This article provides an overview of recent developments in the demand for information and communication technology (ICT) specialists in Europe using data on employment as a proxy. ICT specialists are defined as persons who have the ability to develop, operate and maintain ICT systems and for whom ICTs constitute the main part of their job (OECD, 2004).

The introduction of new technologies and digitalisation — often referred to as the 'fourth industrial revolution' — is having an impact on society through changes to the way that people live, work and interact with one another. ICTs have already been the cause of significant changes to methods of production and patterns of employment within the European Union (EU), and policymakers and researchers therefore have an interest in tracking employment developments for ICT specialists, as these influence a country’s comparative advantage in the development, installation and servicing of ICTs.

**Number of ICT specialists**

In 2017, some 8.4 million persons worked as ICT specialists across the EU-28. The highest number (1.6 million) worked in the United Kingdom, which provided work to almost one fifth (19.4%) of the EU-28’s ICT workforce. Germany (also 1.6 million) had the second largest ICT workforce (18.6% of the EU-28 total), followed by France (1.0 million; 11.8%); none of the remaining EU Member States accounted for a double-digit share.

**Relative share of ICT specialists in the total workforce**

Across the whole of the EU-28, ICT specialists accounted for 3.7% of the total workforce in 2017 (see Figure 1).
Finland had the highest relative share of its total workforce employed as ICT specialists, as its 168 thousand persons employed as ICT specialists represented 6.8% of total employment, followed by Sweden where 333 thousand ICT specialists represented 6.6% of total employment. Relatively high shares were also recorded in Estonia, the United Kingdom, Luxembourg and the Netherlands — in 2017, they each reported that at least 1 in 20 persons within their total workforce was employed as an ICT specialist. By contrast, at the other end of the range, ICT specialists accounted for 2.3% of the total workforce in Bulgaria, Cyprus and Latvia, 2.2% in Portugal, 2.1% in Romania and 1.6% in Greece.

**General developments in the demand for ICT specialists**

During the last decade, the number of persons employed as ICT specialists in the EU-28 generally resisted the effects of the global financial and economic crisis and the downturn experienced in many labour markets and as a consequence the share of ICT specialists in total employment increased by 0.9 percentage points from 2.8% in 2007 to 3.7% in 2017.
The number of persons employed as ICT specialists grew by 36.1% during the period from 2007 to 2017, which was more than 10 times as high as the corresponding increase (3.2%) for total employment (see Figure 3).
Human capital in ICT is a driving force for digital and digital-enabled innovations and may be considered as crucial for the competitiveness of modern-day economies. Although this segment of the labour market is quite small in absolute terms, ICT employment was relatively resistant to the cyclical nature of economic events during the most recent decade for which data are available. Indeed, as can be observed in Figure 3, annual rates of change for the number of persons employed as ICT specialists were consistently higher than those recorded for total employment across the EU-28 economy. That said, the rate of change for the number of persons employed as ICT specialists in the EU-28 slowed somewhat during the global financial and economic crisis and its immediate aftermath and in 2010 there was a modest contraction of 0.2 % (compared with the year before) in the number of ICT specialists employed. There was subsequently a rebound in the number of ICT specialists employed. There was subsequently a rebound in the number of ICT specialists employed in the EU-28, with employment growing by as much as 8.9 % in 2012. Having slowed again in 2013 and 2014, the growth rate quickened somewhat in 2015, with 3.4 % more ICT specialists in the EU-28 compared with the year before, and this pattern was reinforced in 2016 with growth of 6.3 %. In 2017, employment growth for ICT specialists slowed once more, registering an increase of 2.0 %, slightly above the 1.5 % growth rate for total employment.

**ICT specialists by sex**

The vast majority of persons employed as ICT specialists in the EU-28 are men. The share of ICT employment that was accounted for by men stood at 82.8 % in 2017, which was 5.3 percentage points higher than it had been in 2007 (see Figure 4 and Table 1). In 2017, more than 9 out of every 10 ICT specialists in Hungary (91.1 %) and the Czech Republic (90.7 %) were men. While men accounted for at least 8 out of every 10 ICT specialists in the majority of the remaining EU Member States, there were seven Member States where the share of men was lower than this.
In Bulgaria, women accounted for 26.5 % of ICT specialists in 2017 — the highest share among the Member States. Women also accounted for close to one quarter of all ICT specialists in Romania and Lithuania, and for one fifth or more of all ICT specialists in Finland, Latvia, Sweden, Ireland and Denmark.

Table 1: Distribution of persons employed as ICT specialists by sex, education level and age, 2007 and 2017(%)Source: Eurostat (isoc_sks_itsps), (isoc_sks_itspe) and (isoc_sks_itspa)
In absolute terms, there were just over one quarter of a million female ICT specialists employed in the United Kingdom (286 thousand) and Germany (258 thousand) in 2017; these were, by far, the highest levels of female employment, as France (194 thousand) was the only other Member State to record more than 100 thousand women employed as ICT specialists.

A closer analysis of this gender gap reveals that there were only three EU Member States where the female share of ICT specialists rose during the period 2007 to 2017: in France, the share of women in the total number of ICT specialists rose from 17.1 % to 19.6 % (up 2.5 percentage points), while the gains recorded in Belgium and the Netherlands were slightly smaller, up 2.3 and 1.2 percentage points respectively). By contrast, in Hungary, Slovakia, and the Czech Republic, the relative share of men in the total number of ICT specialists rose at a considerably faster pace, up by 24.0, 20.7 and 20.4 percentage points respectively.

Figure 5 shows average annual rates of change for employment among ICT specialists, with data for men and women separately. On average, the number of men employed as ICT specialists in the EU-28 rose by 3.8 % per annum during the period 2007 to 2017, while the corresponding rate for women was 0.4 % per annum. As a result, during the period 2007-2017, the overall number of male ICT specialists increased by 45.3 %, while the overall increase in the number of female ICT specialists was 4.3 %. While there was annual growth in the number of men employed as ICT specialists in all of the EU Member States, there were 10 Member States where the number of female ICT specialists fell; eight of these recorded the lowest overall (male and female) rates of change for ICT employment between 2007 and 2017, while Greece and Estonia were the exceptions, registering overall growth of 2.7 % and 5.8 % per annum despite a negative rate of change for the number of female ICT specialists.
Among the non-EU countries, the most pronounced gender bias among ICT specialists in 2017 was registered in Turkey (where men accounted for 90.0 % of the ICT workforce compared with 10.0 % for women). In the three EFTA countries for which data are available, the gender distribution of the ICT workforce in 2017 was relatively similar to that in the EU-28, as the male shares of ICT specialists in Switzerland, Iceland and Norway were 85.0 %, 83.6 % and 80.5 % respectively.

**ICT specialists by level of education**

In 2017, more than three fifths (62.3 %) of all ICT specialists in the EU-28 had completed a **tertiary level** of educational attainment (see Figure 6). The share of ICT specialists with a tertiary level of educational attainment increased during the most recent decade for which data are available, rising from 54.8 % in 2007; in other words, the share of ICT specialists that had a high level of educational attainment rose by 7.5 percentage points between 2007 and 2017.
Among the EU Member States, the highest shares of ICT specialists with a tertiary level of educational attainment were recorded in Lithuania, Ireland, Cyprus and Spain, as more than four out of every five persons had such a level of education in 2017. A majority of ICT specialists had a tertiary level of education attainment in all but two of the remaining EU Member States, the exceptions being Portugal (49.6%) and Italy (34.1%).

An analysis for the period covering 2007 to 2017 reveals that the share of ICT specialists with a tertiary level of educational attainment rose by more than 20 percentage points in Slovakia, Austria, Lithuania, Hungary, Malta and the Czech Republic. Most of the remaining EU Member States also reported that their share of ICT specialists with a tertiary level of educational attainment increased during this period. However, there were three exceptions: the share of ICT specialists with a tertiary level of educational attainment declined at a modest pace in Belgium (down 0.8 percentage points), at a slightly faster pace in Germany (down 2.0 percentage points) and Cyprus (down 4.3 points).

A majority of ICT specialists had completed a tertiary level of education in all non-EU member countries in 2017, with Switzerland (63.7%) having the highest share and Turkey (53.5%) having the lowest share of persons with a tertiary level of educational attainment.

**ICT specialists by age groups**

The age distribution of ICT specialists has been analysed using two age groups: people aged 15-34 years and those aged 35 years and over; note that the upper age limit for employment data is 74 years.

In 2017, almost two thirds (63.5%) of all persons employed as ICT specialists in the EU-28 were aged 35 years and over. Moreover, the proportion of ICT specialists in this older age group increased by 6.0 percentage points between 2007 and 2017; note this rising share may reflect, among others, changes in the age structure of the EU-28 population (with relatively few young compared with middle and older-aged people) and/or a...
growing share of young people extending their stay within the education system rather than quickly entering the labour market.

Figure 7: Distribution of ICT specialists by age, 2017(%)

Source: Eurostat (isoc_sks_itspa)

In 2017, the EU Member States where people aged 35 years and over accounted for the highest shares of ICT specialists included Italy (76.1 %), Finland (72.2 %), Sweden (68.6 %) and Denmark (68.5 %). By contrast, in Malta, the Baltic Member States and Poland a majority of ICT specialists were aged 15-34 years, while in Bulgaria there was an even split between the two age groups.

Among the non-member countries, Turkey stood out as a large majority (64.0 %) of its ICT specialists in 2017 were aged 15-34 years. The EFTA countries had a similar pattern of age distribution for ICT specialists as observed for most EU Member States, with people aged 35 years and over accounting for 68.2 %, 63.8 % and 57.7 % of the total number of ICT specialists in Norway, Switzerland and Iceland respectively.

Source data for tables and graphs

- ICT specialists in employment: tables and figures

Data sources

The data presented in this article are secondary statistics on ICT specialists derived from the labour force survey (LFS). Data on ICT specialists cover persons working as specialists in all parts of the economy; no analysis by economic activity is available.

Statistics for ICT specialists are constructed based on the OECD definition (provided at the start of this article) which is based on the International Standard Classification of Occupations (ISCO). Note that for data up until 2010, the definition was based on ISCO-88, whereas the data from 2011 onwards are based on ISCO-08; as such, there is a break in series in 2011. Under ISCO-08, Eurostat and the OECD define ICT specialists
as people with the following occupations: ICT service managers; information and communications technology professionals (software and multimedia developers and analysts, and database specialists and systems administrators); information and communications technicians (ICT operations and user support technicians, and communications technicians); electronic engineers; telecommunication engineers; graphic and multimedia designers; information technology trainers; ICT sales professionals; electronics engineering technicians; electronics mechanics and servicers; ICT installers and servicers.

The International Standard Classification of Education (ISCED) provides a standard framework for education statistics. Data by level of educational attainment up until 2013 are classified according to ISCED 1997 and data from 2014 onwards are classified according to ISCED 2011, under which tertiary education is covered by levels 5-8. The 2011 edition of the ISCED classification defines education systems with respect to the following levels:

- Level 0 — less than primary education
- Level 1 — primary education
- Level 2 — lower secondary education
- Level 3 — upper secondary education
- Level 4 — post-secondary non-tertiary education
- Level 5 — short-cycle tertiary education
- Level 6 — bachelor’s or equivalent level
- Level 7 — master’s or equivalent level
- Level 8 — doctoral or equivalent level

For a more detailed listing and corresponding ISCO and ISCED codes, refer to the metadata for statistics on ICT specialists in employment. Labour force survey reference metadata should be consulted for further information relating to the underlying primary source data.

**Context**

Digitalisation and automation can generate new business opportunities through the development of new production processes, new products and new markets. Indeed, the impact of ICTs within the workplace has generally resulted in increased productivity and efficiency, as well as a range of possibilities for more flexible working practices. While these changes have generated a wide range of new jobs, the introduction of ICTs has also led to job losses, for example, as a result of automation.

In recent years, EU policies have given greater attention to ICT skills and in particular to the employment of ICT specialists. The Digital Single Market strategy emphasises the need for policies designed to boost stability in European labour markets and improve the EU’s competitive position. Monitoring the employment of ICT specialists has therefore become increasingly important. The New Skills Agenda for Europe (2016) launched a number of actions to ensure that the right training, the right skills and the right support are available for people in the EU. One such action, the Digital Skills and Jobs Coalition supports cooperation between education, employment and industry to develop a pool of digital talent in the EU-28, while ensuring that individuals and the labour force in general are equipped with adequate digital skills. One of the important objectives of the European employment policy is to ensure that workers in the EU-28 acquire higher-end skills needed in order to prevent the loss of key ICT jobs to other regions of the world. The European Commission is bringing together EU Member States and a range of stakeholders to pledge actions and to monitor progress in developing digital skills through its Digital Progress Report and the Digital Economy and Society Index.

**Other articles**

- ICT specialists — statistics on hard-to-fill vacancies in enterprises
- ICT education - a statistical overview

**Database**

- Digital economy and society (isoc), see:
  - Digital skills (isoc_sk)
  - ICT specialists (isoc_sks)
  - ICT specialists in employment (isoc_skslf)
  - Employed ICT specialists - total (isoc_sks_itspt)
Employed ICT specialists by sex (isoc_sks_itps)
Employed ICT specialists by educational attainment level (isoc_sks_itspe)
Employed ICT specialists by age (isoc_sks_itspa)

Dedicated section

- Digital economy and society
- Employment and unemployment (Labour force survey)

Methodology

- Employment and unemployment (labour force survey) (ESMS metadata file — employ_esms)
- ICT employment statistics in Europe: measurement methodology
- ICT specialists in employment (ESMS metadata file — isoc_skslf_esms)

External links

- Digital Agenda for Europe
- Digital Single Market
- Digital Skills and Jobs Coalition
- EU e-skills strategy
- Europe 2020
- European e-Competence Framework
- ICT specialists in OECD countries, 2014
- New Skills Agenda for Europe (2016)
- Skills Panorama

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