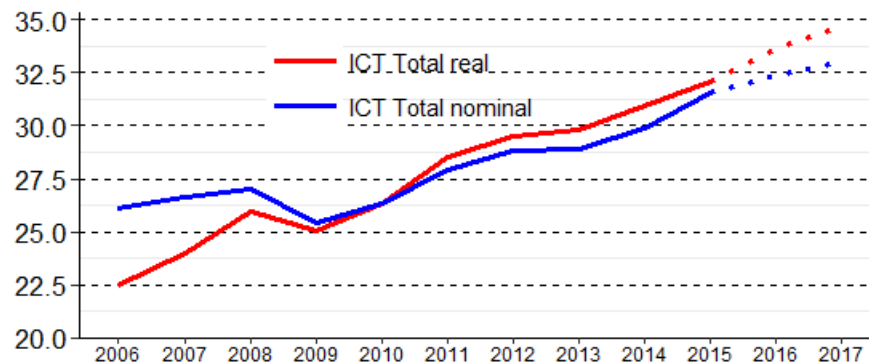
Note: Values for the years 2016 and 2017 are nowcasted data.

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

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

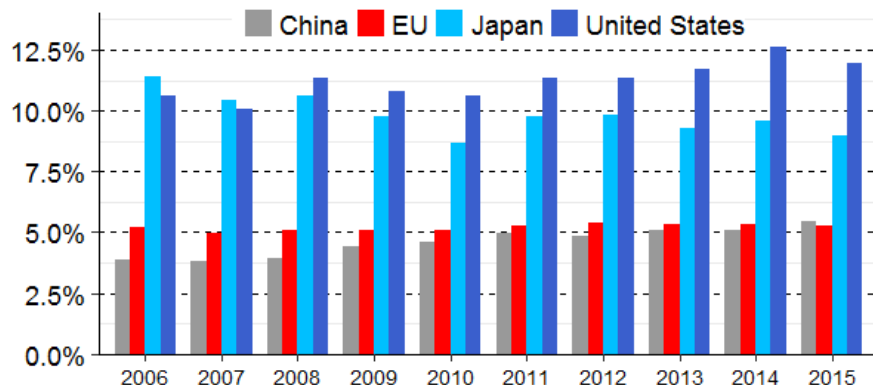
In real terms, R&D expenditure by business companies in the ICT sector grew faster than in the general economy (+ 42 % vs. + 25 % over the period 2006-2015).

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



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

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



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

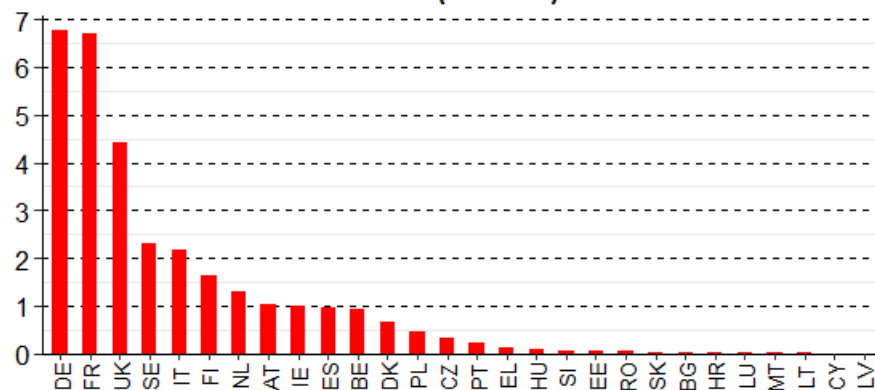
* See methodological note.

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

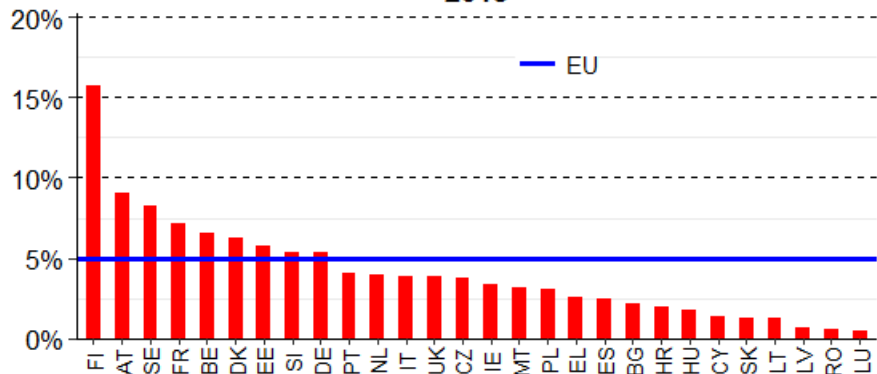
The EU's six main contributors in terms of R&D expenditure by business companies in the ICT sector in 2015 were the EU's four largest economies: Germany, France, the United Kingdom, and Italy, together with two Nordic countries: Sweden and Finland.

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

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



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



Note: Data for Ireland refers to 2014.

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

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

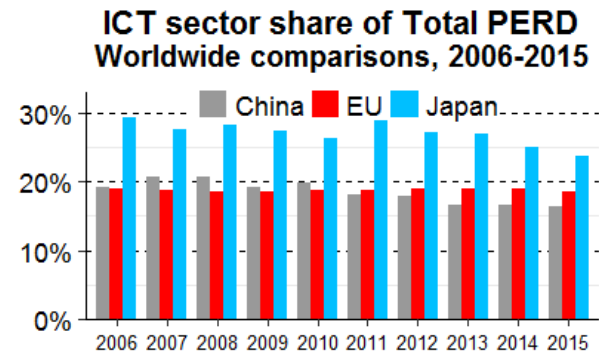
R&D personnel in the ICT sector included 303 000 full-time equivalents (FTEs) in 2015. The top employer was the ICT services sector (excluding telecoms), employing 191 000 FTEs in 2015 (63 % of ICT R&D personnel). **R&D personnel in the ICT sector** made up 19 % of total R&D personnel in 2015.

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

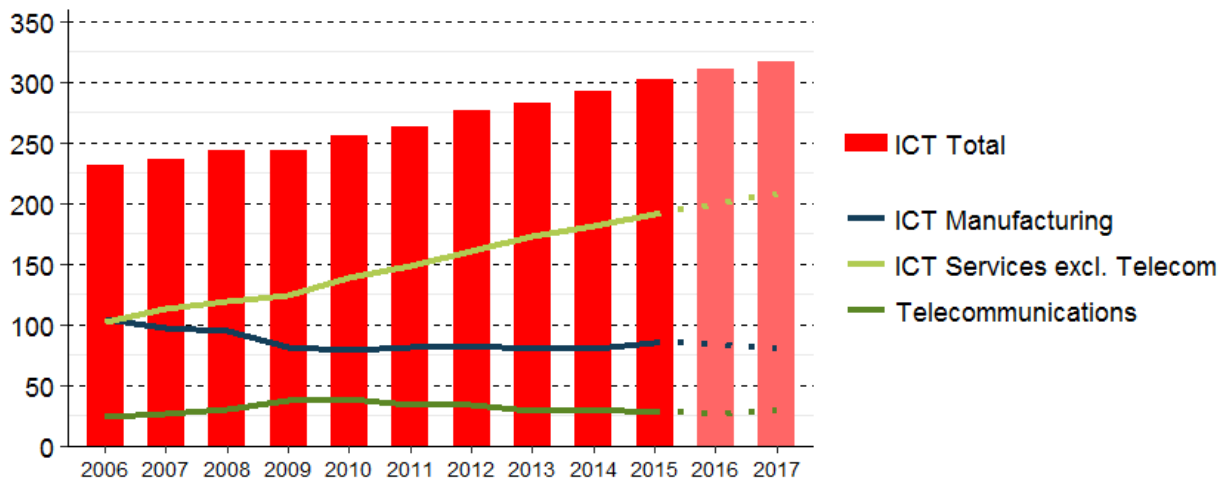
* See methodological note

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

R&D personnel in the ICT sector (comprehensive definition*) made up 19 % of total R&D personnel in 2015, a figure which remained stable over the medium-term period. However, according to the operational definition which enables world comparisons, the EU (19 %) and China (16 %) were behind Japan (24 %) in 2015 and over the medium-term period (no data available for the US).



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

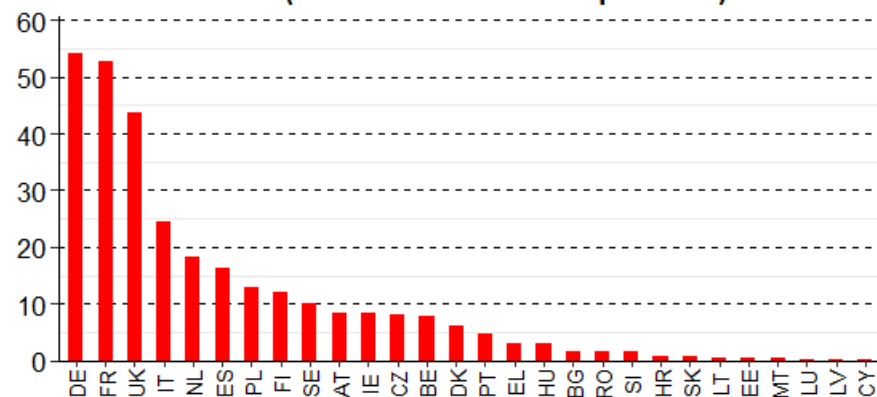


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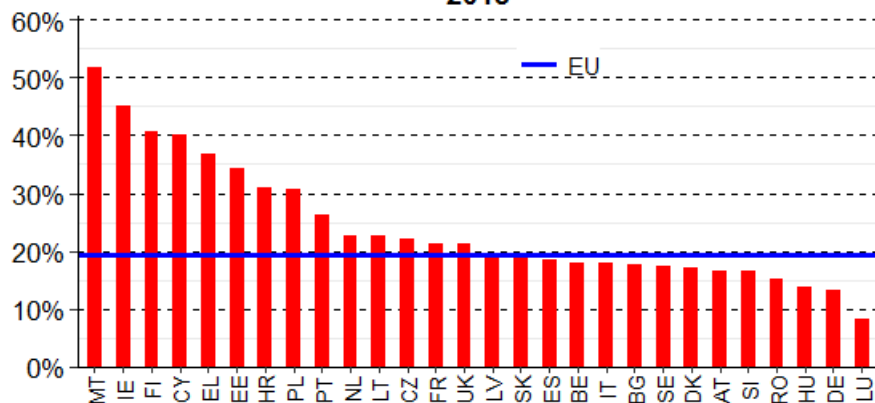
The EU's four largest economies were also the four biggest **employers of R&D personnel** in the ICT sector in 2015: France, Germany, the United Kingdom, and Italy. Malta and Ireland were the two countries with the highest concentration of **R&D personnel in the ICT sector** in 2015.

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

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



ICT sector share of Total PERD in the EU 2015



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

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

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

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

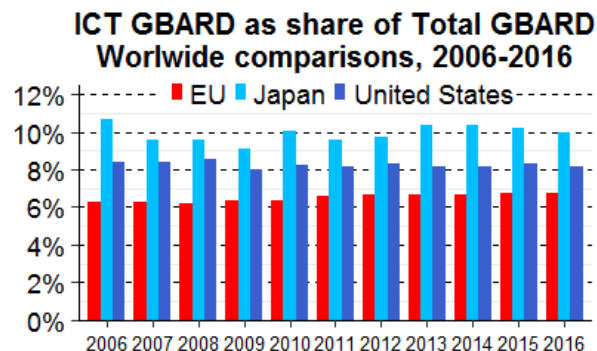
After rising for several years, the estimated level of publicly funded expenditure on R&D in the ICT sector in the EU fell in 2012, but recovered in 2013, and has stabilized since 2015 at its historical peak, reaching EUR 6.4 billion in 2015 and 2016.

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

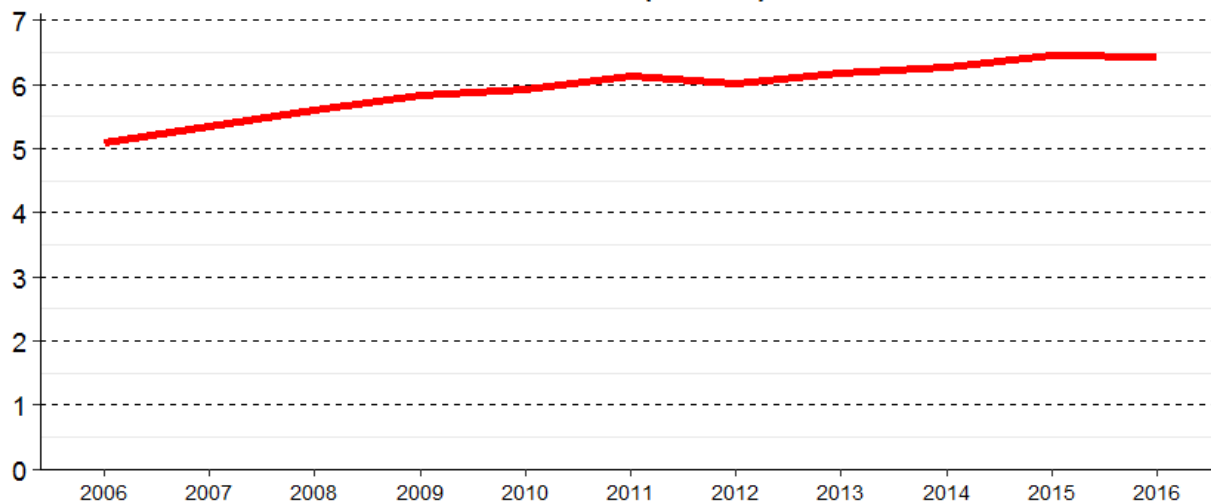
In 2016*, public funding of R&D in the ICT sector represented 6.8 % of EU total 'government budget allocations for R&D' (GBARD), a figure which remained broadly stable over the medium-term period.

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

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



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



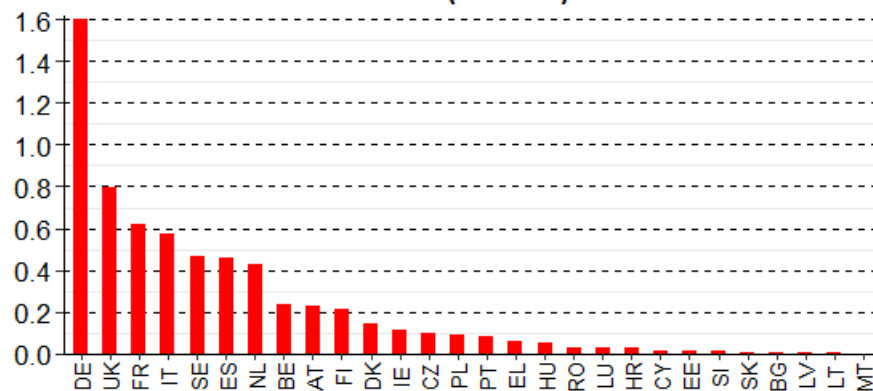
Source: JRC – Dir. B calculations and estimates, based on available EUROSTAT data and other sources, PREDICT project

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

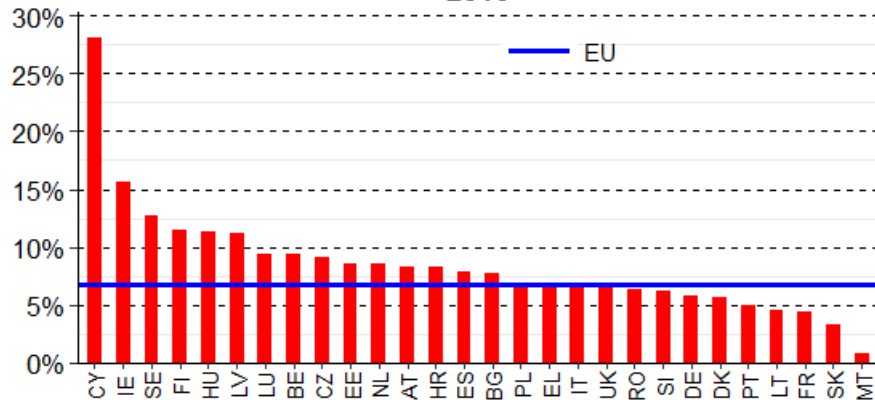
The EU's five biggest public funders of R&D in the ICT sector in 2016 were Germany (EUR 1.6 billion or 25 %), followed by the United Kingdom (EUR 799 million or 12 %), France (EUR 620 million or 10 %), Italy (EUR 577 million or 9 %), and Sweden (EUR 462 million or 7 %).

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

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



ICT GBARD share of Total GBARD in the EU 2016



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

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

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

METHODOLOGICAL NOTE

Definition of the ICT sector

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

ICT manufacturing

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

ICT services

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

METHODOLOGICAL NOTE

Comprehensive vs operational definition

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

The operational definition of the ICT sector enables the EU to be compared with non-EU countries over a longer period (2006-2015), as some of these countries do not have the necessary disaggregated information to estimate all the ICT sub-sectors included in the comprehensive definition. The operational definition does not include the following sectors: manufacture of magnetic and optical media (268) and ICT trade industries (465).

Sector analysis

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

Source

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

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