

THE EU ICT SECTOR AND ITS R&D PERFORMANCE

METHODOLOGICAL NOTE

Definition of the ICT sector

In the following 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 consists of 12 subsectors:

- **ICT Manufacturing**

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

- **ICT Services**

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

Comprehensive vs. Operational definition

The “comprehensive” definition of the ICT sector corresponds to the 2007 OECD definition

The “operational” definition of the ICT sector allows international comparisons but does not include the following sectors: Manufacture of magnetic and optical media (268) and ICT trade industries (465).

Segment analysis

In the following section, a segment analysis is made for each indicator. The 12 subsectors are aggregated into 4 segments: ICT Manufacturing (excluding Communication equipment), Communication equipment, ICT Services (excluding Telecommunications) and Telecommunications

Source

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

VALUE ADDED IN THE ICT SECTOR At EU and World level

The ICT sector Value Added (VA) amounts to €516bn in 2012. After a slowdown in 2009, the ICT sector has experienced a recovery,

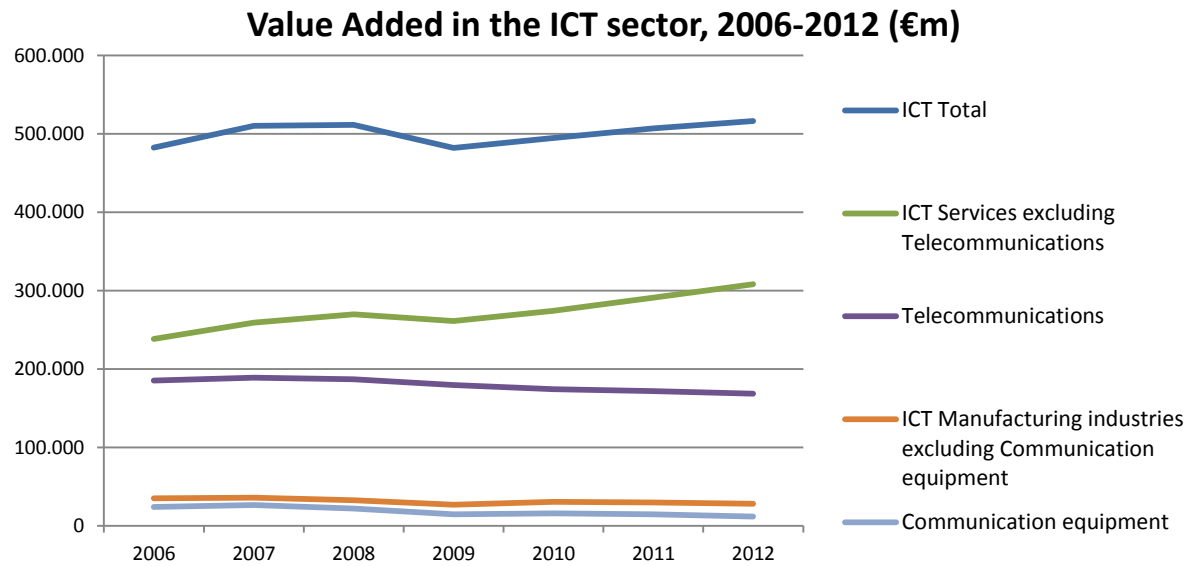
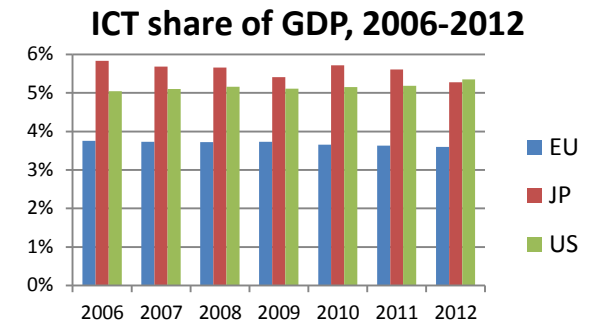
The breakdown by subsectors shows the predominance of ICT services (€477bn and 92% of total ICT VA in 2012) over ICT manufacturing industries (€40bn and 8% of total ICT VA in 2012).

The ICT services (excluding Telecoms) segment is the only one that has recorded an increase in VA in the medium term (2006-12) up to €308bn.

The Communication equipment segment has experienced the sharpest decline (by half) in the medium term (2006-12). From its apex of €27bn in 2007, it has dropped to €12bn in 2012, showing evidence of a structural decline.

In 2012, the ICT VA represents 4.0% of EU GDP (based on the comprehensive definition – see methodological note, page 2).

However (based on the comparable operational definition), ICT VA in EU (3.6%) lags behind Japan (5.3%) and US (5.4%) in 2012.



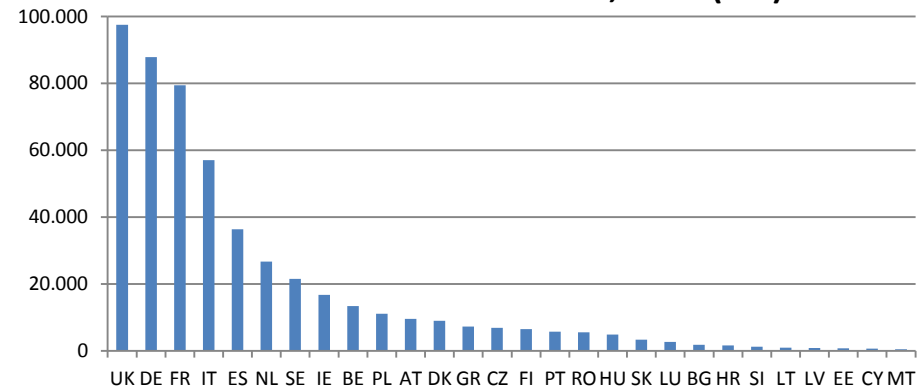
VALUE ADDED IN THE ICT SECTOR

By Member States

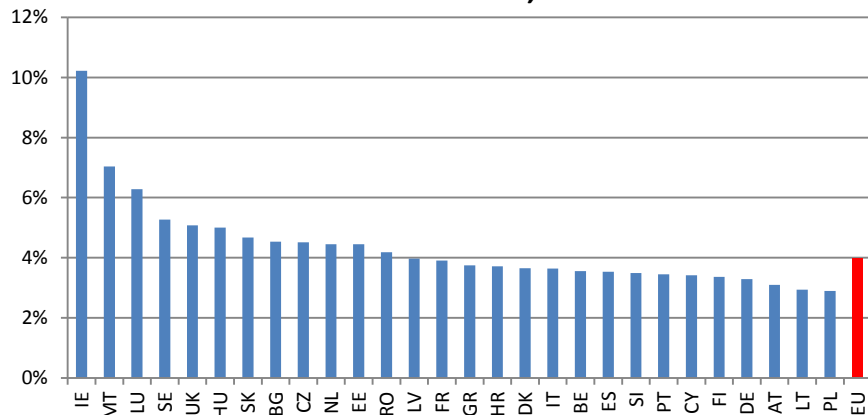
Unsurprisingly, the five largest economies are also the five biggest contributors to ICT VA in 2012: the United Kingdom (€98bn and 19%), Germany (€89bn and 17%), France (€79bn and 16%), Italy (€57bn and 11%) and Spain (€36bn and 7%).

Together, those five countries represent 69% of total EU ICT VA in 2012.

Value Added in the ICT sector, 2012 (€m)



ICT share of GDP, 2012



Ireland has – by far – the highest ICT share of GDP with a ratio of 10.2% in 2012, whereas Poland lags behind with less than 3.0%.

Other countries: Malta (7.0%), Luxembourg (6.3%) followed by Sweden (5.3%). Important shares characterise also some eastern Member States (HU, SK, BG, CZ).

In most of the Member States, ICT shares of GDP remain globally stable in the medium term (2006-12) with the exception of Finland (2012/06: - 3.82pp)

EMPLOYMENT IN THE ICT SECTOR At EU and World level

The ICT sector employs a little less than 6.2m (million) people in 2012, roughly equivalent to its apex of 6.2m in 2008.

The ICT services (excluding Telecoms) segment employs more than 4.3m people and 70% of total ICT employment in 2012. It is the only segment that has recorded a structural increase in the medium term (2006-12)

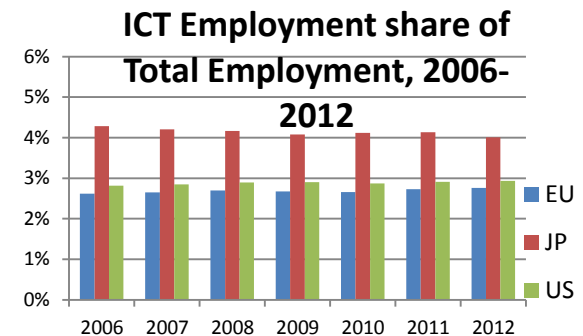
The Telecommunications segment employs more than 1.0m people in 2012, a number which has been decreasing in the medium term.

The ICT manufacturing industries (excl. Communication equipment) segment employs 558k (thousand) people in 2012 and the number has been decreasing.

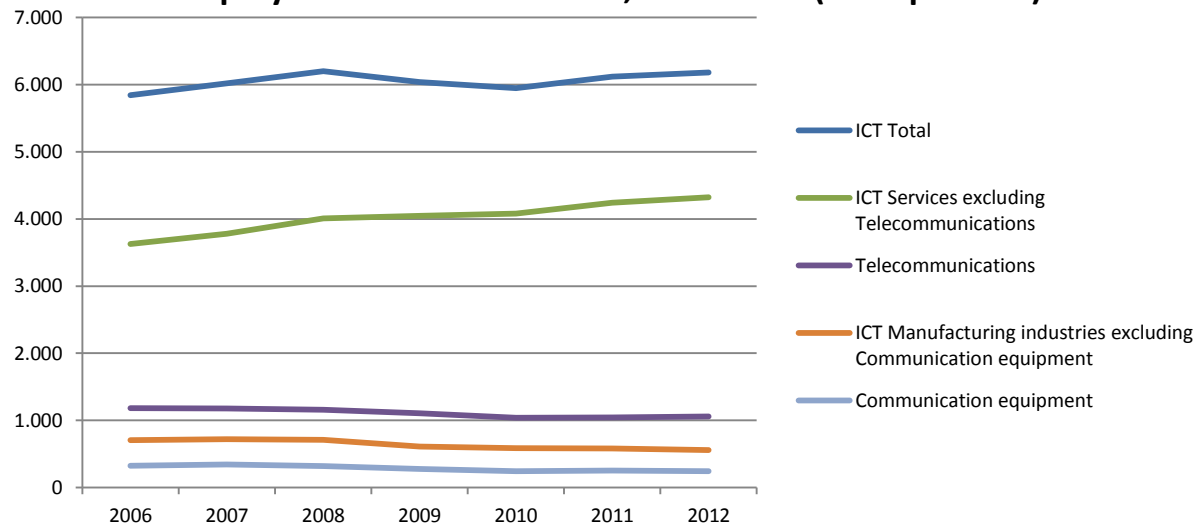
The Communication equipment segment has recorded the sharpest structural decline down to 244k people in 2012.

Employment in the ICT sector represents 2.8% of EU total employment in 2012, remaining remarkably stable in the medium term.

The EU share compares to that of the US (2.9% and stable), but both lag markedly behind Japan (4.0% in slow decline).



Employment in the ICT sector, 2006-2012 (1000 persons)



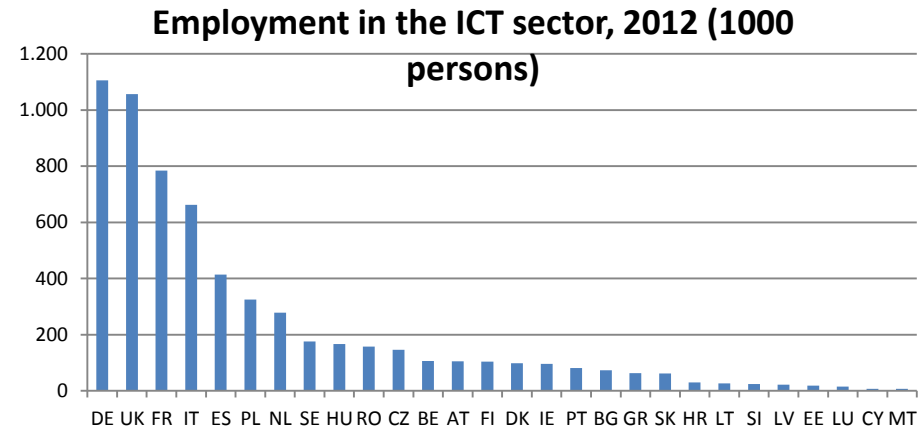
Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

EMPLOYMENT IN THE ICT SECTOR

By Member States

As in the case of Value Added, the five largest economies are also the five biggest employers of the ICT sector in 2012: Germany (1.1m people and 18%), the United Kingdom (1m people and 17%), France (0.78m and 13%), Italy (0.66m and 11%) and Spain (0.41m and 6.7%)

Together, those five biggest employers represent 65% of total ICT employment in 2012.



Ireland holds again the lead with 5.2% of ICT employment in total employment in 2012, and Greece brings up the rear with only 1.5% of ICT employment.

Other countries: Finland and Hungary (4.1% in 2012); Luxembourg, Sweden and Malta follow with ratios between 3.8% and 3.9%.

In the medium term (2006-12), the share of ICT employment in total employment remains stable in almost all countries.

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

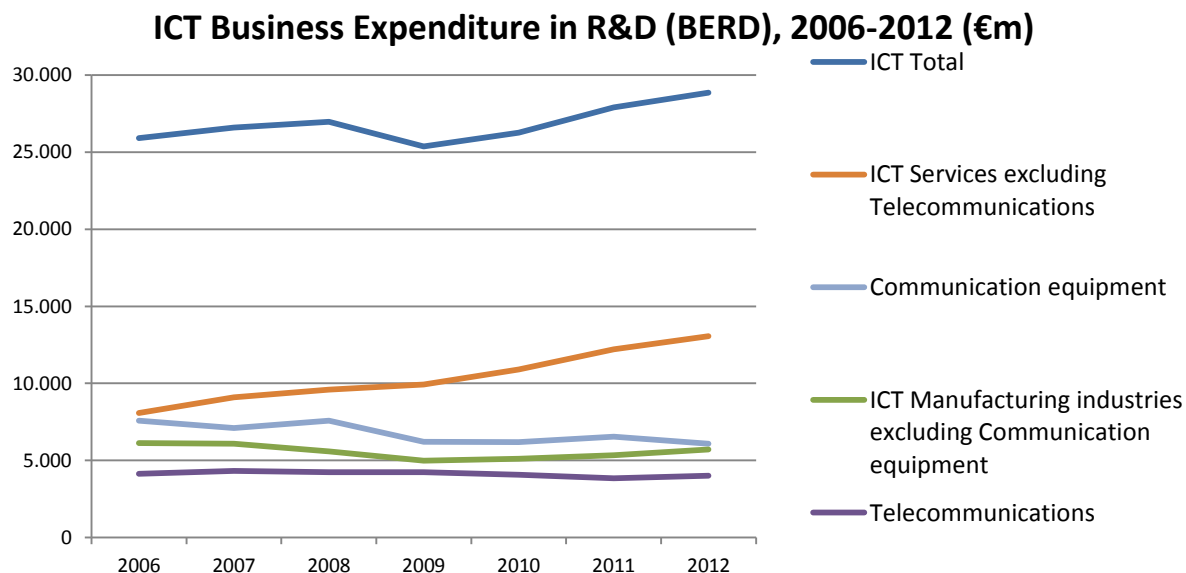
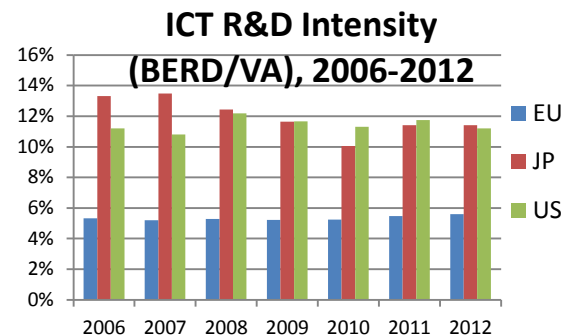
The ICT sector BERD expenditure amounts to €29bn in 2012, its highest point in the medium term (2006-12), with a recovery from the low point of €25bn in 2009.

The breakdown by subsectors shows a more balanced situation for BERD than for VA: despite driving only 8% of ICT VA, the ICT manufacturing segment spends 41% of total ICT BERD (€12bn) while the ICT services segment spends 59% (€17bn) in 2012.

In the medium term (2006-12), the situation is contrasted. The ICT Manufacturing segment records a structural decline (-14% over 2006-12). On the contrary, the ICT services segment shows a structural increase (+40% over 2006-12), especially the ICT Services (excluding Telecoms) segment (+62% over 2006-12).

R&D intensity in the ICT sector (comprehensive definition – see methodological note, page 2) amounts to 5.6% (in 2012).

EU (5.6%) has kept lagging behind US (11.2%) and Japan (11.4%) in 2012 (comparable operational definition).



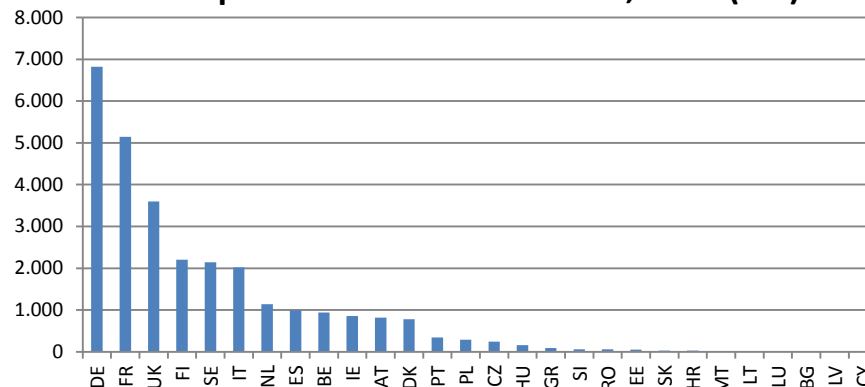
Source: JRC-IPTS calculations and estimates, based on EUROSTAT data, PREDICT project

R&D EXPENDITURE IN THE ICT SECTOR By Member States

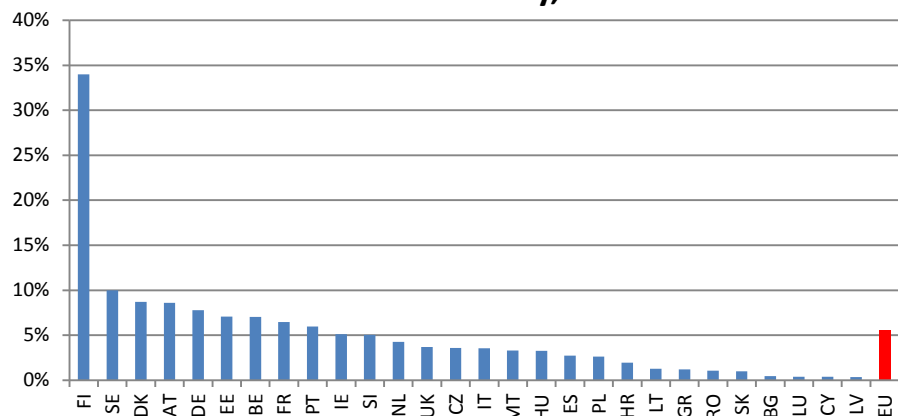
The six main contributors in terms of R&D expenditure in the ICT sector in 2012 are the four main countries of the EU: Germany (€6.8bn and 24%), France (€5.1bn and 18%), the United Kingdom (€3.6bn and 13%) and Italy (€2.0bn and 7.0%), plus two Nordics: Finland (€2.2bn and 7.6%) and Sweden (€2.1bn and 7.4%), confirming the importance of Nordic countries for ICT R&D.

Together, the six biggest contributors represent 76% of ICT R&D expenditure in 2012.

R&D Expenditure in the ICT sector, 2012 (€m)



ICT R&D Intensity, 2012



Finland leads Europe with 34% of ICT R&D Intensity in 2012, and Latvia bottoms out with a tiny 0.3%.

Other Nordic countries: Sweden (10%) and Denmark (8.7%). Other important countries are: Austria (8.6%), Germany (7.8%), Estonia (7.1%), and Belgium (7.0%).

In the medium term (2006-12), ICT R&D intensity remains globally stable with the notable exception of Finland which experiences a surge of about +14pp. (2012/06) due to a sharp drop of its value added (denominator of the ratio).

R&D PERSONNEL IN THE ICT SECTOR At EU and World level

R&D personnel in the ICT sector includes 275k Full Time Equivalent (FTE) in 2012, with an increasing trend in the medium term (2006-2012), and a recovery after 2009.

The ICT services (excluding Telecoms) segment employs 159k FTE in 2012 (58% of R&D personnel in the ICT sector, first place), with an increasing trend.

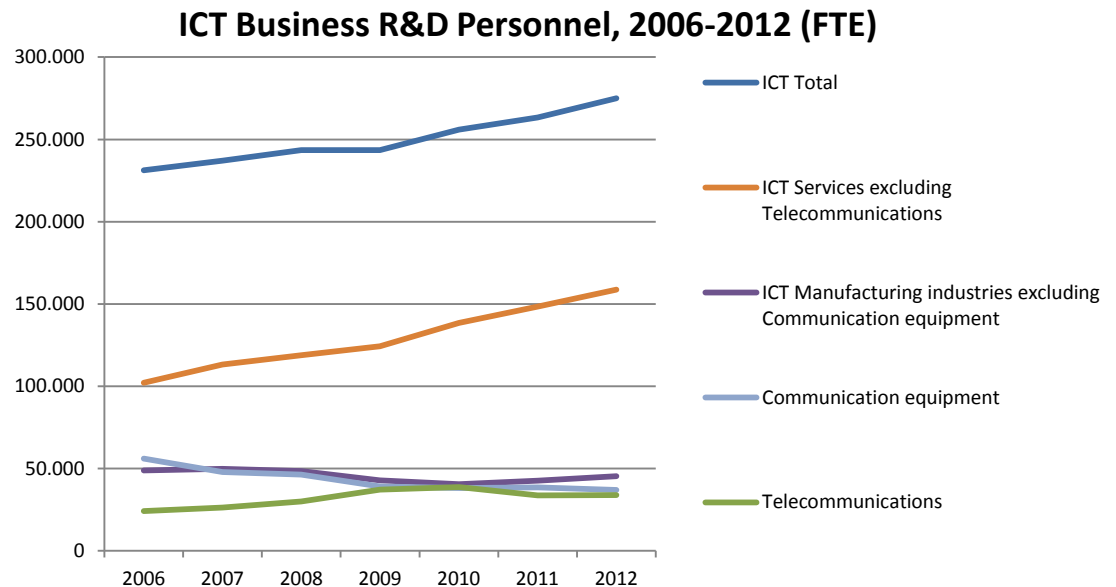
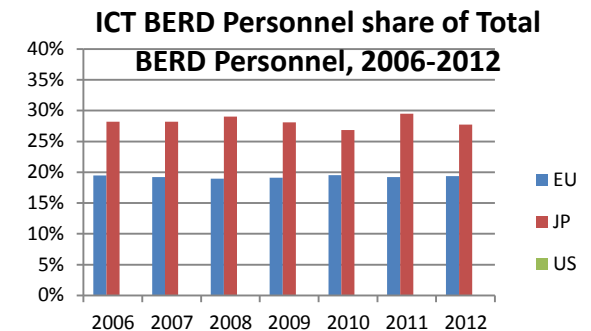
The ICT Manufacturing (excluding Communication equipment) segment employs 45k FTE in 2012, in decline in the medium term (2006-12), but with some recovery after 2010.

The Communication equipment segment has been in constant decline.

The Telecommunications segment employs 34k FTE in 2012 (12% of R&D personnel in the ICT sector), with a strong positive trend (+41% over 2006-12).

R&D personnel in the ICT sector makes up 19% of total R&D personnel in 2012, stable in the medium term.

However, it has remained below Japan (28% in the medium term). No data is available for US.

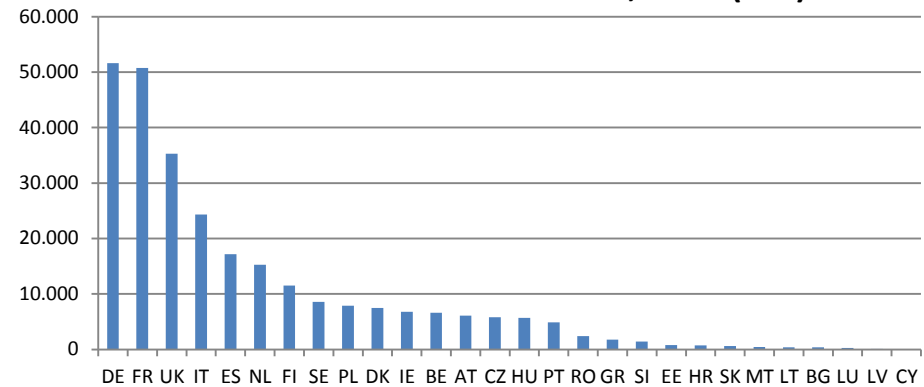


R&D PERSONNEL IN THE ICT SECTOR By Member States

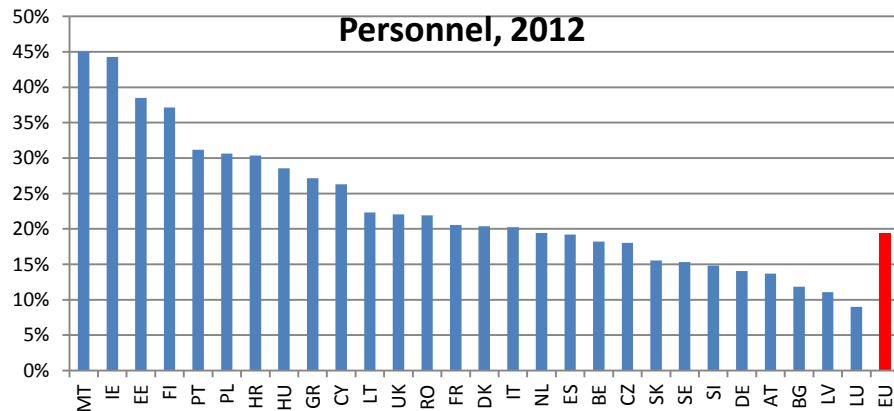
The five largest economies are also the five biggest employers of R&D personnel in the ICT sector in 2012: Germany (52k and 19%), France (51k and 18%), the United Kingdom (35k and 13%), Italy (24k and 8.8%) and Spain (17k and 6.2%).

Together, the five biggest employers represent 65% of total R&D personnel in the ICT sector in 2012.

R&D Personnel in the ICT sector, 2012 (FTE)



**ICT BERD Personnel as share of Total BERD
Personnel, 2012**



Malta (45%) and Ireland (44%) are the countries where R&D personnel is highly concentrated in the ICT sector in 2012. Luxembourg is the weakest (less than 10%).

Other performing countries (between 35-40% of R&D personnel for the ICT sector in 2012) are: Estonia (38%) and Finland (37%).

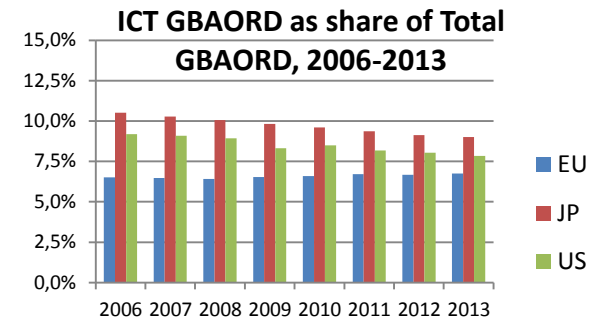
PUBLIC FUNDING ICT R&D EXPENDITURE At EU and World level

After increasing for several years, in 2012 the estimated ICT R&D publicly funded expenditure decreased, but recovered in 2013 and has reached roughly the same level as its peak of 2011.

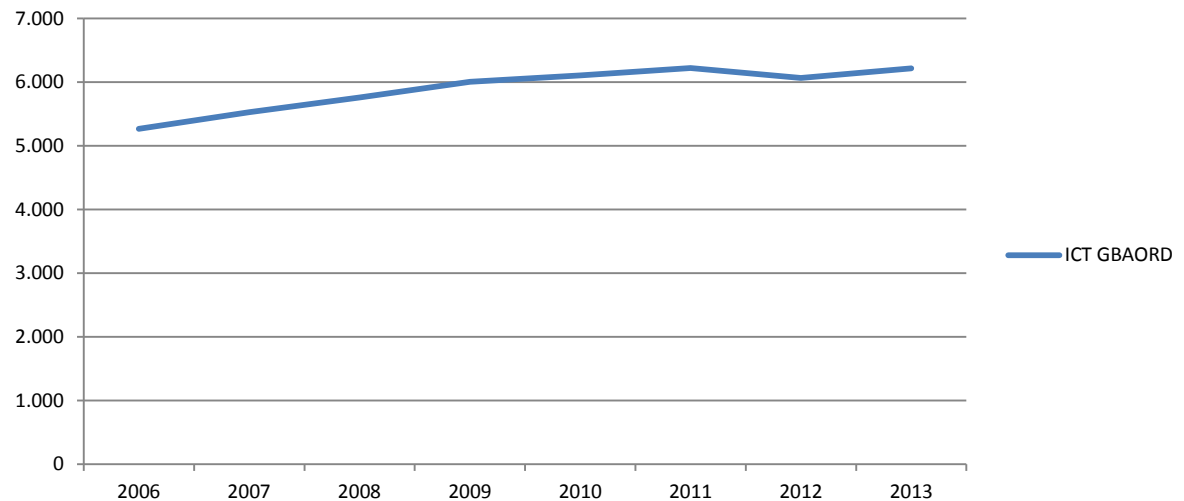
The Digital Agenda target of doubling publicly funded R&D in ICT between 2007 and 2020 requires an annual growth rate of 5.5% (assuming constant annual growth rate). The estimated public ICT R&D is below the necessary trend line; in 2013 the gap is about 20%.

In 2013, ICT GBAORD represents 6.7% of EU Total GBAORD, broadly stable in the medium term

The EU lags behind the US (7.9%) and Japan (9.0%), even if both have experienced some decline in their ratios.



ICT GBAORD, 2006-2013 (€m)

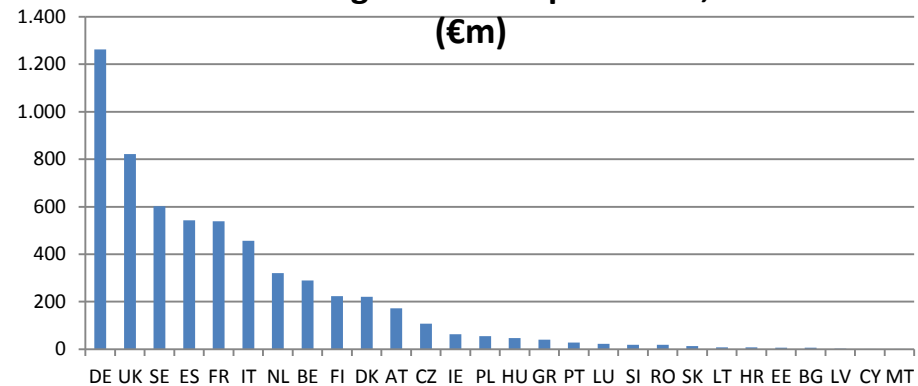


PUBLIC FUNDING ICT R&D EXPENDITURE By Member States

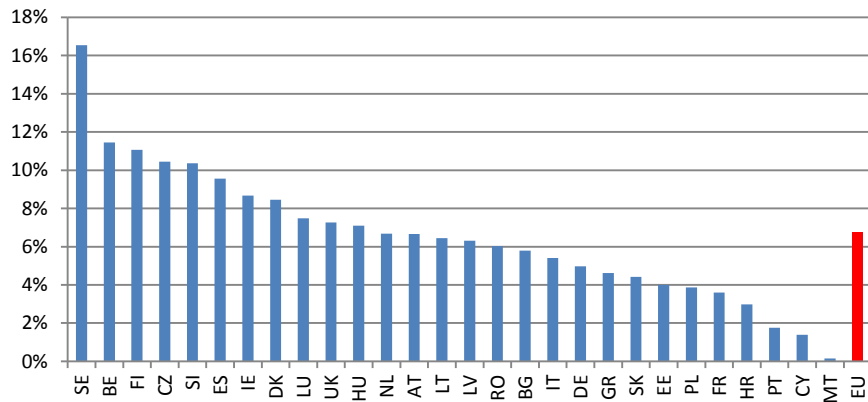
The five biggest public funders of R&D in ICT in 2013: Germany takes – by far – the lead (€1.3bn and 20%), followed by the United Kingdom (€0.82bn and 13%), Sweden (€0.60bn and 9.7%), and on equal footing Spain and France (€0.54bn and 8.7%).

Together, those five countries represent 61% of total public funding of R&D in ICT.

Public funding ICT R&D Expenditure, 2013
(€m)



ICT GBAORD as share of Total GBAORD, 2013



The ranking of ICT GBAORD as share of Total GBAORD in 2013 highlights again the performance of Nordic countries: Sweden (1st with 17%) and Finland (3rd with 11%).

However, other countries do seem to attribute special importance to ICT in their R&D public spending: Belgium (2nd with 11%), the Czech Republic and Slovenia (4th and 5th with %).

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 w_1 , w_2 , w_3 , w_4 are the weights of the component indicators, fixed over time and country

The weights are computed 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 of them, with no distinction according to their 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.

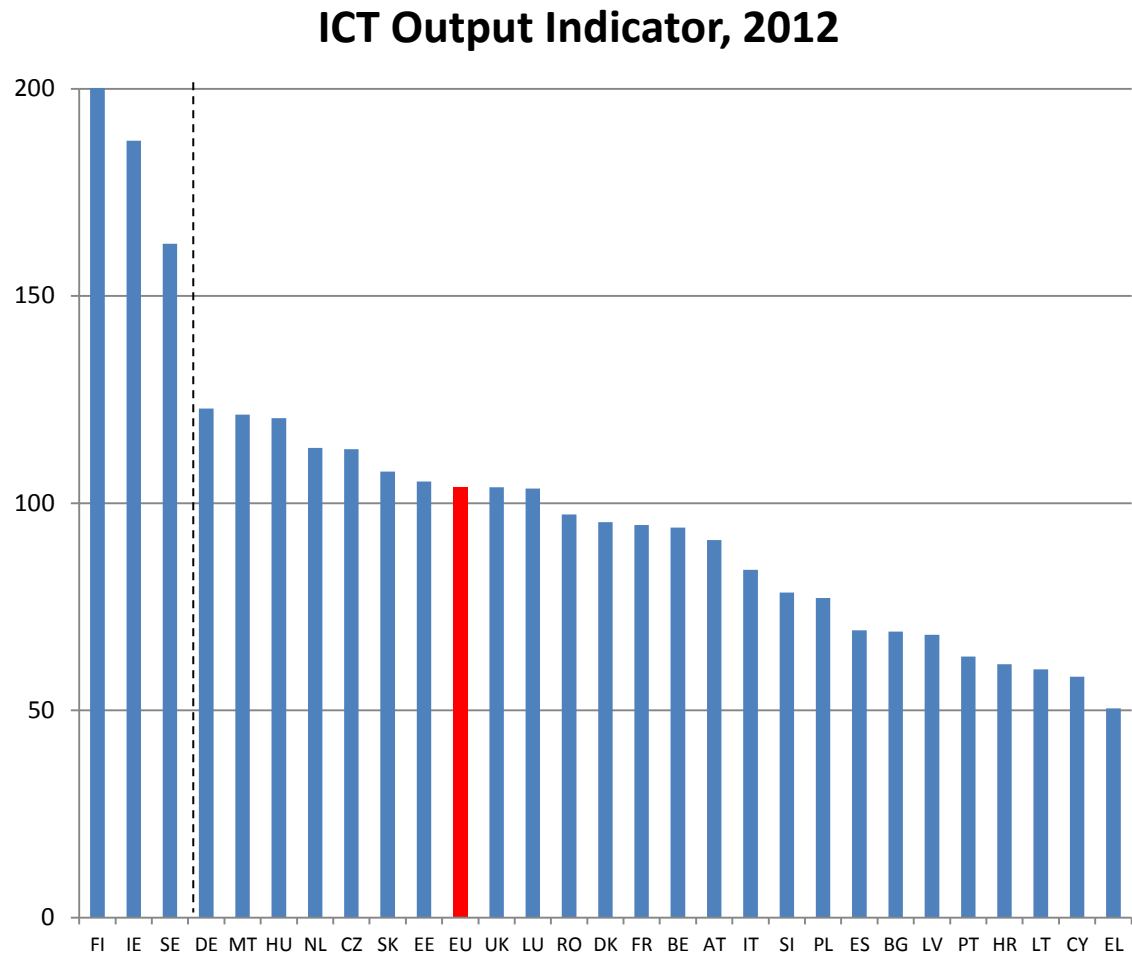
Source: JRC-IPTS calculations and estimates, EURIPIDIS project

ICT INNOVATION OUTPUT INDICATOR By Member States

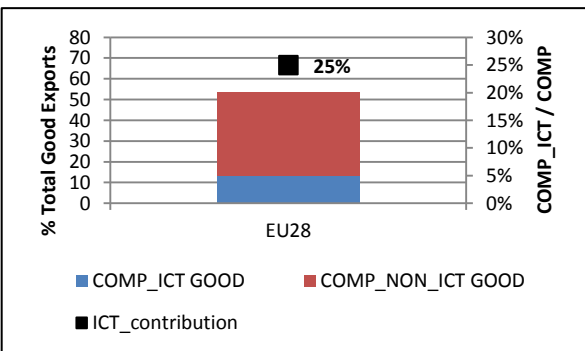
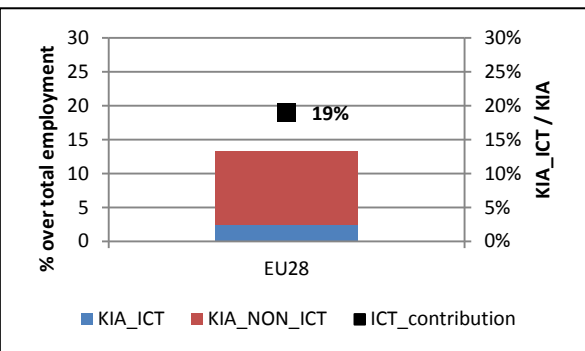
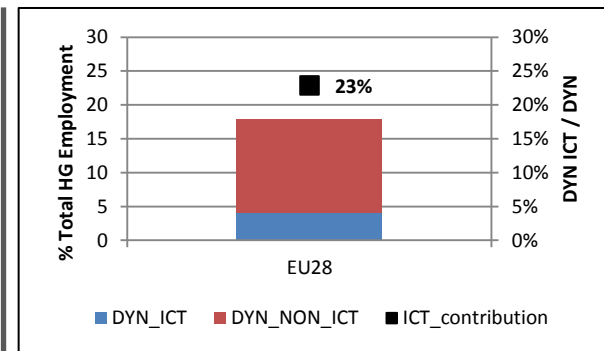
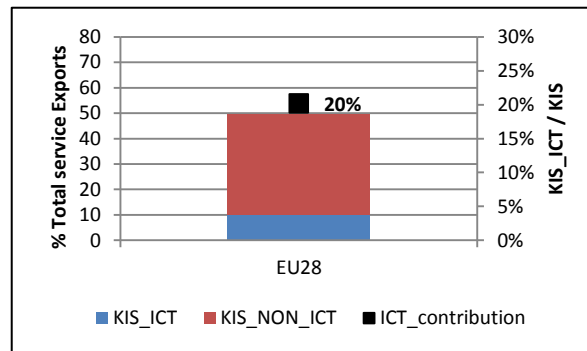
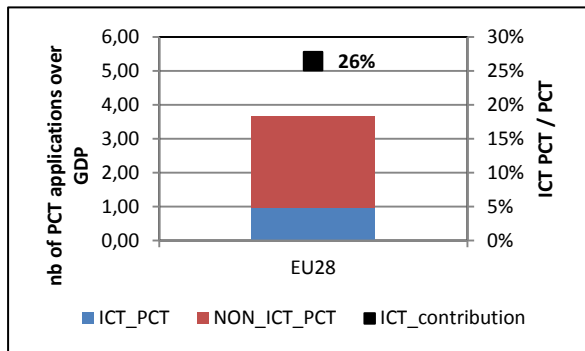
A group of three countries markedly takes the lead with scores higher than 150 (the benchmark has been set to equal 100 for Europe in 2010): Finland (200), Ireland (188) and Sweden (163)

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

On the opposite side of the chart, Lithuania (60), Cyprus (58) and Greece (51) bring up the rear



ICT INNOVATION OUTPUT INDICATOR By Component



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

1. 26% 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. 25% in competitiveness of knowledge goods as measured by exports of medium-high tech goods (COMP_GOOD_ICT)
4. 20% in competitiveness of knowledge services as measured by exports of knowledge intensive services (KIS_ICT)
5. 23% in innovative firm's dynamics as measured by employment of innovative fast-growing firms (DYN_ICT)

Source: JRC-IPTS calculations and estimates, EURIPIDIS project